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PROJECT REPORT

For

the Evaluation of Lake Granbury Water Temperature Due to the Operation of CPNPP Units 3 and 4

Independent Review Required: No

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Reviewer

Reviewed by: NA SF 5/15/09 Date:
Independent Reviewer

Approved by: SCF Date: 5/19/09
Project Manager or Designee

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Summary

The evaluation uses a control volume/energy balance approach based on the first law of thermodynamics or conservation of energy to determine the daily temperatures of the lower Lake Granbury volume (upstream of DeCordova Dam). The methodology uses the highest differential temperature between the discharge and the background temperatures, historically occurring during the winter months, and a period of low flows through the lower lake volume. Historical data with a reasonable number of recorded river temperatures (river temperatures were not recorded on regular bases) and times where low flow rates through the lower lake volume were searched. A 65-day period between December 11, 2001 and February 13, 2002 was selected for evaluation along with assumed preliminary design information for the proposed Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4. The net temperature increase for the 65-day period is conservatively evaluated to be <1.00°F, which would be mitigated by the lake's surface evaporation.

Purpose

The purpose of this evaluation is to enhance the information supplied in the CORMIX runs for the lower Lake Granbury area and to verify results would meet the predicted permit requirements. CORMIX inputs a single flow regime for the river or lake that provides a plume for the thermal or toxin input. Low lake or river flow conditions reliably provide the largest conservative thermal plumes that will meet permitted or proposed permitted conditions as calculated by CORMIX; however, CORMIX provides no information on possible accumulations of heat. This energy balance provides a conservative estimate of heat accumulation in the area between the cooling tower blowdown discharge and the lake intakes.

Results

The cooling tower blowdown discharge into Lake Granbury will create a plume that is warmer than the surrounding environment and will, therefore, be more buoyant. The plume will spread across the surface of the control volume with enough energy to induce additional evaporation. This evaporation provides the largest heat transfer from the control volume and is modeled as a cooling pond for this report. The heat transfer, along with normal mixing limits, will heat the area less than 1°F and agrees with the CORMIX findings. In addition, the normal evaporation that equates to more than 1.7 billion btu/day (Reference 12) removed from the lake surface will more than mitigate the heat buildup determined by this evaluation. Therefore, the discharges from the plant into Lake Granbury should meet the predicted permit requirement of less than 3°F heat buildup.

References

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10. Boss, S.K. White Paper: Revised Elevation-Area-Volume Estimates for Lake Granbury, Hood County, Texas. May 11, 2009.
11. Comanche Peak Nuclear Power Plant, Units 3 & 4, COL Application, Part 3 Environmental Report, Rev 0. Table 2.7-45.
12. Comanche Peak Nuclear Power Plant, Units 3 & 4, COL Application, Part 3 Environmental Report, Rev 0. Table 2.3-2.

Data

mv is in lbm and is obtained from the bathymetric volume in acre-feet (Reference 10) and converted to lbm using the following conversion:

$$Acre-feet * 325{,}851 \frac{gal}{acre-feet} * 8.34 \frac{lbm}{gal} = lbm$$

Where:

8.34 lbm/gal is the mass of water per gallon for the temperatures examined (Reference 5).

Cp specific heat of water is ~1 btu/lbm °F (Reference 5).

mr is the daily mass flow rate through the bathymetric volume in lbm/day. Volumetric flow rate was provided by the Brazos River Authority (Reference 3). The volumetric flow is converted to mass flow (lbm/day), as follows, to determine the mass flow rate used in the evaluation:

$$\frac{lbm}{day} = cfs * 448.83 \frac{gpm}{cfs} * 8.34 \frac{lbm}{gal} * 60 \frac{\min}{hr} * 24 \frac{hr}{day}$$

Where:

gpm is the volumetric flow rate in gallons per minute.

md is the daily discharge flow in lbm/day. Volumetric flow rate was provided by the URS optimization study (Reference 1). The volumetric flow is converted to mass flow (lbm/day), as follows, to determine the mass flow rate used in the evaluation:

$$\frac{lbm}{day} = gpm * 8.34 \frac{lbm}{gal} * 60 \frac{\min}{hr} * 24 \frac{hr}{day}$$

Where:

gpm is the volumetric flow rate in gallons per minute.

mi is the daily intake flow in lbm/day. Volumetric flow rate was provided by the URS optimization study (Reference 1), plus Wolf Hollow and CPNPP Units 1 and 2 historical data. The volumetric flow is converted to mass flow rate (lbm/day), as follows, to determine the mass flow rate used in the evaluation:

$$\frac{lbm}{day} = gpm * 8.34 \frac{lbm}{gal} * 60 \frac{\min}{hr} * 24 \frac{hr}{day}$$

Where:

gpm is the volumetric flow rate in gallons per minute

mri is the additional daily upstream flow into the bathymetric volume due to the difference in the flow between intake and discharge flows in lbm/day.

tv begins as the initial average lake temperature and is the evaluated daily volumetric temperature for each day thereafter. The initial average daily temperature of the lake is the average of temperatures from 12/11/2001 (55.94°F), 1/9/2002 (52.682°F), 1/15/2002 (49.1°F), and 2/13/2002 (49.334°F) provided by the Brazos River Authority for the 65-day study (Reference 6), and calculated to be 51.764°F.

ti is the initial average lake temperature. The initial average daily temperature of the lake is the average of temperatures from 12/11/2001 (55.94°F), 1/9/2002 (52.682°F), 1/15/2002

(49.1°F), and 2/13/2002 (49.334°F) provided by the Brazos River Authority for the 65-day study (Reference 6) or 51.764°F.

td is the discharge temperature based on bin data from the URS optimization study (Reference 1). Average daily wet bulb temperatures as determined from Reference 4 are used in association with bin data from the URS optimization study (Reference 1) for the selection of daily intake and discharge flows, along with the discharge temperature.

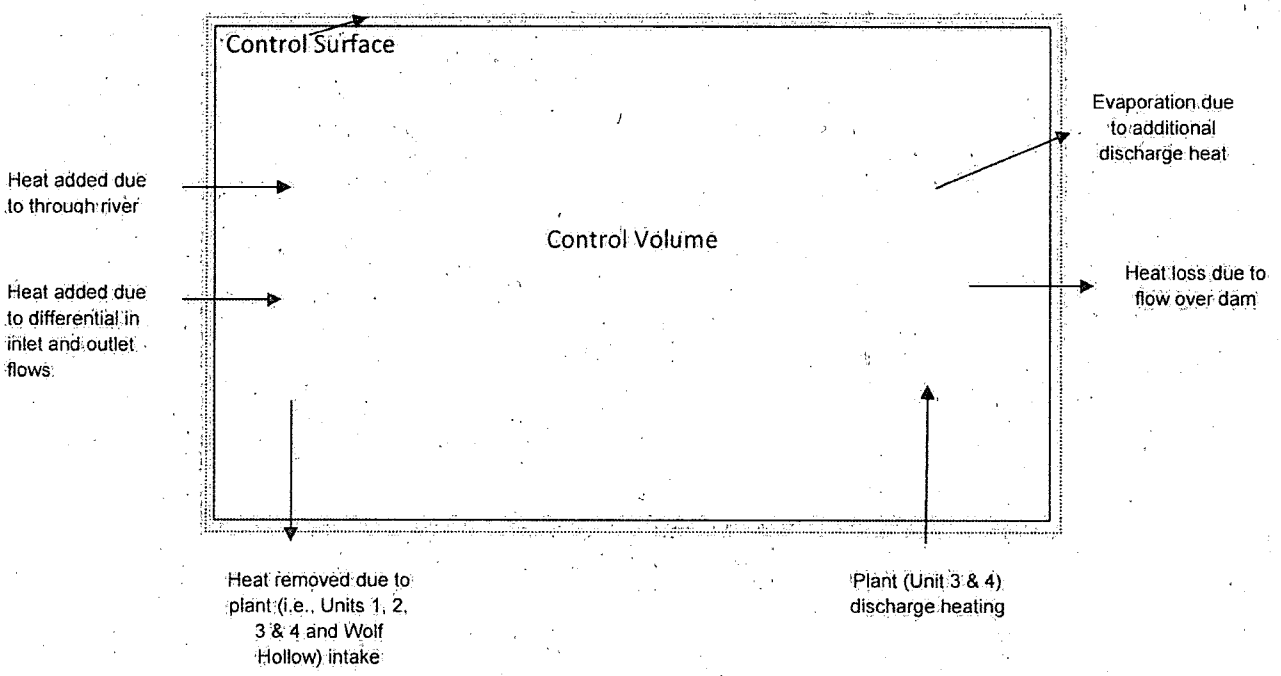
Additional evaporation ($md*Cp*\Delta thl$) used to determine the evaporation losses from the volume is found using cooling pond information from Perry's Chemical Engineers' Handbook (Reference 5). The area of the cooling pond used for cooling the maximum discharge temperature down to an acceptable temperature is found using the nomograph (Attachment A) from Reference 5 and is found to have an approximate size of 118.83 acres. The cooling pond size in Ref. 5 is smaller than the area being evaluated (281.60 acres in Reference 10) and is considered conservative for this study. The temperature (thl) used is the difference in the discharge temperature and the daily volumetric temperature, minus the cooling pond approach of 3°F from Reference 5. The md value is not the mass evaporated, but is used to determine the heat used for evaporation in accordance with Reference 5 guidance.

Assumptions

1. Additional evaporation is estimated in accordance with cooling pond information from Perry's Chemical Engineers' Handbook (Reference 5) and included in Attachment A.
2. Surface or natural evaporation and solar loading were neglected within the formal evaluation, but provide basis for the assumption that zero energy would be transferred across the control surface.
3. Units 3 and 4 discharge temperatures and flows are based on daily average wet bulb temperatures in Ref. 4 and correlate with values from Reference 1.
4. Units 3 and 4 intake flows are based on daily average wet bulb temperatures in Reference 4 and correlate with values from Reference 1.
5. Daily lake temperatures were not available; therefore, the baseline lake temperature is the average of the four lake temperatures for the 65-day run.
6. The highest differential lake temperatures as compared to the cooling tower discharge are assumed to occur during the winter months.
7. Actual permit conditions were not available; therefore, information from the Texas Administrative Code is used. The permit condition for temperature change is assumed to be less than 3°F for the plant discharge (Reference 7).
8. Conservatively assumed winds are 2 mph for the Lake Granbury area. Using Table 2.7-45 of Reference 11, wind speeds for the area near CPNPP are less than 7.5 mph, verifying the conservatism of this assumption.
9. No rain or snow is assumed for this evaluation period.
10. All work such as boating, actions of wildlife, etc. are considered negligible.
11. There is no mass gained or lost from the control volume during this evaluation. Actually mass is lost due to evaporation in the area, but is considered negligible due to the cooling that would occur with this phenomenon.
12. The cooling pond approach of 3°F is used because the discharge pond depth is greater than 5 feet.
13. Heat transfer between earth and pond, changing temperature and humidity of the air as it transverses the water, and rain have minor effects on heat transfer for cooling ponds (Reference 5), and therefore are assumed negligible for this evaluation.
14. The variation temperature as defined in Reference 5 of plus or minus 3°F is assumed to be 0°F for this report, and considered to be conservative because of the large surface area being evaluated.

Methodology

The first law of thermodynamics for a control volume is the approach used to evaluate the lake temperature conditions around the discharge and intake structures. No mass is gained or lost during this evaluation; however, the mass flow rates used provide weighted energy values crossing the control surface.



The basic equation for steady state conditions is as follows:

$$\dot{Q} = \dot{W} + \sum_{in} \dot{m}\left(h + \frac{V^2}{2} + gz\right) - \sum_{ex} \dot{m}\left(h + \frac{V^2}{2} + gz\right)$$

Where:

$\dot{Q}$ is rate of energy transfer by heat across a boundary in btu/day

$\dot{W}$ is the rate of energy transfer by work across a boundary in watts. Work is negligible and considered zero for this evaluation.

The velocity (V) across the control surface does not change and is therefore neglected.

z is elevation in feet. There is no elevation (z) change across the control surface and is z therefore zero.

h is specific enthalpy in btu/lb.

g is gravitational acceleration.

$\dot{m}$ is mass flow rate in lb/day.

Therefore the equation is as follows:

$$\dot{Q} = \sum_{in} \dot{m}\, h - \sum_{ex} \dot{m}\, h$$

$$h = Cp\, T$$

$$\dot{Q} = \sum_{in} \dot{m} Cp\, T - \sum_{ex} \dot{m} Cp\, T$$

ex represents the energy values exiting the control surface.

in represents the energy values entering the control surface.

The following equation provides the internal energy in the control volume:

T_2 represents the final temperature in °F.

T_1 represents the initial temperature in °F.

$$\dot{Q} = m\, Cp\, (T_2 - T_1)$$

$$\dot{Q} = m\, Cp\, T_2 - m\, Cp\, T_1$$

Combining these equations results in the governing equation:

$$T_2 = \left\{ \left(m\, Cp\, T_1 + \sum_{in} \dot{m}\, Cp\, T - \sum_{ex} \dot{m}\, Cp\, T \right) \div Cp\, m \right\}$$

The inlet energy equation is broken down as follows:

$$\sum_{in} \dot{m}\, Cp\, T = \dot{m}r\, Cp\, T_i + \dot{m}ri\, Cp\, T_i + \dot{m}d\, Cp\, T_d$$

Where:

mr is the inlet mass flow due to dam operation, which brings about flow through the control volume in lbm/day.

mri is the mass flow across the control surface due to additional intake flow in lbm/day.

md is the mass flow from Units 3 and 4 in lbm/day.

T_i is the initial temperature in °F.

T_d is the discharge temperature in °F.

Cp is specific heat of water, which is equal to approximately 1 btu/lbm°F.

The exit energy equation is broken down as follows:

$$\sum_{ex} \dot{m}\, Cp\, T = \dot{m}i\, Cp\, T_v + \dot{m}r\, Cp\, T_v + \dot{m}d\, Cp\, \Delta T_e$$

Where:

mi is the mass intake flow in lbm/day.

mr is the through control volume flow (same as in the inlet energy equation above).

md is the mass discharge flow as used per Reference 5 to determine evaporation in lbm/day.

T_v is the temperature of the control volume that is changing on a daily basis in °F.

ΔT_e is the difference between the discharge temperature and T_v, minus the approach temperature of 3°F.

Evaluation

The evaluation for determining the net temperature increase of Lake Granbury due to operation of CPNPP Units 3 and 4 for the 65-day period is detailed in the following table.

EVALUATION FOR DETERMINING THE NET TEMPERATURE INCREASE OF LAKE GRANBURY DUE TO THE OPERATIONS OF CPNPP UNITS 3 AND 4

Date	mv*tv (btu/day)	mr*tl (btu/day)	mri*ti (btu/day)	md*td (btu/day)	mi*tv (btu/day)	mr*tv (btu/day)	additional evap (btu/day)	B+C+D+E-F-G-H (btu/day)	Volume Temperature Q/mv (°F)	Δt (°F)	mri (lbm/day)	mv (lbm/day)	mr (lbm/day)	md (lbm/day)	mi (lbm/day)	tv (°F)	tl (°F)	td (°F)	wet bulb avg (°F)
12/11/2001	1.36E+12	7.664E+09	3.689E+10	1.56E+10	4.88E+10	7.66E+09	3.03E+09	1.36E+12	51.7901613945970	0.0261613945970	7.13E+08	2.63E+10	148060786	2.29E+08	9.42E+08	51.704	51.704	68	30.68512144
12/12/2001	1.360727E+12	7.664E+09	3.881E+10	1.92E+10	5.21E+10	7.67E+09	5.16E+09	1.36E+12	51.8184483869597	0.0544483869597	749751960	2.63E+10	148060786	2.56E+08	1.01E+09		51.704	76	51.20730764
12/13/2001	1.36146E+12	7.667E+09	3.689E+10	1.56E+10	4.88E+10	7.68E+09	3.02E+09	1.36E+12	51.8428257920563	0.0788257920563	712738372	2.63E+10	148114685	229119149	9.42E+08		51.704	68	39.23196116
12/14/2001	1.3621E+12	7.661E+09	3.593E+10	1.4E+10	4.72E+10	7.67E+09	2.19E+09	1.36E+12	51.8649438616573	0.1009438616573	694171531	2.63E+10	148006887	215836531	9.10E+08		51.704	65	36.36746086
12/15/2001	1.36269E+12	7.661E+09	3.79E+10	1.73E+10	5.06E+10	7.68E+09	3.92E+09	1.36E+12	51.8893087251117	0.1253087251117	732193924	2.63E+10	148006887	243002246	9.75E+08		51.704	71	44.0056817
12/16/2001	1.36333E+12	7.67E+09	3.881E+10	1.92E+10	5.22E+10	7.69E+09	5.14E+09	1.36E+12	51.9142071905540	0.1502071905540	749751960	2.63E+10	148168584	2.56E+08	1.01E+09		51.704	79	53.58141187
12/17/2001	1.36398E+12	7.673E+09	3.79E+10	1.73E+10	5.06E+10	7.69E+09	3.91E+09	1.36E+12	51.9369204421362	0.1729204421362	732193924	2.63E+10	148222483	243002246	9.75E+08		51.704	71	44.98307094
12/18/2001	1.36458E+12	7.673E+09	3.689E+10	1.56E+10	4.89E+10	7.7E+09	2.99E+09	1.37E+12	51.9574154207611	0.1934154207611	712738372	2.63E+10	148222483	229119149	9.42E+08		51.704	68	41.69464164
12/19/2001	1.36517E+12	7.678E+09	3.689E+10	1.56E+10	4.89E+10	7.71E+09	2.99E+09	1.37E+12	51.9772380200429	0.2132380200429	712738372	2.63E+10	148330281	229119149	9.42E+08		51.704	68	40.63667076
12/20/2001	1.36564E+12	7.675E+09	3.593E+10	1.4E+10	4.73E+10	7.71E+09	2.16E+09	1.37E+12	51.9950454516233	0.2310454516233	694171531	2.63E+10	148276382	215836531	9.10E+08		51.704	65	36.77306594
12/21/2001	1.3661E+12	7.675E+09	3.689E+10	1.56E+10	4.9E+10	7.71E+09	2.98E+09	1.37E+12	52.0136352705569	0.2496352705569	712738372	2.63E+10	148276382	229119149	9.42E+08		51.704	68	39.70365867
12/22/2001	1.36659E+12	7.675E+09	3.79E+10	1.73E+10	5.07E+10	7.71E+09	3.88E+09	1.37E+12	52.0330162368293	0.2690162368293	732193924	2.63E+10	148276382	243002246	9.75E+08		51.704	71	40.04893312
12/23/2001	1.3671E+12	7.678E+09	3.593E+10	1.4E+10	4.74E+10	7.72E+09	2.15E+09	1.37E+12	52.0490346289348	0.2850346289348	694171531	2.63E+10	148330281	215836531	9.10E+08		51.704	65	35.23318433
12/24/2001	1.36752E+12	7.675E+09	3.552E+10	1.34E+10	4.67E+10	7.72E+09	1.88E+09	1.37E+12	52.0639764765811	0.2999764765811	680197156	2.63E+10	148276382	210143981	8.96E+08		51.704	64	29.30311361
12/25/2001	1.36791E+12	7.673E+09	3.552E+10	1.34E+10	4.67E+10	7.72E+09	1.88E+09	1.37E+12	52.0784437598633	0.3144437598633	680197156	2.63E+10	148276382	210143981	8.96E+08		51.704	64	32.46045477
12/26/2001	1.3683E+12	7.673E+09	3.557E+10	1.34E+10	4.67E+10	7.72E+09	1.87E+09	1.37E+12	52.0924521963680	0.3284521963679	680197156	2.63E+10	148222483	210143981	8.96E+08		51.704	64	32.01087648
12/27/2001	1.36866E+12	7.673E+09	3.593E+10	1.4E+10	4.74E+10	7.72E+09	2.14E+09	1.37E+12	52.1065660437054	0.3425660437054	694171531	2.63E+10	148222483	215836531	9.10E+08		51.704	65	34.13032594
12/28/2001	1.36903E+12	7.67E+09	3.689E+10	1.56E+10	4.91E+10	7.72E+09	2.95E+09	1.37E+12	52.1215026339849	0.3575026339849	712738372	2.63E+10	148168584	229119149	9.42E+08		51.704	68	37.38265026
12/29/2001	1.36943E+12	7.673E+09	3.552E+10	1.34E+10	4.67E+10	7.73E+09	1.87E+09	1.37E+12	52.1341435764862	0.3701435764862	680197156	2.63E+10	148222483	210143981	8.96E+08		51.704	64	33.09852443
12/30/2001	1.36976E+12	7.67E+09	3.552E+10	1.34E+10	4.67E+10	7.72E+09	1.86E+09	1.37E+12	52.1461838183300	0.3823838183300	680197156	2.63E+10	148168584	210143981	8.96E+08		51.704	64	27.46811461
12/31/2001	1.37008E+12	7.667E+09	3.552E+10	1.34E+10	4.67E+10	7.72E+09	1.86E+09	1.37E+12	52.1582361335288	0.3942361335288	680197156	2.63E+10	148114685	210143981	8.96E+08		51.704	64	27.16081251
1/1/2002	1.37039E+12	7.667E+09	3.322E+10	1.34E+10	4.44E+10	7.71E+09	1.86E+09	1.37E+12	52.1703778465363	0.4063778465363	641827851	2.63E+10	148114685	210143981	8.52E+08		51.704	64	28.63872128
1/2/2002	1.37071E+12	7.667E+09	3.322E+10	1.34E+10	4.44E+10	7.73E+09	1.86E+09	1.37E+12	52.1821545064810	0.4181545064810	641827851	2.63E+10	148114685	210143981	8.52E+08		51.704	64	26.72976887
1/3/2002	1.37102E+12	7.664E+09	3.322E+10	1.34E+10	4.45E+10	7.73E+09	1.85E+09	1.37E+12	52.1935779487014	0.4295779487014	641827851	2.63E+10	148060786	210143981	8.52E+08		51.704	64	22.64525856
1/4/2002	1.37132E+12	7.661E+09	3.322E+10	1.34E+10	4.45E+10	7.74E+09	1.85E+09	1.37E+12	52.2046588399226	0.4406588399226	641827851	2.63E+10	148006887	210143981	8.52E+08		51.704	64	40.40100048
1/5/2002	1.37161E+12	7.664E+09	3.46E+10	1.56E+10	4.69E+10	7.73E+09	2.93E+09	1.37E+12	52.2171272028553	0.4531272028553	668369067	2.63E+10	148060786	229119149	8.97E+08		51.704	68	42.14186157
1/6/2002	1.37194E+12	7.661E+09	3.46E+10	1.56E+10	4.69E+10	7.73E+09	2.93E+09	1.37E+12	52.2292090534752	0.4652090534752	668369067	2.63E+10	148006887	229119149	8.97E+08		51.704	68	37.08809701
1/7/2002	1.37226E+12	7.661E+09	3.322E+10	1.34E+10	4.45E+10	7.73E+09	1.84E+09	1.37E+12	52.2392188107874	0.4752188107874	641827851	2.63E+10	148006887	210143981	8.52E+08		51.704	64	32.88670534
1/8/2002	1.37252E+12	7.661E+09	3.46E+10	1.56E+10	4.69E+10	7.73E+09	2.92E+09	1.37E+12	52.2506142321586	0.4866142321586	668369067	2.63E+10	148006887	229119149	8.97E+08		51.704	68	38.9874007
1/9/2002	1.37282E+12	7.661E+09	3.56E+10	1.73E+10	4.88E+10	7.73E+09	3.83E+09	1.37E+12	52.2628804471085	0.4988804471085	687824619	2.63E+10	148006887	243002246	9.31E+08		51.704	71	45.35720485
1/10/2002	1.37314E+12	7.661E+09	3.56E+10	1.73E+10	4.88E+10	7.74E+09	3.82E+09	1.37E+12	52.2747564438258	0.5107564438258	687824619	2.63E+10	148006887	243002246	9.31E+08		51.704	71	47.35986454
1/11/2002	1.37345E+12	7.661E+09	3.46E+10	1.56E+10	4.69E+10	7.74E+09	2.92E+09	1.37E+12	52.2850476417824	0.5210476417824	668369067	2.63E+10	148006887	229119149	8.97E+08		51.704	68	40.09995111
1/12/2002	1.37372E+12	7.664E+09	3.322E+10	1.34E+10	4.45E+10	7.74E+09	1.83E+09	1.37E+12	52.2934777216582	0.5294777216582	641827851	2.63E+10	148060786	210143981	8.52E+08		51.704	64	35.78589119
1/13/2002	1.37394E+12	7.664E+09	3.46E+10	1.56E+10	4.69E+10	7.74E+09	2.91E+09	1.37E+12	52.3030892362247	0.5390892362247	668369067	2.63E+10	148060786	229119149	8.97E+08		51.704	68	37.35191662
1/14/2002	1.3742E+12	7.664E+09	3.46E+10	1.56E+10	4.69E+10	7.74E+09	2.91E+09	1.37E+12	52.3124989732746	0.5484989732746	668369067	2.63E+10	148060786	229119149	8.97E+08		51.704	68	38.45493184
1/15/2002	1.37444E+12	7.661E+09	3.322E+10	1.34E+10	4.46E+10	7.74E+09	1.83E+09	1.37E+12	52.3200048885660	0.5560048885660	641827851	2.63E+10	148006887	210143981	8.52E+08		51.704	64	35.44319146
1/16/2002	1.37464E+12	7.661E+09	3.46E+10	1.56E+10	4.7E+10	7.74E+09	2.91E+09	1.37E+12	52.3288901292911	0.5648901292911	668369067	2.63E+10	148006887	229119149	8.97E+08		51.704	68	41.93953097
1/17/2002	1.37488E+12	7.664E+09	3.322E+10	1.34E+10	4.46E+10	7.75E+09	1.82E+09	1.38E+12	52.3359021386569	0.5719021386569	641827851	2.63E+10	148060786	210143981	8.52E+08		51.704	64	34.49307991
1/18/2002	1.37506E+12	7.667E+09	3.322E+10	1.34E+10	4.46E+10	7.75E+09	1.82E+09	1.38E+12	52.3427021670330	0.5787021670330	641827851	2.63E+10	148114685	210143981	8.52E+08		51.704	64	34.90037646
1/19/2002	1.37524E+12	7.673E+09	3.46E+10	1.56E+10	4.7E+10	7.76E+09	2.90E+09	1.38E+12	52.3508774104472	0.5868774104472	668369067	2.63E+10	148222483	229119149	8.97E+08		51.704	68	38.19607614
1/20/2002	1.37545E+12	7.673E+09	3.322E+10	1.34E+10	4.46E+10	7.76E+09	1.82E+09	1.38E+12	52.3572247863834	0.5932247863834	641827851	2.63E+10	148222483	210143981	8.52E+08		51.704	64	34.55962516
1/21/2002	1.37562E+12	7.673E+09	3.46E+10	1.56E+10	4.7E+10	7.76E+09	2.90E+09	1.38E+12	52.3649486645841	0.6009486645841	668369067	2.63E+10	148222483	229119149	8.97E+08		51.704	68	36.15585061
1/22/2002	1.37582E+12	7.673E+09	3.56E+10	1.73E+10	4.87E+10	7.76E+09	3.80E+09	1.38E+12	52.3735726907618	0.6095726907618	687824619	2.63E+10	148222483	243002246	9.31E+08		51.704	71	45.16687560
1/23/2002	1.37605E+12	7.673E+09	3.741E+10	2.08E+10	5.19E+10	7.76E+09	5.79E+09	1.38E+12	52.3839610060354	0.6199610060354	722772555	2.63E+10	148222483	267958195	9.91E+08		51.704	77	59.23961716
1/24/2002	1.37632E+12	7.678E+09	3.46E+10	1.56E+10	4.7E+10	7.77E+09	2.89E+09	1.38E+12	52.3908513748410	0.6268513748410	668369067	2.63E+10	148330281	229119149	8.97E+08		51.704	68	40.27785708
1/25/2002	1.37656E+12	7.675E+09	3.322E+10	1.34E+10	4.48E+10	7.77E+09	1.81E+09	1.38E+12	52.3959954488738	0.6319954488738	641827851	2.63E+10	148276382	210143981	8.52E+08		51.704	64	32.86164739
1/26/2002	1.37664E+12	7.675E+09	3.46E+10	1.56E+10	4.7E+10	7.77E+09	2.89E+09	1.38E+12	52.4025130324967	0.6385130324967	668369067	2.63E+10	148276382	229119149	8.97E+08		51.704	68	38.12094184
1/27/2002	1.37681E+12	7.675E+09	3.46E+10	1.56E+10	4.7E+10	7.77E+09	2.89E+09	1.38E+12	52.4088280352610	0.6448280352610	668369067	2.63E+10	148276382	229119149	8.97E+08		51.704	68	42.40014874
1/28/2002	1.37698E+12	7.678E+09	3.651E+10	1.92E+10	5.04E+10	7.77E+09	5.01E+09	1.38E+12	52.4170565808091	0.6530565808091	705382654	2.63E+10	148330281	2.56E+08	9.61E+08		51.704	75	52.0776006
1/29/2002	1.37719E+12	7.684E+09	3.741E+10	2.08E+10	5.19E+10	7.78E+09	5.78E+09	1.38E+12	52.4259980202889	0.6619980202889	722772555	2.63E+10	148438080	267958195	9.91E+08		51.704	77	62.41828548
1/30/2002	1.37743E+12	7.692E+09	3.56E+10	1.73E+10	4.88E+10	7.79E+09	3.78E+09	1.38E+12	52.4326699103541	0.6686699103541	687824619	2.63E+10	148599777	243002246	9.31E+08		51.704	71	49.17944738
1/31/2002	1.3776E+12	7.7E+09	3.46E+10	1.56E+10	4.71E+10	7.8E+09	2.88E+09	1.38E+12	52.4380352252633	0.6740352252633	668369067	2.63E+10	148761474	229119149	8.97E+08		51.704	68	36.55953878
2/1/2002	1.37774E+12	7.703E+09	1.606E+10	1.34E+10	2.71E+10	7.8E+09	1.80E+09	1.38E+12	52.4502519418416	0.6862519418416	310290034	2.63E+10	148815373	210143981	5.20E+08		51.704	64	30.36739879
2/2/2002	1.37806E+12	7.703E+09	1.606E+10	1.34E+10	2.73E+10	7.81E+09	1.80E+09	1.38E+12	52.4622551841375	0.6982551841375	310290034	2.63E+10	148815373	210143981	5.20E+08		51.704	64	30.55042093
2/3/2002	1.37838E+12	7.703E+09	1.744E+10	1.56E+10	2.97E+10	7.81E+09	2.87E+09	1.38E+12	52.4755099509773	0.7115099509773	336831250	2.63E+10	148815373	229119149	5.66E+08		51.704	68	39.65859915
2/4/2002	1.37873E+12	7.703E+09	1.744E+10	1.56E+10	2.97E+10	7.81E+09	2.87E+09	1.38E+12	52.4885197150083	0.7245197150083	336831250	2.63E+10	148815373	229119149	5.66E+08		51.704	68	40.10796709
2/5/2002	1.37907E+12	7.709E+09	1.744E+10	1.56E+10	2.97E+10	7.82E+09	2.87E+09	1.38E+12	52.5012860324637	0.7372860324637	336831250	2.63E+10	148923171	229119149	5.66E+08		51.704	68	37.25896960
2/6/2002	1.3794E+12	7.714E+09	1.606E+10	1.34E+10	2.73E+10	7.82E+09	1.79E+09	1.38E+12	52.5123914586947	0.7483914586947	310290034	2.63E+10	149030969	210143981	5.20E+08		51.704	64	32.72678978
2/7/2002	1.37976E+12	7.717E+09	1.606E+10	1.34E+10	2.73E+10	7.83E+09	1.78E+09	1.38E+12	52.5233012030442	0.7593012030442	310290034	2.63E+10	149084869	210143981	5.20E+08		51.704	64	34.23399778
2/8/2002	1.37908E+12	7.723E+09	1.744E+10	1.56E+10	2.97E+10	7.84E+09	2.80E+09	1.38E+12	52.5354166845095	0.7714166845095	336831250	2.63E+10	149192667	229119149	5.66E+08		51.704	68	40.78455452
2/9/2002	1.3803E+12	7.737E+09	1.844E+10	1.73E+10	3.15E+10	7.85E+09	3.70E+09	1.38E+12	52.5483141123340	0.7843141123340	356286802	2.63E+10	149462162	243002246	5.99E+08		51.704	71	44.03985614
2/10/2002	1.38004E+12	7.745E+09	1.744E+10	1.56E+10	2.97E+10	7.86E+09	2.85E+09	1.38E+12	52.5599540213502	0.7959540213502	336831250	2.63E+10	149623859	229119149	5.66E+08		51.704	68	36.04172764
2/11/2002	1.38095E+12	7.742E+09	1.606E+10	1.34E+10	2.74E+10	7.86E+09	1.77E+09	1.38E+12	52.5700174771296	0.8060174771296	310290034	2.63E+10	149569960	210143981	5.20E+08		51.704	64	29.35504801
2/12/2002	1.38121E+12	7.745E+09	1.606E+10	1.34E+10	2.74E+10	7.87E+09	1.77E+09	1.38E+12	52.5799031422365	0.8159031422365	310290034	2.63E+10	149623859	210143981	5.20E+08		51.704	64	33.63358774
2/13/2002	1.38147E+12	7.751E+09	1.744E+10	1.56E+10	2.98E+10	7.87E+09	2.85E+09	1.38E+12	52.5909548364384	0.8269548364384	336831250	2.63E+10	149731658	229119149	5.66E+08		51.704	68	37.02961783

COOLING POND INFORMATION
(Reference 5)

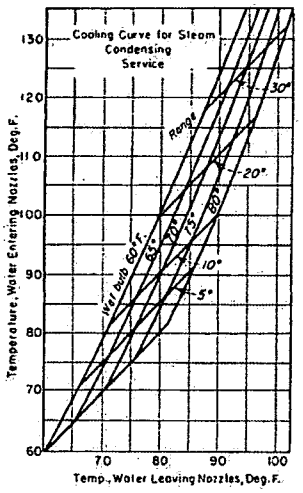


FIG. 12-24 Spray ponds: cooling curves for steam-condensing service.

$$\frac{L}{G} = \frac{(h_2')\text{ air out} - (h_1')\text{ air in}}{\text{water temperature in} - \text{water temperature out}} = 2.05 = \frac{h_2' - 41.58}{10}$$

$h_2' = 61.63$ Btu/lb

Corresponding wet-bulb temperature = 64°F air leaving pond.
Approach possible to air leaving (from Table 12-4) = −2°F.
Water temperature leaving spray pond = 64°F − 2°F = 62°F.
Since leaving-water temperature checks assumption, spray pond is capable of cooling 46,000 gal/min from 102 to 92°F with 75°F wet-bulb temperature and 5-mi/h wind. Total of 1050 spray nozzles required at 42.5 gal/min each, nozzles at 7-lb/in² pressure.

COOLING PONDS

When large ground areas are available, cooling ponds offer a satisfactory method of removing heat from water. A pond may be constructed at a relatively small investment by pushing up an earth dike 1.5 to 3.1 m (6 to 10 ft) high. For a successful pond installation, the soil must be reasonably impervious, and location in a flat area is desirable. Four principal heat-transfer processes are involved in obtaining cooling from an open pond. Heat is lost through evaporation, convection, and radiation and is gained through solar radiation. The required pond area depends on the number of degrees of cooling required and the net heat loss from each square foot of pond surface.

Langhaar [*Chem. Eng.*, 60(S), 194 (1953)] states that under given atmospheric conditions a body of water would eventually come to a temperature at which heat loss would equal heat gain. This temperature is referred to as the equilibrium temperature and is designated as E in Fig. 12-25, a nomograph of cooling-pond performance. The equilibrium temperature is greatly affected by the amount of solar radiation, which is usually not known very accurately and which varies throughout the day. If a pond has at least a 24-h holdup, then daily average weather conditions may be used. For practical purposes, it is recommended that the equilibrium temperature be taken as equal to normal river-water or lake temperature for the specified weather conditions.

In order to cool to the equilibrium temperature, a pond of infinite size would be required for warm water. An approach of 1.7 to 2.2°C (3 to 4°F) is the lowest practicable in a pond of reasonable size. For a pond having more than a 24-h holdup, the leaving-water temperature will vary from the average by plus or minus 1.1°C (2°F) for a 0.9-m (5-ft) depth and 1.7°C (3°F) variation for a 0.9-m (3-ft) depth.

The area of pond required for a given cooling load is almost independent of pond depth. A depth of at least 0.9 m (3 ft) appears advisable to prevent excessive channeling of flow with ponds having irregular bottoms and to avoid large day-to-night changes in outlet temperature.

Factors considered to affect pond performance are air temperature, relative humidity, wind speed, and solar radiation. Items appearing to have only a minor effect include heat transfer between the earth and the pond, changing temperature and humidity of the air as it traverses the water, and rain.

Figure 12-25 provides a rapid method of determining the pond-area requirements for a given cooling duty. D_1 and D_2 are the approaches to equilibrium for the entering and leaving water, °F; V_w is the wind velocity, mi/h; product PQ represents the area of the pond surface, ft²/(gal/min) of flow to the pond. The P factor assumes a pond with uniform flow, without turbulence, and with the water warmer than the air.

Example 16: Calculation of Cooling-Pond Size. Determine the required size of a cooling pond operating at the following conditions:

Relative humidity, percent = 50
Wind velocity, mi/h = 5
Dry-bulb air temperature, °F = 65
Solar heat gain, Btu/(h·ft²) = 100
Water quantity, gal/min = 10,000

TABLE 12-4 Degree Adjustment to Be Applied to Leaving-Air Wet-Bulb Temperature to Find Cooled-Water Temperatures of Spray Ponds*

Cooling range, °F	Entering wet-bulb temp.,† °F	Adjustment, °F. Length of air travel, ft.‡ 100	50	25
10	80	−3	+2	+4
	70	−2	+3	+5
	60	−1.5	+3.5	+5.5
15	80	−5.0	+1	+5
	70	−4.0	+2	+5.5
	60	−3.5	+2.5	+6
20	80	−7	0	+6
	70	−6	+1	+7
	60	−5.5	+1.5	+7.5

Cooled-water temperature = wet-bulb temperature of leaving air plus values shown.
*From "Heating, Ventilating, Air Conditioning Guide," 35th ed., p. 595 American Society of Heating, Refrigerating and Air Conditioning Engineers 1969).
†Wet-bulb temperature of air entering spray-filled volume.
‡Length of air travel through spray-filled volume.

TABLE 12-5 Maximum Expected Solar Radiation at Various North Latitudes*

Btu/(hr.)(sq. ft.)

	24-hr. avg. at north latitude				Noon value at north latitude			
	30°	35°	40°	45°	30°	35°	40°	45°
Jan. 1	65	50	40	30	240	205	170	135
Feb. 1	75	65	55	45	270	240	210	175
Mar. 1	90	80	75	65	305	285	255	230
Apr. 1	110	105	95	90	340	320	300	280
May 1	120	120	120	115	360	350	335	320
June 1	130	130	130	130	365	360	345	335
July 1	130	130	130	130	365	360	350	340
Aug. 1	125	125	125	130	360	350	340	325
Sept. 1	115	110	105	100	350	335	315	300
Oct. 1	100	90	80	75	315	295	270	245
Nov. 1	80	70	60	50	270	245	215	185
Dec. 1	65	55	45	35	240	210	175	140

*Langhaar, *Chem. Eng.*, 60 S), 194 (1953).

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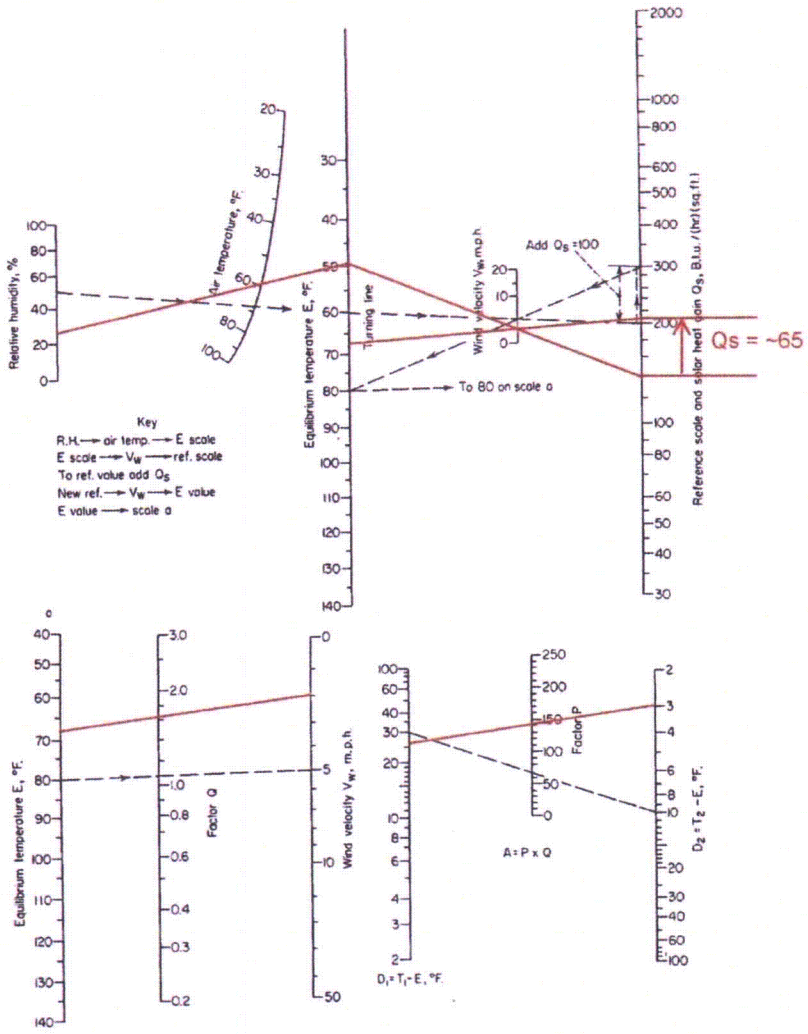

FIG. 12-25 Nomograph for determining cooling-pond performance and size. *Langhar*, Chem. Eng., *60* S. *194* (*1953*).

A = P x Q, 145 x 1.6 = 232 ft^2/gpm

232 ft^2 / gpm x 22312 gpm = 5176384 ft^2

5176384 ft^2 / 43560 acre / ft^2 = 118.83 acres

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Water inlet, °F = 110
Water outlet, °F = 90

From the nomograph, $F = 98$ and $Q = 1.07$, giving an area required of 73 ft²/(gal/min). Area for 10,000 gal/min is thus 730,000 ft², or 17 acres.

With a depth of 5 ft, total volume of the pond would amount to a 45-h holdup, which is more than the 24-h holdup required to maintain a fairly constant discharge temperature throughout the day.

Table 12-5 presents typical values of solar radiation on a horizontal surface, Btu/(h·ft²), based on analysis of Weather Bureau records for a number of stations throughout the United States. These are clear-day values, rarely exceeded even in the high/arid regions. The normal of actual average monthly values are only 50 to 60 percent of the tabulated figures for most of the eastern United States and 80 to 90 percent in the arid southwest. Also, the solar radiation should be multiplied by the absorption coefficient for the pond, which appears to exceed 95 percent.

SOLIDS-DRYING FUNDAMENTALS*

GENERAL REFERENCES: Cook and DuMont, *Process Drying Practice*, McGraw-Hill, 1991. *Drying Technology—An International Journal*, Marcel Dekker, N.Y., 1982. Hall, *Dictionary of Drying*, Marcel Dekker, N.Y., 1979. Keey, *Introduction to Industrial Drying Operations*, Pergamon, N.Y., 1978. Masters, *Spray Drying Handbook*, Wiley, N.Y., 1991. Mujumdar, *Handbook of Industrial Drying*, Marcel Dekker, N.Y., 1987. Nonhebel and Moss, *Drying of Solids in the Chemical Industry*, CRC Press, Ohio, 1971. Van't Land, *Industrial Drying Equipment*, Marcel Dekker, N.Y., 1991.

INTRODUCTION

The material on solids drying is divided into two subsections, "Solids-Drying Fundamentals," and "Solids-Drying Equipment." In this introductory part some elementary definitions are given. In solids-gas contacting equipment, the solids bed can exist in any of the following four conditions.

Static This is a dense bed of solids in which each particle rests upon another at essentially the settled bulk density of the solids phase. Specifically, *there is no relative motion among solids particles* (Fig. 12-26).

Moving This is a slightly expanded bed of solids in which the particles are separated only enough to flow one over another. Usually the flow is downward under the force of gravity, but upward motion by mechanical lifting or agitation may also occur within the process vessel. In some cases, lifting of the solids is accomplished in separate equipment, and solids flow in the presence of the gas phase is downward only. The latter is a moving bed as usually defined in the petroleum industry. In this definition, *solids motion is achieved by either mechanical agitation or gravity force* (Fig. 12-27).

Fluidized This is an expanded condition in which the solids particles are supported by drag forces caused by the gas phase passing through the interstices among the particles at some critical velocity. It is an unstable condition in that the superficial gas velocity upward is less than the terminal settling velocity of the solids particles; the gas velocity is not sufficient to entrain and convey continuously all the solids. At the same time, there exist within the stream of gas, eddies traveling at high enough velocities to lift the particles temporarily. Particle motion is continually upward and falling back. Specifically, the solids phase and the gas phase are intermixed and *together behave like a boiling fluid* (Fig. 12-28).

Dilute This is a fully expanded condition in which the solids particles are so widely separated that they exert essentially no influence upon each other. Specifically, the solids phase is so fully dispersed in the gas that *the density of the suspension is essentially that of the gas phase alone* (Fig. 12-29). Commonly this situation exists when the gas velocity at all points in the system exceeds the terminal settling velocity of the solids and the particles can be lifted and continuously conveyed by the gas; however, this is not always true. Gravity settling chambers such as pulling towers and countercurrent-flow spray dryers are two exceptions in which gas velocity is insufficient to entrain the solids completely.

Gas-Solids Contacting Terms used in this section to describe the method by which gas may contact a bed of solids are the following:

1. *Parallel flow.* The direction of gas flow is parallel to the surface of the solids phase. Contacting is primarily at the interface between phases, with possibly some penetration of gas into the voids among the solids near the surface. The solids bed is usually in a static condition (Fig. 12-30).

FIG. 12-26 Solids bed in static condition (tray dryer).

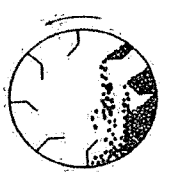

FIG. 12-27 Moving solids bed in a rotary dryer with lifters.

FIG. 12-28 Fluidized solids bed.

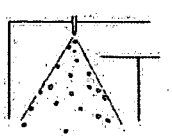

FIG. 12-29 Solids in a dilute condition near the top of a spray dryer.

* The contribution of George A. Sibum, E. I. du Pont de Nemours & Co., to material that was used from the sixth edition is acknowledged. (Solids Drying)

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BIN INFORMATION
(Reference 1)

Dec	wet bulb (°F)	discharge temp (°F)	discharge flow per Unit (gpm)	intake flow per Unit (gpm)	other intake flow (gpm)	U3 & 4 discharge flow (gpm)	U3 & 4 discharge mass flow (lbm/day)	U3 & U4 intake flow (gpm)	total intake flow (gpm)	total intake mass flow (lbm/day)
Bin 8	58	77	11156	27085	32019.3865	22312	2.68E-08	54170	86189.38646	1.04E-09
Bin 9	52	75	10640	25845	32019.3865	21280	2.56E-08	51690	83709.38646	1.01E-09
Bin 10	46	71	10117	24591	32019.3865	20234	2.43E-08	49182	81201.38646	9.75E-08
Bin 11	40	68	9539	23203	32019.3865	19078	2.29E-08	46406	78425.38646	9.42E-08
Bin 12	34	65	8986	21877	32019.3865	17972	2.16E-08	43754	75773.38646	9.10E-08
Bin 13	32	64	8749	21308	32019.3865	17498	2.10E-08	42616	74635.38646	8.96E-08
Jan										
Bin 8	58	77	11156	27085	28324.8999	22312	2.68E-08	54170	82494.89989	9.91E-08
Bin 9	52	75	10640	25845	28324.8999	21280	2.56E-08	51690	80014.89989	9.61E-08
Bin 10	46	71	10117	24591	28324.8999	20234	2.43E-08	49182	77506.89989	9.31E-08
Bin 11	40	68	9539	23203	28324.8999	19078	2.29E-08	46406	74730.89989	8.97E-08
Bin 12	34	65	8986	21877	28324.8999	17972	2.16E-08	43754	72078.89989	8.66E-08
Bin 13	32	64	8749	21308	28324.8999	17498	2.10E-08	42616	70940.89989	8.52E-08
Feb										
Bin 8	58	77	11156	27085	718.83334	22312	2.68E-08	54170	54888.83334	6.59E-08
Bin 9	52	75	10640	25845	718.83334	21280	2.56E-08	51690	52408.83334	6.29E-08
Bin 10	46	71	10117	24591	718.83334	20234	2.43E-08	49182	49900.83334	5.99E-08
Bin 11	40	68	9539	23203	718.83334	19078	2.29E-08	46406	47124.83334	5.66E-08
Bin 12	34	65	8986	21877	718.83334	17972	2.16E-08	43754	44472.83334	5.34E-08
Bin 13	32	64	8749	21308	718.83334	17498	2.10E-08	42616	43334.83334	5.20E-08

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	11	1	48.02	39.7414766		
2001	12	11	2	46.04	39.0879985		
2001	12	11	3	44.96	38.5084443		
2001	12	11	4	42.98	37.4319376		
2001	12	11	5	41	36.3370491		
2001	12	11	6	39.92	36.0979503		
2001	12	11	7	41	36.6996181		
2001	12	11	8	39.02	35.5922987		
2001	12	11	9	37.94	34.9803588		
2001	12	11	10	39.02	35.5922987		
2001	12	11	11	37.94	34.9803588		
2001	12	11	12	39.92	36.0979503		
2001	12	11	13	41	37.151072		
2001	12	11	14	41	37.151072		
2001	12	11	15	42.98	38.9839133		
2001	12	11	16	42.08	40.1515586		
2001	12	11	17	42.08	41.0474107		
2001	12	11	18	42.98	42.0162294		
2001	12	11	19	44.96	43.9633904		
2001	12	11	20	44.96	44.5008883		
2001	12	11	21	46.04	45.4805862		
2001	12	11	22	46.94	46.4661008		
2001	12	11	23	48.02	47.4429532		
2001	12	11	24	46.94	46.94	952.4429	39.68512
2001	12	12	1	46.94	46.4661008		
2001	12	12	2	46.94	46.94		
2001	12	12	3	48.02	47.4429532		
2001	12	12	4	48.02	47.4429532		
2001	12	12	5	48.02	48.02		
2001	12	12	6	48.92	48.92		
2001	12	12	7	48.92	48.92		
2001	12	12	8	50	50		
2001	12	12	9	50	50		
2001	12	12	10	50	50		
2001	12	12	11	51.08	51.08		
2001	12	12	12	51.98	51.4693368		
2001	12	12	13	51.98	51.98		
2001	12	12	14	51.98	51.98		
2001	12	12	15	53.06	53.06		
2001	12	12	16	53.96	53.96		
2001	12	12	17	55.94	55.94		
2001	12	12	18	57.92	56.188185		
2001	12	12	19	57.92	54.4579185		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	12	20	60.98	53.6569405		
2001	12	12	21	62.96	53.9675641		
2001	12	12	22	62.96	53.9675641		
2001	12	12	23	62.96	53.06314		
2001	12	12	24	55.94	50.0427753	1228.975	51.20731
2001	12	13	1	55.04	44.4377008		
2001	12	13	2	53.06	42.7278978		
2001	12	13	3	51.08	42.0555742		
2001	12	13	4	48.02	40.9029544		
2001	12	13	5	46.94	40.3402492		
2001	12	13	6	44.96	39.6928797		
2001	12	13	7	39.92	37.3255343		
2001	12	13	8	39.02	36.4702663		
2001	12	13	9	39.02	36.4702663		
2001	12	13	10	39.02	37.2730675		
2001	12	13	11	37.94	36.676902		
2001	12	13	12	37.94	37.0607235		
2001	12	13	13	39.92	38.1430127		
2001	12	13	14	39.92	38.1430127		
2001	12	13	15	39.92	37.7656923		
2001	12	13	16	39.92	37.7656923		
2001	12	13	17	39.92	38.6086088		
2001	12	13	18	39.92	39.0074214		
2001	12	13	19	39.92	39.0074214		
2001	12	13	20	42.98	40.6221217		
2001	12	13	21	44.06	41.1820768		
2001	12	13	22	44.06	40.3478349		
2001	12	13	23	42.98	39.780131		
2001	12	13	24	42.08	39.7600737	941.5671	39.23196
2001	12	14	1	39.02	37.2730675		
2001	12	14	2	37.94	36.2291524		
2001	12	14	3	35.96	34.7452334		
2001	12	14	4	33.98	33.1674057		
2001	12	14	5	33.08	32.1557166		
2001	12	14	6	35.06	34.2292343		
2001	12	14	7	32	31.537664		
2001	12	14	8	30.92	30.5169255		
2001	12	14	9	28.94	28.1082289		
2001	12	14	10	30.02	29.5475892		
2001	12	14	11	30.92	30.5169255		
2001	12	14	12	28.04	27.5896021		
2001	12	14	13	28.94	28.5552937		
2001	12	14	14	28.94	28.5552937		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	14	15	33.08	33.08		
2001	12	14	16	37.04	36.1758824		
2001	12	14	17	46.94	42.6505121		
2001	12	14	18	51.98	44.7762103		
2001	12	14	19	57.92	46.8683687		
2001	12	14	20	60.98	45.9447598		
2001	12	14	21	60.98	45.6154206		
2001	12	14	22	60.98	46.2293946		
2001	12	14	23	57.92	45.8285317		
2001	12	14	24	51.98	42.922648	872.8191	36.36746
2001	12	15	1	51.08	42.4695546		
2001	12	15	2	48.92	41.752454		
2001	12	15	3	46.94	40.7313288		
2001	12	15	4	46.04	41.0171964		
2001	12	15	5	44.06	40.7971704		
2001	12	15	6	44.96	41.2628488		
2001	12	15	7	44.06	40.7971704		
2001	12	15	8	42.98	40.2336435		
2001	12	15	9	42.98	40.6221217		
2001	12	15	10	42.98	40.6221217		
2001	12	15	11	42.98	40.6221217		
2001	12	15	12	44.06	41.656685		
2001	12	15	13	44.96	42.5189284		
2001	12	15	14	46.04	43.0615959		
2001	12	15	15	48.02	44.0437802		
2001	12	15	16	48.92	45.8820201		
2001	12	15	17	51.08	46.0018159		
2001	12	15	18	50	46.9097761		
2001	12	15	19	50	47.8914289		
2001	12	15	20	48.92	48.4314941		
2001	12	15	21	50	49.4055521		
2001	12	15	22	50	49.4055521		
2001	12	15	23	50	50		
2001	12	16	0	50	50	1056.136	44.00568
2001	12	16	1	50	50		
2001	12	16	2	51.08	50.4761694		
2001	12	16	3	51.08	51.08		
2001	12	16	4	51.08	51.08		
2001	12	16	5	51.98	51.98		
2001	12	16	6	53.06	52.4391857		
2001	12	16	7	51.98	51.98		
2001	12	16	8	51.98	51.98		
2001	12	16	9	53.06	52.4391857		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	16	10	53.96	53.96		
2001	12	16	11	55.94	55.4015376		
2001	12	16	12	55.04	54.4025064		
2001	12	16	13	57.02	56.3661548		
2001	12	16	14	57.02	57.02		
2001	12	16	15	57.02	57.02		
2001	12	16	16	57.02	56.3661548		
2001	12	16	17	55.04	54.4025064		
2001	12	16	18	55.04	54.4025064		
2001	12	16	19	55.04	54.4025064		
2001	12	16	20	53.96	53.4353048		
2001	12	16	21	55.04	53.8821935		
2001	12	16	22	55.94	54.2517349		
2001	12	16	23	55.04	53.2709261		
2001	12	16	24	53.96	53.4353048	1285.474	53.56141
2001	12	17	1	53.96	52.8188577		
2001	12	17	2	53.06	51.9328714		
2001	12	17	3	51.98	50.284787		
2001	12	17	4	50	49.4055521		
2001	12	17	5	48.92	48.4314941		
2001	12	17	6	48.02	47.4429532		
2001	12	17	7	46.94	45.9108555		
2001	12	17	8	46.04	45.0256022		
2001	12	17	9	46.04	44.4929522		
2001	12	17	10	46.04	43.5537733		
2001	12	17	11	44.06	42.0529177		
2001	12	17	12	42.08	39.7600737		
2001	12	17	13	39.92	38.1430127		
2001	12	17	14	39.92	37.7656923		
2001	12	17	15	42.08	39.3030453		
2001	12	17	16	46.04	41.8169971		
2001	12	17	17	48.92	42.8391321		
2001	12	17	18	51.98	44.3560997		
2001	12	17	19	53.96	45.3171226		
2001	12	17	20	55.94	45.2382354		
2001	12	17	21	57.92	46.490647		
2001	12	17	22	59	46.6946745		
2001	12	17	23	57.92	46.490647		
2001	12	17	24	51.98	44.0157068	1079.594	44.98307
2001	12	18	1	48.02	42.0334664		
2001	12	18	2	44.96	40.8169591		
2001	12	18	3	44.06	39.9837116		
2001	12	18	4	42.98	39.780131		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	18	5	41	38.7256971		
2001	12	18	6	39.92	37.7656923		
2001	12	18	7	37.04	35.7246362		
2001	12	18	8	39.92	37.7656923		
2001	12	18	9	39.02	37.2730675		
2001	12	18	10	37.04	36.1758824		
2001	12	18	11	35.06	34.6009614		
2001	12	18	12	33.08	32.1557166		
2001	12	18	13	35.06	34.2292343		
2001	12	18	14	35.96	35.1140772		
2001	12	18	15	39.92	37.7656923		
2001	12	18	16	44.96	41.6448092		
2001	12	18	17	53.96	46.0843237		
2001	12	18	18	62.06	49.8057779		
2001	12	18	19	64.94	50.0639635		
2001	12	18	20	68	51.6991398		
2001	12	18	21	68	51.0529316		
2001	12	18	22	66.92	51.233675		
2001	12	18	23	64.94	50.7472773		
2001	12	18	24	59	48.4288836	1000.671	41.69464
2001	12	19	1	57.02	47.9450865		
2001	12	19	2	53.06	46.0951549		
2001	12	19	3	50	44.6234648		
2001	12	19	4	53.96	44.5919137		
2001	12	19	5	51.08	43.5709862		
2001	12	19	6	48.92	41.3679468		
2001	12	19	7	48.92	41.3679468		
2001	12	19	8	46.04	39.8673624		
2001	12	19	9	44.06	38.8141593		
2001	12	19	10	44.06	38.374482		
2001	12	19	11	42.08	37.2957552		
2001	12	19	12	39.92	36.5536425		
2001	12	19	13	39.02	36.0515549		
2001	12	19	14	39.02	36.4702663		
2001	12	19	15	41	37.5626765		
2001	12	19	16	44.06	38.8141593		
2001	12	19	17	46.94	39.9113381		
2001	12	19	18	48.92	40.6076231		
2001	12	19	19	51.08	41.3381199		
2001	12	19	20	53.06	41.6928003		
2001	12	19	21	53.96	41.5465468		
2001	12	19	22	53.96	41.5465468		
2001	12	19	23	51.98	40.8517116		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	19	24	48.02	38.4188535	975.2801	40.63667
2001	12	20	1	44.06	36.9029639		
2001	12	20	2	44.96	36.4629446		
2001	12	20	3	39.02	34.055112		
2001	12	20	4	37.94	33.106302		
2001	12	20	5	35.96	32.2651979		
2001	12	20	6	35.96	32.6734665		
2001	12	20	7	33.08	31.0091575		
2001	12	20	8	30.92	29.2321615		
2001	12	20	9	30.92	29.2321615		
2001	12	20	10	30.92	29.6701719		
2001	12	20	11	28.94	28.1082289		
2001	12	20	12	28.94	27.7484597		
2001	12	20	13	32	30.7332181		
2001	12	20	14	33.08	31.7802191		
2001	12	20	15	35.96	33.8436971		
2001	12	20	16	42.98	37.7883489		
2001	12	20	17	50	41.5034574		
2001	12	20	18	55.94	44.4786645		
2001	12	20	19	60.08	46.1581191		
2001	12	20	20	64.04	48.0062904		
2001	12	20	21	64.94	48.7139118		
2001	12	20	22	64.94	48.4179672		
2001	12	20	23	62.96	47.1599101		
2001	12	20	24	53.96	43.5034506	882.5536	36.77307
2001	12	21	1	51.98	42.5118279		
2001	12	21	2	50	41.5034574		
2001	12	21	3	48.02	40.4780006		
2001	12	21	4	44.96	38.8588129		
2001	12	21	5	42.08	37.2957552		
2001	12	21	6	41	37.9157949		
2001	12	21	7	39.02	36.4702663		
2001	12	21	8	39.92	36.9691073		
2001	12	21	9	39.02	36.0515549		
2001	12	21	10	35.96	34.3152852		
2001	12	21	11	35.06	31.430612		
2001	12	21	12	35.06	33.3206472		
2001	12	21	13	35.06	33.3206472		
2001	12	21	14	35.06	33.3206472		
2001	12	21	15	39.92	36.0979503		
2001	12	21	16	46.04	39.4351203		
2001	12	21	17	51.08	42.0555742		
2001	12	21	18	57.02	45.0038044		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	21	19	57.92	45.4378081		
2001	12	21	20	62.06	47.3928424		
2001	12	21	21	62.96	47.5082338		
2001	12	21	22	62.96	47.5082338		
2001	12	21	23	60.08	46.1581191		
2001	12	21	24	57.02	44.6877056	955.0478	39.79366
2001	12	22	1	57.92	45.1240921		
2001	12	22	2	57.02	44.6877056		
2001	12	22	3	55.94	44.4786645		
2001	12	22	4	55.94	43.7902509		
2001	12	22	5	55.94	44.1596747		
2001	12	22	6	57.02	54.089844		
2001	12	22	7	59	54.896227		
2001	12	22	8	60.08	55.9188427		
2001	12	22	9	60.98	55.6903573		
2001	12	22	10	60.98	56.2742914		
2001	12	22	11	59	54.896227		
2001	12	22	12	55.94	53.1497494		
2001	12	22	13	53.96	51.7259831		
2001	12	22	14	50	48.9213183		
2001	12	22	15	57.02	51.4665351		
2001	12	22	16	59	48.8476954		
2001	12	22	17	60.98	46.2293946		
2001	12	22	18	62.06	46.4567637		
2001	12	22	19	62.96	46.5559981		
2001	12	22	20	62.96	46.5559981		
2001	12	22	21	62.96	47.1599101		
2001	12	22	22	62.06	47.0897798		
2001	12	22	23	59	45.9543244		
2001	12	22	24	53.06	43.0547675	1177.174	49.04893
2001	12	23	1	50	41.5034574		
2001	12	23	2	46.94	39.5668955		
2001	12	23	3	42.98	37.4319376		
2001	12	23	4	42.98	37.4319376		
2001	12	23	5	41	36.3370491		
2001	12	23	6	37.94	34.1767887		
2001	12	23	7	37.04	33.3067446		
2001	12	23	8	37.04	33.3067446		
2001	12	23	9	33.98	31.5236595		
2001	12	23	10	33.08	31.0091575		
2001	12	23	11	32	30.3855404		
2001	12	23	12	30.02	28.7241711		
2001	12	23	13	32	29.9827441		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	23	14	30.92	28.8796746		
2001	12	23	15	35.96	32.6734665		
2001	12	23	16	44.96	35.2855118		
2001	12	23	17	48.02	36.513957		
2001	12	23	18	48.92	37.77323		
2001	12	23	19	50	38.5993244		
2001	12	23	20	51.08	39.1782844		
2001	12	23	21	51.98	39.6566795		
2001	12	23	22	51.98	39.4212432		
2001	12	23	23	50	37.8619766		
2001	12	23	24	44.06	35.0652481	845.5964	35.23318
2001	12	24	1	41	32.2657756		
2001	12	24	2	37.94	30.2567769		
2001	12	24	3	35.06	28.8117294		
2001	12	24	4	35.96	28.4293846		
2001	12	24	5	30.92	25.4082765		
2001	12	24	6	30.92	25.6404659		
2001	12	24	7	28.94	24.2057178		
2001	12	24	8	28.04	24.4474545		
2001	12	24	9	28.04	24.4474545		
2001	12	24	10	28.04	24.4474545		
2001	12	24	11	26.96	24.3930055		
2001	12	24	12	28.04	26.0764562		
2001	12	24	13	26.96	25.0506924		
2001	12	24	14	28.94	26.6090371		
2001	12	24	15	33.08	29.6217205		
2001	12	24	16	35.06	30.7753174		
2001	12	24	17	39.92	33.5951162		
2001	12	24	18	44.96	33.5147944		
2001	12	24	19	44.96	32.8272013		
2001	12	24	20	46.94	34.305946		
2001	12	24	21	48.02	35.4425781		
2001	12	24	22	46.94	35.2645953		
2001	12	24	23	44.06	35.3174227		
2001	12	24	24	41	33.5603533	704.7147	29.36311
2001	12	25	1	37.94	31.7700379		
2001	12	25	2	37.94	31.7700379		
2001	12	25	3	37.94	32.0883523		
2001	12	25	4	37.94	32.434176		
2001	12	25	5	37.04	31.9060192		
2001	12	25	6	37.04	30.708392		
2001	12	25	7	35.96	30.0811171		
2001	12	25	8	35.96	29.842503		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	25	9	33.08	28.946438		
2001	12	25	10	32	27.7217069		
2001	12	25	11	28.94	25.592111		
2001	12	25	12	28.04	25.0501052		
2001	12	25	13	28.94	25.592111		
2001	12	25	14	28.04	25.3988146		
2001	12	25	15	32	28.982702		
2001	12	25	16	37.04	31.9060192		
2001	12	25	17	42.98	33.1796043		
2001	12	25	18	46.94	34.6583104		
2001	12	25	19	48.92	36.3784467		
2001	12	25	20	53.06	39.9926623		
2001	12	25	21	53.96	41.8711518		
2001	12	25	22	55.04	42.0984035		
2001	12	25	23	53.96	41.5465468		
2001	12	25	24	48.92	39.535144	779.0509	32.46045
2001	12	26	1	44.96	37.7763238		
2001	12	26	2	42.08	36.1859654		
2001	12	26	3	44.96	37.3987		
2001	12	26	4	42.08	34.5057541		
2001	12	26	5	37.94	31.5175384		
2001	12	26	6	35.96	30.6354232		
2001	12	26	7	33.08	28.6810505		
2001	12	26	8	33.08	28.1287924		
2001	12	26	9	28.94	25.3149675		
2001	12	26	10	30.02	25.9617827		
2001	12	26	11	26.96	24.1102047		
2001	12	26	12	28.04	24.7704002		
2001	12	26	13	26.96	24.1102047		
2001	12	26	14	28.04	25.0501052		
2001	12	26	15	33.08	28.946438		
2001	12	26	16	37.04	30.708392		
2001	12	26	17	39.92	32.3660107		
2001	12	26	18	44.06	35.0652481		
2001	12	26	19	46.94	36.683594		
2001	12	26	20	48.92	38.0149832		
2001	12	26	21	50	38.5993244		
2001	12	26	22	51.08	39.1782844		
2001	12	26	23	50	38.5993244		
2001	12	26	24	46.04	36.4300234	768.7398	32.03083
2001	12	27	1	42.98	34.7025368		
2001	12	27	2	41	33.5603533		
2001	12	27	3	37.04	31.5751879		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	27	4	33.08	29.6217205		
2001	12	27	5	33.08	29.6217205		
2001	12	27	6	32	28.982702		
2001	12	27	7	30.92	27.763282		
2001	12	27	8	28.94	26.6090371		
2001	12	27	9	28.94	26.6090371		
2001	12	27	10	28.04	26.0764562		
2001	12	27	11	28.94	26.6090371		
2001	12	27	12	30.02	27.2415804		
2001	12	27	13	30.92	27.763282		
2001	12	27	14	26.06	24.5035498		
2001	12	27	15	37.94	33.4287123		
2001	12	27	16	42.08	36.1859654		
2001	12	27	17	48.02	39.7414766		
2001	12	27	18	51.98	42.181939		
2001	12	27	19	55.04	43.7159724		
2001	12	27	20	57.02	45.0038044		
2001	12	27	21	57.92	45.4378081		
2001	12	27	22	59	45.643436		
2001	12	27	23	55.04	44.037398		
2001	12	27	24	51.98	42.5118279	819.1278	34.13033
2001	12	28	1	51.98	42.5118279		
2001	12	28	2	50	41.5034574		
2001	12	28	3	48.02	40.4780006		
2001	12	28	4	48.02	40.9029544		
2001	12	28	5	46.94	40.3402492		
2001	12	28	6	46.04	41.0171964		
2001	12	28	7	44.96	39.2950925		
2001	12	28	8	42.08	35.9365592		
2001	12	28	9	39.02	35.2234587		
2001	12	28	10	37.04	34.0908548		
2001	12	28	11	35.96	33.4649485		
2001	12	28	12	35.06	32.9389355		
2001	12	28	13	33.98	31.8643611		
2001	12	28	14	32	30.7332181		
2001	12	28	15	37.04	34.0908548		
2001	12	28	16	41	36.3370491		
2001	12	28	17	46.04	39.4351203		
2001	12	28	18	51.08	41.7231425		
2001	12	28	19	55.94	44.4786645		
2001	12	28	20	59	45.643436		
2001	12	28	21	59	45.643436		
2001	12	28	22	60.08	46.8499547		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	28	23	59	45.643435		
2001	12	28	24	55.04	44.037398	945.1836	39.38265
2001	12	29	1	53.06	43.0547675		
2001	12	29	2	51.08	42.0555742		
2001	12	29	3	44.96	38.8568129		
2001	12	29	4	44.06	38.8141593		
2001	12	29	5	42.98	38.2321432		
2001	12	29	6	42.08	38.1507967		
2001	12	29	7	37.04	34.933275		
2001	12	29	8	35.06	32.9389355		
2001	12	29	9	42.98	37.7883489		
2001	12	29	10	42.98	35.0200334		
2001	12	29	11	41	33.5603533		
2001	12	29	12	39.02	32.7272529		
2001	12	29	13	35.06	29.8535056		
2001	12	29	14	32	28.2999378		
2001	12	29	15	32	28.0316134		
2001	12	29	16	35.06	29.8535056		
2001	12	29	17	35.06	29.5531264		
2001	12	29	18	37.04	30.4724055		
2001	12	29	19	37.94	30.7222412		
2001	12	29	20	39.92	31.8543923		
2001	12	29	21	39.92	31.3983027		
2001	12	29	22	39.92	31.2027641		
2001	12	29	23	39.02	30.8822711		
2001	12	29	24	37.94	30.5060675	808.7646	33.69852
2001	12	30	1	35.96	29.346517		
2001	12	30	2	35.96	28.8884693		
2001	12	30	3	35.06	28.8117294		
2001	12	30	4	33.98	28.3886667		
2001	12	30	5	33.98	28.3886667		
2001	12	30	6	32	27.1865217		
2001	12	30	7	30.92	26.1817167		
2001	12	30	8	30.02	25.3916662		
2001	12	30	9	28.04	24.4474545		
2001	12	30	10	28.04	24.1886321		
2001	12	30	11	28.04	24.4474545		
2001	12	30	12	28.94	24.7385164		
2001	12	30	13	28.94	24.9949752		
2001	12	30	14	30.02	25.0990443		
2001	12	30	15	30.92	25.9304035		
2001	12	30	16	32	26.6919566		
2001	12	30	17	33.98	27.9039548		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2001	12	30	18	35.96	29.346517		
2001	12	30	19	39.02	31.3426004		
2001	12	30	20	37.94	30.7222412		
2001	12	30	21	37.04	30.2000579		
2001	12	30	22	35.96	29.346517		
2001	12	30	23	35.96	29.346517		
2001	12	30	24	33.98	27.9039548	659.2348	27.46811
2001	12	31	1	33.08	27.1463074		
2001	12	31	2	33.08	27.3560207		
2001	12	31	3	32	26.6919566		
2001	12	31	4	30.92	27.1054066		
2001	12	31	5	30.02	27.2415804		
2001	12	31	6	28.94	26.6090371		
2001	12	31	7	28.94	26.2366133		
2001	12	31	8	28.94	26.6090371		
2001	12	31	9	28.04	26.0764562		
2001	12	31	10	28.04	26.0764562		
2001	12	31	11	28.04	26.0764562		
2001	12	31	12	28.04	25.7005764		
2001	12	31	13	28.04	25.7005764		
2001	12	31	14	28.04	25.3988146		
2001	12	31	15	28.94	25.9376226		
2001	12	31	16	30.02	26.2358753		
2001	12	31	17	30.92	26.1817167		
2001	12	31	18	32	27.1865217		
2001	12	31	19	35.06	29.0343764		
2001	12	31	20	37.04	29.9818787		
2001	12	31	21	37.94	30.5060675		
2001	12	31	22	37.04	29.9818787		
2001	12	31	23	35.96	29.0921158		
2001	12	31	24	33.98	27.6961517	651.8595	27.16081
2002	1	1	1	33.08	27.1463074		
2002	1	1	2	30.92	26.7668511		
2002	1	1	3	32	26.9568284		
2002	1	1	4	30.92	27.3983715		
2002	1	1	5	32	28.982702		
2002	1	1	6	32	28.2999378		
2002	1	1	7	33.08	28.6810505		
2002	1	1	8	33.08	28.3745332		
2002	1	1	9	32	27.4732511		
2002	1	1	10	32	27.1865217		
2002	1	1	11	30.92	26.4952811		
2002	1	1	12	30.92	26.7668511		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	1	13	30.92	26.7668511		
2002	1	1	14	32	27.4732511		
2002	1	1	15	32	27.4732511		
2002	1	1	16	33.98	28.3886667		
2002	1	1	17	37.04	29.9818787		
2002	1	1	18	35.96	29.346517		
2002	1	1	19	37.94	30.5060675		
2002	1	1	20	39.02	31.3426004		
2002	1	1	21	42.08	33.395894		
2002	1	1	22	39.92	31.6425728		
2002	1	1	23	39.02	31.3426004		
2002	1	1	24	35.96	28.8884693	687.0771	28.62821
2002	1	2	1	35.06	28.5549767		
2002	1	2	2	35.06	29.0343764		
2002	1	2	3	33.98	28.6696764		
2002	1	2	4	33.98	28.6696764		
2002	1	2	5	32	27.7217069		
2002	1	2	6	30.92	26.1817167		
2002	1	2	7	28.04	24.7704002		
2002	1	2	8	28.94	25.3149675		
2002	1	2	9	28.94	24.9949752		
2002	1	2	10	28.04	24.1886321		
2002	1	2	11	26.06	22.9608294		
2002	1	2	12	26.06	22.9608294		
2002	1	2	13	24.98	22.547531		
2002	1	2	14	28.04	24.4474545		
2002	1	2	15	28.94	24.9949752		
2002	1	2	16	33.08	28.1287924		
2002	1	2	17	33.98	29.8075717		
2002	1	2	18	35.06	31.7445309		
2002	1	2	19	33.98	31.1289432		
2002	1	2	20	30.92	30.0479526		
2002	1	2	21	30.92	28.8796746		
2002	1	2	22	30.02	26.5775788		
2002	1	2	23	30.02	25.9617827		
2002	1	2	24	26.06	23.2249019	641.5145	26.72977
2002	1	3	1	26.06	23.5544096		
2002	1	3	2	23	21.2862036		
2002	1	3	3	24.08	21.9773365		
2002	1	3	4	21.92	20.3122667		
2002	1	3	5	21.02	19.4014463		
2002	1	3	6	19.94	18.4232554		
2002	1	3	7	19.04	17.5146339		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	3	8	15.98	14.8570564		
2002	1	3	9	19.04	17.5146339		
2002	1	3	10	15.98	15.104271		
2002	1	3	11	15.98	15.104271		
2002	1	3	12	17.06	16.1540151		
2002	1	3	13	17.96	17.0801431		
2002	1	3	14	17.96	17.3443205		
2002	1	3	15	21.02	19.9994572		
2002	1	3	16	26.06	23.8398075		
2002	1	3	17	30.02	25.9617827		
2002	1	3	18	33.08	27.8451935		
2002	1	3	19	35.96	29.842503		
2002	1	3	20	39.02	31.6094664		
2002	1	3	21	41	33.0024906		
2002	1	3	22	41	33.0024906		
2002	1	3	23	39.92	32.3660107		
2002	1	3	24	35.96	30.3787402	543.4862	22.64526
2002	1	4	1	33.08	28.3745332		
2002	1	4	2	30.92	26.7668511		
2002	1	4	3	30.92	26.7668511		
2002	1	4	4	30.02	26.2358753		
2002	1	4	5	28.94	26.2366133		
2002	1	4	6	26.96	24.3930055		
2002	1	4	7	26.96	24.3930055		
2002	1	4	8	26.96	24.3930055		
2002	1	4	9	26.96	24.3930055		
2002	1	4	10	26.96	24.3930055		
2002	1	4	11	26.06	24.1956261		
2002	1	4	12	26.06	24.1956261		
2002	1	4	13	26.96	24.7455804		
2002	1	4	14	28.94	26.2366133		
2002	1	4	15	32	28.634354		
2002	1	4	16	37.94	32.434176		
2002	1	4	17	42.08	34.8393668		
2002	1	4	18	42.98	35.6375194		
2002	1	4	19	44.96	37.3987		
2002	1	4	20	48.02	39.4236909		
2002	1	4	21	50	41.1679421		
2002	1	4	22	50	41.5034574		
2002	1	4	23	50	41.9212705		
2002	1	4	24	48.92	40.946257	729.6259	30.40108
2002	1	5	1	46.94	39.9113381		
2002	1	5	2	46.04	39.4351203		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	5	3	44.06	38.374482		
2002	1	5	4	42.98	37.7883489		
2002	1	5	5	42.98	38.2321432		
2002	1	5	6	42.98	42.0162294		
2002	1	5	7	42.98	42.0162294		
2002	1	5	8	42.08	42.08		
2002	1	5	9	42.98	42.5358282		
2002	1	5	10	42.98	42.5358282		
2002	1	5	11	44.06	43.5184182		
2002	1	5	12	44.06	43.5184182		
2002	1	5	13	44.06	43.5184182		
2002	1	5	14	44.06	43.5184182		
2002	1	5	15	44.06	43.5184182		
2002	1	5	16	44.96	44.5008883		
2002	1	5	17	46.04	45.0256022		
2002	1	5	18	44.96	43.5265842		
2002	1	5	19	44.06	42.5634196		
2002	1	5	20	46.04	42.6621362		
2002	1	5	21	46.94	42.6505121		
2002	1	5	22	46.04	42.6621362		
2002	1	5	23	48.02	43.650951		
2002	1	5	24	44.96	41.6448092	1011.405	42.14186
2002	1	6	1	42.08	39.7600737		
2002	1	6	2	42.98	39.780131		
2002	1	6	3	41	37.9157949		
2002	1	6	4	39.92	36.5536425		
2002	1	6	5	37.04	34.933275		
2002	1	6	6	37.04	34.4660767		
2002	1	6	7	35.96	33.8436971		
2002	1	6	8	37.04	34.0908548		
2002	1	6	9	35.96	33.4649485		
2002	1	6	10	35.06	32.4967772		
2002	1	6	11	33.98	31.5236595		
2002	1	6	12	33.98	31.1289432		
2002	1	6	13	33.98	31.1289432		
2002	1	6	14	33.98	31.1289432		
2002	1	6	15	37.04	33.656215		
2002	1	6	16	44.06	38.0213811		
2002	1	6	17	48.92	40.946257		
2002	1	6	18	53.06	42.0449878		
2002	1	6	19	57.02	43.6868508		
2002	1	6	20	57.92	43.5455515		
2002	1	6	21	59	43.2647684		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	6	22	57.02	42.0433633		
2002	1	6	23	55.04	41.542017		
2002	1	6	24	51.08	38.6671759	889.6343	37.0681
2002	1	7	1	46.94	36.9295361		
2002	1	7	2	42.98	35.0200334		
2002	1	7	3	42.08	34.8393668		
2002	1	7	4	39.02	33.3663456		
2002	1	7	5	37.04	32.5773427		
2002	1	7	6	33.98	30.4441289		
2002	1	7	7	33.08	29.6217205		
2002	1	7	8	37.04	31.2575805		
2002	1	7	9	32	28.2999378		
2002	1	7	10	30.02	27.2415804		
2002	1	7	11	28.94	26.6090371		
2002	1	7	12	28.04	26.0764562		
2002	1	7	13	28.94	26.9957226		
2002	1	7	14	26.06	24.5035498		
2002	1	7	15	32	29.6588364		
2002	1	7	16	37.04	31.5751879		
2002	1	7	17	39.92	33.2551846		
2002	1	7	18	44.06	35.6319531		
2002	1	7	19	46.94	36.9295361		
2002	1	7	20	50	38.5993244		
2002	1	7	21	51.98	40.2565395		
2002	1	7	22	53.06	40.8202212		
2002	1	7	23	53.06	41.0827795		
2002	1	7	24	46.04	37.6880244	789.2809	32.88671
2002	1	8	1	44.06	36.5972264		
2002	1	8	2	44.06	36.2436745		
2002	1	8	3	42.98	35.6375194		
2002	1	8	4	42.08	35.4877665		
2002	1	8	5	39.92	34.2557918		
2002	1	8	6	35.96	31.9413623		
2002	1	8	7	33.98	31.1289432		
2002	1	8	8	33.98	30.8115306		
2002	1	8	9	35.06	31.7445309		
2002	1	8	10	35.06	31.7445309		
2002	1	8	11	35.06	32.1412611		
2002	1	8	12	35.06	32.1412611		
2002	1	8	13	33.98	31.5236595		
2002	1	8	14	35.06	32.1412611		
2002	1	8	15	39.92	35.3080503		
2002	1	8	16	46.94	39.5668955		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	8	17	59	45.9543244		
2002	1	8	18	62.96	48.1837405		
2002	1	8	19	66.92	49.9669556		
2002	1	8	20	69.08	50.5592302		
2002	1	8	21	71.96	52.155242		
2002	1	8	22	73.04	52.2674404		
2002	1	8	23	69.98	51.3061244		
2002	1	8	24	60.98	46.889294	935.6976	38.9874
2002	1	9	1	59	46.341535		
2002	1	9	2	57.02	45.0038044		
2002	1	9	3	51.08	42.0555742		
2002	1	9	4	48.92	40.946257		
2002	1	9	5	46.94	39.9113381		
2002	1	9	6	44.06	40.3478349		
2002	1	9	7	44.06	40.3478349		
2002	1	9	8	44.06	40.3478349		
2002	1	9	9	42.98	40.2336435		
2002	1	9	10	42.08	38.9326777		
2002	1	9	11	39.92	37.3255343		
2002	1	9	12	41	37.9157949		
2002	1	9	13	42.08	38.9326777		
2002	1	9	14	42.08	38.9326777		
2002	1	9	15	48.02	42.8198886		
2002	1	9	16	53.06	45.6552661		
2002	1	9	17	62.06	50.5640886		
2002	1	9	18	69.08	52.8388508		
2002	1	9	19	71.96	54.412591		
2002	1	9	20	77	55.14891		
2002	1	9	21	77	55.426901		
2002	1	9	22	77	56.0645336		
2002	1	9	23	73.94	54.8417966		
2002	1	9	24	69.08	53.2250708	1088.573	45.3572
2002	1	10	1	66.02	52.6900523		
2002	1	10	2	64.04	52.6598231		
2002	1	10	3	62.06	52.285914		
2002	1	10	4	59	50.4921234		
2002	1	10	5	57.92	50.91191		
2002	1	10	6	53.96	48.234596		
2002	1	10	7	57.02	49.6162356		
2002	1	10	8	53.96	48.234596		
2002	1	10	9	53.96	47.8293123		
2002	1	10	10	50	45.9756505		
2002	1	10	11	48.92	45.4594761		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	10	12	48.92	45.4594761		
2002	1	10	13	53.06	46.9358181		
2002	1	10	14	51.98	44.7762103		
2002	1	10	15	51.08	43.1709417		
2002	1	10	16	51.08	43.1709417		
2002	1	10	17	51.08	44.3372825		
2002	1	10	18	53.06	46.4717434		
2002	1	10	19	55.04	47.8546783		
2002	1	10	20	55.04	47.3981374		
2002	1	10	21	55.04	47.0276819		
2002	1	10	22	53.96	45.7303121		
2002	1	10	23	53.96	45.3171226		
2002	1	10	24	53.96	44.5919137	1136.632	47.35966
2002	1	11	1	53.96	44.2758136		
2002	1	11	2	51.98	42.922648		
2002	1	11	3	48.92	41.3679468		
2002	1	11	4	48.92	41.752454		
2002	1	11	5	48.02	41.2904323		
2002	1	11	6	46.94	40.7313288		
2002	1	11	7	46.04	40.2614742		
2002	1	11	8	44.96	39.6928797		
2002	1	11	9	44.06	39.2150399		
2002	1	11	10	42.08	37.7430134		
2002	1	11	11	41	37.151072		
2002	1	11	12	37.94	34.9803588		
2002	1	11	13	35.96	33.4649485		
2002	1	11	14	35.96	33.4649485		
2002	1	11	15	41	36.6996181		
2002	1	11	16	48.02	40.1367409		
2002	1	11	17	51.08	41.3381199		
2002	1	11	18	53.06	41.6928003		
2002	1	11	19	55.04	42.0984035		
2002	1	11	20	55.94	43.1496274		
2002	1	11	21	57.02	43.4133407		
2002	1	11	22	57.02	42.8432873		
2002	1	11	23	55.94	42.8735953		
2002	1	11	24	50	39.8149349	962.3748	40.09895
2002	1	12	1	48.02	38.760484		
2002	1	12	2	44.96	37.0953379		
2002	1	12	3	42.08	35.4877665		
2002	1	12	4	42.08	35.1280866		
2002	1	12	5	39.02	33.7357084		
2002	1	12	6	33.98	31.1289432		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	12	7	33.98	31.1289432		
2002	1	12	8	32	29.9827441		
2002	1	12	9	32	29.9827441		
2002	1	12	10	30.02	27.9562926		
2002	1	12	11	28.94	27.7484597		
2002	1	12	12	26.96	25.4307516		
2002	1	12	13	30.92	29.2321615		
2002	1	12	14	33.98	31.5236595		
2002	1	12	15	39.92	35.7319747		
2002	1	12	16	48.92	40.2154047		
2002	1	12	17	51.98	41.492704		
2002	1	12	18	55.04	43.0444691		
2002	1	12	19	57.02	43.0971011		
2002	1	12	20	57.92	43.5455515		
2002	1	12	21	59	43.5412922		
2002	1	12	22	57.92	43.0026726		
2002	1	12	23	57.02	42.2688161		
2002	1	12	24	50	38.5993244	858.8614	35.78589
2002	1	13	1	46.02	37.5238826		
2002	1	13	2	46.04	36.7391901		
2002	1	13	3	46.04	36.4300234		
2002	1	13	4	35.96	31.5813421		
2002	1	13	5	37.04	32.2015818		
2002	1	13	6	32	28.982702		
2002	1	13	7	32	29.2839201		
2002	1	13	8	32	28.982702		
2002	1	13	9	33.98	30.8115306		
2002	1	13	10	33.08	29.9196344		
2002	1	13	11	30.02	27.9562926		
2002	1	13	12	32	29.2839201		
2002	1	13	13	30.92	28.1431382		
2002	1	13	14	30.92	28.4713891		
2002	1	13	15	37.04	32.9022789		
2002	1	13	16	46.94	38.847181		
2002	1	13	17	57.92	44.7607894		
2002	1	13	18	64.04	47.0625466		
2002	1	13	19	66.92	48.704909		
2002	1	13	20	69.08	49.6756068		
2002	1	13	21	71.96	50.6427276		
2002	1	13	22	71.96	50.4011198		
2002	1	13	23	69.98	50.0750442		
2002	1	13	24	64.04	47.0625466	896.446	37.35192
2002	1	14	1	59	44.9940157		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	14	2	53.96	42.1518848		
2002	1	14	3	51.98	41.1372459		
2002	1	14	4	51.98	40.8517116		
2002	1	14	5	44.96	38.5084443		
2002	1	14	6	44.06	36.9029639		
2002	1	14	7	42.98	35.9944003		
2002	1	14	8	44.96	36.1375744		
2002	1	14	9	42.08	34.5057541		
2002	1	14	10	41	33.8833606		
2002	1	14	11	39.02	32.7272529		
2002	1	14	12	41	33.8833606		
2002	1	14	13	39.92	32.9291325		
2002	1	14	14	39.02	32.398643		
2002	1	14	15	42.08	34.8393668		
2002	1	14	16	50	39.2095264		
2002	1	14	17	53.06	40.8202212		
2002	1	14	18	55.04	41.8402636		
2002	1	14	19	57.92	42.2416885		
2002	1	14	20	57.92	41.7963625		
2002	1	14	21	60.08	42.7032948		
2002	1	14	22	59	41.7645172		
2002	1	14	23	57.92	41.3854197		
2002	1	14	24	53.96	39.3117671	922.9182	38.45492
2002	1	15	1	48.02	36.3059651		
2002	1	15	2	46.94	35.7001354		
2002	1	15	3	42.98	33.6473738		
2002	1	15	4	37.04	31.0027366		
2002	1	15	5	35.96	30.6364232		
2002	1	15	6	35.96	30.3787402		
2002	1	15	7	33.08	28.946438		
2002	1	15	8	33.98	29.4798464		
2002	1	15	9	37.04	31.2575805		
2002	1	15	10	30.02	26.5775788		
2002	1	15	11	28.94	26.2366133		
2002	1	15	12	30.02	26.8732704		
2002	1	15	13	35.06	29.8535056		
2002	1	15	14	35.96	30.3787402		
2002	1	15	15	39.02	32.398643		
2002	1	15	16	46.04	36.7391901		
2002	1	15	17	51.98	39.9503478		
2002	1	15	18	55.94	42.2982727		
2002	1	15	19	59	44.0792138		
2002	1	15	20	60.98	45.0450826		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	15	21	62.06	45.8582546		
2002	1	15	22	62.96	46.2958306		
2002	1	15	23	62.96	46.5559981		
2002	1	15	24	57.92	44.1308143	850.6366	35.44319
2002	1	16	1	57.02	43.6868508		
2002	1	16	2	55.94	42.8735953		
2002	1	16	3	53.06	41.0827795		
2002	1	16	4	51.98	40.5215467		
2002	1	16	5	51.98	41.1372459		
2002	1	16	6	51.98	42.5118279		
2002	1	16	7	51.08	42.4695546		
2002	1	16	8	51.98	42.5118279		
2002	1	16	9	51.08	42.0555742		
2002	1	16	10	51.08	42.0555742		
2002	1	16	11	50	41.5034574		
2002	1	16	12	51.08	42.0555742		
2002	1	16	13	50	41.5034574		
2002	1	16	14	50	41.5034574		
2002	1	16	15	50	41.5034574		
2002	1	16	16	55.94	44.1596747		
2002	1	16	17	60.98	46.5835006		
2002	1	16	18	68	49.1924		
2002	1	16	19	69.98	49.7692977		
2002	1	16	20	71.96	50.6427276		
2002	1	16	21	71.06	50.0040765		
2002	1	16	22	66.02	47.7258943		
2002	1	16	23	59	44.9940157		
2002	1	16	24	53.96	42.5013753	1054.549	43.93953
2002	1	17	1	51.08	41.028581		
2002	1	17	2	46.94	37.236297		
2002	1	17	3	44.96	35.5752846		
2002	1	17	4	42.98	34.4479832		
2002	1	17	5	41	33.8833606		
2002	1	17	6	39.02	33.3663456		
2002	1	17	7	37.04	32.2015818		
2002	1	17	8	35.96	31.5813421		
2002	1	17	9	35.96	31.2920878		
2002	1	17	10	35.06	30.7753174		
2002	1	17	11	37.04	32.2015818		
2002	1	17	12	37.04	31.5751879		
2002	1	17	13	37.94	32.434176		
2002	1	17	14	39.02	32.7272529		
2002	1	17	15	39.02	32.7272529		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	17	16	39.92	33.2551846		
2002	1	17	17	41	33.8833606		
2002	1	17	18	42.98	35.3510475		
2002	1	17	19	44.96	36.7445348		
2002	1	17	20	44.96	36.4629446		
2002	1	17	21	46.04	37.3404895		
2002	1	17	22	46.04	37.3404895		
2002	1	17	23	46.94	38.1777597		
2002	1	17	24	44.06	36.2436745	827.8531	34.49388
2002	1	18	1	39.92	33.8893032		
2002	1	18	2	37.94	32.733462		
2002	1	18	3	37.94	32.434176		
2002	1	18	4	35.06	31.0672535		
2002	1	18	5	35.96	32.2651979		
2002	1	18	6	35.06	31.0672535		
2002	1	18	7	33.98	31.5236595		
2002	1	18	8	30.92	28.8796746		
2002	1	18	9	33.08	31.3530141		
2002	1	18	10	35.06	32.9389355		
2002	1	18	11	35.96	33.8436971		
2002	1	18	12	35.06	33.3206472		
2002	1	18	13	35.96	33.8436971		
2002	1	18	14	35.96	34.3152852		
2002	1	18	15	37.04	35.3592226		
2002	1	18	16	37.94	36.676902		
2002	1	18	17	39.02	37.6533279		
2002	1	18	18	39.02	37.6533279		
2002	1	18	19	39.92	39.0074214		
2002	1	18	20	41	39.5821156		
2002	1	18	21	39.92	39.4991457		
2002	1	18	22	39.92	39.4991457		
2002	1	18	23	39.92	39.4991457		
2002	1	18	24	39.92	39.92	837.825	34.90938
2002	1	19	1	39.92	39.92		
2002	1	19	2	39.92	39.92		
2002	1	19	3	41	40.4862854		
2002	1	19	4	39.92	39.92		
2002	1	19	5	41	40.0693053		
2002	1	19	6	41	40.4862854		
2002	1	19	7	39.92	39.92		
2002	1	19	8	39.92	39.4991457		
2002	1	19	9	39.92	39.4991457		
2002	1	19	10	39.92	39.0074214		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	19	11	39.92	39.0074214		
2002	1	19	12	39.02	38.1225475		
2002	1	19	13	35.96	35.1140772		
2002	1	19	14	35.06	33.7959241		
2002	1	19	15	37.04	35.3592226		
2002	1	19	16	39.02	36.4702663		
2002	1	19	17	42.08	37.2957552		
2002	1	19	18	44.96	37.7763238		
2002	1	19	19	48.02	39.0559215		
2002	1	19	20	50	38.8980588		
2002	1	19	21	51.08	38.1948051		
2002	1	19	22	51.08	37.7588583		
2002	1	19	23	48.92	36.568714		
2002	1	19	24	44.96	34.5747426	916.7202	38.19668
2002	1	20	1	41	32.4868676		
2002	1	20	2	39.02	31.3426004		
2002	1	20	3	33.98	28.6696764		
2002	1	20	4	35.96	29.842503		
2002	1	20	5	33.98	28.913172		
2002	1	20	6	28.94	25.592111		
2002	1	20	7	33.08	28.6810505		
2002	1	20	8	33.08	28.3745332		
2002	1	20	9	33.08	28.6810505		
2002	1	20	10	33.08	28.946438		
2002	1	20	11	32	28.2999378		
2002	1	20	12	32	28.634354		
2002	1	20	13	33.98	29.8075717		
2002	1	20	14	33.98	30.4441269		
2002	1	20	15	39.02	33.7357084		
2002	1	20	16	44.06	36.9029639		
2002	1	20	17	46.94	37.8329227		
2002	1	20	18	53.06	41.4098974		
2002	1	20	19	57.02	42.5500462		
2002	1	20	20	59	44.0792138		
2002	1	20	21	62.06	45.8682546		
2002	1	20	22	64.04	46.8047101		
2002	1	20	23	64.04	47.0625466		
2002	1	20	24	57.92	44.4687452	829.431	34.55963
2002	1	21	1	53.96	43.1790701		
2002	1	21	2	50	41.1679421		
2002	1	21	3	51.98	41.1372459		
2002	1	21	4	51.08	37.7588583		
2002	1	21	5	46.94	35.2645953		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	21	6	41	32.0109735		
2002	1	21	7	42.08	32.4489227		
2002	1	21	8	42.08	32.2163522		
2002	1	21	9	33.08	28.1287924		
2002	1	21	10	32	27.4732511		
2002	1	21	11	28.04	24.7704002		
2002	1	21	12	28.94	25.3149675		
2002	1	21	13	28.04	24.4474545		
2002	1	21	14	26.96	23.7836903		
2002	1	21	15	35.06	29.5531264		
2002	1	21	16	44.06	34.7742062		
2002	1	21	17	53.06	39.9926623		
2002	1	21	18	60.98	42.9404938		
2002	1	21	19	64.04	44.6645585		
2002	1	21	20	66.92	45.6835427		
2002	1	21	21	68	46.3595501		
2002	1	21	22	68	46.5615351		
2002	1	21	23	66.02	45.6209121		
2002	1	21	24	60.08	42.4873113	867.7404	36.15585
2002	1	22	1	53.96	39.7369731		
2002	1	22	2	51.98	39.4212432		
2002	1	22	3	53.06	40.5168627		
2002	1	22	4	48.02	38.1446324		
2002	1	22	5	48.02	38.1446324		
2002	1	22	6	48.02	38.1446324		
2002	1	22	7	46.94	37.8329227		
2002	1	22	8	44.96	37.3987		
2002	1	22	9	48.02	39.4236909		
2002	1	22	10	48.02	40.1367409		
2002	1	22	11	48.92	40.946257		
2002	1	22	12	48.92	40.946257		
2002	1	22	13	48.92	41.3679468		
2002	1	22	14	50	41.5034574		
2002	1	22	15	51.08	42.0555742		
2002	1	22	16	57.02	45.3974884		
2002	1	22	17	60.08	46.4662142		
2002	1	22	18	66.92	49.6042166		
2002	1	22	19	71.96	51.8069336		
2002	1	22	20	71.6	55		
2002	1	22	21	73.4	55		
2002	1	22	22	73.04	62.3002932		
2002	1	22	23	73.04	62.3002932		
2002	1	22	24	69.08	60.4090535	1084.005	45.16688

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	23	1	64.94	60.0040597		
2002	1	23	2	62.96	59.2743971		
2002	1	23	3	60.98	58.5339988		
2002	1	23	4	62.06	58.939198		
2002	1	23	5	60.98	58.5339988		
2002	1	23	6	60.08	57.5547941		
2002	1	23	7	59	56.612279		
2002	1	23	8	55.04	54.4025064		
2002	1	23	9	53.96	53.4353048		
2002	1	23	10	53.06	53.06		
2002	1	23	11	53.06	53.06		
2002	1	23	12	55.94	55.4015376		
2002	1	23	13	55.94	55.94		
2002	1	23	14	57.02	57.02		
2002	1	23	15	60.08	60.08		
2002	1	23	16	62.06	62.06		
2002	1	23	17	64.04	63.3311073		
2002	1	23	18	66.02	64.7035671		
2002	1	23	19	69.08	67.0013183		
2002	1	23	20	75.02	66.9508204		
2002	1	23	21	78.08	64.5913741		
2002	1	23	22	78.08	63.0322862		
2002	1	23	23	75.92	61.3147914		
2002	1	23	24	68	56.9134729	1421.751	59.23962
2002	1	24	1	66.02	59.2863402		
2002	1	24	2	59	55.9937744		
2002	1	24	3	51.98	48.2621592		
2002	1	24	4	48.02	43.1920385		
2002	1	24	5	46.94	41.0568613		
2002	1	24	6	44.96	39.2950925		
2002	1	24	7	44.06	38.374482		
2002	1	24	8	42.98	37.7883489		
2002	1	24	9	42.98	37.4319376		
2002	1	24	10	39.92	36.9691073		
2002	1	24	11	37.94	36.676902		
2002	1	24	12	37.04	36.1758824		
2002	1	24	13	37.04	35.7246362		
2002	1	24	14	37.04	35.7246362		
2002	1	24	15	35.96	34.7452334		
2002	1	24	16	37.04	35.3592226		
2002	1	24	17	39.92	36.9691073		
2002	1	24	18	44.06	39.2150399		
2002	1	24	19	48.92	40.946257		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	24	20	51.98	41.7998668		
2002	1	24	21	51.08	39.7828197		
2002	1	24	22	51.08	39.474243		
2002	1	24	23	51.08	39.1782844		
2002	1	24	24	46.94	37.236297	966.6686	40.27786
2002	1	25	1	42.98	35.6375194		
2002	1	25	2	39.02	33.0698511		
2002	1	25	3	39.92	33.2551846		
2002	1	25	4	35.96	31.2920678		
2002	1	25	5	35.06	30.7753174		
2002	1	25	6	33.08	29.9196344		
2002	1	25	7	30.92	28.4713891		
2002	1	25	8	30.92	27.763282		
2002	1	25	9	30.92	28.1431382		
2002	1	25	10	30.92	28.1431382		
2002	1	25	11	28.94	26.6090371		
2002	1	25	12	28.04	26.0764562		
2002	1	25	13	24.98	23.8402436		
2002	1	25	14	26.06	24.5035498		
2002	1	25	15	30.92	28.8796746		
2002	1	25	16	39.02	34.055112		
2002	1	25	17	46.04	37.6880244		
2002	1	25	18	51.08	39.1782844		
2002	1	25	19	55.04	39.4960762		
2002	1	25	20	55.94	40.35737		
2002	1	25	21	57.02	40.9202785		
2002	1	25	22	57.92	41.3854197		
2002	1	25	23	57.02	40.5386399		
2002	1	25	24	51.98	38.6808287	788.6795	32.86165
2002	1	26	1	44.96	35.5752846		
2002	1	26	2	44.96	35.2865118		
2002	1	26	3	42.98	34.4479832		
2002	1	26	4	41	33.5603533		
2002	1	26	5	39.02	32.7272529		
2002	1	26	6	35.96	30.6354232		
2002	1	26	7	33.98	29.8075717		
2002	1	26	8	33.08	29.6217205		
2002	1	26	9	32	28.634354		
2002	1	26	10	32	28.634354		
2002	1	26	11	30.92	27.763282		
2002	1	26	12	30.02	27.2415804		
2002	1	26	13	30.92	27.763282		
2002	1	26	14	32	28.634354		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	26	15	37.04	31.9060192		
2002	1	26	16	44.06	36.2436745		
2002	1	26	17	51.98	41.1372459		
2002	1	26	18	59	43.8296339		
2002	1	26	19	62.96	45.7536606		
2002	1	26	20	66.02	47.7258943		
2002	1	26	21	66.02	47.9795318		
2002	1	26	22	66.92	48.3914165		
2002	1	26	23	64.94	47.7998737		
2002	1	26	24	60.08	45.8013412	866.9026	36.12094
2002	1	27	1	51.08	41.7231425		
2002	1	27	2	51.08	42.0555742		
2002	1	27	3	48.92	41.3679468		
2002	1	27	4	46.94	40.3402492		
2002	1	27	5	44.96	39.6928797		
2002	1	27	6	42.98	38.2321432		
2002	1	27	7	39.92	36.0979503		
2002	1	27	8	39.92	36.0979503		
2002	1	27	9	39.92	36.0979503		
2002	1	27	10	39.02	35.5922987		
2002	1	27	11	37.94	34.6080514		
2002	1	27	12	37.94	34.6080514		
2002	1	27	13	37.04	34.4660767		
2002	1	27	14	37.94	34.9803588		
2002	1	27	15	42.98	38.2321432		
2002	1	27	16	51.98	42.922648		
2002	1	27	17	60.08	46.1581191		
2002	1	27	18	64.04	48.6758125		
2002	1	27	19	66.92	50.9327255		
2002	1	27	20	68	52.0675097		
2002	1	27	21	71.06	54.0443684		
2002	1	27	22	69.08	53.5558606		
2002	1	27	23	68	53.5176686		
2002	1	27	24	66.02	53.1200907	1019.188	42.46615
2002	1	28	1	60.08	50.5783905		
2002	1	28	2	60.08	50.5783905		
2002	1	28	3	57.92	50.0161047		
2002	1	28	4	53.96	48.234596		
2002	1	28	5	55.04	48.7261728		
2002	1	28	6	51.08	46.9022474		
2002	1	28	7	48.02	45.0257757		
2002	1	28	8	48.02	45.4515064		
2002	1	28	9	48.02	45.4515064		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	28	10	48.92	45.8820201		
2002	1	28	11	46.94	44.9306196		
2002	1	28	12	46.04	44.0500975		
2002	1	28	13	46.04	44.0600975		
2002	1	28	14	46.94	45.4592736		
2002	1	28	15	50	47.8914289		
2002	1	28	16	55.94	52.0018679		
2002	1	28	17	62.96	56.4725114		
2002	1	28	18	69.08	60.4090535		
2002	1	28	19	71.06	61.6039291		
2002	1	28	20	73.04	62.3002932		
2002	1	28	21	75.92	63.2958371		
2002	1	28	22	75.92	63.2958371		
2002	1	28	23	77	64.230179		
2002	1	28	24	71.96	63.0068386	1249.865	52.07769
2002	1	29	1	69.98	62.320311		
2002	1	29	2	66.92	61.2400741		
2002	1	29	3	66.02	61.5544573		
2002	1	29	4	64.94	61.1698892		
2002	1	29	5	64.04	60.8471204		
2002	1	29	6	60.08	58.7370171		
2002	1	29	7	60.98	59.7337936		
2002	1	29	8	60.98	59.7337936		
2002	1	29	9	60.98	59.7337936		
2002	1	29	10	62.06	60.7983581		
2002	1	29	11	62.96	61.6856538		
2002	1	29	12	64.04	62.0663539		
2002	1	29	13	64.94	62.3813721		
2002	1	29	14	64.94	62.3813721		
2002	1	29	15	66.02	62.7567465		
2002	1	29	16	66.92	63.0673763		
2002	1	29	17	68	64.103235		
2002	1	29	18	71.06	65.123228		
2002	1	29	19	71.96	65.419164		
2002	1	29	20	75.02	65.2580098		
2002	1	29	21	75.02	64.6470725		
2002	1	29	22	75.92	64.9457707		
2002	1	29	23	75.92	64.351534		
2002	1	29	24	73.04	63.9833546	1498.039	62.41829
2002	1	30	1	71.06	63.938116		
2002	1	30	2	69.98	63.5718068		
2002	1	30	3	69.08	63.2644272		
2002	1	30	4	68	62.2518109		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	30	5	66.92	61.8726603		
2002	1	30	6	66.92	62.518722		
2002	1	30	7	66.02	62.2046302		
2002	1	30	8	64.94	61.8250531		
2002	1	30	9	64.94	62.3813721		
2002	1	30	10	51.08	47.8493961		
2002	1	30	11	48.92	45.4594761		
2002	1	30	12	46.04	43.5537733		
2002	1	30	13	44.06	42.5634196		
2002	1	30	14	39.92	39.0074214		
2002	1	30	15	39.92	39.0074214		
2002	1	30	16	41	40.0693053		
2002	1	30	17	41	40.0693053		
2002	1	30	18	41	40.4862854		
2002	1	30	19	39.92	39.92		
2002	1	30	20	41	40.4862854		
2002	1	30	21	41	40.4862854		
2002	1	30	22	41	40.4862854		
2002	1	30	23	39.92	39.4991457		
2002	1	30	24	37.94	37.5343325	1180.307	49.17945
2002	1	31	1	37.04	36.1758824		
2002	1	31	2	37.94	36.676902		
2002	1	31	3	37.94	37.0607235		
2002	1	31	4	39.02	38.1225475		
2002	1	31	5	39.02	38.1225475		
2002	1	31	6	39.92	39.0074214		
2002	1	31	7	39.92	39.4991457		
2002	1	31	8	39.92	39.0074214		
2002	1	31	9	37.04	37.04		
2002	1	31	10	35.96	35.569557		
2002	1	31	11	35.96	35.569557		
2002	1	31	12	37.04	36.1758824		
2002	1	31	13	35.96	35.1140772		
2002	1	31	14	33.98	33.1674057		
2002	1	31	15	33.98	32.6876662		
2002	1	31	16	35.06	33.7959241		
2002	1	31	17	35.06	33.3206472		
2002	1	31	18	35.96	33.0262227		
2002	1	31	19	42.08	35.9365592		
2002	1	31	20	44.06	38.374482		
2002	1	31	21	46.94	39.9113381		
2002	1	31	22	48.02	39.7414766		
2002	1	31	23	46.04	37.6880244		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	1	31	24	42.98	35.6375194	877.4289	36.55954
2002	2	1	1	39.92	33.6893032		
2002	2	1	2	39.02	33.0698511		
2002	2	1	3	35.96	31.2920878		
2002	2	1	4	35.06	31.0672535		
2002	2	1	5	33.08	29.9196344		
2002	2	1	6	33.08	29.6217205		
2002	2	1	7	33.08	29.6217205		
2002	2	1	8	30.92	27.763282		
2002	2	1	9	30.02	26.5775788		
2002	2	1	10	28.94	25.3149675		
2002	2	1	11	28.04	24.7704002		
2002	2	1	12	26.06	23.5544096		
2002	2	1	13	26.06	23.5544096		
2002	2	1	14	26.06	23.5544096		
2002	2	1	15	30.92	26.7668511		
2002	2	1	16	35.96	29.842503		
2002	2	1	17	41	32.4868676		
2002	2	1	18	44.06	33.3816437		
2002	2	1	19	46.04	34.5273102		
2002	2	1	20	46.94	34.8285909		
2002	2	1	21	48.92	35.9498963		
2002	2	1	22	48.92	35.9498963		
2002	2	1	23	50	36.7609846		
2002	2	1	24	46.04	34.7519989	728.8176	30.3674
2002	2	2	1	42.98	33.1796043		
2002	2	2	2	39.02	31.1288118		
2002	2	2	3	37.04	29.9818787		
2002	2	2	4	33.08	28.6810505		
2002	2	2	5	32	28.0316134		
2002	2	2	6	32	28.0316134		
2002	2	2	7	30.02	26.5775788		
2002	2	2	8	26.96	24.7455804		
2002	2	2	9	28.04	24.4474545		
2002	2	2	10	28.04	25.3988146		
2002	2	2	11	26.96	25.0506924		
2002	2	2	12	26.06	24.5035498		
2002	2	2	13	24.98	23.5289229		
2002	2	2	14	26.06	24.5035498		
2002	2	2	15	30.02	28.3683907		
2002	2	2	16	37.04	31.5751879		
2002	2	2	17	42.98	35.3510475		
2002	2	2	18	46.04	36.4300234		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	2	19	46.94	37.236297		
2002	2	2	20	46.94	37.236297		
2002	2	2	21	46.94	37.236297		
2002	2	2	22	46.94	37.236297		
2002	2	2	23	46.04	37.0515247		
2002	2	2	24	46.04	37.6880244	733.2101	30.55042
2002	2	3	1	44.96	37.0953379		
2002	2	3	2	44.06	36.9029639		
2002	2	3	3	44.06	37.2835419		
2002	2	3	4	42.08	37.2957552		
2002	2	3	5	42.08	36.9365592		
2002	2	3	6	42.08	37.2957552		
2002	2	3	7	42.08	37.2957552		
2002	2	3	8	42.08	37.2957552		
2002	2	3	9	42.08	38.1507967		
2002	2	3	10	42.08	38.5006404		
2002	2	3	11	42.08	38.9326777		
2002	2	3	12	42.08	38.5006404		
2002	2	3	13	41	38.3518714		
2002	2	3	14	42.08	39.3030453		
2002	2	3	15	42.98	40.2336435		
2002	2	3	16	46.04	42.1954585		
2002	2	3	17	48.02	42.8198886		
2002	2	3	18	51.08	43.9139754		
2002	2	3	19	50	43.0328575		
2002	2	3	20	48.02	42.385475		
2002	2	3	21	46.94	41.4812512		
2002	2	3	22	48.02	41.6228798		
2002	2	3	23	48.92	42.4898072		
2002	2	3	24	48.92	42.4898072	951.8061	39.65859
2002	2	4	1	48.02	42.385475		
2002	2	4	2	46.94	42.2749361		
2002	2	4	3	48.02	42.0334664		
2002	2	4	4	46.94	41.4812512		
2002	2	4	5	46.94	41.4812512		
2002	2	4	6	46.04	41.0171964		
2002	2	4	7	44.96	40.0341583		
2002	2	4	8	44.06	39.9837116		
2002	2	4	9	42.98	39.4126171		
2002	2	4	10	42.08	38.5006404		
2002	2	4	11	42.08	38.5006404		
2002	2	4	12	42.08	38.5006404		
2002	2	4	13	41	37.9157949		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	4	14	41	37.9157949		
2002	2	4	15	42.98	38.9839133		
2002	2	4	16	44.96	39.6928797		
2002	2	4	17	48.02	39.7414766		
2002	2	4	18	50	39.8149349		
2002	2	4	19	51.08	40.0498887		
2002	2	4	20	51.08	40.0498887		
2002	2	4	21	51.08	40.382619		
2002	2	4	22	51.08	40.6703689		
2002	2	4	23	50	41.1679421		
2002	2	4	24	46.04	40.5996042	962.5911	40.10796
2002	2	5	1	44.96	39.6928797		
2002	2	5	2	44.06	40.3478349		
2002	2	5	3	42.08	39.7600737		
2002	2	5	4	41	40.0693053		
2002	2	5	5	41	40.0693053		
2002	2	5	6	41	40.0693053		
2002	2	5	7	41	40.0693053		
2002	2	5	8	39.92	39.4991457		
2002	2	5	9	39.92	39.4991457		
2002	2	5	10	39.92	39.4991457		
2002	2	5	11	39.92	39.4991457		
2002	2	5	12	39.92	39.0074214		
2002	2	5	13	39.02	38.1225475		
2002	2	5	14	37.94	37.0607235		
2002	2	5	15	35.96	35.569557		
2002	2	5	16	35.96	35.1140772		
2002	2	5	17	35.96	35.569557		
2002	2	5	18	35.96	35.1140772		
2002	2	5	19	35.06	34.6009614		
2002	2	5	20	33.98	33.6047839		
2002	2	5	21	33.98	33.6047839		
2002	2	5	22	33.98	33.6047839		
2002	2	5	23	33.98	33.1674057		
2002	2	5	24	32	32	894.2153	37.25897
2002	2	6	1	32	31.537664		
2002	2	6	2	32	31.537664		
2002	2	6	3	32	31.537664		
2002	2	6	4	32	31.537664		
2002	2	6	5	32	31.537664		
2002	2	6	6	32	31.537664		
2002	2	6	7	32	31.537664		
2002	2	6	8	32	31.1651715		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	6	9	32	31.1651715		
2002	2	6	10	32	31.1651715		
2002	2	6	11	32	31.1651715		
2002	2	6	12	32	31.1651715		
2002	2	6	13	32	31.537664		
2002	2	6	14	32	31.1651715		
2002	2	6	15	32	31.537664		
2002	2	6	16	33.08	32.1557166		
2002	2	6	17	35.06	33.7959241		
2002	2	6	18	35.96	34.3152852		
2002	2	6	19	37.04	34.4660767		
2002	2	6	20	37.94	35.4439299		
2002	2	6	21	37.94	35.4439299		
2002	2	6	22	39.02	36.0515549		
2002	2	6	23	39.02	36.4702663		
2002	2	6	24	39.02	36.4702663	785.443	32.72679
2002	2	7	1	37.94	35.8665725		
2002	2	7	2	37.04	35.3592226		
2002	2	7	3	33.08	32.1557166		
2002	2	7	4	32	31.537664		
2002	2	7	5	30.02	30.0209482		
2002	2	7	6	28.94	28.9408872		
2002	2	7	7	30.02	30.0209482		
2002	2	7	8	30.02	30.0209482		
2002	2	7	9	30.02	29.1652759		
2002	2	7	10	26.96	26.1683069		
2002	2	7	11	28.04	27.5896021		
2002	2	7	12	26.96	26.5935988		
2002	2	7	13	26.06	25.2864218		
2002	2	7	14	26.96	26.5935988		
2002	2	7	15	28.94	28.9408872		
2002	2	7	16	32	32		
2002	2	7	17	39.02	38.1225475		
2002	2	7	18	44.06	39.9837116		
2002	2	7	19	48.02	42.0334664		
2002	2	7	20	51.08	43.9139754		
2002	2	7	21	53.06	44.8822661		
2002	2	7	22	55.04	45.5029021		
2002	2	7	23	55.94	45.9331272		
2002	2	7	24	53.96	44.9823513	821.6159	34.234
2002	2	8	1	48.02	42.0334664		
2002	2	8	2	44.96	40.4556329		
2002	2	8	3	42.98	39.4126171		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	8	4	42.98	39.4126171		
2002	2	8	5	42.08	38.9326777		
2002	2	8	6	39.02	36.8294762		
2002	2	8	7	37.94	36.2291524		
2002	2	8	8	35.96	35.1140772		
2002	2	8	9	35.06	34.6009614		
2002	2	8	10	33.98	33.6047839		
2002	2	8	11	33.08	33.08		
2002	2	8	12	33.08	33.08		
2002	2	8	13	32	32		
2002	2	8	14	32	32		
2002	2	8	15	35.06	35.06		
2002	2	8	16	42.08	41.0474107		
2002	2	8	17	50	45.009805		
2002	2	8	18	57.92	48.7189575		
2002	2	8	19	62.06	50.5640886		
2002	2	8	20	64.04	51.0806781		
2002	2	8	21	64.94	51.0708181		
2002	2	8	22	66.02	50.5395558		
2002	2	8	23	64.04	50.3527526		
2002	2	8	24	60.98	48.5997799	978.8293	40.78455
2002	2	9	1	57.02	47.1742801		
2002	2	9	2	53.06	48.3241429		
2002	2	9	3	51.98	47.8290055		
2002	2	9	4	51.08	46.9022474		
2002	2	9	5	48.92	45.4594761		
2002	2	9	6	48.92	45.4594761		
2002	2	9	7	48.02	44.527809		
2002	2	9	8	46.94	43.5100679		
2002	2	9	9	46.04	43.0615959		
2002	2	9	10	46.04	43.0615959		
2002	2	9	11	44.96	42.5189284		
2002	2	9	12	44.96	42.5189284		
2002	2	9	13	42.08	40.1515586		
2002	2	9	14	39.92	38.6086088		
2002	2	9	15	48.92	42.0823572		
2002	2	9	16	53.96	43.5034506		
2002	2	9	17	57.92	43.8593831		
2002	2	9	18	59	43.5412922		
2002	2	9	19	60.98	44.2441783		
2002	2	9	20	60.08	44.3507341		
2002	2	9	21	60.98	44.7996448		
2002	2	9	22	62.06	45.3219783		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	9	23	60.08	43.5813732		
2002	2	9	24	55.94	42.5544347	1056.957	44.03986
2002	2	10	1	51.98	41.492704		
2002	2	10	2	48.92	39.9000715		
2002	2	10	3	46.04	38.3626749		
2002	2	10	4	44.06	36.9029639		
2002	2	10	5	44.06	36.9029639		
2002	2	10	6	44.06	37.2835419		
2002	2	10	7	42.98	36.3030145		
2002	2	10	8	42.08	35.4877665		
2002	2	10	9	41	34.2201183		
2002	2	10	10	41	34.5115591		
2002	2	10	11	41	34.8746274		
2002	2	10	12	39.92	33.8893032		
2002	2	10	13	39.02	32.7272529		
2002	2	10	14	37.94	31.7700379		
2002	2	10	15	39.92	32.9291325		
2002	2	10	16	41	33.8833606		
2002	2	10	17	42.98	35.0200334		
2002	2	10	18	44.96	36.4629446		
2002	2	10	19	48.02	38.760484		
2002	2	10	20	44.96	36.7445348		
2002	2	10	21	44.06	36.2436745		
2002	2	10	22	44.96	36.7445348		
2002	2	10	23	46.04	37.3404895		
2002	2	10	24	44.06	36.2436745	865.0015	36.04173
2002	2	11	1	42.08	34.8393668		
2002	2	11	2	39.92	32.3660107		
2002	2	11	3	35.96	29.5671239		
2002	2	11	4	35.96	29.5671239		
2002	2	11	5	33.08	27.6180058		
2002	2	11	6	30.92	25.6404659		
2002	2	11	7	30.02	25.0990443		
2002	2	11	8	28.94	24.2057178		
2002	2	11	9	28.94	24.2057178		
2002	2	11	10	28.04	23.3753039		
2002	2	11	11	24.98	21.7260016		
2002	2	11	12	23	20.4482698		
2002	2	11	13	21.92	19.4475616		
2002	2	11	14	24.98	21.972604		
2002	2	11	15	28.94	25.3149675		
2002	2	11	16	35.06	29.5531264		
2002	2	11	17	39.02	31.1288118		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	11	18	42.98	32.5279339		
2002	2	11	19	46.04	34.7519989		
2002	2	11	20	51.08	37.3570851		
2002	2	11	21	51.98	37.4827307		
2002	2	11	22	55.04	39.1387916		
2002	2	11	23	55.04	39.1387916		
2002	2	11	24	51.98	38.0629968	704.5356	29.35565
2002	2	12	1	46.04	34.7519989		
2002	2	12	2	46.04	34.7519989		
2002	2	12	3	42.98	33.4300563		
2002	2	12	4	42.98	33.1796043		
2002	2	12	5	35.96	29.346517		
2002	2	12	6	33.08	27.8451935		
2002	2	12	7	33.08	27.6180058		
2002	2	12	8	30.92	26.1817167		
2002	2	12	9	28.94	24.9949752		
2002	2	12	10	26.96	23.7836903		
2002	2	12	11	28.94	24.9949752		
2002	2	12	12	28.94	25.3149675		
2002	2	12	13	30.02	25.9617827		
2002	2	12	14	30.92	26.4952811		
2002	2	12	15	35.96	30.0811171		
2002	2	12	16	42.98	33.9188242		
2002	2	12	17	51.08	38.9410101		
2002	2	12	18	57.92	41.2094142		
2002	2	12	19	60.08	42.4873113		
2002	2	12	20	62.06	43.4797665		
2002	2	12	21	64.94	44.7282126		
2002	2	12	22	66.02	45.4155436		
2002	2	12	23	64.94	44.5373155		
2002	2	12	24	62.96	43.7568271	807.2061	33.63359
2002	2	13	1	55.94	41.4909266		
2002	2	13	2	51.98	39.6566795		
2002	2	13	3	48.02	37.8277834		
2002	2	13	4	44.96	36.4629446		
2002	2	13	5	44.06	35.9598763		
2002	2	13	6	42.08	34.8393668		
2002	2	13	7	41	34.2201183		
2002	2	13	8	42.08	35.1280866		
2002	2	13	9	41	34.2201183		
2002	2	13	10	39.92	33.5951162		
2002	2	13	11	39.02	32.7272529		
2002	2	13	12	37.94	31.7700379		

WET BULB CONDITIONS

year	month	day	hour	db (°F)	wb (°F)	Total Daily wb (TFD) (°F)	Average Daily wb (AFD) (°F)
2002	2	13	13	37.94	31.7700379		
2002	2	13	14	37.94	31.7700379		
2002	2	13	15	44.06	35.3174227		
2002	2	13	16	44.06	35.0652481		
2002	2	13	17	48.02	37.5238826		
2002	2	13	18	51.98	39.9503478		
2002	2	13	19	55.04	41.8402636		
2002	2	13	20	55.04	41.542017		
2002	2	13	21	57.02	42.5500462		
2002	2	13	22	57.02	42.2688161		
2002	2	13	23	55.94	41.4909266		
2002	2	13	24	53.06	39.7234738	888.7108	37.02962

DECORDOVA READINGS
(References 3 and 6)

	date	flow (cfs)	low flow (cfs)	temp (°F)	
GBYT2	12/11/2001	27.47	27.47	55.94	
GBYT2	12/12/2001	27.47	27.47	0	
GBYT2	12/13/2001	27.48	27.48	0	
GBYT2	12/14/2001	27.46	27.46	0	
GBYT2	12/15/2001	27.46	27.46	0	
GBYT2	12/16/2001	27.49	27.49	0	
GBYT2	12/17/2001	27.50	27.5	0	
GBYT2	12/18/2001	27.50	27.5	0	
GBYT2	12/19/2001	27.52	27.52	0	
GBYT2	12/20/2001	27.51	27.51	0	
GBYT2	12/21/2001	27.51	27.51	0	
GBYT2	12/22/2001	27.51	27.51	0	
GBYT2	12/23/2001	27.52	27.52	0	
GBYT2	12/24/2001	27.51	27.51	0	
GBYT2	12/25/2001	27.51	27.51	0	
GBYT2	12/26/2001	27.50	27.5	0	
GBYT2	12/27/2001	27.50	27.5	0	
GBYT2	12/28/2001	27.49	27.49	0	
GBYT2	12/29/2001	27.50	27.5	0	
GBYT2	12/30/2001	27.49	27.49	0	
GBYT2	12/31/2001	27.48	27.48	0	
GBYT2	1/1/2002	27.48	27.48	0	
GBYT2	1/2/2002	27.48	27.48	0	
GBYT2	1/3/2002	27.47	27.47	0	
GBYT2	1/4/2002	27.46	27.46	0	
GBYT2	1/5/2002	27.47	27.47	0	
GBYT2	1/6/2002	27.46	27.46	0	
GBYT2	1/7/2002	27.46	27.46	0	
GBYT2	1/8/2002	27.46	27.46	0	
GBYT2	1/9/2002	27.46	27.46	52.682	
GBYT2	1/10/2002	27.46	27.46	0	
GBYT2	1/11/2002	27.46	27.46	0	
GBYT2	1/12/2002	27.47	27.47	0	
GBYT2	1/13/2002	27.47	27.47	0	
GBYT2	1/14/2002	27.47	27.47	0	
GBYT2	1/15/2002	27.46	27.46	49.1	
GBYT2	1/16/2002	27.46	27.46	0	
GBYT2	1/17/2002	27.47	27.47	0	
GBYT2	1/18/2002	27.48	27.48	0	
GBYT2	1/19/2002	27.50	27.5	0	
GBYT2	1/20/2002	27.50	27.5	0	
GBYT2	1/21/2002	27.50	27.5	0	
GBYT2	1/22/2002	27.50	27.5	0	
GBYT2	1/23/2002	27.50	27.5	0	
GBYT2	1/24/2002	27.52	27.52	0	
GBYT2	1/25/2002	27.51	27.51	0	
GBYT2	1/26/2002	27.51	27.51	0	
GBYT2	1/27/2002	27.51	27.51	0	
GBYT2	1/28/2002	27.52	27.52	0	
GBYT2	1/29/2002	27.54	27.54	0	
GBYT2	1/30/2002	27.57	27.57	0	
GBYT2	1/31/2002	27.60	27.6	0	
GBYT2	2/1/2002	27.61	27.61	0	
GBYT2	2/2/2002	27.61	27.61	0	
GBYT2	2/3/2002	27.61	27.61	0	
GBYT2	2/4/2002	27.61	27.61	0	
GBYT2	2/5/2002	27.63	27.63	0	
GBYT2	2/6/2002	27.65	27.65	0	
GBYT2	2/7/2002	27.66	27.66	0	
GBYT2	2/8/2002	27.68	27.68	0	
GBYT2	2/9/2002	27.73	27.73	0	
GBYT2	2/10/2002	27.76	27.76	0	
GBYT2	2/11/2002	27.75	27.75	0	
GBYT2	2/12/2002	27.76	27.76	0	
GBYT2	2/13/2002	27.78	27.78	49.334	51.764

OTHER INTAKE FLOWS
(Reference 7)

Units 1 and 2 Diversions from Water Use Reports							
Month	ac-ft/month	gallons/month	gallons/day	gallons/hour	gallons/minute		Max Div gpm
Dec-01	3925	1278965175	42632172.5	1776340.521	29605.67535		31250
Jan 02	3483.2	1135004203	37833473.4	1576394.727	26273.24544		34028
Feb-02	77.3	25188282.3	839609.41	34983.72542	583.0620903		625

Wolf Hollow					
Month	ac-ft/month	gallons/month	gallons/day	gallons/hour	gallons/minute
Dec-06	320	104272320	3475744	144822.6667	2413.711111
Jan-07	272	88631472	2954382.4	123099.2667	2051.654444
Feb-07	18	5865318	195510.6	8146.275	135.7712 5

Dec total	Jan total	Feb total
32019.39	28324.9	718.8333

REVISED ELEVATION-AREA-VOLUME ESTIMATES FOR LAKE GRANBURY, HOOD COUNTY, TEXAS
(Reference 10)

Revised Elevation-Area-Volume Estimates for Lake Granbury, Hood County, Texas

Stephen K. Boss, Ph.D., P.G.
Department of Geosciences
University of Arkansas
Fayetteville, AR

SUMMARY:

Mr. Darren Lovvorn requested revised estimates for elevation-area-volume relations for a modified region of Lake Granbury corresponding to a pool elevation of 691 ft.on 8 May 2009 (Fig. 1). The modified area is reduced somewhat from the original mapped area of Lake Granbury. The normal conservation pool of Lake Granbury is 693 ft and the original studied area was 577 acres. The modified area that is subject of this brief analysis is 310 acres (53.7% of the original area) and 2 feet below the normal conservation pool.

The area for which calculations have been completed includes the main body of the reservoir less the area of the prominent arm immediately northwest of De Cordova Bend Dam. Bathymetric data were not available for the prominent lake arm immediately northwest of the De Cordova Bend Dam. This arm is approximately 30 acres and presumed to be relatively shallow (<6 ft). As such, it very likely represents a relatively small volume of the studied area (less than 180 acre feet at 691 ft. elevation). Note that no data for this arm were reported on prior reports, so results reported here will be comparable to prior reports.

The area for which results are reported here has a measured surface area of 281.6 acres. The estimated volume storage of this area at 691 ft. elevation is 9,668 acre-feet. This volume is ca. 62% of the volume estimated for the original study area. Again, the prominent lake arm NW of the dam site may contribute an additional 100-200 acre-feet to this total if included. Though the area that is subject of this analysis is only slightly more than 50% of the original area, it contains 62% of the storage volume owing to the fact that it includes the deepest portions of the reservoir along an incised portion of the former course of the Brazos River.

Figure 2 of this report illustrates area versus elevation relations for this portion of the reservoir. The overall form of this curve is comparable to that in the original report for the larger mapped area. The prominent changes in slope of the curve apparently reflect the presence of now-submerged stream terraces of the Brazos River.

Figure 3 illustrates area versus volume relations within this portion of the reservoir. Note that area becomes constant as the reservoir is bound along its margins by outcrops with nearly vertical walls. Thus, reservoir area does not increase as volume increases due to rising lake level.

Figure 4 shows the relation of reservoir volume to elevation. This curve is quite typical of river impoundments, and is comparable to that from the original report for this reservoir.

REVISED ELEVATION-AREA-VOLUME ESTIMATES FOR LAKE GRANBURY, HOOD COUNTY, TEXAS

(Reference 10)

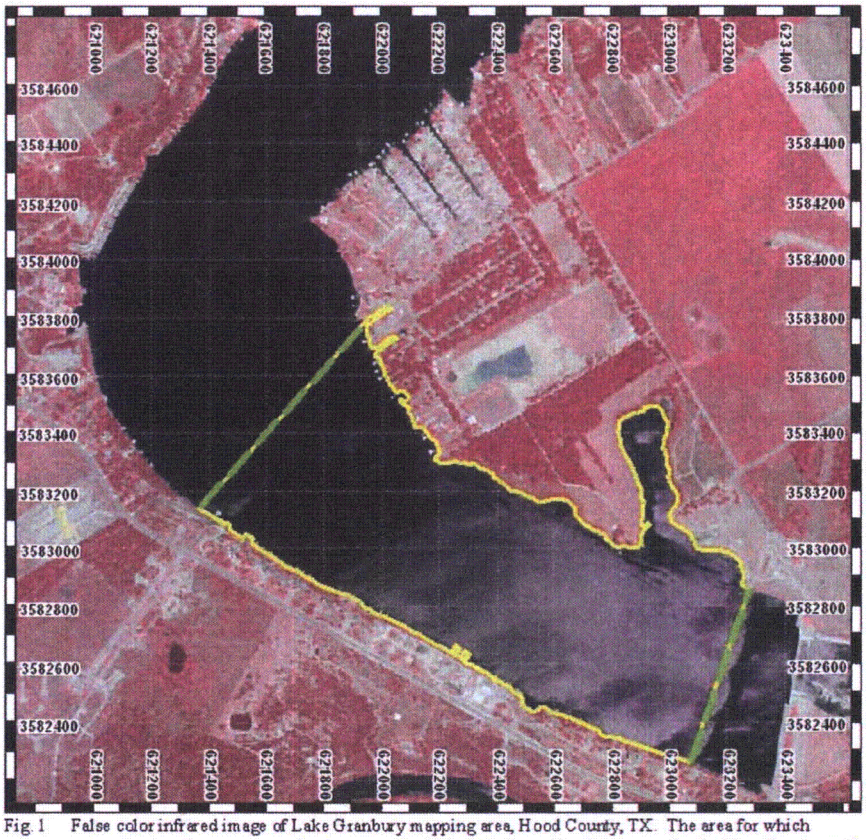

Fig. 1 False color infrared image of Lake Granbury mapping area, Hood County, TX. The area for which reservoir elevations, areas, and volumes was calculated indicated by the area outlined with yellow bound by the green dashed lines (area limits provided by Mr. Darren Lovvorn, P.G., Enercon, Inc. on 08 May 2009).

REVISED ELEVATION-AREA-VOLUME ESTIMATES FOR LAKE GRANBURY, HOOD COUNTY, TEXAS
(Reference 10)

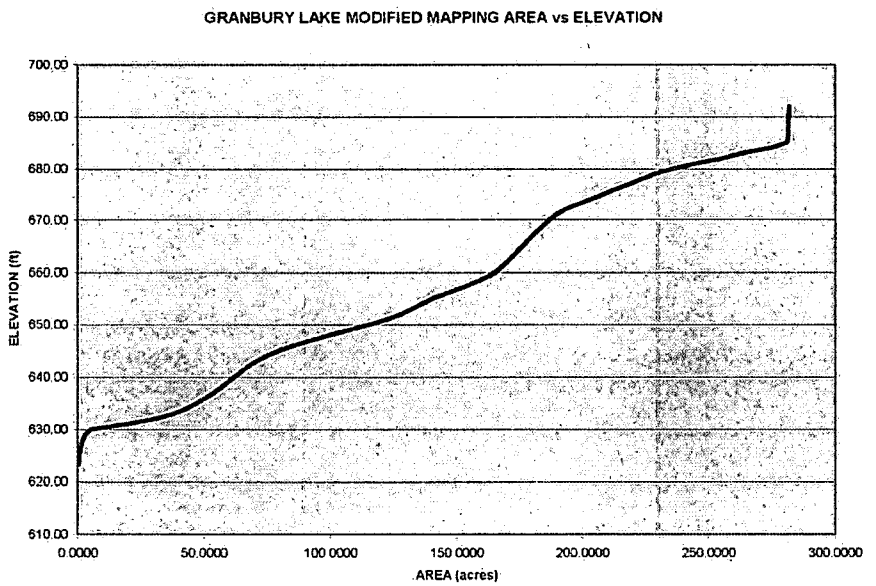

Fig. 2 Reservoir area versus elevation for the modified area depicted in Fig. 1. This curve compares favorably to that generated in the original report on bathymetric mapping in this lake.

REVISED ELEVATION-AREA-VOLUME ESTIMATES FOR LAKE GRANBURY, HOOD COUNTY, TEXAS
(Reference 10)

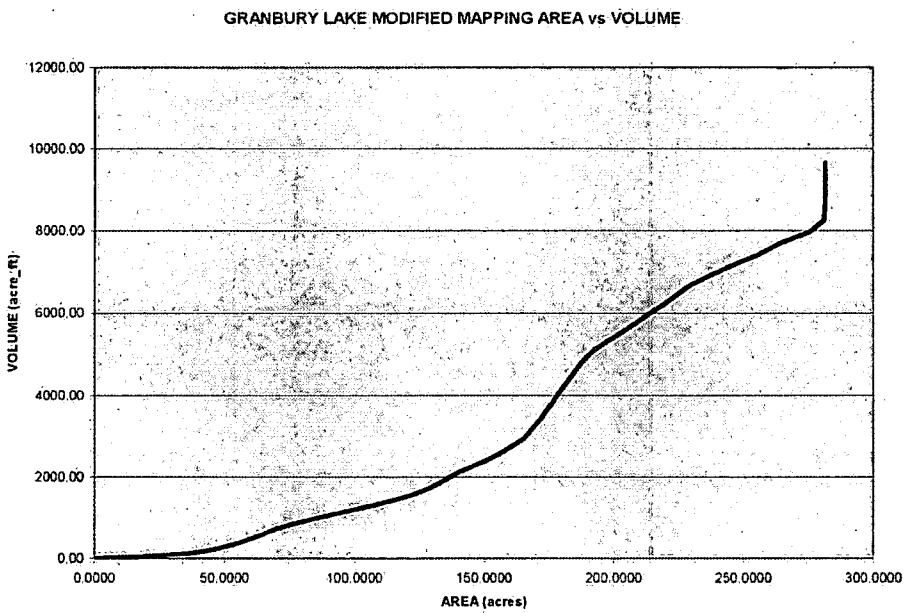

Fig. 3. Area versus volume curve for the modified study area

REVISED ELEVATION-AREA-VOLUME ESTIMATES FOR LAKE GRANBURY, HOOD COUNTY, TEXAS
(Reference 10)

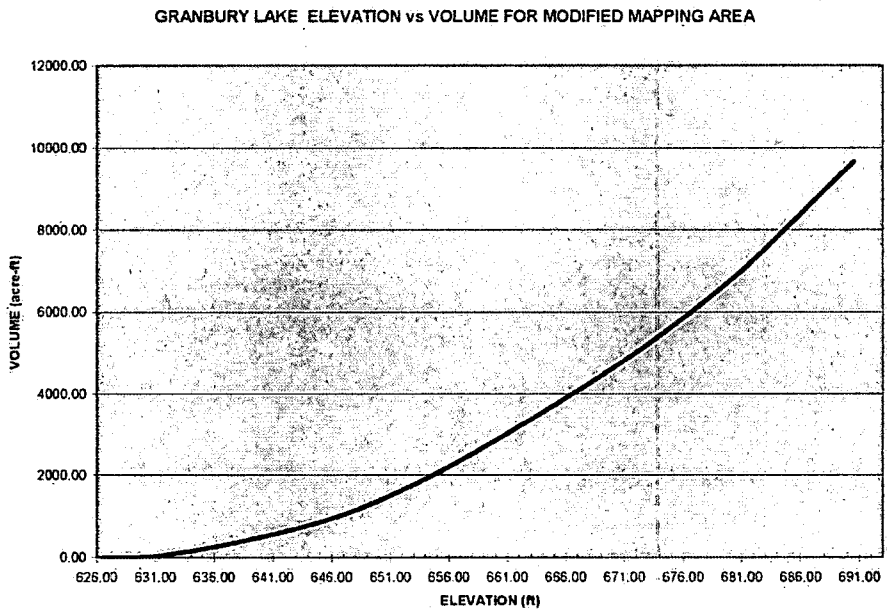

Fig. 4. Elevation versus volume for the modified study area.