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Picnic Table Selection Guide for Heavy Snow Locations

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INTRODUCTION AND BACKGROUND

Picnic tables are an integral component of site furnishings for camping and picnicking in Forest Service, U.S. Department of Agriculture, recreation sites throughout the country. Many considerations go into selecting a picnic table, such as material, life span, resistance to vandalism, resistance to rot, and weather exposure. Esthetics is also a criterion as outlined in the Forest Service's Built Environment Image Guide (BEIG). Another important consideration for picnic tables is that they be sturdy enough to withstand the very high snow loads found in many areas of the country.

Traditional picnic tables are constructed of heavy wood timbers (figure 1). These heavy wood tables are sturdy enough to withstand the very high snow loads. Today's picnic tables are made not only of wood, but also of expanded metal, recycled plastic, concrete, and combinations of products, such as wood top with metal base and recycled plastic top with metal base (figures 2 and 3).

Figure 1. Heavy wood table.

Figure 2. Various picnic table designs.

Figure 3. Various picnic table designs.

In harsh winter climates some of these nontraditional picnic tables—particularly the expanded metal tables—fail under snow and ice loads. Their tops and benches bend and twist after just one winter (figures 4 and 5).

Figure 4. Wasatch-Cache National Forest, Kamas Ranger District, Mirror Lake Campground picnic table under snow.

Figure 5. Mirror Lake campground expanded metal picnic table after winter season.

There is a desire to continue to use expanded metal tables, but a stronger design is needed to keep tables from bending under snow loads. The 11 Western States and Alaska have mountains with the highest snow loads in the country. Forests located within these States should use caution when purchasing expanded metal tables to withstand these loads.

SDTDC researched different picnic tables and how they perform under applied weight and what might be needed to reinforce current tables to prevent further loss. This publication is designed to help select appropriate tables for varying snow loads throughout the United States. Detailed instructions are provided to help determine snow load for the snow conditions and picnic tables suitable in your area. The picnic tables most used by the Forest Service are listed in tabular format in the results section. A section on the feasibility of retrofitting existing tables also is included.

LET'S TALK ABOUT SNOW

Snow and Snow Density

"Snow water equivalent (SWE) is a common snowpack measurement used in determining snow loads. It is the amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously.

"For example, a swimming pool is filled with 36 inches of new powdery snow at 10-percent snow water density. If you could turn all the snow into water, you would be left with a pool of water 3.6 inches deep. In this case, the SWE of your snowpack would equal 36 inches x 0.10 = 3.6 inches.

"The density of new snow ranges from about 5 percent when the air temperature is 14 degrees Fahrenheit (°F) to about 20 percent when the temperature is 32 °F. After the snow falls, its density increases due to gravitational settling, wind packing, melting, and recrystallization.

"Most snow that falls in the Cascade Mountains of Washington and Oregon tends to be higher density snow. In the Cascades, snowpack densities are around 20 to 30 percent in the winter to 30 to 50 percent in the spring. However, east of the Cascades, the snowpack density is much less. Typical values are 10 to 20 percent in the winter and 20 to 40 percent in the spring." (USDA Natural Resources Conservation Service) http://www.or.nrcs.usda.gov/snow/about/swe.html.

Where To Find Snow Load Information

Snow load information is generally available from local building officials or the local building code. Forest facility engineers also can help determine the ground snow load requirement where the picnic table will be used.

The National Snow Load Information Web site (figure 6), developed by Missoula Technology and Development Center for Forest Service use, provides information on snow load information for all 50 States. Visit the Intranet site at: http://fsweb.mtdc.wo.fs.fed.us/snow_load/.

Figure 6. National Snow Load Information Web site.

Other helpful Internet sites with snow load information are:

- http://lwf.ncdc.noaa.gov
- http://www.wcc.nrcs.usda.gov/snotel/
- http://www.id.nrcs.usda.gov/snow/data/geninfo/snowload.html

How To Calculate Snow Load

Open the National Snow Load Information Web site and select the State where the picnic table will be used. Then read the various ways to determine snow load. (California is used for this example.)

California

Use IBC 2003—0 psf-450 psf with Case Study Areas
at higher elevations
—and—
Contact County Building Officials
for determining required snow loads
See list of county building official contacts
In addition, you can estimate/verify your snow loads
by using SNOTEL data to estimate snow load amounts:
http://www.id.nrcs.usda.gov/snow/data/geninfo/snowload.html
& California Data http://www.ca.nrcs.usda.gov/snow/

The first link takes you to California's county building official contacts.

The second link shows you how to estimate snow load amounts from snowpack telemetry (SNOTEL) data. Multiply the SWE value for your area by the weight of 1 inch of water per square foot (5.2), and you will get the pounds per square foot maximum snow load. Use this figure to help find the best picnic table for your application.

The third link takes you to the SNOTEL data for your State. To find the maximum SWE for your area, find the historical data on the Web site for snow.

1. Click on the State (California, per example).

2. Select Snow and Precipitation, Historic, Snow Water Data Table, Select a Site, (we used Ebbetts Pass). To find the historic maximum SWE value, find the largest SWE for your SNOTEL site.

3. For Ebbetts Pass, there are measurements from 1979 through 2005. Scroll through the data until you find the maximum SWE value (76.8 inches), which occurred in 1995. This SWE is the value you use to determine the snow load. The appendix contains a copy of the 1995 table.

4. Multiply the SWE (76.8 inches) by 5.2 to get 399.6 pounds per square foot.

According to this example, in the Ebbetts Pass area of California, a picnic table that supports a 400-pound per square foot snow load would be more than adequate.

A second example is for Kraft Creek in Montana.

1. Click on the State (Montana, per example)

2. Select Snow and Precipitation, Historic, Snow Water Data Table, Select a Site, (we used Kraft Creek). To find the historic maximum SWE value, find the largest SWE for your SNOTEL site.

3. For Kraft Creek, there are measurements from 1981 through 2005. Scroll through the data until you find the maximum SWE value (30.30 inches), which occurred in 1997. The appendix contains a copy of the 1997 table.

4. Multiply the SWE (30.30 inches) by 5.2 to get 158 pounds per square foot.

According to this example, in the Kraft Creek area of Montana, a picnic table that supports a 200-pound per square foot snow load would be more than adequate.

These two examples show substantial differences in snow load amounts. A table purchased for the Kraft Creek area does not need to be extremely heavy duty because the snow load is relatively light. However, a table purchased for the Ebbetts Pass area needs to be extremely heavy duty to support the area's substantial snow load.

When selecting and ordering new tables for your recreation area, remember to use the snow load calculation weight, the BEIG criterion, and the other selection criteria when making your decision.

As an alternative method, Montana State University has developed software that uses latitude and longitude to determine ground snow load for the State of Montana. Visit their Web site at http://www.coe.montana.edu/snowload/.

The next section describes the test methods and results. Use the Picnic Table Selection Guide on page 12 to determine which table meets your area's snow load needs. The picnic tables listed (from lightest to heaviest duty) are a sampling of those most frequently purchased by the Forest Service. If you are ordering a picnic table other than what is illustrated in the Picnic Table Selection Guide, you may specify the table type (wood, expanded metal, etc.) and that the picnic table meet the maximum snow loading requirements (pounds per square foot) for your site.

METHOD

Approach

By looking at snow levels in regions of the country with the heaviest snow load, we determined—from our information about snow—that a load of 600 pounds per square foot and 30-percent density should represent a snow load similar to that in an area with more extreme amounts of snowfall. Because snow density typically ranges from 10 to 50 percent, for testing purposes we selected a 30-percent density with 400 inches of snow, which equals about 600 pounds per square foot. We conducted tests to determine the maximum load each table could sustain prior to permanent deformation, testing up to loads of approximately 600 pounds per square foot. These tests were conducted in an effort to approximate as much as possible the snow loading conditions the tables are experiencing at high elevations.

For testing purposes (figure 7), we ordered different table designs fabricated with various materials typically used on national forests. We include examples of tables able to withstand different snow loads and still meet the Americans with Disabilities Act (ADA) requirements.

Figure 7. Testing a concrete table.

Assumptions

Most snow-load failures occur at the table's weakest point—the extended, cantilevered portion of the picnic tabletop and bench (figure 2). Therefore, the picnic tabletop is the focus of this evaluation. We assumed that if the tabletop can sustain this force, then the seats, which are one-third the width of the top and not cantilevered to the extent of the top, will also sustain the load. We concentrated the evaluation on loading the table to maximize the bending moment over the frame support at the extended portion of the table (figure 8). This assumption also helps determine where to apply bracing on previously purchased tables that are subject to failure under heavy snow conditions.

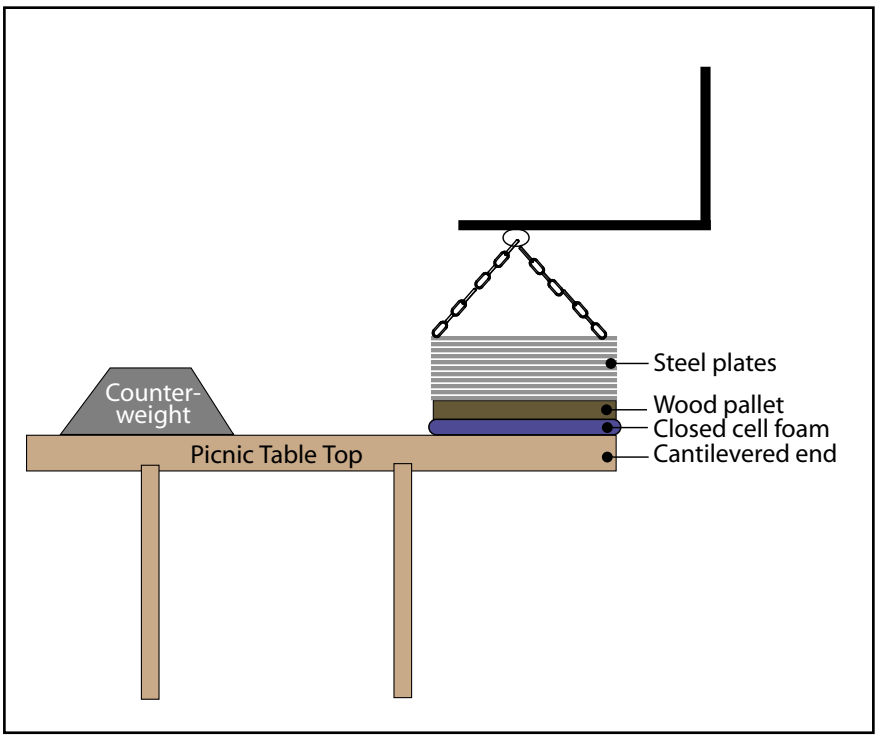

Figure 8.

Procedure

To simulate snow load during picnic table testing, we used a 120 pound 4- by 8-foot 14-gauge steel plate. A local metal fabricator spot-welded our test plates together into “pallets” of various weights. We added a chain for safely transporting the pallets with a forklift. The pallet weight varied between 125 and 494 pounds (figure 9).

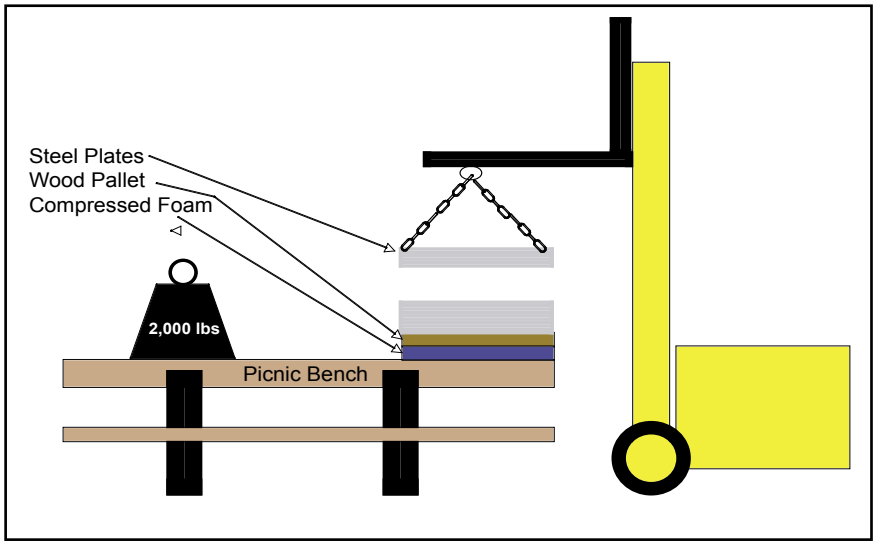

Figure 9. Diagram of the loading process.

We used a forklift to load the pallets in stacks on one end of the table. In order to stabilize the table—and keep it from tipping over as we added the weights—we placed a counterweight of more than 2,000 pounds on the opposite end of the table. The forklift forks did not touch or support any part of the table or the pallet after it was placed on the table. We measured the amount of deflection each time weight was added.

We loaded each table to 500 to 600 pounds per square foot (depending on the square footage of the table tops) or to failure (figures 10 and 11). We added weights until failure occurred or maximum weight was reached (600 pounds per square foot).

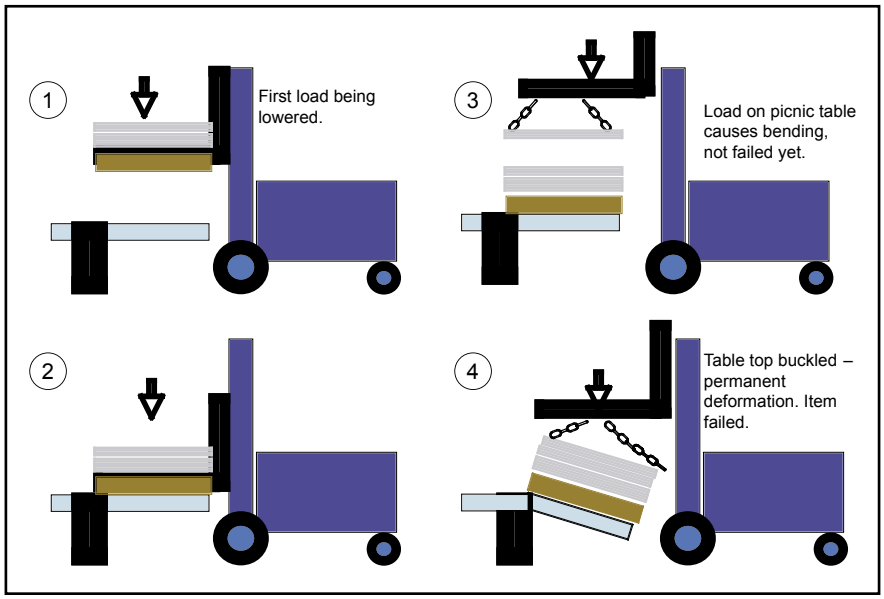

Figure 10. Anticipated loading process showing failure of picnic table.

Figure 11. Steel pallets are loaded on a recycled-plastic picnic table. Note the steel cage placed at the end of the table for safety purposes.

For safety and additional protection, our fabricator built a steel safety cage that fit at the end of the table to catch the falling weights if the table failed (figure 12). This protected the forklift operator and the other personnel who were assisting with the test. We used layers of closed-cell foam under the first pallet to more equally distribute the weight on the loading area. Then we loaded the pallets (from heaviest to lightest) onto the tables.

Figure 12. Fully loaded concrete table illustrating steel pallets, wood pallet, and safety cage.

The difference in each table's surface area accounted for the varied loads for each table and why we were unable to reach the 600 pounds per square foot load on some tables.

Results

Several tables performed well when tested, but showed some deflection under the maximum load. These tables, however, had no permanent deformation. Both lightweight expanded metal tables we tested failed before maximum loading was achieved. Two manufacturers' newer heavy duty expanded metal tables tested well. The wood-topped tables performed better overall due to the flexible nature of wood. Because the concrete table showed no measurable deflection, supported the maximum load requirement, and needed no retrofitting, it was one of the top performers.

PICNIC TABLE SELECTION GUIDE

Photo	Brand/Model	Type	Max. Weight Capacity (lb/ft^2)
	Wabash Valley Mfg., Inc. SG115D-D1	Expanded metal with steel base.	219
	Wabash Valley Mfg., Inc. D5015-55	Expanded metal with steel base.	360
	Pilot Rock Park Equipment XT/G-6VW/E	Expanded metal with steel base.	378
	Pilot Rock Park Equipment AT/W-6N/E1	A-frame recycled plastic.	430
	Pilot Rock Park Equipment XT/G-6UP/E	Wood with steel base.	448

PICNIC TABLE SELECTION GUIDE *(continued)*

Photo	Brand/Model	Type	Max. Weight Capacity (lb/ft²)
	Pilot Rock Park Equipment XT/G-6UP/E	Same model as above table, but retrofitted with 4-inch planks. In very high snow load areas you should use a 4-inch wood deck to ensure the table does not yield.	544
	Litchfield Landscape Elements Series 4000-4083 HA Custom Deluxe	All wood construction.	544
	Pilot Rock Park Equipment WXTH/G-6VN	Expanded metal with steel base.	575
	Litchfield Landscape Elements Series 4000-4083 HA Custom Deluxe	Same model as above table, but retrofitted with 4-inch planks. In very high snow load areas you should use a 4-inch wood deck to ensure the table does not yield.	604

PICNIC TABLE SELECTION GUIDE *(continued)*

Photo	Brand/Model	Type	Max. Weight Capacity (lb/ft^2)
	Outdoor Creations 100S	Concrete.	610
	Wabash Valley Mfg., Inc. DS104D-S1	Expanded metal with steel base.	627

RETROFITTING PICNIC TABLES

Talk to the forest engineer about retrofitting existing undamaged tables with bracing. Each table is constructed differently and will be retrofitted uniquely. A preventative approach is preferred over trying to retrofit after damage has occurred. Caution: Welding a damaged vinyl-coated expanded metal table is highly discouraged because of the off-gassing that occurs during the welding process and resulting damage to the vinyl coating.

We tested one of the lighter weight vinyl expanded metal tables, and it failed before reaching the target snow load weight (figure 13).

Figure 13. Expanded metal table failure.

We added steel reinforcement plates to the inside of the failed area and retested it, and it failed again. Not only was the welding process unsightly, but it damaged the vinyl coating (figure 14).

Figure 14. Damage to vinyl from welding process and weight failure.

We then retrofitted the opposite end of the same table by reinforcing the cantilevered end with steel bracing (figure 15). Adding braces to the expanded metal table worked, but the braces may interfere with wheelchair access and ADA requirements.

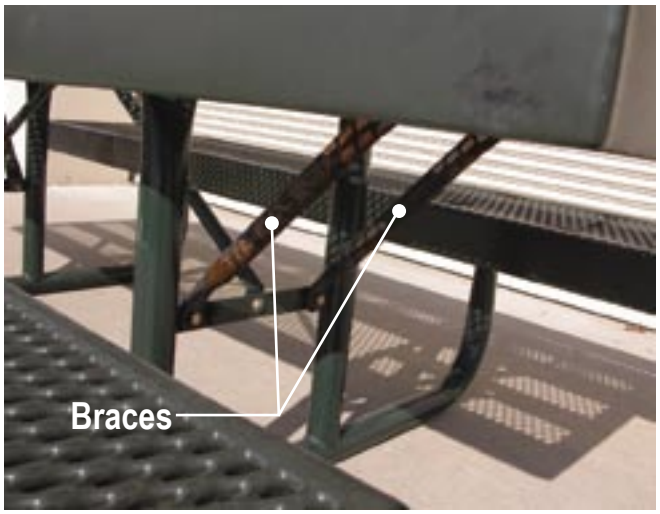

Figure 15. Expanded metal table retrofitted with braces.

We retrofitted two tables—one with a metal base (figure 16) and the other with a wood base (figures 17 and 18)—using heavy 4-inch planks, without additional bracing. They proved extremely strong and did not fail the load test.

Figure 16. Retrofitted metal base table with 4-inch planks.

Figure 17. Retrofitted all-wood table with 4-inch planks.

Figure 18. This all-wood table, retrofitted with 4-inch planks and no additional bracing, performed well under the testing protocol.

Two additional methods to prevent deformation due to snow loading on picnic tables are 1) set the tables on end next to a tree or building so the snow slides off and does not accumulate or 2) remove the tops and seats and store them for the winter if the tables are fixed permanently in the ground.

SUMMARY

In order to select a table that will perform well in a particular area of the country, you must know certain information prior to purchase. First, you must know where the table will be used and the maximum snow load for that area. By visiting the National Snow Load Information Web site, you will learn how to calculate your snow load requirements. After determining the location and loading requirements for the table, consult the BEIG for aesthetic considerations. Be sure to select a table that will withstand your weather conditions and be appropriate for the setting.

Retrofitting an undamaged table is possible, but due to the variety of tables, you should consult the forest engineer to ensure the retrofitted table will meet desired structural requirements and ADA considerations. Welding vinyl-wrapped metal tables as a retrofitting technique is strongly discouraged—bolting is a much more acceptable reinforcing technique.

APPENDIX—SNOW WATER EQUIVALENT TABLES

Ebbetts Pass Data

/cdbs/ca/snot06 **95** Snow Water Equivalent

Station : CA19L19S, **EBBETTS PASS**

------- Unit = inches

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	9.80	16.20	38.40	39.40	66.00	73.30	65.40	23.70	0.00	0.00
2	0.00	0.30	9.80	16.20	38.40	39.40	66.10	75.30	62.90	21.90	0.00	0.00
3	0.00	0.40	9.90	16.20	38.40	40.20	66.30	75.40	61.00	20.40	0.00	0.00
4	0.00	0.50	11.10	16.30	38.40	41.90	66.30	75.50	59.40	18.60	0.00	0.00
5	1.50	0.50	11.10	17.30	38.40	41.90	66.30	75.70	57.40	16.80	0.00	0.00
6	1.50	2.30	11.50	18.70	38.40	41.90	66.30	76.10	56.30	14.60	0.00	0.00
7	1.50	2.50	11.80	19.70	38.40	41.90	66.30	76.30	55.90	12.10	0.00	0.00
8	1.50	2.70	11.80	20.90	38.50	41.90	67.30	76.40	55.90	8.50	0.00	0.00
9	1.10	2.80	11.80	21.80	38.50	41.90	67.50	76.50	55.90	5.60	0.00	0.00
10	0.50	3.50	11.80	22.60	38.60	45.70	67.50	76.80	55.80	2.10	0.00	0.00
11	0.00	3.90	11.80	25.60	38.60	50.90	67.50	76.30	54.30	1.10	0.00	0.00
12	0.00	3.90	11.80	26.00	38.80	52.50	67.60	75.60	51.30	0.00	0.00	0.00
13	0.00	3.90	12.90	27.10	38.80	53.30	67.60	75.30	48.50	0.00	0.00	0.00
14	0.00	3.90	13.20	28.80	39.80	54.10	68.90	75.60	46.60	0.00	0.00	0.00
15	0.00	3.90	13.60	31.00	40.10	54.50	68.90	76.50	45.70	0.00	0.00	0.00
16	0.00	3.90	13.70	31.70	40.10	54.60	69.10	76.50	45.80	0.00	0.00	0.00
17	0.00	4.00	13.90	32.20	40.10	54.60	69.40	76.50	45.80	0.00	0.00	0.00
18	0.00	6.20	13.90	32.40	40.00	54.80	69.50	76.50	45.70	0.00	0.00	0.00
19	0.00	6.70	14.00	32.50	40.00	56.00	69.70	76.50	44.70	0.00	0.00	0.00
20	0.00	6.70	14.10	32.70	40.00	56.10	69.70	76.50	43.20	0.00	0.00	0.00
21	0.00	6.70	14.10	32.90	40.00	59.40	70.30	76.20	41.60	0.00	0.00	0.00
22	0.00	6.70	14.20	33.10	40.00	60.40	70.30	75.80	40.00	0.00	0.00	0.00
23	0.00	6.70	14.20	34.00	40.00	62.90	70.30	75.40	38.50	0.00	0.00	0.00
24	0.00	6.70	14.30	34.40	39.80	64.90	70.30	74.30	36.90	0.00	0.00	0.00
25	0.00	6.70	15.00	35.40	39.60	65.20	70.40	73.80	35.10	0.00	0.00	0.00
26	0.00	9.10	15.00	35.90	39.50	65.30	70.50	72.80	33.30	0.00	0.00	0.00
27	0.00	9.60	15.10	36.90	39.40	65.40	69.50	72.30	31.20	0.00	0.00	0.00
28	0.00	9.80	15.20	37.80	39.40	65.60	69.10	71.80	29.10	0.00	0.00	0.00
29	0.00	9.80	16.00	37.80	~	65.70	70.80	70.90	27.20	0.00	0.00	0.00
30	0.00	9.80	16.00	37.80	~	65.90	72.50	69.60	25.80	0.00	0.00	0.00
31	0.00	~	16.10	38.40	~	66.00	~	67.10	~	0.00	0.00	~
mean	0.25	4.80	13.18	28.40	39.23	53.68	68.59	74.81	46.54	4.69	0.00	0.00
max	1.50	9.80	16.10	38.40	40.10	66.00	72.50	**76.80**	65.40	23.70	0.00	0.00
min	0.00	0.00	9.80	16.20	38.40	39.40	66.00	67.10	25.80	0.00	0.00	0.00

Kraft Creek Data

cdbs/mt/snot30 **97** Snow Water Equivalent

Station : MT13B22S, **KRAFT CREEK**
------- Unit = inches

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	1.20	7.50	15.50	20.20	25.10	28.70	22.30	0.00	0.00	0.00	0.00
2	0.00	1.20	8.20	15.30	20.80	25.50	28.70	21.90	0.00	0.00	0.00	0.00
3	0.00	1.20	8.50	15.30	20.80	25.70	28.70	21.40	0.00	0.00	0.00	0.00
4	0.00	1.20	8.80	15.50	20.80	25.70	28.90	20.80	0.00	0.00	0.00	0.00
5	0.00	1.50	9.00	15.50	20.80	25.80	29.10	20.30	0.00	0.00	0.00	0.00
6	0.00	1.80	9.20	15.50	20.80	26.10	29.20	19.70	0.00	0.00	0.00	0.00
7	0.00	2.10	9.40	15.80	20.80	26.60	29.30	19.10	0.00	0.00	0.00	0.00
8	0.00	2.10	9.60	16.30	20.80	26.60	29.30	18.40	0.00	0.00	0.00	0.00
9	0.00	2.30	9.90	16.50	20.80	26.60	29.30	17.70	0.00	0.00	0.00	0.00
10	0.00	2.30	10.30	17.20	20.80	27.00	29.40	16.70	0.00	0.00	0.00	0.00
11	0.00	2.30	10.40	17.30	20.80	27.60	29.60	15.60	0.00	0.00	0.00	0.00
12	0.00	2.30	10.40	17.30	20.90	28.10	29.70	14.70	0.00	0.00	0.00	0.00
13	0.00	2.30	10.60	17.30	21.40	28.50	29.70	13.60	0.00	0.00	0.00	0.00
14	0.00	2.30	11.30	17.30	21.60	28.70	29.80	12.40	0.00	0.00	0.00	0.00
15	0.00	2.30	11.60	17.30	22.40	28.70	30.30	11.10	0.00	0.00	0.00	0.00
16	0.00	2.50	12.00	17.30	22.70	29.00	30.20	9.70	0.00	0.00	0.00	0.00
17	0.20	2.50	12.00	17.30	22.70	29.00	29.80	8.20	0.00	0.00	0.00	0.00
18	0.20	2.70	12.00	17.80	22.90	29.00	28.80	7.00	0.00	0.00	0.00	0.00
19	0.30	3.50	12.00	17.80	23.00	28.90	28.20	6.40	0.00	0.00	0.00	0.00
20	0.60	4.50	12.00	17.80	23.70	28.50	27.50	5.50	0.00	0.00	0.00	0.00
21	0.70	4.60	12.50	17.80	24.00	28.20	27.20	4.40	0.00	0.00	0.00	0.00
22	0.70	4.70	12.50	18.30	24.10	28.00	26.60	3.40	0.00	0.00	0.00	0.00
23	0.90	4.90	12.60	18.60	24.20	27.90	26.40	2.40	0.00	0.00	0.00	0.00
24	0.90	4.90	12.80	18.70	24.30	28.50	26.10	1.50	0.00	0.00	0.00	0.00
25	1.20	5.30	13.40	19.40	24.30	28.60	25.60	0.90	0.00	0.00	0.00	0.00
26	1.20	6.00	13.50	19.40	24.60	28.60	24.90	1.00	0.00	0.00	0.00	0.00
27	1.20	6.10	14.00	19.40	24.90	28.40	24.20	0.50	0.00	0.00	0.00	0.00
28	1.20	7.00	14.40	19.50	25.00	28.50	23.60	0.00	0.00	0.00	0.00	0.00
29	1.20	7.10	14.60	19.70	~	28.70	23.20	0.00	0.00	0.00	0.00	0.00
30	1.20	7.20	15.50	19.80	~	28.70	22.70	0.00	0.00	0.00	0.00	0.00
31	1.20	~	15.60	20.10	~	28.70	~	0.00	~	0.00	0.00	~
mean	0.42	3.40	11.49	17.54	22.32	27.73	27.82	10.21	0.00	0.00	0.00	0.00
max	1.20	7.20	15.60	20.10	25.00	29.00	**30.30**	22.30	0.00	0.00	0.00	0.00
min	0.00	1.20	7.50	15.30	20.20	25.10	22.70	0.00	0.00	0.00	0.00	0.00

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Forest Service and U.S. Department of the Interior Bureau of Land Management employees also can view videos, CDs, and SDTDC’s individual project pages on their internal computer network at:

http://fsweb.sdtdc.wo.fs.fed.us/.

For additional information on picnic table use in high snow load areas, contact Martha “Marty” Willbee, recreation planner, at SDTDC. Phone 909–599–1267 ext 231. E-mail: mwillbee@fs.fed.us.

About the Author...

Martha Willbee, Outdoor Recreation Planner, joined the Recreation Program in 2002 after many years as Administrative Assistant for the San Dimas Technology and Development Center. She came to the Forest Service in 1991 from the private sector with a background in banking and insurance. She holds a B.A. in Recreation Administration from Chico State University in California.