Colorado Governor's Office Energy Management and Conservation

# **Environmental Systems**

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# **Combined Energy Management Feasibility Study**

Evaluation of Combining Anaerobic Digestion and Geothermal Exchange Technology at the Proposed Lusk Dairy Facility in Springfield, Colorado

# TABLE OF CONTENTS

General Project Assessment	3
Project Overview	3
Contributing Parties and Background Information	3
Water and Waste Assessment	4
Overview	4
Dairy Design Criteria	5
Dairy and Feed Mill Energy Assessment	5
Facility Management	7
Manure Management	7
Design Criteria	8
System Designs	8
Budget Costs	8
Energy Potential	9
AD Cost Benefit – Summary	11
Review of Potential Costs and Benefits	11
Overview	11
Specific Site Considerations	11
Summary	12
Ground Source Heat System	13
Project Overview	13
Heating and Cooling Demands	13
Milk Cooling	14
Ground Source Heat Exchange System Options	15
Alternative 1: Full Milk Cooling and Slurry Heating	15

	Alternative 2: Partial Milk Cooling and Full Slurry Heating	.16
	Alternative 3: Slurry Heating Only	.17
	GSHP Application Summary	18
	Final Analysis Pending	19
AD	and GSHP Energy Systems Summary	.20
	Anaerobic Digestion Technology Application	.20
	GSHP Technology Application	.20
	Attachment 1 – AD Project Cost Details	.22



### **Project Overview**

This feasibility study evaluates financial and energy impacts of combining two renewable energy technologies on a single project site. The available options of biogas generation from anaerobic digestion of manure and geothermal heating and cooling via ground source heat exchange are being considered. Biogas, generated through anaerobic digestion of dairy cow manure has a long but spotty history of success in the dairy industry. Geothermal heating and cooling through ground source heat exchange technology is gaining prominence as energy costs continue rising to levels where significant capital investment can be offset by lower long term net energy requirements. Both of the technologies being considered here have positive energy management potential at this site due to prevailing high costs of both electricity and natural gas.

The overall project considers the facility requirements for a prospective 3,000 milking head integrated dairy and feed mill operation. The project is being considered by the Lusk family due to the presence of the following key economic advantages at their existing farming location.

- Close proximity to primary feed source that reduces feed costs
- Adequate renewable water source and quality
- Positive weather patterns
- Excellent topographic characteristics
- Adequate proximal land for manure management of a large dairy
- Isolated location to minimize neighboring community issues
- Proximity to existing and planned dairy processing facilities
- High water demands that can be used as heat source and/or sink

Completion of this study requires compilation and integration of background planning data for the Lusk dairy facility operation along with technical and financial analysis of each contributing component. This is accomplished by requesting, reviewing and analyzing the detailed facility information available from the owner and his respective system and equipment contractors and vendors.

# **Contributing Parties and Background Information**

The parties involved and their role in developing and/or providing information for this project study are shown below:

- 1) Office of Energy Management and Conservation Project Funding, Review and Approval
- 2) Environmental Systems and Solutions LLC General Project Management and Anaerobic Digestion System Engineering
- 3) EMC, Engineers Ground Source Heat Exchange Engineering
- 4) Lusk Feed Lots Project Owner
- 5) Mason Dairy Contractors Dairy Facility Design and Construction
- 6) Ferrell-Ross, Inc. Feed Mill Design and Construction

The following background information was requested from the Lusk Feed Lots and the two prime facility contractors:

- 1) Facility Site Plans
- 2) Milking Parlor Building Plans
- 3) Free Stall Layouts
- 4) Manure management plan
- 5) List of all electrical and gas operated equipment
- 6) Mechanical and electrical drawings
- 7) List of all heating and cooling equipment and specifications
- 8) Projected run times and demands for all equipment
- **9)** Any energy evaluations and projections available relative to the projected operations costs for this facility

The Lusk dairy project is in the conceptual planning stage and as such, the contractors and vendors were able to provide budget level information relative to all the above requests. Similarly, they were able to provide budget level operations information relative to power, thermal and water usage. In the following sections, the information has been compiled for analysis relative to integration with manure biogas energy potential and geothermal heating and cooling potential.

# Water and Waste Assessment

# Overview

This 3,000 milking head dairy is considered a large facility by most standards. As free stall designs and high producing milking systems have been developed, dairy herd sizes have continued to increase from the 'large' dairies of the past less than 1,000 head. With the larger sizes have come larger overall system challenges related to feed supply and handling, water supply and conservation, waste management and disposal and energy

use and conservation. The primary driving force for the large modern dairy is reduced overall unit production costs which can only be optimized through application of detailed system planning and engineering efforts. This study's goal is to evaluate the optimal net potential renewable energy system for this site.

# **Dairy Design Criteria**

The general basis of design for this dairy is tabulated below in **Table 1 – Lusk Dairy Basis for Design** and provides the criteria used by the vendors and contractors in establishing the facility needs.

Table T - Lusk Dairy Basis for Design							
Component	Design Parameter						
Parlor design	Rotary Floor						
Design Head	3,500						
Milking Head:	3,000						
Milk; lb/day/Head	65						
GPD/Head	7.7						
Initial Milk Temp	100 F						
Target Milk Temp to Storage	32 F						
Milk Flow Rate (lb/min)	155 (~18gpm)						
Ground H <sub>2</sub> O Temp	58 F						
Water Consumed (gpd/cow)	40						
Consumptive Water Flow (gpd/gpm)	120,000/83						
General Water Uses (gpd/gpm)	50,000/34						
Manure Production (gpd/cow)	13						
Solids Level (% TS)	12						
Manure Production (lbs/cow/day)	120						
Manure Production (gpm)	40						
Design Manure Temp	60 F						

Table	1	-	Lusk	Dairv	Basis	for	Design

Note: Milking operations are 21 hours each day with 3 hours for extensive facility and process cleaning

# Dairy and Feed Mill Energy Assessment

The primary energy uses on the Lusk dairy and feed mill consist of the following:

- 1) Milk Cooling
- 2) Cow Cooling (seasonal use of 200 1 HP Fans)
- **3)** Parlor Cooling (Continuous use of 60 1 HP Fans)
- 4) Parlor Lighting and Parlor Heating (radiant only; when outside temps are < 32F)
- 5) Freestall and yard lighting
- 6) Well/water supply pumps
- 7) Irrigation pumps

- 8) Water Distribution pumps
- 9) Feed Mill Equipment Motors
- 10) Feed Mill Boiler

The energy required to operate the proposed facility is based upon the facilities required to provide adequate support to service the above design criteria and general demands. **Table 2 – Dairy Energy Requirements** indicates the energy demands expected of the milking operations and **Table 3 – Feed Mill Energy Requirements** indicates the energy demands expected to process the cattle feed for onsite use.

1 4 6 1 6									
	% Run	kWh	\$/day	\$/Yr					
Major Equipment	80%	6,049	\$ 544	\$198,714					
Seasonal Fans	40%	1,825	\$ 164	\$ 59,967					
Small Equipment	60%	500	\$45	\$ 16,425					
Total		8,375	\$ 754	\$ 275,105					

Table 2 - Dairy Energy Requirements

Note: Power cost is assumed at \$0.09/kw-hr

	Total HP	HP-Hr/Day	kWh /Day	\$/Day
Total Electrical per day	284.58	2,697	2,011	\$ 181
Annual Electrical (350 days)				\$ 63,351
	MBTU/Hr	HP	MBTU/day	\$/Day
Gas Boiler Firing Rate	<b>MBTU/Hr</b> 10.5	<b>HP</b> 250	MBTU/day 126	<b>\$/Day</b> \$ 1,260

Table 3 - Feed Mill Energy Requirements

Note: Power cost is assumed at \$0.09/kw-hr; Gas is assumed at \$10.00/MBtu

The energy use patterns of each facility are substantially different which will be factored into the best energy recovery solution in the final assessment. In general, the dairy base load will occur for approximately 21 hours each day when the normal milking operations are active. When not milking, the milk cooling demand will be gone and the primary demand will be for electrical needs. These will be limited to fans, lighting and water supply pumps.

Unlike the dairy demand, the feed mill demands are focused over 12 hours each day. This pattern provides a special challenge to a biogas production facility that optimally functions on a continuous basis. The greatest single energy demand and cost is the gasfired boiler providing steam for the corn flaking operation. Optimal use of onsite biogas for this application will require up to 12 or more hours of storage capacity and will be compared in capital and operations costs to continuous production of electricity and low level heat from an engine generator.

#### Facility Management

#### **Manure Management**

A wide variety of manure management approaches can be applied on large dairies such as the proposed Lusk operation. If not extensively evaluated, very expensive and inefficient operations can result. However, if example operations can be found to compare, an efficient and optimally profitable program can be developed. The factors considered when developing the best approach are:

- 1) Bedding Material (straw, shredded paper, wood(chips, sawdust), compost, sand)
- 2) Bedding material recovery
- 3) Final manure disposal options
- 4) Scrape
- 5) Scrape and Flush
- 6) Vacuum collection
- 7) Flush

All of the above issues were reviewed with the owner and the facility designers. After extensive consideration of known manure handling issues as they relate to facilities of this size, this operation will use a scrape and flush approach to move manure to the central collection pit. This combination will result in a target manure solids level of ~8% and will facilitate efficient fiber recovery through screening and composting operations. A majority of the compost will be used as bedding and excess compost will be used for soils conditioning in the feed production areas adjacent to the dairy operation. A portion will also be made available for sale to outside parties depending on the local and regional demand. There are several examples of successful composting operations in Colorado that utilize compost in conjunction with normal fertilizer applications and are seeing measurable and profitable benefit to themselves and commercial customers.

With the above decision, the plug flow anaerobic digestion option is essentially eliminated from further consideration due to the low solids concentration. The primary anaerobic digestion options for the Lusk Dairy are:

- 1) Covered lagoon
- 2) Partial or Complete mechanical mix
- 3) Upright cylinder

#### **General Dairy Layout**

A critical component in a large modern dairy is the physical layout. Due to the size and complexity of these facilities, animal behavior, physical needs, regular feeding and manure handling must be properly integrated and designed to minimize operations costs. In cooperation with Mason Dairy Contractors (MDC), a general layout has been developed

that is illustrated in **Figure 1 – Lusk Dairy General Facility Layout**. This geometry will be integrated into the Lusk site such that the low point will be where the manure collection pit is shown. This approach facilitates both ease in manure management and efficient hydraulic flushing of the slabs to maintain a clean operation.

# Design Criteria

Based on the previously described manure management plan at this facility, the basic design criteria that can be considered appropriate for each process at this location are listed below:

	Technology					
Criteria	Covered Lagoon	Complete Mix	Upright Cylinder			
Detention Time	46 Days	17 Days	7 Days			
Required Volume	2,600,000 gallons	960,000 gallons	400,000 gallons			
Loading Rate	7.5 lbs VS/1000 ft <sup>3</sup> /day	20 lbs VS/1000 ft <sup>3</sup> /day	50 lbs VS/1000 ft <sup>3</sup> /day			
Liquid Depth	15 Feet	38 Feet	46 Feet			
Cover Design	Insulated Membrane	Fixed	Fixed			
Mechanical Mixing	Bottom Submersible	External Pump	External Pump			
Hydraulic Mixing	Top Pump with Piping	External Pump	External Pump			
Biogas Storage	None	None	None			
Flare	Candle	Candle	Candle			
Energy Recovery- Boiler	125 HP – 5.6 MBtu/hr	125 HP – 5.6 MBtu/hr	125 HP – 5.6 MBtu/hr			
Electrical Energy Recovery	450 KW	450 KW	450 KW			
Feed Solids % TS	4-8	4-8	4-8			
Manure Heating	NA	.8 MBtu/Hr	.8 MBtu/Hr			
Heat Maintenance	NA	.021 MBtu/Hr	.025 MBtu/Hr			

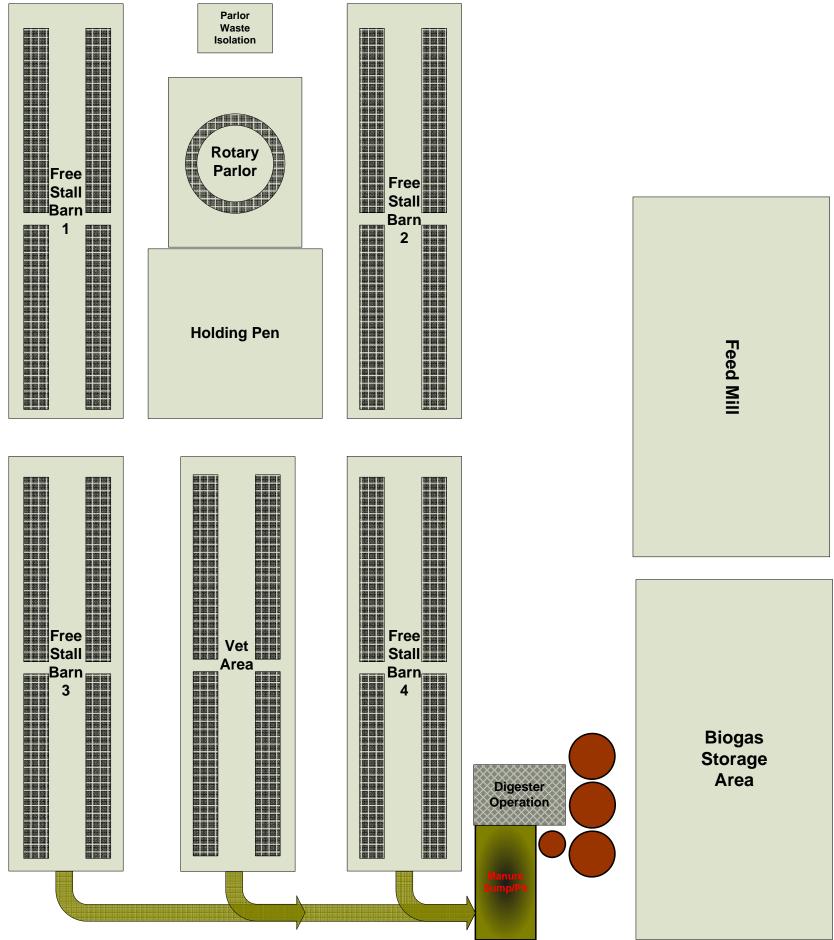
Table 4 - Digester Design Criteria

# System Designs

In order to develop general budget estimates of the above designs, preliminary process flow diagrams were prepared for each system. These diagrams provide a general illustration of the required components and in conjunction with the general site layout and design criteria provide a basis for developing a system estimate. The process flow diagrams are; Figure 2 – Covered Lagoon Digester; Figure 3 – Complete Mix Digester; Figure 4 – Upright Cylinder Digester

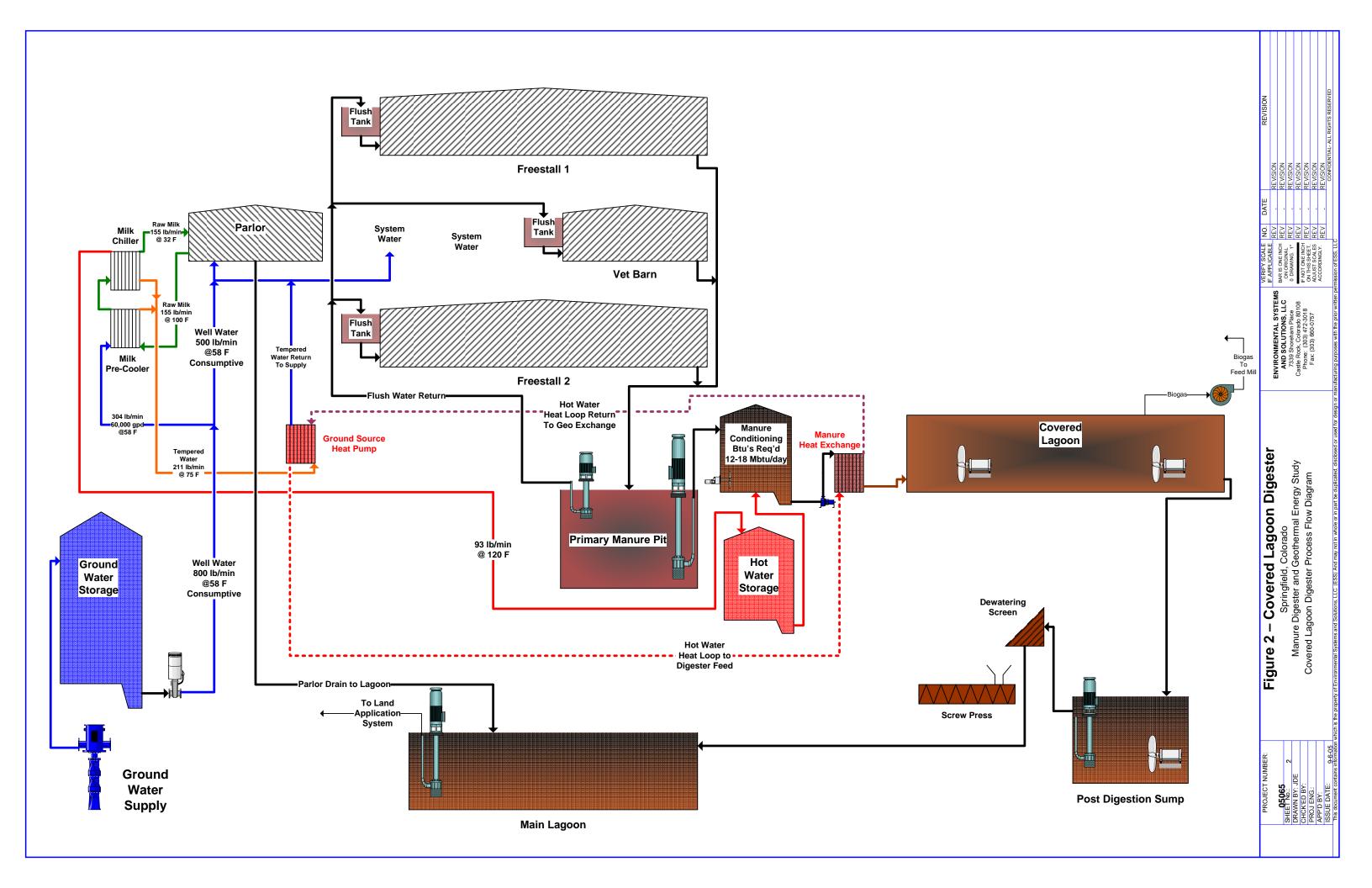
# **Budget Costs**

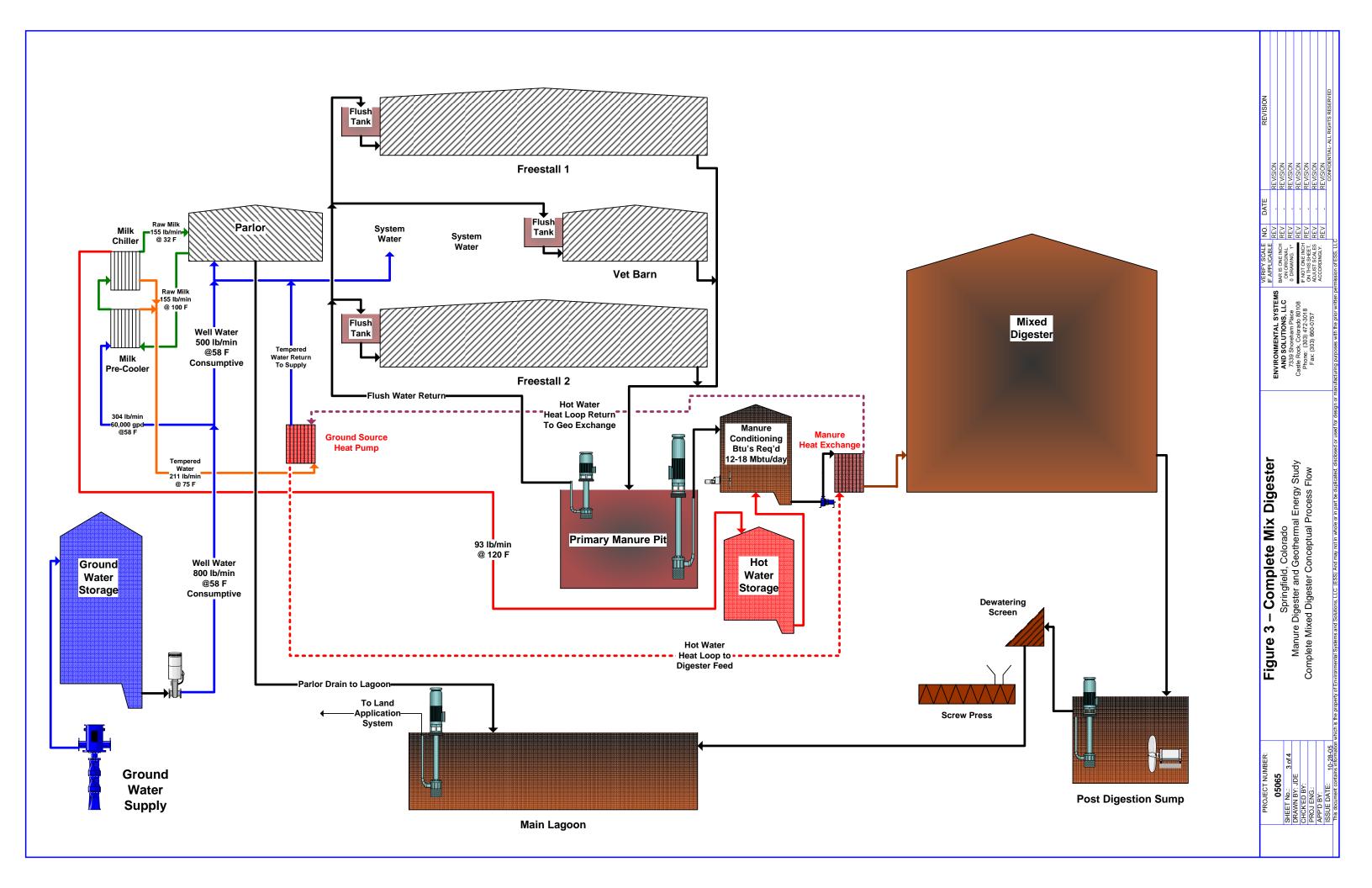
With the above systems being considered appropriate general technology, a preliminary design and construction estimate has been prepared for each of the alternatives. **Table 5** – **System Cost Estimates** below provides a summary of the estimated capital costs. The detailed basis for each estimate is provided as **Attachment 1** – **Detailed Project Estimates**. These estimates represent a compilation of components for a complete system capable of producing and delivering biogas to a final utilization point. These values do not reflect costs for handling manure before and after the systems nor do they

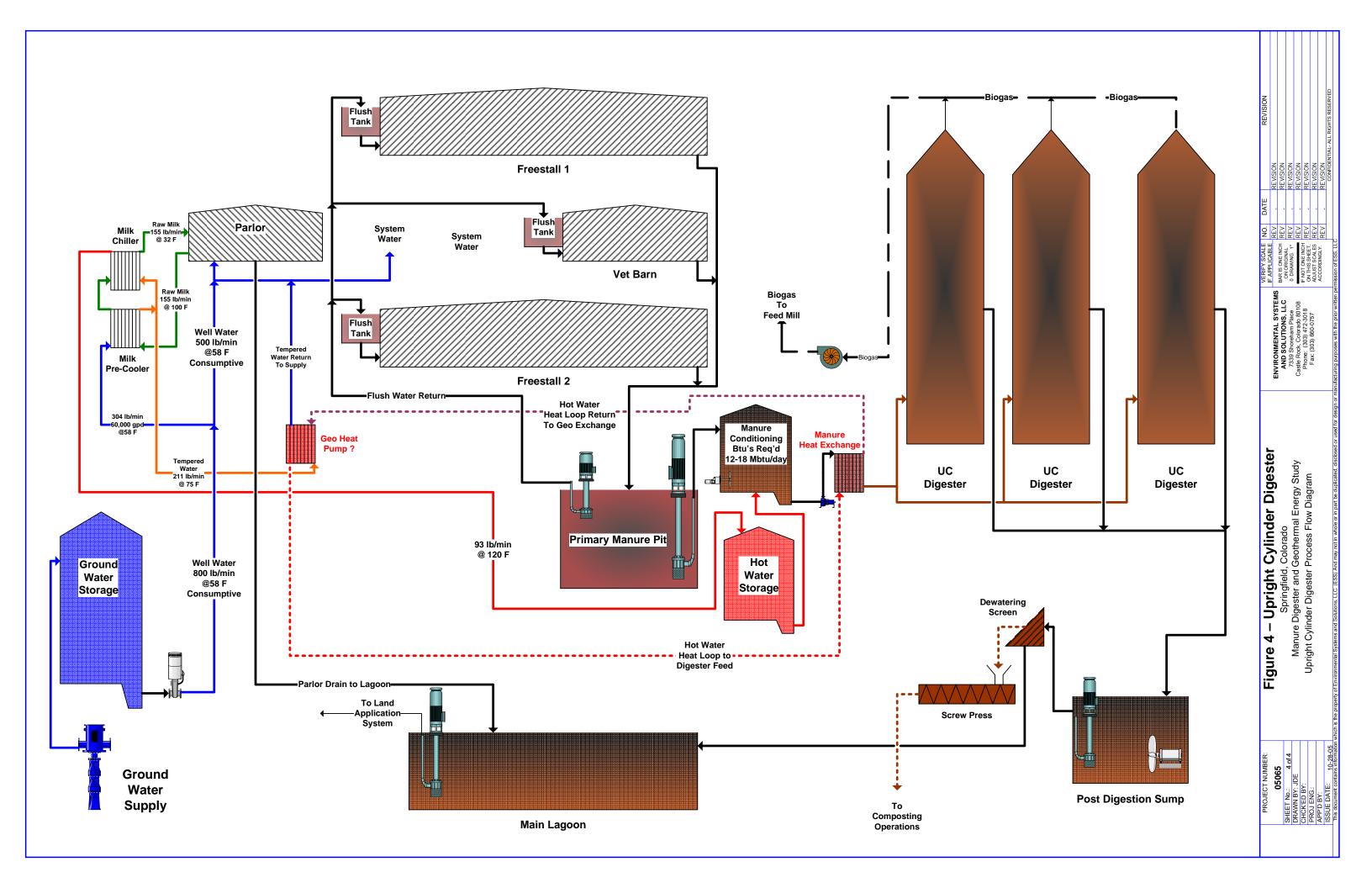


PROJECT NUMBER: 05065 SHEET ND: 1 of 4 SHEET ND: 1 of 4 SHEET BP: SHEET BP: SHEET BP: SHOL PLO: SHOL PLO:	Figure 1 – Lusk Dairy General Facility Layout Springfield, Colorado Manure Digester and Geothermal Energy Study General Facility Conceptual Layout	INVIRONMENTAL SYSTEMS AND SOLUTIONS, LLC 7399 Shoreham Place Castle Rock, Calorado 80108 Phone: (303) 472-3018 Fax: (303) 660-0757	VERIFY SCALE NO. IF APPLICABLE REV BAR ISON ORIGINAL 0 ORIGINAL 1 POTO	DATE	REVISION REVISION REVISION REVISION REVISION REVISION REVISION REVISION
ISSUE DATE: 10-28-05					CONFIDENTIAL- ALL RIGHTS RESERVED

# Composting







include the costs for and electrical production system. Complete electrical production equipment is currently running at approximately \$1,100/kw.

Lusk Dairy Farm Digester System – 3,000 Head							
		Covered Lagoon	UC Digester			CM Digester	
General Conditions	\$	22,000	\$	26,000	\$	33,500	
Engineering	\$	43,100	\$	53,300	\$	51,575	
Site Work	\$	349,250	\$	92,500	\$	79,500	
Finishes	\$	3,500	\$	7,500	\$	5,000	
Tanks & Metals	\$	57,630	\$	485,880	\$	931,630	
Equipment	\$	97,800	\$	115,400	\$	89,400	
Instrumentation	\$	30,200	\$	40,700	\$	30,200	
Mechanical Systems	\$	78,000	\$	78,250	\$	62,750	
Electrical Equipment	\$	74,250	\$	76,750	\$	74,250	
Total	\$	755,730	\$	965,780	\$	1,357,805	
Contingency	\$	188,933	\$	244,070	\$	339,451	
Total – Biogas Only	\$	906,876	\$	1,220,350	\$	1,629,366	
	_					_	
Cost Per Head – Biogas Only	\$	315	\$	407	\$	566	
Engine Generator System	\$	412,500	\$	412,500	\$	412,500	
Total	\$	1,319,376	\$	1,632,850	\$	2,041,866	
Cost Per Head w/ Electricity	\$	436	\$	544	\$	680	

Table	5	- Svs	tem	Cost	Estimates
Tuble	-	- 0,3	conn	0031	Lotinutes

# **Energy Potential**

The only reason for considering a manure digester at this facility is the potential renewable energy available. The gross energy potential estimated from this facility is based upon an assessment of field results and literature review. The values are generally considered conservative in that some facilities with proactive and attentive manure management techniques have shown greater yield results than those projected here. The following excerpt from an agency review (The Minnesota Project 2002) of the Tom Haubenschilds dairy digestion project near Princeton, Minnesota illustrates the possible range; *with 425 cows, the biogas output per cow was almost twice projections – with 750 cows, the output per cow has come down somewhat to about 40 percent above projections. Haubenschild's cows are producing about 50 percent more manure per cow than the digester was engineered for, which somewhat explains the high biogas production per cow.* Also, only the production head numbers are used. If properly managed, dry and heifer cows can contribute up to 25% more production potential. Since dry and heifer cows are often managed in areas where manure handling is less frequent and much more labor and equipment intensive, that source often only goes to composting.

Based on general industry values, 1,000 lactating production cows will produce approximately 1,800 cubic feet of manure each day from which approximately 40  $\rm ft^3$  of biogas per ft<sup>3</sup> of manure at 600/Btu/ft<sup>3</sup> can be expected. The daily Btu value per 1,000

cows is approximately 43.2 million Btu's (MBtu). On a 3,000 head dairy this will translate to approximately 130 MBtu's daily. At current natural gas equivalent pricing of \$10/MBtu, an annual energy value of around \$475,000 (\$1,300/day) is possible. It is likely that this energy pricing will remain at or above this level for the foreseeable future at this location.

A very critical relationship to note at this point is that a digester facility on the Lusk farm has the potential manure energy capable of providing 100% of the raw energy required for the feed mill operation. This is in contrast to being utilized for electrical production at 15,000 BTU/kWh. The electrical value would be approximately 8,970 kWh/day (\$807@\$0.09/ kWh)) for an annual value of just over \$295,000 or approximately 62% of the value potential of the energy when used directly in the feed mill. If actual production values approximate those achieved by the dairy experience from Minnesota, it may be possible to justify both direct biogas utilization and electrical production.



# **Review of Potential Costs and Benefits**

#### Overview

The costs provided represent general facility estimates and include a 25% contingency for this level of pre-design evaluation. The estimated energy values are based on current actual energy costs in this area. **Table 6 – Cost Benefit Summary** provides a general assessment of the economic value for an anaerobic digestion facility on the Lusk Dairy.

Director	Biogas	\	/alue	Sim	ple ROI	
Digester Technology	MBTU/Day	Gas (\$/Day)	Electricity (\$/Day)	Gas (Yrs)	Electricity* (Yrs)	Notes
Covered Lagoon	130	\$1,300	\$807	1.91	4.47	ROI is overstated as gas production is unpredictable and seasonal which will greatly reduce energy value
Upright Cylinder	130	\$1,300	\$807	2.54	5.5	Multiple Tank System Provides Redundancy and Flexibility
Complete Mix	130	\$1,300	\$807	3.54	6.9	Mixing is difficult and one tank system decreases maintenance reliability

The above values clearly show that there is sound economic value to the digester systems considered for the Lusk Dairy and the direct use of biogas provides the greatest net value. This facility shows better economics than most historical assessments due to the fact that gas values are up to 2.5-3.0 times greater than historical values and the regional cost of electricity is 40-50% greater than many other regions.

#### **Specific Site Considerations**

During the course of reviewing the entire system operations and assessing the optimum energy recovery opportunities, a unique feature to the Lusk dairy project became apparent as compared to most facilities considering a digester. This feature is the incorporation of a Feed Mill operation into the integrated project and was mentioned briefly above. Typically, a dairy will produce more energy than it can use which requires benefit be gained from offsite energy sales to a local utility. Since the value of resale is generally less than half of the retail value, buyback programs commonly do not greatly improve the economic justification of an onsite generation facility. This would be the case here as there would be significant periods of excess power production that would have to be sold at the wholesale buyback rate or utilized for service elsewhere on the farm. Even if utilized for operation of the irrigation system and 100% of the electricity can be utilized, it is highly doubtful if the added capital cost can be justified for electrical production. When the additional operations costs are included, electrical production becomes even less attractive at this location.

In considering this option further, the feed mill as planned is to run 12 hours each day. This presents a significant storage challenge/requirement if all of the biogas is to be utilized for feed mill energy. To resolve this issue, the feed mill vendor was contacted relative to the 12 hour operations cycle. When questioned, the vendor indicated that the boiler, currently sized for approximately 250 horsepower could be downsized to run continuously at approximately 125 horsepower as could the material handling equipment. This will require that the feed mill run nearly continuously in order to optimally utilize the available biogas energy. Similarly, Reggie Lusk was contacted relative to this approach. It was felt that the continuous operation would be okay. From an industrial operations approach, continuous operation of this type of equipment can have a number of benefits resulting from lowered stresses by not starting and stopping the equipment as well as easier maintenance activities on the smaller equipment required for material handling. Also, continuous operations can lead to more predictable maintenance schedules and approaches.

# Summary

The concept of anaerobic digestion of the manure produced on the Lusk Dairy appears to have considerable financial merit based upon the review of critical factors as they relate to this dairy location. The site combines a number of unique benefits that actually make anaerobic digestion more attractive here than at most dairy sites. The factors that stand out are:

- 1) Excellent site geography
- 2) Excellent location for feed delivery
- Pending proximal (<80 miles) location of milk processing facilities in Kansas and Texas
- 4) High power costs (> \$0.085/kWh)
- 5) High natural gas costs ( >\$10.00/mmbtu)
- 6) Onsite demand for 100% of energy produced at the optimum offset value
- 7) Temporal location through integrated site design to minimize parasitic losses by integrating feed mill, digestion system and milk cooling and heat transfer systems.

With the above factors and the relatively attractive rate of return on the digestion systems, anaerobic digestion at this facility appears feasible due to both financial and technical factors. Also as stated earlier, production values well in excess of those projected here may be possible with acute attention to the system details. In the second portion of this study (Chapter 3), the potential for enhancing this value further through the incorporation of ground source heat exchange will be considered.



#### **Project Overview**

The potential for this site to integrate ground source heating/cooling technology with the anaerobic digestion facility is being considered due to;

- 1) The large volumes of water commonly used on a dairy operation for cleaning, animal consumption and irrigation.
- 2) The relatively shallow and stable ground water table which can be easily used for ground source heat exchange.
- **3)** Potential net value of ground source heat recovery technology to offset typical parasitic demands for initial and maintenance digester heating demands.

Ground water and soils (ground source) can be used efficiently through the use of integrated ground source heat pumps. Typical ground source heat pump systems use a recirculating coolant similar to automotive cooling systems but take advantage of the tremendous heat sink capacity of natural earth environments. In the case of the Lusk dairy, both ground source loops and direct use of pumped ground water will be assessed for potential application to enhance the planned dairy project's energy efficiency.

#### **Heating and Cooling Demands**

Ground source geothermal systems can provide both heating and cooling functions depending on the system need. Typical systems operate on the heat pump principle where the mechanical energy of the electrically driven heat pump compressor can channel heat either from the ground source or back to the ground source. At the Lusk dairy, an extensive review of the facility heating and cooling demands lead to the following general evaluation:

- 1) Very few general facility (HVAC) cooling and heating demands exist.
- 2) Parlor heating is only performed when outside temperatures are less than 32 F and is provided by gas fired radiant heaters.
- No active heat exchange is used for parlor cooling as it is provided by circulating fans only.
- 4) Cow cooling is a substantial demand but is only accomplished by large 1 HP fans distributed throughout the parlor and freestall barns.
- 5) Preparing milk for storage and shipping represents the single largest cooling demand.

- 6) The potential cooling demand for milk is approximately 14 MBtu/day.
- 7) Depending on the season, preparing manure for digestion represents a heat demand very similar to the milk cooling demand.
- 8) The potential heat demand for manure will range from approximately 7-20 MBTU/day or 5-15% of the expected energy production.

# **Milk Cooling**

Milk enters the piping systems at approximately 100 F and must be cooled to 32 F prior to storage. Milk is shipped from the farm at no more than 34 F. A 3,000 head dairy is expected to produce an average milk flow of approximately 18 gpm of milk that must be chilled. This heat can be removed by the following means:

- 1) Traditional refrigerated chillers and plate heat exchangers.
- 2) Staged chilling using ground water for pre-chilling followed by mechanical chilling in two stage plate heat exchangers.
- 3) Ground water cooled mechanical chillers that use water for a heat sink as compared to air coils.
- **4)** Ground source heat pumps that pass the milk heat to the ground water used for normal consumption.
- 5) Ground source heat pumps that utilize ground loops as a heat sink.

After considerable review with the Dairy contractor, it is clear that ground water is an excellent and energy efficient method for both pre-cooling the milk and has become a standard feature in modern large dairy design. Ground water as a heat sink for mechanical chilling is desirable where power costs are above \$0.05/ kWh such as the Lusk Dairy.

Based on comparing general cooling demands with normal consumptive water use by a dairy this large, the facility can pass normal consumptive water flowing at approximately twice the rate of flow of the milk to provide the pre-cooling at virtually no net increase in operations cost. This water must be pumped and delivered under pressure as part of normal operations and can readily be utilized as a ground water heat sink. In addition, approximately ½ of the ground water used in the pre-cooling heat exchanger can flow to the mechanical chiller and provide an additional heat sink. This combined heat collecting effort then allows that water and heat to be reused in the general operations as shown below:

- 1) Tempered water for cow sanitation
- 2) Warm/Tempered water for manure wash down
- 3) Warm/Tempered water for manure dilution
- 4) Warm/Tempered water for ground source heat pumping to heat the manure

Using normal ground water flows for milk cooling has been determined as a clear energy benefit to the Lusk dairy operation and will be included in the facility plans. The value of extracting heat back out of the flow for manure heating is reviewed and discussed below. In rough terms, the cost of the parasitic demands for manure heating ranges from \$70 - \$200 per day equivalent depending on the raw manure temperatures against a normal biogas production value of \$1,300/day.

# Ground Source Heat Exchange System Options

Based upon the features of the Lusk Dairy and a basic heating and cooling energy demand analysis, it was determined that between the heat available from milk and normal consumptive ground water flows there is little reason to consider a classic ground source loop system and the following ground source heat pump system alternatives can be considered appropriate.

- 1) Full Milk Cooling and Slurry Heating with Ground Source Heat Pumps (GSHP)
- 2) Partial Milk Cooling and Full Slurry Heating with GSHP
- 3) Slurry Heating Only with GSHP

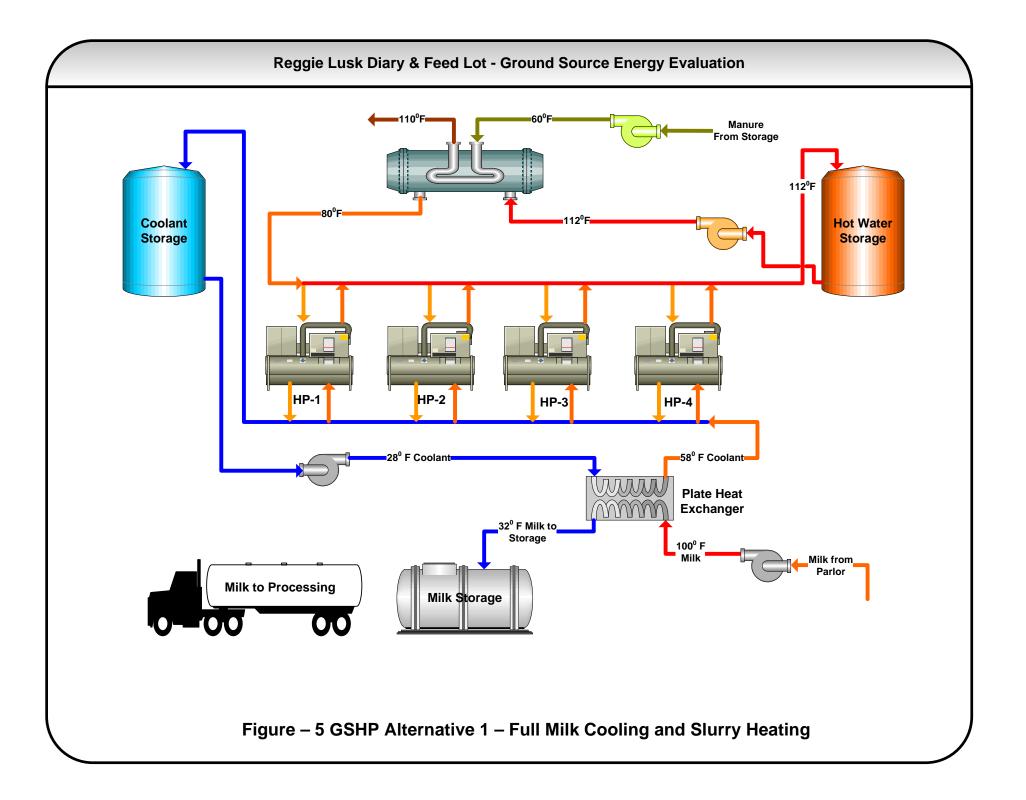
Alternative 1: Full Milk Cooling and Slurry Heating

This GSHP system utilizes water-to-water units to cool the milk from 100°F to 32°F while using the heat rejection side of the heat pumps to raise the temperature of the manure slurry from 60°F up to 115°F before it goes into the manure digesters.

This configuration would replace the chiller plant and pre-cooler heat exchanger, simplify some of the piping in the system, and provide the most energy savings. In order to meet the 260 MBH cooling capacity requirements, the system requires four water-to-water units for a water/glycol piping loop at a flow rate of 45 gpm with two additional heat pump units for standby/backup for a total of 6 units. The cooling side of the heat pumps will provide approximately 28°F fluid to the heat exchanger for the milk process cooling. The leaving temperature of the fluid is approximately 58°F. A series of one or more thermal ice storage tanks will provide a buffer between the heat pumps and the milk heat exchanger for better temperature control during varying modes of operation either due to temperature fluctuations or the rate of milk cooling required. **Figure 5 – Alternative 1 Flow Diagram** depicts a schematic layout of the intended operation for this alternative.

The heating side of the heat pumps has sufficient capacity to heat the manure slurry from 60°F to 115°F and there is approximately 300 MBH of excess heating capacity due to the amount of heat rejection from the heat pump units. The additional heat can be utilized through a ground water heat exchanger to warm the ground water for tempered water applications within the parlor and freestall areas.

**Table 7 – Alternative 1 Performance Information**, summarizes the system performance characteristics of this alternative's process. The energy consumption includes the heat pumps, associated circulating pumps, and both primary and secondary pumps at estimated horse power requirements. The total annual energy consumption for Alternative 1 is 413,000 kWh/yr at an annual cost of \$37,200 at \$0.09/kWh. This does not include energy consumption and implementation cost for the rest of the dairy facility.



System Factor	Value
Total Required Cooling Capacity (Btu/hr)	632,400
Total Required Heating Capacity (Btu/hr)	567,600
Excess Cooling Capacity (Btu/hr)	31,000
Excess Heating Capacity (Btu/hr)	308,200
Annual Energy Consumption (kWh/yr)	413,000
Estimated Total Peak Demand (kW)	54
Annual Operating Cost (@ 0.09/kWhr)	\$37,200
Estimated Implementation Cost for Alternative	\$180,000
Internal Rate of Return (20-year study)	5.3%

Table 7 - Alternative 1 Performance Information

The Internal Rate of Return (IRR) assumes the incremental difference between the baseline system and Alternative 1 as the estimated implementation cost for the alternative, based on the estimated operating cost difference (no chiller and no parasitic gas consumption). The actual cost difference will probably improve the IRR. It should also be noted that interest and inflation rates were not considered for calculating the IRR.

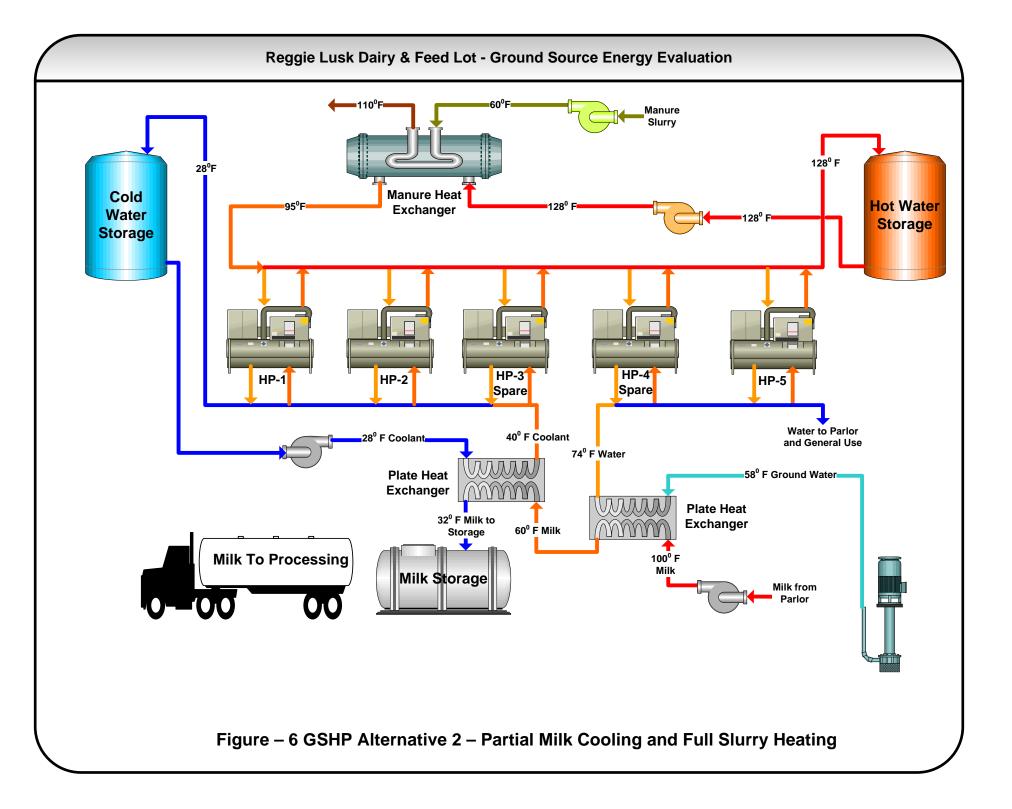
# Alternative 2: Partial Milk Cooling and Full Slurry Heating

This GSHP system utilizes water-to-water units to cool the milk from 60°F to 32°F after passing through the 58°F ground water plate exchanger while using the heat rejection side of the heat pumps to raise the temperature of the manure slurry from 60°F up to 115°F before it goes into the manure digesters.

This configuration would replace the chiller plant but not the pre-cooler heat exchanger. It still takes advantage of the cooling available from the groundwater and provides slurry heating without large excess heat to be shed in another process. In order to meet the cooling capacity requirements of approximately 260 mbh, the system requires two water-to-water units for a water/glycol piping loop at a flow rate of 45 gpm. The cooling side of the heat pumps will provide approximately 28°F fluid to the heat exchanger for the milk process cooling. The leaving temperature of the fluid is approximately 40°F.

A series of one or more thermal ice storage tanks will provide a buffer between the two heat pumps and the milk heat exchanger for better temperature control during varying modes of operation either due to temperature fluctuations or the rate of milk cooling required. **Figure 6 – Alternative 2 Flow Diagram** depicts a schematic layout of the intended operation for Alternative 2.

**Table 8 – Alternative 2 Performance Information**, summarizes the system performance characteristics of this alternative's process. The energy consumption includes the heat pumps, associated circulating pumps, and both primary and secondary pumps at estimated horse power requirements. The total annual energy consumption for Alternative 2 is 316,500 kWh/yr at an annual cost of \$28,500 at \$0.09/kWh. This does not include energy consumption and implementation cost for the rest of the dairy facility. The Internal Rate of Return (IRR) assumes the incremental difference between the baseline system and Alternative 2 as the estimated implementation cost for the alternative and is based on the estimated operating cost difference (no chiller and reduced parasitic gas



consumption). The actual cost difference will probably improve the IRR. It should also be noted that interest and inflation rates were not considered for calculating the IRR. This alternative appears to be the most attractive resulting in the smallest overall system that is more flexible in both cooling and heating modes.

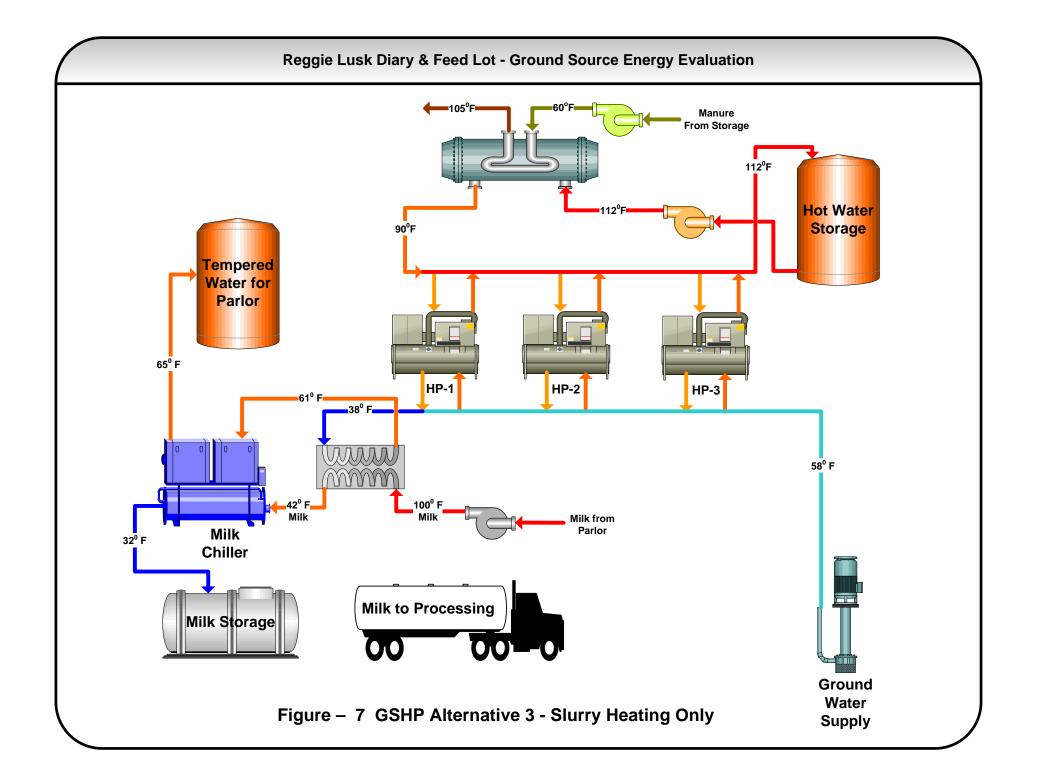
System Factor	Value
Total Required Cooling Capacity (Btu/hr)	260,400
Total Required Heating Capacity (Btu/hr)	567,600
Excess Cooling Capacity (Btu/hr)	5,200
Excess Heating Capacity (Btu/hr)	59,500
Annual Energy Consumption (kWh/yr)	316,525
Estimated Total Peak Demand (kW)	42
Annual Operating Cost (@ 0.09/kWhr)	\$28,500
Estimated Implementation Cost for Alternative	\$150,000
Internal Rate of Return (20-year study)	7.9%

Table 8 - Alternative	2	Performance	Information
	_	1 of formation	monnation

# Alternative 3: Slurry Heating Only

This GSHP system configuration uses water-to-water heat pump units to take consumptive use  $58^{\circ}F$  well water direct from the consumption storage to just boost the manure slurry temperature from  $60^{\circ}F$  to  $105^{\circ}F$ . The chiller and pre-cool heat exchangers and processes remain unchanged from the original design. **Figure 7 – Alternative 3 Flow Diagram** depicts a schematic layout of the intended operation for Alternative 2. This configuration requires 2 heat pumps and a third heat pump is suggested for standby/backup to the other units. If the heating capacity is exactly matched on the manure slurry heat exchanger, the outlet temperature of the manure slurry mixture will approach  $108^{\circ}F$ . The cold side of the heat pumps will cool the well water from  $58^{\circ}F$  down to  $37^{\circ}F$  and require a flow rate of 45 gpm. This  $37^{\circ}F$  water can then be fed to the precooler to significantly improve its efficiency and reduce mechanical chiller energy requirements by up to  $50^{\circ}$ .

**Table 9 – Alternative 3 Performance Information** summarizes the system performance characteristics of this alternative's process. The energy consumption includes the heat pumps, associated circulating pumps, and both primary and secondary pumps at estimated horse power requirements. The total annual energy consumption for Alternative 1 is 218,800 kWh/yr at an annual cost of \$19,700 at \$0.09/kWh. This does not include energy consumption and implementation cost for the rest of the dairy facility. The Internal Rate of Return (IRR) assumes the incremental difference between the baseline system and Alternative 3 as the estimated implementation cost for the alternative, based on the estimated operating cost difference (parasitic gas consumption value). The actual cost difference will probably improve the IRR. It should also be noted that interest and inflation rates were not considered for calculating the IRR.



System Factor	Value
Total Required Cooling Capacity (Btu/hr)	260,400
Total Required Heating Capacity (Btu/hr)	495,400
Excess Cooling Capacity (Btu/hr)	129,000
Excess Heating Capacity (Btu/hr)	5,900
Annual Energy Consumption (kWh/yr)	218,800
Estimated Total Peak Demand (kW)	29
Annual Operating Cost (@ 0.09/kWhr)	\$19,700
Estimated Implementation Cost for Alternative	\$90,000
Internal Rate of Return (20-year study)	8.9%

#### Table 9 - Alternative 3 Performance Information

# **GSHP Application Summary**

The three alternatives described above represent a novel approach to energy management on a modern dairy farm in that GSHP technology has only recently been considered in modern dairy farm design. Some facilities in colder climates than southeast Colorado have utilized GSHP technology to provide milk cooling, slab heating to eliminate ice and parlor air conditioning during humid summer months. At this time, use of GSHP technology to eliminate parasitic demands for manure digestion has not been documented.

The application of ground source heat pumps (GSHP) for this project offers a very unique solution to biomass energy production. After evaluating three different alternatives of utilizing water-to-water ground source heat pumps to provide a heating source to a manure slurry for digestion that creates electricity from the methane created from biomass, it is determined that all three alternatives can meet the goal of removing a gas-fired heating system (parasitic consumption of methane) for biomass energy production, but two of the alternatives can also provide cooling to the milk process load. Each alternative requires different integration requirements.

Alternative 1 replaces the gas-fired heating source, the chiller, and the pre-cooler heat exchanger with well water, and has an excessive amount of additional heat that must be rejected to another process load, ground heat exchanger, or space heating. The electrical consumption for this Alternative has been estimated to be 413,000 kWh/yr.

Alternative 2 replaces the gas-fired heating source and the chiller but requires additional piping configurations. The electrical consumption for this Alternative has been estimated to be 316,525 kWh/yr.

Alternative 3 replaces only the gas-fired heating source with minimal impact to the rest of the milk dairy process and is the smallest system. The electrical consumption has been estimated to be 218,800 kWh/yr and the energy required for complete milk cooling is reduced by about 60%.

Alternative 2 is the recommended alternative if the project proceeds to the design phase. It is suggested that thermal ice and hot water storage tanks be considered to act as a buffer between the heat pumps and the respective process loads so that varying load conditions, such as temperature, can be satisfied.

However; it is important to consider with any of the geothermal heat pump alternatives, each one is scalable with the addition of more GSHP units. In the event production requirements increase in the future, the geothermal heat pump system will only require bringing online the number of heat pumps units that are necessary to meet the new capacity requirements. However, there will be a need to address the increase in electrical load required by the additional heat pump units.

# **Final Analysis Pending**

Due to a lack of detailed cost information from the project contractor, Mason Dairy Contractors (MDC) relative to component costs for the milk cooling operation planned at the Lusk Dairy it has not been possible to fully confirm the relative cost-benefits of a GSHP system. At this point and based upon conversations with GSHP vendors, the capital cost of GSHP equipment for milk cooling is typically lower that standard mechanical chilling equipment and there is a substantial energy savings as well. Based upon this knowledge, it appears that ground source milk cooling should be considered for this facility along with the recovery of this heat for manure heating.

# 4 AD and GSHP Energy Systems Summary

The primary focus of this feasibility study has been to assess the value of integrating anaerobic manure digestion and GSHP technologies to enhance the energy efficiency of a large modern dairy operation planned for the Lusk Feed Lot location near Springfield, Colorado. Based upon extensive research relative to this integration, if this combination is utilized at the Lusk Farm, it may be the first full integration of the two technologies.

# **Anaerobic Digestion Technology Application**

Three AD system alternatives were considered and the mixed multiple above ground tank approach appears to provide the best overall system economics and reliability. This approach provides redundancy and reliability that are critical to full realization of the renewable energy economic benefit. A common challenge for this type of facility is to balance production rates with usage/demands. Biogas storage is generally a mechanical challenge and typically adds a substantial cost and complexity to an operation. Eliminating the need for storage and providing a consistent supply provides a key element in the design approach on this project because the biogas produced can be fully utilized by the feed lot operation in the flake drying facility. Similar to the overall integration of AD and GSHP technologies, this integration appears to be a unique application as the majority of modern dairies can not fully utilize the energy potential provided by the biogas. The projected natural gas demand of the feed mill very closely approaches the projected production from the digestion facility. A further benefit is that the feed mill capital cost can be reduced and efficiency increased by operating on a continuous basis. The estimated When value of this energy at current rates is \$1,300/day or \$475,000 annually. considered in conjunction with the lowered capital of the feed mill equipment the cost benefit of the digestion system becomes even better than that projected. Furthermore, and as noted in the text, it is likely that the production values used can be significantly improved above historical standards through proper system design and management

# **GSHP** Technology Application

The application of GSHP system(s) for the Lusk project presents an interesting opportunity to leverage an additional energy efficient technology to the Lusk project. GSHP systems were considered for application on the entire project. During the preliminary evaluation, it became evident that general space and facility demands were limited and that the primary GSHP application was for providing a medium to transfer milk or ground water heat to the manure and thereby minimize parasitic energy losses related to the heating the manure prior to feeding into the digester. Through the systems reviewed it was found that GSHP technology could be beneficially applied to a variety of applications. Each system was found capable of providing adequate ground source and/or milk source heat for heating the manure.

Based upon vendor conversations, GSHP technology is often found less capital intensive than standard milk chilling systems. When considered in conjunction with the core energy savings as well as parasitic heat savings for digestion, GSHP technology at the proposed Lusk Dairy facility becomes an attractive option.

Attachment 1 - AD Project Cost Details

	overed Lagoon Lusk Dairy Farm Digest		m - 3.00	0 Head	lead					
	Notes			Units	C	ost	Margin	Тс	otal	Total
General Conditions										
Seneral Conditions										
Administrative		\$	8,500		\$	8,500		\$	8,500	
Travel Subsistance		\$	2,500	1		2,500		\$ \$	2,500	
Permits & Fees		\$	2,500		\$	2,500		э \$	2,500	
Startup Services					\$	-		\$	-	
Proj. Management Office and Storage Facilities		\$	7,500	1	\$ \$	7,500		\$ \$	7,500	
Office and Storage Pacifities		\$	2,500		\$			\$		\$ 22,000.0
Engineering										
Civil Engineering-Site		\$	85	120		10,200			10,200	
Civil Engineering-Struct Process Engineering		\$	95 120	60 100		5,700 12,000		\$ \$	5,700 12,000	
Electrical Engineering		\$	95	80	\$	7,600		\$	7,600	
Mechanical Engineering		\$	95	80	\$	7,600		\$	7,600	\$ 43,100.0
Site Work										\$ 43,100.0
Excavation	Cu. Yds.	\$	2.00	12,000		24,000			24,000	
Fill	Cu. Yds.	\$	3.50	12,500		43,750			43,750	
Liner Cover	Sq. Ft Sq. Ft	\$	0.95	60,000 40,000	\$ \$	57,000 180,000			57,000 30,000	
Misc. Concrete	Equipment Pads 100 Sq. Ft @ \$10/sq. Ft.	\$	4.30	40,000	\$	1,000		\$ 10	1,000	
Tank Foundation	Ring Foundation	\$	35,000		\$	-		\$	-	
Piping	Process Piping - 100 Ft. 2-3" PVC @ \$30/ft	\$	30	200	\$	6,000		\$	6,000	
	Biogas Piping - 200 Ft 2" Steel @ \$25/ft. General Water Piping - 100 Ft. of 1" @ \$10/ft	\$	25 10	300 300	\$ \$	7,500 3,000		\$ \$	7,500 3,000	
	Chemical and Misc. 100 Ft. @ \$20/ft	\$	20	200	\$	3,000		\$ \$	3,000	
Site Prep	Sub-base for tanks & building - \$2/sqft @ 300 sqft	\$	2	1,500	\$	3,000		\$	3,000	
Site Work	Site Filling, Grading, Finish site - 5\$/cu.yd.	\$	5	1,000	\$	5,000		\$	5,000	
Accessways	Roads & Misc. Site @ \$15/sq.ft.	\$	15	1,000	\$	15,000		\$	15,000	\$ 240.050.0
Finishes	Misc. Painting	\$	10	350	\$	3,500		\$	3,500	\$ 349,250.0
		Ť.				.,			.,	\$ 3,500.0
Tanks & Metals										
Bolted Steel	NA Holding Tank	\$	0.75	62,000	\$	- 36,580		\$ \$ :	-	
	Clarifier	\$	2.50	62,000	\$ \$	36,580		» \$	- 36,580	
	Preheat	\$	2.50		\$	-		\$	-	
Building	200 sq. ft.	\$	65	200		13,000			13,000	
	Ribbon Drains	\$	50	50		2,500		\$	2,500	
	Pump Stands Doors	\$	250 1,200	6		1,500 1,200		\$	1,500	
	Windows	э \$	350	1		350		э \$	350	
	Rollup Door	\$	2,500	1		2,500		\$	2,500	
										\$ 57,630.0
Equipment Chopper Pump	Vaughan- Feed from pit to Conditioning	\$	4,500	1	\$	4,500		\$	4,500	
Blowers	Rotron	\$	6,500	2		13,000			4,300	
FEB Pumps	Goulds	\$	1,500	1	\$	1,500		\$	1,500	
Chopper Pump	Vaughan	\$	4,200	1		4,200		\$	4,200	
Screen	Basket Strainer	\$	500	1	\$	500		\$	500	
		<b>^</b>	1 500						1 500	
Heat Mix Pump Scrubber	Goulds	\$	1,500	1	\$	1,500		\$	1,500	
Heat Mix Pump Scrubber Heat Ex	ESS	\$ \$	1,500 4,500 3,500	1 1 2	\$	4,500			1,500 4,500 7,000	
Scrubber	ESS ESS Hurst	\$	4,500	1 1 2	\$ \$ \$	4,500		<del>თ თ თ</del> თ	4,500	
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Scrubber Heat Ex Boiler Hot Water Pumps	ESS ESS Hurst Bell&Gosset	\$ \$ \$ \$	4,500 3,500 56,000 400		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - 5,000 -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 3,500 56,000 400 2,500 1,500 4,500 4,500	2 3 4	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	4,500 7,000 - 5,000 - 13,500 18,000	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare	ESS ESS Hurst Beli&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J	\$\$\$\$\$ \$\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 3,500 56,000 400 2,500 1,500 4,500 4,500 3,500	2 3 4 1	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500		\$	4,500 7,000 - 5,000 - 13,500 18,000 3,500	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottorn Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J	\$\$\$\$\$\$\$\$\$\$	4,500 3,500 56,000 400 2,500 1,500 4,500 4,500 3,500 4,500	2 3 4 1	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500		\$\$ \$\$ \$\$ \$\$ \$\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J	<i>\$</i>	4,500 3,500 56,000 2,500 1,500 4,500 4,500 4,500 4,500	2 3 4 1 1 2	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500 9,000		\$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500 9,000	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottorn Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J	\$\$\$\$\$\$\$\$\$\$	4,500 3,500 56,000 400 2,500 1,500 4,500 4,500 3,500 4,500	2 3 4 1 1 2 2 1	\$\$ \$\$ \$\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500		\$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J Fisher	\$\$\$\$\$\$\$\$\$\$\$\$\$	4,500 3,500 56,000 2,500 1,500 4,500 4,500 4,500 4,500 4,500 3,100	2 3 4 1 1 2 2 1	\$\$ \$\$ \$\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500 9,000 3,100		<i>6</i> 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500 9,000 3,100	\$ 97,800.0
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J Fisher Goulds	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 3,500 56,000 400 2,500 1,500 4,500 4,500 4,500 4,500 3,100 1,500	2 3 4 1 1 2 2 1	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - 13,500 18,000 3,500 4,500 9,000 3,100 4,500		\$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 4,500 9,000 3,100 4,500	\$ 97,800.0
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Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FC1 pH meters	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J Coulds 2 inch units 2 inch units	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 3,500 56,000 4,000 4,500 4,500 4,500 4,500 4,500 3,100 1,500 2,800 3,000 1,500	2 3 4 1 1 2 1 3	\$	4,500 7,000 - 5,000 - 13,500 18,000 3,500 9,000 4,500 9,000 4,500 - - - - - - - - - - - - - - - - - -		\$	4,500 7,000 - 5,000 - 13,500 4,500 9,000 4,500 4,500 - 9,000 - 1,500	\$ 97,800.0
Scrubber Heat Ex Boiler Hot Water Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Regulator/Flame Trap Breather Flame Arrestor Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Brea	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J Coulds 2 inch units Rosemount ABS Coulds	\$\$         \$\$<	4,500 3,500 56,000 4,500 4,500 4,500 3,500 4,500 3,500 4,500 3,100 1,500 2,800 3,000 3,000 3,000	2 3 4 1 1 1 3 3 3 3 1 1 3 3 2 2	w w w w w w w w w w w w w w w w w w w	4,500 7,000 - - - 13,500 18,000 3,500 4,500 9,000 3,100 4,500 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 8,000 3,500 4,500 9,000 - - - - - - - - - - - - - - - - - -	\$ 97,800.0
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level RTD's	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J Fisher Goulds 2 inch units Rosemount Krohne	\$\$         \$\$<	4,500 3,500 56,000 400 2,500 4,500 4,500 4,500 4,500 3,100 1,500 2,800 3,000 3,000 3,000 3,000 4,00	2 3 4 1 1 1 3 3 3 3 1 1 3 3 2 8 8	<b>\$</b>	4,500 7,000 - - - - 3,500 18,000 3,500 4,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - 9,000 - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 3,500 4,500 9,000 4,500 - - - 9,000 - - - - 9,000 - - - - 9,000 3,200	\$ 97,800.0
Scrubber Heat Ex Boiler Hot Water Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Regulator/Flame Trap Breather Flame Arrestor Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Breather Brea	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J Fisher Goulds 2 inch units 2 inch units Rosemount Krohne Miltronics	\$\$         \$\$<	4,500 3,500 56,000 4,500 4,500 4,500 3,500 4,500 3,500 4,500 3,100 1,500 2,800 3,000 3,000 3,000	2 3 4 1 1 1 3 3 3 3 1 1 3 3 2 2	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - 13,500 18,000 3,500 4,500 9,000 3,100 4,500 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 8,000 3,500 4,500 9,000 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Othern Pumps Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Level Level Level Level RTD's Misc. Lab & Handhelds	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J Fisher Goulds 2 inch units 2 inch units Rosemount Krohne Miltronics	\$\$         \$\$<	4,500 3,500 56,000 400 2,500 4,500 4,500 4,500 4,500 3,100 1,500 2,800 3,000 3,000 3,000 3,000 400	2 3 4 1 1 1 3 3 3 3 1 1 3 3 2 8 8	<b>\$</b>	4,500 7,000 - - - - 3,500 18,000 3,500 4,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - 9,000 - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - 5,000 - 13,500 3,500 4,500 9,000 4,500 - - - 9,000 - - - - 9,000 - - - - 9,000 3,200	\$ 97,800.0 \$ 30,200.0
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump metry Recirculation Magmeters Gas Flow Meters-FC1 pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J Fisher Goulds 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings	\$\$         \$\$<	4,500 3,500 6,000 4,00 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 1,500 2,800 3,000 3,000 3,000 1,500 1,500 1,500 3,000 3	2 3 4 1 1 1 3 3 3 1 1 3 3 2 8 8 1 1 700	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - 13,500 18,000 3,500 9,000 4,500 4,500 4,500 4,500 4,500 - - - - - 9,000 - - - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 5,000 1 3,500 13,500 4,500 3,100 4,500 3,100 4,500 - - 9,000 5,000 - - - 9,000 - - - 9,000 - - 1,500 - - - - 2,000 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump metry Recirculation Magmeters Gas Flow Meters-FC1 pH meters Conductivity Meters Alkalinity Meters Level Level Level Level Misc. Lab & Handhelds Mechanical Systems Digester Feed Piping Digester Recirc Piping	ESS ESS Hurst Beil&Gosset LMI Widen/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	\$\$         \$\$<	4,500 3,500 56,000 1,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 4,500 1,500 4,500 1,500 4,500 1,500 4,500 1,500 4,500 1,500 4,500 1,500 4,500	2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600	\$       \$	4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 4,500 - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level Level Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Digester Recirc Piping Transfer Piping	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	(4)         (5) <td>4,500 3,500 400 400 400 4,500</td> <td>2 3 4 1 1 1 3 3 3 1 1 3 3 2 8 8 1 1 700</td> <td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td> <td>4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 1,500 - - - - - - - 9,000 5,000 - - - - - - - - - - - - - - - - - -</td> <td></td> <td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td> <td>4,500 7,000 - - - - - - - - - - - - - - - - - -</td> <td></td>	4,500 3,500 400 400 400 4,500	2 3 4 1 1 1 3 3 3 1 1 3 3 2 8 8 1 1 700	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 1,500 - - - - - - - 9,000 5,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Digester Recirc Piping Digester Recirc Piping Transfer Piping Internal Mechanical & Fab	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J Fisher Goulds 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings	\$\$         \$\$<	4,500 3,500 400 400 400 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 1,500 3,000 3,000 3,000 1,500 1,500 1,500 3,000 3,000 3,000 3,000 3,000 4,500 3,000 4,500 3,000 4,500 3,0000 3,0000 3,0000 3,0000 3,00000000	2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - 13,500 18,000 3,500 9,000 3,500 4,500 4,500 - - - - 1,500 - - - 1,500 - - - 1,500 - - 1,500 21,000 18,000 3,200 1,500 4,500 4,500 4,500		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 5,000 1 3,500 1 3,500 4,500 9,000 3,100 4,500 9,000 5,000 5,000 1,500 1,500 1,500 2,000 1,500 2,000 1,500 4,500 4,500 4,500 4,500 4,500 5,0000 5,0000 5,0000 5,00000000	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Strumentation Magmeters Gas Flow Meters-FC1 pH meters Conductivity Meters Alkalinity Meters Level Level Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Feedr Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping	ESS ESS Hurst Beil&Gosset LMI Widen/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	\$\$         \$\$<	4,500 3,500 400 400 400 400 4,500 4,500 4,500 4,500 4,500 3,000 1,500 1,500 1,500 1,500 1,500 3,000 4,500 3,000 4,500 3,500 3,500	2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600	\$       \$ <t< td=""><td>4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - - 9,000 - - - - - - - - - - - - - - - - - -</td><td></td><td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td><td>4,500 7,000 5,000 5,000 18,000 18,000 9,000 4,500 4,500 - - 9,000 4,500 - - 9,000 - - 9,000 - - 9,000 - - - 9,000 - - - - - - - - - - - - - - - - - -</td><td></td></t<>	4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 5,000 5,000 18,000 18,000 9,000 4,500 4,500 - - 9,000 4,500 - - 9,000 - - 9,000 - - 9,000 - - - 9,000 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Digester Recirc Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping HVAC Systems Tank Insulation	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	(4)         (5) <td>4,500 3,500 400 400 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 3,000 1,500 1,500 1,500 1,500 1,500 1,500 1,500 3,000 4,500 3,000 3,000 1,500 3,000 4,500 3,000 1,50</td> <td>2 3 4 1 1 1 3 3 3 1 1 3 3 3 2 2 8 1 1 700 600 2500 2500 1 1</td> <td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td> <td>4,500 7,000 - - - 13,500 18,000 3,500 4,500 9,000 3,100 4,500 - - - - - 9,000 - - - - - - - - - - - - - - - - - -</td> <td></td> <td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td> <td>4,500 7,000 5,000 1 3,500 4,500 9,000 3,100 4,500 9,000 4,500 1,500 1,500 1,500 1,500 2,500 2,500 5,500 1,50</td> <td></td>	4,500 3,500 400 400 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 3,000 1,500 1,500 1,500 1,500 1,500 1,500 1,500 3,000 4,500 3,000 3,000 1,500 3,000 4,500 3,000 1,50	2 3 4 1 1 1 3 3 3 1 1 3 3 3 2 2 8 1 1 700 600 2500 2500 1 1	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - 13,500 18,000 3,500 4,500 9,000 3,100 4,500 - - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 5,000 1 3,500 4,500 9,000 3,100 4,500 9,000 4,500 1,500 1,500 1,500 1,500 2,500 2,500 5,500 1,50	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Strumentation Magmeters Gas Flow Meters-FC1 PH meters Conductivity Meters Alkalinity Meters Level Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Feedr Piping Transfer Piping Internal Mechanical & Fab HVd Systems Tank Insulation Piping Insulation	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	\$\$         \$\$<	4,500 3,500 400 400 400 4,500 4,500 4,500 4,500 4,500 4,500 1,500 1,500 1,500 1,500 1,500 1,500 3,000 4,500 3,000 4,500 3,000 4,500 3,000 4,500 3,000 4,500	2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600 250 1 1 1 1 3300	\$       \$ <t< td=""><td>4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - - - - - - - - - - - - - - -</td><td></td><td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td><td>4,500 7,000 7,000 5,000 1 5,000 1 3,500 4,500 4,500 4,500 - - 9,000 4,500 - - 9,000 - 1,500 - - 9,000 4,500 - - 1,500 - - 2,500 4,500 - - - - - - - - - - - - - - - - - -</td><td></td></t<>	4,500 7,000 - - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - 9,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 7,000 5,000 1 5,000 1 3,500 4,500 4,500 4,500 - - 9,000 4,500 - - 9,000 - 1,500 - - 9,000 4,500 - - 1,500 - - 2,500 4,500 - - - - - - - - - - - - - - - - - -	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump <b>Internetion</b> Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Digester Recirc Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping Hot Water Piping How Scalaves & Fittings	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J		4,500 3,500 400 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 1,500 1,500 3,0000 3,000 3,0000 3,000 3,0000 3,0000 3,00000000	2 3 4 1 1 1 2 1 3 3 3 2 1 1 3 3 2 8 8 1 1 700 600 250 250 1 1 1 1 300 20	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 - - - - - - - - - - - - - - - - - -		s     s       s <td>4,500 7,000 5,000 1 5,000 1 5,000 1 3,500 4,500 4,500 4,500 4,500 4,500 4,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,0000 5,0000 5,0000 5,0000 5,0000 5,0000 5,00000000</td> <td></td>	4,500 7,000 5,000 1 5,000 1 5,000 1 3,500 4,500 4,500 4,500 4,500 4,500 4,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,0000 5,0000 5,0000 5,0000 5,0000 5,0000 5,00000000	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Instrumentation Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level Level Level RTD's Misc. Lab & Handhelds Itechanical Systems Digester Feed Piping Digester Recirc Piping Transfer Piping HVAC Systems Tark Insulation Piping Insulation Misc. Valves & Fittings Chemical Piping	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J	(4)         (5) <td>4,500 3,500 4,00 4,00 4,500 4,500 4,500 4,500 4,500 4,500 4,500 3,000 1,500 1,</td> <td>2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600 250 1 1 1 1 3300</td> <td>\$       \$    <t< td=""><td>4,500 7,000 - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 9,000 4,500 - - - - - 9,000 1,500 1,500 1,500 21,000 1,500 - - 21,000 1,500 - - 21,000 1,500 - - - - - - - - - - - - - - - - - -</td><td></td><td>s     s       s     s</td><td>4,500 7,000 5,000 1 3,500 4,500 9,000 4,500 9,000 4,500 9,000 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500</td><td></td></t<></td>	4,500 3,500 4,00 4,00 4,500 4,500 4,500 4,500 4,500 4,500 4,500 3,000 1,500 1,	2 33 4 1 1 1 3 3 3 3 3 1 1 3 3 2 2 8 8 1 1 700 600 250 1 1 1 1 3300	\$       \$ <t< td=""><td>4,500 7,000 - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 9,000 4,500 - - - - - 9,000 1,500 1,500 1,500 21,000 1,500 - - 21,000 1,500 - - 21,000 1,500 - - - - - - - - - - - - - - - - - -</td><td></td><td>s     s       s     s</td><td>4,500 7,000 5,000 1 3,500 4,500 9,000 4,500 9,000 4,500 9,000 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500</td><td></td></t<>	4,500 7,000 - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 9,000 4,500 - - - - - 9,000 1,500 1,500 1,500 21,000 1,500 - - 21,000 1,500 - - 21,000 1,500 - - - - - - - - - - - - - - - - - -		s     s       s     s	4,500 7,000 5,000 1 3,500 4,500 9,000 4,500 9,000 4,500 9,000 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump <b>Internetion</b> Magmeters Gas Flow Meters-FCI PH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Digester Recirc Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping Hot Water Piping How Scalaves & Fittings	ESS ESS ESS Hurst Beil&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J		4,500 3,500 400 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 4,500 1,500 1,500 3,0000 3,000 3,0000 3,000 3,0000 3,0000 3,00000000	2 3 4 1 1 1 2 1 3 3 3 2 1 1 3 3 2 8 8 1 1 700 600 250 250 1 1 1 1 300 20	\$       \$ <t< td=""><td>4,500 7,000 - - - - - - - - - - - - - - - - - -</td><td></td><td>\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td><td>4,500 7,000 5,000 1 5,000 1 5,000 1 3,500 4,500 4,500 4,500 4,500 4,500 4,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,0000 5,0000 5,0000 5,0000 5,0000 5,0000 5,00000000</td><td></td></t<>	4,500 7,000 - - - - - - - - - - - - - - - - - -		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500 7,000 5,000 1 5,000 1 5,000 1 3,500 4,500 4,500 4,500 4,500 4,500 4,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,000 1,500 5,0000 5,0000 5,0000 5,0000 5,0000 5,0000 5,00000000	
Scrubber Heat Ex Boiler Hot Water Pumps Chem Pumps Chem Pumps Digester Feed Pump Bottom Mixer Recirculation Pumps Flare Pressure Regulator/Flame Trap Breather Flame Arrestor Pressure Relief Digester Recirc Pump Strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level Level Level RTD's Misc. Lab & Handhelds Mechanical Systems Digester Recirc Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping HVAC Systems Install	ESS ESS Hurst Bell&Gosset LMI Wilden/Vogelsang ABS Vaughan S&J S&J S&J S&J S&J S&J S&J S&J		4,500 3,500 400 400 400 400 4,500 4,500 4,500 4,500 4,500 4,500 1,500 1,500 1,500 1,500 1,500 1,500 1,500 3,000 4,500 3,000 4,500 3,000 4,500 3,000 4,500 3,000 4,500 1,	2 3 3 4 1 1 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3	\$       \$ <t< td=""><td>4,500 7,000 - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 9,000 4,500 - - - - - 9,000 1,500 1,500 1,500 21,000 1,500 - - 21,000 1,500 - - 21,000 1,500 - - - - - - - - - - - - - - - - - -</td><td></td><td>s     s       s     s</td><td>4,500 7,000 5,000 8,000 8,000 9,000 4,500 4,500 4,500 - - 9,000 6,000 3,200 1,500 - - 9,000 6,000 3,200 1,500 2,500 4,500 - - - - - - - - - - - - - - - - - -</td><td></td></t<>	4,500 7,000 - - - 13,500 18,000 3,500 4,500 4,500 4,500 - - - - - 9,000 4,500 - - - - - 9,000 1,500 1,500 1,500 21,000 1,500 - - 21,000 1,500 - - 21,000 1,500 - - - - - - - - - - - - - - - - - -		s     s       s     s	4,500 7,000 5,000 8,000 8,000 9,000 4,500 4,500 4,500 - - 9,000 6,000 3,200 1,500 - - 9,000 6,000 3,200 1,500 2,500 4,500 - - - - - - - - - - - - - - - - - -	

	Cost pe	r Head			\$ 314.89		\$ 314.89
		Total			\$ 944,663		\$ 944,662.5
	Contir	igency	25%		188,933	 	\$ 188,932.5
otals					\$ 755,730	\$ 755,730	\$ 755,730.0
							\$ 74,250.0
Misc. Electrical Supplies	Conduit, Wire, Hangars, junction boxes	\$	5,000	1	\$ 5,000	\$ 5,000	
Controls	\$250/day/man	\$	250	10	\$ 2,500	\$ 2,500	
Lighting	\$250/day/man	\$	250		\$ 2,000	\$ 2,000	
Site Electrical	\$250/day/man	\$	250	10	2,500	\$ 2,500	
Equipment Electrical	\$250/day/man	\$	250	10	2,500	\$ 2,500	
Instruments	\$250/day/man	\$	250	5	1,250	\$ 1,250	
MCC	\$250/day/man	\$	250	10	2,500	\$ 2,500	
Underground Electrical	Site and underslab	\$	7,500	1	\$ 7,500	\$ 7,500	
Misc. Electrical	Plugs, Cords, switches, fixtures, hangars etc	\$	7,500	1	\$ 7,500	\$ 7,500	
Controls	Numatics	\$	6,500	1	\$ 6,500	\$ 6,500	
Controls	PLC Panel	\$	17,500	1	\$ 17,500	\$ 17,500	
MCC's	Starters, Power Dist. Lighting	\$	12,500	1	\$ 12,500	\$ 12,500	
Power Supply	Transformers, Main Power to Facility	\$	4,500	1	\$ 4,500	\$ 4,500	
lectrical Equipment							

Site Work         Production         Image of the second se		Lusk Dairy Farm Diges	ter Syste	m - 3,000	Head				
Anama         Image         Image <th< th=""><th></th><th>Notes</th><th>Uni</th><th>t Cost</th><th>Units</th><th>Cost</th><th>Margin</th><th>Total</th><th>Total</th></th<>		Notes	Uni	t Cost	Units	Cost	Margin	Total	Total
basis         basis <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>									
Tote         Image	eneral Conditions								
Trad StatussingImage <th< td=""><td>Administrative</td><td></td><td>\$</td><td>12 500</td><td>1</td><td>\$ 12,500</td><td></td><td>\$ 12,500</td><td></td></th<>	Administrative		\$	12 500	1	\$ 12,500		\$ 12,500	
SubstantSubsta									
Parma Araca Barray Lange and the second strength of the second strengt strength of the second strength of the second									
Phy. But. product of a state of a stat			\$	2,500	1	\$ 2,500			
Offer art Source 1Source 1Source 1Source 3Source 3									
Image: second					2				
space of the space of	Office and Storage Facilities		\$	2,500		\$ -		\$ -	<b>^</b>
Call Engrenering 200         S         A	'n eine e eine e								\$ 33,500.
Col:     Encode Engineering Struct     Note     Note     Note     Note     Note       Machanol     Equipation     S	<u> </u>		¢	05	05	¢ 0.075		¢ 0.075	
Precess Engineering         Image         S									
Elected Engreening         Image         S         100         S         11.400         S         11.400           Each Monthiel Engreening         Image         Image<									
Mechanical Eggineering         Image									
Interval         Part of this Set 3000 pl.         S         <	0 0								
Mac. Convous         Equipment Paid 100 Sq. P1 8 310% P. P1         \$ 10         100         \$ 1,000         \$ 1,000         \$ 1,000           Park Syndition         Regression         S 300         S 300         S 5000         S 5000         S 5000           Park Syndition         S 100         S 100         S 100         S 1000         S 1000         S 1000         S 1000         S 1000           Convert Work Parg 10: 00 10 10 30         S 100         S 1000         S 1000         S 1000         S 1000         S 1000         S 1000           Sin Parg 10: 00 10 10 10 10 10 10 10 10 10 10 10 10									\$ 51,575.
Tank Penne         Non-         S 35,00         1         S 35,00         S 35,00           Pring         Resear Pring- 200 12 Start 8 250.         S 20         S 200         S 7,500         S 7,500         S 7,500           Sim Pring - 200 12 Start 8 250.         S 20         S 000         S 000         S 7,500         S 7,500           Sim Pring - 30b 5ase for fanks 6 Julking - S50,41 9 500 aft         S 2         1000         S 1000         S 5,000         S 5,000           None Addition of the S 1000 aft - S50,41 9 500 aft         S 1         1000         S 10,000         S 5,000           Accessway         Reads & Minc Sim G 1500 aft - S50,41 (1000 aft - S50,41 (1000 aft - S50,40 (10000 aft - S50,40 (10000 aft - S50,40 (10000 aft -	ite Work								
Phones         Phones<	Misc. Concrete	Equipment Pads 100 Sq. Ft @ \$10/sq. Ft.	\$	10	100	\$ 1,000		\$ 1,000	
Bogen Paper 2 Date 2 Sheel 6 35An.         5         200         5         7.500         6         7.500           Chemical and Micr. (DF IC 6 201.         5         1000         5         4.000         5         4.000           Sin Paper 2000         2000         5         1000         5         4.000         5         4.000           Sin Paper 2000         2000         5         1000         5         5.000         5         5.000           Accessway         Noods & Micr. Sin @ 3150g.ft.         5         10         500         5         5.000           Accessway         Noods & Micr. Sin @ 3150g.ft.         5         10         500         5         5.000         5         5.000           Sin Shadia         Incomo         5         1000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000         5         5.000 <td< td=""><td>Tank Foundation</td><td>Ring Foundation</td><td>\$</td><td>35,000</td><td>1</td><td>\$ 35,000</td><td></td><td>\$ 35,000</td><td></td></td<>	Tank Foundation	Ring Foundation	\$	35,000	1	\$ 35,000		\$ 35,000	
General Water Paper, 100 F. 01 ° § 100         § 10         500         § 3.000         § 3.000         § 3.000           Site Name         GAD-Sate IT Wink S building, 32 ourit 200 ougit         § 2         1000         § 3.000         § 3.000         § 3.000           Accessenge         Accessenge         Accessenge         International State IT Wink State	Piping	Process Piping - 100 Ft. 2-3" PVC @ \$30/ft	\$	30	200	\$ 6,000			
Demons and Max. 100 Fit. 8 SAM         \$ 20         200         \$ 4.000         \$ 4.000           Sib Prop.         Sobe for trank 5 Kulling 'Short '8 300'         \$ 1000'         \$ 1.000'         \$ 5.000'         \$ 5.000'           Sib Vort.         Sib Filting, Grand in Sevury.         \$ 1000'         \$ 1.000'         \$ 5.000'         \$ 5.000'         \$ 7.800'           Inshea         Max. Part of Status.         Status. <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>									
Site Parp         Sto-base for tarks & hulding - 'Eorg H 200 org H         \$ 12         1500         \$ 3.000         \$ 5.000           Site Work         State field of Store H.         \$ 1000         \$ 5.000         \$ 5.000         \$ 7.000           Accesswaya         Reads & Mice. Site of Store H.         \$ 1000         \$ 5.000         \$ 5.000         \$ 7.00									
Site Vor.         Site Film, Grand, Pirot her. SKovy.d.         \$ 1         1000         \$ 5.000         \$ 5.000           Accesswy.or         Add SMC: Stin 0 S1500, All         1         1000         \$ 5.000         \$ 5.000           Inshen         Misc. Parling         \$ 10         5000         \$ 5.000         \$ 5.000         \$ 5.000           arbs. A Metals         Incuration         \$ 107         1.000.000         \$ 750.000         \$ 5.000         \$ 5.000           Bolted Steel         1.900.000 galon dighter         \$ 1.00         \$ 750.000         \$ 750.000         \$ 760.000           Bolted Steel         1.900.000 galon dighter         \$ 1.00         \$ 8.000         \$ 8.000         \$ 8.000           Balted Steel         Site Mark         \$ 1.00         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000           Balted Steel         Nethon Drand         \$ 1.00         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000           Balted Steel         Nethon Drand         \$ 1.000         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000           Called Steel         Nethon Drand         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000         \$ 8.000 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									
Accessword         Route & Mice. Parning         \$ 15         100         \$ 15,000         \$ 15,000           riskhen         Horing         \$ 10         500         \$ 5,000         \$ 5,000           Baine & Metal.         Horing         \$ 1,000         \$ 7,000         \$ 7,0000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000         \$ 7,000							<b> </b>		
Inithete         Max. Painting         S         10         500         5         5.000         5         7.9300           intes & Macka         -         -         -         -         -         -         5         5.000         5							I		
minute         Misc. Paning         S         10         500         S         5.00         S         5.00           anks & Matula         -	Accessways	Roads & MISC. Site @ \$15/sq.tt.	\$	15	1000	\$ 15,000		\$ 15,000	¢
ands & Metals         image	iniahaa	Mice Pointing		10		¢		¢ = 0.000	\$ 79,500.
aika & Metais         image         image         image         image           Bobels Sted         1-960.000 gallon digester         \$ 750.000         \$ 750.000         \$ 750.000         \$ 750.000           Bobels Sted         1-260.00         \$ 0.86.00         \$ 0.86.00         \$ 0.86.00         \$ 0.86.00         \$ 0.86.00           Combine         \$ 2.80         \$ 0.00         \$ 0.86.00			\$	10	500	ə 5,000		ຈ 5,000	¢
Bolted Sieled         1 - 950,000 global digoster         \$ 0.75         1.000,000         \$ 7.700         \$ 7.750         \$ 7.75         1.000,000         \$ 7.750,000           Hadding Tark         \$ 0.83         67.000         \$ 5.050         \$ 5.050         \$ 5.050         \$ 5.050         \$ 5.050           Cafferf         \$ 2.80         \$ 2.80         \$ 2.80         \$ 2.80         \$ 2.800         \$ 5.900         \$ 2.	anke & Motale								ə 5,000.
Insulation         S         Box         T2.500         S         T0.500         S		1 - 950 000 gallon digester	¢	0.75	1 000 000	\$ 750.000		\$ 750.000	
Holong Tank         \$ 0.02         8 0.00         \$ 3.050         \$ 3.050         \$ 3.050         \$ 3.050           Charfier         \$ 2.00         \$ 2.00         \$ 2.00         \$ 2.00         \$ 2.00         \$ 2.00           Holding         400 sg.ft.         \$ 6.5         400         \$ 2.000         \$ 2.000         \$ 2.000           Rubbo Drains         \$ 1.00         \$ 1.500         \$ 1.500         \$ 1.500         \$ 1.500         \$ 1.500           Rubbo Drains         \$ 1.20         2         \$ 2.000         \$ 2.000         \$ 2.000         \$ 2.000         \$ 2.000           Rubbo Drains         \$ 1.20         2         \$ 2.000         \$ 2.000         \$ 2.000         \$ 2.000         \$ 2.000           Capper Purp         Vauphan-Feed from pits Conditioning         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500           Elsewars         Rotin         \$ 4.000         \$ 4.200         \$ 4.200         \$ 4.200         \$ 4.200         \$ 4.200           Seman         \$ 6.000         \$ 2         \$ 7.00         \$ 7.00         \$ 7.00         \$ 7.00           Seman-Innop         BallaCossat         \$ 4.00         \$ 1.000         \$ 1.000         \$ 1.000 <tr< td=""><td>Dollar Oleel</td><td></td><td></td><td></td><td></td><td></td><td>ł</td><td></td><td></td></tr<>	Dollar Oleel						ł		
Clarifier         S         2.50         S         .         S         .         S         .         Building         400 sq. ft         S         2.50         S         .         S         .         S         .         S         .         S         .         S <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>									
Proteat         S         2.50         S         .         S         S <ths< th="">         S         S</ths<>					02,000				
Building         400 ts f. h         5         6         400 S         5.000         \$         5.000           Pump Stands         \$         5         5         1.500         \$         5.000           Doors         \$         1.200         2.5         2.400         \$         2.400           Windows         \$         3.50         4         \$         1.400         \$         2.400           Rolup Door         \$         2.500         1         \$         2.600         \$         2.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         3.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         4.500         \$         1.500         \$         1.500         \$         1.500         \$         1.500									
Ribbon Drains         S         50         100         S         5.000         S         5.000           Pump Stands         S         2.50         I         1.000         S         2.400         S         2.400           Windows         S         3.50         I         S         2.000         S         2.400           Windows         S         2.500         I         S         2.500         S         2.500           Chopper Pump         Naughan Foed from pit to Conditioning         S         4.500         I         S         4.500         S         4.500 <th< td=""><td>Building</td><td></td><td></td><td></td><td>400</td><td></td><td></td><td></td><td></td></th<>	Building				400				
Pump Stands         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,600         \$ 1,400           Rollup Door         \$ 2,500         1         \$ 2,500         1         \$ 2,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 4,500         \$ 4,500         \$ 4,500         \$ 4,500         \$ 1,500         \$ 3,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500         \$ 5,500<									
Dors         S         1.200         Z         2.400         S         2.400           Windows         S         3.50         4         5         1.400         S         2.400           Rallup Door         S         2.500         1         S         2.500         S         2.500           Chopper Pump         Vaughan- Feed from pit to Conditioning         S         6.500         2         S         4.500         S         4.500           Biowers         Ratron         S         6.500         2         S         4.500         S         4.500           Chopper Pump         Vaughan         Seade Strainer         S         500         1         S         1.500         S         1.500           Screen         Basket Strainer         S         500         1         S         4.500         S         4.500           Heat Mr. Pump         Guids         S         5.500         2         S         5.500         S         5.500           Heat Mr. Pump         Guids         S         5.500         S         S         S         S         S         S         S         S         S         S         S         S         S<									
Windows         \$ 350         4 \$ 1,400         \$ 1,400           Rollup Door         \$ 2,500         \$ 2,500         \$ 931,830           cutument             5 931,830           Guigement             5 931,830           Bilowers         Rotion         \$ 6,500         1 \$ 4,500         \$ 4,500         \$ 4,500           FEB Fungs         Goulds         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Screen         Baaket Strainer         \$ 6,500         1 \$ 4,500         \$ 4,200         \$ 4,200         \$ 4,200           Boiler         Hurst         \$ 5,600         1 \$ 1,600         \$ 1,600         \$ 1,600         \$ 1,600           Boiler         Hurst         \$ 5,600         2 \$ -         \$ 1,600         \$ 1,600         \$ 1,600         \$ 1,600           Digeter Fred Punp         Wildkork/oglesing         \$ 1,500         \$ 1,800         \$ 1,800         \$ 1,800         \$ 1,800           Digeter Fred Punp         Wildkork/oglesing         \$ 1,600         \$ 1,800         \$ 1,800         \$ 1,800         \$ 1,800           Digeter Fred Punp <thuidkork oglesing<="" th="">         \$ 1,600</thuidkork>									
Rolup Door         S         2.500         I         S         2.500         S         2.500           iquipment         I         I         I         I         I         I         S         931.830           Chopger Pump         Vaughan- Feed from pit to Conditioning         S         6.500         I         S         4.500         I         S         4.500         I         S         4.500         S         1.500         S         3.500         S         3.500         S         3.500         S		Windows		350	4				
squpment         undpan         Feed from pit to Conditioning         \$ 4,500         I <thi<< td=""><td></td><td></td><td></td><td>2,500</td><td>1</td><td></td><td></td><td></td><td></td></thi<<>				2,500	1				
Chopper Pump         Vaughan - Feed from pit to Conditioning         \$ 4,500         \$ 4,500         \$ 4,500         \$ 4,500         \$ 4,500           Biowers         Rotton         \$ 6,600         2 \$ 13,000         \$ 13,000         \$ 1,500           FEB Pumps         Gouds         \$ 1,500         1 \$ 1,500         \$ 4,200         \$ 4,200         \$ 4,200           Screan         Baskel Strainer         \$ 500         1 \$ 500         \$ 5,000         \$ 1,500           Scrubber         ESS         \$ 4,500         \$ 1,500         \$ 1,500         \$ 1,500           Balkel Strainer         \$ 4,500         \$ 1,500         \$ 1,500         \$ 1,500           Balkel Cosset         \$ 4,500         \$ 1,500         \$ 1,500         \$ 1,500           Balkel Cosset         \$ 4,500         \$ 1,500         \$ 1,500         \$ 1,500           Digeter Feach Pump         Willion/Yogelsang         \$ 1,500         \$ 3,100         \$ 1,300           Top Mirer         Lightin         \$ 4,500         \$ 1,500         \$ 3,100         \$ 3,100           Top Mirer         Supers Feach Fame Areabor         \$ 5,1500         \$ 3,100         \$ 3,100         \$ 3,100           Pressure Regulator/Fame Areabor         \$ 5,2800         \$ 5,-         \$ -									\$ 931,630.
Biowers         Rotion         \$         6.500         2         \$         13.000         \$         13.000           Chopper Pump         Vaughan         \$         4.200         \$         1.500         \$         5.000           Screen         Baskel Strainer         \$         5.00         1         \$         5.000         \$         5.000           Heat MR Pump         Goulds         \$         1.500         \$         1.500         \$         4.200           Scrubber         ESS         \$         4.500         1         \$         4.500         \$         4.500           Boller         Hurst         \$         5.6000         \$         \$         \$         \$         \$         \$           Chem Pumps         Bell&Goset         \$         4.000         \$         1.600         \$         1.600           Digester Feed Pump         Widen/Vogelsang         \$         4.500         3         \$ 3.500         \$         3.500           Frare         S&J         S&J         \$         \$         \$         \$         \$         \$         \$           Pressure Regulator/Flame Trag         S&J         \$         \$         \$	Equipment								
FEB Pumps         Gouds         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Chopper Pump         Vaughan         \$ 4,200         1 \$ 4,200         \$ 4,200         \$ 4,200         \$ 4,200         \$ 5,000           Screen         Baskel Strainer         \$ 500         1 \$ 5,00         \$ 1,500         \$ 5,000           Scrueher         ESS         \$ 4,500         \$ 1,500         \$ 1,500         \$ 1,500           Scrubber         ESS         \$ 3,500         2 \$ 7,000         \$ 7,000           Boild         ESS         \$ 4,500         \$ 1,500         \$ 5,000           Boiler         Hurst         \$ 5,600         \$ -         \$ 5,000           Boiler         Hurst         \$ 2,500         \$ 1,600         \$ 1,600           Chem Pumps         Udition/Vogelsang         \$ 1,500         \$ 3,000         \$ 3,1000           Top Mixer         Lightin         \$ 4,500         \$ 3,000         \$ 3,100           Pressure Regulator/Finane Trap         SJ         \$ 4,500         \$ 4,500         \$ 5,000           Pressure Regulator/Finane Trap         SJ         \$ 1,500         \$ 3,100         \$ 3,100         \$ 9,000           Digester Feact Pump         Gouds         \$ 1,500	Chopper Pump	Vaughan- Feed from pit to Conditioning							
Chopper Pump         Vaughan         \$ 4.200         1         \$ 4.200         \$ 4.200           Screen         Basket Strainer         \$ 500         1         \$ 500         \$ 5.00         \$ 1.500         \$ 1.500           Heat Mk Pump         Goulds         \$ 1.500         1         \$ 1.500         \$ 1.500         \$ 1.500           Scrubber         ESS         \$ 4.500         1         \$ 4.500         \$ 7.000         \$ 7.000           Heat Ex         ESS         \$ 4.500         \$ \$ 7.000         \$ 7.000         \$ 7.000           Boller         Hunt         \$ \$ 6.5000         \$ \$ \$ 1.500         \$ 1.600         \$ 1.600           Optaster Feder Pump         Widen/Vogelsang         \$ 1.500         \$ 1.800         \$ 1.800         \$ 1.800           Top Mixer         Lightin         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500           Pressure Regulator/Flame Trap         Sa.J         \$ 3.100         \$ \$ 3.100         \$ 3.100         \$ 3.100           Pressure Regulator/Flame Trap         Sa.J         \$ 4.500         \$ 4.500         \$ 4.500         \$ 4.500           Degester Recirc Pump         Goulds         \$ 1.500         \$ 4.500         \$ 4.500         \$ 4.500									
Screen         Basket Strainer         \$ 500         1         \$ 500         \$ 500           Heat Mk Pump         Goulds         \$ 1.500         1         \$ 4.500         \$ 4.500         \$ 4.500           Strubber         ESS         \$ 3.500         2         \$ 7,000         \$ 7,000           Boller         Hurst         \$ 56,000         \$ 1         \$ 6,000         \$ 1,600         \$ 1,600           Boller         Hurst         \$ 2,500         4         \$ 1,000         \$ 1,000           Chenn Pumps         BellaGosset         \$ 4,600         \$ 1,600         \$ 1,600         \$ 1,600           Digester Feed Pump         Wilder/Vogelsang         \$ 1,500         \$ 3,300         \$ 3,300         \$ 3,500         \$ 3,500           Pressure Reglutator/Flame Trap         \$ 8.1         \$ 4,500         1         \$ 4,500         \$ 4,500           Pressure Reglutator/Flame Trap         \$ 8.1         \$ 1,500         \$ 1,500         \$ 9,000         \$ 9,000           Pressure Reglutator/Flame Trap         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Digester Recirc Pump         Goulds         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500									
Heat MR Pump       Goulds       \$ 1,500       1 \$ 1,500       \$ 1,500       \$ 1,500         Scrubber       ESS       \$ 4,500       1 \$ 4,500       \$ 4,500       \$ 7,000         Heat Ex       ESS       \$ 3,500       2 \$ 7,000       \$ 7,000       \$ 7,000         Boiler       Hurst       \$ 56,000       2 \$ 7,000       \$ 7,000       \$ 7,000         Chem Pumps       Bell60soset       \$ 400       4 \$ 10,000       \$ 1,600       \$ 1,600         Operating Feed Pump       Wilker/Vogalsang       \$ 1,500       \$ 3,300       \$ 3,300       \$ 3,500         Tep Mixer       Lignin       \$ 4,500       1 \$ 4,500       \$ 4,500       \$ 4,500       \$ 4,500         Presure Regulator/Flame Trap       S.J.       \$ 4,500       2 \$ 3,000       \$ 3,100       \$ 3,100         Digeter Recire Pump       Goulds       \$ 1,500       \$ 4,500       2 \$ 3,000       \$ 4,500       \$ 4,500       \$ 4,500         Digeter Recire Pump       Goulds       \$ 1,500       \$ 3,100       \$ 3,100       \$ 3,100       \$ 5,100       \$ 5,100         Struturentation       \$ 2,200       \$ -       \$ -       \$ -       \$ -       \$ -       \$ -         Magmeters       2 inch units       \$ 3,000 <td></td> <td>-</td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td>		-			-				
Strubber         ESS         § 4,500         1 \$ 4,500         \$ 4,500         \$ 4,500           Bela Ex         ESS         \$ 3,500         2 \$ 7,000         \$ 7,000         \$ 7,000           Boller         Hurst         \$ 56,000         \$ -         \$ -         \$ -           Hot Water Pumps         Belt&Gosset         \$ 400         4 \$ 1,600         \$ 1,600         \$ 1,600           Dependence         Widen/Vogelsang         \$ 2,500         4 \$ 1,000         \$ 1,000         \$ 1,000           Dependence         Lightin         \$ 4,500         3 \$ 1,3500         \$ 1,3500         \$ 1,3500           Pressure Regulator/Flame Trap         SkJ         \$ 3,100         1 \$ 3,100         \$ 3,100         \$ 3,100           Degester Registator/Flame Trap         SkJ         \$ 4,500         \$ 4,500         \$ 4,500           Pressure Registator/Flame Trap         SkJ         \$ 1,500         \$ 4,500         \$ 4,500           Degester Registare Recirc Pump         Goulds         \$ 1,500         \$ 4,500         \$ 4,500           Instrumentation         \$ 2,800         \$ -         \$ -         \$ -           Magneters         2 Inch units         \$ 3,000         \$ 9,000         \$ 9,000           Level <t< td=""><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td></t<>					-				
Heat Ex       ESS       \$ 3,500       2 \$ 7,000       \$ 7,000         Boller       Hurst       \$ 66,000       \$ .       \$ .         Hat Water Pumps       BollaGosset       \$ 400       4 \$ 1,600       \$ 1,600         Chem Pumps       LMI       \$ 2,500       4 \$ 1,000       \$ 1,600         Digestor FeedPump       Wilden/Vogelsang       \$ 1,500       2 \$ 3,000       \$ 1,300         Top Mixer       Lignin       \$ 4,500       3 \$ 1,300       \$ 3,500         Fare       SkJ       \$ 3,500       1 \$ 3,500       \$ 4,500         Pressure Regulator/Flame Trap       SkJ       \$ 4,500       \$ 4,500       \$ 4,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 4,500       \$ 4,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 4,500       \$ 4,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 1,500       \$ 1,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 1,500       \$ 1,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 1,500       \$ 1,500         Digestor Feedre Nump       Goulds       \$ 1,500       \$ 1,500       \$ 1,500         Sandoutotity Meters	•								
Boller         Hurst         \$ 5000         \$ .          Digester Recirc Pump <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									
Hot Water Pumps         Beli&Cosset         \$ 400         4         \$ 1,600         \$ 1,600           Dep Pump         LMI         \$ 2,500         4         \$ 1,000         \$ 10,000           Digester Feed Pump         Wilden/Vogelsang         \$ 1,500         2         \$ 3,000         \$ 10,000           Top Mixer         Lighin         \$ 4,500         3         \$ 13,500         \$ 3,000           Top Mixer         S&J         \$ 3,600         \$ 3,600         \$ 3,000         \$ 3,000           Pressure Regulator/Fiame Trap         S&J         \$ 4,500         \$ 4,500         \$ 4,500         \$ 4,500           Pressure Relief         Fisher         \$ 3,100         \$ 3,100         \$ 3,100         \$ 3,100         \$ 3,100           Digester Reicr Pump         Goulds         \$ 1,500         \$ 4,500         \$ 4,500         \$ 4,500           Instrumentation         Image ters         \$ 1,600         \$ 4,500         \$ 4,500         \$ 4,500           Inderter Fer Pump         Quids         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Ingester Reicr Pump         Goulds         \$ 3,000         \$ 9,000         \$ 9,000         \$ 9,000           Ingester Reicr Pump         Quids         \$ 3,000<					2				
Chen Pumps       LMI       \$ 2,500       4 \$ 10,000       \$ 10,000         Digester Feed Pump       Wilden/Vogelsang       \$ 1500       2 \$ 3,000       \$ 3,000         Top Mixer       Lighnin       \$ 4,500       3 \$ 13,500       \$ 13,500         Flare       S&J       \$ 3,600       1 \$ 3,500       \$ 3,500         Pressure Regulator/Flame Traft       S&J       \$ 4,500       2 \$ 9,000       \$ 9,000         Breather Flame Arrestor       S&J       \$ 1,500       3 \$ 4,500       \$ 3,100         Digester Recirc Pump       Goulds       \$ 1,500       3 \$ 4,500       \$ 4,500         Instrumentation       Image: Source Pump       Goulds       \$ 1,500       3 \$ 9,000       \$ 9,000         Instrumentation       Image: Source Pump       Goulds       \$ 1,500       \$ -       \$ -         Agenetics       2 inch units       \$ 2,800       \$ -       \$ -       \$ -         Agenetics       2 inch units       \$ 3,000       \$ 9,000       \$ 9,000       \$ 9,000       \$ -         Ph meters       Rosemount       \$ 1,500       1 \$ 1,500       \$ 1,500       \$ 1,500       \$ 1,500         Conductivity Meters       Image: Source Source       \$ 3,000       \$ 9,000       \$ 9,000       <					4				
Digster Feed Pump         Wilden/Vogelsang         \$ 1,500         2 \$ 3,000         \$ 3,000           Top Mixer         Liginin         \$ 4,500         3 \$ 13,500         \$ 3,500         \$ 3,500           Flare         S&J         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500           Pressure Regulator/Flare Trap         S&J         \$ 4,500         \$ 4,500         \$ 9,000           Pressure Relief         Fisher         \$ 3,100         \$ 9,000         \$ 9,000           Digester Recirc Pump         Goulds         \$ 1,000         \$ 9,000         \$ 4,500         \$ 4,500           nstrumentation             \$ 5         \$ 5           Magneters         2 inch units         \$ 2,800         \$ -         \$ -         \$ 5         \$ 5           Gas Flow Meters-FCI         2 inch units         \$ 3,000         \$ 9,000         \$ 9,000         \$ 9,000         \$ -         \$ -         \$ -           PH meters         Rosemount         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Level         Mitronics         \$ 3,000         2 \$ 6,000         \$ 6,000         \$ 8,000         \$ 3,000         \$ 9,000           Isers Fre	1								
Top Mixer         Lightin         \$ 4,500         3 \$ 13,500         \$ 13,500         \$ 13,500           Flare         S&J         \$ 3,500         1 \$ 3,500         \$ 3,500         \$ 3,500           Fressure Regulator/Flame Trap         S&J         \$ 4,600         1 \$ 4,500         \$ 4,500         \$ 9,000           Breather Flame Arrestor         S&J         \$ 4,600         2 \$ 9,000         \$ 9,000         \$ 9,000           Pressure Regited         Fisher         \$ 3,100         \$ 3,100         \$ 3,100         \$ 3,100           Digester Recirc Pump         Goulds         \$ 1,500         3 \$ 4,500         \$ 4,500           nstrumentation            \$ -         \$ -           Agemeters         2 inch units         \$ 2,800         \$ -         \$ -         \$ -           Conductivity Meters         1         \$ -         \$ -         \$ -         \$ -         \$ -           PI meters         Rosemount         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500         \$ -         \$ -           Conductivity Meters          \$ 3,000         2 \$ 6,000         \$ 6,000         \$ 6,000         \$ 5,000         \$ 5,000         \$ 5,000         \$ 5,000         \$ 5,000									
Fare         SkJ         SkJ         \$ 3,500         1         \$ 3,500         \$ 3,500           Pressure Regulator/Flame Arrestor         SkJ         \$ 4,600         1         \$ 4,500         \$ 4,500           Pressure Regulator/Flame Arrestor         SkJ         \$ 4,600         2         \$ 9,000         \$ 9,000           Pressure Relief         Fisher         \$ 3,100         1         \$ 3,100         \$ 3,100         \$ 3,100           Digester Recirc Pump         Goulds         \$ 1,500         3         \$ 4,500         \$ 4,500           magmeters         2 inch units         \$ 2,800         \$ -         \$ -         \$ -           Gas Flow Meters-FCI         2 inch units         \$ 3,000         3 \$ 9,000         \$ 9,000           PH meters         Rosemount         \$ 1,500         \$ 1,500         \$ 1,500           Conductivity Meters         -         \$ -         \$ -         \$ -           Level         Krohne         \$ 3,000         3 \$ 9,000         \$ 9,000           Itevel         Krohne         \$ 3,000         2 \$ 6,000         \$ 6,000           Itevel         Krohne         \$ 3,000         2 \$ 6,000         \$ 5,000           Digester Feed Piping         Valves, Pipe and Fitting			¢ ¢						
Pressure Regulator/Flame Trap       S&J       \$ 4,500       1       \$ 4,500       \$ 4,500       \$ 4,500         Breather Flame Arrestor       S&J       \$ 4,500       2       \$ 9,000       \$ 9,000         Pressure Regulator/Flame Trap       Goulds       \$ 1,500       3       \$ 4,500       \$ 9,000         Digester Recirc Pump       Goulds       \$ 1,500       3       \$ 4,500       \$ 4,500         nstrumentation            \$ -       \$ -         Magneters       2 inch units       \$ 2,800       \$ -       \$ -       \$ -       \$ -         Gas Flow Meters-FC1       2 inch units       \$ 3,000       3       \$ 9,000       \$ 9,000       \$ 9,000         Conductivity Meters         \$ -       \$ -       \$ -       \$ -         Atkalinity Meters         \$ 3,000       3       \$ 9,000       \$ 9,000         Rosemount       \$ 1,500       1       \$ 1,500       \$ 1,500       \$ 1,500       \$ 1,500       \$ 1,500         Level       Krohne       \$ 3,000       2       \$ 6,000       \$ 5,000       \$ 8,000         Digester Recirc Piping       Valves, Pipe and Fittings       \$ 30			\$						
Breather Flame Arrestor       \$8.J       \$4500       2 \$ 9,000       \$9,000         Pressure Relief       Fisher       \$3,100       1 \$ 3,100       \$3,100       \$3,100         Digester Recirc Pump       Goulds       \$1,500       3 \$ 4,500       \$4,500       \$4,500         Instrumentation          \$0       \$0       \$0       \$0         Magmeters       2 inch units       \$2,800       \$ -       \$							1		
Pressure Relief         Fisher         \$ 3,100         1 \$ 3,100         \$ 3,100           Digester Recirc Pump         Goulds         \$ 1,500         3 \$ 4,500         \$ 4,500           strumentation							1		
Digester Recirc Pump       Goulds       \$ 1,500       3       \$ 4,500       \$ 4,500         Instrumentation       Image of the state of the s							[		
Image: state in the state in thest. The state in the state in the state in the state i							1		
Magmeters       2 inch units       \$ 2,800       \$ -       \$ -       \$ -         Gas Flow Meters-FCI       2 inch units       \$ 3,000       3 \$ 9,000       \$ 9,000       \$ 9,000         PI meters       Rosemount       \$ 1,500       1 \$ 1,500       \$ 1,500       \$ -       \$ -         Conductivity Meters       \$ -       \$ -       \$ -       \$ -       \$ -       \$ -         Alkalinity Meters       \$ -       \$ -       \$ -       \$ -       \$ -       \$ -         Level       Krohne       \$ 3,000       2 \$ 6,000       \$ 9,000       \$ 9,000         Level       Miltronics       \$ 3,000       2 \$ 6,000       \$ 3,200         Isseemount       \$ 400       8 \$ 3,200       \$ 3,200         Misc. Lab & Handhelds       \$ 1,500       1 \$ 1,500       \$ 1,500         Icevel       Miltronics       \$ 30       300       \$ 9,000         Igester Feed Piping       Valves, Pipe and Fittings       \$ 30       300       \$ 3,000         Igester Feed Piping       Valves, Pipe and Fittings       \$ 30       75 \$ 2,250       \$ 2,250         Internal Mechanical & Fab       Valves, Pipe and Fittings       \$ 3,500       1 \$ 4,500       \$ 7,500         HVAC Systems									\$ 89,400.
Gas Flow Meters-FCI         2 inch units         \$         \$         \$           Gas Flow Meters-FCI         2 inch units         \$ 3,000         3 \$ 9,000         \$ 9,000           pH meters         Rosemount         \$ 1,500         1 \$ 1,500         \$ 1,500           Conductivity Meters         \$         \$         \$         \$           Alkalinity Meters         \$         \$         \$         \$           Level         Krohne         \$ 3,000         3 \$ 9,000         \$ 9,000           Level         Miltronics         \$ 3,000         2 \$ 6,000         \$ 6,000           RD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         1 \$ 1,500         \$ 1,500           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 3,000         \$ 3,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 4,500         \$ 4,500           Hot Mater Piping         Valves, Pipe and Fittings         \$ 3,500         \$ 7,500         \$ 7,500	nstrumentation								
Gas Flow Meters-FCI       2 inch units       \$ 3,000       3 \$ 9,000       \$ 9,000         PH meters       Rosemount       \$ 1,500       1 \$ 1,500       \$ 1,500         Conductivity Meters       \$ 1,500       \$ 1,500       \$ 1,500         Conductivity Meters       \$ 1,500       \$ 1,500       \$ 1,500         Level       Krohne       \$ 3,000       \$ 9,000       \$ 9,000         Level       Miltronics       \$ 3,000       \$ 9,000       \$ 9,000         Misc. Lab & Handhelds       \$ 1,500       \$ 1,500       \$ 3,200       \$ 3,200         Misc. Lab & Handhelds       \$ 1,500       \$ 1,500       \$ 1,500       \$ 1,500         Digester Feedr Piping       Valves, Pipe and Fittings       \$ 30       300       \$ 9,000       \$ 9,000         Digester Feedric Piping       Valves, Pipe and Fittings       \$ 30       100       \$ 3,000       \$ 3,000         Transfer Piping       Valves, Pipe and Fittings       \$ 30       75       \$ 2,250       \$ 2,250         Internal Mechanical & Fab       Valves, Pipe and Fittings       \$ 3,500       \$ 3,000       \$ 3,000         Hot Water Piping       Valves, Pipe and Fittings       \$ 3,000       \$ 7,500       \$ 7,500         Piping Insulation       \$ 10	Magmeters	2 inch units	\$	2,800					
pH meters         Rosemount         \$ 1,500         \$ 1,500         \$ 1,500           Conductivity Meters         \$ -         \$ -         \$ -         \$ -           Alkalinity Meters         \$ -         \$ -         \$ -         \$ -           Level         Krohne         \$ 3,000         3 \$ 9,000         \$ 9,000           Level         Miltronics         \$ 3,000         2 \$ 6,000         \$ 6,000           Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         \$ 1,500         \$ 1,500           Itechanical Systems         \$ 1,500         \$ 1,500         \$ 1,500           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000           Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 7,000           Hvide Systems         Fans, Filters, Etc.         \$ 2,500         \$ 7,500         \$ 7,500           Hvides & Fittings         \$ 3,500         \$ 1,500         \$ 1,500         \$ 1,500           Hvides & Fibe and Fittings         \$									
pH meters         Rosemount         \$ 1,500         1 \$ 1,500         \$ 1,500           Conductivity Meters         \$ -         \$ -         \$ -         \$ -           Alkalinity Meters         \$ -         \$ -         \$ -         \$ -           Level         Krohne         \$ 3,000         \$ 9,000         \$ 9,000           Level         Miltronics         \$ 3,000         \$ 9,000         \$ 9,000           RTD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         \$ 1,500         \$ 1,500           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         3000         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         3000         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         3000         \$ 9,000           Transfer Piping         Valves, Pipe and Fittings         \$ 300         300         \$ 3,000         \$ 3,000           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 3,500         \$ 7,500         \$ 7,500           HVA Systems         Fans, Filters, Etc.         \$ 2,500         \$ 3,000         \$ 3,000         \$ 3,000	Gas Flow Meters-FCI	2 inch units	\$	3,000	3				
Conductivity Meters         \$							I		
Alkalinity Meters         Kohne         \$ 3,000         \$ 9,000         \$ 9,000           Level         Mitronics         \$ 3,000         2 \$ 6,000         \$ 6,000           RTD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         1 \$ 1,500         \$ 1,500           Mechanical Systems		Rosemount	\$	1,500	1		<b> </b>		
Level         Krohne         \$ 3,000         \$ 9,000         \$ 9,000           Level         Mittronics         \$ 3,000         2 \$ 6,000         \$ 6,000           RTD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         1 \$ 1,500         \$ 1,500         \$ 3,200           Mechanical Systems         \$ 1,500         \$ 1,500         \$ 9,000         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2 \$ 7,000         \$ 7,500           HVXG Systems         Fans, Filters, Etc.         \$ 2,500         3 \$ 7,500         \$ 7,500           Piping Insulation         \$ 10/tt.         \$ 10         300         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 7,500         \$ 7,500         \$ 7,500         \$ 7,500         \$ 7,500 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>									
Level         Miltronics         \$ 3,000         2 \$ 6,000         \$ 6,000           RTD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         1 \$ 1,500         \$ 1,500           Misc. Lab & Handhelds         \$ 1,500         \$ 1,500         \$ 1,500           Mechanical Systems		Marker -		0.000					
RTD's         Rosemount         \$ 400         8 \$ 3,200         \$ 3,200           Misc. Lab & Handhelds         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Aechanical Systems         Image: Constraint of the systems         S 30,200         \$ 30,200           Idechanical Systems         Image: Constraint of the systems         Image: Constraint of the systems         Image: Constraint of the systems         \$ 30           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000         \$ 9,000           Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         75         \$ 2,250         \$ 2,250           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 3,500         \$ 2,500         \$ 7,500         \$ 7,500           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         \$ 7,500         \$ 7,500         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 3,000         \$ 3,000         \$ 3,000         \$ 3,000           HvAc Systems Install         \$ men 10 days @ \$250/day/man         \$ 250         30							I		
Misc. Lab & Handhelds         \$ 1,500         \$ 1,500         \$ 1,500         \$ 1,500           Mechanical Systems         Image: Constraint of the systems         Image: Constraint of the systems         S 30,200           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000         \$ 9,000           Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000         \$ 9,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         \$ 2,500         \$ 7,500         \$ 7,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         \$ 2,500         \$ 3,000         \$ 3,000         \$ 3,000           Hisc. Valves & Fittings         \$ 2,500         \$ 2,500         \$ 3,000         \$ 3,000         \$ 3,000         \$ 3,000           Hisc. Valves & Fittings         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500           Chemical Piping         \$ 3,000							ł		
Alechanical Systems         Marchanical Systems         S         30,200.           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000           Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000           Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 9,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         75         \$ 2,250         \$ 2,250           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 7,000           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 3,000         \$ 3,000           Hisc. Valves & Fittings         \$ 3,000         \$ 3,000         \$ 3,000         \$ 3,000         \$ 3,000           Chemical Piping         \$ 10 days @ \$250/day/man <td></td> <td>RUSEITIOUNT</td> <td></td> <td></td> <td>8</td> <td></td> <td><del> </del></td> <td></td> <td></td>		RUSEITIOUNT			8		<del> </del>		
International Systems         Internatevalue Systems         International Systems			Э	1,500	1	φ 1,500		φ 1,500	¢ 20.000
Digester Feed Piping         Valves, Pipe and Fittings         \$ 30         300         \$ 9,000         \$ 9,000           Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         75         \$ 2,250         \$ 2,250           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 7,000           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         3000         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 20         150         \$ 3,000         \$ 3,000         \$ 3,000           HVAC Systems Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Lequipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$	lechanical Systems								φ 30,200.
Digester Recirc Piping         Valves, Pipe and Fittings         \$ 30         100         \$ 3,000         \$ 3,000           Transfer Piping         Valves, Pipe and Fittings         \$ 30         75         \$ 2,250         \$ 2,250           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 7,000           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         300         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 3,000         \$ 3,000           Chemical Piping         \$ 200         150         \$ 3,000         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 300         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500           Misc. Valves & Fittings         \$ 3,600         \$ 3,500         \$ 3,500         \$ 3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechani		Valves Pine and Fittings	¢	20	200	\$ 0.000	<del> </del>	\$ 0.000	
Transfer Piping         Valves, Pipe and Fittings         \$ 30         75         \$ 2,250         \$ 2,250           Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 4,500           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         300         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 1,500           Chemical Piping         \$ 2,00         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500           Misc. Kupipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500							-		
Internal Mechanical & Fab         Valves, Pipe and Fittings         \$ 4,500         1         \$ 4,500         \$ 4,500           Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 7,000           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         3000         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 1,500           Chemical Piping         \$ 2,500         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3,600         \$ 3,500         \$ 3,000         \$ 3,000           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500									
Hot Water Piping         Valves, Pipe and Fittings         \$ 3,500         2         \$ 7,000         \$ 7,000           HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         300         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 1,500           Chemical Piping         \$ 2,00         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3,600         \$ 3,000         \$ 3,000           Misc. Capuipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Explorate Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500									
HVAC Systems         Fans, Filters, Etc.         \$ 2,500         3         \$ 7,500         \$ 7,500           Piping Insulation         \$10/ft.         \$ 10         300         \$ 3,000         \$ 3,000           Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 1,500           Chemical Piping         \$ 20         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3,500         1         \$ 3,500         \$ 3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500							1		
Piping Insulation         \$10/ft.         \$10         300         \$3,000         \$3,000           Misc. Valves & Fittings         \$75         20         \$1,500         \$1,500           Chemical Piping         \$20         150         \$3,000         \$3,000           HVAC Systems Install         \$3,500         \$3,500         \$3,500         \$3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$250         30         \$7,500         \$7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$250         30         \$7,500         \$7,500									
Misc. Valves & Fittings         \$ 75         20         \$ 1,500         \$ 1,500           Chemical Piping         \$ 20         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500							1		
Chemical Piping         \$ 20         150         \$ 3,000         \$ 3,000           HVAC Systems Install         \$ 3,500         \$ 3,500         \$ 3,500         \$ 3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500							1		
HVAC Systems Install         \$ 3,500         1         \$ 3,500         \$ 3,500           Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500									
Misc. Equipment Install         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500           Misc. Mechanical Labor         3 men 10 days @ \$250/day/man         \$ 250         30         \$ 7,500         \$ 7,500							1		
Misc. Mechanical Labor 3 men 10 days @ \$250/day/man \$ 250 30 \$ 7,500 \$ 7,500		3 men 10 days @ \$250/day/man					1		
							1		
	MISC. Mechanical Labor				50	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	i	,000	

	Cost per Head	d l			\$	565.75		\$	565.75
	Tota	l			\$	1,697,256		\$	1,697,256.25
	Contingency		25%			339,451	 	\$	339,451.25
lotals					\$	1,357,805	 \$ 1,357,805	\$	1,357,805.00
								¥	,200100
Mise. Electrical Supplies	Conduit, whe, mangars, junction boxes	Ψ	3,000	1	ψ	3,000	\$ 3,000	\$	74,250.00
Misc. Electrical Supplies	Conduit, Wire, Hangars, junction boxes	\$	5,000	1	\$ \$	5,000	\$ 5,000		
Controls	\$250/day/man	\$	250		\$	2,000	\$ 2,000		
Lighting	\$250/day/man	\$	250		۹ \$	2,000	\$ 2,000		
Site Electrical	\$250/day/man	\$	250	12		2,500	\$ 2,500		
Equipment Electrical	\$250/day/man	э \$	250	12		3,000	\$ 3,000		
MCC Instruments	\$250/day/man \$250/day/man	\$ \$	250 250	10	\$ \$	2,500 1,250	\$ 2,500 \$ 1,250		
Underground Electrical	Site and underslab	\$	7,500	1	\$	7,500	\$ 7,500		
Misc. Electrical	Plugs, Cords, switches, fixtures, hangars etc	\$	7,500	1	\$	7,500	\$ 7,500		
Controls	Numatics	\$	6,500	1	\$	6,500	\$ 6,500		
Controls	PLC Panel		17,500	1	\$	17,500	\$ 17,500		
MCC's	Starters, Power Dist. Lighting	\$	12,500	1	\$	12,500	\$ 12,500		
Power Supply	Transformers, Main Power to Facility	\$	4,500	1	\$	4,500	\$ 4,500		
lectrical Equipment									

	Lusk Dairy Farm Digest	ter Syste	m - 3,000	Head				
	Notes		it Cost	Units	Cost	Margin	Total	Total
eneral Conditions								
A -l		¢	40.000		¢ 10.000		¢ 10.000	
Administrative		\$	10,000	1	\$ 10,000		\$ 10,000	
Travel Subsistance		\$ \$	2,500	1	\$ 2,500 \$ 1,000		\$ 2,500 \$ 1,000	
				1				
Permits & Fees		\$	2,500	1	\$ 2,500 \$ -		\$ 2,500 \$ -	
Startup Services		\$	7,500	1	\$ - \$ 7,500		\$- \$7,500	
Proj. Management		\$	2,500	1				
Office and Storage Facilities		\$	2,500	1	\$ 2,500		\$ 2,500	\$ 26,000.
nginooring								φ 20,000.
ngineering Civil Engineering-Site		¢	05	80	¢ 6.800		¢ 6.900	
		\$	85	80			\$ 6,800	
Civil Engineering-Struct		\$	95	100			\$ 9,500	
Process Engineering		\$	120	150			\$ 18,000	
Electrical Engineering		\$	95	100			\$ 9,500	
Mechanical Engineering		\$	95	100	\$ 9,500		\$ 9,500	¢ 52.200
ite Work								\$ 53,300.
	Equipment Pads 100 Sq. Ft @ \$10/sq. Ft.	\$	10	100	\$ 1,000		\$ 1,000	
Misc. Concrete								
Tank Foundation	Ring Foundation	\$	12,000	4	\$ 48,000		\$ 48,000	
Piping	Process Piping - 100 Ft. 2-3" PVC @ \$30/ft	\$	30	200	\$ 6,000		\$ 6,000	
	Biogas Piping - 200 Ft 2" Steel @ \$25/ft.	\$	25	300	\$ 7,500		\$ 7,500	
	General Water Piping - 100 Ft. of 1" @ \$10/ft	\$	10	300	\$ 3,000	ļ	\$ 3,000	
	Chemical and Misc. 100 Ft. @ \$20/ft	\$	20	200	\$ 4,000		\$ 4,000	
Site Prep	Sub-base for tanks & building - \$2/sqft @ 300 sqft	\$	2	1500	\$ 3,000		\$ 3,000	
Site Work	Site Filling, Grading, Finish site - 5\$/cu.yd.	\$	5	1000	\$ 5,000		\$ 5,000	
Accessways	Roads & Misc. Site @ \$15/sq.ft.	\$	15	1000	\$ 15,000		\$ 15,000	
								\$ 92,500.
inishes	Misc. Painting	\$	10	750	\$ 7,500		\$ 7,500	
								\$ 7,500.
anks & Metals								
Bolted Steel	4 - 100,000 gal. Digesters	\$	0.75	400,000	\$ 300,000	1	\$ 300,000	
	Insulation Sq.ft.	\$	8.50	13,000	\$ 110,500	1	\$ 110,500	
	Holding Tank	\$	0.59	62,000	\$ 36,580		\$ 36,580	
	Clarifier	\$	2.50	02,000	\$ -		\$ -	
	Preheat	\$	2.50		\$-		\$-	
Building	400 sq. ft.	\$	2.50	400	\$ 26,000		\$ 26,000	
Building		\$	50	100				
	Ribbon Drains							
	Pump Stands	\$	250	6			\$ 1,500	
	Doors	\$	1,200	2	\$ 2,400		\$ 2,400	
	Windows	\$	350	4	\$ 1,400		\$ 1,400	
	Rollup Door	\$	2,500	1	\$ 2,500		\$ 2,500	
								\$ 485,880.
Equipment								
Chopper Pump	Vaughan- Feed from pit to Conditioning	\$	4,500	1			\$ 4,500	
Blowers	Rotron	\$	6,500	3	\$ 19,500		\$ 19,500	
FEB Pumps	Goulds	\$	1,500	1	\$ 1,500		\$ 1,500	
Chopper Pump	Vaughan	\$	4,200	1	\$ 4,200		\$ 4,200	
Screen	Basket Strainer	\$	500	1	\$ 500		\$ 500	
Heat Mix Pump	Goulds	\$	1,500	1	\$ 1,500		\$ 1,500	
Scrubber	ESS	\$	15,000	1	\$ 15,000		\$ 15,000	
Heat Ex	ESS	\$	3,500	2	\$ 7,000		\$ 7,000	
Boiler	Hurst	\$	56,000	_	\$ -		\$ -	
Hot Water Pumps	Bell&Gosset	\$	400	4			\$ 1,600	
Chem Pumps	LMI	\$	2,500	4	\$ 10,000		\$ 10,000	
Digester Feed Pump	Wilden/Vogelsang	\$	1,500	4			\$ 6,000	
		φ ¢		4				
Mixer	Ligtnin	¢	4,500	4	\$ 18,000 \$ 3,500		\$ 18,000	
Flare	S&J	\$	3,500	1			\$ 3,500	
Pressure Regulator/Flame Trap	S&J	\$	4,500	1	\$ 4,500		\$ 4,500	
Breather Flame Arrestor	S&J	\$	4,500				\$ 9,000	
Pressure Relief	Fisher			1	\$ 3,100		\$ 3,100	
		\$	3,100				\$ 6,000	
Digester Recirc Pump	Goulds	\$	1,500	4	\$ 6,000		φ 0,000	
	Goulds			4	\$ 6,000		¢ 0,000	\$ 115,400.
nstrumentation		\$	1,500	4	\$ 6,000			\$ 115,400.
	Goulds 2 inch units			4	\$-		\$-	\$ 115,400.
nstrumentation Magmeters		\$	1,500	4				\$ 115,400.0
nstrumentation		\$	1,500	4	\$-		\$-	\$ 115,400.
nstrumentation Magmeters	2 inch units	\$	1,500 2,800	4	\$- \$-		\$ - \$ -	\$ 115,400.
nstrumentation Magmeters	2 inch units	\$	1,500 2,800	5	\$ - \$ - \$ 15,000		\$ - \$ - \$ 15,000	\$ 115,400.
nstrumentation Magmeters Gas Flow Meters-FCI pH meters	2 inch units 2 inch units	\$ \$ \$	1,500 2,800 3,000	5	\$ - \$ - \$ 15,000 \$ - \$ 3,000		\$ - \$ - \$ 15,000 \$ - \$ 3,000	\$ 115,400.
nstrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters	2 inch units 2 inch units	\$ \$ \$	1,500 2,800 3,000	5	\$ - \$ - \$ 15,000 \$ - \$ 3,000 \$ -		\$ - \$ - \$ 15,000 \$ - \$ 3,000 \$ -	\$ 115,400.
strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters	2 inch units 2 inch units 2 inch units Rosemount	\$ \$ \$ \$	1,500 2,800 3,000 1,500	5	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ -		\$ - \$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ -	\$ 115,400.
strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level	2 inch units 2 inch units Rosemount Krohne	\$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$ -		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ - \$ 12,000	\$ 115,400.
Instrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000	5	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ 6,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ - \$ - \$ - \$ - \$ - \$ 12,000	\$ <u>115,400</u> .
strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's	2 inch units 2 inch units Rosemount Krohne	\$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000 400		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200	<u>\$</u> 115,400.
Instrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000	5	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ 6,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ - \$ - \$ - \$ - \$ - \$ 12,000	
Astrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics	\$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000 400	5	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200	\$ 115,400. \$ 40,700.
Instrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Instrumentation Instrumentatio Instrumen	2 inch units 2 inch units 2 inch units Kosemount Krohne Miltronics Rosemount	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000 400 1,500	5 2 4 8 1	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500	
Instrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Digester Feed Piping	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 400 1,500 3,000	5 2 4 4 8 1 1 300	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ 2,00 \$ 6,000 \$ 6,000 \$ 3,220 \$ 1,500 \$ 1,500 \$ 2,000 \$ 3,220 \$ 3,200 \$ 3,20		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ 3,000 \$ - \$ 5 \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,000 \$ 3,200 \$ 3,000 \$ 3	
Istrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Igester Feed Piping Digester Recirc Piping	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 400 1,500 1,500 3,00000000	5 2 2 4 2 8 1 1 300 100	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 2 \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 3,200 \$ 3,000 \$ 3		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,000 \$ 3,000	
Istrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds Ingester Feed Piping Digester Recirc Piping Digester Recirc Piping	2 inch units 2 inch units 2 inch units Kosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000 1,500 1,500 1,500 1,500 3,000 3,000 3,000 3,000 3,000 3,000 3,000 1,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,000 \$ 3,000 \$ 3,000 \$ 2,250		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,200 \$ 5,250 \$ 3,250 \$ 5,250 \$ 5,550 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,55000 \$ 5,5500	
Internal Wechanical & Fab	2 inch units 2 inch units 2 inch units 2 inch units Krohne Mittronics Rosemount Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 400 1,500 300 300 300 4,500	5 2 2 4 2 8 1 1 300 100	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 2,250 \$ 18,000 \$ 2,250 \$ 18,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 9,000 \$ 3,000 \$ 2,250 \$ 18,000	
Internal Wechanical & Fab	2 inch units 2 inch units 2 inch units Kosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 3,000 1,500 1,500 1,500 1,500 3,000 3,000 3,000 3,000 3,000 3,000 3,000 1,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,000 \$ 3,000 \$ 3,000 \$ 2,250		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,200 \$ 5,250 \$ 3,250 \$ 5,250 \$ 5,550 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,5500 \$ 5,55000 \$ 5,5500	
strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds echanical Systems Digester Feed Piping Digester Recirc Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping	2 inch units 2 inch units 2 inch units Rosemount Krohne Mittronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings Valves, Pipe and Fittings	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 1,500 3,000 400 1,500 300 300 300 4,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 2,250 \$ 18,000 \$ 2,250 \$ 18,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 9,000 \$ 3,000 \$ 2,250 \$ 18,000	
strumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds echanical Systems Digester Feed Piping Digester Feed Piping Transfer Piping Internal Mechanical & Fab Hot Water Piping HvAC Systems	2 inch units 2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 1,500 3,000 3,000 400 1,500 1,500 3,000 3,000 3,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,000 \$ 2,250 \$ 18,000 \$ 18,000 \$ 14,000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ 3,200 \$ 12,000 \$ 12,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 1,500 \$ 3,200 \$ 1,500 \$ 1,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,200 \$ 1,500 \$ 1,000 \$ 3,000 \$ 3,200 \$ 1,000 \$ 3,200 \$ 1,000 \$ 3,200 \$ 1,000 \$ 3,200 \$ 1,000 \$ 3,200 \$ 1,000 \$ 3,200 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 1,000 \$ 1,000 \$ 1,000 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 1,000 \$ 2,250 \$ 1,000 \$ 2,500 \$ 1,000 \$ 2,500 \$ 1,000 \$ 1,000 \$ 2,500 \$ 1,000 \$	
Internal Mechanical & Fab How Meters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level RTD's Misc. Lab & Handhelds Internal Mechanical & Fab Hot Water Piping Internal Mechanical & Fab Hot Water Piping Piya Insulation	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Fans, Filters, Etc.	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	1,500 2,800 3,000 3,000 3,000 3,000 4,500 3,500 3,500 2,500	3000 75 44 4 3000 75 4 4 1 300	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,000 \$ 2,250 \$ 18,000 \$ 2,550 \$ 3,000 \$ 5,000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,000 \$ 5,0000 \$ 5,000 \$ 5,000 \$ 5		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,200 \$ 1,500 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 3,000 \$ 1,500 \$ 3,000 \$ 1,500 \$ 3,000 \$ 1,500 \$ 3,000 \$ 1,500 \$ 3,000 \$ 1,500 \$ 3,000 \$ 1,500 \$ 2,250 \$ 14,000 \$ 2,250 \$ 14,000 \$ 2,250 \$ 14,000 \$ 2,500 \$ 1,500 \$ 1,500 \$ 1,500 \$ 2,250 \$ 1,500 \$ 1,500 \$ 1,500 \$ 2,250 \$ 1,500 \$ 1,500 \$ 2,250 \$ 1,500 \$ 1,500 \$ 2,250 \$ 1,500 \$ 2,250 \$ 2,500 \$ 3,000 \$ 2,500 \$ 2,500 \$ 3,000 \$ 2,500 \$ 3,000 \$ 2,500 \$ 3,000 \$ 2,500 \$ 3,000 \$ 2,500 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,	
Internal Mechanical & Fab Hot Water Piping Harter Piping Hater Piping Hater Piping Hot Water Piping Hot Wate	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Fans, Filters, Etc.	\$         \$           \$         \$	1,500 2,800 3,000 1,500 1,500 1,500 1,500 1,500 3,000 3,000 3,000 3,500 2,500 7,5	5 2 2 4 4 2 8 1 1 300 100 100 75 4 4 4 4 1 300 20	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 3,200 \$ 1,500 \$ 18,000 \$ 2,250 \$ 18,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 1,500		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ 12,000 \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 3,200 \$ 3,200 \$ 1,500 \$ 2,250 \$ 18,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 3,000 \$ 14,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 14,000 \$ 14,0000 \$ 14,0000 \$ 14,0000 \$ 14,0000 \$ 14,0000 \$ 14,0000	
Internal Mechanical & Fab Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level Misc. Lab & Handhelds Misc. Valves & Flore Piping Insulation Misc. Valves & Flittings Chemical Piping	2 inch units 2 inch units 2 inch units Rosemount Krohne Miltronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Fans, Filters, Etc.	\$         \$           \$         \$	1,500 2,800 3,000 3,000 3,000 3,000 4,500 3,500 2,500 10 75 20	5 2 2 4 4 2 8 1 1 300 100 75 4 4 1 1 300 20 20 150	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 2,000 \$ 6,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 3,200 \$ 3,200 \$ 3,200 \$ 1,500 \$ 3,000 \$ 3,0000 \$ 3,0000 \$ 3,0000		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 12,000 \$ 3,200 \$ 14,000 \$ 2,250 \$ 14,000 \$ 3,000 \$ 5,000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,0000 \$ 5,00000 \$ 5,00000 \$ 5,00000 \$ 5,00000 \$ 5,00000000 \$ 5,000000000000000000000000000000000000	
Istrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds Internal Mechanical & Fab Hot Water Piping Internal Mechanical & Fab HotWater Piping HotXA Systems Piping Insulation Misc. Valves & Fittings Chemical Piping HVAC Systems Install	2 inch units 2 inch units 2 inch units 2 inch units Rosemount Krohne Mittronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Pittings Valves	\$         \$           \$         \$	1,500 2,800 3,000 3,000 3,000 4,500 3,000 4,500 3,500 2,500 10 75 2,00 3,500	300 75 4 4 2 8 8 1 1 300 75 4 4 4 4 4 4 1 300 20 150 1 1	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 3,200 \$ 1,500 \$ 3,000 \$ 2,250 \$ 14,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 2,250 \$ 14,000 \$ 3,000 \$ 2,250 \$ 1,500 \$ 3,000 \$ 3,		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 2,250 \$ 18,000 \$ 14,000 \$ 2,250 \$ 18,000 \$ 14,000 \$ 14,000 \$ 14,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 2,250 \$ 3,000 \$ 3,000\$ \$ 3,00	
Internation Intern	2 inch units 2 inch units 2 inch units Rosemount Krohne Mitronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Fittings Same Same Same Same Same Same Same Same	\$         \$	1,500 2,800 3,000 1,500 3,000 3,000 4,00 1,500 3,000 4,500 3,500 2,500 10 75 20 3,500 2,500	3000 75 3000 100 100 200 150 1 300 100 100 100 100 100 100 100 100	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 2,250 \$ 18,000 \$ 2,250 \$ 14,000 \$ 2,250 \$ 14,000 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,0		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 3,200 \$ 1,500 \$ 2,250 \$ 18,000 \$ 2,500 \$ 3,000 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,000 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,000	
Istrumentation Magmeters Gas Flow Meters-FCI pH meters Conductivity Meters Alkalinity Meters Level Level Level RTD's Misc. Lab & Handhelds Internal Mechanical & Fab Hot Water Piping Internal Mechanical & Fab HotWater Piping HotXA Systems Piping Insulation Misc. Valves & Fittings Chemical Piping HVAC Systems Install	2 inch units 2 inch units 2 inch units 2 inch units Rosemount Krohne Mittronics Rosemount Valves, Pipe and Fittings Valves, Pipe and Pittings Valves	\$         \$           \$         \$	1,500 2,800 3,000 3,000 3,000 4,500 3,000 4,500 3,500 2,500 10 75 2,00 3,500	3000 75 4 4 3000 100 75 4 4 4 1 300 200 150 1 300	\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 1,500 \$ 2,250 \$ 18,000 \$ 2,250 \$ 14,000 \$ 2,250 \$ 14,000 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,0		\$ - \$ 15,000 \$ - \$ 3,000 \$ - \$ - \$ 12,000 \$ 6,000 \$ 12,000 \$ 6,000 \$ 3,200 \$ 1,500 \$ 3,200 \$ 1,500 \$ 3,000 \$ 2,250 \$ 14,000 \$ 14,000 \$ 14,000 \$ 14,000 \$ 3,000 \$ 2,250 \$ 3,000 \$ 2,500 \$ 3,000 \$ 3,0000 \$ 3,000 \$ 5,000 \$	

	Cost per Head	ł			\$	406.78			\$	406.78
	Tota	1			\$	1,220,350			\$	1,220,350.00
	Contingency		25%			244,070			\$	244,070.00
otals					\$	976,280	\$	976,280	\$	976,280.00
		T							•	,
Mise. Electrical Supplies	Conduit, whe, mangars, junction boxes	-	5,000	1	Ψ	5,000	Ψ	3,000	\$	76,750.00
Misc. Electrical Supplies	Conduit, Wire, Hangars, junction boxes	\$ \$	5,000	10	۹ \$	5,000	φ \$	5,000		
Controls	\$250/day/man	۹ \$	250	10		2,000	э \$	2,000		
Site Electrical Lighting	\$250/day/man \$250/day/man	\$ \$	250 250	15	Դ Տ	3,750	\$ \$	3,750		
Equipment Electrical	\$250/day/man	\$	250	10		2,500	\$	2,500		
Instruments	\$250/day/man	\$	250		\$	1,250	\$	1,250		
MCC	\$250/day/man	\$	250	15		3,750	\$	3,750		
Underground Electrical	Site and underslab	\$	7,500	1	\$	7,500	\$	7,500		
Misc. Electrical	Plugs, Cords, switches, fixtures, hangars etc	\$	7,500	1	\$	7,500	\$	7,500		
Controls	Numatics	\$	6,500	1	\$	6,500	 \$	6,500		
Controls	PLC Panel	\$	17,500	1	\$	17,500	\$	17,500		
MCC's	Starters, Power Dist. Lighting	\$	12,500	1	\$	12,500	\$	12,500		
Power Supply	Transformers, Main Power to Facility	\$	4,500	1	\$	4,500	\$	4,500		
lectrical Equipment										