DRAFT – March 10, 2006
Santee Sioux Water Supply Feasibility Study
Results of January 18-19, 2006 Alternatives Screening Process Meeting

Purpose and Summary

This report summarizes the results of a meeting held on January 18-19, 2006 to evaluate and rank alternatives being considered for the Santee Water Supply Feasibility Study. In attendance at the meeting were Reclamation technical specialists and representatives from the Santee Sioux Nation (Nation) (see Attachment A for list of attendees).

The meeting resulted in a joint recommendation by Reclamation and the Nation that the alternative using a raw water supply diversion from Missouri River alluvium should be evaluated in more detail for the feasibility study. Following is a description of the process and information that was used to reach that recommendation.

Background

This meeting was a culmination of an alternatives screening process that began in October 2005. The alternatives screening process involved the formulation of alternatives to be evaluated, and the definition of a process to facilitate the screening of those alternatives. The primary goal of the screening process was to jointly identify the most reasonable alternative(s) to be advanced in the feasibility study for detailed engineering design, cost estimation, and evaluation. The alternatives under consideration at the meeting are described below and shown in Figure 1. The screening process was developed during a series of conference calls between representatives from the Nation, Reclamation, and the Village of Niobrara (Niobrara) is described in Attachment B.

Alternatives

In 2004, Reclamation published a Needs Assessment document that described the water supply situation of the Santee Nation. Existing and future water needs were estimated in this document, using population projections, an assessment of economic conditions, and available water use data. Six alternatives addressing the future water supply needs of the Santee Nation were developed during the study and described in this Needs Assessment. Following public scoping meetings held in August 2005 in Santee and subsequent team discussions in September 2005, five additional alternatives were added to the original six by the study team resulting in the eleven alternatives listed below.

> Alternative 1 - Development of well field in aquifer in southeast corner of Reservation – installation of wells in Quaternary alluvial deposits, treatment facility with chlorination and fluoridation.
>
> Alternative 2 - Surface water diversion and treatment plant at Bazile Creek – in vicinity of present Bazile Creek water treatment facility, install new surface water intake and treatment plant.

Alternative 3 - Missouri River diversion and treatment plant –

a - direct surface water intake in Missouri River near village of Santee and treatment plant

b - infiltration gallery installed in Missouri River alluvium with treatment plant

Alternative 4 - Expansion of Existing Well Field at Bazile Creek – installation of additional wells and new reverse osmosis (RO) treatment facility

Alternative 5 - Connection to Cedar-Knox Rural Water System – requires new or expansion of existing Cedar-Knox treatment facility, or Cedar-Knox obtaining additional supply (possibly Yankton) to meet project demands, and the connection of Cedar-Knox system to Reservation distribution system

Alternative 6 - Connection to West Knox Rural Water System – requires West Knox to install more wells to meet demands and connection to Reservation distribution system.

Alternative 7 - Connection to Cedar-Knox and West Knox Rural Water Systems – define two Reservation distribution systems and connect to supply system. Use remaining capacity in Cedar-Knox to meet portion of Reservation's demands.

Alternative 8 - New well field in aquifer to south of Reservation - install wells in Ogallala aquifer off-Reservation, and convey by pipeline to Reservation. For consistency in the alternatives evaluation process, the distance to the Ogallala with adequate amount of saturated thickness was approximately 40 miles to the south of the reservation. Water from this source would not require any treatment.

Alternative 9 - Connection to existing municipal supply system off Reservation – this alternative is generic and considers connecting to existing nearby municipal supply system. For consistency in the alternatives evaluation process, the community connected to was assumed to be the village of Bloomfield.

Alternative 10 - Tribal purchase of existing Devils Nest intake and treatment facility from Cedar-Knox Rural Water District and connection to Reservation distribution system.

Alternative 11 - Tribal purchase of existing Devils Nest treatment facility from Cedar-Knox and installation of distribution system to service northern portions of Reservation; and installation of distribution system and connection to West-Knox Rural Water System for servicing southern portions of Reservation and possibly Niobrara.

Existing and Future Water Demand

Water demands estimates as described in the 2004 Water Needs Assessment were reviewed during the January 2006 screening meeting. Both Reclamation and the Santee Nation agreed that the projected irrigation water demand for a potential golf course located in the vicinity of the tribal casino would be met using existing wells and not from the potable water system being

considered in this study. Also, the representative from the village of Niobrara indicated that present water demand for the village was about twice that reported in the 2004 Needs Assessment. Using these revised demand estimates for the purposes of the screening process, year 2050 average demands for the proposed water system is 464,000 gallons per day (gpd) or about 350 gallons per minute (gpm). Applying a peak day factor of 2 (as was done in the 2004 Needs Assessment), gives a peak day demand of about 928,000 gpd or 700 gpm. The screening team chose to use 750 gpm as their reference demand figure during the alternatives screening process

Screening Process

Screening Criteria and Weights -

The alternatives screening process began in October 2005. In consultation with the Santee Nation, Reclamation developed a set of 11 criteria to be used in evaluating each proposed alternative. Once the criteria were agreed upon, each criterion was separately compared to the other ten criteria to give an indication of its relative importance. These comparisons were translated into the decision matrix, with the criterion that scored highest given the greatest weight and the criterion with the lowest score from the scoring matrix given the least weight. (See Attachment B for a complete description of the development of the scoring matrix and criteria weights).

At this juncture, Reclamation and the Santee Nation independently developed ranking weights for each criterion. Reclamation's and the Nation's weights were similar in many aspects, however, the weights associated with criteria I and J reflect the Santee Nation's strong preference for alternatives that preserve the sovereignty of the Nation along with providing for employment opportunities for tribal members.

Criteria	Reclamation Weights	Santee Nation Weights
A – Provide sufficient quantity of water	10	8
B – Provide suitable water quality	10	8
C – Low construction cost	4	4
D – Low O&M oversight and cost	5	4
E – Minimal adverse effects to existing environment	5	4
F – Minimal adverse effects to listed T&E species	5	4
G – Minimal adverse effects to existing water users	3	3

H – Minimal effects to cultural and historic features	3	6
I – Provide for Tribal Self-Determination	5	10
J – Enhance Tribal Employment and Income	5	10
K – Reliability of water system	8	7

Alternative Ranking -

Using both Reclamation's and the Santee Nation's weighting results, a decision matrix tool was developed (see Attachment C) to facilitate the team selection of a recommended alternative. The decision matrix utilized the 11 criteria that the alternatives were numerically ranked against during a January 18-19, 2006 meeting attended by representatives of the Santee Nation and Reclamation.

A consensus approach was used at this meeting to rank the alternatives against the criteria. Study team discipline specialists provided input as to how each alternative should be ranked. Comments were added (see Attachment C) to the decision matrix spreadsheet to support the assigned ranking values. For each criterion, an alternative was assigned a value, or ranking, from 1 to 5 which, respectively, represented how well that alternative would meet the criterion from poor to excellent.

The ranking of alternatives was based mainly on professional judgment and evaluation utilizing existing published information and information gathered from site visits. To assist with the evaluations, various data from existing reports, etc. applicable to the alternatives were collected and compiled by NKAO[1] and distributed to the alternatives-screening team. This data included information regarding water quality, water supply, estimated costs, etc.

The alternatives being considered differed primarily in the source and treatment of the water supply. There would be some differences in the size and placement of supply lines connecting each alternative's treatment facility and the primary distribution system but compared to other features, these differences were thought to be minor. All of the alternatives have a distribution system requirement to supply treated water to the Reservation and Niobrara. The distribution system required by each alternative is considered to be relatively the same in design and construction costs. Hence, for the purposes of this evaluation of alternatives, the distribution system did not play a significant factor in choosing a recommended alternative.

[1] Reference: Design Data for Alternative Screening, MR&I Water Supply System, Santee Sioux Nation , Nebraska December 2005

Results

In the following table, the alternatives with the highest total scores represent the alternatives that meet the criteria the best when evaluated using the two sets of weights, Reclamation's and the Santee Nation's, as described above:

	Total Scores	
Alternative	**BOR**	**Nation**
Alt 1 - Southeast Well Field	232	261
Alt 2 - Bazile Cr. SW Treatment	194	234
Alt 3 - Missouri River Diversion	257	287
Alt 4 - Bazile Cr. Well Field Expansion	219	250
Alt 5 - Connect to Cedar-Knox	227	215
Alt 6 - Connect to West Knox	206	197
Alt 7 - Connect to West Knox and Cedar-Knox	224	212
Alt 8 - Well Field South of Reservation	236	246
Alt 9 - Connect to Municipal Water Supply Off Reservation	212	203
Alt 10 - Purchase of Devils Nest Treatment	257	281
Alt 11 - Purchase Devils Nest for Supplying N. Reservation, and connect to West Knox for S. Reservation	231	241

From this table, it can be seen that the top four alternatives for Reclamation are:

1- Alternative 3 – Missouri River Diversion
2- Alternative 10 – Purchase of Devils Nest treatment facility
3- Alternative 8 – Well field south of Reservation
4- Alternative 1 – Southeast Reservation well field

For the Santee Nation, the top four ranking alternatives are:

1- Alternative 3 – Missouri River Diversion
2- Alternative 10 – Purchase of Devils Nest treatment facility
3- Alternative 1 – Southeast Reservation well field
4- Alternative 4 – Bazile Creek well field expansion

For both Reclamation and the Nation, the top two ranking alternatives were 3 and 10. Both of these alternatives are similar in that they involve the diversion and treatment of Missouri River water and only vary in whether a new treatment facility is constructed or an existing treatment facility is purchased from Cedar-Knox. There would also be differences in the location of raw water intake and pipeline and finished water pipelines. Alternative 1 was ranked highly using both criteria weighting levels.

From the Nation's perspective, as indicated by their criteria weights, they have a strong preference for alternatives that are independently operated by the tribe and provide employment opportunities for tribal members. Connecting to existing rural water supply systems or

municipal systems off-Reservation, as in alternatives 5, 6, 7, 9, 10, and 11, would not meet those preferences resulting in a low score for these alternatives for the tribal self-determination and employment and income criteria.

Connecting to existing rural water systems was also problematic in that both the Cedar-Knox and West Knox water districts do not have sufficient existing capacity to meet the year 2050 demands of the project. West Knox would need to develop more supplies and Cedar-Knox would need to expand treatment capacity. The team assumed that the costs of those expansions would be passed on to end-users on the Reservation and Niobrara.

After the first iteration at ranking the alternatives, the team reviewed the evaluation of these top four alternatives. The team conducted a more detailed deliberation of background data for the top four alternatives, and took into consideration the Nation's preferences. This deliberation resulted in the following key points:

1. With regards to alternatives 3 and 10, the encroaching sediment delta in Lewis and Clark Reservoir (see Figure 2) in the vicinity of the Reservation is raising considerable uncertainty as to whether a stable location could be found for a surface water intake for meeting year 2050 demands. Existing open channels in the vicinity of the Village of Santee may shift with continued sedimentation. It is estimated that the sediment delta may progress to the eastern edge of the Reservation and the vicinity of the Devils Nest intake some time before year 2050. It is not known how or whether the Corps of Engineers will address the sedimentation problem. They may use dredging to keep existing channels open, or they may consider attempts at flushing sediment from the reservoir. It is not known if the flushing process may result in lateral movement of existing channels and potential problems for a surface water intake. This uncertainty resulted in the team recommending pursuing a Missouri River alluvial diversion (alternative 3b) rather than a direct surface water diversion (alternative 3a). Attachment E provides additional information in support of pursuing alternative 3b instead of alternative 3a.

2. With regards to alternative 1, previous ground-water modeling indicated that the aquifer in this area could provide significant quantities of water to meet year 2050 demands. However, to meet those quantities, wells would need to be installed very near the southern boundary of the Reservation where the aquifer is of sufficient thickness. This would require the acquisition of private lands which raises some uncertainty as to availability. This area has existing irrigation wells that raise the potential for the development of more irrigation wells in the future. Additional development could result in adverse impacts to this projects supply wells. Nitrate levels in the groundwater in this area are approaching EPA limits raising health concerns and a likely need for advanced water treatment. Reverse Osmosis (RO) techniques were discussed by the team as a viable approach to this potential treatment need. These potential problems resulted in the team ranking alternative 3 as more favorable than alternative 1

3. With regards to alternative 10, Reclamation engineers and Tribal consultants who reviewed the existing Devils Nest intake and treatment facility have concluded that considerable rehabilitation will be required to bring the facility to a level necessary to meet operations to year 2050 (see Attachment D). The Nation does do not support this alternative.

4. With regards to alternative 8, there is indication of considerable areas of high nitrate levels in the aquifers just to the south of the Reservation. To avoid these areas, it was estimated that wells would need to be located in the Ogallala aquifer approximately 40 miles to the south of the Reservation (see Figure 3). The long supply line needed to reach a Reservation distribution system raises concerns of high maintenance and operational costs. The long distance to supply wells and a treatment facility from the Reservation would hinder regular visits by operational personnel and add cost. The Nation does not support this alternative.

5. With regards to alternative 4, there is concern that future sedimentation of Bazile Creek could potentially result in the river channel moving closer to the well field. Presently the wells are located in an aquifer considered not to be under the influence of surface water. If the channel cuts near the wells, then the aquifer may fall under the influence of surface water which would trigger more vigorous treatment. A dike paralleling the channel may be needed to prevent flooding of the well structures.

6. With regards to alternative 3, it was recognized that diverting water from Missouri River alluvium would be a viable alternative to surface water diversions. However, two test wells installed in 1993 by Reclamation into Missouri alluvium in locations to the west of the Village of Santee resulted in water of poor quality (TDS ranged from 2420 – 2604 mg/l). These wells were completed down to the shale bedrock underlying the alluvium. Speculation is that water moving upward from the shale is influencing water in the alluvium. The team concluded that placement of wells or infiltration gallery in alluvium has potential to control the level of contamination and that potential treatment methods are adequate to handle anticipated contamination.

7. Based on appraisal level cost estimates presented in the 2004 Needs Assessment, there is a relatively minor differences in costs of $13,000,000 to $16,000,000 for alternatives 1 through 6. As stated previously, the team concluded that the costs for the distribution system for treated water should be relatively the same between all alternatives, with some variance for supply lines from the treatment plant to the primary distribution system. The team estimated that an RO treatment facility with pretreatment by micro-filtration would cost in the vicinity of $4,000,000 (subsequent to the meeting, the costs for a RO plant were estimated to be closer to $3,100,000). The 2004 Needs Assessment estimated the costs for a surface-water treatment facility would be $1,400,000.

Consideration of these key points by the team resulted in the conclusion that alternative 3 using the Missouri River alluvium as the raw water supply would be the most viable alternative for recommendation. This alternative would involve determination of an appropriate method to

divert the alluvial water, whether it is an infiltration gallery system or wells. This approach would eliminate the high degree of uncertainty as to locating a surface water intake system in a reservoir with aggradation problems. The water quality problems that may be associated with pumping water from the alluvium may be minimized by diverting water closer to the surface rather than near the bottom of aquifer. If there are unavoidable water quality problems, then it was determined that a RO plant would be capable of treating the water to meet primary and secondary standards.

The Village of Niobrara has recently entered into agreement with Reclamation to participate in the study. The recommended alternative should be adequate to meet the needs of both the Santee Nation and Niobrara. Further analyses by the team and study engineers will determine the most viable method for connecting the Santee Nation system to Niobrara. Providing service to Niobrara will include consideration of alleviating or minimizing impacts to affected wetlands areas located between the Santee Reservation and Niobrara.

Figure 1
Santee Sioux Water Supply Feasibility Study
Alternatives Locations

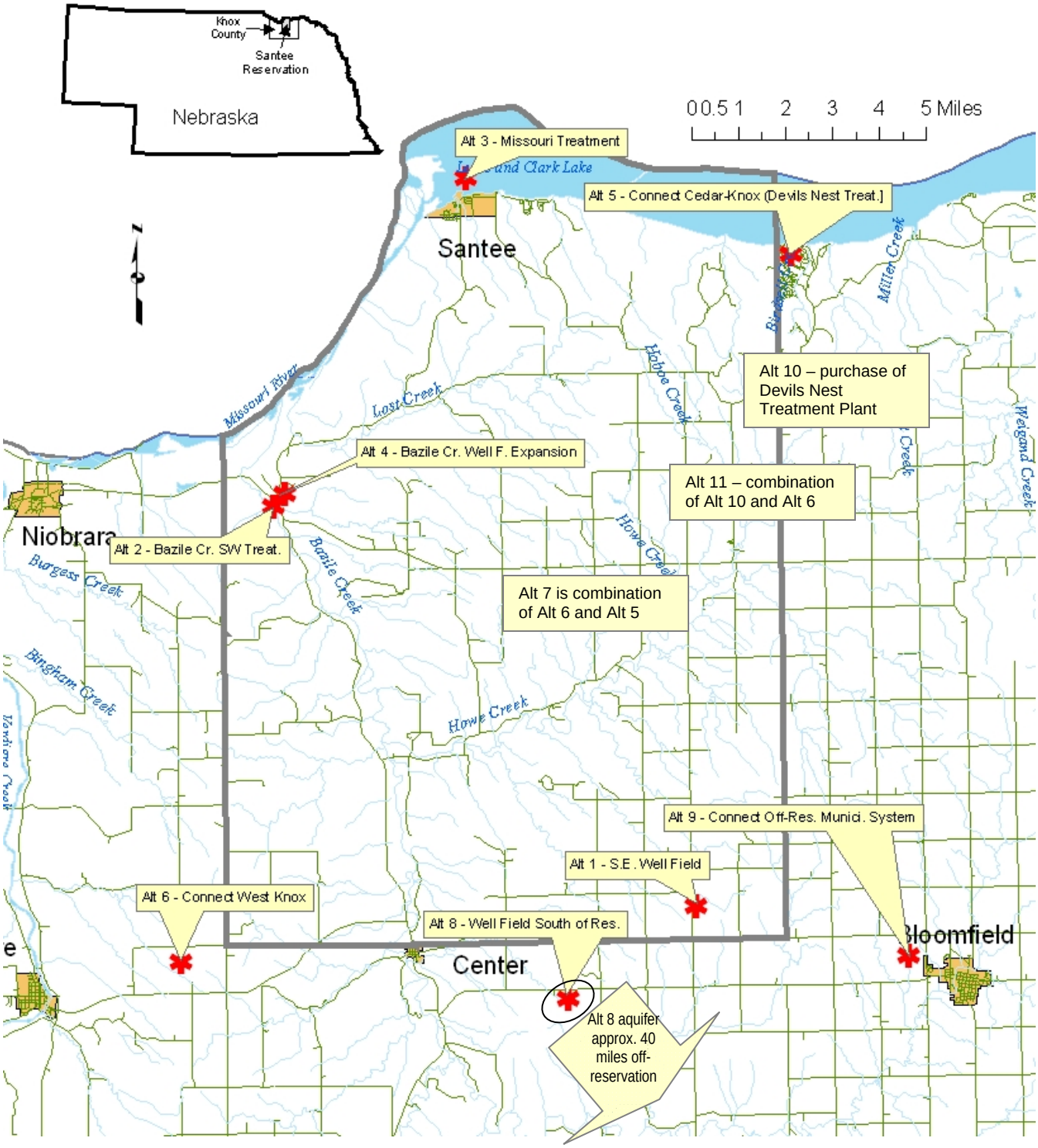
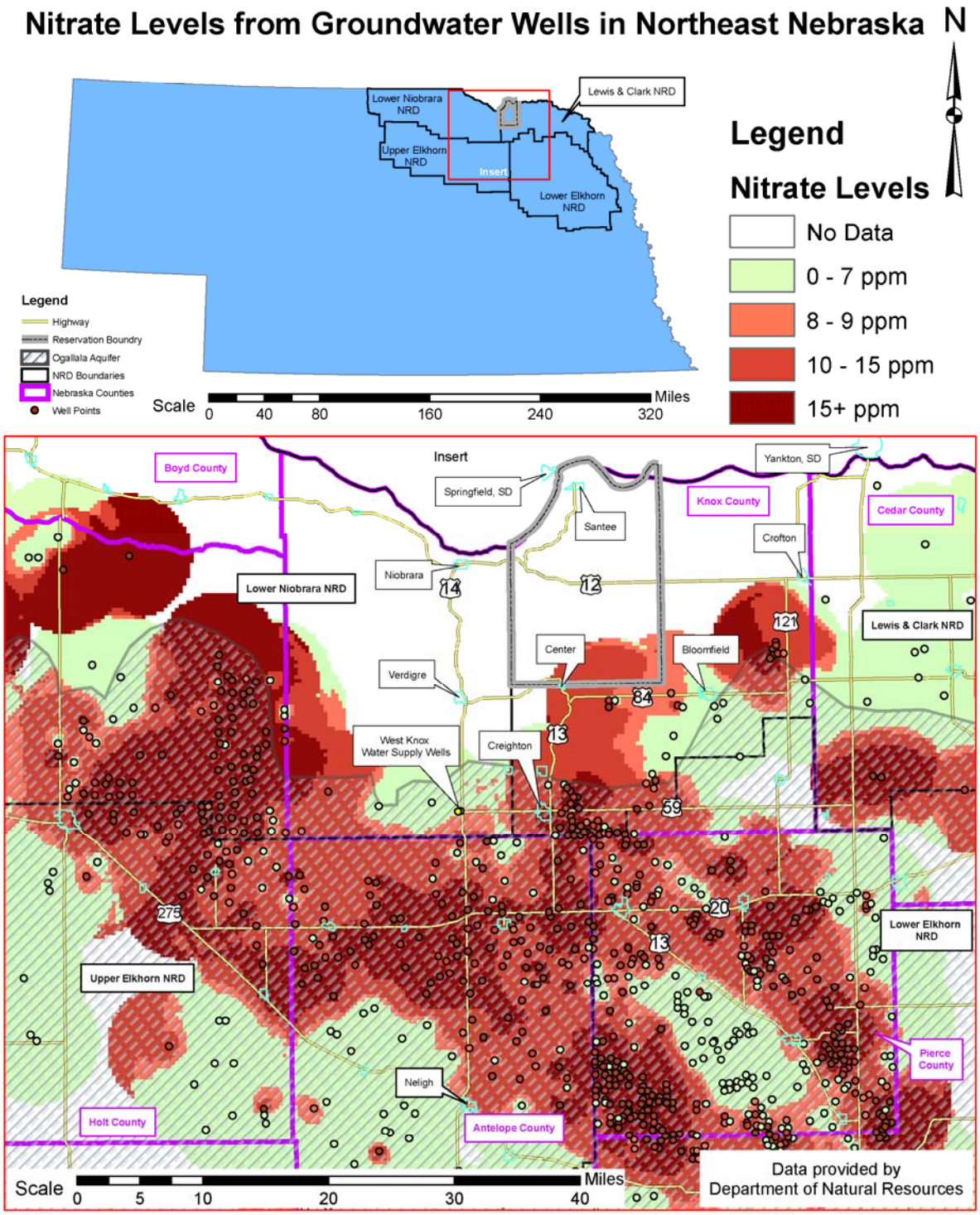



Figure 2 – Areal Photo of Vicinity of Santee Village Illustrating Lewis and Clark Lake Aggradation
Village of Santee
[Data Source: Nebraska Data Bank Image Date = 03/31/1999]

Figure 3


Nitrate Levels from Groundwater Wells in Northeast Nebraska
N
Lower Niobrara NRD
Upper Elkhorn NRD
Lewis & Clark NRD
Lower Elkhorn NRD
Insert
Legend
Highway
Reservation Boundry
Ogallala Aquifer
NRD Boundaries
Nebraska Counties
Well Points
Scale 0 40 80 160 240 320 Miles
Legend
Nitrate Levels
No Data
0 - 7 ppm
8 - 9 ppm
10 - 15 ppm
15+ ppm
Boyd County
Insert
Springfield, SD
Yankton, SD
Knox County
Cedar County
Santee
Crofton
Niobrara
Lower Niobrara NRD
Lewis & Clark NRD
Center
Bloomfield
Verdigre
West Knox Water Supply Wells
Creighton
Lower Elkhorn NRD
Upper Elkhorn NRD
Pierce County
Neligh
Holt County
Antelope County
Scale 0 5 10 20 30 40 Miles
Data provided by Department of Natural Resources

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Attachment A

Following is list of attendees at the January 18-19, 2006 alternatives screening meeting held at the Technical Service Center in Denver, CO:

Santee Sioux Nation:

Dave Henry	Santee Sioux Nation - Vice Chairman
Lee Ickes	Santee Sioux Nation
EuGene Saul	Santee Sioux Nation
Ralph Davis	University of Arkansas – Hydrologic Consultant for Nation
Felix Kitto	Santee Sioux Nation
Mike Crosley	Santee Sioux Nation

Reclamation:

Mark Phillips	BOR – GPRO – Study Team Lead
Joe Lyons	BOR – TSC – Water Supply
Steve Piper	BOR – TSC – Economics
Bob Jurenka	BOR – TSC – Water Treatment
Mike Kube	BOR – NKAO
Chou Cha	BOR – TSC - Water Conveyance
Jill Manring	BOR – NKAO – Environment (attended by conference phone)
Bob Schieffer	BOR – NKAO - Engineering (attended by conference phone)
Jack Wergin	BOR – NKAO – Water Supply (attended by conference phone)
Ted McIntyre	A/E Consultant for Reclamation (attended by conference phone)

Village of Niobrara:

Bob Olsen	Village Clerk (attended by conference phone)

Attachment B

The Santee Sioux Reservation Water Supply Feasibility Study
Alternatives Formulation/ Screening Process Support Document
December 8, 2005

I. Alternatives

a. Alternatives Formulation

1. **Problems –**
   - Potential for poor quality water at existing well field and problems related to streambed sedimentation.
   - Present well field inadequate to meet future demands
   - Significant number of wells throughout Reservation have problem with nitrates and coliform bacteria.
   - Naturally occurring minerals in wells causing problems with taste and staining.

2. **Goals –**
   - Public Law 108-204, Sec. 125 authorizes a "…feasibility study to determine the most feasible method of developing a safe and adequate municipal, rural, and industrial water treatment and distribution system to meet the needs of the Santee Sioux Nation of Nebraska that could serve the tribal community and adjacent communities and incorporate population growth and economic development activities for a period of 40 years."

3. **Constraints -**
   - Service area is Santee Reservation and Village of Niobrara.
   - Village of Center has declined to participate in study.
   - Study to identify and meet projected service area demands for year 2050.

4. **Guidelines –** following text taken from March 10,1983 Economic and Environmental Principals and Guidelines for Water and Related Land Resources Implementation Studies, U.S. Water Resources Council (also known as P&Gs):

   "Alternative Plans - Various alternative plans are to be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated.

   (a) A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be identified as the NED [*national economic development*] plan.

(b) Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan should also be formulated.

(c) Plans may be formulated which require changes in existing statutes, administrative regulations, and established common law; such required changes are to be identified.

(d) Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Appropriate mitigation of adverse effects is to be an integral part of each alternative plan."

b. Alternatives to be screened -

1. Development of well field in aquifer in southeast corner of Reservation – installation of wells in Quaternary alluvial deposits, small treatment facility with chlorination and fluoridation.

2. Surface water diversion and treatment plant at Bazile Creek – in vicinity of present Bazile Creek water treatment facility, install new surface water intake and treatment plant.

3. Missouri River diversion and treatment plant –
   a - direct surface water intake in Missouri River near village of Santee and treatment plant
   b - infiltration gallery installed in Missouri River alluvium with treatment plant

4. Expansion of Existing Well Field at Bazile Creek – installation of additional wells and new reverse osmosis treatment facility

5. Connection to Cedar-Knox Rural Water System – requires new or expansion of existing Cedar-Knox treatment facility, or Cedar-Knox obtaining additional supply (possibly Yankton) to meet project demands, and the connection of Cedar-Knox system to Reservation distribution system

6. Connection to West Knox Rural Water System – requires West Knox to install more wells to meet demands and connection to Reservation distribution system.

7. Connection to Cedar-Knox and West Knox Rural Water Systems – define two Reservation distribution systems and connect to supply system. Use remaining capacity in Cedar-Knox to meet portion of Reservation's demands.

8. New well field in aquifer to south of Reservation – install wells in aquifer (could be Ogallala or other aquifer) off Reservation, install treatment facility if required, and convey by pipeline to Reservation.

9. Connection to existing municipal supply system off Reservation – generic...connect to existing nearby municipal supply system.

10. Tribal purchase of existing Devils Nest treatment facility from Cedar-Knox Rural Water System and connection to Reservation distribution system.

11. Tribal purchase of existing Devils Nest treatment facility from Cedar-Knox and installation of distribution system to service northern portions of Reservation; and installation of distribution system and connection to West-Knox Rural Water System for servicing southern portions of Reservation and possibly community of Niobrara.

c. Sub-Alternatives – these are potential modifications to the primary alternatives above. They will be considered after the primary alternative(s) are selected via the screening process.

1. Construct separate water treatment plant for Niobrara for removal of aesthetics problems with existing water supply from wells presently serving the village. This would be separate from the water treatment and distribution system serving the Reservation.

2. Evaluation will be made to assess whether screened alternative(s) should be further refined to contain either a singular pipeline system for transmittal of potable water, or dual pipeline system for transmittal of potable and non-potable water.

II. Screening of Alternatives

a. Purpose of screening – to reduce number of alternatives for detailed feasibility level analyses, thereby reducing study costs. Screening will identify the alternative(s) that rank the highest according to criteria to be defined by the study screening team.

b. Screening Process Steps –

1. Identify members of screening team; will include members from Santee Sioux Nation (Nation), Nebraska-Kansas Area Office (NKAO), Great Plains Regional Office (GPRO), Reclamation's Technical Service Center (TSC), and Village of Niobrara (Village)

2. Define all alternatives to be considered by way of conference calls with team members.

Complete by November 18

3. Define screening criteria to be used to evaluate each alternative by way of conference calls with team members.

   Complete by November 3

4. Technical study team specialists will identify data needed to be compiled to evaluate how each alternative meets the defined screening criteria. Existing reports/data will be used to evaluate alternatives. Much of available data is appraisal level. Primary source of data is 'Needs Assessment, MR&I Water System, Santee Indian Reservation, Nebraska'; Bureau of Reclamation; March, 2004. Data in this document will be reviewed for adequacy. Data package will be prepared by NKAO for transmittal to TSC.

   Complete by November 28

5. Assign weights of importance to each screening criteria. A scoring matrix will be developed to assist team in defining criteria weights of importance (see section below on "Using the Criteria Scoring Matrix"). To more equally balance the desires of the Nation and the Federal team members, each group (Federal and Nation) will separately evaluate and score the criteria to arrive at a set of criteria weights. For the Nation, it is suggested that their criteria weights will be shared between Tribal council members and staff to obtain approval. The Federal team will share their criteria weights with representatives from the Village, and Regional and Area office management to obtain approval. At this point, there will be two sets of criteria weights (Tribal and Federal) for ranking the alternatives.

   Complete by December 16

6. At a face-to-face meeting with all screening team members, alternatives listed above will be reviewed and those identified as not meeting the purpose and intent of the authorizing legislation will be dropped from further evaluation. Team will then evaluate and numerically rank each screening criteria for each alternative using an evaluation matrix worksheet (see section below on "Using the Decision Matrix"). Team will perform ranking process by consensus, relying on input from the technical specialists. These alternative ranking values will be multiplied by the two sets of screening criteria weights (Tribal and Federal) to obtain weighted score.

7. Weighted criteria scores will be totaled for each alternative. Team will now have a top scoring alternative based on Tribal criteria weights, and a top scoring alternative based of Federal criteria weights. If the both Tribal and Federal top score alternatives are the same alternative, then that alternative will be selected to be evaluated at feasibility level. If the Tribal and Federal top score alternatives are different, then the study team will confer with Tribal and Federal management to reach decision on whether to go forward with feasibility analyses for one or two of the top ranked alternatives.

The selected alternative(s) may be further refined by sub-alternatives specified in section I.6 above. Team will do this jointly and by consensus.
Complete by January 13

8. NED alternative to be defined from list of potential alternatives, whether or not it is selected for detailed analyses.

c. Screening Criteria

1. Provide sufficient quantity of water – at minimum, meets both projected 2050 peak day demand and yearly volume withdrawn from the source to meet the 2050 average day demand plus all system losses . Would be better if greater potential to meet demands beyond that level. Less chance of being impacted quantitatively by future development.

2. Provide water of suitable quality – Should meet EPA primary and secondary drinking water standards. Less chance of being impacted by other contaminants (herbicides, pesticides, nitrates, coliforms, etc).

3. Low cost of construction – Low cost alternatives are preferred over higher cost alternatives.

4. Low operations and maintenance (O&M) and cost – A process that requires low levels of operation and maintenance (labor, power, chemicals, and materials) is preferred.

5. Minimal effects to existing environment- this would include wetlands, fisheries, etc. For water treatment there are residual waste products (i.e. sludge or a concentrated waste-stream) to be properly disposed.

6. Minimal effects to listed threatened and endangered (T&E) species

7. Minimal effects to existing water users – less quantitative or qualitative impacts by the proposed diversions and treatment process to existing nearby water diversions.

8. Minimal effects to cultural and historic features – less impacts to archeological sites.

9. Provide for Tribal self determination – increases opportunities and enhances environment for Nation maintain control over their future; enhances Tribal technical capacity.

10. Enhances Tribal employment and income – provides more employment opportunities for Tribal members.

11. Reliability of water system – less chance for mechanical failure or interruption of water supply to customers. This can be a function of simplicity of design and operation. Employing state-of-the-art technology may enhance reliability.

III. Screening Process Schedule – interim target completion dates listed in above process steps.

a. Workshop – meeting of screening team members to rank alternatives according to criteria.

1. Where: Denver TSC
2. When: January 10-11, 2006
3. Anticipated Length: 2 days
4. Who: Screening team members including staff from Nation, NKAO, GPRO, and TSC.

b. Date for completion of screening process – January 13, 2006

IV. Screening Team Members –

NKAO – Mike Kube, Jill Manring
GPRO – Mark Phillips
TSC – Joe Lyons, Bob Jurenka, Chou Cha, Steve Piper
Nation – Lee Ickes, Felix Kitto, Eugene Saul
Village – Robert Olsen

Using the Criteria Scoring Matrix

The criteria scoring matrix is used to assist team members in developing weights for the screening criteria. The scoring process involves comparing all of the criteria, two at a time, against one another. Team members will consider the relative importance of the two selected criteria and assign a numerical rating from 1 to 4 that describe their preference between the two. Between two criteria, the criterion with a lesser preference will be assigned a value of 1. The other criterion with higher preference will be assigned points from the following table based on degree of preference above the lesser preference criterion:

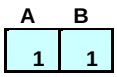
Level	Score
No Preference	1 point each criteria
Minor Preference	2 points
Medium Preference	3 points
Major Preference	4 points

Note, that if there is no preference between two criteria, each criterion is assigned 1 point each. The selected scores are entered into the appropriate cells in the criteria scoring matrix.

For example, the reviewer considers the first two criteria: A. Provide sufficient quantity of water and B. Provide water of suitable quality, to be of equal importance. Following the preference scale, each criteria is assigned a rating of 1 in the appropriate spreadsheet cells (marked A and B below).

A. Provide sufficient quantity of water

B. Provide water of suitable quality



Team members will progress through the entire matrix, making one-on-one comparisons until the entire preference matrix is filled-in with numerical ratings from 1 to 4 as shown in the example criteria scoring matrix below.

The spreadsheet application automatically totals up the rating points for each criteria, which is shown near the top of the decision matrix (see 'raw score' row in example decision matrix below). Using the criterion with the highest score, the spreadsheet application converts the each criterion's raw score into a normalized criterion weight scaled from 1 to 10. This result is shown in the 'weights of importance' row in the example decision matrix below.

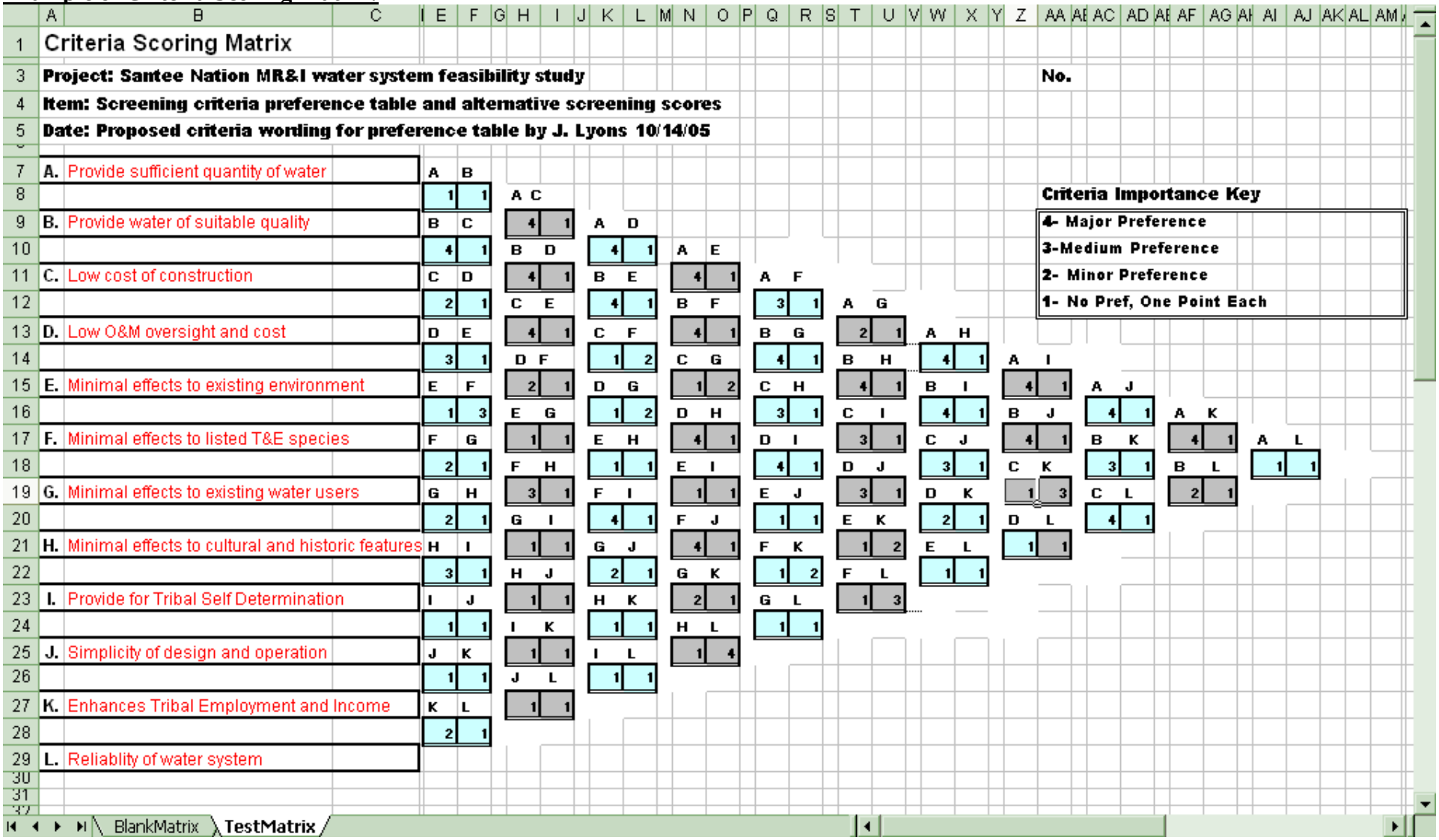
Using the Decision Matrix -

Now that the criteria weights have been determined, the next step is to rank each alternative for all criteria (refer to the example decision matrix below). This process will occur during a meeting of the screening team members. Using input from discipline specialists, how well an alternative meets each criterion will be ranked based on the following levels and assigned the respective score:

Level	Score
Poor	1
Fair	2
Good	3
Very Good	4
Excellent	5

The score is then entered into the respective cell in the decision matrix worksheet (upper left diagonal in example matrix). Note that in the example decision matrix, the letters 'L – A' correspond to the criteria in the example criteria scoring matrix. The spreadsheet will automatically multiply the score by the appropriate criteria weight to obtain a weighted score (lower right diagonal in example matrix). The spreadsheet sums the weighted score into a total score for each alternative, as shown in rightmost column in example decision matrix.

Example of Criteria Scoring Matrix:



Example of Decision Matrix:

Alternative Key

5-Excellent	2-Fair
4-Very Good	1-Poor
3-Good	

	Alternatives	Raw Score	L	K	J	I	H	G	F	E	D	C	B	A	Highest Score	38
			16	16	11	11	13	16	23	11	23	24	38	35		
	Weight of Importance		4	4	3	3	3	4	6	3	6	6	10	9	Total	
1	Alt 1 - Southeast Well Field		0	0	5 / 15	5 / 15	3 / 9	2 / 8	3 / 18	3 / 9	3 / 18	2 / 12	1 / 10	2 / 18		132
2	Alt 2 - Bazile Cr. SW Treatment		0	0	5 / 15	5 / 15	3 / 9	3 / 12	4 / 24	2 / 6	2 / 12	3 / 18	2 / 20	2 / 18		149
3	Alt 3 - Missouri SW Treatment		0	0	5 / 15	5 / 15	5 / 15	5 / 20	2 / 12	1 / 3	1 / 6	3 / 18	5 / 50	5 / 45		199
4	Alt 4 - Bazile Cr. Well Field Expansion		0	0	5 / 15	5 / 15	3 / 9	4 / 16	4 / 24	3 / 9	3 / 18	1 / 6	4 / 40	2 / 18		170
5	Alt 5 - Connect to Cedar-Knox		0	0	1 / 3	1 / 3	1 / 3	5 / 20	5 / 30	5 / 15	5 / 30	4 / 24	3 / 30	5 / 45		203
6	Alt 6 - Connect to West Knox		0	0	3 / 9	1 / 3	1 / 3	5 / 20	5 / 30	5 / 15	5 / 30	5 / 30	3 / 30	5 / 45		215
7			0	0	0	0	0	0	0	0	0	0	0	0		0
8			0	0	0	0	0	0	0	0	0	0	0	0		0
9			0	0	0	0	0	0	0	0	0	0	0	0		0
#			0	0	0	0	0	0	0	0	0	0	0	0		0
#			0	0	0	0	0	0	0	0	0	0	0	0		0

BlankMatrix | TestMatrix

Attachment B-1 – Results of scoring exercises for GPRO/NKAO and TSC:

During the week of November 28, 2005, Reclamation staff performed the criteria scoring exercise to arrive at the criteria weights to represent Reclamation's viewpoint. The process actually involved two exercises: GPRO/NKAO staff performed a criteria scoring exercise via consensus and TSC staff also performed a separate criteria scoring exercise via consensus. The criteria weights resulting from those two exercises are shown below. Since the resultant weights were similar, it was decided that the results of the two exercises could be averaged together to arrive at a set or criteria weight representing Reclamation's view. To arrive at the averaged weights, the total raw scores for each criterion for both exercises were averaged together.

The Santee Nation also performed the scoring exercise with results shown in following table:

Criteria	GPRO/NKAO Weights	TSC Weights	Reclamation Weights based on averaging of scores		Santee Tribal Weights
A – Provide sufficient quantity of water	9	10	10		8
B – Provide suitable water quality	10	10	10		8
C – Low construction cost	4	4	4		4
D – Low O&M oversight and cost	4	5	5		4
E – Minimal adverse effects to existing environment	5	4	5		4
F – Minimal adverse effects to listed T&E species	5	4	5		4
G – Minimal adverse effects to existing water users	3	4	3		3
H – Minimal effects to cultural and historic features	3	4	3		6
I – Provide for Tribal Self-Determination	5	5	5		10
J – Enhance Tribal Employment and Income	5	5	5		10
K – Reliability of water system	7	10	8		7

Attachment C – Decision Matrix – Criteria A-C

Tribal Weights ----------> Criteria Weights of Importance [Lo=1 Hi=10] Reclamation Weights ------>			Criteria A - Provide sufficient quantity of water [Used 750 gpm peak day demand for evaluation]			Criteria B - Provide water of suitable quality [Evaluation based on raw water]			Criteria C - Low cost of construction [assumed relative cost levels for evaluation]		
	8	10		8	10		4	4			
Alternatives	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments		
Alt 1 - Southeast Well Field	5	40 50	GW modeling indicates aquifer capable to meet 750 gpm system. Good potential to obtain land for locating well. Two wells required spaced 1/4 mile. Third backup well. Existing well field used for golf course.	2	16 20	Existing nitrate levels near EPA limits. Conditions only expected to get worse. Other water quality parameters ok. Requires RO treatment.	2	8 8	two wells, plus one backup well, RO treatment, longer distribution line		
Alt 2 - Bazile Cr. SW Treatment	4	32 40	Lowest recorded flows above 25cfs….demand around 2 cfs. Some susceptibility to drought…upstream demand impacts	2	16 20	Present nitrate not significant concern. Potential contaminants from upstream sources. Main concern is TDS…sulfates.	1	4 4	diversion structure crossing creek required, treatment plant plus RO, low transmission costs		
Alt 3 - Missouri Diversion	5	40 50	Most dependable supply source available.	4	32 40	By far best water quality near Reservation. Taste and odor problems with algal blooms. Variable quality will require more monitoring.	2	8 8	aggradation problems for intake structure, shorter large diameter pipes, closer to main demands		
Alt 4 - Bazile Cr. Well Field Expansion	4	32 40	Need to add two production wells 1/4 mi spaced and one additional backup well. Alternative more susceptible to drawdown impacts. Existing well field as part of expansion.	2	16 20	Doesn't meet EPA secondary standards. Meets all primary standards. Potential for future increased influence by Bazille Creek.	2	8 8	additional two wells plus backup well, manganese treatment, river course stabilization, RO treatment		
Alt 5 - Connect to Cedar-Knox	5	40 50	Rural water system would need to expand supply and treatment to meet demands. Ultimate source is assumed to be Missouri…should be adequate	4	32 40	see above for Missouri	2	8 8	rural water system needs to expand supply and treatment and assume will pass on those costs through water charges.		
Alt 6 - Connect to West Knox	5	40	Rural water system would need to expand supply. Preliminary information indicates they can	3	24	West Knox near edge of nitrate plume…potential for future contamination. Overall, good	2	8	additional wells required to meet demand, RO may be needed for nitrate in future.		

		50	obtain supply.		30	quality as of present.		8	
Alt 7 - Connect to West Knox and Cedar-Knox	5	40 50	Advantage …less needed expansion of existing rural water systems.	4	32 40	see above	2	8 8	see 5 and 6
Alt 8 - Well Field South of Reservation	5	40 50	Tapping Ogallala aquifer	5	40 50	Assume locating source in location of Ogallala where sufficient thickness exists and away from nitrate plumes. May need to complete wells near lower portion of aquifer.	1	4 4	approximately 40 miles to get to zone in Ogallala of adequate saturated thickness and clear of nitrate plumes. High transmission line cost
Alt 9 - Connect to Municipal Water Supply Off Reservation (assumed Village of Bloomfield for evaluation consistency)	5	40 50	Indications are nearby communities could supply adequate volume	3	24 30	May have future nitrate problems.	2	8 8	May need RO in future for nitrate
Alt 10 - Purchase of Devils Nest Treatment	5	40 50	Ultimate Missouri River supply	4	32 40	same as Missouri	2	8 8	high rehabilitation costs, can use existing intake structure
Alt 11 - Purchase Devils Nest for Supplying N. Reservation, and connect to West Knox for S. Reservation	5	40 50	see above reasons	4	32 40	same as Missouri	2	8 8	see above

Attachment C (cont.) – Decision Matrix – Criteria D - F

Tribal Weights ----------> Criteria Weights of Importance [Lo=1 Hi=10] Reclamation Weights ------>		4	Criteria D - Low O&M oversight and cost		4	Criteria E - Minimal effects to existing environment		4	Criteria F - Minimal effects to listed T&E species
		5			5			5	
Alternatives	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments
Alt 1 - Southeast Well Field	2	8 10	RO operational costs, well maintenance, pumping costs, brine discharge	4	16 20	brine discharge, minor from well drilling	3	12 15	less dilution of brine discharge due to distance to Bazille Ck.
Alt 2 - Bazile Cr. SW Treatment	1	4 5	shorter distance to remove brine, sedimentation control	2	8 10	wetlands impacts, brine discharge, river diversion structure	4	16 20	
Alt 3 - Missouri Diversion	3	12 15	No RO, dredging potential	3	12 15	wetlands impact, some waste sludge	4	16 20	
Alt 4 - Bazile Cr. Well Field Expansion	2	8 10	brine disposal from RO, manganese and iron treatment	3	12 15	wetlands impacts, brine discharge	4	16 20	
Alt 5 - Connect to Cedar-Knox	4	16 20	minor distribution system O&M on project, monthly water fees, costs distributed to more users	4	16 20		4	16 20	
Alt 6 - Connect to West Knox	3	12	see above	4	16	brine discharge	4	16	

		15			20			20	
Alt 7 - Connect to West Knox and Cedar-Knox	4	16 20	cedar-knox serving main demand	4	16 20		4	16 20	
Alt 8 - Well Field South of Reservation	3	12 15	higher pumping costs	5	20 25		3	12 15	more potential impacts to American Burying Beatle
Alt 9 - Connect to Municipal Water Supply Off Reservation (assumed Village of Bloomfield for evaluation consistency)	3	12 15		4	16 20	Potential RO	4	16 20	
Alt 10 - Purchase of Devils Nest Treatment	3	12 15	Same as Missouri	4	16 20	existing plant less impacts then new	4	16 20	
Alt 11 - Purchase Devils Nest for Supplying N. Reservation, and connect to West Knox for S. Reservation	3	12 15		4	16 20	See Alts 6 &10	4	16 20	

Attachment C (cont.) – Decision Matrix – Criteria H - I

Tribal Weights ----------> Criteria Weights of Importance [Lo=1 Hi=10] Reclamation Weights ------>		3	Criteria G - Minimal effects to existing water users		6	Criteria H - Minimal effects to cultural and historic features		10	Criteria I - Provide for Tribal Self Determination [based on maintaining tribal sovereignty]
		3			3			5	
Alternatives	Rank	Score	Comments	Rank	Score	Comments	Rank	Score	Comments
Alt 1 - Southeast Well Field	4	12		4	24		5	50	
		12			12			25	
Alt 2 - Bazile Cr. SW Treatment	3	9	may be some impact to existing water rights	4	24		5	50	
		9			12			25	
Alt 3 - Missouri Diversion	5	15		4	24		5	50	
		15			12			25	
Alt 4 - Bazile Cr. Well Field Expansion	3	9	may be some impact to existing water rights	4	24		5	50	
		9			12			25	
Alt 5 - Connect to Cedar-Knox	5	15		4	24		1	10	
		15			12			5	
Alt 6 - Connect to West Knox	3	9	additional wells for rural water system may impact existing irrigators, past contention on transbasin	4	24		1	10	

		9	diversion of GW		12			5	
Alt 7 - Connect to West Knox and Cedar-Knox	4	12 12	additional wells for rural water system may impact existing irrigators	4	24 12		1	10 5	
Alt 8 - Well Field South of Reservation	3	9 9	wells for rural water system may impact existing irrigators, potential for contention with transbasin diversion of GW	3	18 9	longer pipeline increases potential for more impacts	4	40 20	
Alt 9 - Connect to Municipal Water Supply Off Reservation (assumed Village of Bloomfield for evaluation consistency)	5	15 15		4	24 12		1	10 5	
Alt 10 - Purchase of Devils Nest Treatment	5	15 15		4	24 12		4	40 20	
Alt 11 - Purchase Devils Nest for Supplying N. Reservation, and connect to West Knox for S. Reservation	4	12 12	wells for rural water system may impact existing irrigators	4	24 12		2	20 10	

Attachment C (cont.) – Decision Matrix - Criteria J-K and Total Scores

T Tribal Weights ----------> Criteria Weights of Importance [Lo=1 Hi=10] Reclamation Weights ------>	10 5	Criteria J - Enhances Tribal Employment and Income [based on immediate employment and not economic enhancement]	7 8	Criteria K - Reliablity of water system	Weighted Totals [Tribal top, Reclm bottom]

Alternatives	Rank	Score	Comments	Rank	Score	Comments	Weighted Totals [Tribal top, Reclm bottom]
Alt 1 - Southeast Well Field	4	40 20		5	35 40	RO systems would be expected to be more reliable than traditional SW treatment facitlity.	261 232
Alt 2 - Bazile Cr. SW Treatment	5	50 25		3	21 24	lower reliability for SW treatment, aggradation problems	234 194
Alt 3 - Missouri Diversion	5	50 25		4	28 32	lower reliability for SW treatment, aggradation problems	287 257
Alt 4 - Bazile Cr. Well Field Expansion	4	40 20		5	35 40		250 219
Alt 5 - Connect to Cedar-Knox	1	10 5	operated by non-tribal staff	4	28 32	lower reliability for SW treatment, potential aggradation problems	215 227
Alt 6 - Connect to West Knox	1	10		4	28	more pumping stations required	197

		5			32		206
Alt 7 - Connect to West Knox and Cedar-Knox	1	10		4	28	see alternative 5	212
		5			32		224
Alt 8 - Well Field South of Reservation	3	30	needs less staff to operate	3	21	longer transmission lines allow for more potential problems, more pumps	246
		15			24		236
Alt 9 - Connect to Municipal Water Supply Off Reservation (assumed Village of Bloomfield for evaluation consistency)	1	10	non-tribal staff operating	4	28		203
		5			32		212
Alt 10 - Purchase of Devils Nest Treatment	5	50		4	28	SW treatment has slightly lower reliability	281
		25			32		257
Alt 11 - Purchase Devils Nest for Supplying N. Reservation, and connect to West Knox for S. Reservation	4	40	partially owned system	3	21	dealing with two entities	241
		20			24		231

Attachment D – Justification for elimination of Alternative 10

Factors Against Alternative #10

Following are the determining factors against the purchase of the Cedar-Knox Rural Water District's Devil's Nest WTP by the Santee Sioux Tribe.

1. The original Devil's Nest WTP was built in 1971 for snowmaking and retrofitted in 1981 for drinking water purposes. Several subsequent modifications have also occurred. Overall, the existing equipment and piping are 25-35 years old. The WTP structures, equipment, and piping are nearing the end of their design life. During Reclamation's August 2005 site visit, the reliability of some equipment was already questionable. Demonstration of some equipment was not possible due to malfunction or miscellaneous operational problems.

2. Purchase of an existing WTP can be economically justified if the cost savings associated with the location of the existing WTP and/or the usefulness of the existing facilities make the purchase option less expensive than other alternatives providing the same water supply. The primary economic factors to be considered when evaluating the purchase of the Devil's Nest WTP are the initial purchase cost, cost of rehabilitation, and annual O&M costs. These costs then need to be compared to the other water supply alternatives.

   The initial purchase price of the Devil's Nest WTP may be relatively low, but it is estimated that replacing the existing conventional chemical equipment with new state of the art equipment through a comprehensive WTP rehabilitation program would cost more than if a new facility were constructed with new equipment. Experience shows that unless only a minor modification is required, rehabilitation of an existing plant is more costly than construction of a new plant.

   Given the need (identified and unknown) to upgrade the Devil's Nest WTP facilities with new state of the art equipment (that would also likely be used in other alternatives) the annual O&M costs associated with the Devil' Nest purchase would actually be greater due to its location.

3. The Devil's Nest technology, conventional chemical treatment, may not be the preferred treatment process. Today, membrane treatment is considered the state of the art for surface water sources like the Missouri River. Microfiltration has many advantages over conventional chemical treatment including:

Comparison of:	Microfiltration	Conventional Chemical
1. Process	**Physical – less chemicals required**	**Chemical**
2. Particle removal	**0.1 micron**	**1 micron with coagulant**
3. Virus removal	**100%**	**99%**
4. *Giardia lamblia* removal	**100%**	**97-99.9%**
5. Silt density index	**3**	**5**

6. Consistent quality irrespective of feedwater temperature and concentration	**Yes**	**No**
7. Operation	**Fully automated – remote operation possible**	**Partially automated – partially operable remotely**
8. Phasing flexibility	**Modular design is highly flexible**	**Not flexible**
9. Footprint	**Minimal land requirements resulting in lower capital costs**	**Land intensive**

4. If selected, a new WTP should be constructed on Tribal land. Building on Tribal land facilitates economic development on the reservation.

5. There is significant concern about the protection of the WTP intake during periods of high sediment loading in the Missouri River (see item #6 in table). The Corps of Engineers (in a report entitled: Niobrara and Missouri Rivers, South Dakota and Nebraska Sediment Strategies, Nov. 2001) states on page 6: "By 2050 it (the visual delta) should be in the Bon Homme Mennonite Colony/Devils Nest Area." The visual delta front is defined in this report to be the portion of the delta above the water line. For this reservoir, the pool elevation remains reasonably constant , fluctuating only a couple of feet during the year. The COE also recognized that the breakpoint between the topset slope (think visual delta) and the foreset slope (think underwater leading edge of the delta) is located closer tot he dam than the visual delta front. Therefore, the COE concluded that very little boating activity could occur "for some distance" in front of the visual delta. Thus, the sedimentation impacts to the existing intake at Devil's Nest occurs prior to 2050 in the COE's estimation as the delta proceeds downstream. Also, the COE operation plan for the reservoir will have an impact to the timing as well because a sediment flushing scheme would result in a longer, flatter foreset slope that would likely reach the Devil's Nest earlier than delta building under reservoir conditions that have less total and seasonal elevational fluctuations.

6. The WTP is located 20 driving minutes east of the reservation's eastern-most boundary. This area is somewhat remote and accessible only by gravel surfaced county roads which twist and turn. Due to road conditions, chemical delivery is done by an operator in a small pickup truck. This situation is unique to the Devil's Nest location and places the owner and operator responsible for meeting Hazardous Materials Transportation Act (HMTA) requirements. HMTA requirements include compliance with proper labeling and placards, responsibility for spills or other emergencies, and compliance with occupational and public safety and health requirements.

7. Loading docks are not available; therefore, chemical unloading is by hand and very labor intensive. Chemical delivery and manual unloading contributes to high O&M costs.

8. The exact length, in miles, of new distribution system piping that would be required from the existing WTP to the reservation has not been determined. However, it would be

significantly more costly, in terms of earthwork and materials, than required by a new WTP within reservation boundaries.

9. The WTP capacity is 1,100,000 gpd which is more than sufficient to meet the current estimated reservation-wide peak day demand of 335,000 gpd. At this capacity, the WTP also meets the year 2050 reservation-wide peak day demand of 1,080,000 gpd (based upon 750 gpm). The Devil's Nest site will not accommodate future expansion.

Attachment E – Justification for elimination of Alternative 3A

Factors Against Alternative #3A

Following are the determining factors against the design of a surface water intake in Lewis and Clark Lake adjacent to the village of Santee. For this screening of alternatives, the study team consulted with sedimentation experts within the U.S. Army Corps of Engineers –Omaha District (COE) regarding reservoir sedimentation conditions in Lewis and Clark Lake. Phone conversations and e-mail exchanges with Mr. John Remus (Chief, Sedimentation and Channel Stabilization Section, Omaha District) and other COE engineers during February and March 2006 form the basis of the factors described below.

1. The portion of the reservoir directly adjacent to the village of Santee has experienced sediment deposition since Gavin's Point Dam was completed in 1957. The COE has monitored sedimentation in this area, and conducted periodic surveys across established range lines. For example, the survey data for range line 871.5[2] from 1955 through 1995 as shown in the attached figure indicates filling of much of the main channel of the Missouri River and general aggradation within the reservoir area. Springfield, SD (just across the lake from Santee) developed additional water sources including wells as the delta developed around the town's surface water intake in Lewis and Clark Lake. Although not designed as an infiltration gallery, some water can be pumped from this intake structure in limited circumstances when flow water conditions are locally present in the reservoir. However, Springfield relies on other sources to supply the bulk of its water needs

2. The COE is currently planning for sediment flushing numerical modeling studies at Lewis and Clark Lake. In the opinion of the COE experts, flushing of sediments at Lewis and Clark Lake (and reconfiguring the delta deposits in the lake) will become more effective in the future as the delta deposits move closer to the dam. Also, it is likely that delta conditions at Santee will not be directly affected by sediment flushing (because of the distance to the dam) but as the delta grows, changes in location of the channels across the delta could occur.

3. River stabilization structures (such as the bendway weirs currently in place near the intake structure for the Buford-Trenton Irrigation District near the upper end of Lake Sakakawea in North Dakota) are primarily used in flowing water situations. Currently, there are no structures of this type located in the sediment deposition areas of the COE's Missouri River reservoirs.

4. The uncertainty associated with future delta conditions and the lack of any currently successful intakes in delta areas (upon which our design could be based) would suggest that this option should be eliminated from consideration.

[2] The COE uses river distance in miles upstream from the mouth of the Missouri River as the designator for range line location in Lewis and Clark Lake. The southern endpoint of range line 871.5 is located downsteam of the Santee village boat ramp .

/GAVINS POINT AGG PROJECT/871.5/STATION (LR)-ELEV./16MAY1955/1955//