Expansion

Mark Suhr, Vice President Operations

Southern Minnesota Beet Sugar Cooperative Renville, Minnesota

Southern Minnesota Beet Sugar Cooperative (SMBSC) is owned by 550 shareholders and is located near Renville, Minnesota. Sugar beets are grown within a 60-mile radius and are supplied by the shareholders. This single factory cooperative began a massive $103 million expansion project in 1999. The project is in its final stages.

The factory was built in 1975 on one square mile of land. The plant capacity has grown from originally processing 800,000 tons of sugarbeets to over 2,000,000 tons per processing season. The daily slicing capacity has increased from 6,000 to 9,500 tons along with increases in thick juice storage. Over the years, this was accomplished with only modest capital investments, allowing shareholders a good investment return. The only major capital investment made to the original facility was a molasses desugarization plant, designed by FinnSugar, in 1990.

Evidence of increasing equipment wear rates, declining equipment reliability despite a rapidly increasing maintenance budget, along with changes in environmental constraints necessitated a review of the need to modernize. In addition, the impacts by the farm bill, depressed commodity pricing, and NAFTA/GATT agreements were evident. The Cooperative's ability to continue to effectively compete in the market needed to be evaluated.

In the modernization evaluation, it became apparent that $60,000,000 was needed to bring the Cooperative's processing facility into environmental compliance and replace worn equipment. Obtaining funds at this investment level would be difficult to justify with the minor efficiency gains offered only by equipment replacement.

An expansion of the processing facility would allow us to raise equity, meet modernization needs and gain on efficiency. The design criteria was simple: expand without increasing any input (with the exception of sugar beets), reduce labor, fuel, limestone and chemical costs, as well as reduce daily operating maintenance. It was also important that the expansion meet the environmental issues and provide satisfactory returns in addition to reducing exposure to inflationary effects.

Utilizing the 1997 campaign year as a base and comparing these results to forecasted factory results, an analysis of the return to the shareholders was performed. This allowed our shareholders an evaluation method without allowing sugar and by-product pricing and inflation to distort the comparisons. The result was a positive response by the shareholders and an approval from the Board of Directors.

The five-year capital plan was announced which would expand the factory capacity to obtain the lowest cost for capital invested. The project itself was to expand daily processing from the current 9,500 tons of sugarbeets to 14,500 tons and the daily sugar granulation from 20,000 cwt to 27,500 cwt. Once completed, the expansion project would result in a $5 per ton increase in the beet payment and provide a hedge against the inflation effect on employee cost and potential higher energy costs. The acreage for sugar beets would also be increased in a planned sequence from the 100,000 acres to 147,000 acres. With the increase in acres, additional piling sites were added along with upgrades to existing pilers. Refer to *SMBSC Acreage Expansion* insert.

An in-house team undertook the project's design, planning and engineering with limited input from external specialists. Phil Thompson of SKIL and Steve Ahlschlager of ACE Services aided process design and equipment selections. They were responsible for process modeling using Sugars^{Tm} software to analyze many different scenarios. This allowed the design to be optimized for thawed and frozen beet conditions at a range of throughputs as the factory capacity was progressively increased.

Equipment selection and process design was done based on the best available proven technology after reviewing experiences in several countries and selecting the best match to SMBSC's expansion objectives.

Major cost centers were identified and included labor, energy, limekiln and maintenance. Within this report are the charts reflecting the expected performances.

The future operating parameters and results were also identified and designed around these constraints:

Operating Parameters	Operating Results
14,500 tons beets/day	604 tons/hour
Tare dirt	<4.0%
Extraction	82.9% on sucrose
Sucrose in the beet	17.0% on beets
Thick juice purity	90%
Main sewer loss	0.20% sucrose on beets
Diffusion loss	0.20% sucrose on beets
Lime cake loss	0.05% sucrose on beets
Standard liquor purity	92%
B-sugar purity	96%
Affinated C-sugar purity	93%
C-sugar purity	88%
Sucrose loss in molasses	14.8 tons/hour
Sucrose loss in molasses on beets	2.45%
Sucrose production	75 tons/hour
Standard liquor to storage	51.1 tons/hour
Molasses purity	60% purity
Molasses production	31.5 tons/hour at 80 brix
Draft	105%/112% (frozen)
Lime cake	28 tons/hour
Pulp press moisture	72.5% max
Beet pulp pellet production	35.6 tons/hr

An obstacle to this expansion centered on a cultural shift in how SMBSC operated as much as in selecting and installing the correct equipment. We shifted from staffing for the worst case scenario with limited scope and responsibility to a staff that is one-third smaller, adjusting to all new equipment and having greater operational discretion. The workforce was a veteran group, which was an asset since many were still here from the original start-up. It was important for them to change their skills and efforts in order for us to meet the operational needs. Workforce reduction would only come by attrition.

The expansion's initial focus involved the beet-end equipment. This was due to the current equipment's wearing as well as the slice capacity required to process beets from the increased acreage. The sugar-end modifications were scheduled to begin later. Additional thick juice storage would be utilized to offset the sugar-end constraints prior to the sugar-end completion.

Previously, the factory was decentralized with most stations essentially operating without centralized control monitoring. The expansion allowed a completely centralized area with all controls monitored and adjusted from the control room with the exception of adjustments from the boilerhouse and limekiln operations. It is important to note throughout the expansion, the workforce adjusted to this control change and their performance has been remarkable.

During the planning progress, a second turbine generator of eight mega watts was planned. In discussion with our municipal electrical power supplier it was determined a rate structure could be developed that essentially made the need to generate any electrical power unnecessary. The 10-year agreement still allows an option to export power from our existing generators if economics warrant. This unique opportunity was good for both parties but did require additional work in the summer of 1999.

The expansion project's first stage was very aggressive. Scheduling and completion were difficult the first year due to environmental permitting constraints, needing to have the wastewater treatment facility and the two steam dryers operating, and undergoing a complete electrical system change.

A majority of the equipment was installed within the existing facility structure and required the installation to be complete and operational in only 130 days. (A complete equipment listing is identified in the1997-2002 Capital Equipment Expansion outline). It became apparent that during this first campaign not only were we going to deal with the new equipment, but a near record crop was produced and had to be processed.

It took incredible effort and dedication to have the factory slicing beets on September 13, 1999. The instrumentation and control screens developed by our own employees were exceptional and allowed start-up to be remarkably trouble free. The washhouse had initial difficulty with entrained air in pumps that took time to solve. Slice, however, remained relatively constant. The major miss was the 16° angle involved with the dirty beet conveyor from dry handling to the pre-washer. The beets would not consistently convey at the selected belt speed so a 24-hour shutdown was made to change the angle to 13.66° with small cleats added to the belt to ensure optimal performance the rest of the campaign.

Another operational issue was the head pulley on the beet conveyor for both clean beets and cossettes. The problem was apparent only when we processed frozen beets, as the conveyors with the oversized lagged head pulleys and snub pulleys experienced problems of hydroplaning and consequently slippage. Ceramic head pulleys were installed which eliminated the issue. The overall campaign results showed an increase in slice, and reductions in energy, labor and limestone. The installation proved to be robust and allowed much operating flexibility.

In the factory's beet end, a common pump model was used for almost all areas. The pumps chosen are reliable and robust units from Chesteron with high chrome wear parts. By using belt drives and variable frequency drives (VFDs) it was possible to match most duties with a single pump, and some larger duties with two running parallel. In general, there are no installed spares and in the event of a failure, a spare pump can be obtained from inventory. This is one of the benefits of standardization, along with a reduction in inventory and increased familiarity for the maintenance staff.

VFDs are used extensively at Southern Minnesota Beet Sugar Cooperative in preference to control valves wherever possible. A large portion of the factory load is now powered through VFDs including the beet slicers, diffusers, pulp presses, pumps, steam dryers, batch centrifugals etc. An unusual feature is the use of steam turbines on large drives involving the boiler FD air, coal pulveriser mills, boiler feed pump and lime kiln gas compressors. These factors combine to give a relatively low electrical power demand of nine mega watts at a 500 ton per hour slice rate (20kWh per metric ton of beet).

With the two steam dryers installed, the turbo generator was taken out of service and all of the factory power is imported from a municipal power supplier via one of two 16-mega watt high voltage transformers. The supplier was able to offer low prices down to three cents/kWh for a large supply contract. This low price combined with the relatively low boiler steam pressure and the existing direct drive turbines made generation unattractive as relatively little steam was available to pass through to exhaust pressure. In the future, the turbine may be brought back into use as power prices for cogenerated electricity are rising.

An additional 1.5 - 2 mega watts are used in the water treatment plant where Broadbent decanter centrifuges are used to remove solids from the beet washing water before the anaerobic and aerobic treatments. The anaerobic and aerobic treatments result in a discharge water meeting very high water quality standards.

Total factory fuel consumption has fallen from 8% on beet standard fuel (10,000 Btu/lb or 23 MJ/kg coal basis) to around 5% on beet. This reduction is mostly due to the steam dryers that effectively eliminate the pulp dryer fuel demand previously met with natural gas. The financial savings have increased by recent high gas prices while the boilers continue to run on low priced coal. When the new evaporators and heat recovery systems are fully operational, the process steam demand will fall to 24% beet (frozen beet basis) which equates to a standard fuel demand of 3% beet:

	Fuel kWh/t Beet	Electricity kWh/t Beet	Total	kWh/t Sugar
1998	469	26	495	3325
1999/2000	293	24	317	2078
2002	176	22	198	1247

The 180-day operating campaign length was selected to give the overall best economy. The dry matter "shrink" or loss from beets increases with increasing campaign length. This effect is compounded by the reduction in sucrose yield, which can occur if storage conditions are less than perfect. The 2000 campaign experienced freezing night temperatures and above average day temperatures (86°F), which severely affected the beet before harvest and led to deterioration in storage, illustrating the vulnerability of the factory to climatic variability. For these reasons, the factory design is on the cautious side rather than aiming for a maximum 220-230 day campaign. Extensive thick juice storage combined with the molasses desugarization facility allows the sugar warehouse to be operational for most of the year, producing some 375,000 metric tons of granulated sugar per year from a single facility.

Environmentally, over 800 tons of emissions were eliminated by removing the conventional direct-fired pulp dryers and installing two fluidized steam dryers. The wastewater treatment facility was modified and expanded with the addition of an anaerobic system. The system's capacity of 1.5 million gallons per day (MGD) and an extended aeration/activated sludge system with nitrification capabilities and a hydraulic capacity of approximately two-MGD. Final clarification, effluent filtration and effluent aeration completed the treatment.

The existing ponds remained in service to treat and/or store barometric condenser water, dryer and evaporator condensates, boiler blowdown, effluent from the mechanical wastewater treatment facility (as needed) and smaller waste streams. The expanded wastewater treatment facility discharges, on a continuous basis, to a county ditch. An interesting aspect of the wastewater treatment facility involves phosphorus trading. Phosphorus trading is done not only to offset what we are discharging, but it provides a 40% reduction in phosphorus discharged to the Minnesota River. SMBSC is involved in several projects that reduce phosphorus such as use of cover crops, exclusion of cattle from streams, stream bank protection as well as other similar projects.

Due to a boiler failure in the spring of 2000, and a 20-year low in sugar prices, the stock sales slowed and the second phase of the expansion was delayed.

The new six-effect Balcke-Duerr falling film evaporators were installed and put into operation during the current 2000-2001 campaign. Given the condition of a dehydrated frost damaged beet crop this season, the short retention time and high heat transfer coefficient of the evaporators have helped greatly.

The remaining items to be addressed with the expansion include the installation of continuous pans and centrifugals for high and low raw sugar, carbonation replacement and a back-up boiler to our single pulverized coal-fired boiler.

In summary, the overall results of the expansion provided environmental improvements to land, water and air. It will also enable us to meet projected returns and clearly place Southern Minnesota Beet Sugar Cooperative as a leader in the North America factories in reducing labor and energy.

SMBSC ACREAGE EXPANSION

Year	*Stock Acres*	*Stock Sale*	*Expected Slice*	*Expected Harvest Tons*
1998	110,000	10,000	9,400	2,000,000
1999	120,000	10,000	10,800	2,225,000
2000	120,000	2,000	11,500	2,400,000
2001	123,000	0	13,000	2,600,000
2002	130,000	2,000	14,000	2,720,000
2003	140,000	2,000	14,500	2,800,000
2004	147,000	5,000	14,500	2,900,000

CAPITAL EXPLANSION PLAN

Fiscal 1998 Installations

Project Description	Capital Request (estimate)
Pre-construction	$1,000,000
Initial purchase payments For FY-99	$7,000,000
Waste water treatment	$6,800000

Fiscal 1999 Installations

Project Description	Capital Request (estimate)
Agricultural 2 pilers	$1,200,000
Dry handling of beets	$3,600,000
Wash station for beets	$5,600,000
Extraction station	$15,300,000
Pulp press station	$8,000,000
Pulp drying station	$9,200,000

Fiscal 2000 Installations

Project Description	Capital Request (estimate)
Agricultural 2 pilers and 2 new sites	$2,800,000
Powerhouse upgrade	$4,500,000
Evaporators	$8,500,000
White centrifugal upgrade	$2,000,000
Continuous hi-raw pan	$2,000,000
Tare lab upgrade	$1,000,000
Carbonation Phase 1	$2,000,000

Fiscal 2001 Installations

Project Description	Capital Request (estimate)
Agricultural 2 pilers and 2 sites	$2,800,000
Carbonation Phase 2	$2,500,000
White pan modifications	$2,000,000
Pond improvements	$2,800,000
Pulp pellet loading and storage improvements	$3,500,000
Juice storage	$2,000,000
White sugar loading and packaging	$3,500,000

Fiscal 2002 Installations

Project Description	Capital Request (estimate)
Agricultural 1 piler and 1 site	$1,400,000
Water management	$1,200,000
Affination	$ 800,000

Southern Minnesota Beet Sugar Cooperative
1997 to 2002 Capital Expansion Plan

Beet End Installations

Beet Receiving
- Receiving System Concrete Station
  6 - Drive over truck hoppers (max 250 Tons/Hr ea.)
  Hydraulic controlled conveyors
  2 – 60' Hydraulic controlled truck side dumping units
  2 – Self-dumping high capacity yard truck stations
  Above to supply factory with a total 750 Tons/Hr. PLC controlled for a total capacity of 18,000 tons/day
  Designed by Dakota Machine Inc.
  Installed by North Central Construction Inc.

Beet Washing
- Beet Pre-washing Drum (for dry beet feeding)
  92' long x 16' diameter, total through put capacity of 18,000 tons/day
  3 compartments: prewashing, water separation, and washing
  Friction tire double electric drive system
  (1 ¼" shell thickness w/ 3CR12 internals)
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

- Beet Washing Drum (for dry beet feeding)
  50' long x 14' diameter, total through put capacity of 18,000 tons/day
  3 compartments: prewashing, water separation, and washing
  Friction tire double drive system
  (1 ¼" shell thickness w/ 3CR12 internals)
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

- Stone Catchers (2)
  Rotary drum type, 13' diameter
  12 rock catching pockets with discharge chutes
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

- Fork Type Weed Catcher
  Designed by MAGUIN (Fr.), Installed by North Central Construction Inc.

- Sand Catcher

Rotary drum type, 9' diameter
8 sand catching pockets
Designed by MAGUIN (Fr.)
Installed by North Central Construction Inc.

- Vibrating Screens (2), Weed Washing, Sand Screening
  Designed by FMC (USA)
  Installed by North Central Construction Inc.

- Weed and Chip Separator
  Separates weeds & chips from wash water
  By means of a Dynamic separator discharges beet chips onto clean beet belt, & discharges weeds to weed washing station.
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

- Beet Screw
  6' Diameter x 32' long 3CR12 screw
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

- Final Washer
  High pressure spray bar washing table with reciprocating motion
  Designed by MAGUIN (Fr.)
  Installed by North Central Construction Inc.

Beet Slicing

- Beet Slicer Hopper
  500 Ton capacity (45 min @ 16,000 Ton/Day Slice)
  Designed by SMBSC

- Putsch Slicers (3) (model 2200-22-600)
  Horizontal drum type slicer
  Approx. capacity of 430 ton/hr unfrozen beets per unit/10,000 tons/day ea.
  Designed by Putsch, (Ger.)

Extraction

- Countercurrent Cossette Mixer
  Feed hopper, mixer body, AC drive shaft mounted, defoaming screens, mixer conveying shaft
  Designed by BMA (Ger.)

- Extraction Tower (2)
  Vertical design, bottom cossette feed, top cossette discharge, internal flighting 3CR12, 25' diameter x 110' tall
  VFD top shaft mounted drive system
  Designed by BMA (Ger.)

Pulp Pressing

- Vertical Tower Presses (2 per extraction tower) model HP 4000
  Vertical design, upper feed, center spindle, screened internal shell for water, juice, & pulp separation
  16' diameter x 60' tall
  Bottom Mounted 10 unit drive system
  Designed by BMA (Ger.)

Pulp Drying

- Vertical Steam Pulp Dryer (2) Size H
  Pressurized fluid bed type
  35' diameter x 60' tall
  Designed by EnerDry ApS (DK) (NIRO)

Pellet Cooling

- Vertical pellet coolers (4)
  Model: CPM 2GA2 vertical coolers
  Approx. 3.6 Ton/Hr/unit, retention time 5 min.
  Designed by California Pellet Mill

Sugar End Installations

Evaporation

- 6 Effect Plate Type Falling Film Evaporator
  Approx. 430,600 total ft^2
  300,000 lbs./hr steam introduced, 733 ton/hr juice rate, evaporation to 70 brix
  50% juice to storage, remainder processed to white sugar
  Evaporator design by Balcke Duerr

Juice Heating

- Alfa Laval plate type multipass heat exchangers
  Models: MA-30SMFM, M-20MFG
  Extraction heaters: 7 heaters totaling 13,154 ft^2
  Raw juice heaters: 6 heaters totaling 19,858 ft^2
  Carbonation heaters: 4 heaters totaling 17,661 ft^2
  Thin juice heaters: 5 heaters totaling 8,864 ft^2
  Wastewater heaters: 2 totaling 6,232 ft^2

High/Low Raw Continuous Centrifugals

- Continuous Centrifugals (7)
  High Raw
  Normal Station Throughput: 75.4 Ton/Hr
  Max Station Throughput: 90.4 Ton/Hr
  Low Raw
  Normal Throughput: 33.4 Ton/Hr
  Max Throughput: 40.1 Ton/Hr
  30 degree basket, 1,300mm basket
  Operating Speed: 1,885 RPM
  Designed by BMA (Ger.)

White Centrifugals

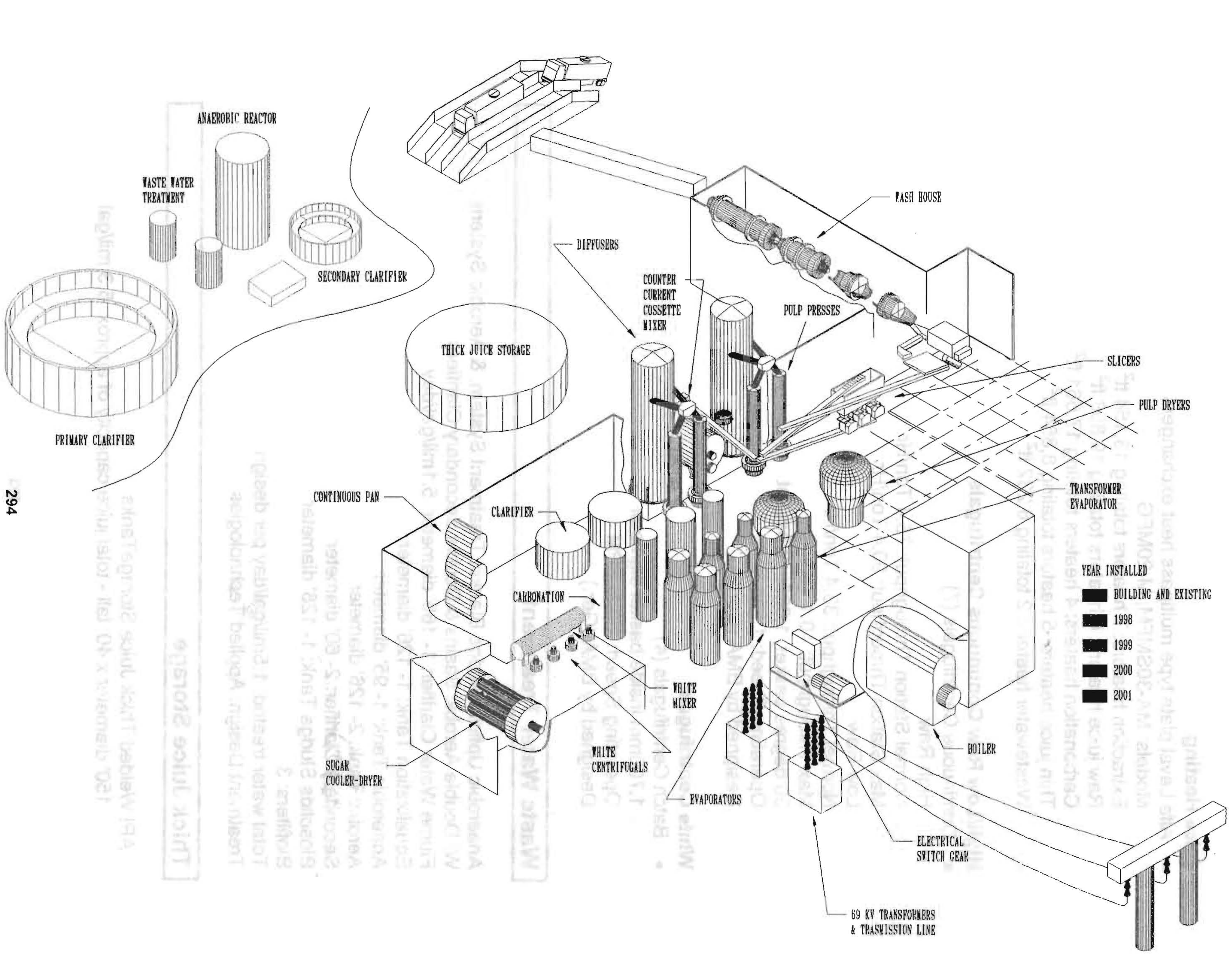
- Batch Centrifugals (4)
  1,700mm inside basket diameter
  Operating Speed: 1,030 RPM
  Designed by BMA (Ger.)

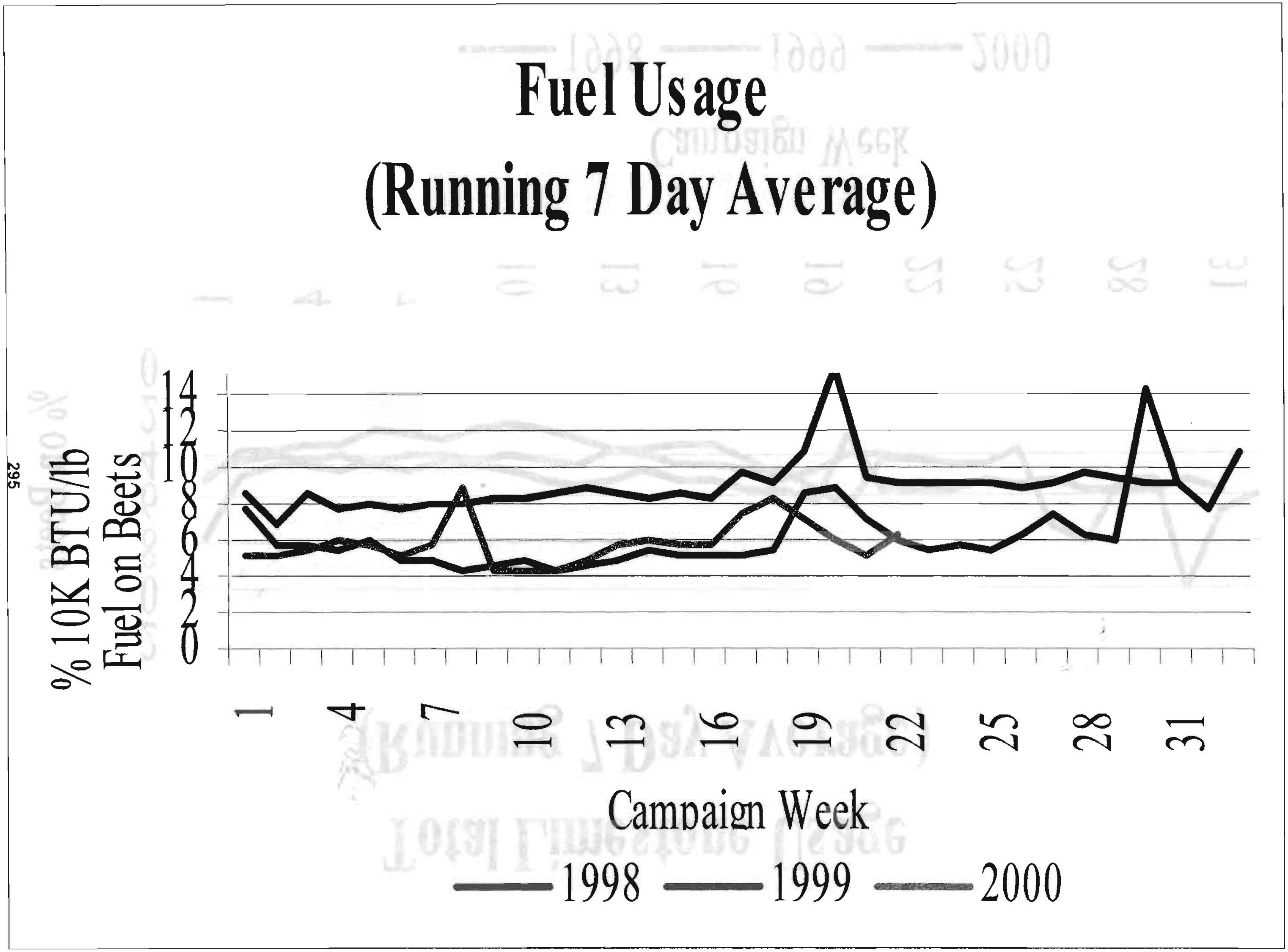
Waste Water Treatment

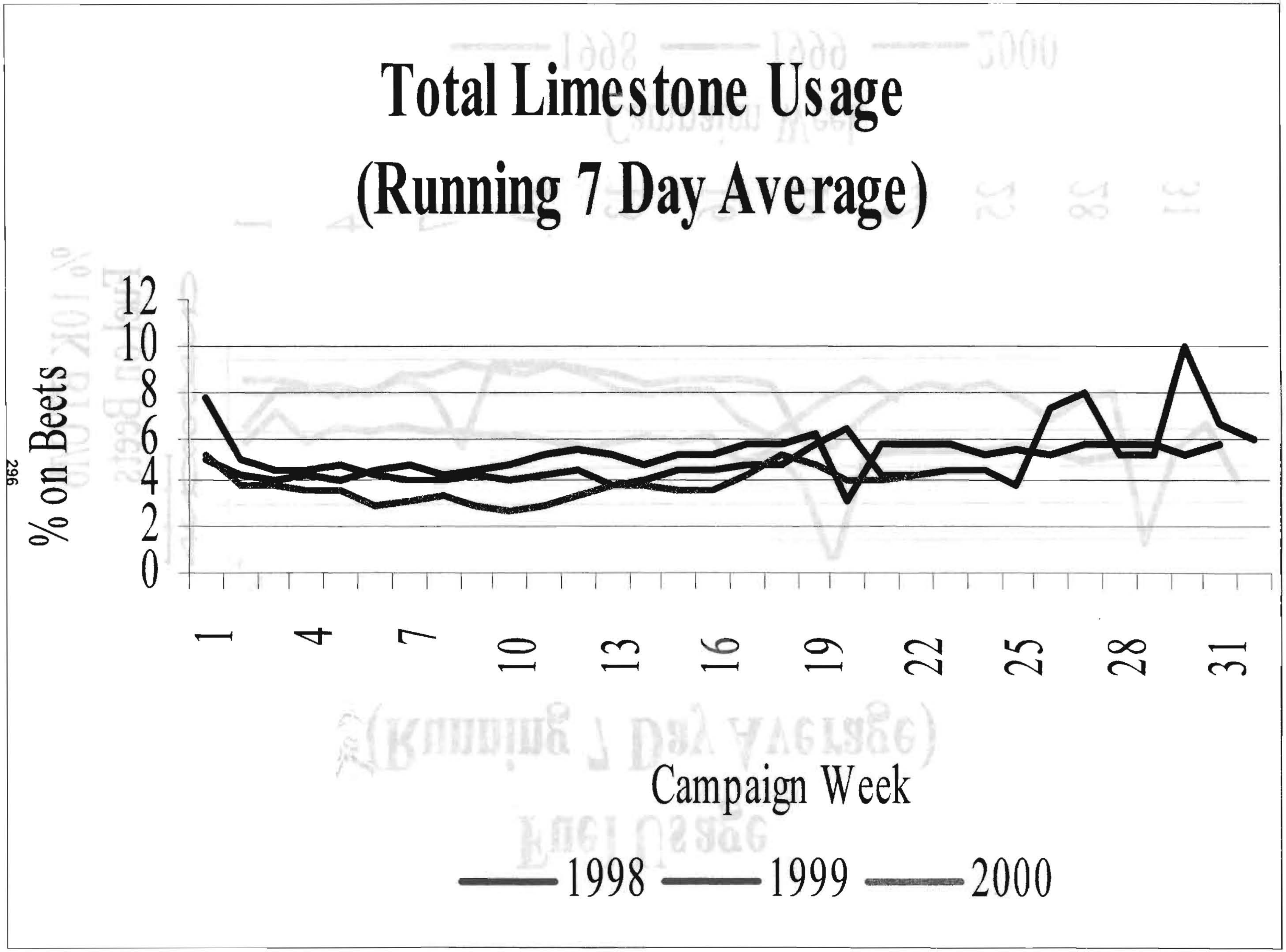
Anaerobic Upflow Sludge Blanket Treatment System, & Aerobic System
W/ Double Aerobic Basins & Double Secondary Clarifiers
Flume Water Clarifier: 1- 160' diameter 5.1mil/gal/day
Equalization Tank: 1- 126' diameter
Anaerobic Tank: 1- 95' diameter
Aerobic Tank: 2- 126' diameter
Secondary Clarifier: 2- 60' diameter
Biosolids Sludge Tank: 1- 126' diameter
Biofilters: 3
Total water treated: 1.5mil/gal/day per design
Treatment Design: Applied Technologies

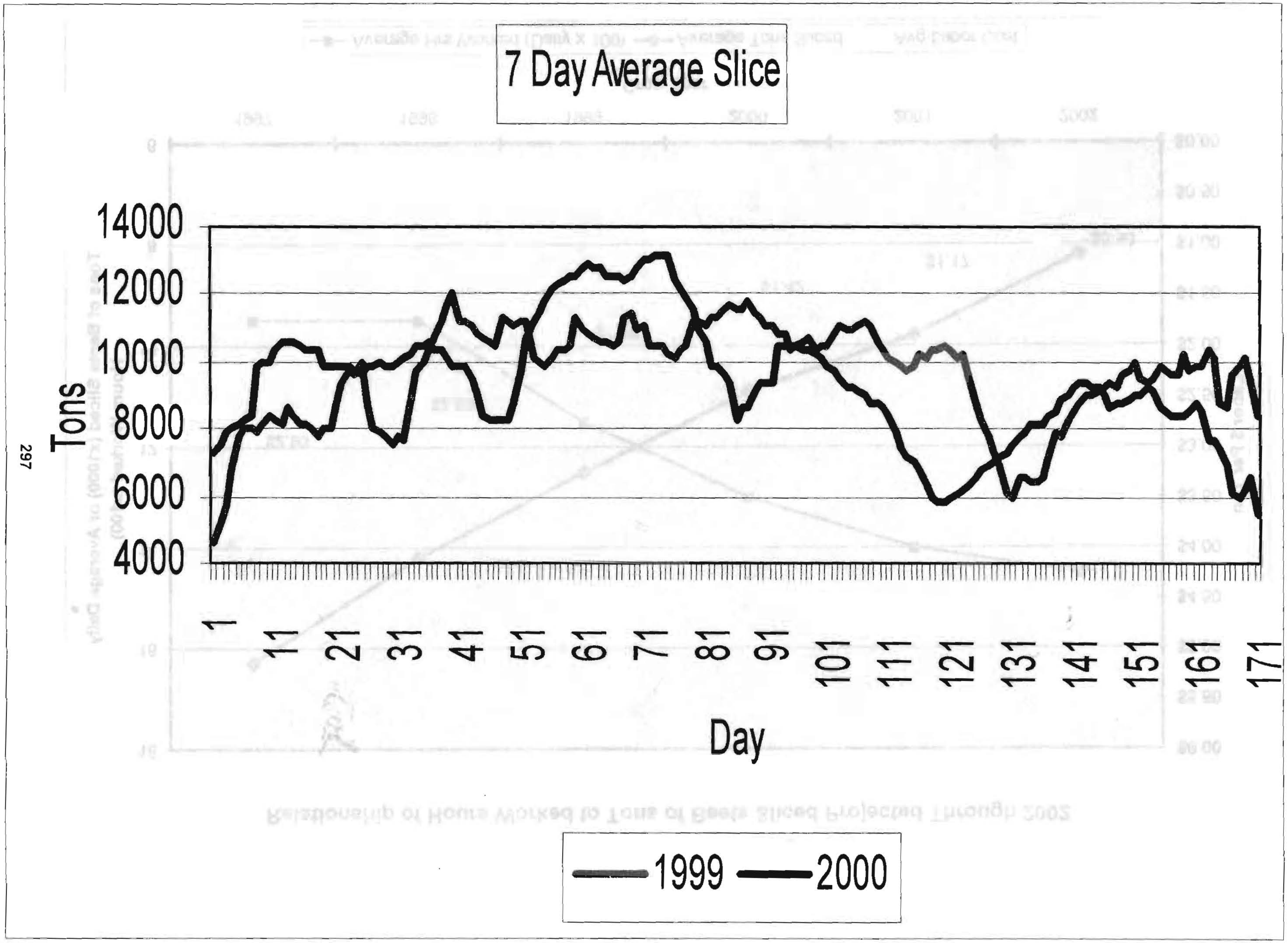
Thick Juice Storage

3 API Welded Thick Juice StorageTanks
150' diameter x 40' tall - total juice capacity of approx. 5.3 mil/gal

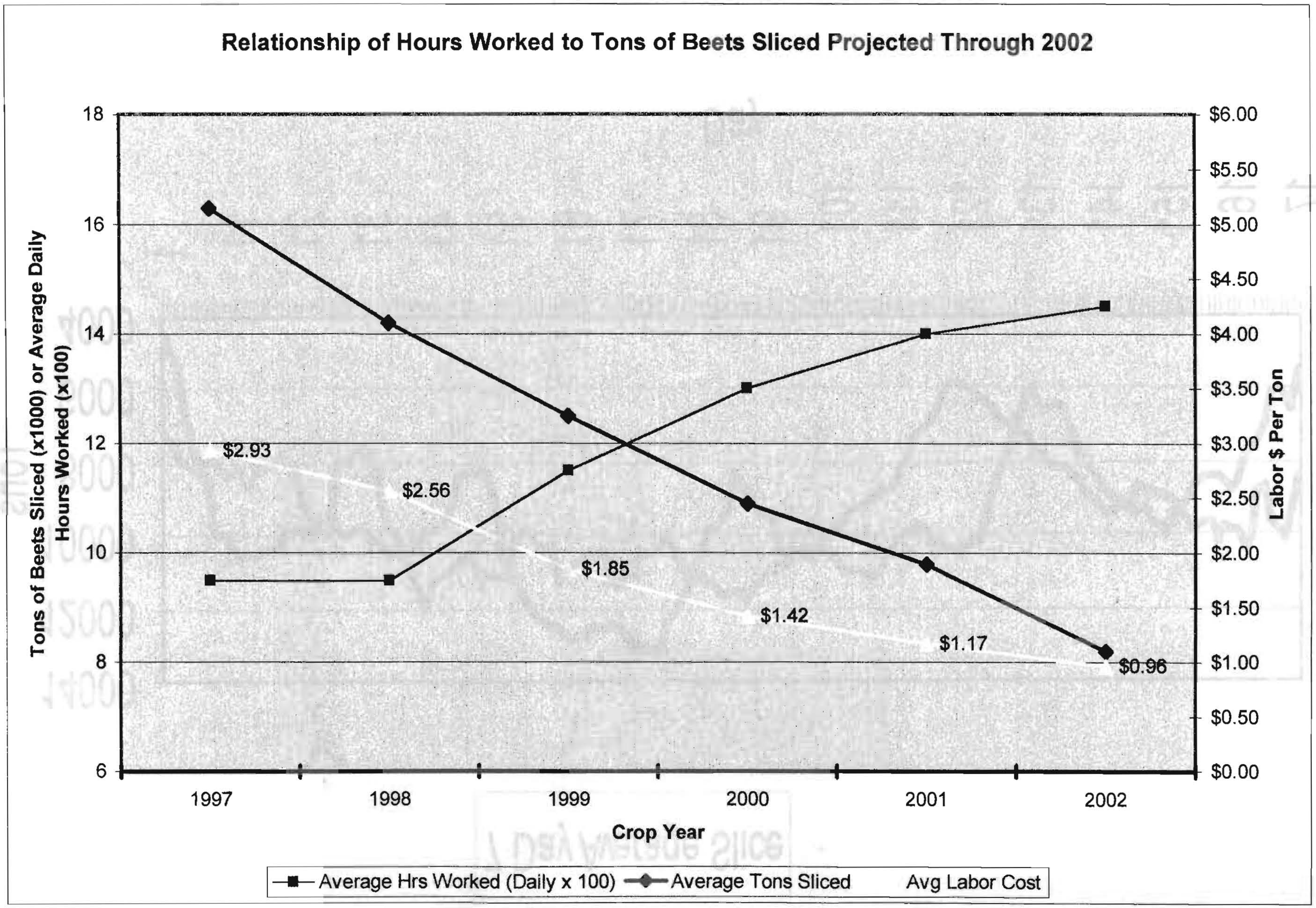

ANAEROBIC REACTOR
WASTE WATER TREATMENT
SECONDARY CLARIFIER
PRIMARY CLARIFIER
THICK JUICE STORAGE
DIFFUSERS
COUNTER CURRENT COSSETTE MIXER
WASH HOUSE
PULP PRESSES
SLICERS
PULP DRYERS
TRANSFORMER EVAPORATOR
CONTINUOUS PAN
CLARIFIER
CARBONATION
WHITE MIXER
WHITE CENTRIFUGALS
SUGAR COOLER-DRYER
EVAPORATORS
YEAR INSTALLED
BUILDING AND EXISTING
1998
1999
2000
2001
BOILER
ELECTRICAL SWITCH GEAR
69 KV TRANSFORMERS & TRASMISSION LINE

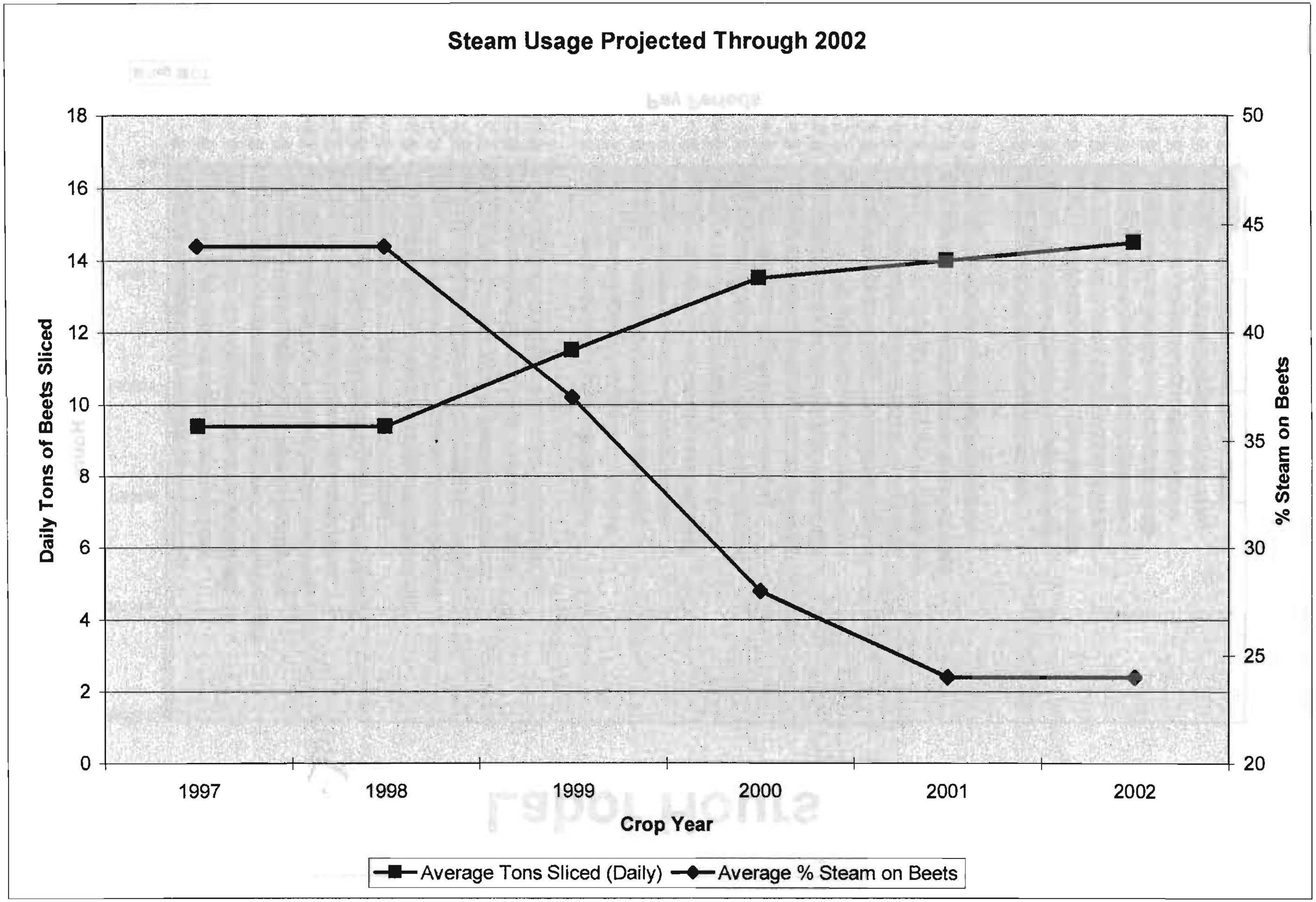

Fuel Usage
(Running 7 Day Average)
% 10K BTU/lb
Fuel on Beets
0
2
4
6
8
10
12
14
1
4
7
10
13
16
19
22
25
28
31
Campaign Week
1998
1999
2000

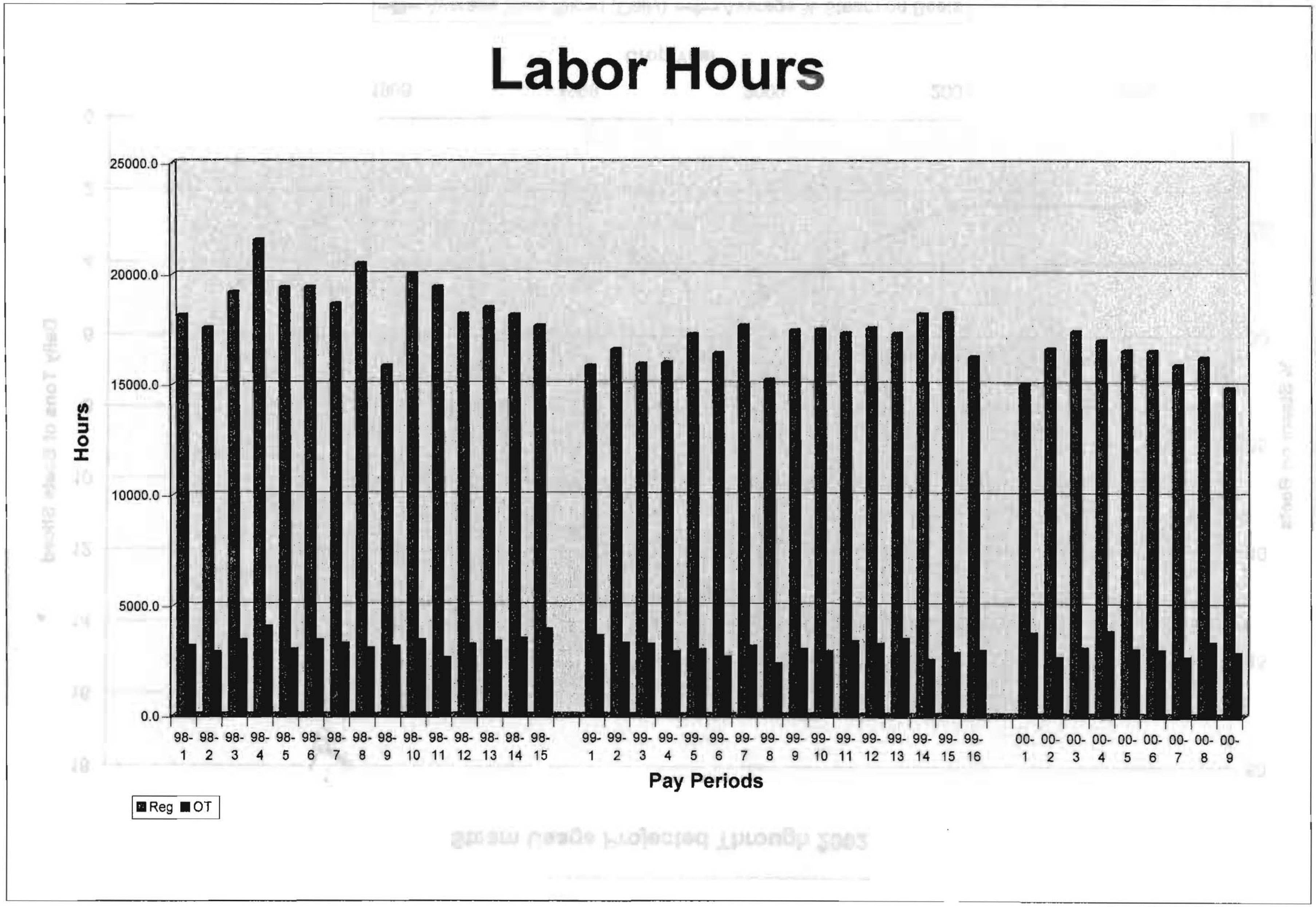

Total Limestone Usage
(Running 7 Day Average)
% on Beets
0
2
4
6
8
10
12
1
4
7
10
13
16
19
22
25
28
31
Campaign Week
1998
1999
2000



7 Day Average Slice
14000
12000
10000
8000
6000
4000
Tons
1
11
21
31
41
51
61
71
81
91
101
111
121
131
141
151
161
171
Day
1999
2000


Relationship of Hours Worked to Tons of Beets Sliced Projected Through 2002
Tons of Beets Sliced (x1000) or Average Daily Hours Worked (x100)
18
16
14
12
10
8
6
$6.00
$5.50
$5.00
$4.50
$4.00
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Labor $ Per Ton
$2.93
$2.56
$1.85
$1.42
$1.17
$0.96
1997
1998
1999
2000
2001
2002
Crop Year
Average Hrs Worked (Daily x 100)
Average Tons Sliced
Avg Labor Cost


Steam Usage Projected Through 2002
Daily Tons of Beets Sliced
% Steam on Beets
Crop Year
1997
1998
1999
2000
2001
2002
Average Tons Sliced (Daily)
Average % Steam on Beets



Labor Hours
Hours
25000.0
20000.0
15000.0
10000.0
5000.0
0.0
98-1 98-2 98-3 98-4 98-5 98-6 98-7 98-8 98-9 98-10 98-11 98-12 98-13 98-14 98-15
99-1 99-2 99-3 99-4 99-5 99-6 99-7 99-8 99-9 99-10 99-11 99-12 99-13 99-14 99-15 99-16
00-1 00-2 00-3 00-4 00-5 00-6 00-7 00-8 00-9
Pay Periods
Reg
OT