The Village of Cimarron, New Mexico
Wastewater System Improvements

Supplemental Wastewater Preliminary Engineering Report

Prepared by Nolte Associates, Inc.
Colorado Springs, CO
Revised March 31, 2009

NOLTE
BEYOND ENGINEERING

March 26th, 2009
CSB070002

Thomas Andrews
Project Engineer
New Mexico Environmental Department
Construction Programs Bureau
1190 St. Francis Drive
PO Box 26110
Santa Fe, NM 87502-6110

Subject: Response to Supplemental Wastewater PER Comments

Dear Tom:

Nolte Associates, Inc. has received your comments dated January 27 and February 5, 2009 regarding the Supplemental Wastewater Preliminary Engineering Report submitted to the Construction Programs Bureau on December 4, 2008 and offers the following responses.

1. *Page 9: It appears that the recommendation should be Alternative 1 in Table 1 rather than Alternative 2. Please confirm this and contact Robert George for the NMED-GWQB comments.*

   Nolte's recommendation for Alternative 2 is intentional. As documented in the Supplemental Wastewater PER, this is not the least costly option, but it does provide the Village the operational flexibility necessary to discontinue discharge from the treatment lagoons to neighboring French Lake. Alternative 1 was the least costly alternative identified in the Supplemental PER, but more detailed study shows that it would require additional excavation to increase the capacity of the east lagoon for adequate storage.

   When the Supplemental PER was prepared, irrigation was assumed possible over nine of the twelve months. Further research into the climatology data for Cimarron from the National Oceanic and Atmospheric Administration (NOAA) reveals that there is a 90% chance that freezing temperatures in Cimarron will not exceed 158 days. This forecast is attached. Based on this information, the winter storage requirements are greater than originally estimated. For the Supplemental PER, it is estimated that winter storage is required for five complete months and two partial months. These volumes can be seen in the attached spreadsheet titled Cimarron Reuse Water Storage Volumes.

   The storage volume spreadsheet shows that the east lagoon would need to store approximately 37 acre-feet of water once converted to a reuse storage basin. To store this amount of reuse water, the bottom of the lagoon must be excavated. Using a side

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slope of three (3) feet horizontal to one (1) vertical foot, the depth of the new basin must be 17 feet, which is 10 feet lower than the existing bottom of the lagoon. Using a side slope of four (4) feet horizontal to one (1) vertical foot, the depth of the new basin must be 21 feet, which is 14 feet lower than the existing bottom of the lagoon.

When the Supplemental PER was prepared, excavating the bottom of the east lagoon was not included in the cost estimate for Alternative 1, since this analysis had not been performed at that time.

An additional consideration with more than doubling the depth of the east basin is the stability of the earthen partition between the west lagoon and the east basin when the west lagoon is full of wastewater and the east basin is empty. Additional geotechnical engineering fees have been included as well as construction costs for reinforcement/stabilization of the partition wall between the west lagoon and the east basin.

After adding these costs, Alternative 1 is estimated to cost approximately $1,814,000. This revised cost estimate and summary are attached for your reference. While this alternative is still the lowest cost, the recommendation for Alternative 2 remains. As described in the Supplemental PER, Alternatives 2 and 3 provide much more operational flexibility than Alternative 1, providing much greater assurance of environmental compliance during the upset conditions that will invariably occur from time to time. Alternative 2 is selected over Alternative 3 due to the small percentage difference in costs at this preliminary estimating level of detail and greater ground water protection from lining the west lagoon.

2. *Please add to the replies to NMED comments, a calculation of the estimated TN concentration for Alternative 1 since that is the least costly option.*

Using field measurements of various parameters at the influent and effluent portions of the existing lagoons from August of 2007, the estimated total nitrogen for Alternative 1 following aeration and settling treatment is 48 mg/L. This calculation assumes complete mix aeration in two-thirds of the existing west lagoon and settling in one-third of the lagoon. Please see the attached calculations for more details on the assumptions used, as well as the results.

Alternatives 2 and 3 are estimated to provide a similar level of nitrogen removal.

Additional measurements and testing are required to provide a more detailed estimate of total nitrogen levels in the effluent of the proposed design. Many of the parameters that affect the total nitrogen level, as well as other wastewater characteristics, will be investigated in greater detail during final design.

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All new or revised information has been attached to this letter for your convenience. If you have any further questions or comments, do not hesitate to contact me.

Sincerely,

Wilbur L. Koger
Group Director, Water Resources
719-268-8570

CC: Steve Pedro – NMED GWQB
Mayor Pavletich – Village of Cimarron
Mindy Cahill – Village of Cimarron

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I. GENERAL

The purpose of this Supplemental Preliminary Engineering Report is to identify, provide background information on, and estimate construction costs regarding additional alternatives for the Village of Cimarron's wastewater treatment works. Please see the Wastewater Preliminary Engineering Report (PER) prepared for the Village revised February 8, 2008 for additional background information and the comparison of original alternatives.

II. ALTERNATIVES CONSIDERED

The two alternatives compared in the original PER were aerated lagoons and total evaporative lagoons. At the time of the comparison, both options were feasible and the most cost effective solution was the construction of aerated lagoons to treat the wastewater. Since that time, the Village has considered modifications to the wastewater lagoons to achieve a zero discharge system to avoid costly mechanical treatment necessary to meat biomonitoring requirements anticipated by the upcoming NPDES permit for the Village.

The Village staff has confirmed that there is no requirement for the release of return flows to French Lake to meet water right requirements. This allows the Village to pursue a wastewater treatment system with zero discharge.

All three alternatives considered in this supplemental PER are based on the discontinued release of wastewater to French Lake.

While the total evaporative lagoon system would have met the new zero discharge goals, the 56 acres required for evaporation make the system impractical. As an alternative, the Village has met with the adjacent property owner, Vermejo Park Ranch (Ranch), to consider using the treated wastewater as reuse water for irrigation purposes on the Ranch.

The wastewater will be treated using aeration and disinfection as described in the original PER. The Village intends to meet Class 2 Reclaimed Wastewater that will be stored and used for irrigation purposes according to NMED Ground Water Quality Bureau Guidance: Above Ground Use of Reclaimed Domestic Wastewater, January 2007.

At this time, the following analysis does not include the evaluation of small package treatment plants located at the Village's largest users for reuse on individual properties. Given the Village's few users with high wastewater flow and the few employees available to operate and maintain the package treatment plants, this type of solution may be more labor intensive than the Village's available resources. Future circumstances may allow this alternative to be evaluated.

The three alternatives detailed below consider varying implementation plans to achieve collection, treatment, storage, and reuse of the Village's wastewater. Those alternatives are:

1) West Lagoon Treatment – East Lagoon Storage Basin
2) Two Train West Lagoon Treatment – East Lagoon and New Basin Storage
3) One Train West Lagoon Treatment – East Lagoon and New Basin Storage

1. West Lagoon Treatment – East Lagoon Storage Basin

A. Description

The end result of this alternative is to use the existing west lagoon for wastewater treatment and to transform the east lagoon to a reuse water storage basin. Treatment will be achieved through the use of aerators in the west lagoon and an ultraviolet or sodium hypochlorite disinfection system between the lagoons.

Phasing:

All wastewater will be directed to the west lagoon for treatment and accumulation while the wastewater and sludge in the east lagoon are removed and land applied on the Ranch property (see attached Sheet 1 for possible land application sites). The land application site will be different than the future irrigation area. With the wastewater and sludge removed from the east lagoon, it could be thoroughly cleaned and lined to prepare it for reuse water storage.

While the east lagoon is being transformed, the west lagoon would be equipped with aeration equipment for the treatment of Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) in the wastewater. Disinfection equipment would be installed between the two lagoons. With these treatment systems in place, the reuse water entering the east storage basin would be useful for irrigation purposes.

A new pump station and distribution pipe would deliver the reuse water to the future irrigation area on the Ranch property. During winter months, when irrigation is not feasible, the east basin would provide storage of reuse water for five complete months during the winter and two partial months during the spring and fall (see Design Criteria below and the Appendix for additional details).

B. Design Criteria

This analysis assumes that the Village generates 80,000 gallons per day (gpd) of wastewater, which is conservative considering the average wastewater flow over a two and a half year period (September, 2005 to March, 2008) was 62,700 gpd (revised PER). Using 80,000 gpd, the total volume of wastewater generated in a year is approximately 90 acre-feet (ac-ft). To achieve a zero discharge system, the Ranch would need to use the 90 ac-ft of reuse water, less the evaporation volume from the lagoons.

Based on climatology data from the National Oceanic and Atmospheric Administration (NOAA), there is a 90% chance that freezing temperatures in Cimarron will not exceed 158 days. This forecast is attached. Based on this information, the winter storage requirements are five complete months and two partial months. These volumes can be seen in the attached spreadsheet titled Cimarron Reuse Water Storage Volumes.

To store reuse water for this length of time, the east lagoon would need to hold approximately 37 acre-feet of water once converted to a reuse storage basin. To store this amount of reuse water, the bottom of the lagoon must be excavated. Using a side

slope of three (3) feet horizontal to one (1) vertical foot, the depth of the new basin must be 17 feet, which is 10 feet lower than the existing bottom of the lagoon. Using a side slope of four (4) feet horizontal to one (1) vertical foot, the depth of the new basin must be 21 feet, which is 14 feet lower than the existing bottom of the lagoon. Another way to increase the storage capacity is to construct a third basin for additional storage (Alternatives 2 or 3).

To determine the acreage required for irrigation, the NOAA data was again referenced. The Cimarron area receives approximately 18-inches of precipitation each year and depending on the type of crops planted by the Ranch, the 90 ac-ft would need to be distributed over 40-50 acres.

C. Map – Schematic Layout
See the attached map titled Wastewater Alternative 1.

D. Environmental Impacts
None at this time. The reuse water will meet all applicable standards required by the New Mexico Ground Water Quality Bureau.

E. Land Requirement
This solution does not require the purchase of any additional land. The disinfection station, pump station, and distribution main will remain on the land currently fenced in with the lagoons. The number of irrigation acres required will be determined by the Ranch as they evaluate how they wish to use the reuse water.

F. Construction Problems
The removal of biosolids and wastewater from the east lagoon as well as all improvements for treatment in the west lagoon will need to be completed within three months of directing all wastewater to the east lagoon. Three months is the amount of time it will take to add 18-inches to the water level of the lagoons. After three months, the wastewater needs to flow into the reuse basin.

Excavating the bottom of the east lagoon to obtain the required storage volumes will more than double to depth of the existing lagoon. The stability of the earthen partition between the west lagoon and the east basin when the west lagoon is full of wastewater and the east basin is empty will be a concern. Thorough geotechnical engineering will be required to determine the appropriate reinforcement/stabilization of the earthen partition wall between the west lagoon and the east basin.

G. Cost Estimates

1. Construction
The estimated construction cost for the Wastewater Reuse Alternative is $1,444,000. Please see attached breakdown of estimated costs.

2. Non-Construction

Non-construction costs, including permitting, engineering design fees, legal fees, and construction management are estimated to be $130,000. Please see attached breakdown of estimated costs.

3. Annual Operations and Maintenance

Annual operation and maintenance costs are estimated to be $63,000. This cost includes employee salaries, benefits, regular equipment maintenance, and electric costs. Please see attached breakdown of estimated costs.

H. Advantages / Disadvantages

This alternative allows the Village to produce reuse water utilizing many of the existing facilities without the construction of a new lagoon.

The disadvantages of this alternative include the construction problems associated with the depth of excavation and geotechnical stabilization of the existing facilities. Additionally, cleaning, repair, construction, and other circumstance may require that the west lagoon be taken out of service. With the west lagoon out of service, the Village would have no other option but to send wastewater to the east lagoon, which would contaminate it with respect to reuse water storage. Additionally, this alternative does not provide storage of reuse water for more than three months during the winter without substantial excavation and geotechnical evaluation.

2. Two Train West Lagoon Treatment – East Lagoon and New Basin Storage

A. Description

The end result of this alternative is to modify the west lagoon to be composed of two parallel treatment trains each capable of treating the Village's wastewater to reuse standards in the event that one or the other needs maintenance or repairs. Treatment would be achieved through the use of aeration and an ultraviolet or sodium hypochlorite disinfection system between the two existing lagoons.

After disinfection, treated wastewater would flow into the cleaned and lined east basin for reuse storage. Additional reuse storage would be contained in the new storage basin constructed to the east of the existing east lagoon.

A pump station and distribution main would deliver reuse water to the irrigation fields located on the adjacent Ranch property just south of the existing lagoons.

Phasing:

A new lagoon with a 30 ac-ft capacity would be constructed to serve as an intermittent reuse storage basin.

Once this basin was constructed, all wastewater would be directed to the east lagoon for treatment. The wastewater would flow into the new storage basin after receiving disinfection treatment.

During that time, the west lagoon would receive all improvements necessary to transform it into the future treatment lagoon. Improvements would include removal of all sludge and wastewater, construction of a partition wall to create two treatment trains, installation of a liner, aeration equipment, disinfection equipment, pipe works, and valving to connect the lagoons.

Once the west lagoon received the prescribed improvements, all wastewater would be directed to the west lagoon for treatment. The east lagoon would be closed off, top water could be pumped to the west lagoon for treatment, and the sludge would be allowed to dry out completely. The treated wastewater would flow to the new basin for storage and reuse.

When the east lagoon dries up and the Village obtains adequate funding, the sludge could be removed and land applied. Then the east lagoon would receive a liner and pipe works to be used as the future storage basin.

B. Design Criteria

The design of this alternative uses the same calculations and assumptions regarding wastewater flow, storage volume, and irrigation usage as the first alternative.

The new storage basin would be constructed to the east of the existing east lagoon because the general direction of flow from the Village to the irrigation fields is from the west to the east. Constructing the new storage basin on the east side reduces the length of piping and matches the general direction of flow from the west to the east.

C. Map – Schematic Layout

See the attached map titled Wastewater Alternative 2.

D. Environmental Impacts

None at this time. The reuse water will meet all applicable standards required by the New Mexico Ground Water Quality Bureau.

E. Land Requirement

This alternative requires approximately four acres of land to construct a new lagoon for reuse storage. The disinfection station, pump station, and distribution main will remain on the land currently fenced in with the lagoons, just like the first alternative. Similar to the first alternative, the number of irrigation acres needed will be determined by the Ranch as they evaluate how they wish to use the reuse water.

F. Construction Problems

Temporary piping may be needed to allow the lagoons to connect properly during the cleaning of the west lagoon. This piping may need to be altered to provide proper functioning once the west lagoon is brought back on-line.

G. Cost Estimates

1. Construction

The estimated construction cost for the Wastewater Reuse Alternative is $1,674,000. Please see attached breakdown of estimated costs.

2. Non-Construction

Non-construction costs, including permitting, engineering design fees, legal fees, and construction management are estimated to be $225,000. Please see attached breakdown of estimated costs.

3. Annual Operations and Maintenance

Annual operation and maintenance costs are estimated to be $63,000. This cost includes employee salaries, benefits, regular equipment maintenance, and electric costs. Please see attached breakdown of estimated costs.

H. Advantages / Disadvantages

The greatest advantage to this alternative is the creation of a treatment lagoon with parallel treatment trains. This allows the Village to take one of the trains out of service for maintenance or repairs. Additionally, this alternative provides reuse water storage for emergencies or and flexibility for future improvements in the lagoons.

The disadvantage compared to the first alternative, is the cost in constructing a third basin. Additionally, the east lagoon has accumulated more biosolids and is in greater need of removal. With the greater accumulation of biosolids, the retention time is less in the east lagoon, which may affect treatment for the removal of BOD and TSS. Aeration equipment must be installed temporarily in the east lagoon to achieve adequate treatment.

3. One Train West Lagoon Treatment – East Lagoon and New Basin Storage

A. Description

The end result of this alternative is to use the west lagoon for treatment and a cleaned and lined east basin for reuse storage. Additional reuse storage would be contained in the new storage basin constructed to the east of the existing east lagoon.

The substantial difference between this alternative and the second alternative is that the west lagoon would not be lined and would not be divided into two parallel treatment trains. The west lagoon would still receive aeration equipment and an ultraviolet or sodium hypochlorite disinfection system would still be installed between the west and east lagoons.

Phasing:
A new lagoon with a 30ac-ft capacity would be constructed to serve as an intermittent reuse storage basin.

During that time, the west lagoon would receive aeration equipment, disinfection equipment, pipe works, and valving to connect the west lagoon to the new basin.

Once the new basin was constructed and the west lagoon had received the new treatment equipment, all wastewater would be directed to the west lagoon for treatment. The wastewater would receive aeration and disinfection treatment before flowing to the new basin for storage and reuse.

This lagoon and basin combination would provide complete treatment and storage of the wastewater and reuse water allowing the east lagoon to dry out for future biosolids removal and land application. Once the biosolids were removed, the east lagoon could be cleaned, lined and prepared to serve as a settling lagoon or as a reuse water storage basin. When the Village obtains adequate funding, the west lagoon could be dredged of biosolids for land application while in operation.

B. Design Criteria
The design of this alternative uses the same calculations and assumptions regarding wastewater flow, storage volume, and irrigation usage as the first two alternatives.

C. Map – Schematic Layout
See the attached map titled Wastewater Alternative 3.

D. Environmental Impacts
None at this time. The reuse water will meet all applicable standards required by the New Mexico Ground Water Quality Bureau.

E. Land Requirement
This alternative requires approximately four acres of land to construct a new lagoon for reuse storage. The disinfection station, pump station, and distribution main will remain on the land currently fenced in with the lagoons, just like the first two alternatives. Again similar to the first two alternatives, the number of irrigation acres required will be determined by the Ranch as they evaluate how they wish to use the reuse water.

F. Construction Problems
Temporary piping may be needed to allow the lagoons to connect properly during the cleaning of the east lagoon. This piping may need to be altered to provide proper functioning once the east basin is brought back on-line.

G. Cost Estimates

1. Construction
The estimated construction cost for the Wastewater Reuse Alternative is $1,582,500. Please see attached breakdown of estimated costs.

2. Non-Construction
Non-construction costs, including permitting, engineering design fees, legal fees, and construction management are estimated to be $225,000. Please see attached breakdown of estimated costs.

3. Annual Operations and Maintenance
Annual operation and maintenance costs are estimated to be $63,000. This cost includes employee salaries, benefits, regular equipment maintenance, and electric costs. Please see attached breakdown of estimated costs.

H. Advantages / Disadvantages
Similar to alternative two, this alternative provides additional reuse water storage for emergencies or to provide flexibility for future improvements in the lagoons. Additionally, the east lagoon has accumulated more solids and is in greater need of biosolids removal. This alternative would allow for continued treatment in the west lagoon with biosolids removal from the east lagoon sooner than Alternative 2.

One disadvantage compared to the first alternative, is the cost in constructing a third lagoon. Additionally, if the east lagoon is taken out of service first, the west lagoon will not be able to receive any lining improvements or partition walls without using the east lagoon for treatment. If the east lagoon is used for treatment, the lagoon would need cleaning before being brought back into service for reuse storage. The east lagoon could possibly serve as a settling lagoon in the future, but the Village would lose the option for emergency storage.

III. SELECTION OF AN ALTERNATIVE

A. Present Worth (Life Cycle) Cost Analysis
The following cost analysis presents the total estimated capital cost required to design and construct the new alternatives considered in this report and the original alternatives considered in the PER revised February 8, 2008. In addition, the estimated annual operation and maintenance costs have been tabulated for each alternative. A 20 year life cycle was considered for this analysis and total present worth of operation and maintenance costs over this period can be found in the following Table 1:

Table 1 – Revised Cost Analysis

Project Alternative	Capital Cost	Annual O&M Cost	Present Worth of Annual O&M Costs Over 20yrs*	Present Worth Total (20year) Cost
Aerated Lagoons	$1,265,800	$63,000	$1,740,000	$3,005,800
Total Evaporative Lagoons	$6,161,200	$35,000	$970,000	$7,131,200
Wastewater Reuse Alternative 1	$1,814,000	$63,000	$1,740,000	$3,554,000
Wastewater Reuse Alternative 2	$2,189,000	$63,000	$1,740,000	$3,929,000
Wastewater Reuse Alternative 3	$2,087,500	$63,000	$1,740,000	$3,827,500

*Cost calculated using "Real" federal discount rate from Appendix C of OMB Circular A-94

From Table 1, the most cost effective solution appears to be the construction of the Wastewater Reuse Alternative 1. This is due to the fact that the wastewater lagoons receive the fewest modifications for the future treatment of the Village's wastewater.

IV. CONCLUSIONS AND RECOMMENDATIONS

As described above, Alternatives 2 and 3 provide much more operational flexibility than Alternative 1, providing greater assurance of environmental compliance during the upset conditions that will invariably occur from time to time. Alternative 2 is selected over Alternative 3 due to the small percentage difference in costs at this preliminary estimating level of detail and greater ground water protection from lining the west lagoon.

With the construction of Alternative 2, the Village will be able to close one side of the treatment lagoon for repairs or improvements without interrupting treatment. Additionally, this alternative provides emergency storage of reuse water if the Ranch is unable to use the reuse water.

Based on the information contained in this Supplemental PER, the best alternative for future treatment and reuse of the Village's wastewater is Wastewater Reuse Alternative 2, the Two Train Western Lagoon Treatment with East Lagoon and New Basin Storage.

ENGINEER'S OPINION OF PROBABLE COST

Project: Wastewater System Improvements
Location: Village of Cimarron, New Mexico
Subject: Cost Estimate for Supplemental Wastewater PER
Job No: CSB070002
Date: Dec. 2008

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Treated Wastewater for Reuse - Alternative One
West Lagoon Treatment - East Lagoon Storage Basin

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COST
	Items Common to All Three Reuse Alternatives				
1	Mobilization	LS	1	$ 25,000	$ 25,000
2	Aeration Equipment in West Lagoon	EA	4	$ 15,000	$ 60,000
3	Disinfection Equipment	LS	1	$ 30,000	$ 30,000
4	Remove Solids from East and West Lagoon (over two years)	GAL	7,000,000	$ 0.075	$ 525,000
5	Install Synthetic Liner on Bottom of East Lagoon	SF	160,000	$ 0.40	$ 64,000
6	Pump Station	LS	1	$ 100,000	$ 100,000
7	Irrigation Piping to Fields	LF	1,000	$ 60	$ 60,000
8	Provide Power to Lagoons	LS	1	$ 50,000	$ 50,000
9					
10				Subtotal	$ 914,000
11					
12	**Items Specific to This Alternative**				
13	Excavation of East Lagoon for Reuse Storage	CY	32,000	$ 15.00	$ 480,000
14	Reinforcement/Stabilization of Partition Wall	LS	1	$ 50,000.00	$ 50,000
15					
16				Subtotal	$ 530,000
17					
18				**Construction Total**	**$ 1,444,000**
19					
20	**Engineering & Misc. Fees**				
21	Civil Engineering/Survey	LS	1	$ 45,000	$ 45,000
22	Geotechnical Analysis	LS	1	$ 30,000	$ 30,000
23	Legal	LS	1	$ 5,000	$ 5,000
24	Construction Observation	LS	1	$ 50,000	$ 50,000
				Professional Services Subtotal	**$ 130,000**
				Subtotal	$ 1,574,000
				15% Contingency	$ 240,000
				Total Cost:	**$ 1,814,000**

PROFESSIONAL ENGINEERING AND MISC. FEES ARE ROUGH ESTIMATES AND ARE INTENDED FOR BUDGETARY PURPOSES ONLY.
A DETAILED COST ANALYSIS AND CONTRACT AGREEMENT SHALL BE COMPLETED FOR THE FINAL PROJECT EXECUTION.
UNIT PRICES ARE ONLY GOOD FOR THREE (3) MONTHS FROM DATE OF SUPPLEMENTAL PRELIMINARY ENGINEERING REPORT AND SHALL BE REEVALUATED AT THE TIME OF PROJECT EXECUTION.

ENGINEER'S OPINION OF PROBABLE COST

Project: Wastewater System Improvements
Location: Village of Cimarron, New Mexico
Subject: Cost Estimate for Supplemental Wastewater PER
Job No: CSB070002
Date: Dec. 2008

NOLTE
BEYOND ENGINEERING

Treated Wastewater for Reuse - Alternative Two
Two Train West Lagoon Treatment -
East Lagoon and New Basin Storage

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COST
	Items Common to All Three Reuse Alternatives				
1	Mobilization	LS	1	$ 25,000	$ 25,000
2	Aeration Equipment in West Lagoon	EA	4	$ 15,000	$ 60,000
3	Disinfection Equipment	LS	1	$ 30,000	$ 30,000
4	Remove Solids from East and West Lagoon (over two years)	GAL	7,000,000	$ 0.075	$ 525,000
5	Install Synthetic Liner on Bottom of East Lagoon	SF	160,000	$ 0.40	$ 64,000
6	Pump Station	LS	1	$ 100,000	$ 100,000
7	Irrigation Piping to Fields	LF	1,000	$ 60	$ 60,000
8	Provide Power to Lagoons	LS	1	$ 50,000	$ 50,000
9					
10				Subtotal	$ 914,000
11	**Items Specific to This Alternative**				
12	Clearing and Grubbing	Ac	4.00	$ 2,500	$ 10,000
13	Construct New Lagoon	CY	41,000	$ 15	$ 615,000
14	Temporary Piping Between East Lagoon and New Lagoon	LF	75	$ 60	$ 4,500
15	Temporary Treatment and Disinfection in East Lagoon	LS	1	$ 15,000	$ 15,000
16	Construct Partition Wall in West Lagoon	CY	1,500	$ 15	$ 22,500
17	Install Synthetic Liner on Bottom of West Lagoon	SF	160,000	$ 0.40	$ 64,000
18	Piping to Connect West Lagoon and New Lagoon	LF	650	$ 60	$ 39,000
19					
20				Subtotal	$ 760,000
21					
22				**Construction Total**	**$ 1,674,000**
23					
24	**Engineering & Misc. Fees**				
25	Civil Engineering/Survey	LS	1	$ 100,000	$ 100,000
26	Geotechnical Analysis	LS	1	$ 20,000	$ 20,000
27	Legal	LS	1	$ 5,000	$ 5,000
28	Construction Observation	LS	1	$ 100,000	$ 100,000
				Professional Services Subtotal	**$ 225,000**
				Construction and Professional Subtotal	$ 1,899,000
				15% Contingency	$ 290,000
				Total Cost:	**$ 2,189,000**

PROFESSIONAL ENGINEERING AND MISC. FEES ARE ROUGH ESTIMATES AND ARE INTENDED FOR BUDGETARY PURPOSES ONLY. A DETAILED COST ANALYSIS AND CONTRACT AGREEMENT SHALL BE COMPLETED FOR THE FINAL PROJECT EXECUTION. UNIT PRICES ARE ONLY GOOD FOR THREE (3) MONTHS FROM DATE OF SUPPLEMENTAL PRELIMINARY ENGINEERING REPORT AND SHALL BE REEVALUATED AT THE TIME OF PROJECT EXECUTION.

ENGINEER'S OPINION OF PROBABLE COST

Project: Wastewater System Improvements
Location: Village of Cimarron, New Mexico
Subject: Cost Estimate for Supplemental Wastewater PER
Job No: CSB070002
Date: Dec. 2008

NOLTE
BEYOND ENGINEERING

Treated Wastewater for Reuse - Alternative Three
One Train West Lagoon Treatment -
East Lagoon and New Basin Storage

ITEM NO.	ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COST
	Items Common to All Three Reuse Alternatives				
1	Mobilization	LS	1	$ 25,000	$ 25,000
2	Aeration Equipment in West Lagoon	EA	4	$ 15,000	$ 60,000
3	Disinfection Equipment	LS	1	$ 30,000	$ 30,000
4	Remove Solids from East and West Lagoon (over two years)	GAL	7,000,000	$ 0.075	$ 525,000
5	Install Synthetic Liner on Bottom of East Lagoon	SF	160,000	$ 0.40	$ 64,000
6	Pump Station	LS	1	$ 100,000	$ 100,000
7	Irrigation Piping to Fields	LF	1,000	$ 60	$ 60,000
8	Provide Power to Lagoons	LS	1	$ 50,000	$ 50,000
9					
10				Subtotal	$ 914,000
11	**Items Specific to This Alternative**				
12	Clearing and Grubbing	Ac	4.00	$ 2,500	$ 10,000
13	Construct New Lagoon	CY	41,000	$ 15	$ 615,000
14	Temporary Piping Between West Lagoon and New Lagoon	LF	650	$ 60	$ 39,000
15	Piping to Connect East Lagoon and New Lagoon	LF	75	$ 60	$ 4,500
16					
17				Subtotal	$ 668,500
18					
19				**Construction Total**	**$ 1,582,500**
20					
21	**Engineering & Misc. Fees**				
22	Civil Engineering/Survey	LS	1	$ 100,000	$ 100,000
23	Geotechnical Analysis	LS	1	$ 20,000	$ 20,000
24	Legal	LS	1	$ 5,000	$ 5,000
25	Construction Observation	LS	1	$ 100,000	$ 100,000
				Professional Services Subtotal	**$ 225,000**
				Construction and Professional Subtotal	$ 1,807,500
				15% Contingency	$ 280,000
				Total Cost:	**$ 2,087,500**

PROFESSIONAL ENGINEERING AND MISC. FEES ARE ROUGH ESTIMATES AND ARE INTENDED FOR BUDGETARY PURPOSES ONLY.
A DETAILED COST ANALYSIS AND CONTRACT AGREEMENT SHALL BE COMPLETED FOR THE FINAL PROJECT EXECUTION.
UNIT PRICES ARE ONLY GOOD FOR THREE (3) MONTHS FROM DATE OF SUPPLEMENTAL PRELIMINARY ENGINEERING REPORT AND SHALL BE REEVALUATED AT THE TIME OF PROJECT EXECUTION.

ENGINEER'S OPINION OF PROBABLE COST
Project: Wastewater System Improvements
Location: Village of Cimarron, New Mexico
Subject: Cost Estimate for Supplemental Wastewater PER
Job No: CSB070002
Date: Dec. 2008

NOLTE
BEYOND ENGINEERING

Cost Analysis

Project Alternative	Capital Cost	Annual O&M Cost	Present Worth of Annual O&M Costs Over 20yrs.*	Present Worth Total (20 Year) Cost
Aerated Lagoons**	$ 1,265,800	$ 63,000	$ 1,740,000	$ 3,005,800
Total Evaporative Lagoons**	$ 6,161,200	$ 35,000	$ 970,000	$ 7,131,200
Reuse Alternative One	$ 1,814,000	$ 63,000	$ 1,740,000	$ 3,554,000
Reuse Alternative Two	$ 2,189,000	$ 63,000	$ 1,740,000	$ 3,929,000
Reuse Alternative Three	$ 2,087,500	$ 63,000	$ 1,740,000	$ 3,827,500

*Cost calculated using "Real" federal discount rate from Appendix C of OMB Circular A-94
** From Water Preliminary Engineering Report February 2008

Operation and Maintenance Costs for **Aerated Lagoons and All Three Reuse Options**

Item Description	Price/Year
Employee Salary and Benefits	$ 28,000
Regular Maintenance of System	$ 5,000
Disinfection Costs	$ 10,000
Electric Costs for Aerators, 26hp, 24hrs/day,$0.10/KWH	$ 20,000
Total	$ 63,000

Operation and Maintenance Costs for **Total Evaporative Lagoons**

Item Description	Price/Year
Employee Salary and Benefits	$ 28,000
Regular Maintenance of System	$ 7,000
Total	$ 35,000

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: CIMARRON 4 SW, NM **COOP ID: 291813**

Climate Division: NM 2 **NWS Call Sign:** **Elevation: 6,540 Feet** **Lat: 36°28N** **Lon: 104°57W**

Freeze Data

Spring Freeze Dates (Month/Day)

Temp (F)	Probability of later date in spring (thru Jul 31) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	6/10	6/05	6/02	5/30	5/27	5/25	5/22	5/19	5/14
32	5/28	5/23	5/19	5/16	5/14	5/11	5/08	5/04	4/29
28	5/15	5/11	5/07	5/05	5/02	4/29	4/27	4/23	4/19
24	5/06	5/01	4/26	4/23	4/20	4/16	4/13	4/08	4/03
20	4/28	4/22	4/18	4/15	4/12	4/09	4/05	4/01	3/27
16	4/17	4/10	4/05	4/01	3/28	3/25	3/21	3/16	3/09

Fall Freeze Dates (Month/Day)

Temp (F)	Probability of earlier date in fall (beginning Aug 1) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	9/13	9/16	9/19	9/21	9/23	9/25	9/27	9/29	10/02
32	9/19	9/23	9/25	9/27	9/30	10/02	10/04	10/06	10/10
28	9/26	10/01	10/04	10/06	10/09	10/11	10/14	10/17	10/21
24	10/03	10/09	10/13	10/16	10/19	10/22	10/26	10/30	11/04
20	10/13	10/18	10/22	10/25	10/28	10/31	11/03	11/07	11/12
16	10/26	10/30	11/02	11/05	11/07	11/10	11/12	11/15	11/20

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	136	129	125	121	118	114	110	106	99
32	158	151	146	142	138	134	130	125	118
28	177	171	166	163	159	156	152	147	141
24	203	196	191	186	182	178	173	168	161
20	218	211	206	202	199	195	191	186	180
16	246	238	232	227	223	218	214	208	200

* Probability of observing a temperature as cold, or colder, later in the spring or earlier in the fall than the indicated date.

0/00 Indicates that the probability of occurrence of threshold temperature is less than the indicated probability.
Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

Cimarron Reuse Water Storage Volumes

February 11, 2009

	Irrigation		Partial Irrigation	Winter Storage					Partial Irrigation	Irrigation			
	September	October	November	December	January	February	March	April	May	June	July	August	September
Approximate Wastewater Inflow (gpd)	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
Estimated Irrigation Outflow (gpd)	(160,000)	(160,000)	(80,000)	-	-	-	-	-	(80,000)	(160,000)	(160,000)	(160,000)	(160,000)
Net (gpd)	(80,000)	(80,000)	-	80,000	80,000	80,000	80,000	80,000	-	(80,000)	(80,000)	(80,000)	(80,000)
Days/Month	30	31	30	31	31	28	31	30	31	30	31	31	30
Cumulative Gal. in Storage Basin(s)	2,320,000	(160,000)	-	2,480,000	4,960,000	7,200,000	9,680,000	12,080,000	12,080,000	9,680,000	7,200,000	4,720,000	2,320,000
Cumulative Cubic Ft in Storage Basin(s) at End of Month	310,119	(21,388)	-	331,506	663,013	962,438	1,293,945	1,614,757	1,614,757	1,293,945	962,438	630,932	310,119
Cumulative Ac-Ft in Storage Basin(s)	7.12	(0.49)	-	7.61	15.22	22.09	29.70	37.07	37.07	29.70	22.09	14.48	7.12
Existing East Lagoon Storage Only: Depth in East Lagoon in Feet (Based on Current Footprint at Surface: 3.09 ac)	2.30	(0.16)	-	2.46	4.93	7.15	9.61	12.00	12.00	9.61	7.15	4.69	2.30
Two Basin Storage: Depth in East Lagoon in Feet (Based on Current Footprint at Surface: 3.09 ac and new basin with area of 3.0 ac)	1.17	(0.08)	-	1.25	2.50	3.63	4.88	6.09	6.09	4.88	3.63	2.38	1.17

East Lagoon/Basin Storage Volumes with Excavation

Village of Cimarron Supplemental Wastewater PER

Using 3:1 Slopes

	Depth from Surface	Elev.	Area (SF)	Area (Ac)	Incremental Storage (Ac-Ft)	Cumulative Storage (Ac-Ft)	Additional Excavation (Ac-Ft)
Liquid Surface	-	6,392	128,231	2.944			
	(1)	6,391	124,071	2.848	2.90	2.90	
	(2)	6,390	119,972	2.754	2.80	5.70	
	(3)	6,389	115,932	2.661	2.71	8.41	
	(4)	6,388	111,951	2.570	2.62	11.02	
	(5)	6,387	108,030	2.480	2.53	13.55	
	(6)	6,386	104,168	2.391	2.44	15.98	
Current Depth	(7)	6,385	100,365	2.304	2.35	18.33	
of Lagoons	(8)	6,384	96,622	2.218	2.26	20.59	2.26
	(9)	6,383	92,939	2.134	2.18	22.77	4.44
	(10)	6,382	89,315	2.050	2.09	24.86	6.53
	(11)	6,381	85,750	1.969	2.01	26.87	8.54
	(12)	6,380	82,245	1.888	1.93	28.80	10.47
	(13)	6,379	78,799	1.809	1.85	30.64	12.32
	(14)	6,378	75,412	1.731	1.77	32.41	14.09
	(15)	6,377	72,088	1.655	1.69	34.11	15.78
	(16)	6,376	68,828	1.580	1.62	35.73	17.40
	(17)	6,375	65,632	1.507	1.54	37.27	18.94

Using 4:1 Slopes

Depth from Surface	Elev.	Area (SF)	Area (Ac)	Incremental Storage (Ac-Ft)	Cumulative Storage (Ac-Ft)	Additional Excavation (Ac-Ft)
-	6,392	128,230	2.944			
(1)	6,391	122,698	2.817	2.88	2.88	
(2)	6,390	117,272	2.692	2.75	5.63	
(3)	6,389	111,951	2.570	2.63	8.27	
(4)	6,388	106,736	2.450	2.51	10.78	
(5)	6,387	101,626	2.333	2.39	13.17	
(6)	6,386	96,622	2.218	2.28	15.44	
(7)	6,385	91,724	2.106	2.16	17.61	
(8)	6,384	86,932	1.996	2.05	19.66	2.05
(9)	6,383	82,245	1.888	1.94	21.60	3.99
(10)	6,382	77,663	1.783	1.84	23.43	5.83
(11)	6,381	73,189	1.680	1.73	25.16	7.56
(12)	6,380	68,828	1.580	1.63	26.79	9.19
(13)	6,379	64,580	1.483	1.53	28.33	10.72
(14)	6,378	60,445	1.388	1.44	29.76	12.16
(15)	6,377	56,424	1.295	1.34	31.10	13.50
(16)	6,376	52,516	1.206	1.25	32.35	14.75
(17)	6,375	48,721	1.118	1.16	33.52	15.91
(18)	6,374	45,039	1.034	1.08	34.59	16.99
(19)	6,373	41,473	0.952	0.99	35.58	17.98
(20)	6,372	38,026	0.873	0.91	36.50	18.89
(21)	6,371	34,697	0.797	0.83	37.33	19.73

Notes:

1) To achieve adequate reuse storage volume, the basin must hold approximately 37 ac-ft of reuse water.
2) Existing slope in the lagoons is unknown at this time.

Projected Nitrogen Removal in Ponds (using typical values)

Inputs

Parameter	Unit	Value	Description
Influent Ammonia	mg/L	58	
N_0	mg/L	96.7	Total influent nitrogen
T	°C	19.3	Water temperature
k_T	d^{-1}	0.006	Temperature dependent removal coefficient
V	cf	735,900	Pond volume
V	gallons	5,504,532	Pond volume
Q	gpd	80,000	Flow
pH	-	7.67	

Assumptions

Parameter	Unit	Value	Description
k_{20}	d^{-1}	0.0064	Removal coefficient at 20°C
θ	-	1.039	

Calculated Parameters

t	day	68.81	Detention time (V/Q)

Projected Effluent Total Nitrogen

Equation 1 N_e	mg/L	42
Equation 2 N_e	mg/L	48