IOWA DNR WORKSHOP #2 HANDOUT
TRANSFER STATION ECONOMICS

The full cost of a transfer station consists of the sum of the construction and operating costs, the transportation cost to deliver waste from the transfer station to a permitted landfill and the disposal cost at the landfill. Shaw Environmental, Inc. (Shaw) has developed a cost model to estimate the construction and operating costs for a transfer station designed to handle 30 tons per day (tpd) of waste. The assumptions used to derive these costs are based on regulatory requirements, design features of existing transfer stations of similar size and Shaw's knowledge of and experience with the design and operation of transfer stations across the country. The assumptions have been reviewed and accepted by the Iowa DNR as representative of a "typical" facility. Actual facility costs will differ based on specific site conditions, the final design of the facility and operating costs specific to each planning area.

Shaw has also provided information that planning areas can utilize to calculate the transportation and disposal costs associated with the development of a transfer station.

Transfer Station Construction and Operating Cost Estimates

Cost estimates were prepared for the construction and operation of transfer stations developed in one of two manners: 1) a retrofit of an existing building, and 2) a new facility. For each type of transfer station two cost estimates were developed, resulting in a range of costs which may be expected with either development scenario. For the retrofit of an existing building, the two options considered were 1) top-load of transfer trailers at grade within the building, and 2) truck-to-truck transfer. For the construction of a new facility, the two cost estimates developed were based on 1) RS Means cost estimates for building construction, and 2) square foot cost for building construction based on the actual cost of construction for an approximately 30 tpd transfer station in Iowa.

The following assumptions / parameters summarize key elements of the cost estimates. Specific costs are outlined in Tables 1 through 4 at the back of this handout. (Note: Per ton costs indicated in Tables 1 through 4 are calculated assuming that landfills increase their current tipping fees by $17.10 (low landfill increment) to $21.54 (high landfill increment) per ton for an 18-month period prior to construction of either a new landfill cell or transfer station. This increased fee would be placed in a construction reserve fund to allow landfill cell construction to be performed without financing the construction costs, based on incremental cost increases calculated in Workshop #1. If the planning area opts to develop a transfer station instead, the reserve fund is assumed to be applied directly to the capital investment for the transfer station and the remainder of the capital investment will be financed for 15 years at a rate of 5%.)

General Assumptions / Parameters

- Average throughput of 30 tpd of waste materials
- Did not assume additional costs for stormwater management, local approvals, land acquisition or permitting
- Personnel include 3 full-time staff, consisting of a supervisor / equipment operator, a scalehouse clerk and a general laborer
- All equipment will be purchased new (other options would include leasing equipment or purchasing used equipment)

Retrofit of an Existing Building with Top-Load of Transfer Trailers (Table 1)

Existing conditions / preliminary requirements:

- Building dimensions must be a minimum of 60 feet deep and 60 feet wide
- The building must have a clear-span height of 30 feet
- No center columns are present within the building
- The building has an existing concrete floor with a minimum thickness of 6 inches
- A scale and scalehouse are in place and available for the facility's use
- Tipping floor access doors are of minimum dimensions of 24 feet high by 15 feet wide for collection vehicle access and 16 feet high by 12 feet wide for passenger vehicle / self-haul access
- All necessary utilities are present on-site and are connected to the building, including electric, water, telephone, gas and sanitary sewer
- Fencing has been previously installed around the facility perimeter
- No site grading or placement of gravel for vehicle maneuvering areas is required

Modifications:

- Floor will be modified by pouring an overlay of the existing floor consisting of 6 inches of reinforced concrete
- A concrete pushwall consisting of concrete gravity blocks will be installed along the rear and side wall of the building to a height of 8 feet
- A 500-gallon washwater storage tank will be installed and the existing floor drain(s) will be connected to the tank to prevent discharge of washwater to the sanitary sewer system or septic system / pond

Equipment requirements:

- A front-end wheel loader of sufficient size to top-load a trailer at grade

Retrofit of an Existing Building with Truck-to-Truck Transfer (Table 2)

Existing conditions / preliminary requirements:

- Building dimensions must be a minimum of 90 feet deep and 30 feet wide
- The building must have a clear-span height of 30 feet
- No center columns are present within the building
- Access is available from both ends of the building
- A scale and scalehouse are in place and available for the facility's use
- Access doors are of minimum dimensions of 24 feet high by 15 feet wide
- All necessary utilities are present on-site and are connected to the building, including electric, water, telephone, gas and sanitary sewer
- Adequate space is available on-site for development of a citizen convenience center
- Fencing has been previously installed around the facility perimeter
- No site grading or placement of gravel for vehicle maneuvering areas is required

Modifications:

- Loading ramp will be constructed within the building for collection vehicles to back to the level of the trailer bed (approximately 4 feet high)
- A citizen convenience center consisting of roll-off boxes and signs indicating operating procedures will be developed adjacent to the building
- A 500-gallon washwater storage tank will be installed and the existing floor drain(s) will be connected to the tank to prevent discharge of washwater to the sanitary sewer system or septic system / pond

Equipment requirements:

- A small wheel loader to collect spilled refuse, should that occur, and capable of maneuvering into the transfer trailer to move small amounts of waste
- Two transfer trailers designed for truck-to-truck transfer

Construction of a New Facility (Tables 3 and 4)

Site requirements:

- Minimum site size of approximately 1.25 acres
- All necessary utilities are available from the property line, including electric, water, telephone, gas and sanitary sewer
- All vehicle maneuvering areas and access roads within the facility will be gravel
- Scale and scalehouse must be constructed
- Site is level, requiring minimal grading or excavation

Building requirements:

- Building dimensions must be a minimum of 60 feet deep and 60 feet wide
- The building must have a clear-span height of 30 feet
- No center columns are present within the building
- Tipping floor access doors are of minimum dimensions of 24 feet high by 15 feet wide for collection vehicle access and 16 feet high by 12 feet wide for passenger vehicle / self-haul access
- The tipping floor will consist of 12 inches of reinforced concrete
- Reinforced concrete pushwalls will be constructed along rear and side of the building to a height of 8 feet
- A depressed loading bay with a ramp grade of 7% will be constructed along one side of building to a depth of 6 feet to facilitate trailer loading
- Floor drains will be installed within the building to capture washwater and convey it to a 500-gallon washwater storage tank

Equipment requirements:

- A front-end wheel loader of sufficient size to top-load a trailer at 6 feet below grade

Calculation of Total Transfer Station Costs

When evaluating the development of a transfer station, the construction and operating costs are only one component of the total cost of the facility. The cost estimates contained in Tables 1 through 4 of this handout do not include a cost for transportation or disposal of the waste delivered to the transfer station.

Transportation costs are dependent on several factors: 1) the number of hours of round-trip travel, calculated by knowing the distance to the landfill and the average travel speed to access the landfill, 2) the cost to operate a transfer trailer vehicle, typically expressed at an hourly rate, and 3) the payload of the transfer trailer. A per ton transportation cost may be calculated by the following formula:

$$Transportation\ Cost\ per\ Ton = \frac{(Trailer\ Cost\ per\ Hour)\ x\ (Number\ of\ Hours)}{(Tons\ per\ Load)}$$

Disposal costs will vary depending on the landfill selected. Negotiating with multiple landfills will result in a planning area obtaining the lowest per ton disposal cost the marketplace will allow. Small, local landfills may be willing to offer a lower disposal fee to other planning areas because the increased tonnage going into the landfill will reduce the landfill's costs on a per ton basis. Additionally, the selected landfill may not be the nearest landfill, as some larger, regional landfills may be able to offer a lower disposal fee than a smaller, local landfill because their per ton costs have been reduced by being distributed across a larger wasteshed (the increased transportation cost to access these landfills may be offset by the lower disposal cost).

The total cost of a transfer station may be calculated when each of the component costs have been identified. The cost may be calculated by the following formula:

$$Cost\ per\ Ton = (Construction/Operating\ Cost\ per\ Ton) + (Transportation\ Cost\ per\ Ton) + (Disposal\ Cost\ per\ Ton)$$

TABLE 1. TRANSFER STATION COST SUMMARY:
RETROFIT OF AN EXISTING BUILDING WITH TOP-LOAD OF TRANSFER TRAILERS

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Capital Costs					
Development Costs					
Tipping floor	3,600	square feet	$10.11	$36,400	
Pushwalls	1	lump sum	$1,000.00	$1,000	
Washwater storage tank	1	each	$3,000.00	$3,000	
Equipment Costs					
Front-end loader	1	each	$250,000.00	$250,000	
Less, Location Factor				($6,500)	
Plus, Contingency				$5,100	
Subtotal				$289,000	
Less, Initial Reserve (Low Landfill Increment)				($220,077)	
Less, Initial Reserve (High Landfill Increment)				($277,220)	
Capital Costs to be Financed (Low Landfill Increment)				$68,923	
Capital Costs to be Financed (High Landfill Increment)				$11,780	
Amortized Cost (Low Landfill Increment)				$6,640	$0.77
Amortized Cost (High Landfill Increment)				$1,135	$0.13
Operating Costs					
Loader fuel and maintenance	572	hours	$27.00	$15,400	
Building / site maintenance	1	each	$8,600.00	$8,600	
Utilities	3,600	square feet	$0.50	$1,800	
Leachate removal	1,500	gallons	$0.10	$200	
Supervisor / loader operator	1	each	$50,000.00	$50,000	
Scalehouse clerk	1	each	$35,000.00	$35,000	
Laborer	1	each	$40,000.00	$40,000	
Subtotal				$151,000	$17.60
Total Annual Costs (Low Landfill Increment)				**$157,640**	**$18.37**
Total Annual Costs (High Landfill Increment)				**$152,135**	**$17.73**

TABLE 2. TRANSFER STATION COST SUMMARY:
RETROFIT OF AN EXISTING BUILDING WITH TRUCK-TO-TRUCK TRANSFER

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Capital Costs					
Development Costs					
Loading ramp	1	each	$800.00	$800	
Washwater storage tank	1	each	$3,000.00	$3,000	
Equipment Costs					
Roll-off containers	4	each	$2,200.00	$8,800	
Transfer trailers	2	each	$75,000.00	$150,000	
Wheel loader	1	each	$150,000.00	$150,000	
Less, Location Factor				($600)	
Plus, Contingency				$500	
Subtotal				$312,500	
Less, Initial Reserve (Low Landfill Increment)				($220,077)	
Less, Initial Reserve (High Landfill Increment)				($277,220)	
Capital Costs to be Financed (Low Landfill Increment)				$92,423	
Capital Costs to be Financed (High Landfill Increment)				$35,280	
Amortized Cost (Low Landfill Increment)				$8,902	$1.04
Amortized Cost (High Landfill Increment)				$3,396	$0.40
Operating Costs					
Loader fuel and maintenance	572	hours	$13.00	$7,400	
Transfer trailer maintenance	2	each	$1,500.00	$3,000	
Building / site maintenance	1	each	$8,600.00	$8,600	
Utilities	2,700	square feet	$0.50	$1,400	
Leachate removal	1,500	gallons	$0.10	$200	
Supervisor / loader operator	1	each	$50,000.00	$50,000	
Scalehouse clerk	1	each	$35,000.00	$35,000	
Laborer	1	each	$40,000.00	$40,000	
Subtotal				$145,600	$16.97
Total Annual Costs (Low Landfill Increment)				**$154,502**	**$18.01**
Total Annual Costs (High Landfill Increment)				**$148,996**	**$17.37**

TABLE 3. TRANSFER STATION COST SUMMARY:
CONSTRUCTION OF A NEW FACILITY (LOW ESTIMATE)

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Capital Costs					
Sitework costs					
Equipment mobilization	3	each	$207.00	$621	
Excavation	526	cubic yards	$10.00	$5,260	
Crushed rock backfill	143	cubic yards	$20.00	$2,860	
Gravel surface					
Strip 12" aggregate fill	1,597	cubic yards	$0.69	$1,102	
6" base course	4,790	sq. yards	$6.80	$32,572	
Fine grading	4,790	sq. yards	$0.80	$3,832	
Fencing	895	linear feet	$20.00	$17,900	
Gates	2	each	$2,500.00	$5,000	
Ground cover	6	m.s.f.	$380.00	$2,280	
Utilities	310	linear feet	$33.00	$10,230	
Lighting	3,870	square foot	$0.50	$1,935	
Signage	1	each	$1,000.00	$1,000	
Transfer building costs					
Slab on grade, 12" thick	3,600	square feet	$14.85	$53,460	
Strip footing	40	cubic yards	$214.00	$8,560	
Building shell	4,440	square feet	$18.00	$79,920	
Electrical	4,440	square feet	$6.00	$26,640	
Ventilation	4,440	square feet	$2.00	$8,880	
Trench drain	60	linear feet	$30.00	$1,800	
Bollards	4	each	$600.00	$2,400	
Overhead doors	2	each	$5,000.00	$10,000	
Concrete pushwalls (8' high)	90	linear feet	$360.00	$32,400	
Load out tunnel					
Exterior retaining wall	60	cubic yards	$576.00	$34,560	
Interior retaining wall	60	cubic yards	$360.00	$21,600	
Slab on grade, 8" thick	2,044	square feet	$10.77	$22,014	
Ramp retaining wall	86	cubic yards	$360.00	$30,960	
Overhead door	1	each	$5,000.00	$5,000	
Trench drain	14	linear feet	$30.00	$420	
Washwater storage tank	1	each	$3,000.00	$3,000	

**TABLE 3. TRANSFER STATION COST SUMMARY:
CONSTRUCTION OF A NEW FACILITY (LOW ESTIMATE)**

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Scale	1	each	$67,500.00	$67,500	
Scalehouse	270	square feet	$70.00	$18,900	
Equipment Costs					
Front-end loader	1	each	$250,000.00	$250,000	
Less, Location Factor				($82,000)	
Plus, Contingency				$64,600	
Subtotal				$745,206	
Less, Initial Reserve (Low Landfill Increment)				($220,077)	
Less, Initial Reserve (High Landfill Increment)				($277,220)	
Capital Costs to be Financed (Low Landfill Increment)				$525,129	
Capital Costs to be Financed (High Landfill Increment)				$467,986	
Amortized Cost (Low Landfill Increment)				$50,592	$5.90
Amortized Cost (High Landfill Increment)				$45,087	$5.25
Operating Costs					
Loader fuel and maintenance	572	hours	$27.00	$15,400	
Building / site maintenance	1	each	$8,600.00	$8,600	
Utilities	4,710	square feet	$0.50	$2,400	
Leachate removal	1,500	gallons	$0.10	$200	
Supervisor / loader operator	1	each	$50,000.00	$50,000	
Scalehouse clerk	1	each	$35,000.00	$35,000	
Laborer	1	each	$40,000.00	$40,000	
Subtotal				$151,600	$17.67
Total Annual Costs (Low Landfill Increment)				**$202,192**	**$23.57**
Total Annual Costs (High Landfill Increment)				**$196,687**	**$22.92**

TABLE 4. TRANSFER STATION COST SUMMARY:
CONSTRUCTION OF A NEW FACILITY (HIGH ESTIMATE)

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Capital Costs					
Sitework costs					
Equipment mobilization	3	each	$207.00	$621	
Excavation	526	cubic yards	$10.00	$5,260	
Crushed rock backfill	143	cubic yards	$20.00	$2,860	
Gravel surface					
Strip 12" aggregate fill	1,597	cubic yards	$0.69	$1,102	
6" base course	4,790	sq. yards	$6.80	$32,572	
Fine grading	4,790	sq. yards	$0.80	$3,832	
Fencing	895	linear feet	$20.00	$17,900	
Gates	2	each	$2,500.00	$5,000	
Ground cover	6	m.s.f.	$380.00	$2,280	
Utilities	310	linear feet	$33.00	$10,230	
Lighting	3,870	square foot	$0.50	$1,935	
Signage	1	each	$1,000.00	$1,000	
Transfer building costs	4,440	square foot	$33.65	$149,406	
Scale	1	each	$67,500.00	$67,500	
Scalehouse	270	square feet	$70.00	$18,900	
Equipment Costs					
Front-end loader	1	each	$250,000.00	$250,000	
Less, Location Factor				($27,400)	
Plus, Contingency				$43,900	
Subtotal				$586,898	
Less, Initial Reserve (Low Landfill Increment)				($220,077)	
Less, Initial Reserve (High Landfill Increment)				($277,220)	
Capital Costs to be Financed (Low Landfill Increment)				$366,821	
Capital Costs to be Financed (High Landfill Increment)				$309,678	
Amortized Cost (Low Landfill Increment)				$35,340	$4.12
Amortized Cost (High Landfill Increment)				$29,835	$3.48

**TABLE 4. TRANSFER STATION COST SUMMARY:
CONSTRUCTION OF A NEW FACILITY (HIGH ESTIMATE)**

	# Units	Unit	Unit Cost	Total Cost	Cost / Ton
Operating Costs					
Loader fuel and maintenance	572	hours	$27.00	$15,400	
Building / site maintenance	1	each	$4,700.00	$4,700	
Utilities	4,710	square feet	$0.50	$2,400	
Leachate removal	1,500	gallons	$0.10	$200	
Supervisor / loader operator	1	each	$50,000.00	$50,000	
Scalehouse clerk	1	each	$35,000.00	$35,000	
Laborer	1	each	$40,000.00	$40,000	
Subtotal				$147,700	$17.21
Total Annual Costs (Low Landfill Increment)				**$183,040**	**$21.33**
Total Annual Costs (High Landfill Increment)				**$177,535**	**$20.69**