

TXU – COMANCHE PEAK UNITS 3 & 4  
OPTIMIZATION STUDY  
SECONDARY SIDE COOLING WATER SYSTEM

### 3.5 CT Blow down Outfall Locations

A detailed discussion is provided below of the pros & cons for CT blow down outfall for the following locations:

- Return to SCR (directly or thru U1 & 2 CWS),
- Return to SCR below the SCR dam,
- Return to Brazos River below the LG Dam
- Return to LG via existing line,

Additionally, Zero Liquid Discharge (blowdown converted to solid via concentrators and crystallizers and pure water returned to basin or plant makeup) is discussed in Section 3.7 of this report.

#### Intake/Discharge Options

There are several issues with respect to the use of cooling water related to expansion of generation capacity at Comanche Peak. The site is located approximately 60 miles southwest of the Dallas-Fort Worth area on a reservoir/cooling lake that is formed by a dam on the Squaw Creek drainage. Squaw Creek is approximately 3.75 miles west of the Brazos River at the plant location and joins the Brazos River at the confluence of the Brazos River, the Paluxy River and Squaw Creek, about 4.8 miles to the south-southeast, near Glen Rose, Texas.

The Brazos River is dammed to form Lake Granbury to the east of the Comanche Peak site. The use of cooling water from the reservoir is related to the discharge of heated effluent for at least two reasons:

- (1) the build-up of heat in the reservoir water resulting in recirculation of heat to the intake structures, and
- (2) the accumulation of dissolved solids in the reservoir due to evaporative losses in the CT, and evaporation of water from the water body. This is both naturally occurring and additional evaporation induced by the introduction of heat from the power plant cooling systems from both existing and future units.

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The purpose of this study is to evaluate intake and discharge location and preliminary design options, taking into consideration effects on plant operations (at both the existing units 1 & 2 and the future units 3 & 4), the availability of an adequate water supply, the impact of water use on thermal conditions in the reservoir, and the water quality (primarily the build-up of total dissolved solids (TDS)) that results from each intake or discharge location and design option.

### Intake Design Options

The following intake design options were considered:

- Shoreline intake structure with pump-wells behind conventional traveling screens equipped with Ristoph-type bucket fish handling and return system. (Figure A)
- Offshore-bottom mounted velocity cap intake with a shoreline pump-house (potentially also requiring traveling screens with fish return capability). (Figure B)
- Offshore-bottom mounted intake with passive, fine-mesh, screens with a shoreline pump-house (*not* requiring traveling screens in the pump-house). (Figure C)

### Intake Location Options

The various intake structure location options are shown on Figure D.

The advantages and disadvantages of each of the intake options are presented in Table 3.5-1. There are two basic options for cooling water make-up to Units 3 & 4: withdraw from Squaw Creek Reservoir, or from Lake Granbury. All of the other options are variation of these two choices. In this table, the Squaw Creek options will be addressed first, followed by the Lake Granbury options. The Zero Liquid Discharge option results in having no outfall from Units 3 & 4, but will still require a make up water supply.

### General Intake Discussion

The first group of intake options is to obtain all the necessary cooling water for Units 3 & 4 from Squaw Creek Reservoir. The first option, a shoreline intake structure with conventional traveling screens and a fish return system (I-1) has the advantage of being the nearest source of water to the plant and has the least impact due to construction. All of the Squaw Creek Reservoir intake options have disadvantages of further degrading the water supply situation in Squaw Creek Reservoir by increased withdrawals that compete with the existing withdrawals to support Units 1 & 2.

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Both of the offshore design options (fine-mesh screens (I-2) and velocity caps (I-3) on Squaw Creek Reservoir would reduce the potential for fisheries impacts, but do nothing to resolve the water supply, availability and water quality issues. The passive fine-mesh screen design has an additional advantage of having lower operating costs than either the shoreline intake or the velocity cap, both of which would require the operation of a traveling screen with a fish return system to mitigate impingement impacts to fish populations.

The second group of intake options considered an alternate water supply from Lake Granbury on the Brazos River. This approach uses Lake Granbury as the source of all make-up water to Units 3 & 4 at the Comanche Peak Site. This was done to adequately address the Squaw Creek Reservoir water supply and water quality issues. There are a number of designs and location variations to this option as described Table 3.5-1. The major benefit of the Lake Granbury option is the improvements to water supply and water quality in Squaw Creek Reservoir by using Lake Granbury water. The option to pump Lake Granbury water directly into the Units 3 & 4 cooling tower (I-5 & I-8) as make-up water minimizes the interaction of the new units with the water supply in Squaw Creek Reservoir, and has the potential to eliminate the need for a new intake structure on Squaw Creek Reservoir for Units 3 & 4. Alternatively Lake Granbury water can be pumped into Squaw Creek Reservoir (I-4 & I-7), and both Units 1 & 2 and Units 3 & 4 would draw cooling water from the lake. However, this option requires two intake structures, one on Lake Granbury and one for Units 3 & 4 on Squaw Creek Reservoir. Options I-6 and I-9 are hybrids of these two basic approaches in that Lake Granbury water is used to both make up to the Unit 3 & 4 cooling towers and supplement the water in Squaw Creek Reservoir.

If the assumption is made that a resolution to the water supply and water quality issues on Squaw Creek Reservoir is a desired outcome of development of Units 3 & 4 at Comanche Peak, as well as resulting in an improvement in the operations of Units 1 & 2, then the Lake Granbury water supply make-up into Squaw Creek Reservoir would be the selected option going forward. If only Units 3 & 4 are considered, the direct make-up to the cooling tower for Units 3 & 4 would be the selected option. All of the Lake Granbury options require an intake structure and pump-house on Lake Granbury. (The offshore passive screen intake would again avoid the need for traveling water screens in the pump-house).

#### Intake Conclusion

Between the two options of drawing a water supply from Lake Granbury or Squaw Creek Reservoir, it can be concluded that the better alternative would be to draw from Lake Granbury. This avoids further degradation of Squaw Creek Reservoir by adding to the TDS problem. The optimal intake structure option at Lake Granbury is the offshore intake structure with passive fine-

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mesh screen modules. This structure is advantageous due to its low visual impact and lower maintenance costs than that of the designs requiring traveling water screens.

The final selection for the makeup water intake for the CT was Lake Granbury, which was discussed in details during the May 7, 2007 meeting in Princeton.

#### Outfall Location Options

The advantages and disadvantages of each of the discharge options are presented in Table 3.5-2. There are two basic options for discharge from Units 3 & 4: the Brazos River and Squaw Creek. All other options are various locations for outfalls along these waterways. The discharge location options are shown in on Figure E.

#### General Outfall Discussion

One option is to discharge the cooling tower blow down into Squaw Creek Reservoir (D-1). This is the shortest and most cost effective selection. The second option is to install a discharge pipeline into Squaw Creek Reservoir below the dam (D-2). However, the implementation of either of these options does not resolve the high Total Dissolved Solids (TDS) water quality standards issue downstream of the creek where it intersects a high water quality stream, the Paluxy River, just above the confluence with the Brazos River. (Texas Water Quality Criteria are presented in Table 3.5-3.). Even more importantly to the continued operation of Squaw Creek Reservoir for the Comanche Peak Units, the direct discharge to Squaw Creek Reservoir is undesirable.

Option D-3 is to discharge the cooling water downstream of the dam on Lake Granbury into the Brazos River near Cox Bend. At this location, the Brazos River has a water quality criteria of 1,600 mg/L. The final option (D-4) is to utilize the existing discharge route into Lake Granbury, where the water quality criteria is 2,500 mg/L. This less stringent criteria will allow for the discharge of the cooling water blow down into Lake Granbury with somewhat higher cycles of concentration. It will also reduce the degradation of the quality of water in the Brazos River. Furthermore, the construction of an outfall structure at Brazos River presents challenges due to the existing topography.

The Zero Liquid Discharge (ZLD) option results in no outfall for Units 3 & 4. This avoids all outfall/discharge water quality issues in any of the water bodies discussed above. The option would require disposal of solids (salts) that are generated in the process of evaporating the cooling water to dryness. Disposal of solid waste has been addressed in this study in Section 3.7.

### Outfall Conclusion

The best route for discharging the cooling water is to utilize the existing pipeline route and discharge directly into Lake Granbury, where the blowdown can be discharged into a water body with a lower water quality standard (i.e. higher number). This option avoids the TDS buildup in Squaw Creek Reservoir and does not change the TDS concentration from the operation of existing Units 1 & 2. It also minimizes impact to the Brazos River, where the water quality standard is higher (i.e. lower number) and discharge during periods of low flow may be unacceptable.

Based on meeting on May 7, 2007 and TXU e-mail dated April 24, 2007, the final blowdown location from the CTs is to Lake Granbury.

### Cost Comparison

Placement of intake structures and outfalls near the Squaw Creek Reservoir presents an obvious cost savings on pipeline material and construction. However, that cost advantage does not mitigate the Squaw Creek Reservoir disadvantage in terms of water supply and quality. A water intake on Lake Granbury would allow for better water quality for the facility without disrupting the intake or discharge processes at Units 1 & 2. The shoreline intake structure with traveling water screens equipped with a fish return system require continuous operation to remove impinged fish and as a result generally have higher operating costs, therefore, offshore intake structures are recommended.

With respect to the location of the Squaw Creek Reservoir Dam, discharging to the Squaw Creek Reservoir or immediately below has the greatest cost advantage and discharging into Lake Granbury has the least advantage. However, further discharge to the Squaw Creek reservoir will continue to impact water quality (high TDS). This will also impact the discharge of Squaw Creek Reservoir water from the dam, as will a discharge of cooling water blowdown below the dam. This will eventually affect the Paluxy River drainage downstream. Discharging to the Brazos River, near Cox Bend presents an option that is intermediate in cost. Although the Brazos River is more capable of accepting a blow down discharge than the Paluxy River, it has a higher water quality standard than Lake Granbury, and maintaining it is desirable. Furthermore, utilizing the existing pipeline route from the Comanche Peak site to Lake Granbury may prove to be cost effective.

The optimal approach is to withdraw water from an intake structure in Lake Granbury and reticulate it back to the lake via the existing pipeline route. Although both conclusions may be the most costly of the alternatives, they

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serve to maintain the water quality in Squaw Creek Reservoir and provide the greatest potential for the receiving water body to accept the blowdown discharge and meet water quality standards.

As stated before, based on review by TXU and e-mail dated April 24, 2007 from TXU, the final selection of the CT blowdown location is to Lake Granbury. This was discussed in details during the May 7, 2007 meetings in Princeton.