APT Cooling Water Supply Make-up Trade Study, Revision 1

by

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DOE Contract No. **DE-AC09-96SR18500**

DISCLAIMER

APT

Cooling Water Supply Make-up

Trade Study

Revision (1)

August 8, 1996

APT Cooling Water Supply/Make-up Trade Study

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Date: August 8, 1996

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Approved By :_

APT Cooling Water Supply/Make-up Trade Study

1.0 Objectives:

In the conceptual design of the APT cooling water system, several options exist for the design of the system(s) which serve as the ultimate heat sink. There are basically two approaches which are being considered for APT. The first approach involves the use of cooling towers at the APT site and providing makeup water to account for evaporative losses and blowdown. The second approach involves the use of heat exchangers at the APT and a larger water supply to remove the heat from the heat exchangers and transfer it directly to the ultimate heat sink, the Savannah River via PAR pond or the atmosphere through the K Area natural draft cooling tower.

It is not cost effective or desirable to proceed with the conceptual design without identifying specifically how the heat is to be removed from APT and transmitted to an ultimate heat sink. Thus, this trade study will evaluate several variations of the above methodologies.

2.0 Scope:

This study will evaluate alternative methods of providing an ultimate heat sink to the APT. Specifically, either cooling towers with a source of makeup water, or a once through river water cooling system utilizing PAR pond for the heated effluent will be evaluated. This study will consider APT sites #2 and #8 currently being evaluated for selection (Reference attachment 9.4). All cost and technical discussion is based on Site#2 with a discussion of the relation to Site #8 provided in Section 6.0. Utilization of cooling towers at the APT site and a supply of makeup water from the River Water system (identified as Alternative 1 herein) is the basis for the APT CDR estimate, therefore, it will be the base case for this study. Thus, no cost is presented for Alternative #1, and the other alternatives present a cost delta relative to the base cost.

All alternatives will include the structures and equipment that form the portion of the heat removal system that extends from the cooling or makeup water source through the tertiary cooling loops to the APT secondary cooling loops up to the primary heat exchangers or chillers. Piping costs are included up to the general location of APT. The general intra-area pipe routing is considered equivalent for all options. Blowdown is considered in every case. The cost differential between each alternative's control system is not considered significant and therefore has not been included in this evaluation. Additionally, none of the alternatives include surge tanks for flow control. Although it is probable that additional provisions for flow control will be required, this requirement would effect all alternatives and is not considered in this evaluation

All alternatives will utilize existing SRS systems and structures where possible. Specific assumptions related to each alternative are identified in Section 5.0. This study will rank all alternatives on direct equipment costs, operating and maintenance costs, and permitting risks.

3.0 Alternatives:

Several alternative methods of providing the process cooling water are described as follows:

1. River Water Makeup: Supply makeup water from the existing river water system (originally used to supply cooling water makeup to the reactors) to the APT mechanical draft cooling towers. Heated effluent is discharged to the atmosphere and continuos blowdown is directed to PAR Pond.
2. River Water Once Through: Provide heat exchangers at the APT site with cooling water supplied from the existing river water system using either the 681-1G or 681-3G pump house. Heated effluent and continuos blowdown is directed to PAR Pond.
3. Well Field Makeup: Supply makeup water from a new well field to APT mechanical draft cooling towers. Heated effluent is discharged to the atmosphere and continuos blowdown is directed to PAR Pond.
4. K Area Cooling Tower: Use the K Area cooling tower to remove heat from the cooling water. This alternative makes use of portions of the existing river water system in order to minimize new runs of large diameter concrete pipe. Heated effluent is discharged to the atmosphere and continuos blowdown is directed to the K-area outfall.

All alternatives have been simplified to focus on the primary cost drivers. A judicious effort has been made to maintain a fair comparison between each alternative.

Several variations on the above alternatives exist, and were not specifically evaluated. These include:

- Supply cooling water to the APT heat exchangers from the existing river water system using 681-6G pump house at PAR pond. This option was not evaluated due to the fact that the 681-6G pump house has not been maintained, and thus the equipment condition was suspect. The cost and feasibility associated with this option is essentially identical to Alternative 2 above. The primary difference would be the additional cost in restoring the

pump house, and the lower operating cost due to lower horse power pumps.

- Make use of a new cooling pond to remove heat from the APT heat exchangers. This option was not evaluated due to the fact that preliminary estimates of the retention pond size indicated that the pond would have to be extremely large to remove the required heat. Thus, this option was not considered technically feasible.

- A once through cooling system utilizing well water supply. This alternative is not considered feasible as the number of wells required to meet the demand would be cost prohibitive and the permitting risk associated with this production rate was considered to be extremely high.

These alternatives cover the most common and frequently used types of systems. Other alternatives or variations may exist, but were not considered in this report.

4.0 Basis for Evaluation and Selection:

Alternatives are evaluated on technical feasibility, direct capital costs, operating and maintainability costs, and permitting risks. Technical feasibility is evaluated on a go/no go basis, and all of the alternatives evaluated herein are technically feasible in that they can provide the required cooling given that the proper equipment (either new or modified) is in place. The remaining criteria will be assigned a numerical value or score based on a performance scale of 0 to 5 such that 3 is the rating of the base alternative (Alternative 2) with higher numbers increasingly better than the base and lower numbers increasingly worse. For the purpose of this study the criteria were weighted as: direct capital cost - 20%, operating and maintainability costs - 30%, and permitting risk - 50%.

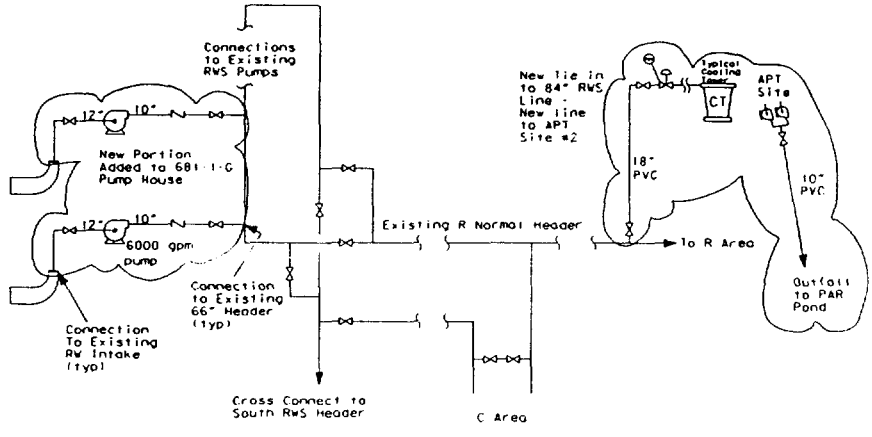
5.0 Evaluation of Alternatives for APT Site #2:

5.1 River Water Makeup (Alternative #1)

Description of System:
This scenario relies on mechanical draft cooling towers as the primary means of transferring heat from APT to the atmosphere. Makeup water is required to account for evaporative losses and continuous blowdown. Preliminary calculations indicate that approximately 6000 gpm of makeup water will satisfy the peak demand for APT. This 6000 gpm could be supplied using a portion of the existing river water system. The modified system would consist of 2 replacement pumps (one is utilized as a spare) in

either the 681-1G or the 681-3G pump house, use of the existing "R-Normal" river water header, and the addition of approximately 18,000 ft of 18" PVC pipe. Additionally, approximately 24,000 ft of 10" PVC pipe would be required along with pumps for continuous blowdown to PAR pond. Figure 1 shows a rough schematic of the proposed system.

Figure 1: 6000 gpm Makeup from RWS



The specific equipment and modifications required for this alternative include:

- Remove 2 existing RWS pumps in the 681-1-G or 681-3G pump house.
- Add two 12" Schedule 40 carbon steel pump suction lines, each with a 12" suction isolation gate valve.
- Add 2 new and smaller river water centrifugal pumps (one to be utilized as a spare). These pumps should be rated at 6000 gpm @ 420 ft TDH.
- Add two 10" Schedule 40 carbon steel pump discharge lines, each with a 10" check valve and a 10" discharge isolation gate valve, and a tie in to the existing 66" header in 681-1-G.
- Add 18" carbon steel tie in connection to existing 84" RWS header between C Area and H Area including an 18" isolation gate valve.
- Add 18,000 ft of 18" PVC pipe - bell and spigot type.
- Add 18" carbon steel line to connect to the APT cooling tower. The line should include an 18" isolation gate valve as well as a flow control valves at the APT site cooling towers.
- Add 24,000 ft of 10" PVC pipe - bell and spigot type and pumps for continuous blowdown to PAR Pond.

Significant Assumptions:

- It is assumed that the existing outfall structure at PAR pond may be utilized. Site Services Engineering has indicated that the outfall is in good condition, and was sized to handle in excess of 200,000 gpm.
- The piping lengths are based on a rough straight line estimate from the river water system to the APT site.
- The existing river water intake structure can be permitted for use by APT.
- It is assumed that the cooling tower basins have adequate inlet surge capacity for system flow stability. No additional cooling water capacity is provided for pump start-up or other system operational transients.
- One spare supply header pump has been considered sufficient to maintain the required system operability requirements. Additional pumps may be required but were not considered in this evaluation.

Advantages:

This type of system is very common and provides a stable and predictable source of makeup water.

The existing river water system is permitted to remove significantly more water than the 6000 gpm required for makeup to APT, and the ability to outfall to PAR pond has been evaluated and found acceptable in Reference 9.2. Also, the required equipment is common and should be readily available.

Disadvantages:

A possible disadvantage of this system is that the existing river water system is beyond it's original design life, and to continue to rely on the integrity of the piping and components could be a concern. However, this has been addressed in Reference 9.1 (River Water System Shutdown: Lay-up Requirements (U), EFR-ENG-950067) which concluded that the river water system is in exceptional condition and should be usable for many years to come. The only real disadvantage of this system is that there is a potential for stagnation or biological fouling problems to result from the very low water velocity in the large river water pipes. This results from the fact that the existing river water system was designed for flows on the order of 150,000 gpm. There is only limited experience to predict how the pipe will respond to the very lows flows required by APT. The fouling may be eliminated by chemical treatment at the river water pump house.

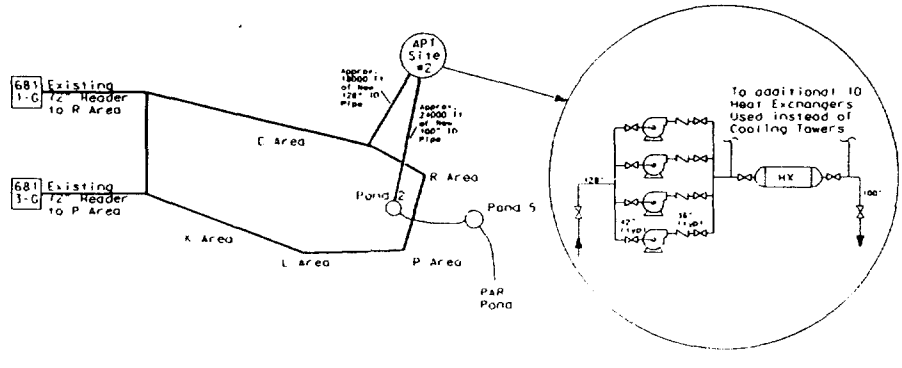
It is not certain at this time how favorable this option is for SCDHEC permitting. Should the intake structure require a new permit, the facility may also be required to upgrade to new design standards.

Cost:
The capital cost of the above described modifications and additions are defined as the base case for evaluation of all alternatives. Other study case costs will be reflected as cost adjustments to this base cost.

5.2 River Water Once Through (Alternative #2)

Description of System:
This scenario relies on heat exchangers (used in lieu of cooling towers) as the primary means of transferring heat from APT to the river water. Preliminary calculations indicate that approximately 125,000 gpm supply of cooling water to the heat exchangers will satisfy the maximum heat loading for the APT. This 125,000 gpm could be supplied using a portion of the existing river water system. The modified system would utilize the existing pumps in either the 681-1G or the 681-3G pump house, use the existing "R-Normal" river water header, and the addition of approximately 18,000 ft of 128" concrete pipe connecting the river water system to the heat exchangers at the APT site. Additionally, four new pumps and approximately 24,000 ft of 100" concrete pipe would be required for discharge to PAR pond. Figure 2 shows a schematic of the proposed system.

Figure 2: 125000 gpm Supply from RWS



The specific equipment and modifications required for this alternative include:

- Add approximately 18,000 linear ft of 128" internal diameter concrete pipe rated at roughly 80 psig to connect from "R Normal Header" to APT Site #2. This line should include 2 isolation valves (one at either end).
- Add four 42" Schedule 10 carbon steel pump suction lines, each with a 42" suction isolation gate valve.
- Add four new pumps rated at 50,000 gpm at 80 ft TDH.
- Add four 36" Schedule 10 carbon steel pump discharge lines, each with a 36" check valve and a 36" discharge isolation gate valve.
- Add approximately 24,000 linear ft of 100" internal diameter concrete pipe rated at 80 psig to connect APT Site #2 to Pond 2 which will outfall into PAR Pond. This line should include 2 isolation valves (one at either end).
- Eliminate the cooling station cooling towers.
- Replace the existing primary heat exchangers with heat exchangers designed for the once through cooling system operation.

Significant Assumptions:

- It is assumed that the use of the existing outfall structure at PAR pond may be utilized. Site Services Engineering has indicated that the outfall is in good condition, and was sized to handle in excess of 200,000 gpm.
- The piping lengths are based on a rough straight line estimate from the river water system to the APT site.
- It is assumed that the river water system may be operated close to its design capacity for the life of the APT. This may be possible given the good condition of the pipe as reported in Reference 9.1.
- It is assumed that the existing river water pumps can produce sufficient head to supply the flow requirements of APT. Significant head loss can be expected in the existing river water lines and the new lines to APT. Detailed head loss data for the existing lines is not available, and this may affect the usability of the river water pumps though some margin appears to exist based on preliminary analysis.

- It is assumed that no inlet flow surge capacity is required for system flow stability. No additional cooling water capacity is provided for pump start-up or other system operational transients. Proper system control may require the addition of a surge tank but these costs have not been included in this evaluation.
- One spare supply header pump has been considered sufficient to maintain the required system operability requirements. Additional pumps may be required but were not considered in this evaluation.
- The control system required by this alternative is assumed to be of equivalent cost and complexity to other alternatives being evaluated. This system, in fact, may require a more complex control system due to the complexity and size of the pumping system.
- The once through heat exchangers are assumed to be of equal cost when compared to the base case primary heat exchangers. Further analysis is requried to determine the actual surface area and flow rates requried. This assumptions should provide a reasonalble basis for order of magnitude cost comparisons.

Advantages:
This type of system also is very common and provides a very stable and predictable source of makeup water.

The existing river water system is permitted to remove significantly more water than the 125,000 gpm required for APT, and the ability to outfall to PAR pond has been evaluated and found acceptable in Reference 9.2.

Disadvantages:
A possible disadvantage of this system is that the existing river water system is beyond its original design life, and to continue to rely on the integrity of the pumps, piping, and components could be a concern. However, this has been addressed in Reference 9.1 (River Water System Shutdown: Lay-up Requirements (U), EFR-ENG-950067) which concluded that the river water system is in exceptional condition and should be usable for many years to come. One real disadvantage of this system is that it requires special order equipment such as very large diameter pipe, large pumps, and many large heat exchangers. There is also a substantial and difficult installation associated with the long runs of large diameter pipe. Additionally, the electrical power requirements are large due to the energy required to move 125,000 gpm from the river to the APT site (~ 10MW).

It is not certain at this time how favorable this option is for SCDHEC permitting. Should the intake structure require a new permit, the facility may also be required to upgrade to new design standards.

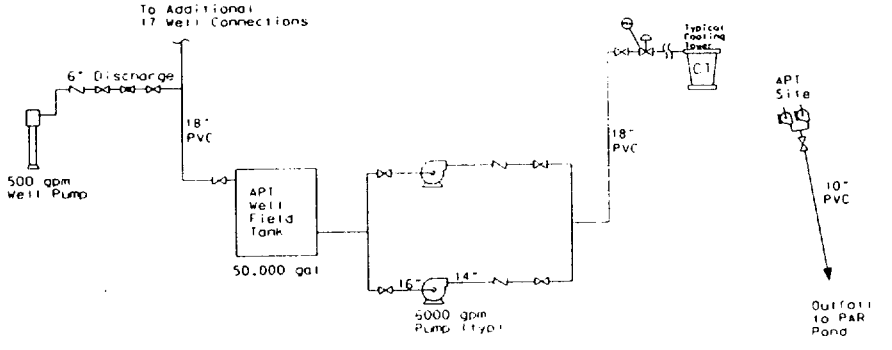
Cost:
The additional capital cost of the above described modifications and additions relative to Alternative 1 has been estimated at $21.2M. (Referenced the attached cost estimate)

The estimated costs of this option has been credited for the elimination of the cooling towers.

5.3 Well Field Makeup (Alternative #3)

Description of System:
This scenario relies on mechanical draft cooling towers as the primary means of transferring heat from APT to the atmosphere. Makeup water is required to account for evaporative losses and continuous blowdown. Preliminary calculations indicate that approximately 6000 gpm of makeup water will satisfy the maximum heat load conditions for APT. This 6000 gpm could be supplied using a well field located as close to the APT site as practical. Current estimates indicate that this system would include 18 production wells rated for approximately 500 gpm each, and a distribution system to deliver the water to the APT site. Figure 3 shows a schematic of the proposed system. Location of a well field has not been determined and thus assumptions are used to estimate piping lengths required.

Figure 3: 6000 gpm Makeup from Wells



The specific equipment and modifications required for this alternative include:

- Drill 18 production wells rated for 500 gpm
- Add 18 well pumps rated at 500 gpm at approximately 50 ft TDH.
- For each well add 10 ft of 6" Schedule 10 stainless steel pipe to include two 6" isolation gate valves, one 6" control valve, and one flow measuring device.
- For each well add 100 ft of 6" PVC pipe
- Add 1000 ft of 18" PVC pipe to connect all wells to well field tank.
- One well field tank - 50,000 gallon.
- Add two 16" carbon steel pump suction lines, each with a 16" suction isolation valve.
- Add 2 centrifugal pumps. These pumps should be rated at 6000 gpm @ 100 ft TDH (example Goulds model 3415-DV 14x16-18).
- Add two 14" carbon steel pump discharge lines, each with a 14" check valve and a 14" discharge isolation valve.
- 5000 ft of 18" PVC pipe - bell and spigot type (example J-M Pipe, Big Blue large diameter PVC pressure pipe).
- Add 24,000 ft of 10" PVC pipe - bell and spigot type (example J-M Pipe, Big Blue large diameter PVC pressure pipe) for continuous blowdown to PAR Pond.

Sinificant Assumptions:

- It is assumed that the use of the existing outfall structure into PAR pond may be used. Site Services Engineering has indicated that the outfall is in good condition, and was sized to handle in excess of 200,000 gpm.
- The piping lengths are based on assumptions that the wells are located within approximately 500 ft of one another, and that the well field is not more than 5000 ft from the APT site.
- It is assumed that production wells can be developed to provide the required 500 gpm per well. Estimates from the geotechnical group indicate that this is the maximum flow that can be expected from a deep well at SRS (Reference 9.3).
- It is assumed that 12 wells is sufficient to provide the required 6000 gpm. An additional 6 wells are included in the estimate to account for any problems associated with the wells (e.g. degradation, plugging, etc.). This provides a reasonable degree of conservatism as the 6000 gpm requirement is a peak load requirement.

- It is assumed that ground water use permits will be granted by SCDHEC and that ground water flow characteristics will not adversely effect the aquifer.
- A 50,000 gallon collection/surge tank was selected to provide inlet surge capacity for system flow stability. It is assumed that this capacity is adequate to accommodate well pump start-up and other system operational transients.
- No costs have been included for well controls or field housing of instrumentation and equipment. It is not believed that these costs are of a magnitude to significantly affect the evaluation's results.

Advantages:
This type of system is very common and provides a reasonably stable source of makeup water. Also, the required equipment is common and should be readily available.

Disadvantages:
A significant disadvantage of this system is that permitting is perceived to be difficult based on preliminary evaluations by the site geotechnical services department (Reference 9.3). This is due to the evaluation that removal of 6000 gpm may result in the SRS seriously impacting the affected aquifer system.

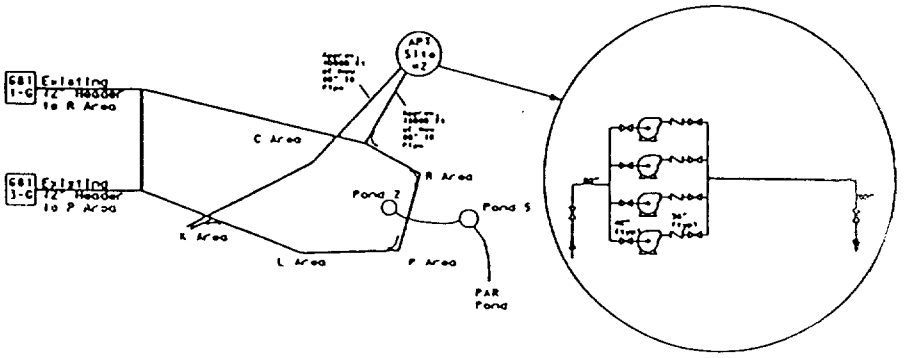
Cost:
The additional cost of the above described modifications and additions relative to Alternative 1 has been estimated at $1.1M. (Reference the attached cost estimate)

5.4 K Area Cooling Tower (Alternative #4)

Description of System:
This scenario relies on heat exchangers (used in lieu of cooling towers) as the primary means of transferring heat from the APT site. The heat is dissipated to the atmosphere using the K Area (natural draft) cooling tower. Preliminary calculations indicate that approximately 125,000 gpm supply of cooling water to the heat exchangers will satisfy the maximum heat load for APT. This 125,000 gpm could be supplied using the existing K Area Cooling Tower pumps and approximately 40,000 ft of 80" concrete pipe. The return leg would require additional pumps, approximately 18,000 ft of 80" concrete pipe, and would make use of a portion of the existing river water system to minimize the amount of new pipe required. Additionally, a source of makeup water would need to provide

approximately 6000 gpm to account for evaporative losses and continuous blowdown. Figure 4 shows a rough schematic of the proposed system.

Figure 4: 125000 gpm K Cooling Tower



The specific equipment and modifications required for this alternative include:

- Add approximately 40,000 linear ft of 80" internal diameter concrete pipe rated at roughly 125 psig to connect from K Area Cooling Tower to APT Site #2. This line should include 2 isolation valves (one at either end).
- Add four 42" Schedule 10 carbon steel pump suction lines, each with a 42" suction isolation gate valve.
- Add four new pumps rated at 50,000 gpm at 130 ft TDH (example Goulds model 3420 36x42-48 High Q).
- Add four 36" Schedule 10 carbon steel pump discharge lines, each with a 36" check valve and a 36" discharge isolation gate valve.
- Add piping and valves associated with the heat exchangers that will serve as the ultimate heat sink for APT
- Add approximately 18,000 linear ft of 80" internal diameter concrete pipe rated at roughly 100 psig to connect APT Site #2 to the "R Normal Header" which will then deliver flow back to K Area Cooling Tower. This new line should include 2 isolation valves (one at either end of the new portion) if possible.
- Modify R Area and P Area lines to allow flow to K Area. This should require approximately 300 ft of 78" ID concrete pipe.

- Tie in to 84" ID "P Normal Header" to branch off to K Area Cooling Tower for return line. This should require approximately 300 ft of 80" ID concrete pipe.
- Provide makeup water supply using a method similar to Alternative 1 except routing the makeup water flow to the K Area Cooling Tower which would require only a few hundred feet of 18" PVC pipe in lieu of the 18,000 ft required by Alternative 1. If permitting does not allow discharge to the K-area outfall, additional cost will be incurred as a result of routing to an alternate outfall such as PAR Pond.
- Eliminate the cooling towers at the APT site cooling stations.

Significant Assumptions:

- It is assumed that the existing K Area outfall may be utilized for system blowdown.
- The piping lengths are based on a rough straight line estimate from the river water system to the APT site.
- It is assumed that portions of the river water system may be operated close to its design capacity for the life of the APT. This may be possible given the good condition that the pipe is reported to be in Reference 9.1.
- It is assumed that the existing K Area Cooling Tower pumps can produce sufficient head to supply the flow requirements of APT, and that the pumps are in usable condition. There were known problems associated with these pumps, of which most are reported have been resolved.
- K-cooling tower is assumed to be in tact and in good condition. No costs have been included for any modification, repairs, or upgrades to the structure. Although some portions of the cooling tower system have been removed for use elsewhere, it is not believed that the resulting equipment repair/replacement costs will significantly affect the results of this evaluation.
- It is assumed for this evaluation that the cooling tower will function in all modes of APT operation. It has not been determined if the conditions of operation are adequate to induce a natural draft in the tower, nor has it been determined that a draft would be required to provide the required cooling. A detailed engineering study is required to determine the technical adequacy of the cooling tower.

Advantages:
This type of system also is very common and provides a stable and predictable source of makeup water. The existing river water system is permitted to remove significantly more water than the 6,000 gpm required for APT makeup. The ability to outfall at K Area does not appear to be a problem as the outfall is currently permitted for a larger flow.

Disadvantages:
A possible disadvantage of this system is that the existing river water system is beyond its original design life, and to continue to rely on the integrity of the piping and components could be a concern. However, this has been addressed in Reference 9.1 (River Water System Shutdown: Lay-up Requirements (U), EFR-ENG-950067) which concluded that the river water system is in exceptional condition and should be usable for many years to come. One real disadvantage of this system is that it requires special order equipment such as very large diameter pipe, large pumps, and many large heat exchangers. There is also a substantial and difficult installation associated with the long runs of large diameter pipe. Additionally, the electrical power requirements are large due to the energy required to move 125,000 gpm from the K Area to the APT site and back.

It is not certain at this time how favorable this option is for SCDHEC permitting. The cooling tower facilities may be required to upgrade to new design standards prior to permit approval.

Cost:
The additional capital cost of the above described modifications and additions relative to Alternative 1 has been estimated at $15.7M. (Reference the attached cost estimate)

6.0 Evaluation of Alternatives for APT Site #8:

The alternatives for APT Site #8 are identical to those for APT Site #2. The advantages and disadvantages are the same; however, the costs associated with each alternative may fluctuate due to the different site location. Specifically, APT Site #8 is further from the existing River Water system lines than APT Site #2. This will result in higher costs for Alternatives 1, 2, and 4. Alternative 3 (Well Field Makeup) may or may not be affected dependent on where the actual well fields can be located for the respective sites.

7.0 Assignment of Scores:

Assignment of Scores for Capital Costs		
Alternative	**Score**	**Basis**
1. River Water Make-up	3	Base Alternative
2. River Water Once Thru	1	Significantly more expensive than the base case (by $21.2M)
3. Well Field Make-up	3	Expense is only marginally higher (by $1.1M)
4. K-Cooling Tower	1	More expensive than the base case (by $15.7M)

Assignment of Scores for Operating and Maintenance Costs		
Alternative	**Score**	**Basis**
1. River Water Make-up	3	Base Alternative
2. River Water Once Thru	1	Old pumps require more maintenance. Very high operating costs are expected due to large power requirements
3. Well Field Make-up	2	More expensive than the base case due to the large number of wells to be maintained.
4. K-Cooling Tower	2	More and larger pumps require additional maintenance. Very high operating costs due to greater power requirements

Assignment of Scores for Permitting Risk		
Alternative	**Score**	**Basis**
1. River Water Make-up	3	Base Alternative
2. River Water Once Thru	2	Increased permitting risk due to large water demand from the river.
3. Well Field Make-up	1	Significant permitting risk due to large demand on the Cretaceous aquifer
4. K-Cooling Tower	2	Permitting risk associated with permitting the cooling tower.

8.0 Conclusions:

While the descriptions and information presented above are not detailed, they do provide enough information to make a selection of an alternative based on the identified criteria. Clearly, the costs associated with running long lines of large diameter concrete pipe is not cost effective relative to providing makeup water where smaller diameter PVC pipe can be used. The following is a summary of all alternatives and their ranking:

Criteria	Weighting (%)	River Water Make-up	River Water Once Thru	Well Field Make-up	K-Cooling Tower
Capital Costs	20	3	1	3	1
Ops & Maint Costs	30	3	1	2	2
Permitting Risks	50	3	2	1	2
Ranking Factor		**3**	**1.5**	**1.7**	**1.8**

Based on the above, Alternative 1: River Water Makeup is the favorable alternative. This alternative has the lowest cost, and no disadvantages that appear insurmountable.

9.0 References:

9.1 River Water System Shutdown: Lay-up Requirements (U), EFR-ENG-950067

9.2 Study on allowable temp of discharge to PAR pond

9.3 IOM from Dale E. Stephenson to Elizabeth Topp, "Preliminary Evaluation of Proposed Well Field for APT", dated 7 May 1996. (Attachment 1)

9.4 APT Siting Map (Attachment 2)

9.5 Trade Study Estimate (Attachment 3

Attachment (1)

"Proposed Well Field for APT IOM"

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INTER-OFFICE MEMORANDUM
WESTINGHOUSE SAVANNAH RIVER COMPANY

7 May 1996

DRAFT

TO: Elizabeth G. Topp, 730-2B

FROM: Dale E. Stephenson, 730-2B

PRELIMINARY EVALUATION OF PROPOSED WELL FIELD FOR APT

A very preliminary analysis of requirements for supplying groundwater at the rate of 6000 gpm (gallons per minute) for the APT was made at the request of Jeff England. The assumption was made that the wells will pump from the Cretaceous aquifer and the 6000 gpm is continuous. This equals 8.64×10^6 gpd (gallons per day) total production to support the APT operation.

Most Dublin-Midville aquifer system production well drilled at SRS in recent years were designed to produce 500 gpm, even though a few in the early years could produce 1500 gpm maximum. Assuming that any new wells will be designed to produce 500 gpm a well field to supply 6000 gpm will require 12 well that will operate continuously. To provide backup a minimum of 24 well should be constructed to supply groundwater for the operation of the ATP. To control the amount of drawdown to no more than approximately one-half the aquifer thickness the wells should be placed one per acre. This will result in about 25 feet of drawdown at the mid-point between the wells. The last estimate of the cost of a production well that will produce 500 gpm from the Dublin-Midville aquifer system was $500,000.00 per well.

The concerns of this proposed well field to supply 6000 gpm or 8.64 Mgpd is that this will result in the SRS seriously impacting the aquifer system. Marine and Routt (1975) calculated the flux in the aquifer system at the SRS as at least 19.4 Mgpd and maybe as high as 42 Mgpd. Hubbard et al (1988) calculated the groundwater flow through the Dublin-Midville system to be about 25 Mgpd and Aadland et al (1996) estimate a value of 16 Mgpd fir the flow through the system. As of 1993 the groundwater pumpage at SRS was 6.4 Mgpd under normal operating conditions with this being mostly from the Dublin-Midville aquifer system. If the ATP requirements are added to the current groundwater use the SRS will be extracting about 15 Mgpd from the aquifer system which will be approaching the total flux within the system. If any other demands are placed on the system the SRS could start to mine the aquifer. For this reason it is my opinion that obtaining a permit from the State will be difficult.

Attachment (2)

APT Siting Map

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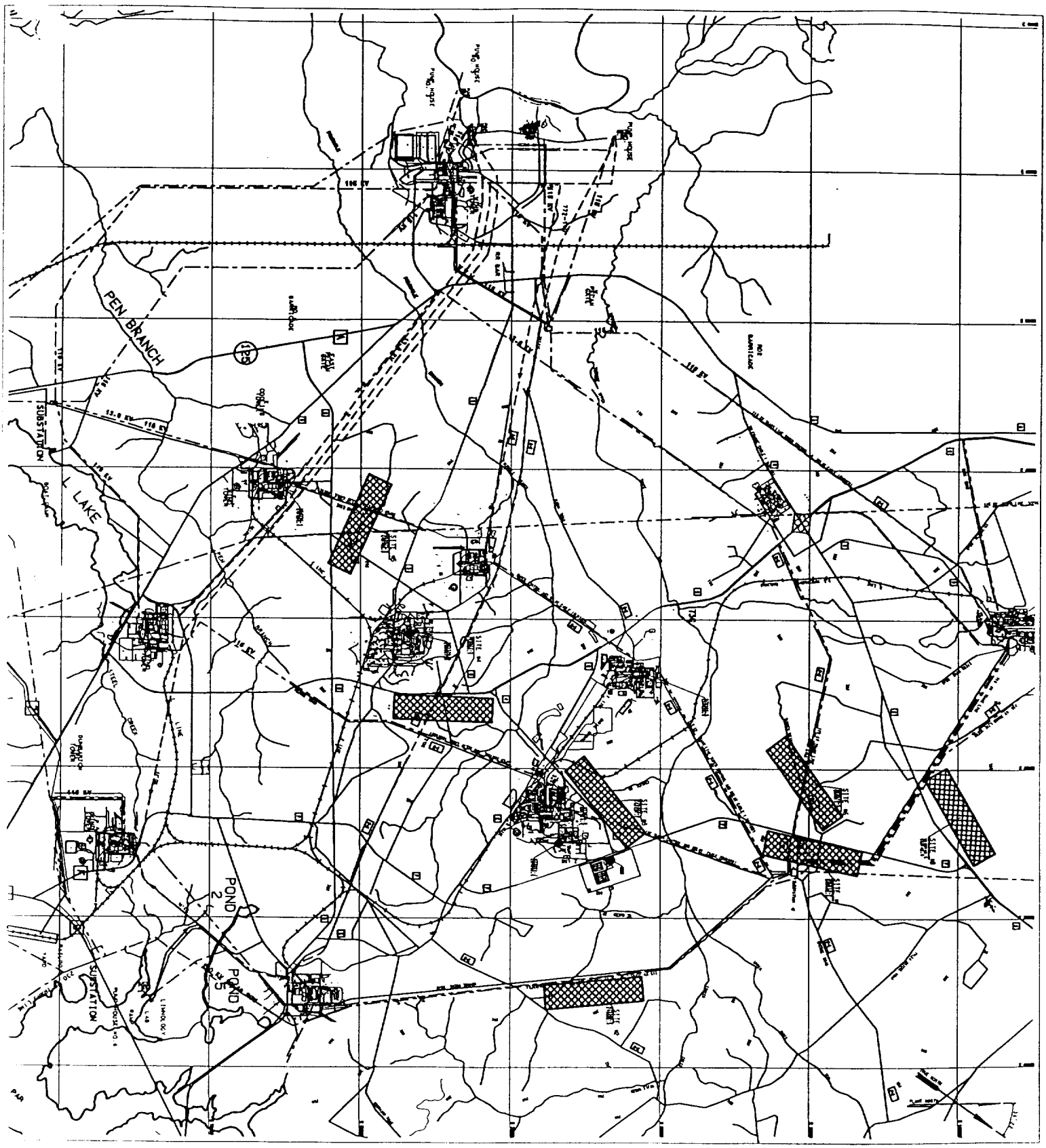
PEN BRANCH
POND 2
POND 5
SUBSTATION
SUBSTATION

Attachment (3)

Trade Study Estimate

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ENGINEERING & CONSTRUCTION SERVICES DIVISION
SITE PROJECT ESTIMATING
DETAIL LINE ITEMS

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.1.01					SITE #2, COOLING OPTION #1						
	1940	REMOVE EXISTING RWS PUMPS [25000 GPM @ 3000 HP]	2.0	EA	0.00	940.000	1,880	1.00	SRSX01	17.60	0	0	0	33,088	0	33,088
	1310	INSTALL NEW RWS PUMPS [6000 GPM @ 300 HP]	2.0	EA	180000.00	180.000	360	1.00	SRSX01	17.60	0	360,000	0	6,336	0	366,336
	4270	MODIFY INLET CONN. - 46"x 36"x 1/4" STEEL PLATE [75#]	2.0	EA	45.00	11.250	23	1.00	SRSX01	17.60	0	0	90	396	0	486
	8317	36"x 12" CS REDUCER	2.0	EA	720.00	35.000	70	1.00	SRSX25	17.60	0	0	1,440	1,232	0	2,672
	8313	12" PIPE, CS, STD	20.0	LF	29.20	0.770	15	1.00	SRSX25	17.60	0	0	584	271	0	855
	8313	12" ELL, 90	2.0	EA	205.00	13.000	26	1.00	SRSX25	17.60	0	0	410	458	0	868
	8313	12" FLANGE, WN, 150#	6.0	EA	150.00	8.300	50	1.00	SRSX25	17.60	0	0	900	876	0	1,776
	8714	12" GATE VALVE, FLG, CS	2.0	EA	4000.00	4.800	10	1.00	SRSX25	17.60	0	0	8,000	169	0	8,169
	8313	12" BOLT-UP W/ B&G SET	6.0	EA	32.00	3.500	21	1.00	SRSX25	17.60	0	0	192	370	0	562
	8912	12" HYDROTEST	20.0	LF	0.00	0.340	7	1.00	SRSX25	17.60	0	0	0	120	0	120
	4569	12" PIPE - PRIME & PAINT 20LF	70.0	SF	0.70	0.108	8	1.00	SRSX14	15.60	0	0	49	118	0	167
	8313	10" WELDOLET, CS [66' PIPE TIE-IN] - ALLOWANCE	2.0	EA	100.00	19.400	39	1.00	SRSX25	17.60	0	0	200	683	0	883
	8313	10" PIPE, CS, STD	20.0	LF	24.00	0.660	13	1.00	SRSX25	17.60	0	0	480	232	0	712
	8313	10" FLANGE, WN, 150#	10.0	EA	100.00	7.000	70	1.00	SRSX25	17.60	0	0	1,000	1,232	0	2,232
	8714	10" CHECK VALVE, FLG, CS	2.0	EA	2400.00	3.600	7	1.00	SRSX25	17.60	0	0	4,800	127	0	4,927
	8714	10" GATE VALVE, FLG, CS	2.0	EA	3100.00	3.600	7	1.00	SRSX25	17.60	0	0	6,200	127	0	6,327
	8313	10" BOLT-UP W/ B&G SET	10.0	EA	30.00	3.500	35	1.00	SRSX25	17.60	0	0	300	616	0	916
	8653	10" PIPE, PVC	24,000.0	LF	12.20	0.220	5,280	1.00	SRSX25	17.60	0	0	292,800	92,928	0	385,728
	8912	10" HYDROTEST	20.0	LF	0.00	0.310	6	1.00	SRSX25	17.60	0	0	0	109	0	109
	4569	10" PIPE - PRIME & PAINT 20LF	15.0	SF	0.70	0.108	2	1.00	SRSX14	15.60	0	0	11	25	0	36
	3940	84" CONCRETE PIPE, D&R 8" THK CONCRETE [18" TIE-IN]	1.0	LS	100.00	24.000	24	1.00	SRSX26	17.10	0	0	100	410	0	510
	8315	18" WELDOLET, CS [84" PIPE TIE-IN]	1.0	EA	140.00	32.700	33	1.00	SRSX25	17.60	0	0	140	576	0	716
	8315	18" PIPE, CS, STD	20.0	LF	51.50	0.950	19	1.00	SRSX25	17.60	0	0	1,030	334	0	1,364
	8315	18" FLANGE, WN, 150#	7.0	EA	480.00	12.700	89	1.00	SRSX25	17.60	0	0	3,360	1,565	0	4,925
	8315	18" ELL, 90	2.0	EA	490.00	20.500	41	1.00	SRSX25	17.60	0	0	980	722	0	1,702
	8714	18" GATE VALVE, FLG, CS	2.0	EA	12400.00	6.700	13	1.00	SRSX25	17.60	0	0	24,800	236	0	25,036
	8714	18" FLOW CONTROL VALVE, FLG, CS	1.0	EA	30000.00	15.000	15	1.00	SRSX25	17.60	0	0	30,000	264	0	30,264
	8313	18" BOLT-UP W/ B&G SET	7.0	EA	68.00	6.600	46	1.00	SRSX25	17.60	0	0	476	813	0	1,289
	8912	18" HYDROTEST	20.0	LF	0.00	0.510	10	1.00	SRSX25	17.60	0	0	0	180	0	180
	8654	18" PIPE, PVC, BIG BLUE	18,000.0	LF	28.00	0.260	4,680	1.00	SRSX25	17.60	0	0	504,000	82,368	0	586,368
	8240	18" ELL, 90, MJ,	18.0	EA	660.00	9.800	176	1.00	SRSX25	17.60	0	0	11,880	3,105	0	14,985
WBS1.2.1.01		SITE #2, COOLING OPTION #1 SUBTOTAL					13,075			17.60	0	360,000	894,222	230,084	0	1,484,306
					WBS 1.2.1.02					SITE #2, COOLING OPTION #2						
	1310	INSTALL NEW COOLING WATER PUMPS [50,000 GPM @ 1,500 HP]	4.0	EA	300000.00	420.000	1,680	1.00	SRSX01	17.60	0	1,200,000	0	29,568	0	1,229,568
	1400	COOLING EQUIPMENT COST ADJUSTMENT (DELETE CT)	(10.0)	EA			0	1.00	SRSX01		0	(5,620,000)	0	0	0	(5,620,000)

GROUP : NO APT GROUP IDENTIFIED
ACCOUNT CODE:

WBS 1.2.1.02 SITE #2, COOLING OPTION #2

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
8673		126" ID CONCRETE PIPE	18,000.0	LF	575.00	3.500	63,000	1.00	SRSX25	17.60	0	10,350,000	0	1,108,800	0	11,458,800
8673		126" ID PIPE JOINTS [GROUT & GASKET-12' OD @ 37.7LF]	450.0	EA	0.00	62.000	27,900	1.00	SRSX25	17.60	0	0	0	491,040	0	491,040
8673		126"x 84" CONCRETE REDUCER	1.0	EA	41000.00	20.000	20	1.00	SRSX25	17.60	0	41,000	0	352	0	41,352
3940		84" CONCRETE PIPE, D&R 8" THK CONCRETE [84" TIE-IN]	1.0	LS	1000.00	180.000	180	1.00	SRSX26	17.10	0	0	1,000	3,078	0	4,078
8673		126" FLANGE ADAPTERS	4.0	EA	32000.00	60.000	240	1.00	SRSX25	17.60	0	128,000	0	4,224	0	132,224
8673		126" GATE VALVE, FLG [ALLOWANCE]	2.0	EA	40000.00	80.000	160	1.00	SRSX25	17.60	0	80,000	0	2,816	0	82,816
8673		126" ID PNEUMATIC PIPE JOINT TEST	450.0	EA	0.00	2.400	1,080	1.00	SRSX25	17.60	0	0	0	19,008	0	19,008
8673		102" ID CONCRETE PIPE	24,000.0	LF	388.00	2.800	67,200	1.00	SRSX25	17.60	0	9,312,000	0	1,182,720	0	10,494,720
8673		102" ID PIPE JOINTS [GROUT & GASKET-9.75'OD @ 30.6LF]	600.0	EA	0.00	50.000	30,000	1.00	SRSX25	17.60	0	0	0	528,000	0	528,000
8673		102" x 36 CONCRETE REDUCER	1.0	EA	4500.00	16.000	16	1.00	SRSX25	17.60	0	4,500	0	282	0	4,782
8673		102" ID FLANGE ADAPTERS	4.0	EA	17000.00	48.000	192	1.00	SRSX25	17.60	0	68,000	0	3,379	0	71,379
8714		102 " ID GATE VALVE, FLG [ALLOWANCE]	2.0	EA	32000.00	64.000	128	1.00	SRSX25	17.60	0	64,000	0	2,253	0	66,253
8912		102' ID PNEUMATIC PIPE JOINT TEST	600.0	EA	0.00	2.000	1,200	1.00	SRSX25	17.60	0	0	0	21,120	0	21,120
8317		42" CS PIPE, SCH 10	120.0	LF	102.00	1.600	192	1.00	SRSX25	17.60	0	12,240	0	3,379	0	15,619
8317		42" TEE	3.0	EA	2200.00	68.000	204	1.00	SRSX25	17.60	0	6,600	0	3,590	0	10,190
8317		42" ELL, 90	4.0	EA	1300.00	48.000	192	1.00	SRSX25	17.60	0	5,200	0	3,379	0	8,579
8317		42" FLANGE, WN	12.0	EA	1000.00	26.000	312	1.00	SRSX25	17.60	0	12,000	0	5,491	0	17,491
8714		42" GATE VALVE, FLG	4.0	EA	37000.00	48.000	192	1.00	SRSX25	17.60	0	148,000	0	3,379	0	151,379
8520		42" PIPE SUPPORT [ALLOWANCE]	8.0	EA	100.00	30.000	240	1.00	SRSX25	17.60	0	0	800	4,224	0	5,024
4569		42" PIPE - PRIME & PAINT - 120 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
8912		42" PIPE HYDROTEST	120.0	LF	0.00	0.600	72	1.00	SRSX25	17.60	0	0	0	1,267	0	1,267
8317		36" CS PIPE, SCH 10	140.0	LF	95.00	1.500	210	1.00	SRSX25	17.60	0	13,300	0	3,696	0	16,996
8317		36" TEE	3.0	EA	2100.00	59.000	177	1.00	SRSX25	17.60	0	6,300	0	3,115	0	9,415
8317		36" ELL, 90	8.0	EA	1200.00	42.000	336	1.00	SRSX25	17.60	0	9,600	0	5,914	0	15,514
8317		36" FLANGE, WN	20.0	EA	940.00	24.000	480	1.00	SRSX25	17.60	0	18,800	0	8,448	0	27,248
8714		36" GATE VALVE, FLG	4.0	EA	35000.00	34.000	136	1.00	SRSX25	17.60	0	140,000	0	2,394	0	142,394
8714		36' CHECK VALVE, FLG	4.0	EA	30000.00	34.000	136	1.00	SRSX25	17.60	0	120,000	0	2,394	0	122,394
8520		36" PIPE SUPPORT [ALLOWANCE]	6.0	EA	75.00	25.000	150	1.00	SRSX25	17.60	0	0	450	2,640	0	3,090
4569		36" PIPE - PRIME & PAINT - 1300 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
8912		36" PIPE HYDROTEST	140.0	LF	0.00	0.368	52	1.00	SRSX25	17.60	0	0	0	907	0	907
3211		MACHINE EXCAVATE FOR SITE	220,409.0	CY	0.00	0.030	6,612	1.00	SRSX05	16.20	202,776	0	0	107,119	0	309,895
3212		HAND EXCAVATE FOR SITE	4,500.0	CY	0.00	4.000	18,000	1.00	SRSX04	11.80	0	0	0	212,400	0	212,400
3221		FURNISH & PLACE PIPE BEDDING SAND	8,834.0	CY	8.00	0.830	7,332	1.00	SRSX04	11.80	0	0	70,672	86,520	0	157,192

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.1.02						SITE #2, COOLING OPTION #2					
	3221	TRENCH BACKFILL & COMPACTION	107,627.0	CY	0.00	0.060	6,458	1.00	SRSX05	16.20	88,254	0	0	104,613	0	192,868
	3216	HAUL & DUMP (EXCESS)	117,294.0	CY	0.00	1.200	140,753	1.00	SRSX05	16.20	0	0	0	2,280,195	0	2,280,195
	4160	CONCRETE FOR PUMP PADS	20.0	CY	60.00	2.500	50	1.00	SRSX10	12.20	0	0	1,200	610	0	1,810
	4140	REBAR FOR FOR PUMP PADS	1.0	TON	600.00	20.000	20	1.00	SRSX08	17.30	0	0	600	346	0	946
	4120	FORMWORK FOR PUMP PADS	164.0	SFCA	0.75	0.500	82	1.00	SRSX07	14.60	0	0	123	1,197	0	1,320
	4140	FURNISH FAB & PLACE COVER/ GRATING	800.0	SF	8.35	0.093	74	1.00	SRSX12	17.50	1,296	0	6,680	1,302	0	9,278
WBS1.2.1.02	SITE #2, COOLING OPTION #2 SUBTOTAL						375,722			16.63	292,326	16,119,540	83,109	6,249,278	0	22,744,254
					WBS 1.2.1.03						SITE #2, COOLING OPTION #3					
	3720	6" DIA WELL CASING W/ PUMP [500 GPM @ 15 HP)	18.0	EA	0.00	0.000	0	1.00			0	0	0	0	900,000	900,000
		WELL FIELD TANK [23.5' DIA x 15.5' HIGH - 50000 GAL]	1.0	EA	0.00	0.000	0	1.00			0	0	0	0	55,000	55,000
		6" PIPE, STN STL	180.0	LF	32.00	0.390	70	1.00	SRSX25	17.60	0	0	5,760	1,236	0	6,996
		6" ELL, 90	36.0	EA	95.00	9.400	338	1.00	SRSX25	17.60	0	0	3,420	5,956	0	9,376
		6" FLANGE, WN	144.0	EA	167.00	9.200	1,325	1.00	SRSX25	17.60	0	0	24,048	23,316	0	47,364
		6" GATE VALVE, FLG	36.0	EA	3000.00	3.100	112	1.00	SRSX25	17.60	0	108,000	0	1,964	0	109,964
		6" CHECK VALVE, FLG	18.0	EA	2100.00	3.100	56	1.00	SRSX25	17.60	0	37,800	0	982	0	38,782
		6" CONTROL VALVE, FLG	18.0	EA	19000.00	6.000	108	1.00	SRSX25	17.60	0	342,000	0	1,901	0	343,901
		6" PIPE SUPPORT, STN STL	36.0	EA	75.00	16.000	576	1.00	SRSX25	17.60	0	0	2,700	10,138	0	12,838
		6" HYDROTEST	180.0	LF	0.00	0.250	45	1.00	SRSX25	17.60	0	0	0	792	0	792
		6" PIPE, PVC	1,800.0	LF	1.60	0.140	252	1.00	SRSX25	17.60	0	0	2,880	4,435	0	7,315
		6" HYDROTEST	1,800.0	LF	0.00	0.150	270	1.00	SRSX25	17.60	0	0	0	4,752	0	4,752
		10" PIPE, PVC	24,000.0	LF	12.20	0.150	3,600	1.00	SRSX25	17.60	0	0	292,800	63,360	0	356,160
		10" HYDROTEST	24,000.0	LF	0.00	0.310	7,440	1.00	SRSX25	17.60	0	0	0	130,944	0	130,944
		18" PIPE, PVC	6,000.0	LF	13.50	0.250	1,500	1.00	SRSX25	17.60	0	0	81,000	26,400	0	107,400
		18" HYDROTEST	6,000.0	LF	0.00	0.250	1,500	1.00	SRSX25	17.60	0	0	0	26,400	0	26,400
		14" PIPE, CS	10.0	LF	25.80	0.830	8	1.00	SRSX25	17.60	0	0	258	146	0	404
		14" TEE	1.0	EA	430.00	23.000	23	1.00	SRSX25	17.60	0	0	430	405	0	835
		14" ELL, 90	2.0	EA	280.00	15.000	30	1.00	SRSX25	17.60	0	0	560	528	0	1,088
		14" GATE VALVE, FLG	2.0	EA	7500.00	5.100	10	1.00	SRSX25	17.60	0	15,000	0	180	0	15,180
		14" CHECK VALVE, FLG	2.0	EA	4800.00	5.100	10	1.00	SRSX25	17.60	0	9,600	0	180	0	9,780
		14" FLANGE, WN	10.0	EA	220.00	6.200	62	1.00	SRSX25	17.60	0	0	2,200	1,091	0	3,291
		14" PIPE SUPPORT, CS	4.0	EA	40.00	12.000	48	1.00	SRSX25	17.60	0	0	160	845	0	1,005
		18" X 14" REDUCER	1.0	EA	260.00	17.000	17	1.00	SRSX25	17.60	0	0	260	299	0	559
		14" HYDROTEST	10.0	LF	0.00	0.380	4	1.00	SRSX25	17.60	0	0	0	67	0	67
		14" PIPE - PRIME & PAINT - 10 LF	40.0	SF	0.70	0.108	4	1.00	SRSX14	15.60	0	0	28	67	0	95
		16" PIPE, CS	10.0	LF	30.80	0.890	9	1.00	SRSX25	17.60	0	0	308	157	0	465
		16" TEE	1.0	EA	520.00	26.000	26	1.00	SRSX25	17.60	0	0	520	458	0	978
		16" ELL, 90	2.0	EA	380.00	18.000	36	1.00	SRSX25	17.60	0	0	760	634	0	1,394
		16" GATE VALVE, FLG	2.0	EA	10200.00	5.900	12	1.00	SRSX25	17.60	0	20,400	0	208	0	20,608

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP :	NO APT GROUP IDENTIFIED															
	ACCOUNT CODE:															
					WBS 1.2.1.03					SITE #2, COOLING OPTION #3						
		16" FLANGE, WN	6.0	EA	350.00	6.900	41	1.00	SRSX25	17.60	0	0	2,100	729	0	2,829
		16" PIPE SUPPORT, CS	4.0	EA	50.00	15.000	60	1.00	SRSX25	17.60	0	0	200	1,056	0	1,256
		16" HYDROTEST	10.0	LF	0.00	0.440	4	1.00	SRSX25	17.60	0	0	0	77	0	77
		16" PIPE - PRIME & PAINT - 10 LF	40.0	SF	0.60	0.100	4	1.00	SRSX14	15.60	0	0	24	62	0	86
	3211	MACHINE EXCAVATE FOR SITE	12,024.0	CY	0.00	0.030	361	1.00	SRSX05	16.20	11,062	0	0	5,844	0	16,906
	3212	HAND EXCAVATE FOR SITE	4,008.0	CY	0.00	4.000	16,032	1.00	SRSX04	11.80	0	0	0	189,178	0	189,178
	3221	FURNISH & PLACE PIPE BEDDING SAND	1,629.0	CY	8.00	0.830	1,352	1.00	SRSX04	11.80	0	0	13,032	15,954	0	28,986
	3221	TRENCH BACKFILL & COMPACTION	13,139.0	CY	0.00	0.060	788	1.00	SRSX05	16.20	10,774	0	0	12,771	0	23,545
	3216	HAUL & DUMP (EXCESS)	3,360.0	CY	0.00	1.200	4,032	1.00	SRSX05	16.20	0	0	0	65,318	0	65,318
	8315	18" PIPE, CS, STD	20.0	LF	51.50	0.950	19	1.00	SRSX25	17.60	0	0	1,030	334	0	1,364
	8315	18" FLANGE, WN, 150#	7.0	EA	480.00	12.700	89	1.00	SRSX25	17.60	0	0	3,360	1,565	0	4,925
	8315	18" ELL, 90	2.0	EA	490.00	20.500	41	1.00	SRSX25	17.60	0	0	980	722	0	1,702
	8714	18" GATE VALVE, FLG, CS	2.0	EA	12400.00	6.700	13	1.00	SRSX25	17.60	0	0	24,800	236	0	25,036
	8714	18" FLOW CONTROL VALVE, FLG, CS	1.0	EA	30000.00	15.000	15	1.00	SRSX25	17.60	0	0	30,000	264	0	30,264
	8313	18" BOLT-UP W/ B&G SET	7.0	EA	68.00	6.600	46	1.00	SRSX25	17.60	0	0	476	813	0	1,289
WBS1.2.1.03		SITE #2, COOLING OPTION #3 SUBTOTAL					40,390			14.92	21,836	532,800	494,094	602,762	955,000	2,606,492
					WBS 1.2.1.04					SITE #2, COOLING OPTION #4						
	3211	MACHINE EXCAVATE FOR SITE	225,957.0	CY	0.00	0.030	6,779	1.00	SRSX05	16.20	207,880	0	0	109,815	0	317,696
	3212	HAND EXCAVATE FOR SITE	4,600.0	CY	0.00	4.000	18,400	1.00	SRSX04	11.80	0	0	0	217,120	0	217,120
	3221	FURNISH & PLACE PIPE BEDDING SAND	10,380.0	CY	8.00	0.830	8,615	1.00	SRSX04	11.80	0	0	83,040	101,662	0	184,702
	3221	TRENCH BACKFILL & COMPACTION	123,626.0	CY	0.00	0.060	7,418	1.00	SRSX05	16.20	101,373	0	0	120,164	0	221,538
	3216	HAUL & DUMP (EXCESS)	122,981.0	CY	0.00	1.200	147,577	1.00	SRSX05	16.20	0	0	0	2,390,751	0	2,390,751
	4160	CONCRETE PUMP PADS	20.0	CY	60.00	2.500	50	1.00	SRSX10	12.20	0	0	1,200	610	0	1,810
	4140	REBAR FOR PUMP PADS	1.0	TON	600.00	20.000	20	1.00	SRSX08	17.30	0	0	600	346	0	946
	4120	FORMWORK FOR PUMP PADS	164.0	SFCA	0.75	0.500	82	1.00	SRSX07	14.60	0	0	123	1,197	0	1,320
	4140	FURNISH FAB & PLACE COVER/ GRATING	800.0	SF	8.35	0.093	74	1.00	SRSX12	17.50	1,296	0	6,680	1,302	0	9,278
	1310	COOLING WATER PUMPS [50000GPM @ 2250 HP]	4.0	EA	400000.00	720.000	2,880	1.00	SRSX01	17.60	0	1,600,000	0	50,688	0	1,650,688
	1400	ADJUSTMENT FOR COOLING EQUIPMENT (DELETE CT)	(10.0)	EA			0	1.00			0	0	0	0	(5,620,000)	(5,620,000)
	8673	84" ID CONCRETE PIPE	58,300.0	LF	245.00	1.400	81,620	1.00	SRSX25	17.60	0	14,283,500	0	1,436,512	0	15,720,012
	8673	84" ID PIPE JOINT [GROUT & GASKET-8.25' OD @ 25.9 LF]	1,458.0	EA	0.00	42.000	61,236	1.00	SRSX25	17.60	0	0	0	1,077,754	0	1,077,754
	3940	84" CONCRETE PIPE, D&R 8" THK CONCRETE [84" TIE-IN]	2.0	EA	1180.00	180.000	360	1.00	SRSX26	17.10	0	360	2,000	6,156	0	8,516
	8673	84" ID FLANGE ADAPTERS	8.0	EA	8000.00	54.000	432	1.00	SRSX25	17.60	0	64,000	0	7,603	0	71,603

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.1.04							**SITE #2, COOLING OPTION #4**				
	8714	84" ID GATE VALVE, FLG [ALLOWANCE]	4.0	EA	28000.00	56.000	224	1.00	SRSX25	17.60	0	112,000	0	3,942	0	115,942
	3940	84" CONCRETE PIPE D & R	48.0	LF	0.00	2.600	125	1.00	SRSX25	17.60	0	0	0	2,196	0	2,196
	8673	84" CONCRETE PIPE CAP	8.0	EA	8800.00	42.000	336	1.00	SRSX25	17.60	0	70,400	0	5,914	0	76,314
	8912	84" ID PNEUMATIC PIPE JOINT TEST	1,458.0	EA	0.00	1.800	2,624	1.00	SRSX25	17.60	0	0	0	46,189	0	46,189
	8673	78" ID CONCRETE PIPE	600.0	LF	233.00	1.400	840	1.00	SRSX25	17.60	0	139,800	0	14,784	0	154,584
	8673	78" ID PIPE JOINT [GROUT & GASKET- 7.5 ' @ 23.6 LF]	15.0	EA	0.00	39.000	585	1.00	SRSX25	17.60	0	0	0	10,296	0	10,296
	8673	78" ID CONCRETE TIE-IN	4.0	EA	950.00	170.000	680	1.00	SRSX25	17.60	0	3,800	0	11,968	0	15,768
	8912	78" ID PNUEMATIC PIPE JOINT TEST	15.0	EA	1.60	1.600	24	1.00	SRSX25	17.60	0	24	0	422	0	446
	8317	42" CS PIPE, SCH 10	120.0	LF	102.00	1.600	192	1.00	SRSX25	17.60	0	12,240	0	3,379	0	15,619
	8317	42" TEE	3.0	EA	2200.00	68.000	204	1.00	SRSX25	17.60	0	6,600	0	3,590	0	10,190
	8317	42" ELL, 90	4.0	EA	1300.00	48.000	192	1.00	SRSX25	17.60	0	5,200	0	3,379	0	8,579
	8317	42" FLANGE, WN	12.0	EA	1000.00	26.000	312	1.00	SRSX25	17.60	0	12,000	0	5,491	0	17,491
	8714	42" GATE VALVE, FLG	4.0	EA	37000.00	48.000	192	1.00	SRSX25	17.60	0	148,000	0	3,379	0	151,379
	8520	42" PIPE SUPPORT [ALLOWANCE]	8.0	EA	100.00	30.000	240	1.00	SRSX25	17.60	0	0	800	4,224	0	5,024
	4569	42" PIPE - PRIME & PAINT - 120 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
	8912	42" PIPE HYDROTEST	120.0	LF	0.00	0.600	72	1.00	SRSX25	17.60	0	0	0	1,267	0	1,267
	8317	36" CS PIPE, SCH 10	140.0	LF	95.00	1.500	210	1.00	SRSX25	17.60	0	13,300	0	3,696	0	16,996
	8317	36" TEE	3.0	EA	2100.00	59.000	177	1.00	SRSX25	17.60	0	6,300	0	3,115	0	9,415
	8317	36" ELL, 90	8.0	EA	1200.00	42.000	336	1.00	SRSX25	17.60	0	9,600	0	5,914	0	15,514
	8317	36" FLANGE, WN	20.0	EA	940.00	24.000	480	1.00	SRSX25	17.60	0	18,800	0	8,448	0	27,248
	8714	36" GATE VALVE, FLG	4.0	EA	35000.00	34.000	136	1.00	SRSX25	17.60	0	140,000	0	2,394	0	142,394
	8714	36' CHECK VALVE, FLG	4.0	EA	30000.00	34.000	136	1.00	SRSX25	17.60	0	120,000	0	2,394	0	122,394
	8520	36" PIPE SUPPORT [ALLOWANCE]	6.0	EA	75.00	25.000	150	1.00	SRSX25	17.60	0	0	450	2,640	0	3,090
	4569	36" PIPE - PRIME & PAINT - 1300 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
	8912	36" PIPE HYDROTEST	140.0	LF	0.00	0.368	52	1.00	SRSX25	17.60	0	0	0	907	0	907
WBS1.2.1.04		SITE #2, COOLING OPTION #4 SUBTOTAL					344,326			16.48	310,550	16,765,924	96,477	5,675,728	(5,620,000)	17,228,679
					WBS 1.2.1.05							**SITE #8, COOLING OPTION #1**				
	1940	REMOVE EXISTING RWS PUMPS [25000 GPM @ 3000 HP]	2.0	EA	0.00	940.000	1,880	1.00	SRSX01	17.60	0	0	0	33,088	0	33,088
	1310	INSTALL NEW RWS PUMPS [6000 GPM @ 850 HP]	2.0	EA	180000.00	250.000	500	1.00	SRSX01	17.60	0	360,000	0	8,800	0	368,800
	4270	MODIFY INLET CONN. - 46"x 36"x 1/4' STEEL PLATE [75#]	2.0	EA	45.00	11.250	23	1.00	SRSX01	17.60	0	0	90	396	0	486
	8317	36"x 12" CS REDUCER	2.0	EA	720.00	35.000	70	1.00	SRSX25	17.60	0	0	1,440	1,232	0	2,672
	8313	12" PIPE, CS, STD	20.0	LF	29.20	0.770	15	1.00	SRSX25	17.60	0	0	584	271	0	855
	8313	12" ELL, 90	2.0	EA	205.00	13.000	26	1.00	SRSX25	17.60	0	0	410	458	0	868
	8313	12" FLANGE, WN, 150#	6.0	EA	150.00	8.300	50	1.00	SRSX25	17.60	0	0	900	876	0	1,776

ENGINEERING & CONSTRUCTION SERVICES DIVISION
SITE PROJECT ESTIMATING
DETAIL LINE ITEMS

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP :	NO APT GROUP IDENTIFIED															
	ACCOUNT CODE:															
					WBS 1.2.1.05					SITE #8, COOLING OPTION #1						
	8714	12" GATE VALVE, FLG, CS	2.0	EA	4000.00	4.800	10	1.00	SRSX25	17.60	0	0	8,000	169	0	8,169
	8313	12" BOLT-UP W/ B&G SET	6.0	EA	32.00	3.500	21	1.00	SRSX25	17.60	0	0	192	370	0	562
	8912	12" HYDROTEST	20.0	LF	0.00	0.340	7	1.00	SRSX25	17.60	0	0	0	120	0	120
	4569	12" PIPE - PRIME & PAINT 20LF	70.0	SF	0.70	0.108	8	1.00	SRSX14	15.60	0	0	49	118	0	167
	8313	10" WELDOLET, CS [66' PIPE TIE-IN] - ALLOWANCE	2.0	EA	100.00	19.400	39	1.00	SRSX25	17.60	0	0	200	683	0	883
	8313	10" PIPE, CS, STD	20.0	LF	24.00	0.660	13	1.00	SRSX25	17.60	0	0	480	232	0	712
	8313	10" FLANGE, WN, 150#	10.0	EA	100.00	7.000	70	1.00	SRSX25	17.60	0	0	1,000	1,232	0	2,232
	8714	10" CHECK VALVE, FLG, CS	2.0	EA	2400.00	3.600	7	1.00	SRSX25	17.60	0	0	4,800	127	0	4,927
	8714	10" GATE VALVE, FLG, CS	2.0	EA	3100.00	3.600	7	1.00	SRSX25	17.60	0	0	6,200	127	0	6,327
	8313	10" BOLT-UP W/ B&G SET	10.0	EA	30.00	3.500	35	1.00	SRSX25	17.60	0	0	300	616	0	916
	8653	10" PIPE, PVC	24,000.0	LF	12.20	0.220	5,280	1.00	SRSX25	17.60	0	0	292,800	92,928	0	385,728
	8912	10" HYDROTEST	20.0	LF	0.00	0.310	6	1.00	SRSX25	17.60	0	0	0	109	0	109
	4569	10" PIPE - PRIME & PAINT 20LF	15.0	SF	0.70	0.108	2	1.00	SRSX14	15.60	0	0	11	25	0	36
	3940	84" CONCRETE PIPE, D&R 8" THK CONCRETE [20" TIE-IN]	1.0	LS	125.00	26.000	26	1.00	SRSX26	17.10	0	0	125	445	0	570
	8315	20" WELDOLET, CS [84" PIPE TIE-IN]	1.0	EA	150.00	35.000	35	1.00	SRSX25	17.60	0	0	150	616	0	766
	8315	20" PIPE, CS, STD	20.0	LF	57.30	0.990	20	1.00	SRSX25	17.60	0	0	1,146	348	0	1,494
	8315	20" FLANGE, WN, 150#	7.0	EA	610.00	14.900	104	1.00	SRSX25	17.60	0	0	4,270	1,836	0	6,106
	8315	20" ELL, 90	2.0	EA	715.00	22.700	45	1.00	SRSX25	17.60	0	0	1,430	799	0	2,229
	8714	20" GATE VALVE, FLG, CS	2.0	EA	15400.00	7.700	15	1.00	SRSX25	17.60	0	30,800	0	271	0	31,071
	8714	20" FLOW CONTROL VALVE, FLG, CS	1.0	EA	32000.00	17.300	17	1.00	SRSX25	17.60	0	32,000	0	304	0	32,304
	8313	20" BOLT-UP W/ B&G SET	7.0	EA	100.00	7.500	53	1.00	SRSX25	17.60	0	0	700	924	0	1,624
	8912	20" HYDROTEST	20.0	LF	0.00	0.570	11	1.00	SRSX25	17.60	0	0	0	201	0	201
	8654	20" PIPE, PVC, BIG BLUE	36,000.0	LF	20.00	0.280	10,080	1.00	SRSX25	17.60	0	0	720,000	177,408	0	897,408
	8240	20" ELL, 90, MJ,	18.0	EA	700.00	11.000	198	1.00	SRSX25	17.60	0	0	12,600	3,485	0	16,085
WBS1.2.1.05	SITE #8, COOLING OPTION #1 SUBTOTAL						18,673			17.60	0	422,800	1,057,877	328,613	0	1,809,290
					WBS 1.2.1.06					SITE #8, COOLING OPTION #2						
	1310	INSTALL NEW COOLING WATER PUMPS [50,000 GPM @ 1,500 HP]	4.0	EA	300000.00	420.000	1,680	1.00	SRSX01	17.60	0	1,200,000	0	29,568	0	1,229,568
	1400	COOLING EQUIPMENT COST ADJUSTMENT (DELETE CT)	(10.0)	EA			0	1.00	SRSX01		0	(5,620,000)	0	0	0	(5,620,000)
	8673	102" ID CONCRETE PIPE	86,000.0	LF	388.00	2.800	240,800	1.00	SRSX25	17.60	0	33,368,000	0	4,238,080	0	37,606,080
	8673	102" ID PIPE JOINTS [GROUT & GASKET-9.75' OD @ 30.6LF]	2,150.0	EA	0.00	50.000	107,500	1.00	SRSX25	17.60	0	0	0	1,892,000	0	1,892,000
	8673	102"x 84" CONCRETE REDUCER	1.0	EA	38000.00	18.000	18	1.00	SRSX25	17.60	0	38,000	0	317	0	38,317
	3940	84" CONCRETE PIPE, D&R 8" THK CONCRETE [84" TIE-IN]	1.0	LS	1000.00	180.000	180	1.00	SRSX26	17.10	0	0	1,000	3,078	0	4,078
	8673	102" FLANGE ADAPTERS	8.0	EA	17000.00	48.000	384	1.00	SRSX25	17.60	0	136,000	0	6,758	0	142,758
	8673	102" GATE VALVE, FLG [ALLOWANCE]	4.0	EA	40000.00	80.000	320	1.00	SRSX25	17.60	0	160,000	0	5,632	0	165,632

GROUP : NO APT GROUP IDENTIFIED
ACCOUNT CODE:

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
		WBS 1.2.1.06 SITE #8, COOLING OPTION #2														
	8673	102" ID PNEUMATIC PIPE JOINT TEST	2,150.0	EA	0.00	2.000	4,300	1.00	SRSX25	17.60	0	0	0	75,680	0	75,680
	8673	102" x 36 CONCRETE REDUCER	1.0	EA	4500.00	16.000	16	1.00	SRSX25	17.60	0	4,500	0	282	0	4,782
	8714	102 " ID GATE VALVE, FLG [ALLOWANCE]	4.0	EA	32000.00	64.000	256	1.00	SRSX25	17.60	0	128,000	0	4,506	0	132,506
	8317	42" CS PIPE, SCH 10	120.0	LF	102.00	1.600	192	1.00	SRSX25	17.60	0	12,240	0	3,379	0	15,619
	8317	42" TEE	3.0	EA	2200.00	68.000	204	1.00	SRSX25	17.60	0	6,600	0	3,590	0	10,190
	8317	42" ELL, 90	4.0	EA	1300.00	48.000	192	1.00	SRSX25	17.60	0	5,200	0	3,379	0	8,579
	8317	42" FLANGE, WN	12.0	EA	1000.00	26.000	312	1.00	SRSX25	17.60	0	12,000	0	5,491	0	17,491
	8714	42" GATE VALVE, FLG	4.0	EA	37000.00	48.000	192	1.00	SRSX25	17.60	0	148,000	0	3,379	0	151,379
	8520	42" PIPE SUPPORT [ALLOWANCE]	8.0	EA	100.00	30.000	240	1.00	SRSX25	17.60	0	0	800	4,224	0	5,024
	4569	42" PIPE - PRIME & PAINT - 120 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
	8912	42" PIPE HYDROTEST	120.0	LF	0.00	0.600	72	1.00	SRSX25	17.60	0	0	0	1,267	0	1,267
	8317	36" CS PIPE, SCH 10	1,300.0	LF	95.00	1.500	1,950	1.00	SRSX25	17.60	0	123,500	0	34,320	0	157,820
	8317	36" TEE	120.0	EA	2100.00	59.000	7,080	1.00	SRSX25	17.60	0	252,000	0	124,608	0	376,608
	8317	36" ELL, 90	6.0	EA	1200.00	42.000	252	1.00	SRSX25	17.60	0	7,200	0	4,435	0	11,635
	8317	36" FLANGE, WN	252.0	EA	940.00	24.000	6,048	1.00	SRSX25	17.60	0	236,880	0	106,445	0	343,325
	8714	36" GATE VALVE, FLG	124.0	EA	35000.00	34.000	4,216	1.00	SRSX25	17.60	0	4,340,000	0	74,202	0	4,414,202
	8714	36" CHECK VALVE, FLG	4.0	EA	30000.00	34.000	136	1.00	SRSX25	17.60	0	120,000	0	2,394	0	122,394
	8520	36" PIPE SUPPORT [ALLOWANCE]	44.0	EA	75.00	25.000	1,100	1.00	SRSX25	17.60	0	0	3,300	19,360	0	22,660
	4569	36" PIPE - PRIME & PAINT - 1300 LF	12,200.0	SF	0.60	0.100	1,220	1.00	SRSX14	15.60	0	0	7,320	19,032	0	26,352
	8912	36" PIPE HYDROTEST	1,300.0	LF	0.00	0.368	478	1.00	SRSX25	17.60	0	0	0	8,420	0	8,420
	3211	MACHINE EXCAVATE FOR SITE	506,020.0	CY	0.00	0.030	15,181	1.00	SRSX05	16.20	465,538	0	0	245,926	0	711,464
	3212	HAND EXCAVATE FOR SITE	10,000.0	CY	0.00	4.000	40,000	1.00	SRSX04	11.80	0	0	0	472,000	0	472,000
	3221	FURNISH & PLACE PIPE BEDDING SAND	1,911.0	CY	8.00	0.830	1,586	1.00	SRSX04	11.80	0	0	15,288	18,716	0	34,004
	3221	TRENCH BACKFILL & COMPACTION	246,733.0	CY	0.00	0.060	14,804	1.00	SRSX05	16.20	202,321	0	0	239,824	0	442,146
	3216	HAUL & DUMP (EXCESS)	27,999.0	CY	0.00	1.200	33,599	1.00	SRSX05	16.20	0	0	0	544,301	0	544,301
	4160	CONCRETE FOR PUMP PADS	20.0	CY	60.00	2.500	50	1.00	SRSX10	12.20	0	0	1,200	610	0	1,810
	4140	REBAR FOR FOR PUMP PADS	1.0	TON	600.00	20.000	20	1.00	SRSX08	17.30	0	0	600	346	0	946
	4120	FORMWORK FOR PUMP PADS	164.0	SFCA	0.75	0.500	82	1.00	SRSX07	14.60	0	0	123	1,197	0	1,320
	4140	FURNISH FAB & PLACE COVER/ GRATING	800.0	SF	8.35	0.093	74	1.00	SRSX12	17.50	1,296	0	6,680	1,302	0	9,278
WBS1.2.1.06		SITE #8, COOLING OPTION #2 SUBTOTAL					484,866			16.91	669,155	34,678,120	37,103	8,200,107	0	43,584,486
		WBS 1.2.1.07 SITE #8, COOLING OPTION #3														
	3211	MACHINE EXCAVATE FOR SITE	12,024.0	CY	0.00	0.030	361	1.00	SRSX05	16.20	11,062	0	0	5,844	0	16,906
	3212	HAND EXCAVATE FOR SITE	4,008.0	CY	0.00	4.000	16,032	1.00	SRSX04	11.80	0	0	0	189,178	0	189,178

ENGINEERING & CONSTRUCTION SERVICES DIVISION
SITE PROJECT ESTIMATING
DETAIL LINE ITEMS

GROUP : NO APT GROUP IDENTIFIED
ACCOUNT CODE:

WBS 1.2.1.07 SITE #8, COOLING OPTION #3

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
	3221	FURNISH & PLACE PIPE BEDDING SAND	1,629.0	CY	8.00	0.830	1,352	1.00	SRSX04	11.80	0	0	13,032	15,954	0	28,986
	3221	TRENCH BACKFILL & COMPACTION	13,139.0	CY	0.00	0.060	788	1.00	SRSX05	16.20	10,774	0	0	12,771	0	23,545
	3216	HAUL & DUMP (EXCESS)	3,360.0	CY	0.00	1.200	4,032	1.00	SRSX05	16.20	0	0	0	65,318	0	65,318
	3720	6" DIA WELL CASING W/ PUMP [500 GPM @ 15 HP)	18.0	EA	0.00	0.000	0	1.00			0	0	0	0	900,000	900,000
		WELL FIELD TANK [23.5' DIA x 15.5' HIGH - 50000 GAL]	1.0	EA	0.00	0.000	0	1.00			0	0	0	0	55,000	55,000
		6" PIPE, STN STL	180.0	LF	32.00	0.390	70	1.00	SRSX25	17.60	0	0	5,760	1,236	0	6,996
		6" ELL, 90	36.0	EA	95.00	9.400	338	1.00	SRSX25	17.60	0	0	3,420	5,956	0	9,376
		6" FLANGE, WN	144.0	EA	167.00	9.200	1,325	1.00	SRSX25	17.60	0	0	24,048	23,316	0	47,364
		6" GATE VALVE, FLG	36.0	EA	3000.00	3.100	112	1.00	SRSX25	17.60	0	108,000	0	1,964	0	109,964
		6" CHECK VALVE, FLG	18.0	EA	2100.00	3.100	56	1.00	SRSX25	17.60	0	37,800	0	982	0	38,782
		6" CONTROL VALVE, FLG	18.0	EA	19000.00	6.000	108	1.00	SRSX25	17.60	0	342,000	0	1,901	0	343,901
		6" PIPE SUPPORT, STN STL	36.0	EA	75.00	16.000	576	1.00	SRSX25	17.60	0	0	2,700	10,138	0	12,838
		6" HYDROTEST	180.0	LF	0.00	0.250	45	1.00	SRSX25	17.60	0	0	0	792	0	792
		6" PIPE, PVC	1,800.0	LF	1.60	0.140	252	1.00	SRSX25	17.60	0	0	2,880	4,435	0	7,315
		6" HYDROTEST	1,800.0	LF	0.00	0.150	270	1.00	SRSX25	17.60	0	0	0	4,752	0	4,752
		10" PIPE, PVC	24,000.0	LF	12.20	0.150	3,600	1.00	SRSX25	17.60	0	0	292,800	63,360	0	356,160
		10" HYDROTEST	24,000.0	LF	0.00	0.310	7,440	1.00	SRSX25	17.60	0	0	0	130,944	0	130,944
		18" PIPE, PVC	6,000.0	LF	13.50	0.250	1,500	1.00	SRSX25	17.60	0	0	81,000	26,400	0	107,400
		18" HYDROTEST	6,000.0	LF	0.00	0.250	1,500	1.00	SRSX25	17.60	0	0	0	26,400	0	26,400
		14" PIPE, CS	10.0	LF	25.80	0.830	8	1.00	SRSX25	17.60	0	0	258	146	0	404
		14" TEE	1.0	EA	430.00	23.000	23	1.00	SRSX25	17.60	0	0	430	405	0	835
		14" ELL, 90	2.0	EA	280.00	15.000	30	1.00	SRSX25	17.60	0	0	560	528	0	1,088
		14" GATE VALVE, FLG	2.0	EA	7500.00	5.100	10	1.00	SRSX25	17.60	0	15,000	0	180	0	15,180
		14" CHECK VALVE, FLG	2.0	EA	4800.00	5.100	10	1.00	SRSX25	17.60	0	9,600	0	180	0	9,780
		14" FLANGE, WN	10.0	EA	220.00	6.200	62	1.00	SRSX25	17.60	0	0	2,200	1,091	0	3,291
		14" PIPE SUPPORT, CS	4.0	EA	40.00	12.000	48	1.00	SRSX25	17.60	0	0	160	845	0	1,005
		18" X 14" REDUCER	1.0	EA	260.00	17.000	17	1.00	SRSX25	17.60	0	0	260	299	0	559
		14" HYDROTEST	10.0	LF	0.00	0.380	4	1.00	SRSX25	17.60	0	0	0	67	0	67
		14" PIPE - PRIME & PAINT - 10 LF	40.0	SF	0.70	0.108	4	1.00	SRSX14	15.60	0	0	28	67	0	95
		16" PIPE, CS	10.0	LF	30.80	0.890	9	1.00	SRSX25	17.60	0	0	308	157	0	465
		16" TEE	1.0	EA	520.00	26.000	26	1.00	SRSX25	17.60	0	0	520	458	0	978
		16" ELL, 90	2.0	EA	380.00	18.000	36	1.00	SRSX25	17.60	0	0	760	634	0	1,394
		16" GATE VALVE, FLG	2.0	EA	10200.00	5.900	12	1.00	SRSX25	17.60	0	20,400	0	208	0	20,608
		16" FLANGE, WN	6.0	EA	350.00	6.900	41	1.00	SRSX25	17.60	0	0	2,100	729	0	2,829
		16" PIPE SUPPORT, CS	4.0	EA	50.00	15.000	60	1.00	SRSX25	17.60	0	0	200	1,056	0	1,256
		16" HYDROTEST	10.0	LF	0.00	0.440	4	1.00	SRSX25	17.60	0	0	0	77	0	77
		16" PIPE - PRIME & PAINT - 10 LF	40.0	SF	0.60	0.100	4	1.00	SRSX14	15.60	0	0	24	62	0	86
			0.0				0	1.00			0	0	0	0	0	0
	8315	18" PIPE, CS, STD	20.0	LF	51.50	0.950	19	1.00	SRSX25	17.60	0	0	1,030	334	0	1,364
	8315	18" FLANGE, WN, 150#	7.0	EA	480.00	12.700	89	1.00	SRSX25	17.60	0	0	3,360	1,565	0	4,925

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP :	NO APT GROUP IDENTIFIED															
	ACCOUNT CODE:															
					WBS 1.2.1.07							SITE #8, COOLING OPTION #3				
	8315	18" ELL, 90	2.0	EA	490.00	20.500	41	1.00	SRSX25	17.60	0	0	980	722	0	1,702
	8714	18" GATE VALVE, FLG, CS	2.0	EA	12400.00	6.700	13	1.00	SRSX25	17.60	0	0	24,800	236	0	25,036
	8714	18" FLOW CONTROL VALVE, FLG, CS	1.0	EA	30000.00	15.000	15	1.00	SRSX25	17.60	0	0	30,000	264	0	30,264
	8313	18" BOLT-UP W/ B&G SET	7.0	EA	68.00	6.600	46	1.00	SRSX25	17.60	0	0	476	813	0	1,289
WBS1.2.1.07		SITE #8, COOLING OPTION #3 SUBTOTAL					40,390		14.92		21,836	532,800	494,094	602,762	955,000	2,606,492
					WBS 1.2.1.08							SITE #8, COOLING OPTION #4				
	1310	COOLING WATER PUMPS [50000GPM @ 2250 HP]	4.0	EA	400000.00	720.000	2,880	1.00	SRSX01	17.60	0	1,600,000	0	50,688	0	1,650,688
	1400	ADJUSTMENT FOR COOLING EQUIPMENT (DELETE CT)	(10.0)	EA			0	1.00			0	(5,620,000)	0	0	0	(5,620,000)
	8673	84" ID CONCRETE PIPE	90,300.0	LF	245.00	1.400	126,420	1.00	SRSX25	17.60	0	22,123,500	0	2,224,992	0	24,348,492
	8673	84" ID PIPE JOINT (GROUT & GASKET-8.25' OD @ 25.9 LF]	2,258.0	EA	0.00	42.000	94,836	1.00	SRSX25	17.60	0	0	0	1,669,114	0	1,669,114
	3940	84" CONCRETE PIPE, D&R 8" THK CONCRETE [84" TIE-IN]	2.0	EA	1180.00	180.000	360	1.00	SRSX26	17.10	0	360	2,000	6,156	0	8,516
	8673	84" ID FLANGE ADAPTERS	18.0	EA	8000.00	54.000	972	1.00	SRSX25	17.60	0	144,000	0	17,107	0	161,107
	8714	84" ID GATE VALVE, FLG [ALLOWANCE]	9.0	EA	28000.00	56.000	504	1.00	SRSX25	17.60	0	252,000	0	8,870	0	260,870
	3940	84" CONCRETE PIPE D & R	48.0	LF	0.00	2.600	125	1.00	SRSX25	17.60	0	0	0	2,196	0	2,196
	8673	84" CONCRETE PIPE CAP	8.0	EA	8800.00	42.000	336	1.00	SRSX25	17.60	0	70,400	0	5,914	0	76,314
	8912	84" ID PNEUMATIC PIPE JOINT TEST	2,258.0	EA	0.00	1.800	4,064	1.00	SRSX25	17.60	0	0	0	71,533	0	71,533
	8673	78" ID CONCRETE PIPE	600.0	LF	233.00	1.400	840	1.00	SRSX25	17.60	0	139,800	0	14,784	0	154,584
	8673	78" ID PIPE JOINT (GROUT & GASKET- 7.5 ' @ 23.6 LF]	15.0	EA	0.00	39.000	585	1.00	SRSX25	17.60	0	0	0	10,296	0	10,296
	8673	78" ID CONCRETE TIE-IN	4.0	EA	950.00	170.000	680	1.00	SRSX25	17.60	0	3,800	0	11,968	0	15,768
	8912	78" ID PNUEMATIC PIPE JOINT TEST	15.0	EA	1.60	1.600	24	1.00	SRSX25	17.60	0	24	0	422	0	446
	8317	42" CS PIPE, SCH 10	120.0	LF	102.00	1.600	192	1.00	SRSX25	17.60	0	12,240	0	3,379	0	15,619
	8317	42" TEE	3.0	EA	2200.00	68.000	204	1.00	SRSX25	17.60	0	6,600	0	3,590	0	10,190
	8317	42" ELL, 90	4.0	EA	1300.00	48.000	192	1.00	SRSX25	17.60	0	5,200	0	3,379	0	8,579
	8317	42" FLANGE, WN	12.0	EA	1000.00	26.000	312	1.00	SRSX25	17.60	0	12,000	0	5,491	0	17,491
	8714	42" GATE VALVE, FLG	4.0	EA	37000.00	48.000	192	1.00	SRSX25	17.60	0	148,000	0	3,379	0	151,379
	8520	42" PIPE SUPPORT [ALLOWANCE]	8.0	EA	100.00	30.000	240	1.00	SRSX25	17.60	0	0	800	4,224	0	5,024
	4569	42" PIPE - PRIME & PAINT - 120 LF	1,320.0	SF	0.60	0.100	132	1.00	SRSX14	15.60	0	0	792	2,059	0	2,851
	8912	42" PIPE HYDROTEST	120.0	LF	0.00	0.600	72	1.00	SRSX25	17.60	0	0	0	1,267	0	1,267
	8317	36" CS PIPE, SCH 10	1,300.0	LF	95.00	1.500	1,950	1.00	SRSX25	17.60	0	123,500	0	34,320	0	157,820
	8317	36" TEE	120.0	EA	2100.00	59.000	7,080	1.00	SRSX25	17.60	0	252,000	0	124,608	0	376,608
	8317	36" ELL, 90	6.0	EA	1200.00	42.000	252	1.00	SRSX25	17.60	0	7,200	0	4,435	0	11,635
	8317	36" FLANGE, WN	252.0	EA	940.00	24.000	6,048	1.00	SRSX25	17.60	0	236,880	0	106,445	0	343,325
	8714	36" GATE VALVE, FLG	124.0	EA	35000.00	34.000	4,216	1.00	SRSX25	17.60	0	4,340,000	0	74,202	0	4,414,202
	8714	36" CHECK VALVE, FLG	4.0	EA	30000.00	34.000	136	1.00	SRSX25	17.60	0	120,000	0	2,394	0	122,394

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.1.08						**SITE #8, COOLING OPTION #4**					
	8520	36" PIPE SUPPORT (ALLOWANCE)	44.0	EA	75.00	25.000	1,100	1.00	SRSX25	17.60	0	0	3,300	19,360	0	22,660
	4569	36" PIPE - PRIME & PAINT - 1300 LF	12,200.0	SF	0.60	0.100	1,220	1.00	SRSX14	15.60	0	0	7,320	19,032	0	26,352
	8912	36" PIPE HYDROTEST	1,300.0	LF	0.00	0.368	478	1.00	SRSX25	17.60	0	0	0	8,420	0	8,420
	3211	MACHINE EXCAVATE FOR SITE	403,887.0	CY	0.00	0.030	12,117	1.00	SRSX05	16.20	371,576	0	0	196,289	0	567,865
	3212	HAND EXCAVATE FOR SITE	4,600.0	CY	0.00	4.000	18,400	1.00	SRSX04	11.80	0	0	0	217,120	0	217,120
	3221	FURNISH & PLACE PIPE BEDDING SAND	17,167.0	CY	8.00	0.830	14,249	1.00	SRSX04	11.80	0	0	137,336	168,134	0	305,470
	3221	TRENCH BACKFILL & COMPACTION	211,554.0	CY	0.00	0.060	12,693	1.00	SRSX05	16.20	173,474	0	0	205,630	0	379,105
	3216	HAUL & DUMP (EXCESS)	230,473.0	CY	0.00	1.200	276,568	1.00	SRSX05	16.20	0	0	0	4,480,395	0	4,480,395
	4160	CONCRETE PUMP PADS	20.0	CY	60.00	2.500	50	1.00	SRSX10	12.20	0	0	1,200	610	0	1,810
	4140	REBAR FOR PUMP PADS	1.0	TON	600.00	20.000	20	1.00	SRSX08	17.30	0	0	600	346	0	946
	4120	FORMWORK FOR PUMP PADS	164.0	SFCA	0.75	0.500	82	1.00	SRSX07	14.60	0	0	123	1,197	0	1,320
	4140	FURNISH FAB & PLACE COVER/ GRATING	800.0	SF	8.35	0.093	74	1.00	SRSX12	17.50	1,296	0	6,680	1,302	0	9,278
WBS1.2.1.08		SITE #8, COOLING OPTION #4 SUBTOTAL					590,895			16.56	546,346	23,977,504	160,151	9,785,049	0	34,469,051
					WBS 1.2.2.1						**CASE 10 - OPTION #1**					
1.06.05.04.01	1420	COOLING TOWER, 3 CELL @ 150 HP FAN - 56MW	1.0	EA	0.00	0.000	0	1.00			0	0	0	0	562,000	562,000
1.06.05.04.01	1310	CW SUPPLY PUMP, 12000 GPM @ 400 HP	3.0	EA	180000.00	180.000	540	1.00	SRSX01	17.60	0	540,000	0	9,504	0	549,504
1.06.05.04.01	8313	36" PIPE CS, STD	950.0	LF	99.75	1.500	1,425	1.00	SRSX25	17.60	0	0	94,763	25,080	0	119,843
1.06.05.04.01	8313	36" TEE	10.0	EA	2205.00	59.000	590	1.00	SRSX25	17.60	0	0	22,050	10,384	0	32,434
1.06.05.04.01	8313	36" ELL, 90	20.0	EA	1260.00	42.000	840	1.00	SRSX25	17.60	0	0	25,200	14,784	0	39,984
1.06.05.04.01	8313	36" FLANGE, WN	26.0	EA	987.00	24.000	624	1.00	SRSX25	17.60	0	0	25,662	10,982	0	36,644
1.06.05.04.01	8313	36" VALVES, FLG	10.0	EA	36750.00	34.000	340	1.00	SRSX25	17.60	0	0	367,500	5,984	0	373,484
1.06.05.04.01	8313	18" PIPE, CS, STD	3,100.0	LF	51.50	0.950	2,945	1.00	SRSX25	17.60	0	0	159,650	51,832	0	211,482
1.06.05.04.01	8313	18" TEE	8.0	EA	850.00	29.200	234	1.00	SRSX25	17.60	0	0	6,800	4,111	0	10,911
1.06.05.04.01	8313	18" ELL, 90	15.0	EA	490.00	20.500	308	1.00	SRSX25	17.60	0	0	7,350	5,412	0	12,762
1.06.05.04.01	8313	18" FLANGE, WN	20.0	EA	480.00	12.700	254	1.00	SRSX25	17.60	0	0	9,600	4,470	0	14,070
1.06.05.04.01	8313	18" VALVES, FLG	6.0	EA	12400.00	6.600	40	1.00	SRSX25	17.60	0	0	74,400	697	0	75,097
1.06.05.04.01	8912	HYDROTEST	4,050.0	LF	0.00	0.480	1,944	1.00	SRSX25	17.60	0	0	0	34,214	0	34,214
1.05.03.04.03.01	4140	BUILDING FOR HOUSING EQT.	12,000.0	SF	35.00	1.000	12,000	1.00	SRSX29	15.10	0	0	420,000	181,200	0	601,200
1.05.03.04.03.01	4120	FORMWORK FOR HOUSING EQT	1,200.0	SF	0.75	1.000	1,200	1.00	SRSX07	14.60	0	0	900	17,520	0	18,420
1.05.03.04.03.01	4140	REBAR FOR HOUSING EQT	22.0	TN	600.00	20.000	440	1.00	SRSX08	17.30	0	0	13,200	7,612	0	20,812
1.05.03.04.03.01	4160	CONCRETE FOR HOUSING EQT	444.0	CY	62.00	1.500	666	1.00	SRSX10	12.20	0	0	27,528	8,125	0	35,653
1.05.03.04.03.01	4120	FORMWK /EQT FOUND. & HEAT EXCH.	2,040.0	SF	0.75	1.000	2,040	1.00	SRSX07	14.60	0	0	1,530	29,784	0	31,314
1.05.03.04.03.01	4140	REBAR / EQT FOUNDATION & HEAT EXCH.	15.0	TN	600.00	20.000	300	1.00	SRSX08	17.30	0	0	9,000	5,190	0	14,190

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.2.1						CASE 10 - OPTION #1					
1.05.03.04.03.01	4160	CONCRETE/ EQT FOUNDATION & HEAT EXH	444.0	CY	62.00	1.500	666	1.00	SRSX10	12.20	0	0	27,528	8,125	0	35,653
1.05.03.04.03.01	4160	SHIELDING WALLS	175.0	CY	300.00	12.000	2,100	1.00	SRSX13	16.20	0	0	52,500	34,020	0	86,520
1.05.03.04.03.01	3211	EXCAVATE FOR SLAB COOLING TOWER & PUMP PADS	500.0	CY	0.00	0.100	50	1.00	SRSX05	16.20	0	0	0	810	0	810
1.05.03.04.03.01	3212	FORMWORK FOR COOLING TOWER & PUMP PADS	540.0	CY	0.75	1.000	540	1.00	SRSX07	14.60	0	0	405	7,884	0	8,289
1.05.03.04.03.01	4140	REBAR/CHILLER COOLING TOWER & PUMP PADS	26.0	TN	600.00	20.000	520	1.00	SRSX08	17.30	0	0	15,600	8,996	0	24,596
1.05.03.04.03.01	4160	CONCRETE FOR COOLING TOWER & PUMP PADS	520.0	CY	62.00	1.500	780	1.00	SRSX10	12.20	0	0	32,240	9,516	0	41,756
WBS1.2.2.1		CASE 10 - OPTION #1 SUBTOTAL					31,385			15.81	0	540,000	1,393,406	496,238	562,000	2,991,643
					WBS 1.2.2.2						CASE 10 - OPTION #2					
		CHILLER, 1000 TON CAPACITY	2.0	EA	0.00	0.000	0	1.00			0	0	0	0	400,000	400,000
		CW HEAT EXCHANGERS	6.0	EA	2100000.00	72.000	432	1.00	SRSX01	17.60	0	12,600,000	0	7,603	0	12,607,603
		36" PIPE CS, STD	950.0	LF	99.75	1.500	1,425	1.00	SRSX25	17.60	0	0	94,763	25,080	0	119,843
		36" TEE	10.0	EA	2205.00	59.000	590	1.00	SRSX25	17.60	0	0	22,050	10,384	0	32,434
		36" ELL, 90	20.0	EA	1260.00	42.000	840	1.00	SRSX25	17.60	0	0	25,200	14,784	0	39,984
		36" FLANGE, WN	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		36" VALVES, FLG	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		18" PIPE, CS, STD	4,150.0	LF	51.50	0.950	3,943	1.00	SRSX25	17.60	0	0	213,725	69,388	0	283,113
		18" TEE	10.0	EA	850.00	29.200	292	1.00	SRSX25	17.60	0	0	8,500	5,139	0	13,639
		18" ELL, 90	20.0	EA	490.00	20.500	410	1.00	SRSX25	17.60	0	0	9,800	7,216	0	17,016
		18" FLANGE, WN	26.0	EA	480.00	12.700	330	1.00	SRSX25	17.60	0	0	12,480	5,812	0	18,292
		18" VALVES, FLG	10.0	EA	12400.00	6.600	66	1.00	SRSX25	17.60	0	0	124,000	1,162	0	125,162
		HYDROTEST	5,100.0	LF	0.00	0.480	2,448	1.00	SRSX25	17.60	0	0	0	43,085	0	43,085
		BUILDING FOR CHILLERS	21,500.0	SF	35.00	1.000	21,500	1.00	SRSX29	15.10	0	0	752,500	324,650	0	1,077,150
		FORM WORK CHILL	1,975.0	SF	0.75	1.000	1,975	1.00	SRSX07	14.60	0	0	1,481	28,835	0	30,316
		REBAR CHIILL	40.0	TN	600.00	20.000	800	1.00	SRSX08	17.30	0	0	24,000	13,840	0	37,840
		CONCRETE FOR CHILLERS	800.0	CY	62.00	1.500	1,200	1.00	SRSX10	12.20	0	0	49,600	14,640	0	64,240
		FORMWK /EQT FOUND. CHILLER & HEAT EXCH.	23,880.0	SF	0.75	1.000	23,880	1.00	SRSX07	14.60	0	0	17,910	348,648	0	366,558
		REBAR / EQT FOUNDATION CHILL. & HEAT EXCH.	32.0	TN	600.00	20.000	640	1.00	SRSX08	17.30	0	0	19,200	11,072	0	30,272
		CONCRETE/ EQT FOUNDATION FOR CHILL.& HEAT EXH	978.0	CY	62.00	1.500	1,467	1.00	SRSX10	12.20	0	0	60,636	17,897	0	78,533
		SHIELDING WALLS	342.0	CY	300.00	12.000	4,104	1.00	SRSX13	16.20	0	0	102,600	66,485	0	169,085
WBS1.2.2.2		CASE 10 - OPTION #2 SUBTOTAL					66,342			15.31	0	12,600,000	1,538,445	1,015,720	400,000	15,554,164
					WBS 1.2.2.3						CASE 10 - OPTION #3					
		BUILDING FOR CHILLERS	12,000.0	SF	35.00	1.000	12,000	1.00	SRSX29	15.10	0	0	420,000	181,200	0	601,200
		FORM WORK CHILL	1,200.0	SF	0.75	1.000	1,200	1.00	SRSX07	14.60	0	0	900	17,520	0	18,420

GROUP : NO APT GROUP IDENTIFIED
ACCOUNT CODE:

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
					WBS 1.2.2.3					CASE 10 - OPTION #3						
		REBAR CHIILL	22.0	TN	600.00	20.000	440	1.00	SRSX08	17.30	0	0	13,200	7,612	0	20,812
		CONCRETE FOR CHILLERS	444.0	CY	62.00	1.500	666	1.00	SRSX10	12.20	0	0	27,528	8,125	0	35,653
		FORMWK /EQT FOUND. CHILLER & HEAT EXCH.	2,040.0	SF	0.75	1.000	2,040	1.00	SRSX07	14.60	0	0	1,530	29,784	0	31,314
		REBAR / EQT FOUNDATION CHILL. & HEAT EXCH.	15.0	TN	600.00	20.000	300	1.00	SRSX08	17.30	0	0	9,000	5,190	0	14,190
		CONCRETE/ EQT FOUNDATION FOR CHILL.& HEAT EXH	444.0	CY	62.00	1.500	666	1.00	SRSX10	12.20	0	0	27,528	8,125	0	35,653
		SHIELDING WALLS	175.0	CY	300.00	12.000	2,100	1.00	SRSX13	16.20	0	0	52,500	34,020	0	86,520
		COOLING TOWER, 3 CELL @ 150 HP FAN - 56MW	1.0	EA	0.00	0.000	0	1.00			0	0	0	0	562,000	562,000
		CHILLER, 1000 TON CAPACITY	2.0	EA	0.00	0.000	0	1.00			0	0	0	0	400,000	400,000
		CW SUPPLY PUMP, 12000 GPM @ 400 HP	3.0	EA	180000.00	180.000	540	1.00	SRSX01	17.60	0	540,000	0	9,504	0	549,504
		CW HEAT EXCHANGERS	2.0	EA	2100000.00	72.000	144	1.00	SRSX01	17.60	0	4,200,000	0	2,534	0	4,202,534
		36" PIPE CS, STD	950.0	LF	99.75	1.500	1,425	1.00	SRSX25	17.60	0	0	94,763	25,080	0	119,843
		36" TEE	10.0	EA	2205.00	59.000	590	1.00	SRSX25	17.60	0	0	22,050	10,384	0	32,434
		36" ELL, 90	20.0	EA	1260.00	42.000	840	1.00	SRSX25	17.60	0	0	25,200	14,784	0	39,984
		36" FLANGE, WN	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		36" VALVES, FLG	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		18" PIPE, CS, STD	4,150.0	LF	51.50	0.950	3,943	1.00	SRSX25	17.60	0	0	213,725	69,388	0	283,113
		18" TEE	10.0	EA	850.00	29.200	292	1.00	SRSX25	17.60	0	0	8,500	5,139	0	13,639
		18" ELL, 90	20.0	EA	490.00	20.500	410	1.00	SRSX25	17.60	0	0	9,800	7,216	0	17,016
		18" FLANGE, WN	26.0	EA	480.00	12.700	330	1.00	SRSX25	17.60	0	0	12,480	5,812	0	18,292
		18" VALVES, FLG	10.0	EA	12400.00	6.600	66	1.00	SRSX25	17.60	0	0	124,000	1,162	0	125,162
		HYDROTEST	5,100.0	LF	0.00	0.480	2,448	1.00	SRSX25	17.60	0	0	0	43,085	0	43,085
		EXCAVATE FOR SLAB COOLING TOWER	500.0	CY	0.00	0.100	50	1.00	SRSX05	16.20	0	0	0	810	0	810
		FORMWORK FOR COOLING TOWER	540.0	CY	0.75	1.000	540	1.00	SRSX07	14.60	0	0	405	7,884	0	8,289
		REBAR/CHILLER COOLING TOWER	26.0	TN	600.00	20.000	520	1.00	SRSX08	17.30	0	0	15,600	8,996	0	24,596
		CONCRETE FOR COOLING TOWER	520.0	CY	62.00	1.500	780	1.00	SRSX10	12.20	0	0	32,240	9,516	0	41,756
WBS1.2.2.3		CASE 10 - OPTION #3 SUBTOTAL					32,330			15.86	0	4,740,000	1,110,949	512,870	962,000	7,325,818
					WBS 1.2.2.4					CASE 10 - OPTION #4						
		CHILLER, 1000 TON CAPACITY	2.0	EA	0.00	0.000	0	1.00			0	0	0	0	400,000	400,000
		CW HEAT EXCHANGERS	6.0	EA	2100000.00	72.000	432	1.00	SRSX01	17.60	0	12,600,000	0	7,603	0	12,607,603
		36" PIPE CS, STD	950.0	LF	99.75	1.500	1,425	1.00	SRSX25	17.60	0	0	94,763	25,080	0	119,843
		36" TEE	10.0	EA	2205.00	59.000	590	1.00	SRSX25	17.60	0	0	22,050	10,384	0	32,434
		36" ELL, 90	20.0	EA	1260.00	42.000	840	1.00	SRSX25	17.60	0	0	25,200	14,784	0	39,984
		36" FLANGE, WN	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		36" VALVES, FLG	0.0				0	1.00	SRSX25		0	0	0	0	0	0
		18" PIPE, CS, STD	4,150.0	LF	51.50	0.950	3,943	1.00	SRSX25	17.60	0	0	213,725	69,388	0	283,113

GROUP : NO APT GROUP IDENTIFIED
ACCOUNT CODE:

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
		WBS 1.2.2.4 CASE 10 - OPTION #4														
		18" TEE	10.0	EA	850.00	29.200	292	1.00	SRSX25	17.60	0	0	8,500	5,139	0	13,639
		18" ELL, 90	20.0	EA	490.00	20.500	410	1.00	SRSX25	17.60	0	0	9,800	7,216	0	17,016
		18" FLANGE, WN	26.0	EA	480.00	12.700	330	1.00	SRSX25	17.60	0	0	12,480	5,812	0	18,292
		18" VALVES, FLG	10.0	EA	12400.00	6.600	66	1.00	SRSX25	17.60	0	0	124,000	1,162	0	125,162
		HYDROTEST	5,100.0	LF	0.00	0.480	2,448	1.00	SRSX25	17.60	0	0	0	43,085	0	43,085
		BUILDING FOR CHILLERS	21,500.0	SF	35.00	1.000	21,500	1.00	SRSX29	15.10	0	0	752,500	324,650	0	1,077,150
		FORM WORK CHILL	1,975.0	SF	0.75	1.000	1,975	1.00	SRSX07	14.60	0	0	1,481	28,835	0	30,316
		REBAR CHIILL	40.0	TN	600.00	20.000	800	1.00	SRSX08	17.30	0	0	24,000	13,840	0	37,840
		CONCRETE FOR CHILLERS	800.0	CY	62.00	1.500	1,200	1.00	SRSX10	12.20	0	0	49,600	14,640	0	64,240
		FORMWK /EQT FOUND. CHILLER & HEAT EXCH.	23,880.0	SF	0.75	1.000	23,880	1.00	SRSX07	14.60	0	0	17,910	348,648	0	366,558
		REBAR / EQT FOUNDATION CHILL. & HEAT EXCH.	32.0	TN	600.00	20.000	640	1.00	SRSX08	17.30	0	0	19,200	11,072	0	30,272
		CONCRETE/ EQT FOUNDATION FOR CHILL.& HEAT EXH	978.0	CY	62.00	1.500	1,467	1.00	SRSX10	12.20	0	0	60,636	17,897	0	78,533
		SHIELDING WALLS	342.0	CY	300.00	12.000	4,104	1.00	SRSX13	16.20	0	0	102,600	66,485	0	169,085
WBS1.2.2.4		CASE 10 - OPTION #4 SUBTOTAL					66,342			15.31	0	12,600,000	1,538,445	1,015,720	400,000	15,554,164
		WBS 1.2.2.5 STATION 11														
1.06.05.04.02	1420	COOLING TOWER, 3 CELL @ 150 HP FAN - 56MW	2.0	EA	0.00	0.000	0	1.00			0	0	0	0	1,696,000	1,696,000
1.06.05.04.02	1310	CW SUPPLY PUMP, 12000 GPM @ 400 HP	6.0	EA	180000.00	180.000	1,080	1.00	SRSX01	17.60	0	1,080,000	0	19,008	0	1,099,008
1.06.05.04.02	8313	CW HEAT EXCHANGERS	4.0	EA	800000.00	72.000	288	1.00	SRSX01	17.60	0	3,200,000	0	5,069	0	3,205,069
1.06.05.04.02	8313	36" PIPE CS, STD	1,420.0	LF	99.75	1.500	2,130	1.00	SRSX25	17.60	0	0	141,645	37,488	0	179,133
1.06.05.04.02	8313	36" TEE	20.0	EA	2205.00	59.000	1,180	1.00	SRSX25	17.60	0	0	44,100	20,768	0	64,868
1.06.05.04.02	8313	36" ELL, 90	40.0	EA	1260.00	42.000	1,680	1.00	SRSX25	17.60	0	0	50,400	29,568	0	79,968
1.06.05.04.02	8313	36" FLANGE, WN	52.0	EA	987.00	24.000	1,248	1.00	SRSX25	17.60	0	0	51,324	21,965	0	73,289
1.06.05.04.02	8313	36" VALVES, FLG	20.0	EA	36750.00	34.000	680	1.00	SRSX25	17.60	0	0	735,000	11,968	0	746,968
1.06.05.04.02	8313	18" PIPE, CS, STD	2,650.0	LF	51.50	0.950	2,518	1.00	SRSX25	17.60	0	0	136,475	44,308	0	180,783
1.06.05.04.02	8313	18" TEE	16.0	EA	850.00	29.200	467	1.00	SRSX25	17.60	0	0	13,600	8,223	0	21,823
1.06.05.04.02	8313	18" ELL, 90	30.0	EA	490.00	20.500	615	1.00	SRSX25	17.60	0	0	14,700	10,824	0	25,524
1.06.05.04.02	8313	18" FLANGE, WN	40.0	EA	480.00	12.700	508	1.00	SRSX25	17.60	0	0	19,200	8,941	0	28,141
1.06.05.04.02	8912	18" VALVES, FLG	12.0	EA	12400.00	6.600	79	1.00	SRSX25	17.60	0	0	148,800	1,394	0	150,194
1.06.05.04.02	8912	HYDROTEST	6,070.0	LF	0.00	0.480	2,914	1.00	SRSX25	17.60	0	0	0	51,279	0	51,279
1.05.03.04.03.02	4140	BUILDING FOR HOUSING EQT.	24,000.0	SF	35.00	1.000	24,000	1.00	SRSX29	15.10	0	0	840,000	362,400	0	1,202,400
1.05.03.04.03.02	4120	FORMWORK FOR HOUSING EQT.	2,400.0	SF	0.75	1.000	2,400	1.00	SRSX07	14.60	0	0	1,800	35,040	0	36,840
1.05.03.04.03.02	4140	REBAR FOR HOUSING EQT.	44.0	TN	600.00	20.000	880	1.00	SRSX08	17.30	0	0	26,400	15,224	0	41,624
1.05.03.04.03.02	4160	CONCRETE FOR HOUSING EQT.	888.0	CY	62.00	1.500	1,332	1.00	SRSX10	12.20	0	0	55,056	16,250	0	71,306
1.05.03.04.03.02	4120	FORMWK /EQT FOUND. & HEAT EXCH.	2,040.0	SF	0.75	1.000	2,040	1.00	SRSX07	14.60	0	0	1,530	29,784	0	31,314
1.05.03.04.03.02	4140	REBAR / EQT FOUNDATION & HEAT EXCH.	15.0	TN	600.00	20.000	300	1.00	SRSX08	17.30	0	0	9,000	5,190	0	14,190

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : NO APT GROUP IDENTIFIED																
ACCOUNT CODE:																
					WBS 1.2.2.5					STATION 11						
1.05.03.04.03.02	4160	CONCRETE/ EQT FOUNDATION .& HEAT EXH	444.0	CY	62.00	1.500	666	1.00	SRSX10	12.20	0	0	27,528	8,125	0	35,653
1.05.03.04.03.02	4160	SHIELDING WALLS	175.0	CY	300.00	12.000	2,100	1.00	SRSX13	16.20	0	0	52,500	34,020	0	86,520
1.05.03.04.03.02	3211	EXCAVATE FOR SLAB COOLING TOWER/ PUMP PADS	800.0	CY	0.00	0.100	80	1.00	SRSX05	16.20	0	0	0	1,296	0	1,296
1.05.03.04.03.02	3212	FORMWORK FOR COOLING TOWER / PUMP PADS	950.0	CY	0.75	1.000	950	1.00	SRSX07	14.60	0	0	713	13,870	0	14,583
1.05.03.04.03.02	4140	REBAR/CHILLER COOLING TOWER / PUMP PADS	50.0	TN	600.00	20.000	1,000	1.00	SRSX08	17.30	0	0	30,000	17,300	0	47,300
1.05.03.04.03.02	4160	CONCRETE FOR COOLING TOWER / PUMP PADS	900.0	CY	62.00	1.500	1,350	1.00	SRSX10	12.20	0	0	55,800	16,470	0	72,270
WBS1.2.2.5	STATION 11 SUBTOTAL						52,485			15.73	0	4,280,000	2,455,571	825,772	1,696,000	9,257,342
					WBS 1.2.5.1					ADDED SITE EXCAVATION						
		EXCAVATE HAZARDOUS DIRT BY MACHINE	225,000.0	CY	0.00	0.048	10,800	1.60	SRSX05	16.20	207,000	0	0	174,960	0	381,960
		HAUL & DUMP	225,000.0	CY	0.00	0.037	8,280	1.60	SRSX05	16.20	1,012,500	0	0	134,136	0	1,146,636
		ASSUME THAT 50% OF HAZARDOUS DIRT IS TREATED	112,500.0	CY	0.00	0.000	0	1.00			0	0	0	0	*,***,***	33,750,000
		ASSUME THAT 50% OF HAZARDOUS DIRT IS DISPOSED	112,500.0	CY	0.00	0.000	0	1.00			0	0	0	0	*,***,***	16,875,000
		PURCHASE & INSTALL CLEAN FILL COMMON BORROW	225,000.0	CY	3.64	0.023	5,175	1.00	SRSX05	16.20	321,750	0	819,000	83,835	0	1,224,585
		COMPACT COMMON BORROW	225,000.0	CY	0.00	0.007	1,575	1.00	SRSX05	16.20	45,000	0	0	25,515	0	70,515
WBS1.2.5.1	ADDED SITE EXCAVATION SUBTOTAL						25,830			16.20	1,586,250	0	819,000	418,446	50,625,000	53,448,696
	SUBTOTAL						2,183,049			16.47	$3,448,300	$128,149,488	$12,172,940	$35,959,148	$*,***,***	$230,664,876
NO APT GROUP IDENTIFIED GROUP SUBTOTAL							2,183,049			16.47	3,448,300	128,149,488	12,172,940	35,959,148	50,935,000	230,664,876
GROUP : BALANCE OF PLANT																
ACCOUNT CODE: BO2110 STRUCTURES AND IMPROVEMENTS																
					WBS 1.2.1.01					SITE #2, COOLING OPTION #1						
	3211	MACHINE EXCAVATE FOR SITE 2 OPTION 1	17,174.0	CY	0.00	0.030	515	1.00	SRSX05	16.20	15,800	0	0	8,347	0	24,147
	3212	HAND EXCAVATE FOR SITE 2 OPTION 1	5,725.0	CY	0.00	4.000	22,900	1.00	SRSX04	11.80	0	0	0	270,220	0	270,220
	3221	FURNISH & PLACE PIPE BEDDING SAND	2,425.0	CY	8.00	0.830	2,013	1.00	SRSX04	11.80	0	0	19,400	23,750	0	43,150
	3221	TRENCH BACKFILL & COMPACTION	18,497.0	CY	0.00	0.060	1,110	1.00	SRSX05	16.20	15,168	0	0	17,979	0	33,147

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
GROUP : BALANCE OF PLANT																
ACCOUNT CODE: BO2110 STRUCTURES AND IMPROVEMENTS																
					WBS 1.2.1.01						**SITE #2, COOLING OPTION #1**					
	3216	HAUL & DUMP (EXCESS)	5,091.0	CY	0.00	1.200	6,109	1.00	SRSX05	16.20	0	0	0	98,969	0	98,969
WBS1.2.1.01		SITE #2, COOLING OPTION #1 SUBTOTAL					32,647			12.84	30,968	0	19,400	419,265	0	469,633
					WBS 1.2.1.05						**SITE #8, COOLING OPTION #1**					
	3211	MACHINE EXCAVATE FOR SITE 8 OPTION 1	30,174.0	CY	0.00	0.030	905	1.00	SRSX05	16.20	27,760	0	0	14,665	0	42,425
	3212	HAND EXCAVATE FOR SITE 8 OPTION 1	10,059.0	CY	0.00	4.000	40,236	1.00	SRSX04	11.80	0	0	0	474,785	0	474,785
	3221	FURNISH & PLACE PIPE BEDDING SAND	3,792.0	CY	8.00	0.830	3,147	1.00	SRSX04	11.80	0	0	30,336	37,139	0	67,475
	3221	TRENCH BACKFILL & COMPACTION	32,245.0	CY	0.00	0.060	1,935	1.00	SRSX05	16.20	26,441	0	0	31,342	0	57,783
	3216	HAUL & DUMP (EXCESS)	10,661.0	CY	0.00	1.200	12,793	1.00	SRSX05	16.20	0	0	0	207,250	0	207,250
WBS1.2.1.05		SITE #8, COOLING OPTION #1 SUBTOTAL					59,016			12.97	54,201	0	30,336	765,180	0	849,717
		BO2110 STRUCTURES AND IMPROVEMENTS SUBTOTAL					91,663			12.92	$85,169	$0	$49,736	$1,184,445	$0	$1,319,350
BALANCE OF PLANT GROUP SUBTOTAL							91,663			12.92	85,169	0	49,736	1,184,445	0	1,319,350

WBS	TWC	DESCRIPTION	QUANTITY	UOM	UNIT MATL	UNIT MHRS	TTL HOURS	ADJ FACT	CREW	$/MH	CONST. EQUIP.	ENGR'D EQUIP.	MAT'L	CRAFT LABOR	CONTRACT SERVICES	TOTAL COST
		PROJECT SUBTOTAL					2,274,712	16.33			$3,533,469	$128,149,488	$12,222,676	$37,143,594	$*,***,***	$231,984,226
		PROJECT ESCALATION									$0	$0	$0	$0	$0	$0
		PROJECT SUBTOTAL INCLUDING ESCALATION					2,274,712	16.33			$3,533,469	$128,149,488	$12,222,676	$37,143,594	$50,935,000	$231,984,226
		SUBTOTAL INCLUDING ESCALATION					2,274,712	16.33			$3,533,469	$128,149,488	$12,222,676	$37,143,594	$50,935,000	$231,984,226

MANAGEMENT RESERVE @ 0.00 % $0

CONTINGENCY @ 0.00 % $0
CONTINGENCY NOTE 1
CONTINGENCY NOTE 2

PROJECT TOTAL COST $231,984,000