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Simulating Recharge in a Wisconsin Watershed: the Effect of Sub Annual Precipitation Patterns

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SIMULATING RECHARGE IN A WISCONSIN WATERSHED: THE EFFECT OF SUB ANNUAL
PRECIPITATION PATTERNS

by

Alice Egan

A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

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ABSTRACT

SIMULATING RECHARGE IN A WISCONSIN WATERSHED: THE EFFECT OF SUB ANNUAL PRECIPITATION PATTERNS

by

Alice Egan

The University of Wisconsin-Milwaukee, 2014

Under the Supervision of Professor Shangping Xu

A watershed, the Prairie River in north-central Wisconsin was used to analyze why the same annual precipitation generates variable annual recharge rates. Global Climate Models (GCMs) with three greenhouse gas emission scenarios (B1, A1B and A2) for two time series 2047-2065 and 2082-2100 were used to examine the annual and monthly differences between the Prairie River watershed future projections and the Prairie River watershed historical record, 1954-2009. The USGS soil water balance (SWB) model was used to calculate recharge.

In the Prairie River watershed, there is a strong correlation ($R^2=0.84$) between growing season recharge and growing season precipitation, and there is a strong correlation ($R^2=0.74$) between non-growing season recharge and non-growing season precipitation. Using the linear regression equations from the two correlation plots, recharge for the watershed was calculated that shows that higher non-growing season precipitation and lower growing season precipitation generate higher annual recharge rates. Simulations of annual precipitation were generated using SDSM, a statistical

downscaling model. Using SWB, recharge rates were generated for the simulations. The correlations were similar to the non-simulated data with a correlation ($R^2=0.75$) between growing season recharge and growing season precipitation and a correlation ($R^2=0.83$) between non-growing season recharge and non-growing season precipitation. The linear regression equations for growing season recharge and precipitation and non-growing season recharge and precipitation showed similar equations to the non-simulated data.

For the future climate data, the student's t-test was applied to compare the annual and monthly means of precipitation, temperature, recharge and ET of the Prairie River watershed time series, 1954-2009 to the time series, 2047-2065 and 2082-2100 for the Global Climate Models using three greenhouse gas emission scenarios B1, A1B and A2. For all scenarios for both time series, the t-values predict significant increases in recharge in December and January although annual recharge is not predicted to change, significant increases in temperature in all months with the highest increases occurring in July, August, and September and significant annual increases in ET.

This is dedicated to my patient, kind and supportive husband,
to my four terrific children who cheered me up and on,
to my parents who always asked me about my research and
supported me completely,
to my thesis adviser, Shangping Xu who supported me
and guided me through my extended stay at UWM
and to everyone in the Geosciences Department.

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LIST OF SYMBOLS

A1B	greenhouse gas emission scenario
A2	greenhouse gas emission scenario
AWC	available water content
B1	greenhouse gas emission scenario
DEM	Digital Elevation Model
CFGl	Continuous Frozen Ground Index
ET	evapotranspiration
GCM	Global Climate Model
IPCC	The Intergovernmental Panel on Climate Change
NCEP	National Centers for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resources Conservation Service
R^2	coefficient of determination
SDSM	Statistical downscaling model
SWB	soil water balance method

1. INTRODUCTION

Groundwater recharge represents the amount of water that infiltrates into the saturated zone to replenish the underlying aquifer. The time it takes for the infiltrating water to reach the water table depends on the thickness of the vadose zone and the vertical hydraulic conductivity of the unsaturated soils (Freeze and Cherry, 1979). The water budget describes the water inputs or sources and outputs or sinks into a watershed with recharge calculated from the following equation (Westenbroek, 2012; Freeze and Cherry, 1979; Fetter, 2001):

$$\text{Recharge} = (\text{precipitation} + \text{snowmelt} + \text{inflow}) [\text{sources}] - (\text{interception} + \text{outflow} + \text{Evapotranspiration}) [\text{sinks}] - \text{change in soil moisture}$$

There is a multitude of ways to calculate recharge: water budgets, unsaturated zone methods, water table fluctuations, tracers, computer modeling, and stream flow methods (USGS, 2013). The selection of groundwater recharge estimation methods depends on budgets, time frames and the climatology of the region. One method, the chloride mass balance method is not valid in humid environments due to the low concentrations of chloride in the unsaturated zone (Scanlon, 2012).

For this study two methods were used to calculate recharge: SWB, a soil water balance computer model based on the Thornthwaite-Mather soil-water accounting method and PART, a USGS base flow separation program. The PART recharge values were used to calibrate the SWB model. Previous studies have used the SWB model to

measure recharge in counties that fit the grid format required by SWB. This study used SWB to measure recharge using a watershed. Boundary conditions were necessary to fit the watershed into the grid. Using a watershed in SWB allows for calibration to base flow. This is the first time the SWB model has been calibrated to a base flow separation program.

Recharge can vary spatially and temporally. Precipitation is one of the most important driving forces of recharge. The main goals of this study include: 1) to calibrate the SWB model to PART-extracted stream base flow, 2) to analyze simulated recharge focusing on precipitation patterns and their effect on recharge, and 3) to examine the potential effects of future climate change on groundwater recharge in a northern Wisconsin watershed.

2. SETTING

Study Area

The Prairie River watershed is located in north-central Wisconsin and spans Lincoln, Langlade and Oneida counties (Figure 1). The drainage area is 184 square miles. It is part of the Upper Wisconsin River watershed and the Mississippi River watershed.



Figure 1. Location of the Prairie River watershed.

The topography of the area is hummocky with glacial till deposited during the Wisconsin glaciation approximately 11,000 years ago. The area is characterized by moraines. Elevations range from a high of 588 feet to a low of 396 feet.

The watershed has a gaging station with historical daily discharge data. The gaging station 05394500 is located at 45°14'09"N, 89°38'59"W eight miles upstream from the mouth of the watershed.

Climate and precipitation

Climate data was retrieved from the National Oceanic and Atmospheric Administration's National Climatic Data center from 1953-2009 (9 years were omitted due to lack of data) for the Merrill Station, WI475364, Latitude: 45°10'14N, Longitude: 089°39'41W. This time series was used because it had the most complete consecutive data for daily precipitation and minimum and maximum temperatures. The average annual temperature and precipitation is 41.7° F and 31.7 inches, respectively. Sixty percent of the precipitation falls during the growing season which starts the middle of May and ends late September/early October (NOAA, 2006) with a growing season length of approximately 140 days.

Bedrock Geology

The Prairie river watershed is underlain by lower Proterozoic basalts and rhyolites interspersed with metasedimentary rock and meta-gabbros and diorites. This area is called the northern highlands and is part of the Canadian Shield that contains the oldest rocks in North America. Throughout its history, it underwent uplift, folding, erosion and scouring and deposition by continental ice sheets.

The bedrock in the south Prairie River watershed is at a depth of 50 feet to five feet from the surface. The center of the Prairie river watershed has the bedrock at a

depth of between 100 feet and 50 feet of the surface. The rest of the Prairie River watershed has the bedrock at greater than 100 feet from the surface.

Pleistocene sand and gravel make up the surficial deposits of the watershed.

The soil makeup of the area includes a range of soil types A-D with sand having the highest percentage due to recent glaciation (Table 1). The watershed is approximately 70% forested and 25% agricultural (Table 1).

Soil Type	Area (%)	Vegetation Class	Area (%)
A	35	Broad leaved deciduous	28
B	25	Aspen	19
C	22	Grassland	9
D	16	Sugar Maples	7
		Mixed deciduous/conifers	7
		Agriculture	25
		Urban	0

Table 1. Soils and land use for the Prairie River watershed.

Hydrostratigraphy

At the surface of the Prairie River watershed is the sand and gravel aquifer which is the main source of water to wells. Depth to the water table ranges from 0 to 20 feet in the southwest and the northwest, greater than 50 feet in the center of the watershed and from 20 to 50 feet for the remainder of the watershed. Underlying the sand and gravel aquifer is the crystalline bedrock aquifer which holds water within cracks.

3. LITERATURE REVIEW

The effect of precipitation on recharge

Annual precipitation is not always the main determinant of the amount of annual recharge a watershed receives due its high intra-variability. Other factors influencing diffuse recharge include soil type, vegetation, temperature, solar radiation, vapor pressure deficit and CO₂ concentrations, but rainfall has been found to be the most vital (Allen et al., 2004; Serrat-Capdevila et al., 2007). Watersheds with the same soil and annual vegetation have higher annual recharge rates if they have winter dominated rainfall as opposed to summer dominated rainfall (Barron et al., 2012). In a New Mexico watershed, more intense summer storms or more frequent winter rainfall increased recharge (Vivoni, 2009). A study of the Spring Mountains in Nevada, showed that very intense, short summer storms which make up a third of the annual precipitation for the region account for only 10% of the annual recharge while the late snowmelt contributes to the majority of annual recharge (Winograd et al., 1998).

Rainfall intensity is an important factor in annual recharge. Increase in rainfall intensity can increase recharge as well as the percentage of precipitation that becomes recharge (Barron, 2012). The spatial variation in rainfall is another important factor as variations in soil permeability and root depth affect the amount of recharge. In a Kalahari catchment, 0.77% of the area contributes 7.2% of the recharge (Wanke, 2008).

Recharge depends on distribution of precipitation events such as the locality of the storm center and periods of wetness or dryness (Sheffer et al., 2010). For example,

two watersheds with similar climatic and lithological characteristics, one in Israel and one in Texas have annual precipitation rates of 23 inches. For the Israeli watershed, 25% to 35% of precipitation recharges the underlying Israeli aquifer (Gvirtzman, 2002). For the Texas Edwards aquifer only 5% to 10% of precipitation becomes recharge (Abbott, 1975). The recharge difference is due to the temporal characteristic of the precipitation. The Israeli watershed received winter precipitation while the Texas watershed had an even annual distribution of precipitation (Sheffer et al., 2010). At Lake Grace in Western Australia, a semi-arid region 11.8 inches of annual precipitation produced a range of recharge between 0 and 2 inches. At times lower amounts of annual precipitation can generate more recharge. In 1968 the annual precipitation was 14.6 and the annual recharge rate of 4.3 inches. In 1963 annual precipitation was 22.7 inches but the annual recharge rate was 3.8 inches. It was hypothesized that the intensity of the rainfall in 1968 produced 23 days of recharge compared to 88 days of recharge in 1963 (Lewis, 1998).

A study of recharge in Dane County, Wisconsin using the SWB model showed a range of recharge rates for similar annual precipitation. For example, 32.5 inches of annual precipitation generated recharge from 7 inches up to 14 inches. The study did not determine the reason for the range but suggested possible factors involved including soil moisture, previous year's snowmelt, rainfall strength and duration and ET (Hart et al., 2012).

Climate change

There have been many studies of the effect of climate change on the hydrology of watersheds using Global Climate Models (GCMs) (McCabe et al, 1997, Markstrom et al., 2011, Christiansen, 2011). GCMs are numerical models which include the Earth's atmosphere, oceans, land surface and cryosphere and their physical responses to increases in greenhouse gas concentrations (Markstrom et al., 2011). The Intergovernmental Panel on Climate Change (IPCC) generates climate data from the GCMs using different greenhouse gas emission scenarios. One GCM study looked at the Trout Lake Basin in north-central Wisconsin to analyze the effect of climate change using global climate models using three emission scenarios, B1, A1B and A2 (Markstrom et al., 2011). The Trout Lake Basin lies at a similar latitude as the Prairie River. An analysis of GCM projections with three emission scenarios showed that increases in temperature, ET and length of the growing season will occur during this century at the Trout Lake Basin. Less snowfall due to higher temperatures will result in a decrease in recharge pulses in April and May. More recharge is predicted to occur during the growing season and late fall (Markstrom et al., 2011).

According to a study of growing seasons, the Trout Lake basin will see an earlier spring and a longer fall depending on the emission scenario. For emission scenarios B1, A1B and A2 projections have predicted that spring will arrive 10, 17 and 20 days earlier, respectively and fall will last 11, 15 and 19 days longer, respectively (Christiansen et al., 2011).

4. OBJECTIVE

The main objectives of this study are 1) to analyze why similar annual precipitations generate remarkable variability in recharge rates by using SWB to calculate recharge rates for the years 1954-2009 and for SDSM annual precipitation simulations; 2) to estimate future recharge rates using SWB from the GCMs using three greenhouse gas emission scenarios B1, A1B and A2 for the years, 2047-2065 and 2082-2100 and to compare each future time series to the historical record to determine changes on an annual and monthly scale.

5. METHODS

SWB

SWB, the USGS soil water balance method is a computer model that calculates a daily groundwater recharge and ET rate. The computer program is available for download from http://wi.water.usgs.gov/Soil_Water_Balance/index.html. The model was used throughout the study. It was used to calculate recharge for the time series, 1953-2009, the SDSM simulations and the GCMs. The model works on a grid system. The recharge rate for each grid cell is calculated by determining the sources and sinks to each grid cell. The sources are 1) daily precipitation, 2) snowmelt that is permitted to accumulate or melt based on daily temperatures, and 3) inflow using a flow direction file. The sinks are 1) interception which is precipitation trapped by foliage from trees, 2) evapotranspiration (ET) a combination of water transpired by plants and evaporation from the land surface, and 3) surface runoff. Surface runoff is calculated using the United States Department of Agriculture, National Resources Conservation Service curve numbers that represent a precipitation-runoff relationship. Curve numbers are calculated based on soil type, land use, surface condition and antecedent runoff condition (Westenbroek et al., 2010). Curve numbers are increased or decreased depending on the soil moisture with higher curve numbers causing more runoff. Three antecedent runoff conditions I, II, III are dry, average and near saturation, respectively. For near saturated soils, antecedent runoff condition III, the curve numbers are increased causing more runoff. The SWB model accommodates for frozen ground using

a continuous frozen ground index (CFG I) in units, degree-Celsius-days. The CFG I is calculated at a daily time step using daily air temperatures (Molnau et al., 1983). An upper and lower limit CFG I, 83 and 55, respectively is set in the control file that runs SWB. These values are suggested by the literature (Westenbroek et al., 2010). The ground is considered frozen when the daily calculated CFG I value is greater than the upper limit; the curve numbers are shifted to antecedent runoff condition III from antecedent runoff condition II causing runoff. A CFG I value above 83 should not generate recharge.

The model domain used for the Prairie River watershed was 1211 by 1002 with a cell size of 30 meters. Since watersheds are not grid-shaped, boundary conditions must be created to eliminate recharge outside of the watershed.

There are five inputs into the model: the climate data including minimum and maximum temperature and daily precipitation, land use (Figure 2), Digital Elevation Model (DEM) (Figure 3), soils (Figure 4) and the available water content (AWC) (Figure 5) which is created from the soils file. The available water content is the maximum amount of water capacity a soil can hold with units in inches per foot of thickness. A schematic of the process is described in Figure 6.

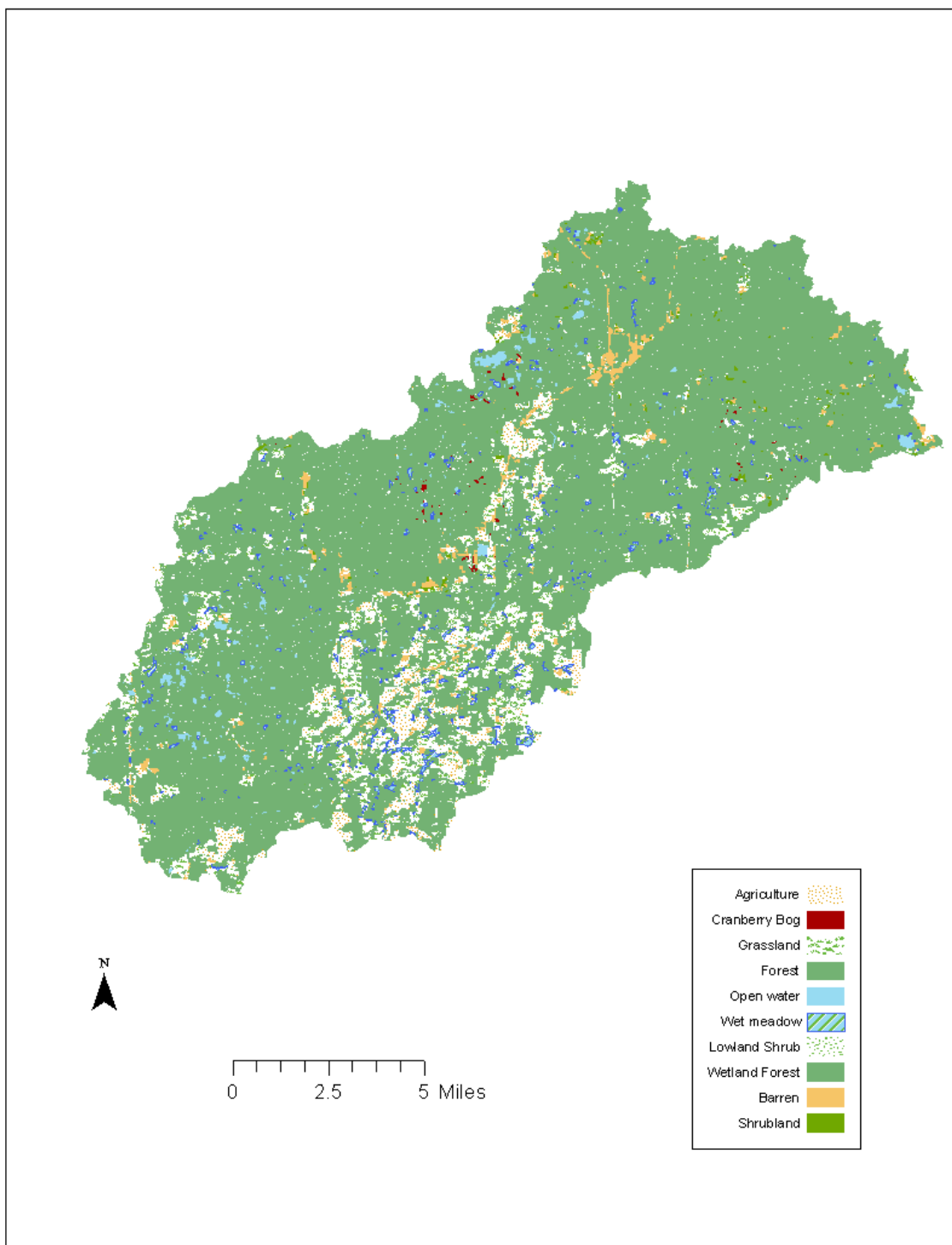


Figure 2. Land use of the Prairie River.

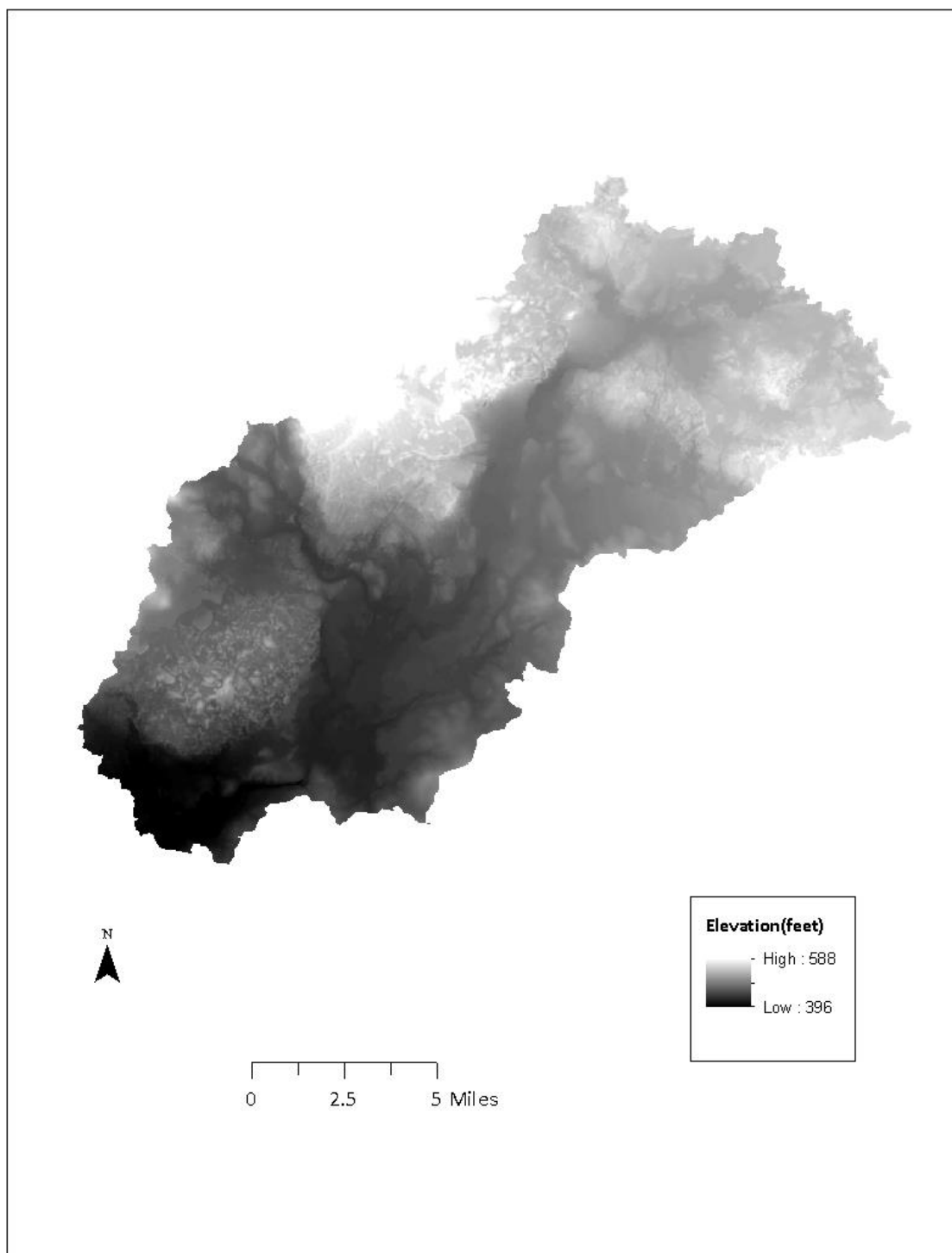


Figure 3. Digital Elevation Model of the Prairie River.

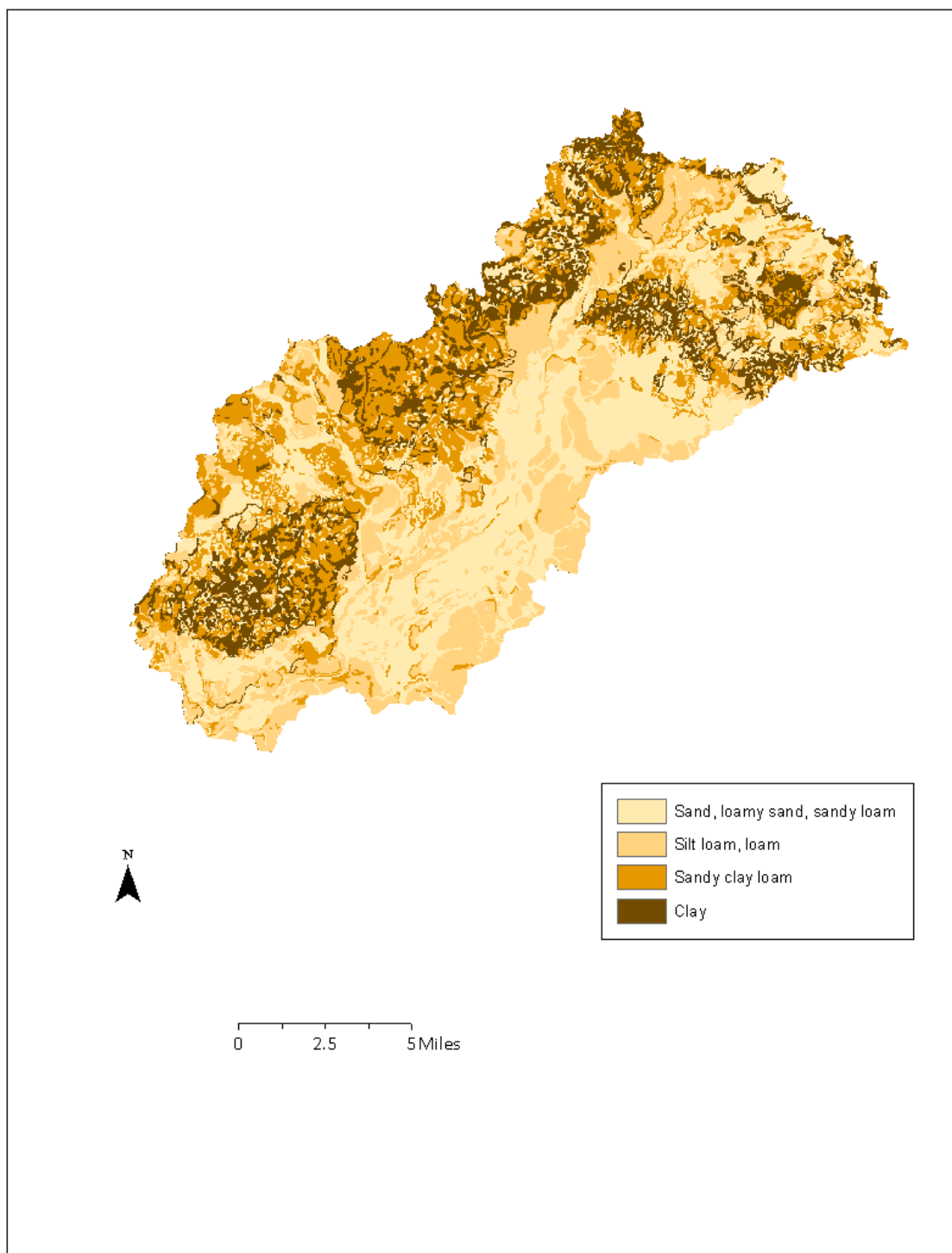


Figure 4. Soils of the Prairie River.

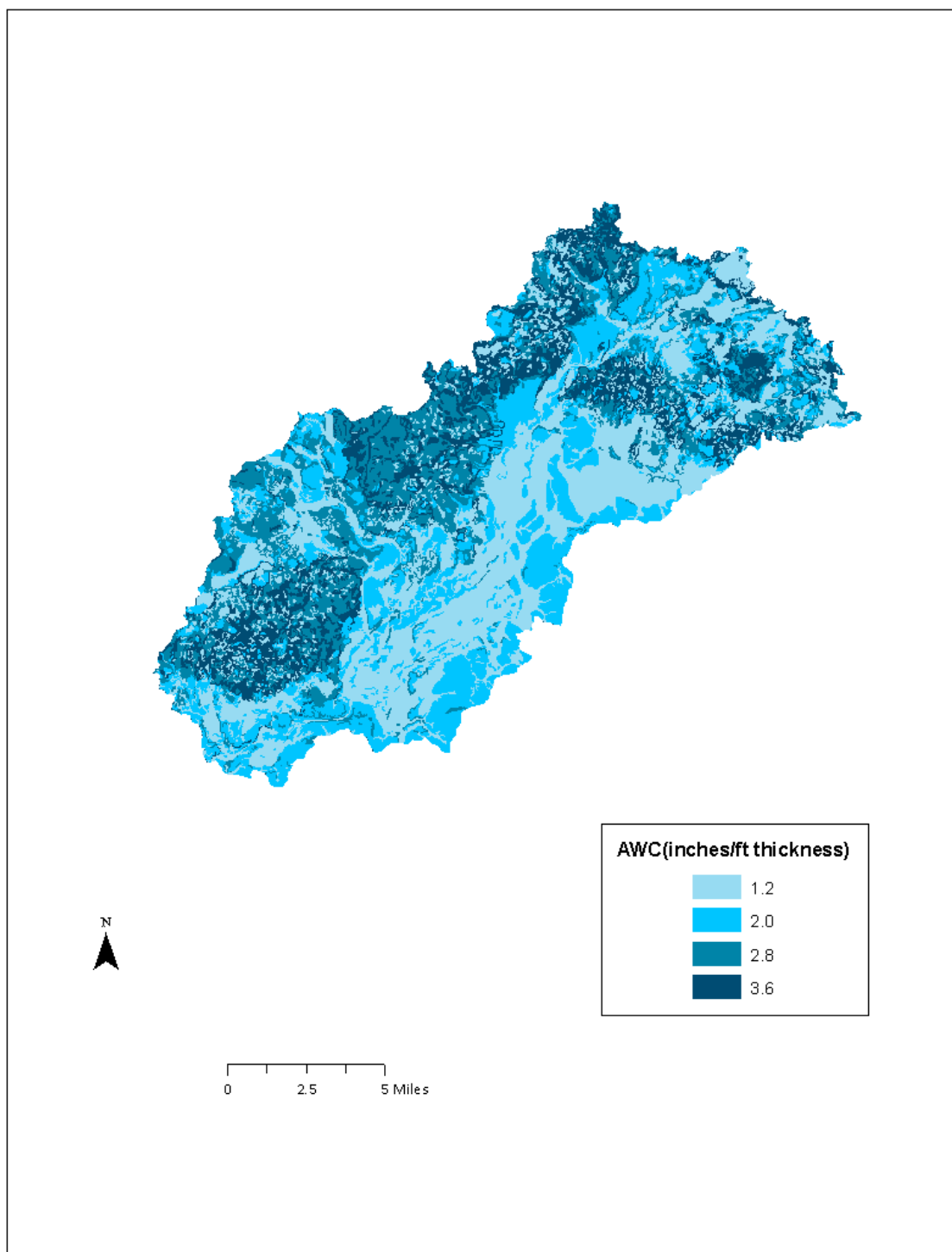


Figure 5. Available water content of the Prairie River.

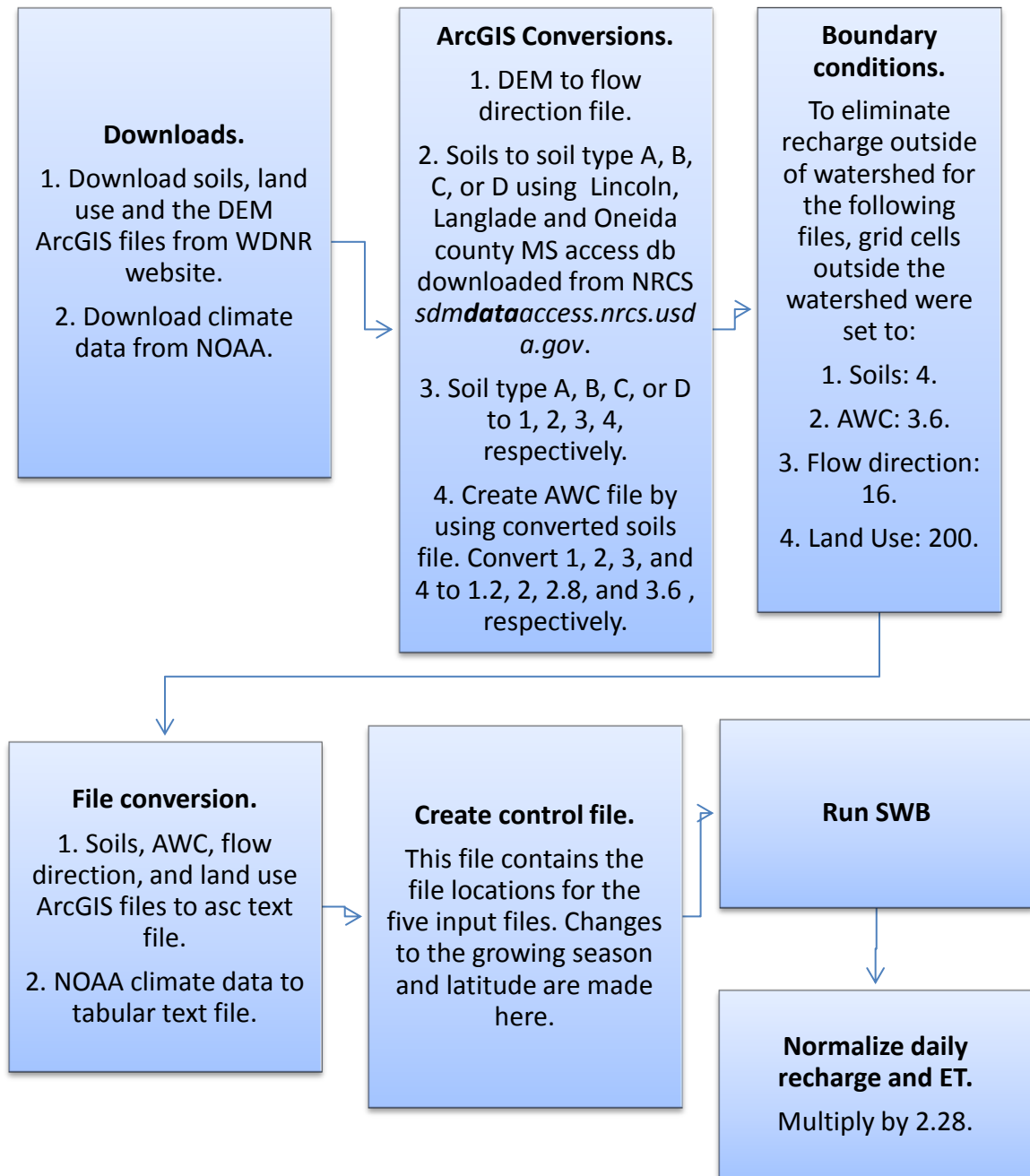


Figure 6. Schematic of the process to run SWB.

The first year of each time series, 1953, the first SDSM simulation, 2046 and 2081 was used to initialize the SWB model. Each run of the model provides an initial snow cover and soil moisture content value that is input into the following year's run of the model. One of the limitations of the SWB model is the use of the grid system. SWB calculates daily recharge and ET using the entire grid. To calculate recharge and ET for the watershed only, the values were normalized. To accomplish this, daily recharge and ET were multiplied by 2.8. This number was calculated by dividing the total number of grid cells by the total number of watershed cells.

Calibration of SWB to PART

Using a watershed in SWB allows for direct calibration to base flow. Stream flow data recorded at the Prairie River gaging station for the time period 1954-2009 were used to extract base flow values using the USGS computer program PART which gives an annual and monthly recharge rate. The monthly base flow was lagged by two months to account for the amount of time recharge from the aquifer becomes stream flow. To calibrate the SWB model to PART, the land use look up table, an SWB standard input table with curve numbers, maximum recharge and interception for all soil types (A-D) was modified by increasing the maximum recharge values by 35% to maximize the R^2 value for the plot of SWB annual recharge and PART annual recharge (Figure 7). The modified land use look up table was used in all subsequent runs of the SWB model. The intercept for the linear regression line was zeroed because when there is zero annual recharge for SWB there is zero annual recharge for PART. The most important factor for

the calibration was the slope. When the slope became one, the mean annual recharge for SWB and PART were the same for 1954-2009.

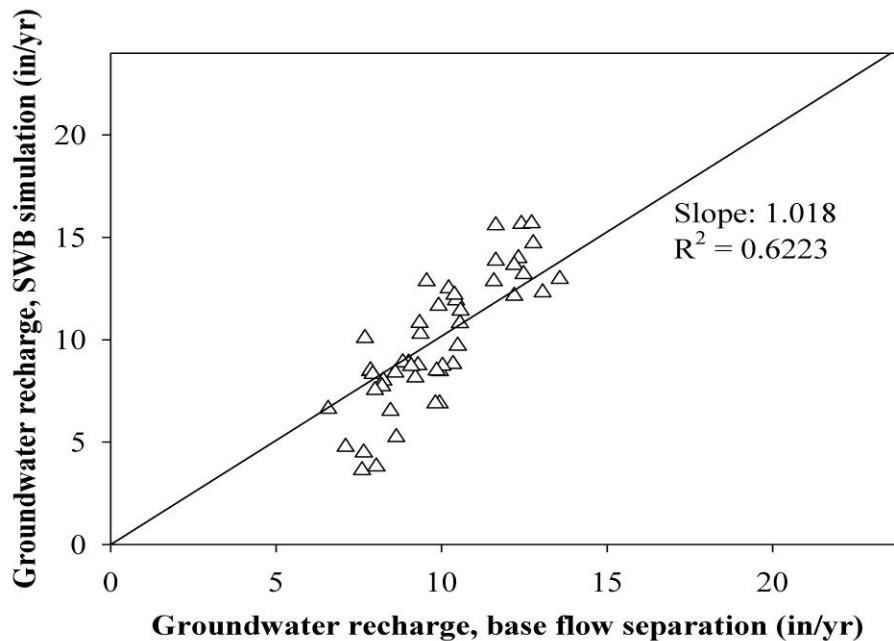


Figure 7. Calibration of SWB to PART.

The SDSM Model

The time series, 1954-2009 with 9 years omitted due to lack of data represents only 47 years of data to analyze similar annual precipitation with variable recharge rates. For further analysis, 1,000 files with similar annual precipitation but variable daily precipitation were generated using SDSM, a statistical downscaling model SDSM 4.2.9 (<http://co-public.lboro.ac.uk/cocwd/SDSM/sdsmmain.html>) Annual temperature and initial snow cover were kept constant for the 1,000 simulations to eliminate these variables' effects on variable recharge rates. For all simulations, the annual temperature was set to 42°F using the year 1990 temperature data from the Merrill station. It was

set to 42°F because it is the mean temperature of the watershed. Initial snow cover was set to 0.9 inches, the mean initial snow cover for the watershed. This is a limitation of the study.

SDSM generates local present day daily maximum and minimum temperatures and precipitation simulations using large scale atmospheric forces called National Center for Environmental Predictions (NCEP) predictor variables and the statistics of the observed weather at the designated location, in this case the Merrill NOAA station. The present day is for the time period, 1961-1990, and the predictor variables are the means for this time period. SDSM also can generate future climate scenarios using GCMs. For the purposes of this study, the present day predictor variables were used to generate precipitation simulations for that time period. From these simulations, the precipitation data for the year 1990 was extracted from the output file and used in SWB. The reason for this is the use of the 1990 temperature data. A schematic of the process is described in Figure 8.

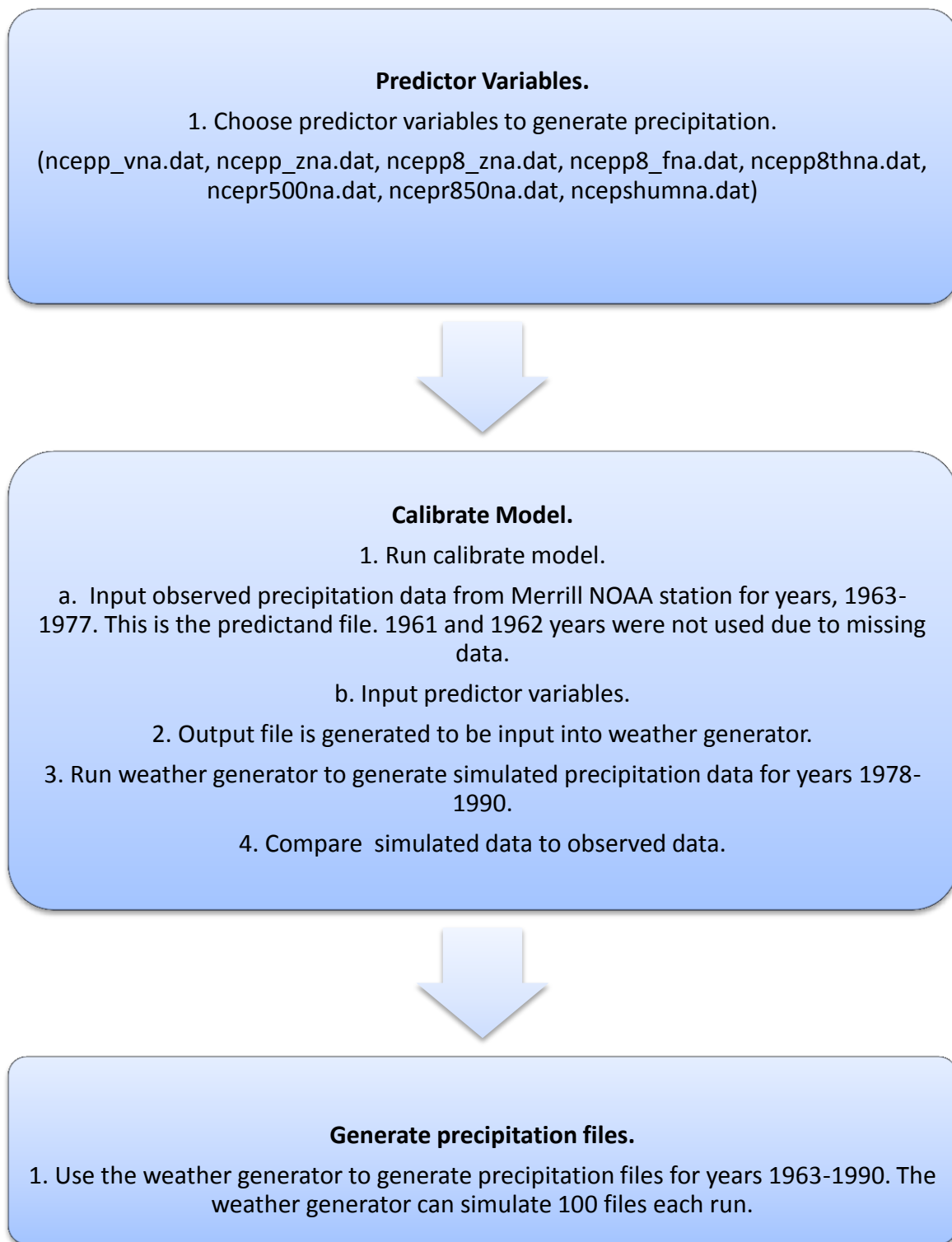


Figure 8. Schematic of the process to run SDSM.

Global Climate Models with three emission scenarios

Downscaled global climate simulations (Table 2) of three greenhouse gas emission scenarios, B1, A1B and A2 (Table 3) were provided by the University of Wisconsin-Madison. The simulations are for the time periods, 2046-2065 and 2081-2100, respectively. The first year of each series, 2046 and 2081 was used to initialize the SWB model. The other input files, land use, flow direction, soils and AWC were kept the same. A limitation of this study is the assumption that land use remains unchanged at the end of the 21st century.

GCM, vintage	Description
cccma-cgcm3.1, 2005	Canadian Centre for Climate Modelling and Analysis
cccma-cgcm3.1.t63,2005	Canadian Centre for Climate Modelling and Analysis
cnr-mc3, 2004	Météo-France/Centre National de Recherches Météorologiques, France
csiro-mk3.0, 2001	Commonwealth Scientific and Industrial Research Organisation (CSIRO) Atmospheric Research, Australia
csiro-mk3.5, 2006	Commonwealth Scientific and Industrial Research Organisation (CSIRO) Atmospheric Research, Australia
gfdl-cm2.0, 2005	U.S. Department of Commerce/NOAA/Geophysical Fluid Dynamics Laboratory (GFDL), USA
giss-aom, 2004	National Aeronautics and Space Administration (NASA)/Goddard Institute for Space Studies (GISS), USA
giss-model.e.r, 2004	National Aeronautics and Space Administration (NASA)/Goddard Institute for Space Studies (GISS), USA
iap-fgoals1.0.g, 2004	LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences
miroc3.2(hires), 2004	Center for Climate System Research (University of Tokyo), Japan
miub-echo g, 2001	Meteorological Institute University of Bonn, Germany
mpi-echam5, 2005	Max Planck Institute, Germany
mri-cgcm2.3.2a, 2003	Meteorological Research Institute, Japan

Table 2. Description of Global Climate Models.

Emission Scenario	Description
B1 (low)	Population peaking middle of the 21st century but global economies more ecologically prudent
A1B (medium)	Fast economic development using multiple energy sources and population peaking in the middle of the 21st century.
A2 (high)	High population growth and regional economic growth and slow technological changes

Table 3. Description of greenhouse gas emission scenarios.

6. RESULTS AND DISCUSSION

SWB results for the time series, 1954-2009

The SWB mean annual recharge rate for the Prairie River is 9.9 inches with a standard deviation of 3.2 inches for the time series, 1954-2009. The mean ET is 17.1 inches with a standard deviation of 1.7 inches. The mean initial snow cover is 1.17 inches with a standard deviation of 0.84 inches. The annual water budget for the Prairie River watershed is:

31.7 inches precipitation = 9.9 inches recharge + 17.1 inches ET + 4.7 inches runoff.

Variable recharge rates with same annual precipitation using the time series, 1954-2009

There is a strong correlation ($R^2=0.78$) between annual recharge and annual precipitation (Figure 9).

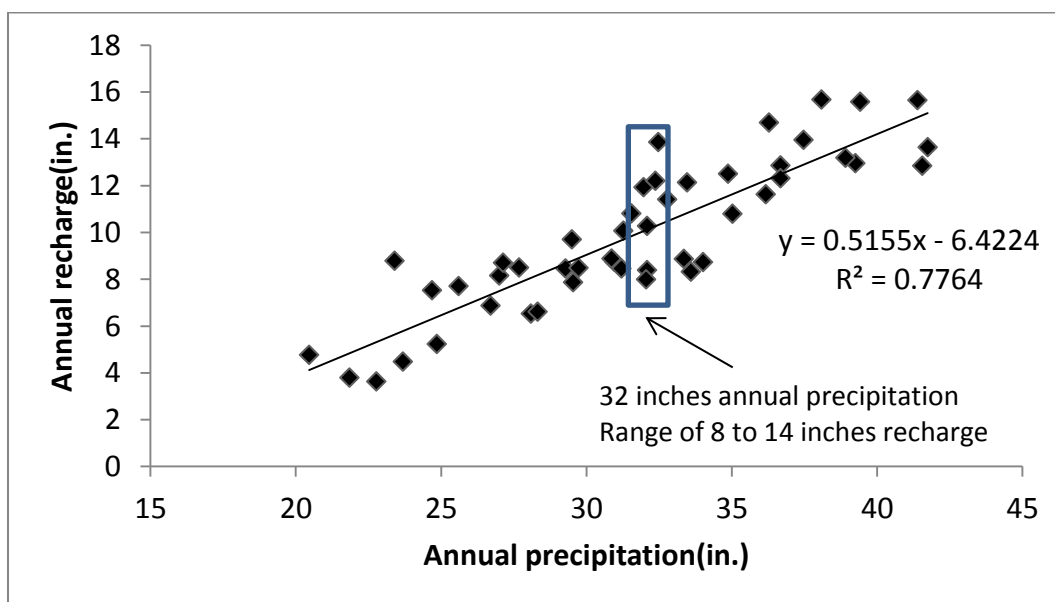


Figure 9. Annual recharge plotted against annual precipitation. 32 inches of annual precipitation generate a range of recharge rates from 8 to 14 inches.

Figure 9 shows the variability in recharge rates with similar annual precipitation. Thirty-two inches of annual precipitation generate a range of annual recharge rates from 8 to 14 inches. For two years that had similar annual precipitation rates but very different recharge rates, two plots were generated that show daily precipitation, minimum and maximum temperatures and recharge rates (Figures 10 and 11). Two plots were generated that show the daily recharge and continuous frozen ground index (CFGF) (Figures 12 and 13).

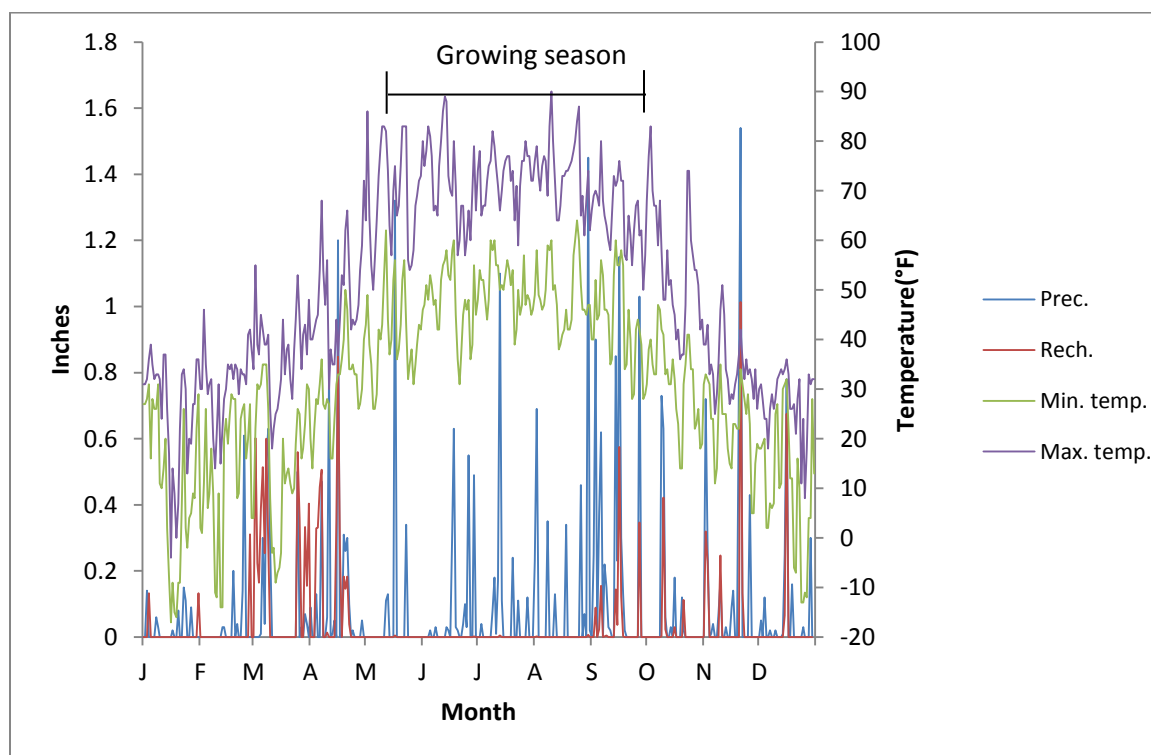


Figure 10. Plot of 32.5 inches of annual precipitation and 13.86 inches of recharge for the year 1992.

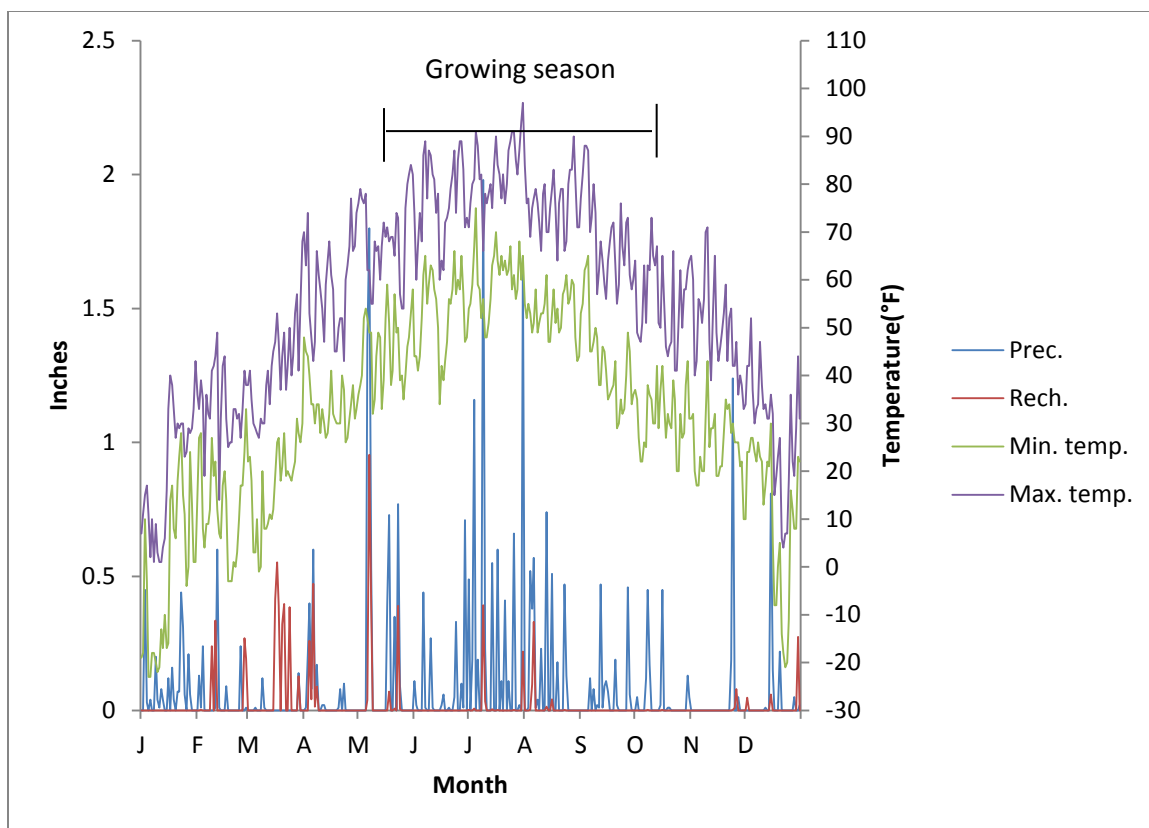


Figure 11. Plot of 32.1 inches of precipitation and 7.99 inches of recharge for the year 1999.

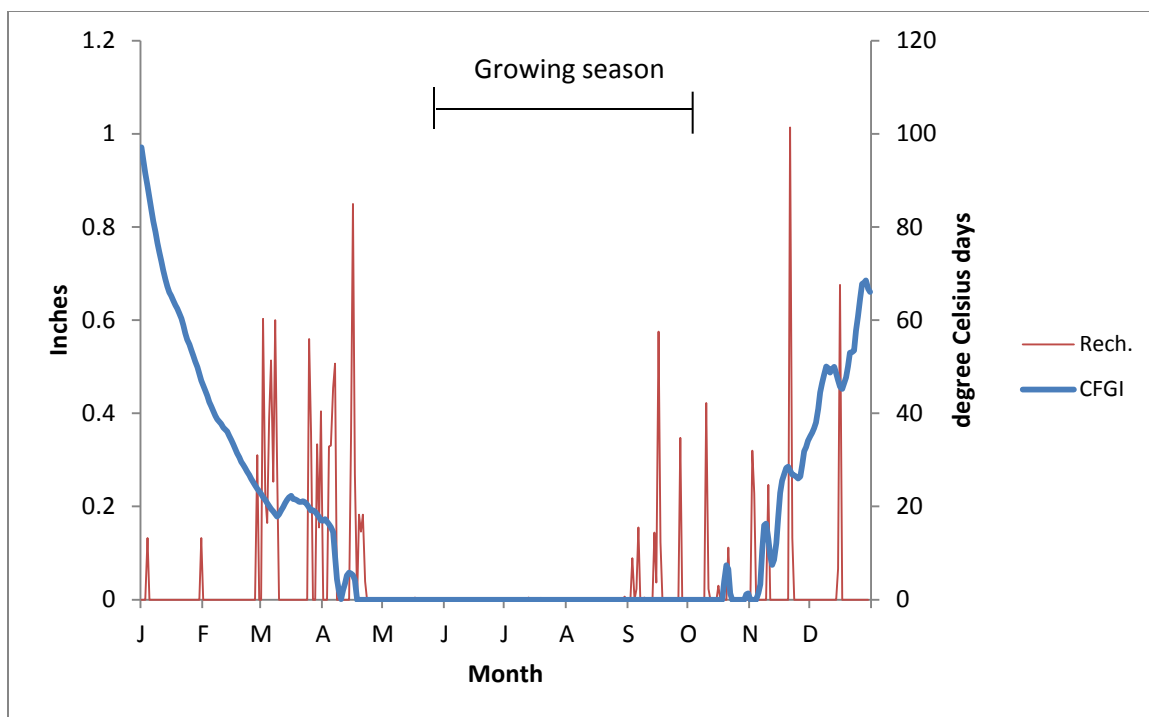


Figure 12. Recharge and CFGI for the year 1992.

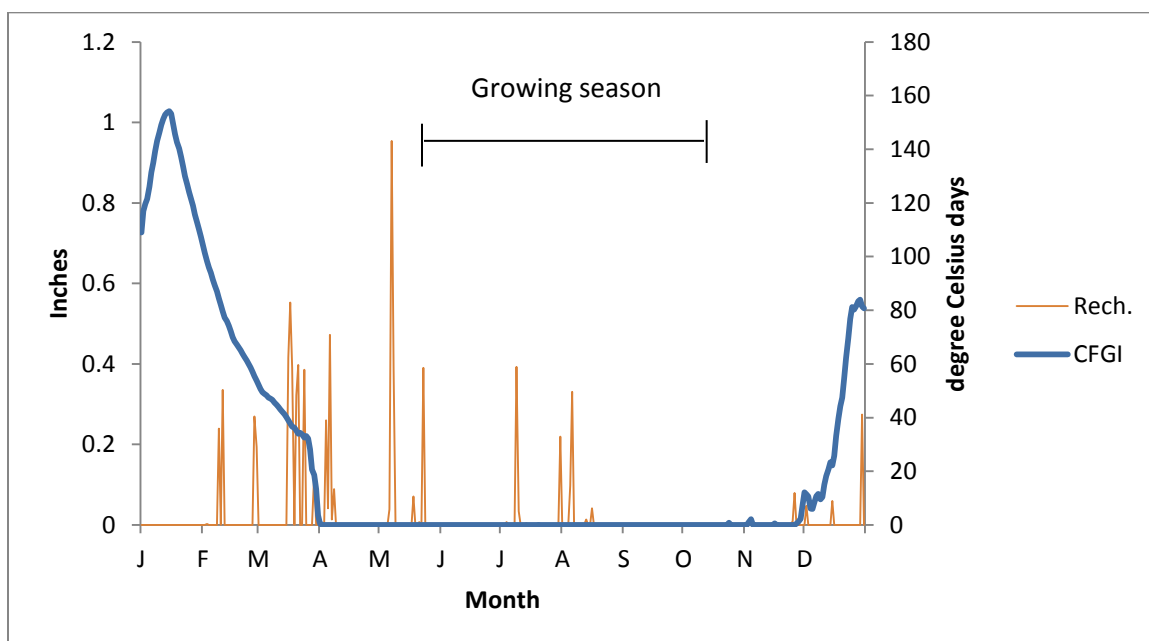


Figure 13. Recharge and CFGI for the year 1999.

The annual recharge rates were 13.9 and 8.0 inches for 1992 and 1999, respectively. Figures 10 and 11 show recharge generated in the spring months and high

peaks of precipitation in the summer months generating very little recharge. The initial snow cover was 3.6 and 0.7 inches for 1992 and 1999, respectively. The mean annual temperature was 40.9°F and 43.6°F for 1992 and 1999, respectively. The 1992 and 1999 growing seasons had 16 inches and 22 inches of precipitation, respectively. In 1992 mean annual ET was 14.7 inches with 11.2 inches in the growing season and 3.4 inches in the non-growing season. In 1999 mean annual ET was 19.8 inches with 15.4 inches in the growing season and 4.4 inches in the non-growing season. Figures 12 and 13 show that recharge occurs when the CFGI is below 83 which can occur in the winter months. As a result of more precipitation occurring in the growing season and a higher annual ET of 5 inches, less initial snow cover and higher annual temperature, 1999 had 6 inches less recharge than 1992.

In the Prairie River watershed, there are two recharge seasons: the growing season which starts middle May and ends early October and the non-growing season which starts early October and concludes the middle of May. Evapotranspiration (ET) mainly occurs in the growing season. Table 4 shows the means for precipitation, recharge and ET in the growing and non-growing seasons.

Season	Prec. (in.)	Std. dev.	Rech. (in.)	Std. dev.	ET (in.)	Std. dev.
Growing	19	4.3	2.4	1.7	13.40	0.92
Non-growing	12.6	2.8	7.5	2.4	3.73	0.59

Table 4. Means and standard deviations for precipitation, recharge and ET for the growing and non-growing seasons.

The growing season has 50% more precipitation than the non-growing season but 3 times less recharge. Table 4 shows that ET uses 70% of the growing season

precipitation and 30% of the non-growing season precipitation. ET occurs in the non-growing season as the result of conifers. Conifers constitute 15% of the watershed.

If growing season recharge is plotted against growing season precipitation and non-growing season recharge is plotted against non-growing season precipitation, strong correlations are found, $R^2=0.84$ and $R^2=0.74$, respectively (Figures 14 and 15).

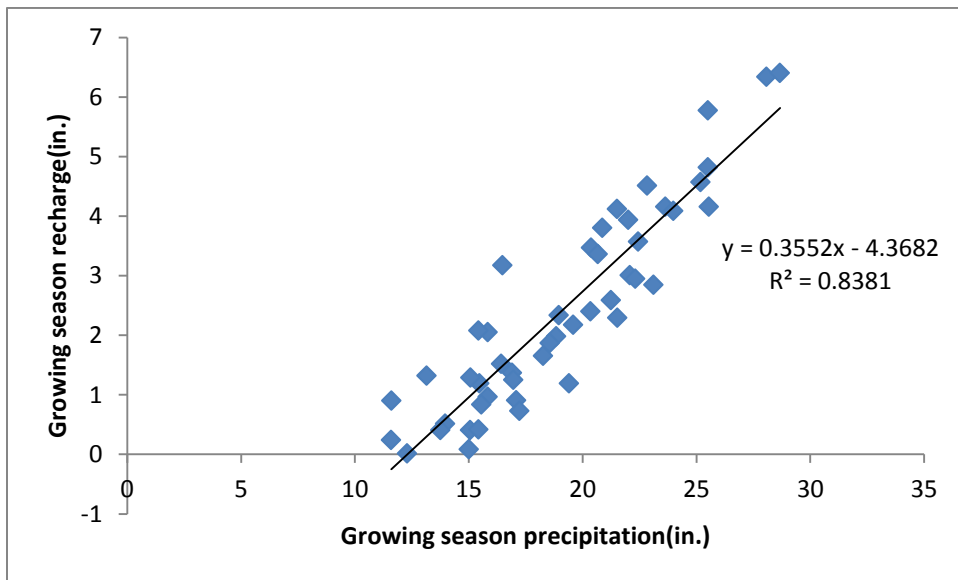


Figure 14. Growing season recharge plotted against growing season precipitation.

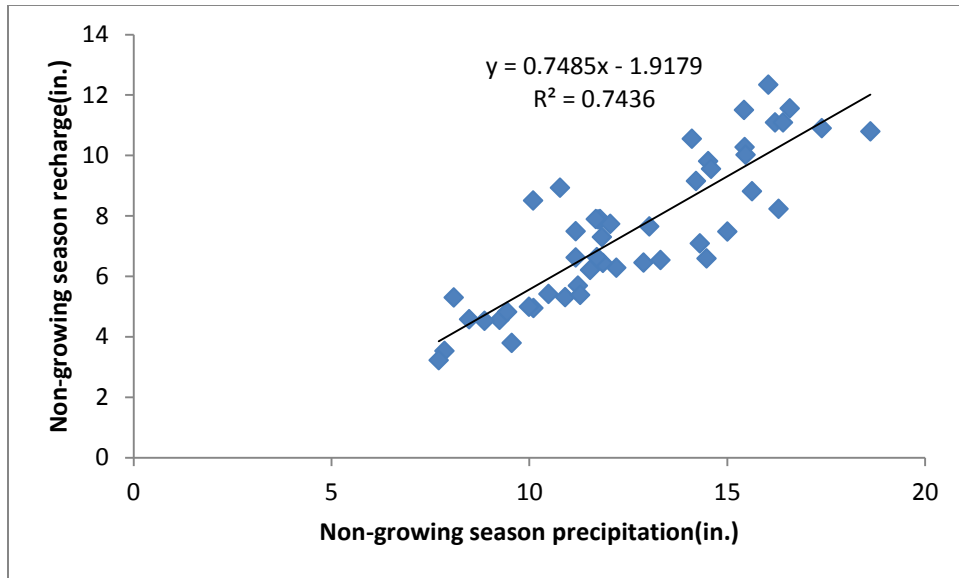


Figure 15. Non-growing season recharge plotted against non-growing season precipitation.

Due to these correlations, this part of the study will focus on these relationships and their effects on similar annual precipitation generating variable recharge rates.

From these two plots, the regression line equations are used to calculate the annual recharge rate for the Prairie River.

The equation for annual recharge for the Prairie River is:

$$R = (0.35GP - 4.3682) + (0.75NP - 1.9179) \quad [1]$$

where R is recharge, GP is growing season precipitation, and NP is non-growing season precipitation.

Using this equation, recharge can be calculated for any combination of growing season and non-growing season precipitation (Table 5). The range of inches of precipitation for the growing season and non-growing season for the Prairie River are 12 to 29 inches and 8 to 19 inches, respectively.

Growing season prec. (in.)	Non-growing season prec. (in.)	Growing season rech. (in.)	Non-growing season rech. (in.)	Total rech. (in.)
12	20	0.00	13.08	13.08
13	19	0.18	12.33	12.51
14	18	0.53	11.58	12.11
15	17	0.88	10.83	11.71
16	16	1.23	10.08	11.31
17	15	1.58	9.33	10.91
18	14	1.93	8.58	10.51
19	13	2.28	7.83	10.11
20	12	2.63	7.08	9.71
21	11	2.98	6.33	9.31
22	10	3.33	5.58	8.91
23	9	3.68	4.83	8.51
24	8	4.03	4.08	8.11
25	7	4.38	3.33	7.71
26	6	4.73	2.58	7.31
27	5	5.08	1.83	6.91
28	4	5.43	1.08	6.51
29	3	5.78	0.33	6.11

Table 5. Growing season and non-growing season precipitation and recharge and total recharge for 32 inches of annual precipitation.

Table 5 shows that, for 32 inches of annual precipitation, increasing the non-growing season precipitation generates higher non-growing season recharge rates and higher annual recharge rates. Higher growing season precipitation generates higher growing season recharge rates but lower annual recharge rates. Therefore, variable recharge rates for the same annual precipitation are the result of variable timing of precipitation between the growing and the non-growing season. Table 6 shows the data from 1954-2009 for different years with 32 inches annual precipitation and shows the same pattern as in Table 5.

Growing season prec. (in.)	Non-growing season prec. (in.)	Growing season rech. (in.)	Non growing season rech. (in.)	Ann rech. (in.)
22.07	9.99	3.006175	4.985184	7.991359
17.08	15.01	0.908472	7.480058	8.38853
20.35	11.74	2.399005	7.884077	10.283083
16.96	14.59	1.250861	9.557218	10.808079
15.56	16.41	0.837712	11.088838	11.92655
18.26	14.11	1.65488	10.547863	12.202743
16.43	16.04	1.52249	12.339699	13.862189

Table 6. 32 inches of annual precipitation for time series, 1954-2009.

There exists variability between growing season recharge and growing season precipitation and between non-growing season recharge and non-growing season precipitation. These relationships were analyzed to see if other factors explain the variability. Annual temperature, annual ET and initial snow cover were analyzed producing no significant results. Temperatures in the growing and non-growing season and ET in the growing and non-growing season were not analyzed. To further analyze variable recharge rates with similar annual precipitation simulations were performed using SDSM.

Simulations using SDSM

SDSM was used to generate 1,000 unique simulations of annual precipitation to further analyze why similar annual precipitations generate variable annual recharge rates while keeping temperature and initial snow cover constant. Annual temperature was set to 42°F; initial snow cover was 0.9 inches. Plots were generated of growing season recharge plotted against growing season precipitation and non-growing season recharge plotted against non-growing season precipitation (Figures 16 and 17).

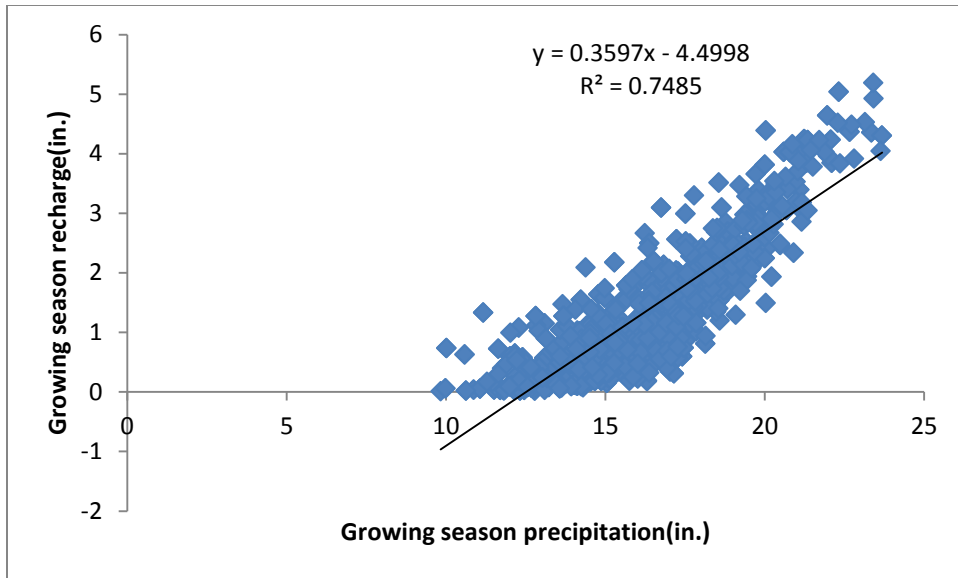


Figure 16. Plot of 1,000 SDSM simulations of annual precipitation with growing season recharge plotted against growing season precipitation with adjusted R^2 .

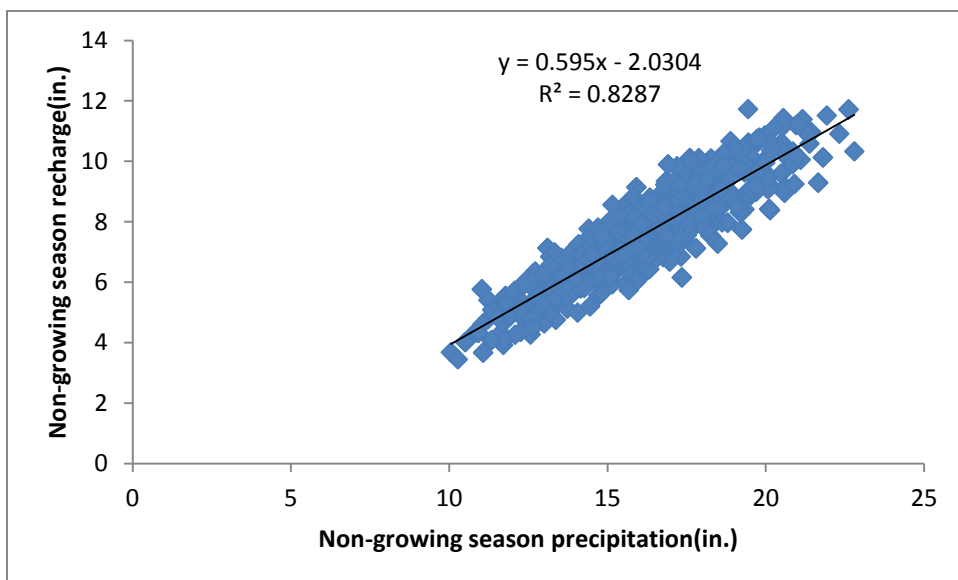


Figure 17. Plot of 1,000 SDSM simulations of annual precipitation with non-growing season recharge plotted against non-growing season precipitation with adjusted R^2 .

The correlations, $R^2=0.75$ and $R^2=0.83$ are for growing season recharge and growing season precipitation and non-growing season recharge and non-growing season precipitation, respectively. The equation for annual recharge for the Prairie River using the simulations is:

$$R = (0.36GP - 4.5) + (0.60NP - 2.0) \quad [2]$$

where R is recharge, GP is growing season precipitation, and NP is non-growing season precipitation. The linear regression equation for the growing season is very similar to the linear regression equation for the non-simulated data. The slope of the linear regression equation for the non-growing season is 20% lower than the non-simulated data. The reason for this discrepancy could be small effects of temperature and initial snow cover on the non-simulated data.

Student t-tests to compare monthly and annual means of the historical record, 1954-2009 to two time series, 2047-2065 and 2082-2100.

Tables were generated to show the monthly and annual means for the historical record, 1954-2009 and for the SWB projections for the three emission scenarios for the two time series, 2047-2065 and 2082-2100 (Tables 7-14). To analyze the differences of the monthly and annual means between the historical record, 1954-2009 and the SWB projections from 2047-2065 and 2082-2100, student t-tests were used to determine if there will be significant ($p < 0.05$) annual and monthly changes by the middle and the end of the 21st century in the Prairie River watershed (Tables 30 and 31). These values are useful to analyze overall changes to the watershed in the middle and the 21st century. Stream flow is fed by groundwater. Any changes to groundwater changes stream flow that can affect watersheds downstream. This analysis could be used for a comparison to other watersheds in Wisconsin. The amount of growing and non-growing season precipitation are vital to the amount of recharge occurring in the watershed. For this part of the study, these factors were not analyzed due to the uncertainties of changes in

the length of the growing season by the middle and the end of the 21st century. As mentioned in the literature review, an analysis using GCMs of the Trout Lake Basin showed an increase in the length of the growing season by the end of the 21st century.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std.dev.	(2047-2065)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	1.01	0.77	1.12	0.15	1.31	0.16	1.23	0.23
Feb.	0.94	0.65	0.99	0.20	1.04	0.22	1.02	0.12
Mar.	1.79	1.06	2.00	0.23	2.06	0.28	2.15	0.29
Apr.	2.74	1.21	2.97	0.33	3.06	0.27	2.92	0.43
May	3.39	1.26	3.80	0.47	3.98	0.33	3.62	0.53
June	3.89	1.91	3.93	0.42	4.01	0.42	3.97	0.43
July	3.70	1.83	3.81	0.47	3.65	0.39	3.74	0.33
Aug.	4.04	2.00	4.16	0.51	4.19	0.44	4.23	0.58
Sept.	3.96	2.07	4.08	0.39	4.25	0.44	4.37	0.55
Oct.	2.77	1.39	2.90	0.32	2.99	0.39	2.83	0.41
Nov.	2.17	1.35	2.06	0.34	2.12	0.20	2.17	0.48
Dec.	1.28	0.70	1.36	0.25	1.50	0.19	1.48	0.26
Ann.	31.67	5.38	33.18	1.83	34.17	1.17	33.72	1.30

Table 7. Table of monthly and annual means for precipitation for the historical record, 1954-2009 and the three emission scenarios for the time series, 2047-2065. Ann., annual.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std.dev.	(2082-2100)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	1.01	0.77	1.19	0.25	1.30	0.16	1.29	0.23
Feb.	0.94	0.65	0.94	0.17	1.06	0.12	1.15	0.12
Mar.	1.79	1.06	2.08	0.23	2.17	0.22	2.29	0.29
Apr.	2.74	1.21	2.86	0.31	3.31	0.35	3.33	0.43
May	3.39	1.26	3.85	0.37	4.11	0.36	4.33	0.53
June	3.89	1.91	4.15	0.36	4.15	0.48	4.13	0.43
July	3.70	1.83	3.86	0.43	4.00	0.48	3.89	0.33
Aug.	4.04	2.00	4.22	0.38	4.46	0.58	4.40	0.58
Sept.	3.96	2.07	4.22	0.53	4.47	0.52	4.41	0.55
Oct.	2.77	1.39	3.05	0.40	3.17	0.42	3.04	0.41
Nov.	2.17	1.35	2.16	0.24	2.24	0.24	2.31	0.48
Dec.	1.28	0.70	1.58	0.25	1.51	0.17	1.49	0.26
Ann.	31.67	5.38	34.14	1.01	35.93	1.84	36.06	1.36

Table 8. Table of monthly and annual means for precipitation for the historical record, 1954-2009 and the three emission scenarios for the time series, 2082-2100. Ann., annual.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std.dev.	(2047-2065)	Std. dev.
	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
Jan.	11.66	5.90	17.31	2.07	19.28	1.85	18.46	2.10
Feb.	16.00	5.66	19.89	1.61	22.27	1.64	20.85	2.33
Mar.	27.08	3.83	30.59	1.48	32.28	1.32	31.54	1.97
Apr.	42.26	3.15	45.53	0.86	46.88	0.99	46.27	1.69
May	54.17	3.76	58.26	1.02	59.21	0.98	58.88	1.35
June	63.93	2.90	66.73	0.95	67.93	1.05	67.43	1.49
July	68.05	2.60	71.11	0.59	72.54	1.11	72.20	0.86
Aug.	65.53	2.52	69.05	0.70	70.31	0.91	70.66	1.18
Sept.	56.74	2.81	60.67	0.78	61.85	1.02	61.34	1.21
Oct.	45.19	3.41	49.81	0.74	50.78	1.02	50.25	1.38
Nov.	31.22	3.98	35.22	0.97	36.72	1.07	36.74	1.50
Dec.	17.41	5.47	22.39	1.24	24.38	1.42	24.32	1.17
Ann.	41.72	0.46	45.67	0.58	47.15	0.76	46.70	0.89

Table 9. Table of monthly and annual means for temperature for the historical record, 1954-2009 and the three emission scenarios for the time series, 2047-2065. Ann., annual.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std. dev.
	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
Jan.	11.66	5.90	18.01	1.46	20.45	1.51	20.35	1.89
Feb.	16.00	5.66	20.51	1.17	22.89	1.03	22.62	2.23
Mar.	27.08	3.83	30.71	1.43	32.56	1.00	32.57	1.98
Apr.	42.26	3.15	45.26	1.14	47.03	0.87	47.35	1.95
May	54.17	3.76	57.67	1.00	59.00	0.87	59.63	1.33
June	63.93	2.90	65.60	0.84	67.22	0.66	67.67	1.53
July	68.05	2.60	69.97	0.57	71.66	0.75	72.38	1.28
Aug.	65.53	2.52	67.95	0.85	69.72	0.59	70.86	1.34
Sept.	56.74	2.81	59.89	0.74	61.58	0.84	61.90	1.15
Oct.	45.19	3.41	49.36	0.94	50.93	1.08	51.28	1.24
Nov.	31.22	3.98	35.25	1.16	36.90	1.12	38.06	1.83
Dec.	17.41	5.47	22.78	1.17	25.27	1.07	25.87	1.56
Ann.	41.72	0.46	47.38	0.40	49.71	0.47	51.11	1.12

Table 10. Table of monthly and annual means for temperature for the historical record, 1954-2009 and the three emission scenarios for the time series, 2082-2100.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	0.14	0.23	0.50	0.17	0.72	0.14	0.64	0.17
Feb.	0.72	0.91	0.82	0.21	0.96	0.18	0.89	0.20
Mar.	2.34	1.15	2.21	0.30	2.12	0.24	2.21	0.31
Apr.	2.20	1.33	1.81	0.31	1.73	0.21	1.71	0.35
May	0.70	0.64	0.82	0.22	0.88	0.16	0.78	0.21
June	0.48	0.77	0.38	0.16	0.37	0.13	0.37	0.14
July	0.21	0.50	0.22	0.12	0.17	0.06	0.18	0.09
Aug.	0.30	0.64	0.29	0.10	0.31	0.12	0.31	0.13
Sept.	0.67	0.91	0.58	0.17	0.60	0.20	0.67	0.23
Oct.	0.85	0.73	0.76	0.23	0.78	0.24	0.71	0.25
Nov.	0.86	0.81	0.80	0.20	0.89	0.14	0.95	0.28
Dec.	0.42	0.54	0.60	0.18	0.71	0.09	0.76	0.18
Ann.	9.90	0.76	9.81	0.90	10.23	0.69	10.19	0.77

Table 11. Table of monthly and annual means for recharge for the historical record, 1954-2009 and the three emission scenarios for the time series, 2047-2065. Ann., annual.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std.dev.	(2082-2100)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	0.14	0.23	0.69	0.16	0.82	0.13	0.85	0.17
Feb.	0.72	0.91	0.89	0.18	0.95	0.18	0.98	0.23
Mar.	2.34	1.15	2.04	0.25	1.96	0.12	2.02	0.35
Apr.	2.20	1.33	1.58	0.27	1.63	0.25	1.55	0.26
May	0.70	0.64	0.79	0.22	0.86	0.19	0.86	0.22
June	0.48	0.77	0.38	0.14	0.40	0.14	0.38	0.14
July	0.21	0.50	0.21	0.09	0.23	0.10	0.20	0.10
Aug.	0.30	0.64	0.30	0.12	0.36	0.15	0.30	0.13
Sept.	0.67	0.91	0.61	0.23	0.69	0.20	0.64	0.25
Oct.	0.85	0.73	0.76	0.25	0.81	0.26	0.73	0.24
Nov.	0.86	0.81	0.94	0.16	0.95	0.17	0.94	0.30
Dec.	0.42	0.54	0.73	0.17	0.82	0.16	0.79	0.21
Ann.	9.90	0.76	9.91	0.56	10.47	0.92	10.24	0.59

Table 12. Table of monthly and annual means for recharge for the historical record, 1954-2009 and the three emission scenarios for the time series, 2082-2100.

	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std. dev.	(2047-2065)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb.	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Mar.	0.01	0.06	0.07	0.04	0.10	0.05	0.07	0.05
Apr.	0.98	0.35	1.27	0.10	1.41	0.10	1.32	0.19
May	2.73	0.40	3.09	0.10	3.16	0.11	3.07	0.12
June	3.53	0.52	3.65	0.13	3.76	0.17	3.63	0.18
July	3.41	0.64	3.56	0.20	3.56	0.15	3.57	0.15
Aug.	3.00	0.73	3.03	0.17	3.02	0.16	3.03	0.19
Sept.	2.10	0.47	2.23	0.11	2.29	0.14	2.29	0.16
Oct.	1.15	0.32	1.36	0.06	1.39	0.06	1.39	0.10
Nov.	0.23	0.18	0.36	0.05	0.40	0.04	0.39	0.08
Dec.	0.00	0.02	0.02	0.01	0.03	0.01	0.03	0.02
Ann.	17.13	1.67	18.63	0.48	19.12	0.41	18.80	0.62

Table 13. Table of monthly and annual means for ET for the historical record, 1954-2009 and the three emission scenarios for the time series, 2047-2065.

Month	Historic		B1		A1B		A2	
	1954-2009	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std. dev.	(2082-2100)	Std. dev.
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
Jan.	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
Feb.	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Mar.	0.01	0.06	0.11	0.04	0.20	0.04	0.22	0.10
Apr.	0.98	0.35	1.43	0.11	1.62	0.09	1.73	0.20
May	2.73	0.40	3.19	0.12	3.36	0.11	3.50	0.15
June	3.53	0.52	3.73	0.11	3.87	0.15	3.96	0.19
July	3.41	0.64	3.69	0.20	3.72	0.21	3.78	0.24
Aug.	3.00	0.73	3.09	0.18	3.21	0.22	3.17	0.29
Sept.	2.10	0.47	2.31	0.10	2.44	0.14	2.43	0.14
Oct.	1.15	0.32	1.45	0.08	1.54	0.13	1.56	0.12
Nov.	0.23	0.18	0.41	0.07	0.47	0.05	0.55	0.09
Dec.	0.00	0.02	0.03	0.01	0.06	0.02	0.08	0.03
Ann.	17.13	1.67	19.45	0.48	20.50	0.65	21.01	0.82

Table 14. Table of monthly and annual means for ET for the historical record, 1954-2009 and the three emission scenarios for the time series, 2082-2100.

For precipitation, the t-values show no changes are predicted to occur for the time series, 2047-2065 (Table 30). For the time series, 2082-2100 precipitation is predicted to increase in April and May and in March, April and May for the A1B and A2 scenarios, respectively (Table 31). For annual precipitation, the A2 and A1B scenario predict significant increases in 2082-2100 (Table 31).

For recharge for all scenarios and both time series, significant increases are predicted to occur in January with the highest increases and December (Tables 30 and 31). The 2082-2100 time series shows larger increases compared to the time series, 2047-2065 (Tables 30 and 31). Significant decreases in April are predicted to occur for the A2 and B1 scenarios for the time series, 2082-2100 (Table 31). Although these increases are predicted to occur, annual recharge is not predicted to change. The reason

for this is the offsetting gains and losses in monthly recharge in spring and fall months which cumulatively become significant. These results suggest a change in the timing of stream flow which is dependent on groundwater. The stream flow will be higher in the early spring months and lower in the summer and winter months affecting water budgets on the watershed and on downstream rivers and lakes.

For temperature for all scenarios and both time series, all months are predicted to significantly increase (Tables 30 and 31). The greatest increases will occur in July, August and September. The time series, 2082-2100 has the greater increases than 2047-2065 due to an increase of temperatures through the 21st century due to the effect of ever increasing greenhouse gas emissions through the century (Tables 30 and 31). The A2 scenario which is the greatest greenhouse gas emission scenario shows the greatest increases while the B1 scenario which is the lowest greenhouse gas emission scenario shows the smallest increases. Overall, the annual temperature is predicted to increase for all scenarios for both time series (Tables 30 and 31).

For ET, the time series 2047-2065 shows the greatest predicted increases in April and December for the A2 scenario and March and April for the A1B scenario and March and May for the B1 scenario (Table 30). The time series 2082-2100 shows the greatest increases in March and December for the A2 and A1B scenarios and March and April for the B1 scenario (Table 31). Plants and trees will require more water due to increased temperatures. Again the A2 scenario predicts the greatest increases while the B1 scenario exhibits the smallest increases. For annual ET, all scenarios for both time series

predict significant increases (Tables 30 and 31). Table 14 shows that the highest predicted increase in annual ET is 4 inches at the end of the 21st century for the A2 scenario. Table 8 shows that the highest predicted increase in annual precipitation is approximately 5 inches at the end of the 21st century for the A2 scenario. The predicted monthly increases in precipitation for this scenario will provide for the ET increases (Tables 8 and 14). The mass balance equation for the watershed may not change in the future. This is beneficial to the agriculture of the watershed that constitutes 25% of the land use.

7. CONCLUSIONS

This study shows that the SWB model can be used for a watershed. Previous studies using the SWB model have been used to measure recharge for areas that are rectangular shaped such as counties that fit into the grid system required by SWB. This may indeed be the first time a watershed was used and calibrated to base flow using PART, a base flow separation program. SWB is a robust model that provides a daily recharge and ET rate and also an initial snow cover and soil moisture content. It requires five inputs that are easily acquired online.

In this study it was shown that the main driver of recharge is precipitation, and the timing of precipitation remains the most important factor affecting recharge. In the Prairie River watershed, the majority (75%) of recharge occurs during the non-growing season that spans early October to the middle of May when only 40% of the watershed's annual precipitation occurs. To study the variable recharge rates with similar annual precipitation, focus was placed on the non-growing season because of the higher recharge rate.

There are strong correlations, $R^2=.84$ and $R^2=.74$ for growing season recharge and precipitation and non-growing season recharge and precipitation, respectively. The two linear regression equations were used to calculate growing season and non-growing season recharge rates. It was shown that with increasing non-growing season precipitation and decreasing growing season precipitation, annual recharge increased. The SDSM annual precipitation simulations gave similar results although the slope from

the non-growing season linear regression equation from the simulations was lower.

There still exists variability between growing season recharge and growing season precipitation and non-growing season recharge and non-growing season precipitation.

Annual temperature, annual ET and initial snow cover were analyzed, but there were no significant results. Further studies could look at the growing and non-growing season temperatures and the growing and non-growing season ET and their effects on variable recharge rates. A similar analysis could be done using other watersheds to compare the results to the Prairie River watershed.

This study also looked at the effect of climate change on precipitation, recharge, temperature and ET in the Prairie River watershed using GCMs with three emission scenarios. The A2 scenario which is the highest greenhouse gas emission scenario predicts the greatest increases with the B1 scenario which is the lowest emission scenario predicts the lowest increases. The most significant changes predicted are increasing temperatures in all months. Annual ET is predicted to increase for all scenarios. The timing of recharge is predicted to change. Increases are predicted in January and December although annual recharge is not predicted to change due to insignificant but cumulative decreases in recharge in spring and fall months. Because of the predicted changes in the recharge pulses, stream flow will also change with increases in early spring and decreases in summer and winter months. Since the Prairie River watershed is 25% agricultural, increasing temperatures will require higher water demands for the crops that will be met with the increasing predicted precipitation. This analysis could be used on other watersheds in north central Wisconsin to compare

results. Further studies could also analyze changes in the growing and non-growing season precipitation, recharge, ET and temperature because the length of the growing season is predicted to increase.

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APPENDIX A

SAMPLE CONTROL FILE TO RUN SWB

Table 15. Sample control file to run the SWB model.

```

#      SWB      Model annotated      control      file
#
#      This test case covers a      grid centered      in      central
#      Wisconsin at the
#      Prairie River watershed. Atmospheric data for this
#      case is derived from the climate station at
#      Merrill.
#
#
#-----

#      MODEL DOMAIN DEFINITION
#
#      Definition of the model domain. Units of meters are
#      assumed.
#      All subsequent input grids must match the specified model
#      domain exactly.
#
#      Lower LH      Corner Upper RH      Corner Grid
#      |_____|      |_____|      Cell
#      NX      NY      X0      Y0      X1      Y1      Size
GRID 1211      1002      544440.7      527793.5      580770.7      557853.5      30
#*****

#      LENGTH UNITS
#
#      Must specify whether grid coordinate are given in
#      METERS or FEET.
#      This affects conversion of values from inches to acre-
#      ft.
GRID_LENGTH_UNITS METERS
#*****

#      OUTPUT CONTROL
#
#      If running SWB in batch "mode," it may be
#      desirable to turn off "the""
#      daily mass balance summary that is normally
#      printed to the screen.
#      Screen output and DISLIN messages may be suppressed by
#      uncommenting

```

```

# the directives below.

# TURN OFF SCREEN OUTPUT?

SUPPRESS_SCREEN_OUTPUT

# TURN OFF INTEGRATED OUTPUT (i.e. use external SWBREAD
# program after run completion)
#SUPPRESS_INTEGRATED_OUTPUT

# TURN OFF SUPPLEMENTAL MASS BALANCE / DAILY REPORT FILES?

#SUPPRESS_DAILY_FILES

# TURN OFF DISLIN MESSAGES

#SUPPRESS_DISLIN_MESSAGES

#*****

# GROWING SEASON
#
# Define 1) beginning and 2) ending Julian day of
# growing season;
# and 3) flag indicating whether or not the
# problem is in the
# Northern hemisphere (possible values: TRUE / FALSE)
#
# The growing season defines only the timespan within
# which
# interception terms will be calculated.
#
GROWING_SEASON 133 268 TRUE

#*****

# If you have access to a terminal program such
# as "rxvt""", ""
# the SWB model can provide screen output with color coding
# for positive
# and negative values. (possible values: TRUE /
# FALSE)
#
# rxvt is a package that may be installed as
# an option along with
# the Cygwin Un*x emulation package (www.cygwin.com).
#
ANSI_COLORS FALSE

#*****

```

```

# In order to conserve disk "space," real values are
# converted "to""
# integer "values," and the resulting data stream is
# compressed "using""
# a simple run-length encoding (RLE) scheme. A larger
# value for the
# RLE multiplier preserves more of the real data value
# and lowers the
# amount of data compression that takes place. "However," a
# value "for""
# the RLE_MULTIPLIER that is too large may result in
# an INTEGER OVERFLOW
# "error," in which the converted data value exceeds
# the storage "capacity""
# for the integer data structure. In this "case,"
# the "RLE_MULTIPLIER""
# must be lowered in order that the maximum
# integer value to be stored
# stays within the limitations of the data type. For a
# 4-byte "integer, ""
# the converted real value must stay inside the range from
#
# "-2,147,483,647" and "2,147,483,647.00" A real value of
# "22,000," with "a""
# RLE_MULTIPLIER value of "100,000" will result in an
# INTEGER "OVERFLOW""
# condition; the resulting integer value of
# "2,200,000,000""
# exceeds the maximum that can be represented by
# a 4-byte integer.
#

```

```

RLE_MULTIPLIER      10000

```

```

#*****

```

```

# PRECIPITATION
#

```

```

# Choose option for precipitation input. Options are:
#

```

- ```

1) PRECIPITATION_SINGLE_STATION
2) PRECIPITATION_ARC_GRID file_prefix
3) PRECIPITATION_SURFER file_prefix
#

```

```

If precipitation is input using "grids," the model
assumes that "a""
separate grid file exists for each day of simulation.
The naming
convention for the precipitation files is:
#

```

```

prefix_yyyy_mm_dd.suffix
#

```

```

For "example," a series of grids for the first few
days of 1990 would "be""
names "precip_1990_01_01.asc""", " "precip_1990_01_02.asc""", "
"etc.""

#

PRECIPITATION SINGLE_STATION

#PRECIPITATION ARC_GRID precip\precip

#*****

TEMPERATURE

#

Choose option for temperature input. Options are:

1) TEMPERATURE SINGLE_STATION

2) TEMPERATURE ARC_GRID TMAXprefix TMINprefix

3) TEMPERATURE SURFER TMAXprefix TMINprefix

#

If temperature is input using "grids," the model
assumes that "a""
separate grid file exists for each day of simulation.
The naming
convention for the temperature files is:

#

TMAXprefix_yyyy_mm_dd.suffix TMINprefix_yyyy_mm_dd.suffix

#

For "example," a series of grids for the first few
days of 1990 would "be""
names "tmin_1990_01_01.asc""", " "tmin_1990_01_02.asc""", " "etc.""

#

TEMPERATURE SINGLE_STATION

#TEMPERATURE ARC_GRID precip\tmax precip\tmin

#*****

OUTPUT GRID FILENAME SUFFIX

#

Set the output grid filename suffix with the
OUTPUT_GRID_SUFFIX
option. This applies only to annual and monthly
output grids.
Daily grids have the filename pattern "filename.###,"
where "###""

```

```

is the Julian day of the simulation
#
OUTPUT_GRID_SUFFIX asc
#*****

INITIAL ABSTRACTION METHOD
#
The method for calculating the initial abstraction within
the
SCS curve number runoff procedure may be specified in
two ways:
#
1) TR-55: Ia is assumed equal to 0.2 * S
2) Hawkins (2002): Ia is assumed equal to
0.05 * S
#
If the Hawkins method is "used," curve numbers
are "adjusted""
as per Equation 9 of Hawkins (2002). Net
effect should be to
increase runoff for smaller precip events. This method
has been
suggested to be more appropriate to long-term
simulation model applications.
#
#INITIAL_ABSTRACTION_METHOD TR55
INITIAL_ABSTRACTION_METHOD HAWKINS
#*****

INITIAL CONTINUOUS FROZEN GROUND INDEX
#
assume that ground is initially "frozen," "frozen"""" >=
"83""
#
INITIAL_FROZEN_GROUND_INDEX CONSTANT 100
#*****

FROZEN GROUND THRESHOLD CFGI VALUE
#
Use this option to set a different value defining
the boundary
between "unfrozen"""" and "frozen"""" ground.
Literature value is "83.""

```

```

For "example," for a CFGI < "83," the ground is
considered "unfrozen;""
with a CFGI >= "83," the ground is considered
"frozen.""
#
When frozen ground conditions "exist," the curve numbers
are "uniformly""
assumed to reflect antecedant runoff condition III
(i.e. increased
proportion of runoff for a given amount of
precipitation).
#
The default "value," if no other value is
"specified," is "9999.""
#
NOTE! BY DEFAULT the FROZEN GROUND INDEX is OFF -9999
#
UPPER_LIMIT_CFGI 83
LOWER_LIMIT_CFGI 55
#*****

NOTE on GRID SPECIFICATION:
#
The format for the following input grid specifications
is:
DIRECTIVE OPTION FILENAME
#
where the "directive"" is a key word that
identifies the intended use "for""
the model input "grid," "option"" is either ARC_GRID
or "SURFER," "depending""
on the format of the input grid "file," and
"filename"" is the "local""
directory name plus file name of the input grid
#
(e.g. input\soil_group.asc)
#
The local directory specification may be omitted if
the program executable
and the input grid files share the same directory name
#*****

FLOW DIRECTION
#
#
The user must use the ARCINFO "flowdirection""
command to generate "this""
grid from a DEM. The number within each cell indicates
the direction to
which surface runoff is routed from that cell.

```

```

1 in a cell indicates that runoff from this cell
will be routed to the
cell to the right

4 in a cell indicates that runoff from this cell
will be routed to
the cell below

16 in a cell indicates that runoff from this cell
will be routed to
the cell to the "left," etc "...""

#

32 64 128

16 center 1

8 4 2

#

A number other than the eight listed above designates a
closed depression.

#

FLOW_DIRECTION ARC_GRID input\flow_direction_merrill.asc

#*****

SOIL GROUP

#

SCS Curve Number Hydrologic Soil Groups: The Soil
Conservation Service (SCS)
has categorized every soil within the United States into one
of four
hydrologic soil groups based on its infiltration capacity
(A - D)
(input to the model as 1 - 4).

"A"""""" soils have a high minimum infiltration
capacity and subsequently a "low""""
overland flow potential while "D"""""" soils have a
very low "infiltration""""
capacity and subsequently a high overland flow
potential. The user must
use the SCS soil surveys to look up the soil
group for all soils within
the model "area," and use ARCINFO or ArcView
to assign and generate "an""""
input grid. If the user does not have access to the
SCS soil survey or
a soil has not been previously assigned to a
"group," infiltration data "can""""
be used to assign the soil to a hydrologic soil
group:

#

Soil Group A: > 0.76 cm/h

```

```

Soil Group B: 0.38 - 0.76 cm/h
Soil Group C: 0.13 - 0.38 cm/h
Soil Group D: < 0.13 cm/h
#
SOIL_GROUP ARC_GRID input\soils_Merrill.asc
#*****

LAND USE/COVER CLASSIFICATION
#
The model uses land use "information," together
"with""
the soil available water capacity "information," to
calculate "surface""
runoff and assign a maximum soil moisture holding
capacity for each
grid cell. THIS VERSION OF THE MODEL CAN HANDLE ANY
ARBITRARY LAND USE
CLASSIFICATION "METHOD," AS LONG AS THE ACCOMPANYING
LAND USE LOOKUP "TABLE""
CONTAINS CURVE "NUMBER," "INTERCEPTION," AND ROOTING
DEPTH DATA FOR "EACH""
LAND USE TYPE CONTAINED IN THE GRID.
#
LAND_USE ARC_GRID input\land_cover_merrill.asc
#*****

SPECIFY OPEN WATER LAND USE
#
This option forces the cells of the given land use to
be treated
as open water cells. In these "cells," recharge is
NOT "calculated, ""
nor is flow routing or soil-moisture accounting
performed. Water is
either allowed to leave these cells as actual "ET," or
assumed to "leave""
the grid flow out of grid via surface water
features.
#
OPEN_WATER_LAND_USE 200
#*****

#
Land Use LOOKUP table:

```

```

#
The first line of this file must begin with:
#
NUM_LANDUSE_TYPES
#
where ## is the number of land use types contained
in the table.
#
The remainder of the file is a tab-delimited text
file having one line for each land use specified within the land use grid.
#
Data items must be specified as follows for each
line (separated by a tab):
Column Number Description

#
1 Land use code Integer value corresponding to the
integer values contained in the land use ARC ASCII grid.
#
#
2 Land use description Not used by model; for use
by user to document the description of the land use corresponding to
the integer land use code.
#
#
3 Assumed impervious area Not used by model; for
use by user to document assumed impervious area associated
with the land use code.
#
#
4-7* SCS base curve numbers SCS base curve numbers
for hydrologic soil groups "A-D," respectively. The curve "numbers""
are those associated with antecedent runoff
condition II. A curve number must
be specified for each soil type.
#
#
8-11* Maximum infiltration rates Maximum infiltration rates
(inches/day) for each soil type.
#
#
"12,13" Interception storage values Interception storage
values for "growing""

```

```

season and non-growing season.
#
14-17* Depth of root zone Root zone "depth," in
"FEET," for each soil group "A-D."""
#
"18,19" Reference Not used by model; for use by
users "in""
documenting the sources of information
placed into the table
#
* Column numbering will obviously change if more than
4 soil types are used.
#
LAND_USE_LOOKUP_TABLE
std_input\LU_lookup_WISCLAND_w_forested_hillslope_125.txt

#*****

BASE SOIL WATER CAPACITY
#
The model uses soil "information," together with land
cover "information,"""
to calculate surface runoff and assign a maximum
soil moisture holding
capacity to each grid cell. Soil "classifications," which
include "the""
requisite available water capacity or textural
"information," are "typically""
available through the state soil conservation service.
#
Each soil type or soil series within the model area must
be assigned a water capacity. If available water
capacity data are not
"available," the user can use soil texture to assign
a value (see "table""
below from Thornthwaite). ARCINFO or ArcView is
used to
code and generate the ascii input file.
#
SOIL TEXTURE AVAILABLE WATER CAPACITY (in / ft)
#
sand 1.2
#
loamy sand 1.4
#
sandy loam 1.6

```

```

fine sandy loam 1.8
very fine sandy loam 2
loam 2.2
silt loam 2.4
silt 2.55
sandy clay loam 2.7
silty clay loam 2.85
clay loam 3
sandy clay 3.2
silty clay 3.4
clay 3.6
#
WATER_CAPACITY ARC_GRID input\soils_awc_Merrill.asc
#*****

ADJUSTED WATER CAPACITY
#
The model will calculate the total available water
capacity from
the base soil water capacity grid and the land use
"grid," using "the""
rooting depth functions as specified in the land
use lookup table.
#
"Alternatively," the adjusted water capacity may be
calculated "external""
to the model and read in as an ASCII grid. If
this is "done," "internal""
calculation of the rooting depth and resulting
adjusted water capacity is
disabled in the model.
#
#ADJUSTED_WATER_CAPACITY ARC_GRID input\MAX_SM_STORAGE.grd
#*****

SOIL MOISTURE ACCOUNTING METHOD
#
The model currently only contains one soil-moisture
accounting

```

```

calculation option: Thornthwaite-Mather "(1948," "1957).""
#
The Thornthwaite-Mather soil moisture retention tables are
included
in the standard table "soil-moisture-retention-
extended.grd""""""""
#
If the DRIPPS_COMPATIBLE option is "TRUE," then the
"Thornthwaite-Mather""
tables are "ignored," and the polynomials developed by
Wes "Dripps""
(based on the same tables) are used instead.
#
SM T-M std_input\soil-moisture-retention-extended.grd
#*****

INITIAL SOIL MOISTURE
#
If "CONSTANT," initial soil moisture is specified
as a PERCENTAGE "saturation""
of the available water capacity.
#
If an ASCII GRID "FILE," initial soil moisture
is specified in INCHES of "water.""
#
#INITIAL_SOIL_MOISTURE CONSTANT 100
INITIAL_SOIL_MOISTURE ARC_GRID output\future\final_pct_sm_1954.asc
#*****

INITIAL SNOW COVER
#
Initial snow cover is specified as an equivalent
moisture value.
This may be specified as a single constant value
or as an ASCII grid file.
#
#INITIAL_SNOW_COVER CONSTANT 0
INITIAL_SNOW_COVER ARC_GRID output\future\final_snow_cover_1954.asc
#*****

```

```

SOLUTION METHOD

#

Two solution methods are available for the
routing of surface water
through the model domain. The "ITERATIVE" method
closely "resembles"
Wes Dripps' original solution "method," wherein
water is iteratively "moved"
across the entire grid until all water has either infiltrated
or
left the grid via surface flow.

#

The "DOWNHILL" method was developed by Vic
"Kelson," and "involves"
a pre-simulation step whereby the model grid cells
are sorted in an
upstream to downstream fashion. "Thereafter," runoff is
calculated "once"
for the entire model "domain," proceeding from the
upstream cells to "the"
downstream cells. The DOWNHILL option is preferred.

#

#RUNOFF C-N ITERATIVE

RUNOFF C-N DOWNHILL

#RUNOFF C-N NO_ROUTING

ITERATIVE METHOD TOLERANCE

#

The iterative method sometimes fails to converge for
exceedingly
small solution tolerances (i.e. < 1.00E-06 change in
calculated
runoff in a cell from one iteration to the next).
This option is
offered as a way to force convergence. The
default value is 1E-12.

#

#ITERATIVE_METHOD_TOLERANCE 1.00E-04

EVAPOTRANSPIRATION METHOD

#

The model implements several different methods for
estimating "ET,"

```

```

including:

1) Thornthwaite-Mather (program option: "T-M""""
latitude)""""
2) Jensen-Haise (program option: "J-H"""" latitude
albedo a_s b_s)""""
3) Blaney-Criddle (program option: "B-C""""
latitude)""""
4) Turc (program option: "TURC"""" latitude albedo
a_s b_s)""""
5) Hargreaves (program option: "HARGREAVES""""
southerly lat northerly "lat)""""

#ET HARGREAVES 42.89 43.24

#ET TURC 43 0.23 0.25 0.75

#ET J-H 45 0.23 0.25 0.5

ET T-M 45

PLOTTING CUSTOMIZATION

#

This version of the SWB model allows very limited
assignment of
DISLIN plotting parameters for the generation of
images.
See http://www.mps.mpg.de/dislin/ for more information about
this
package.

#

If no customizations are "specified," default values
will be "used.""""

#

DISLIN_PARAMETERS RECHARGE

SET_Z_AXIS_RANGE DAILY 0 1.5 0.1

SET_Z_AXIS_RANGE MONTHLY 0 7 1

SET_Z_AXIS_RANGE ANNUAL 0 20 2

Z_AXIS_TITLE "RECHARGE," IN INCHES

#

DISLIN_PARAMETERS ACT_ET

SET_Z_AXIS_RANGE DAILY 0 0.8 0.05

SET_Z_AXIS_RANGE MONTHLY 0 10 0.5

SET_Z_AXIS_RANGE ANNUAL 0 40 5

```

```

#SET_DEVICE PDF

#SET_FONT Helvetica-Bold

#

DISLIN_PARAMETERS POT_ET

SET_Z_AXIS_RANGE DAILY 0 0.8 0.05

SET_Z_AXIS_RANGE MONTHLY 0 10 0.5

SET_Z_AXIS_RANGE ANNUAL 0 45 5

#SET_DEVICE WMF

#SET_FONT Courier New Italic

#DISLIN_PARAMETERS RUNOFF_OUTSIDE

#SET_Z_AXIS_RANGE DAILY 0 5 0.5

#SET_Z_AXIS_RANGE MONTHLY 0 12 0.5

#SET_Z_AXIS_RANGE ANNUAL 0 25 5

#DISLIN_PARAMETERS SNOWCOVER

#SET_Z_AXIS_RANGE DAILY 0 12 0.5

DISLIN_PARAMETERS SM_APWL

SET_Z_AXIS_RANGE DAILY -20 0 2

SET_COLOR_TABLE RRAIN

OUTPUT OPTIONS

The SWB code can generate image and ARCGIS/Surfer output
at the
"daily," "monthly," or annual timescale. This section
allows the user "to"
specify exactly what output should be generated for
each of 24
internal variables at each of the three timescales.

Format for specifying output options is:

OUTPUT_OPTIONS variable_name daily_option monthly_option
"annual_option""", ""

where the possible values for each option are:

"NONE," GRAPH (or "PLOT)," "GRID," or "BOTH""

OUTPUT_OPTIONS RECHARGE NONE NONE BOTH

OUTPUT_OPTIONS SM_APWL NONE NONE NONE

```

```

OUTPUT_OPTIONS SNOWCOVER NONE NONE NONE
OUTPUT_OPTIONS INTERCEPTION NONE NONE PLOT
OUTPUT_OPTIONS RUNOFF_OUTSIDE NONE NONE PLOT
OUTPUT_OPTIONS ACT_ET NONE NONE NONE
OUTPUT_OPTIONS POT_ET NONE NONE PLOT

#*****

OUTPUT GRID FILE FORMAT
#
Next line specifies output grid format: ARC_GRID or
SURFER
#
OUTPUT_FORMAT ARC_GRID

#*****

BEGIN SOLUTION
#
The time series file contains daily values with the
following space or
tab-delimited fields:
#
1) Month
2) Day
3) Year
4) Mean Air Temperature (F)
5) Precipitation (in)
6) Mean Relative Humidity (%)
7) Maximum Air Temperature TMAX (F)
8) Minimum Air Temperature (F)
9) Mean Wind Velocity (m/sec)
10) Minimum Relative Humidity (%)
11) Percent of Possible Sunshine (%)
#
Any fields without data should be filled in with a
"-99999"

```

```
SOLVE climate\Merrill_climate_1952_2009\Merrill_1955.txt
```

```
#
```

```
EOJ
```

```
#
```

## **APPENDIX B**

### **CALIBRATION OF SWB TO PART**

Table 16. Monthly PART base flow data.

| Year | Month |      |      |      |      |      |      |      |      |      |      |      |
|------|-------|------|------|------|------|------|------|------|------|------|------|------|
|      | 1     | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| 1953 | 0.51  | 0.45 | 1.36 | 2.45 | 1.06 | 0.75 | 0.72 | 0.7  | 0.45 | 0.5  | 0.51 | 0.55 |
| 1954 | 0.44  | 0.45 | 0.58 | 1.53 | 1.5  | 0.86 | 0.7  | 0.53 | 0.68 | 0.8  | 0.67 | 0.53 |
| 1955 | 0.47  | 0.44 | 0.73 | 2.29 | 0.73 | 0.87 | 0.48 | 0.63 | 0.51 | 0.69 | 0.72 | 0.52 |
| 1956 | 0.44  | 0.39 | 0.42 | 1.59 | 0.87 | 0.61 | 0.79 | 0.6  | 0.42 | 0.45 | 0.61 | 0.5  |
| 1957 | 0.42  | 0.37 | 0.78 | 1.18 | 0.84 | 0.6  | 0.47 | 0.4  | 0.62 | 0.5  | 0.79 | 0.6  |
| 1958 | 0.44  | 0.38 | 0.65 | 1.55 | 0.77 | 0.63 | 1    | 0.42 | 0.6  | 0.8  | 0.74 | 0.5  |
| 1959 | 0.42  | 0.37 | 0.45 | 1.3  | 1.06 | 0.46 | 0.57 | 1.15 | 2.01 | 2.3  | 1.16 | 0.75 |
| 1960 | 0.96  | 0.61 | 0.53 | 2.07 | 3.28 | 1.19 | 0.85 | 0.95 | 0.98 | 0.84 | 1.14 | 0.82 |
| 1961 | 0.53  | 0.49 | 1.05 | 2.08 | 1.8  | 0.76 | 0.64 | 0.6  | 0.69 | 0.98 | 1.18 | 0.78 |
| 1962 | 0.56  | 0.46 | 0.7  | 2.3  | 1.42 | 0.84 | 0.55 | 0.81 | 1.09 | 0.88 | 0.73 | 0.66 |
| 1963 | 0.51  | 0.46 | 0.65 | 1.06 | 1.24 | 0.56 | 0.45 | 0.51 | 0.65 | 0.58 | 0.55 | 0.49 |
| 1964 | 0.43  | 0.42 | 0.53 | 1.35 | 1.54 | 0.5  | 0.51 | 0.48 | 0.95 | 0.73 | 0.87 | 0.5  |
| 1965 | 0.46  | 0.41 | 0.52 | 3.33 | 2.05 | 0.92 | 0.53 | 0.49 | 0.74 | 0.97 | 0.88 | 0.85 |
| 1966 | 0.63  | 0.5  | 1.47 | 1.79 | 1.12 | 0.75 | 0.49 | 0.55 | 0.46 | 0.57 | 0.53 | 0.5  |
| 1967 | 0.51  | 0.47 | 0.62 | 2.89 | 1.02 | 0.93 | 0.67 | 0.58 | 0.54 | 0.79 | 0.7  | 0.53 |
| 1968 | 0.5   | 0.44 | 0.8  | 1.67 | 1.55 | 2.02 | 1.43 | 0.81 | 1.21 | 1.01 | 0.83 | 0.75 |
| 1969 | 0.81  | 0.75 | 0.81 | 2.55 | 1.32 | 0.93 | 0.81 | 0.57 | 0.51 | 0.74 | 0.65 | 0.51 |
| 1970 | 0.52  | 0.44 | 0.52 | 1.25 | 1.43 | 0.73 | 0.46 | 0.43 | 0.59 | 0.74 | 1.17 | 0.9  |
| 1971 | 0.62  | 0.52 | 0.67 | 2.51 | 1.02 | 0.78 | 0.54 | 0.54 | 0.58 | 0.88 | 0.76 | 0.68 |
| 1972 | 0.53  | 0.46 | 0.65 | 3.12 | 1.29 | 0.48 | 0.5  | 0.95 | 0.83 | 1.43 | 1.26 | 0.77 |
| 1973 | 0.92  | 0.62 | 2.11 | 1.98 | 2.26 | 1.02 | 0.61 | 0.63 | 0.82 | 0.73 | 0.74 | 0.65 |
| 1974 | 0.54  | 0.45 | 0.72 | 1.41 | 0.92 | 0.83 | 0.5  | 0.59 | 0.62 | 0.63 | 0.84 | 0.52 |
| 1975 | 0.55  | 0.5  | 0.63 | 2.3  | 1.36 | 0.84 | 0.52 | 0.5  | 0.77 | 0.61 | 0.87 | 0.77 |
| 1976 | 0.65  | 0.62 | 1.33 | 3.47 | 1.17 | 0.58 | 0.47 | 0.49 | 0.46 | 0.51 | 0.47 | 0.5  |
| 1977 | 0.49  | 0.41 | 0.67 | 1.49 | 0.61 | 0.51 | 0.49 | 0.47 | 0.92 | 0.95 | 1.02 | 0.57 |
| 1978 | 0.5   | 0.4  | 0.55 | 1.48 | 0.98 | 0.81 | 1.24 | 0.85 | 1.01 | 0.89 | 0.64 | 0.56 |
| 1979 | 0.55  | 0.47 | 1.17 | 2.94 | 1.76 | 1.1  | 0.76 | 0.67 | 0.56 | 0.84 | 1.05 | 0.74 |
| 1980 | 0.61  | 0.52 | 0.65 | 1.79 | 0.84 | 0.74 | 0.61 | 0.72 | 1.32 | 0.91 | 0.8  | 0.5  |
| 1981 | 0.42  | 0.61 | 0.93 | 1.83 | 1.29 | 0.99 | 0.72 | 0.63 | 0.53 | 0.83 | 0.62 | 0.54 |
| 1982 | 0.49  | 0.41 | 0.55 | 2.49 | 1.41 | 0.58 | 0.65 | 0.51 | 0.97 | 1.3  | 1.38 | 1    |
| 1983 | 0.81  | 0.67 | 1.53 | 1.54 | 1.52 | 1.02 | 0.65 | 0.58 | 0.71 | 1.13 | 1.09 | 0.94 |
| 1984 | 0.67  | 0.81 | 0.73 | 1.68 | 1.44 | 0.8  | 0.63 | 0.56 | 0.63 | 0.9  | 1.06 | 0.79 |
| 1985 | 0.64  | 0.53 | 1.03 | 2.22 | 1.26 | 0.72 | 0.54 | 0.69 | 1.09 | 2.15 | 1.43 | 0.89 |
| 1986 | 0.85  | 0.7  | 1.1  | 2.15 | 0.83 | 0.71 | 1.07 | 0.79 | 1.21 | 2.13 | 0.95 | 0.85 |
| 1987 | 0.67  | 0.59 | 0.88 | 1.08 | 0.71 | 0.62 | 0.61 | 0.51 | 0.46 | 0.65 | 0.85 | 0.71 |
| 1988 | 0.51  | 0.44 | 0.76 | 1.49 | 0.71 | 0.4  | 0.46 | 0.44 | 0.53 | 0.56 | 0.98 | 0.62 |
| 1989 | 0.5   | 0.39 | 0.64 | 1.66 | 0.88 | 0.7  | 0.4  | 0.41 | 0.37 | 0.42 | 0.47 | 0.39 |
| 1990 | 0.4   | 0.36 | 0.68 | 0.56 | 1.12 | 0.82 | 0.6  | 0.81 | 1.21 | 1.12 | 0.84 | 0.75 |

|      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1991 | 0.56 | 0.48 | 1.01 | 2.22 | 1.38 | 1.11 | 0.76 | 0.65 | 0.6  | 0.73 | 1.22 | 1.11 |
| 1992 | 0.8  | 0.6  | 1.29 | 2.62 | 1.06 | 0.6  | 0.64 | 0.54 | 0.84 | 0.93 | 1.01 | 1    |
| 1993 | 0.62 | 0.49 | 0.7  | 2.14 | 1.83 | 1.78 | 0.91 | 0.73 | 1    | 0.95 | 0.83 | 0.7  |
| 1994 | 0.64 | 0.56 | 0.79 | 1.43 | 1.11 | 0.66 | 0.66 | 0.56 | 1.02 | 1.09 | 0.81 | 0.71 |
| 1995 | 0.54 | 0.47 | 0.97 | 0.99 | 1.21 | 0.62 | 0.52 | 1.16 | 0.8  | 1.31 | 1.01 | 0.69 |
| 1996 | 0.67 | 0.6  | 0.73 | 3.37 | 1.67 | 0.99 | 0.74 | 0.69 | 0.61 | 0.79 | 0.9  | 0.72 |
| 1997 | 0.66 | 0.61 | 0.68 | 2.08 | 1.15 | 0.76 | 0.85 | 0.75 | 0.78 | 1.03 | 0.72 | 0.57 |
| 1998 | 0.46 | 0.66 | 1.01 | 1.36 | 0.67 | 0.71 | 0.49 | 0.45 | 0.46 | 0.58 | 0.66 | 0.51 |
| 1999 | 0.46 | 0.49 | 0.66 | 0.95 | 1.04 | 0.68 | 0.92 | 0.82 | 0.52 | 0.61 | 0.58 | 0.49 |
| 2000 | 0.46 | 0.51 | 1.02 | 0.8  | 0.64 | 0.83 | 0.74 | 0.56 | 0.74 | 0.59 | 0.64 | 0.53 |
| 2001 | 0.45 | 0.38 | 0.52 | 2.39 | 1.02 | 0.8  | 0.51 | 0.47 | 0.57 | 0.62 | 0.68 | 0.82 |
| 2002 | 0.48 | 0.45 | 0.61 | 2.71 | 2.01 | 0.86 | 0.57 | 0.71 | 0.73 | 1.37 | 0.8  | 0.54 |
| 2003 | 0.38 | 0.35 | 0.83 | 1.52 | 1.6  | 0.89 | 0.56 | 0.54 | 0.52 | 0.62 | 0.66 | 0.52 |
| 2004 | 0.41 | 0.41 | 0.93 | 2.32 | 1.19 | 1.19 | 0.61 | 0.54 | 0.52 | 0.65 | 0.87 | 0.65 |
| 2005 | 0.58 | 0.52 | 0.65 | 2.05 | 0.85 | 0.65 | 0.46 | 0.45 | 0.42 | 0.59 | 0.59 | 0.6  |
| 2006 | 0.49 | 0.4  | 0.71 | 1.57 | 1    | 0.5  | 0.4  | 0.46 | 0.44 | 0.58 | 0.52 | 0.55 |
| 2007 | 0.56 | 0.39 | 0.8  | 1.03 | 0.64 | 0.5  | 0.43 | 0.38 | 0.38 | 0.68 | 0.44 | 0.44 |
| 2008 | 0.46 | 0.39 | 0.44 | 2.41 | 1.15 | 0.77 | 0.44 | 0.38 | 0.36 | 0.43 | 0.43 | 0.4  |
| 2009 | 0.42 | 0.36 | 0.66 | 0.99 | 0.92 | 0.56 | 0.36 | 0.39 | 0.34 | 0.53 | 0.52 | 0.38 |

**Table 17. Annual PART recharge and Annual SWB recharge increasing infiltration by 35%.**

| Years | 2 month lag | Increase infil. by 35% |
|-------|-------------|------------------------|
|       | PART        | SWB                    |
| 1953  | 9.94        | 6.887                  |
| 1954  | 9.29        | 8.751                  |
| 1955  | 9           | 8.877                  |
| 1956  | 7.65        | 4.49                   |
| 1957  | 7.6         | 3.626                  |
| 1958  | 8.45        | 6.53                   |
| 1961  | 11.58       | 12.858                 |
| 1964  | 8.83        | 8.9                    |
| 1965  | 12.41       | 15.654                 |
| 1966  | 9.21        | 8.156                  |
| 1967  | 10.21       | 12.506                 |
| 1970  | 9.36        | 10.285                 |
| 1971  | 9.95        | 8.465                  |
| 1974  | 8.63        | 5.241                  |
| 1975  | 10.44       | 11.923                 |
| 1976  | 10.35       | 8.806                  |
| 1977  | 8.6         | 8.401                  |

|      |       |        |
|------|-------|--------|
| 1978 | 10.03 | 8.726  |
| 1979 | 12.72 | 15.687 |
| 1980 | 9.91  | 11.657 |
| 1981 | 9.81  | 6.885  |
| 1982 | 12.32 | 13.977 |
| 1983 | 12.19 | 12.145 |
| 1984 | 10.39 | 12.199 |
| 1985 | 13.57 | 12.97  |
| 1986 | 13.05 | 12.313 |
| 1987 | 8.03  | 3.813  |
| 1988 | 7.84  | 8.457  |
| 1989 | 7.1   | 4.766  |
| 1990 | 9.55  | 12.858 |
| 1991 | 12.19 | 13.651 |
| 1992 | 11.64 | 13.851 |
| 1993 | 12.77 | 14.704 |
| 1994 | 9.85  | 8.494  |
| 1995 | 10.55 | 10.806 |
| 1996 | 12.48 | 13.201 |
| 1997 | 10.49 | 9.71   |
| 1998 | 7.85  | 8.503  |
| 1999 | 8.24  | 7.996  |
| 2000 | 7.92  | 8.328  |
| 2001 | 9.33  | 10.812 |
| 2002 | 11.64 | 15.59  |
| 2003 | 9.08  | 8.717  |
| 2004 | 10.57 | 11.417 |
| 2005 | 8.2   | 7.717  |
| 2006 | 7.68  | 10.077 |
| 2007 | 6.57  | 6.624  |
| 2008 | 7.99  | 7.541  |

## **APPENDIX C**

### **SWB OUTPUT FOR TIME SERIES, 1954-2009**

**Table 18. SWB annual output for time series 1954-2009.**

| Year | Ann<br>prec.<br>(in.) | Ann<br>rech.<br>(in.) | Ann<br>temp<br>(°F) | Initial<br>snow<br>cover<br>(in.) | Total<br>ET(in.) | Non-<br>growing<br>prec.<br>(in.) | Non<br>growing<br>rech.(in.) | Growing season<br>prec.(in.) | Growing season<br>rech.(in.) |
|------|-----------------------|-----------------------|---------------------|-----------------------------------|------------------|-----------------------------------|------------------------------|------------------------------|------------------------------|
| 1954 | 30.97                 | 8.74                  | 42.90               | 0.79                              | 17.17            | 10.11                             | 4.94                         | 20.86                        | 3.80                         |
| 1955 | 33.35                 | 8.87                  | 42.73               | 0.68                              | 19.78            | 10.91                             | 5.30                         | 22.44                        | 3.57                         |
| 1956 | 23.69                 | 4.49                  | 42.22               | 1.25                              | 16.61            | 7.86                              | 3.52                         | 15.83                        | 0.97                         |
| 1957 | 22.77                 | 3.63                  | 42.42               | 1.42                              | 16.01            | 7.71                              | 3.22                         | 15.06                        | 0.41                         |
| 1958 | 28.09                 | 6.54                  | 42.31               | 0.96                              | 18.82            | 9.25                              | 4.55                         | 18.84                        | 1.98                         |
| 1961 | 36.68                 | 12.86                 | 42.22               | 0.10                              | 18.61            | 15.44                             | 10.27                        | 21.24                        | 2.59                         |
| 1964 | 30.87                 | 8.89                  | 43.71               | 0.69                              | 16.87            | 10.49                             | 5.42                         | 20.38                        | 3.47                         |
| 1965 | 41.39                 | 15.66                 | 41.91               | 1.29                              | 19.33            | 16.21                             | 11.08                        | 25.18                        | 4.57                         |
| 1966 | 27.00                 | 8.16                  | 42.08               | 1.25                              | 15.97            | 13.03                             | 7.64                         | 13.97                        | 0.52                         |
| 1967 | 34.88                 | 12.51                 | 41.49               | 1.18                              | 17.75            | 14.21                             | 9.15                         | 20.67                        | 3.36                         |
| 1970 | 32.09                 | 10.28                 | 42.62               | 1.90                              | 17.70            | 11.74                             | 7.88                         | 20.35                        | 2.40                         |
| 1971 | 31.21                 | 8.45                  | 41.97               | 1.35                              | 16.90            | 14.31                             | 7.08                         | 16.90                        | 1.37                         |
| 1974 | 24.86                 | 5.24                  | 41.32               | 0.94                              | 15.63            | 9.44                              | 4.82                         | 15.42                        | 0.42                         |
| 1975 | 31.97                 | 11.93                 | 42.02               | 1.85                              | 16.32            | 16.41                             | 11.09                        | 15.56                        | 0.84                         |
| 1976 | 23.40                 | 8.79                  | 38.62               | 0.35                              | 12.99            | 11.79                             | 7.89                         | 11.61                        | 0.90                         |
| 1977 | 32.09                 | 8.39                  | 41.05               | 0.51                              | 16.62            | 15.01                             | 7.48                         | 17.08                        | 0.91                         |
| 1978 | 34.02                 | 8.73                  | 39.09               | 1.19                              | 19.35            | 8.48                              | 4.57                         | 25.54                        | 4.16                         |
| 1979 | 38.09                 | 15.68                 | 38.78               | 2.63                              | 17.36            | 16.58                             | 11.55                        | 21.51                        | 4.12                         |
| 1980 | 36.17                 | 11.64                 | 40.32               | 0.14                              | 18.28            | 8.09                              | 5.30                         | 28.08                        | 6.34                         |
| 1981 | 26.70                 | 6.88                  | 41.58               | 0.47                              | 15.86            | 11.23                             | 5.69                         | 15.47                        | 1.19                         |
| 1982 | 37.47                 | 13.96                 | 39.55               | 1.08                              | 17.40            | 15.47                             | 10.02                        | 22.00                        | 3.94                         |
| 1983 | 33.47                 | 12.14                 | 42.22               | 1.75                              | 16.13            | 14.52                             | 9.81                         | 18.95                        | 2.34                         |
| 1984 | 32.37                 | 12.20                 | 41.64               | 2.13                              | 16.99            | 14.11                             | 10.55                        | 18.26                        | 1.65                         |
| 1985 | 39.26                 | 12.97                 | 39.77               | 0.39                              | 18.36            | 15.63                             | 8.81                         | 23.63                        | 4.16                         |
| 1986 | 36.68                 | 12.31                 | 41.53               | 2.76                              | 19.07            | 11.17                             | 7.49                         | 25.51                        | 4.82                         |
| 1987 | 21.85                 | 3.81                  | 44.61               | 0.46                              | 14.84            | 9.56                              | 3.79                         | 12.29                        | 0.01                         |
| 1988 | 29.28                 | 8.46                  | 41.40               | 0.98                              | 16.63            | 12.05                             | 7.73                         | 17.23                        | 0.73                         |
| 1989 | 20.46                 | 4.76                  | 39.19               | 1.32                              | 14.30            | 8.87                              | 4.52                         | 11.59                        | 0.24                         |
| 1990 | 41.56                 | 12.85                 | 42.67               | 1.00                              | 19.87            | 12.89                             | 6.45                         | 28.67                        | 6.40                         |
| 1991 | 41.74                 | 13.64                 | 41.82               | 1.18                              | 19.96            | 18.62                             | 10.79                        | 23.12                        | 2.85                         |
| 1992 | 32.47                 | 13.86                 | 40.86               | 3.57                              | 14.69            | 16.04                             | 12.34                        | 16.43                        | 1.52                         |
| 1993 | 36.28                 | 14.70                 | 39.98               | 2.00                              | 17.17            | 10.78                             | 8.92                         | 25.50                        | 5.77                         |
| 1994 | 29.73                 | 8.49                  | 41.47               | 0.27                              | 17.39            | 11.17                             | 6.62                         | 18.56                        | 1.87                         |
| 1995 | 35.03                 | 10.79                 | 41.20               | 0.19                              | 17.01            | 12.20                             | 6.28                         | 22.83                        | 4.51                         |
| 1996 | 38.92                 | 13.20                 | 38.81               | 2.43                              | 18.99            | 17.39                             | 10.90                        | 21.53                        | 2.30                         |
| 1997 | 29.50                 | 9.70                  | 40.97               | 3.52                              | 17.93            | 10.10                             | 8.50                         | 19.40                        | 1.19                         |

|      |       |       |       |      |       |       |       |       |      |
|------|-------|-------|-------|------|-------|-------|-------|-------|------|
| 1998 | 27.69 | 8.50  | 46.06 | 0.05 | 16.01 | 11.86 | 6.44  | 15.83 | 2.05 |
| 1999 | 32.06 | 7.99  | 43.60 | 0.70 | 19.78 | 9.99  | 4.99  | 22.07 | 3.01 |
| 2000 | 33.60 | 8.32  | 42.18 | 0.71 | 19.54 | 11.29 | 5.38  | 22.31 | 2.95 |
| 2001 | 31.55 | 10.81 | 43.63 | 1.91 | 17.46 | 14.59 | 9.56  | 16.96 | 1.25 |
| 2002 | 39.42 | 15.59 | 43.10 | 0.47 | 18.72 | 15.43 | 11.50 | 23.99 | 4.09 |
| 2003 | 27.14 | 8.71  | 41.62 | 0.11 | 14.42 | 11.71 | 6.63  | 15.43 | 2.08 |
| 2004 | 32.78 | 11.41 | 41.13 | 0.45 | 15.29 | 16.30 | 8.23  | 16.48 | 3.18 |
| 2005 | 25.60 | 7.71  | 43.22 | 1.48 | 15.75 | 11.84 | 7.30  | 13.76 | 0.41 |
| 2006 | 31.27 | 10.07 | 44.27 | 0.60 | 16.98 | 11.68 | 7.89  | 19.59 | 2.18 |
| 2007 | 28.32 | 6.62  | 43.78 | 0.70 | 17.21 | 13.32 | 6.53  | 15.00 | 0.09 |
| 2008 | 24.69 | 7.53  | 40.40 | 1.65 | 14.58 | 11.54 | 6.21  | 13.15 | 1.32 |
| 2009 | 29.55 | 7.87  | 40.71 | 1.64 | 15.99 | 14.48 | 6.59  | 15.07 | 1.29 |

## **APPENDIX D**

**SWB OUTPUTFOR SDSM SIMULATION DATA AND SIM FILE TO RUN SDSM**

**WEATHER GENERATOR**

**Table 19. SWB output for SDSM Simulations of 28 inches of annual precipitation.**

| Simulated Run | Ann. prec.(in.) | Ann. rech.(in.) | Non-growing prec.(in.) | Non-growing rech.(in.) | Growing prec.(in.) | Growing rech.(in.) |
|---------------|-----------------|-----------------|------------------------|------------------------|--------------------|--------------------|
| 1             | 28.46           | 7.98            | 18.63                  | 7.98                   | 9.83               | 0.01               |
| 2             | 28.22           | 8.28            | 17.35                  | 8.24                   | 10.87              | 0.04               |
| 3             | 28.42           | 7.20            | 16.61                  | 7.17                   | 11.81              | 0.03               |
| 4             | 28.26           | 6.97            | 14.32                  | 6.78                   | 13.94              | 0.19               |
| 5             | 28.12           | 5.61            | 13.49                  | 5.35                   | 14.63              | 0.25               |
| 6             | 28.14           | 7.12            | 15.05                  | 6.56                   | 13.09              | 0.57               |
| 7             | 28.27           | 7.20            | 15.99                  | 6.12                   | 12.28              | 1.08               |
| 8             | 28.14           | 7.09            | 15.21                  | 6.94                   | 12.93              | 0.16               |
| 9             | 28.43           | 5.96            | 10.83                  | 4.33                   | 17.60              | 1.63               |
| 10            | 28.34           | 6.96            | 13.95                  | 6.49                   | 14.39              | 0.47               |
| 11            | 28.04           | 6.46            | 14.27                  | 6.32                   | 13.77              | 0.15               |
| 12            | 28.35           | 5.08            | 11.64                  | 4.03                   | 16.71              | 1.06               |
| 13            | 28.48           | 6.85            | 13.45                  | 6.58                   | 15.03              | 0.27               |
| 14            | 28.16           | 6.53            | 11.25                  | 5.40                   | 16.91              | 1.13               |
| 15            | 28.08           | 5.41            | 12.53                  | 4.48                   | 15.55              | 0.93               |
| 16            | 28.38           | 6.39            | 13.85                  | 5.77                   | 14.53              | 0.62               |
| 17            | 28.16           | 5.80            | 11.22                  | 4.77                   | 16.94              | 1.03               |
| 18            | 28.36           | 6.97            | 15.31                  | 6.71                   | 13.05              | 0.27               |
| 19            | 28.4            | 5.91            | 12.39                  | 4.75                   | 16.01              | 1.16               |
| 20            | 28.25           | 6.34            | 11.75                  | 4.70                   | 16.50              | 1.65               |
| 21            | 28.45           | 6.09            | 13.72                  | 5.78                   | 14.73              | 0.31               |
| 22            | 28.14           | 6.29            | 13.61                  | 6.00                   | 14.53              | 0.29               |
| 23            | 28.14           | 6.40            | 12.68                  | 5.17                   | 15.46              | 1.23               |
| 24            | 28.08           | 5.80            | 14.72                  | 5.56                   | 13.36              | 0.24               |
| 25            | 28.02           | 7.19            | 14.72                  | 7.04                   | 13.30              | 0.15               |
| 26            | 28.22           | 6.52            | 14.76                  | 6.28                   | 13.46              | 0.24               |
| 27            | 28.2            | 7.53            | 13.26                  | 6.93                   | 14.94              | 0.60               |
| 28            | 28.16           | 5.20            | 11.90                  | 4.86                   | 16.26              | 0.34               |
| 29            | 28.13           | 6.27            | 13.41                  | 5.93                   | 14.72              | 0.33               |
| 30            | 28.02           | 6.15            | 12.78                  | 5.16                   | 15.24              | 0.99               |
| 31            | 28.38           | 6.56            | 12.74                  | 6.03                   | 15.64              | 0.53               |
| 32            | 28.25           | 5.88            | 12.75                  | 5.26                   | 15.50              | 0.62               |
| 33            | 28.46           | 7.32            | 16.06                  | 6.74                   | 12.40              | 0.58               |
| 34            | 28.21           | 6.17            | 13.49                  | 5.74                   | 14.72              | 0.43               |
| 35            | 28.06           | 6.06            | 12.97                  | 5.12                   | 15.09              | 0.94               |
| 36            | 28.16           | 6.29            | 14.04                  | 6.19                   | 14.12              | 0.10               |
| 37            | 28.42           | 6.59            | 11.69                  | 5.25                   | 16.73              | 1.34               |

|    |       |      |       |      |       |      |
|----|-------|------|-------|------|-------|------|
| 38 | 28.43 | 6.30 | 13.49 | 5.38 | 14.94 | 0.92 |
| 39 | 28.1  | 6.21 | 15.95 | 6.18 | 12.15 | 0.03 |
| 40 | 28.5  | 6.58 | 15.24 | 6.35 | 13.26 | 0.24 |
| 41 | 28    | 8.04 | 17.41 | 7.42 | 10.59 | 0.63 |
| 42 | 28.26 | 5.43 | 11.73 | 4.15 | 16.53 | 1.28 |
| 43 | 28.32 | 6.58 | 15.53 | 6.56 | 12.79 | 0.02 |
| 44 | 28.19 | 6.80 | 15.74 | 6.77 | 12.45 | 0.03 |
| 45 | 28.5  | 8.01 | 18.48 | 7.28 | 10.02 | 0.73 |
| 46 | 28.44 | 6.77 | 14.42 | 6.66 | 14.02 | 0.12 |
| 47 | 28.41 | 6.42 | 13.65 | 5.74 | 14.76 | 0.68 |
| 48 | 28.13 | 6.96 | 14.10 | 6.42 | 14.03 | 0.54 |
| 49 | 28.27 | 6.26 | 13.54 | 5.99 | 14.73 | 0.28 |
| 50 | 28.22 | 7.32 | 14.99 | 7.24 | 13.23 | 0.08 |
| 51 | 28.48 | 7.39 | 16.78 | 7.36 | 11.70 | 0.03 |
| 52 | 28.15 | 6.63 | 14.74 | 5.89 | 13.41 | 0.74 |
| 53 | 28.48 | 7.70 | 13.11 | 7.13 | 15.37 | 0.58 |
| 54 | 28.08 | 7.34 | 15.68 | 6.79 | 12.40 | 0.54 |
| 55 | 28.45 | 6.13 | 12.39 | 5.22 | 16.06 | 0.91 |
| 56 | 28.13 | 6.61 | 15.26 | 6.38 | 12.87 | 0.23 |
| 57 | 28.09 | 7.61 | 13.68 | 6.50 | 14.41 | 1.11 |
| 58 | 28.11 | 8.14 | 18.12 | 8.08 | 9.99  | 0.06 |
| 59 | 28.31 | 6.34 | 14.22 | 6.16 | 14.09 | 0.18 |
| 60 | 28.14 | 6.77 | 13.44 | 6.09 | 14.70 | 0.68 |
| 61 | 28.24 | 7.40 | 15.14 | 6.25 | 13.10 | 1.15 |
| 62 | 28.32 | 5.34 | 13.73 | 5.12 | 14.59 | 0.22 |
| 63 | 28.48 | 7.07 | 16.32 | 6.43 | 12.16 | 0.64 |
| 64 | 28.03 | 7.07 | 15.94 | 6.90 | 12.09 | 0.17 |
| 65 | 28.1  | 7.39 | 15.84 | 7.10 | 12.26 | 0.29 |
| 66 | 28.24 | 8.41 | 15.57 | 8.22 | 12.67 | 0.20 |
| 67 | 28.21 | 8.46 | 16.53 | 8.38 | 11.68 | 0.08 |
| 68 | 28.39 | 6.59 | 14.22 | 6.25 | 14.17 | 0.34 |
| 69 | 28.34 | 6.73 | 12.12 | 5.28 | 16.22 | 1.46 |
| 70 | 28.42 | 7.13 | 13.27 | 6.53 | 15.15 | 0.60 |
| 71 | 28.04 | 6.62 | 15.06 | 6.51 | 12.98 | 0.11 |
| 72 | 28.42 | 5.82 | 14.81 | 5.63 | 13.61 | 0.19 |
| 73 | 28.12 | 6.33 | 15.94 | 6.07 | 12.18 | 0.26 |
| 74 | 28.5  | 7.35 | 15.55 | 7.20 | 12.95 | 0.14 |
| 75 | 28.39 | 7.16 | 14.60 | 6.74 | 13.79 | 0.42 |
| 76 | 28.07 | 6.84 | 15.36 | 6.67 | 12.71 | 0.17 |
| 77 | 28.41 | 7.08 | 14.66 | 6.90 | 13.75 | 0.19 |
| 78 | 28.07 | 8.90 | 16.06 | 8.30 | 12.01 | 0.59 |

|     |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|
| 79  | 28.25 | 6.72 | 11.78 | 5.54 | 16.47 | 1.18 |
| 80  | 28.32 | 7.78 | 11.04 | 5.76 | 17.28 | 2.02 |
| 81  | 28.43 | 6.55 | 13.91 | 5.64 | 14.52 | 0.91 |
| 82  | 28.06 | 5.79 | 12.57 | 4.27 | 15.49 | 1.52 |
| 83  | 28.42 | 6.15 | 13.32 | 5.75 | 15.10 | 0.40 |
| 84  | 28.31 | 6.68 | 14.12 | 6.42 | 14.19 | 0.26 |
| 85  | 28.22 | 6.66 | 15.01 | 6.45 | 13.21 | 0.21 |
| 86  | 28.18 | 7.86 | 16.67 | 7.82 | 11.51 | 0.03 |
| 87  | 28.43 | 6.30 | 12.20 | 5.44 | 16.23 | 0.86 |
| 88  | 28.13 | 6.08 | 13.37 | 4.76 | 14.76 | 1.32 |
| 89  | 28.21 | 6.14 | 12.26 | 4.35 | 15.95 | 1.79 |
| 90  | 28.21 | 6.88 | 13.09 | 5.60 | 15.12 | 1.28 |
| 91  | 28.08 | 5.64 | 10.87 | 4.37 | 17.21 | 1.27 |
| 92  | 28.05 | 6.17 | 11.83 | 5.00 | 16.22 | 1.17 |
| 93  | 28.32 | 6.31 | 11.75 | 4.95 | 16.57 | 1.36 |
| 94  | 28.41 | 7.01 | 16.09 | 6.99 | 12.32 | 0.02 |
| 95  | 28.21 | 5.46 | 10.06 | 3.67 | 18.15 | 1.79 |
| 96  | 28.22 | 8.28 | 17.35 | 8.24 | 10.87 | 0.04 |
| 97  | 28.42 | 7.20 | 16.61 | 7.17 | 11.81 | 0.03 |
| 98  | 28.26 | 6.97 | 14.32 | 6.78 | 13.94 | 0.19 |
| 99  | 28.12 | 5.61 | 13.49 | 5.35 | 14.63 | 0.25 |
| 100 | 28.14 | 7.12 | 15.05 | 6.56 | 13.09 | 0.57 |
| 101 | 28.27 | 7.20 | 15.99 | 6.12 | 12.28 | 1.08 |
| 102 | 28.14 | 7.09 | 15.21 | 6.94 | 12.93 | 0.16 |
| 103 | 28.43 | 5.96 | 10.83 | 4.33 | 17.60 | 1.63 |
| 104 | 28.34 | 6.96 | 13.95 | 6.49 | 14.39 | 0.47 |
| 105 | 28.04 | 6.46 | 14.27 | 6.32 | 13.77 | 0.15 |
| 106 | 28.35 | 5.08 | 11.64 | 4.03 | 16.71 | 1.06 |
| 107 | 28.48 | 6.85 | 13.45 | 6.58 | 15.03 | 0.27 |
| 108 | 28.16 | 6.53 | 11.25 | 5.40 | 16.91 | 1.13 |
| 109 | 28.08 | 5.41 | 12.53 | 4.48 | 15.55 | 0.93 |
| 110 | 28.38 | 6.39 | 13.85 | 5.77 | 14.53 | 0.62 |
| 111 | 28.16 | 5.80 | 11.22 | 4.77 | 16.94 | 1.03 |
| 112 | 28.36 | 6.97 | 15.31 | 6.71 | 13.05 | 0.27 |
| 113 | 28.4  | 5.91 | 12.39 | 4.75 | 16.01 | 1.16 |
| 114 | 28.25 | 6.34 | 11.75 | 4.70 | 16.50 | 1.65 |
| 115 | 28.45 | 6.09 | 13.72 | 5.78 | 14.73 | 0.31 |
| 116 | 28.14 | 6.29 | 13.61 | 6.00 | 14.53 | 0.29 |
| 117 | 28.14 | 6.40 | 12.68 | 5.17 | 15.46 | 1.23 |
| 118 | 28.08 | 5.80 | 14.72 | 5.56 | 13.36 | 0.24 |
| 119 | 28.02 | 7.19 | 14.72 | 7.04 | 13.30 | 0.15 |

|     |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|
| 120 | 28.22 | 6.52 | 14.76 | 6.28 | 13.46 | 0.24 |
| 121 | 28.2  | 7.53 | 13.26 | 6.93 | 14.94 | 0.60 |
| 122 | 28.16 | 5.20 | 11.90 | 4.86 | 16.26 | 0.34 |
| 123 | 28.13 | 6.27 | 13.41 | 5.93 | 14.72 | 0.33 |
| 124 | 28.02 | 6.15 | 12.78 | 5.16 | 15.24 | 0.99 |
| 125 | 28.38 | 6.56 | 12.74 | 6.03 | 15.64 | 0.53 |
| 126 | 28.25 | 5.88 | 12.75 | 5.26 | 15.50 | 0.62 |
| 127 | 28.46 | 7.32 | 16.06 | 6.74 | 12.40 | 0.58 |
| 128 | 28.21 | 6.17 | 13.49 | 5.74 | 14.72 | 0.43 |
| 129 | 28.06 | 6.06 | 12.97 | 5.12 | 15.09 | 0.94 |
| 130 | 28.16 | 6.29 | 14.04 | 6.19 | 14.12 | 0.10 |
| 131 | 28.42 | 6.59 | 11.69 | 5.25 | 16.73 | 1.34 |
| 132 | 28.43 | 6.30 | 13.49 | 5.38 | 14.94 | 0.92 |
| 133 | 28.1  | 6.21 | 15.95 | 6.18 | 12.15 | 0.03 |
| 134 | 28.5  | 6.58 | 15.24 | 6.35 | 13.26 | 0.24 |
| 135 | 28    | 8.04 | 17.41 | 7.42 | 10.59 | 0.63 |
| 136 | 28.26 | 5.43 | 11.73 | 4.15 | 16.53 | 1.28 |
| 137 | 28.32 | 6.58 | 15.53 | 6.56 | 12.79 | 0.02 |
| 138 | 28.19 | 6.80 | 15.74 | 6.77 | 12.45 | 0.03 |
| 139 | 28.5  | 8.01 | 18.48 | 7.28 | 10.02 | 0.73 |
| 140 | 28.44 | 6.77 | 14.42 | 6.66 | 14.02 | 0.12 |
| 141 | 28.41 | 6.42 | 13.65 | 5.74 | 14.76 | 0.68 |
| 142 | 28.13 | 6.96 | 14.10 | 6.42 | 14.03 | 0.54 |
| 143 | 28.27 | 6.26 | 13.54 | 5.99 | 14.73 | 0.28 |
| 144 | 28.22 | 7.32 | 14.99 | 7.24 | 13.23 | 0.08 |
| 145 | 28.48 | 7.39 | 16.78 | 7.36 | 11.70 | 0.03 |
| 146 | 28.15 | 6.63 | 14.74 | 5.89 | 13.41 | 0.74 |
| 147 | 28.48 | 7.70 | 13.11 | 7.13 | 15.37 | 0.58 |
| 148 | 28.08 | 7.34 | 15.68 | 6.79 | 12.40 | 0.54 |
| 149 | 28.45 | 6.13 | 12.39 | 5.22 | 16.06 | 0.91 |
| 150 | 28.13 | 6.61 | 15.26 | 6.38 | 12.87 | 0.23 |
| 151 | 28.09 | 7.61 | 13.68 | 6.50 | 14.41 | 1.11 |
| 152 | 28.11 | 8.14 | 18.12 | 8.08 | 9.99  | 0.06 |
| 153 | 28.31 | 6.34 | 14.22 | 6.16 | 14.09 | 0.18 |
| 154 | 28.14 | 6.77 | 13.44 | 6.09 | 14.70 | 0.68 |
| 155 | 28.24 | 7.40 | 15.14 | 6.25 | 13.10 | 1.15 |
| 156 | 28.32 | 5.34 | 13.73 | 5.12 | 14.59 | 0.22 |
| 157 | 28.48 | 7.07 | 16.32 | 6.43 | 12.16 | 0.64 |
| 158 | 28.03 | 7.07 | 15.94 | 6.90 | 12.09 | 0.17 |
| 159 | 28.1  | 7.39 | 15.84 | 7.10 | 12.26 | 0.29 |
| 160 | 28.24 | 8.41 | 15.57 | 8.22 | 12.67 | 0.20 |

|     |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|
| 161 | 28.21 | 8.46 | 16.53 | 8.38 | 11.68 | 0.08 |
| 162 | 28.39 | 6.59 | 14.22 | 6.25 | 14.17 | 0.34 |
| 163 | 28.34 | 6.73 | 12.12 | 5.28 | 16.22 | 1.46 |
| 164 | 28.42 | 7.13 | 13.27 | 6.53 | 15.15 | 0.60 |
| 165 | 28.04 | 6.62 | 15.06 | 6.51 | 12.98 | 0.11 |
| 166 | 28.42 | 5.82 | 14.81 | 5.63 | 13.61 | 0.19 |
| 167 | 28.12 | 6.33 | 15.94 | 6.07 | 12.18 | 0.26 |
| 168 | 28.5  | 7.35 | 15.55 | 7.20 | 12.95 | 0.14 |
| 169 | 28.39 | 7.16 | 14.60 | 6.74 | 13.79 | 0.42 |
| 170 | 28.07 | 6.84 | 15.36 | 6.67 | 12.71 | 0.17 |
| 171 | 28.41 | 7.08 | 14.66 | 6.90 | 13.75 | 0.19 |
| 172 | 28.07 | 8.90 | 16.06 | 8.30 | 12.01 | 0.59 |
| 173 | 28.25 | 6.72 | 11.78 | 5.54 | 16.47 | 1.18 |
| 174 | 28.32 | 7.78 | 11.04 | 5.76 | 17.28 | 2.02 |
| 175 | 28.43 | 6.55 | 13.91 | 5.64 | 14.52 | 0.91 |
| 176 | 28.06 | 5.79 | 12.57 | 4.27 | 15.49 | 1.52 |
| 177 | 28.42 | 6.15 | 13.32 | 5.75 | 15.10 | 0.40 |
| 178 | 28.31 | 6.68 | 14.12 | 6.42 | 14.19 | 0.26 |
| 179 | 28.22 | 6.66 | 15.01 | 6.45 | 13.21 | 0.21 |
| 180 | 28.18 | 7.86 | 16.67 | 7.82 | 11.51 | 0.03 |
| 181 | 28.43 | 6.30 | 12.20 | 5.44 | 16.23 | 0.86 |
| 182 | 28.13 | 6.08 | 13.37 | 4.76 | 14.76 | 1.32 |
| 183 | 28.21 | 6.14 | 12.26 | 4.35 | 15.95 | 1.79 |
| 184 | 28.21 | 6.88 | 13.09 | 5.60 | 15.12 | 1.28 |
| 185 | 28.08 | 5.64 | 10.87 | 4.37 | 17.21 | 1.27 |
| 186 | 28.05 | 6.17 | 11.83 | 5.00 | 16.22 | 1.17 |
| 187 | 28.32 | 6.31 | 11.75 | 4.95 | 16.57 | 1.36 |
| 188 | 28.41 | 7.01 | 16.09 | 6.99 | 12.32 | 0.02 |
| 189 | 28.06 | 6.99 | 14.57 | 6.83 | 13.49 | 0.16 |
| 190 | 28.06 | 7.59 | 16.51 | 7.50 | 11.55 | 0.09 |
| 191 | 28.2  | 6.44 | 13.76 | 5.92 | 14.44 | 0.51 |
| 192 | 28.15 | 7.62 | 16.39 | 7.22 | 11.76 | 0.39 |
| 193 | 28.22 | 6.80 | 16.39 | 6.77 | 11.83 | 0.03 |
| 194 | 28.39 | 5.88 | 12.57 | 5.23 | 15.82 | 0.65 |
| 195 | 28.44 | 7.08 | 14.06 | 4.99 | 14.38 | 2.09 |
| 196 | 28.34 | 5.99 | 13.01 | 4.62 | 15.33 | 1.37 |
| 197 | 28.04 | 6.33 | 11.89 | 5.32 | 16.15 | 1.02 |
| 198 | 28.23 | 6.31 | 14.66 | 6.03 | 13.57 | 0.28 |
| 199 | 28.03 | 4.82 | 12.09 | 4.25 | 15.94 | 0.57 |
| 200 | 28.2  | 5.30 | 11.63 | 4.32 | 16.57 | 0.98 |

**Table 20. SWB output for SDSM Simulations of 30 inches of annual precipitation.**

| Simulated Run | Ann. prec. (in.) | Ann. Rech. (in.) | Non-growing prec.(in.) | Non-growing rech.(in.) | Growing prec.(in.) | Growing rech.(in.) |
|---------------|------------------|------------------|------------------------|------------------------|--------------------|--------------------|
| 1             | 30.13            | 8.72             | 18.67                  | 8.55                   | 11.46              | 0.16               |
| 2             | 30.29            | 7.30             | 10.92                  | 4.32                   | 19.37              | 2.97               |
| 3             | 30.24            | 8.45             | 16.00                  | 7.76                   | 14.24              | 0.68               |
| 4             | 30.47            | 7.84             | 16.34                  | 7.66                   | 14.13              | 0.18               |
| 5             | 30.3             | 7.38             | 13.38                  | 6.34                   | 16.92              | 1.04               |
| 6             | 30.02            | 6.95             | 12.53                  | 5.03                   | 17.49              | 1.93               |
| 7             | 30.16            | 6.39             | 14.16                  | 5.80                   | 16.00              | 0.59               |
| 8             | 30.08            | 7.13             | 11.37                  | 5.08                   | 18.71              | 2.05               |
| 9             | 30.4             | 7.33             | 13.66                  | 6.41                   | 16.74              | 0.92               |
| 10            | 30.36            | 7.25             | 16.41                  | 6.77                   | 13.95              | 0.48               |
| 11            | 30.08            | 6.88             | 12.67                  | 6.29                   | 17.41              | 0.59               |
| 12            | 30.13            | 8.60             | 13.78                  | 6.79                   | 16.35              | 1.81               |
| 13            | 30.01            | 8.89             | 18.94                  | 8.84                   | 11.07              | 0.05               |
| 14            | 30.3             | 7.44             | 11.82                  | 5.30                   | 18.48              | 2.14               |
| 15            | 30.48            | 6.95             | 14.28                  | 6.29                   | 16.20              | 0.66               |
| 16            | 29.97            | 9.29             | 18.80                  | 7.96                   | 11.17              | 1.33               |
| 17            | 30.47            | 9.44             | 17.55                  | 8.42                   | 12.92              | 1.02               |
| 18            | 30.02            | 6.48             | 13.97                  | 5.70                   | 16.05              | 0.79               |
| 19            | 30.23            | 6.07             | 14.45                  | 5.20                   | 15.78              | 0.87               |
| 20            | 30.07            | 7.49             | 16.51                  | 7.42                   | 13.56              | 0.07               |
| 21            | 30.23            | 7.67             | 10.51                  | 4.02                   | 19.72              | 3.66               |
| 22            | 30.43            | 8.10             | 16.80                  | 8.03                   | 13.63              | 0.08               |
| 23            | 30.41            | 8.05             | 16.48                  | 7.75                   | 13.93              | 0.30               |
| 24            | 30.39            | 8.22             | 15.61                  | 7.36                   | 14.78              | 0.87               |
| 25            | 30.21            | 7.72             | 15.04                  | 6.86                   | 15.17              | 0.87               |
| 26            | 30.52            | 7.39             | 16.03                  | 6.91                   | 14.49              | 0.48               |
| 27            | 30.06            | 7.03             | 13.90                  | 6.73                   | 16.16              | 0.31               |
| 28            | 30.43            | 6.59             | 11.74                  | 4.09                   | 18.69              | 2.50               |
| 29            | 30.13            | 6.61             | 12.69                  | 5.24                   | 17.44              | 1.37               |
| 30            | 30.42            | 8.68             | 15.85                  | 8.01                   | 14.57              | 0.67               |
| 31            | 30.34            | 7.91             | 12.69                  | 6.19                   | 17.65              | 1.72               |
| 32            | 30.39            | 8.34             | 16.71                  | 7.49                   | 13.68              | 0.85               |
| 33            | 30.36            | 6.98             | 15.32                  | 6.83                   | 15.04              | 0.15               |
| 34            | 30.17            | 7.43             | 17.35                  | 6.16                   | 12.82              | 1.27               |
| 35            | 30.18            | 8.84             | 15.77                  | 8.06                   | 14.41              | 0.78               |
| 36            | 30.08            | 7.01             | 16.29                  | 6.43                   | 13.79              | 0.59               |
| 37            | 30.15            | 6.50             | 13.12                  | 6.16                   | 17.03              | 0.34               |
| 38            | 30.53            | 7.74             | 15.69                  | 7.18                   | 14.84              | 0.56               |

|    |       |      |       |      |       |      |
|----|-------|------|-------|------|-------|------|
| 39 | 30.39 | 8.11 | 15.69 | 7.60 | 14.70 | 0.51 |
| 40 | 30.29 | 7.71 | 16.08 | 6.97 | 14.21 | 0.74 |
| 41 | 30.32 | 7.93 | 16.24 | 7.81 | 14.08 | 0.11 |
| 42 | 30.14 | 6.90 | 14.85 | 6.11 | 15.29 | 0.79 |
| 43 | 30.31 | 6.96 | 12.42 | 4.80 | 17.89 | 2.16 |
| 44 | 30.29 | 6.50 | 12.49 | 4.91 | 17.80 | 1.59 |
| 45 | 30.23 | 8.76 | 15.09 | 7.59 | 15.14 | 1.17 |
| 46 | 30.52 | 7.76 | 15.29 | 7.49 | 15.23 | 0.26 |
| 47 | 30.02 | 7.47 | 13.23 | 5.67 | 16.79 | 1.80 |
| 48 | 30.25 | 7.79 | 12.72 | 6.34 | 17.53 | 1.45 |
| 49 | 30.3  | 7.21 | 14.32 | 5.98 | 15.98 | 1.23 |
| 50 | 30.01 | 8.74 | 19.38 | 8.72 | 10.63 | 0.02 |
| 51 | 30.11 | 8.13 | 12.08 | 5.71 | 18.03 | 2.42 |
| 52 | 30.25 | 7.95 | 15.00 | 6.76 | 15.25 | 1.19 |
| 53 | 30.29 | 6.78 | 11.54 | 4.83 | 18.75 | 1.95 |
| 54 | 30.32 | 6.77 | 11.34 | 4.07 | 18.98 | 2.70 |
| 55 | 30.26 | 7.57 | 16.10 | 6.96 | 14.16 | 0.62 |
| 56 | 30.31 | 8.28 | 13.54 | 6.80 | 16.77 | 1.48 |
| 57 | 30.21 | 7.96 | 17.18 | 7.47 | 13.03 | 0.50 |
| 58 | 30.33 | 8.20 | 15.80 | 7.72 | 14.53 | 0.47 |
| 59 | 30.46 | 9.19 | 17.22 | 8.98 | 13.24 | 0.20 |
| 60 | 30.34 | 8.51 | 14.77 | 7.51 | 15.57 | 1.00 |
| 61 | 30.05 | 7.88 | 13.20 | 6.84 | 16.85 | 1.04 |
| 62 | 30.16 | 7.84 | 15.08 | 7.59 | 15.08 | 0.25 |
| 63 | 30.21 | 8.89 | 18.92 | 8.72 | 11.29 | 0.17 |
| 64 | 30.16 | 8.00 | 18.26 | 7.53 | 11.90 | 0.47 |
| 65 | 30.23 | 8.17 | 12.39 | 5.96 | 17.84 | 2.21 |
| 66 | 30.39 | 8.98 | 16.22 | 8.35 | 14.17 | 0.63 |
| 67 | 30.36 | 8.63 | 17.67 | 8.56 | 12.69 | 0.07 |
| 68 | 30.35 | 7.30 | 17.05 | 6.95 | 13.30 | 0.35 |
| 69 | 30.37 | 8.26 | 16.00 | 7.57 | 14.37 | 0.69 |
| 70 | 30.14 | 9.96 | 18.50 | 9.24 | 11.64 | 0.72 |
| 71 | 30    | 6.72 | 11.95 | 4.93 | 18.05 | 1.79 |
| 72 | 30.43 | 8.11 | 14.57 | 7.22 | 15.86 | 0.89 |
| 73 | 30.22 | 6.88 | 14.80 | 6.53 | 15.42 | 0.35 |
| 74 | 30.23 | 8.26 | 15.98 | 7.81 | 14.25 | 0.45 |
| 75 | 30.35 | 7.60 | 12.47 | 6.06 | 17.88 | 1.54 |
| 76 | 30.17 | 6.85 | 15.30 | 6.67 | 14.87 | 0.18 |
| 77 | 30.1  | 7.41 | 15.46 | 6.78 | 14.64 | 0.63 |
| 78 | 30.33 | 7.14 | 15.58 | 6.58 | 14.75 | 0.56 |
| 79 | 30.27 | 8.33 | 15.88 | 7.65 | 14.39 | 0.68 |

|     |       |       |       |      |       |      |
|-----|-------|-------|-------|------|-------|------|
| 80  | 30.41 | 7.93  | 15.91 | 7.05 | 14.50 | 0.88 |
| 81  | 30.35 | 7.79  | 14.03 | 6.35 | 16.32 | 1.44 |
| 82  | 30.33 | 9.92  | 18.03 | 9.72 | 12.30 | 0.19 |
| 83  | 30.04 | 8.89  | 15.81 | 7.34 | 14.23 | 1.55 |
| 84  | 30.12 | 6.89  | 15.91 | 6.01 | 14.21 | 0.88 |
| 85  | 30.07 | 6.95  | 12.62 | 6.01 | 17.45 | 0.93 |
| 86  | 30.21 | 6.99  | 15.15 | 5.93 | 15.06 | 1.06 |
| 87  | 30.34 | 7.40  | 13.93 | 6.58 | 16.41 | 0.82 |
| 88  | 30.26 | 7.68  | 15.71 | 6.55 | 14.55 | 1.13 |
| 89  | 30.16 | 8.32  | 16.16 | 7.91 | 14.00 | 0.40 |
| 90  | 30.07 | 7.16  | 14.00 | 6.85 | 16.07 | 0.31 |
| 91  | 30.29 | 7.98  | 12.90 | 6.09 | 17.39 | 1.88 |
| 92  | 30.32 | 7.06  | 13.75 | 6.58 | 16.57 | 0.49 |
| 93  | 30    | 5.60  | 11.71 | 3.92 | 18.29 | 1.68 |
| 94  | 30.19 | 9.63  | 18.12 | 9.52 | 12.07 | 0.11 |
| 95  | 30.21 | 7.24  | 13.53 | 6.34 | 16.68 | 0.90 |
| 96  | 30.01 | 8.05  | 16.56 | 7.72 | 13.45 | 0.33 |
| 97  | 30.25 | 7.68  | 12.61 | 5.32 | 17.64 | 2.36 |
| 98  | 30.17 | 7.17  | 16.77 | 6.82 | 13.40 | 0.35 |
| 99  | 30.51 | 6.55  | 11.06 | 4.61 | 19.45 | 1.94 |
| 100 | 30.39 | 10.60 | 17.55 | 9.48 | 12.84 | 1.12 |
| 101 | 30.47 | 7.70  | 15.86 | 7.33 | 14.61 | 0.38 |
| 102 | 30.08 | 6.83  | 10.28 | 3.44 | 19.80 | 3.39 |
| 103 | 30.01 | 6.09  | 13.69 | 5.48 | 16.32 | 0.61 |
| 104 | 30.09 | 6.89  | 17.32 | 6.85 | 12.77 | 0.05 |
| 105 | 30.1  | 6.46  | 13.79 | 6.27 | 16.31 | 0.19 |
| 106 | 29.97 | 7.79  | 16.57 | 7.64 | 13.40 | 0.15 |
| 107 | 30.22 | 9.47  | 18.57 | 9.16 | 11.65 | 0.30 |
| 108 | 30.4  | 6.99  | 11.49 | 4.89 | 18.91 | 2.10 |
| 109 | 30.35 | 7.90  | 15.58 | 7.51 | 14.77 | 0.39 |
| 110 | 30.28 | 6.66  | 13.17 | 5.30 | 17.11 | 1.36 |
| 111 | 30.39 | 6.93  | 11.92 | 5.47 | 18.47 | 1.47 |
| 112 | 30.23 | 6.71  | 12.84 | 5.37 | 17.39 | 1.34 |
| 113 | 30.43 | 8.53  | 16.15 | 8.23 | 14.28 | 0.29 |
| 114 | 30.18 | 6.38  | 12.95 | 5.62 | 17.23 | 0.76 |
| 115 | 30.29 | 7.30  | 10.92 | 4.32 | 19.37 | 2.97 |
| 116 | 30.24 | 8.45  | 16.00 | 7.76 | 14.24 | 0.68 |
| 117 | 30.47 | 7.84  | 16.34 | 7.66 | 14.13 | 0.18 |
| 118 | 30.3  | 7.38  | 13.38 | 6.34 | 16.92 | 1.04 |
| 119 | 30.02 | 6.95  | 12.53 | 5.03 | 17.49 | 1.93 |
| 120 | 30.16 | 6.39  | 14.16 | 5.80 | 16.00 | 0.59 |

|     |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|
| 121 | 30.08 | 7.13 | 11.37 | 5.08 | 18.71 | 2.05 |
| 122 | 30.4  | 7.33 | 13.66 | 6.41 | 16.74 | 0.92 |
| 123 | 30.36 | 7.25 | 16.41 | 6.77 | 13.95 | 0.48 |
| 124 | 30.08 | 6.88 | 12.67 | 6.29 | 17.41 | 0.59 |
| 125 | 30.13 | 8.60 | 13.78 | 6.79 | 16.35 | 1.81 |
| 126 | 30.01 | 8.89 | 18.94 | 8.84 | 11.07 | 0.05 |
| 127 | 30.3  | 7.44 | 11.82 | 5.30 | 18.48 | 2.14 |
| 128 | 30.48 | 6.95 | 14.28 | 6.29 | 16.20 | 0.66 |
| 129 | 29.97 | 9.29 | 18.80 | 7.96 | 11.17 | 1.33 |
| 130 | 30.47 | 9.44 | 17.55 | 8.42 | 12.92 | 1.02 |
| 131 | 30.02 | 6.48 | 13.97 | 5.70 | 16.05 | 0.79 |
| 132 | 30.23 | 6.07 | 14.45 | 5.20 | 15.78 | 0.87 |
| 133 | 30.07 | 7.49 | 16.51 | 7.42 | 13.56 | 0.07 |
| 134 | 30.23 | 7.67 | 10.51 | 4.02 | 19.72 | 3.66 |
| 135 | 30.43 | 8.10 | 16.80 | 8.03 | 13.63 | 0.08 |
| 136 | 30.41 | 8.05 | 16.48 | 7.75 | 13.93 | 0.30 |
| 137 | 30.39 | 8.22 | 15.61 | 7.36 | 14.78 | 0.87 |
| 138 | 30.21 | 7.72 | 15.04 | 6.86 | 15.17 | 0.87 |
| 139 | 30.52 | 7.39 | 16.03 | 6.91 | 14.49 | 0.48 |
| 140 | 30.06 | 7.03 | 13.90 | 6.73 | 16.16 | 0.31 |
| 141 | 30.43 | 6.59 | 11.74 | 4.09 | 18.69 | 2.50 |
| 142 | 30.13 | 6.61 | 12.69 | 5.24 | 17.44 | 1.37 |
| 143 | 30.42 | 8.68 | 15.85 | 8.01 | 14.57 | 0.67 |
| 144 | 30.34 | 7.91 | 12.69 | 6.19 | 17.65 | 1.72 |
| 145 | 30.39 | 8.34 | 16.71 | 7.49 | 13.68 | 0.85 |
| 146 | 30.36 | 6.98 | 15.32 | 6.83 | 15.04 | 0.15 |
| 147 | 30.17 | 7.43 | 17.35 | 6.16 | 12.82 | 1.27 |
| 148 | 30.18 | 8.84 | 15.77 | 8.06 | 14.41 | 0.78 |
| 149 | 30.08 | 7.01 | 16.29 | 6.43 | 13.79 | 0.59 |
| 150 | 30.15 | 6.50 | 13.12 | 6.16 | 17.03 | 0.34 |
| 151 | 30.53 | 7.74 | 15.69 | 7.18 | 14.84 | 0.56 |
| 152 | 30.39 | 8.11 | 15.69 | 7.60 | 14.70 | 0.51 |
| 153 | 30.29 | 7.71 | 16.08 | 6.97 | 14.21 | 0.74 |
| 154 | 30.32 | 7.93 | 16.24 | 7.81 | 14.08 | 0.11 |
| 155 | 30.14 | 6.90 | 14.85 | 6.11 | 15.29 | 0.79 |
| 156 | 30.31 | 6.96 | 12.42 | 4.80 | 17.89 | 2.16 |
| 157 | 30.29 | 6.50 | 12.49 | 4.91 | 17.80 | 1.59 |
| 158 | 30.23 | 8.76 | 15.09 | 7.59 | 15.14 | 1.17 |
| 159 | 30.52 | 7.76 | 15.29 | 7.49 | 15.23 | 0.26 |
| 160 | 30.02 | 7.47 | 13.23 | 5.67 | 16.79 | 1.80 |
| 161 | 30.25 | 7.79 | 12.72 | 6.34 | 17.53 | 1.45 |

|     |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|
| 162 | 30.3  | 7.21 | 14.32 | 5.98 | 15.98 | 1.23 |
| 163 | 30.01 | 8.74 | 19.38 | 8.72 | 10.63 | 0.02 |
| 164 | 30.11 | 8.13 | 12.08 | 5.71 | 18.03 | 2.42 |
| 165 | 30.25 | 7.95 | 15.00 | 6.76 | 15.25 | 1.19 |
| 166 | 30.29 | 6.78 | 11.54 | 4.83 | 18.75 | 1.95 |
| 167 | 30.32 | 6.77 | 11.34 | 4.07 | 18.98 | 2.70 |
| 168 | 30.26 | 7.57 | 16.10 | 6.96 | 14.16 | 0.62 |
| 169 | 30.31 | 8.28 | 13.54 | 6.80 | 16.77 | 1.48 |
| 170 | 30.21 | 7.96 | 17.18 | 7.47 | 13.03 | 0.50 |
| 171 | 30.33 | 8.20 | 15.80 | 7.72 | 14.53 | 0.47 |
| 172 | 30.46 | 9.19 | 17.22 | 8.98 | 13.24 | 0.20 |
| 173 | 30.34 | 8.51 | 14.77 | 7.51 | 15.57 | 1.00 |
| 174 | 30.05 | 7.88 | 13.20 | 6.84 | 16.85 | 1.04 |
| 175 | 30.16 | 7.84 | 15.08 | 7.59 | 15.08 | 0.25 |
| 176 | 30.21 | 8.89 | 18.92 | 8.72 | 11.29 | 0.17 |
| 177 | 30.16 | 8.00 | 18.26 | 7.53 | 11.90 | 0.47 |
| 178 | 30.23 | 8.17 | 12.39 | 5.96 | 17.84 | 2.21 |
| 179 | 30.39 | 8.98 | 16.22 | 8.35 | 14.17 | 0.63 |
| 180 | 30.36 | 8.63 | 17.67 | 8.56 | 12.69 | 0.07 |
| 181 | 30.35 | 7.30 | 17.05 | 6.95 | 13.30 | 0.35 |
| 182 | 30.37 | 8.26 | 16.00 | 7.57 | 14.37 | 0.69 |
| 183 | 30.14 | 9.96 | 18.50 | 9.24 | 11.64 | 0.72 |
| 184 | 30    | 6.72 | 11.95 | 4.93 | 18.05 | 1.79 |
| 185 | 30.43 | 8.11 | 14.57 | 7.22 | 15.86 | 0.89 |
| 186 | 30.22 | 6.88 | 14.80 | 6.53 | 15.42 | 0.35 |
| 187 | 30.23 | 8.26 | 15.98 | 7.81 | 14.25 | 0.45 |
| 188 | 30.35 | 7.60 | 12.47 | 6.06 | 17.88 | 1.54 |
| 189 | 30.17 | 6.85 | 15.30 | 6.67 | 14.87 | 0.18 |
| 190 | 30.1  | 7.41 | 15.46 | 6.78 | 14.64 | 0.63 |
| 191 | 30.33 | 7.14 | 15.58 | 6.58 | 14.75 | 0.56 |
| 192 | 30.27 | 8.33 | 15.88 | 7.65 | 14.39 | 0.68 |
| 193 | 30.41 | 7.93 | 15.91 | 7.05 | 14.50 | 0.88 |
| 194 | 30.35 | 7.79 | 14.03 | 6.35 | 16.32 | 1.44 |
| 195 | 30.33 | 9.92 | 18.03 | 9.72 | 12.30 | 0.19 |
| 196 | 30.04 | 8.89 | 15.81 | 7.34 | 14.23 | 1.55 |
| 197 | 30.12 | 6.89 | 15.91 | 6.01 | 14.21 | 0.88 |
| 198 | 30.07 | 6.95 | 12.62 | 6.01 | 17.45 | 0.93 |
| 199 | 30.21 | 6.99 | 15.15 | 5.93 | 15.06 | 1.06 |
| 200 | 30.34 | 7.40 | 13.93 | 6.58 | 16.41 | 0.82 |

**Table 21. SWB output for SDSM simulations of 32 inches of annual precipitation.**

| Simulated Run | Ann. prec.(in.) | Ann. rech.(in.) | Non-growing prec.(in.) | Non-growing rech.(in.) | Growing prec.(in.) | Growing rech.(in.) |
|---------------|-----------------|-----------------|------------------------|------------------------|--------------------|--------------------|
| 1             | 32.35           | 7.78            | 16.16                  | 6.80                   | 16.19              | 0.99               |
| 2             | 32.35           | 9.24            | 17.01                  | 8.26                   | 15.34              | 0.98               |
| 3             | 32.44           | 8.83            | 13.43                  | 6.54                   | 19.01              | 2.29               |
| 4             | 32.18           | 7.77            | 13.12                  | 5.58                   | 19.06              | 2.19               |
| 5             | 32.30           | 7.93            | 18.20                  | 7.76                   | 14.10              | 0.17               |
| 6             | 32.01           | 10.30           | 16.66                  | 8.89                   | 15.35              | 1.42               |
| 7             | 32.52           | 9.74            | 15.77                  | 8.19                   | 16.75              | 1.55               |
| 8             | 32.42           | 9.13            | 16.42                  | 8.41                   | 16.00              | 0.72               |
| 9             | 32.17           | 6.93            | 12.76                  | 4.95                   | 19.41              | 1.99               |
| 10            | 32.06           | 8.06            | 14.27                  | 5.95                   | 17.79              | 2.11               |
| 11            | 32.32           | 9.82            | 19.75                  | 9.74                   | 12.57              | 0.08               |
| 12            | 32.02           | 10.24           | 15.84                  | 8.28                   | 16.18              | 1.95               |
| 13            | 32.21           | 9.79            | 17.64                  | 8.74                   | 14.57              | 1.05               |
| 14            | 32.37           | 9.20            | 19.23                  | 8.30                   | 13.14              | 0.89               |
| 15            | 32.21           | 10.60           | 15.83                  | 8.11                   | 16.38              | 2.50               |
| 16            | 32.24           | 8.86            | 13.64                  | 6.37                   | 18.60              | 2.49               |
| 17            | 32.53           | 7.54            | 12.64                  | 4.73                   | 19.89              | 2.81               |
| 18            | 32.07           | 8.85            | 16.33                  | 7.92                   | 15.74              | 0.93               |
| 19            | 32.13           | 7.71            | 16.19                  | 7.21                   | 15.94              | 0.50               |
| 20            | 32.47           | 9.06            | 17.31                  | 8.84                   | 15.16              | 0.22               |
| 21            | 32.37           | 8.93            | 17.08                  | 8.42                   | 15.29              | 0.52               |
| 22            | 32.20           | 9.65            | 13.33                  | 6.98                   | 18.87              | 2.67               |
| 23            | 32.19           | 8.85            | 16.12                  | 7.30                   | 16.07              | 1.55               |
| 24            | 32.07           | 7.24            | 14.09                  | 5.82                   | 17.98              | 1.42               |
| 25            | 32.37           | 8.34            | 17.60                  | 7.82                   | 14.77              | 0.51               |
| 26            | 32.25           | 10.13           | 20.08                  | 9.53                   | 12.17              | 0.60               |
| 27            | 32.29           | 9.96            | 17.70                  | 9.34                   | 14.59              | 0.62               |
| 28            | 32.16           | 9.11            | 18.98                  | 8.88                   | 13.18              | 0.23               |
| 29            | 32.41           | 7.49            | 16.97                  | 6.68                   | 15.44              | 0.81               |
| 30            | 32.30           | 7.99            | 12.59                  | 4.78                   | 19.71              | 3.22               |
| 31            | 32.27           | 8.50            | 16.53                  | 6.78                   | 15.74              | 1.72               |
| 32            | 32.12           | 8.09            | 17.50                  | 7.55                   | 14.62              | 0.54               |
| 33            | 32.41           | 8.24            | 16.13                  | 7.85                   | 16.28              | 0.39               |
| 34            | 32.12           | 8.76            | 17.88                  | 8.66                   | 14.24              | 0.10               |
| 35            | 32.14           | 9.87            | 17.95                  | 8.86                   | 14.19              | 1.01               |
| 36            | 32.05           | 7.68            | 14.78                  | 7.11                   | 17.27              | 0.58               |
| 37            | 32.46           | 9.64            | 18.89                  | 9.51                   | 13.57              | 0.13               |
| 38            | 32.19           | 9.41            | 16.89                  | 8.78                   | 15.30              | 0.63               |

|    |       |       |       |       |       |      |
|----|-------|-------|-------|-------|-------|------|
| 39 | 32.48 | 9.67  | 20.49 | 9.58  | 11.99 | 0.09 |
| 40 | 32.02 | 9.15  | 18.11 | 8.68  | 13.91 | 0.47 |
| 41 | 32.38 | 7.77  | 15.06 | 6.54  | 17.32 | 1.23 |
| 42 | 32.16 | 7.20  | 15.59 | 5.98  | 16.57 | 1.22 |
| 43 | 32.19 | 11.37 | 19.97 | 10.84 | 12.22 | 0.53 |
| 44 | 32.37 | 8.85  | 15.43 | 7.03  | 16.94 | 1.82 |
| 45 | 32.28 | 9.12  | 15.45 | 6.99  | 16.83 | 2.13 |
| 46 | 32.22 | 7.58  | 12.65 | 4.50  | 19.57 | 3.08 |
| 47 | 32.17 | 9.57  | 14.66 | 6.58  | 17.51 | 2.99 |
| 48 | 32.43 | 8.83  | 15.68 | 5.74  | 16.75 | 3.09 |
| 49 | 32.52 | 9.39  | 18.27 | 8.50  | 14.25 | 0.89 |
| 50 | 32.20 | 8.98  | 17.67 | 8.00  | 14.53 | 0.98 |
| 51 | 32.35 | 9.12  | 14.41 | 7.76  | 17.94 | 1.36 |
| 52 | 32.09 | 9.91  | 15.56 | 7.71  | 16.53 | 2.19 |
| 53 | 32.44 | 9.90  | 17.66 | 8.27  | 14.78 | 1.64 |
| 54 | 32.15 | 10.18 | 19.22 | 9.77  | 12.93 | 0.41 |
| 55 | 32.49 | 8.05  | 17.65 | 7.74  | 14.84 | 0.31 |
| 56 | 32.24 | 8.47  | 14.39 | 7.45  | 17.85 | 1.02 |
| 57 | 32.45 | 9.95  | 17.15 | 8.57  | 15.30 | 1.38 |
| 58 | 32.10 | 7.98  | 13.62 | 6.63  | 18.48 | 1.35 |
| 59 | 31.98 | 8.20  | 14.66 | 6.81  | 17.32 | 1.39 |
| 60 | 32.26 | 8.59  | 16.64 | 8.16  | 15.62 | 0.43 |
| 61 | 32.31 | 9.93  | 18.73 | 9.43  | 13.58 | 0.49 |
| 62 | 32.18 | 7.32  | 14.04 | 6.51  | 18.14 | 0.81 |
| 63 | 32.24 | 8.47  | 13.73 | 6.21  | 18.51 | 2.26 |
| 64 | 32.44 | 9.49  | 13.85 | 6.97  | 18.59 | 2.52 |
| 65 | 32.25 | 9.83  | 17.11 | 8.55  | 15.14 | 1.28 |
| 66 | 32.48 | 9.03  | 15.48 | 7.30  | 17.00 | 1.72 |
| 67 | 32.36 | 8.12  | 14.57 | 6.43  | 17.79 | 1.69 |
| 68 | 32.24 | 7.12  | 15.93 | 6.94  | 16.31 | 0.18 |
| 69 | 32.30 | 7.67  | 17.17 | 7.35  | 15.13 | 0.32 |
| 70 | 32.52 | 8.54  | 14.35 | 6.66  | 18.17 | 1.87 |
| 71 | 32.18 | 9.18  | 19.45 | 9.03  | 12.73 | 0.15 |
| 72 | 32.45 | 9.94  | 17.28 | 9.15  | 15.17 | 0.79 |
| 73 | 32.27 | 8.15  | 17.73 | 7.98  | 14.54 | 0.17 |
| 74 | 32.49 | 7.27  | 13.90 | 6.07  | 18.59 | 1.20 |
| 75 | 32.50 | 7.94  | 15.14 | 6.73  | 17.36 | 1.21 |
| 76 | 32.50 | 11.21 | 18.89 | 10.67 | 13.61 | 0.54 |
| 77 | 32.28 | 8.41  | 11.93 | 4.91  | 20.35 | 3.49 |
| 78 | 32.16 | 8.15  | 16.73 | 7.81  | 15.43 | 0.34 |
| 79 | 32.07 | 9.85  | 18.49 | 8.80  | 13.58 | 1.04 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 80  | 32.05 | 9.61  | 17.10 | 8.65  | 14.95 | 0.96 |
| 81  | 32.51 | 9.23  | 14.70 | 7.81  | 17.81 | 1.42 |
| 82  | 32.14 | 9.00  | 17.84 | 8.92  | 14.30 | 0.08 |
| 83  | 32.38 | 9.20  | 16.04 | 7.30  | 16.34 | 1.90 |
| 84  | 32.16 | 9.37  | 20.14 | 8.37  | 12.02 | 0.99 |
| 85  | 32.33 | 9.48  | 15.82 | 7.86  | 16.51 | 1.62 |
| 86  | 32.42 | 10.99 | 16.18 | 8.33  | 16.24 | 2.66 |
| 87  | 32.09 | 9.07  | 15.49 | 7.47  | 16.60 | 1.59 |
| 88  | 32.16 | 8.59  | 15.66 | 6.40  | 16.50 | 2.19 |
| 89  | 32.43 | 8.44  | 19.33 | 8.41  | 13.10 | 0.03 |
| 90  | 32.13 | 9.04  | 16.21 | 7.95  | 15.92 | 1.09 |
| 91  | 32.21 | 7.32  | 16.12 | 6.59  | 16.09 | 0.74 |
| 92  | 32.11 | 9.76  | 16.01 | 8.31  | 16.10 | 1.46 |
| 93  | 32.13 | 8.61  | 15.63 | 7.90  | 16.50 | 0.71 |
| 94  | 32.38 | 10.45 | 18.72 | 8.98  | 13.66 | 1.47 |
| 95  | 32.04 | 8.37  | 15.16 | 6.83  | 16.88 | 1.54 |
| 96  | 32.02 | 7.99  | 13.62 | 6.25  | 18.40 | 1.73 |
| 97  | 32.37 | 7.32  | 14.85 | 6.46  | 17.52 | 0.86 |
| 98  | 32.04 | 9.82  | 14.38 | 7.33  | 17.66 | 2.49 |
| 99  | 31.95 | 9.61  | 16.83 | 9.22  | 15.12 | 0.39 |
| 100 | 32.22 | 9.38  | 13.44 | 6.54  | 18.78 | 2.84 |
| 101 | 32.39 | 8.79  | 15.69 | 7.27  | 16.70 | 1.52 |
| 102 | 32.02 | 8.97  | 17.79 | 8.19  | 14.23 | 0.78 |
| 103 | 32.30 | 9.92  | 17.28 | 8.77  | 15.02 | 1.15 |
| 104 | 32.46 | 10.46 | 18.69 | 10.27 | 13.77 | 0.19 |
| 105 | 32.17 | 9.47  | 16.75 | 8.77  | 15.42 | 0.70 |
| 106 | 32.15 | 8.51  | 14.88 | 6.94  | 17.27 | 1.57 |
| 107 | 32.08 | 8.70  | 16.65 | 8.26  | 15.43 | 0.44 |
| 108 | 32.07 | 8.79  | 17.50 | 7.99  | 14.57 | 0.80 |
| 109 | 32.41 | 8.21  | 16.17 | 7.73  | 16.24 | 0.47 |
| 110 | 32.08 | 8.06  | 14.93 | 6.19  | 17.15 | 1.87 |
| 111 | 32.18 | 9.21  | 18.02 | 8.76  | 14.16 | 0.45 |
| 112 | 32.32 | 9.44  | 13.11 | 5.98  | 19.21 | 3.47 |
| 113 | 32.17 | 9.78  | 18.11 | 8.40  | 14.06 | 1.38 |
| 114 | 32.25 | 7.59  | 15.87 | 6.76  | 16.38 | 0.83 |
| 115 | 32.41 | 9.56  | 14.27 | 7.22  | 18.14 | 2.34 |
| 116 | 32.05 | 7.55  | 12.96 | 6.25  | 19.09 | 1.29 |
| 117 | 32.27 | 7.90  | 17.04 | 7.30  | 15.23 | 0.60 |
| 118 | 32.41 | 8.57  | 15.19 | 6.53  | 17.22 | 2.04 |
| 119 | 32.50 | 9.72  | 18.38 | 8.69  | 14.12 | 1.03 |
| 120 | 32.46 | 8.97  | 14.46 | 7.02  | 18.00 | 1.95 |

|     |       |       |       |      |       |      |
|-----|-------|-------|-------|------|-------|------|
| 121 | 32.35 | 9.15  | 12.36 | 5.89 | 19.99 | 3.25 |
| 122 | 32.44 | 9.45  | 16.84 | 7.93 | 15.60 | 1.52 |
| 123 | 32.03 | 9.01  | 16.33 | 7.94 | 15.70 | 1.07 |
| 124 | 32.06 | 8.77  | 15.84 | 7.84 | 16.22 | 0.92 |
| 125 | 32.24 | 8.03  | 14.48 | 6.40 | 17.76 | 1.63 |
| 126 | 32.13 | 8.31  | 14.79 | 6.72 | 17.34 | 1.59 |
| 127 | 32.19 | 8.65  | 14.38 | 6.45 | 17.81 | 2.21 |
| 128 | 32.14 | 8.05  | 15.87 | 7.42 | 16.27 | 0.63 |
| 129 | 32.16 | 7.53  | 13.20 | 5.43 | 18.96 | 2.10 |
| 130 | 32.13 | 9.41  | 18.32 | 8.31 | 13.81 | 1.10 |
| 131 | 32.37 | 9.03  | 15.85 | 7.94 | 16.52 | 1.09 |
| 132 | 32.35 | 7.78  | 16.16 | 6.80 | 16.19 | 0.99 |
| 133 | 32.35 | 9.24  | 17.01 | 8.26 | 15.34 | 0.98 |
| 134 | 32.44 | 8.83  | 13.43 | 6.54 | 19.01 | 2.29 |
| 135 | 32.18 | 7.77  | 13.12 | 5.58 | 19.06 | 2.19 |
| 136 | 32.30 | 7.93  | 18.20 | 7.76 | 14.10 | 0.17 |
| 137 | 32.01 | 10.30 | 16.66 | 8.89 | 15.35 | 1.42 |
| 138 | 32.52 | 9.74  | 15.77 | 8.19 | 16.75 | 1.55 |
| 139 | 32.42 | 9.13  | 16.42 | 8.41 | 16.00 | 0.72 |
| 140 | 32.17 | 6.93  | 12.76 | 4.95 | 19.41 | 1.99 |
| 141 | 32.06 | 8.06  | 14.27 | 5.95 | 17.79 | 2.11 |
| 142 | 32.32 | 9.82  | 19.75 | 9.74 | 12.57 | 0.08 |
| 143 | 32.02 | 10.24 | 15.84 | 8.28 | 16.18 | 1.95 |
| 144 | 32.21 | 9.79  | 17.64 | 8.74 | 14.57 | 1.05 |
| 145 | 32.37 | 9.20  | 19.23 | 8.30 | 13.14 | 0.89 |
| 146 | 32.21 | 10.60 | 15.83 | 8.11 | 16.38 | 2.50 |
| 147 | 32.24 | 8.86  | 13.64 | 6.37 | 18.60 | 2.49 |
| 148 | 32.53 | 7.54  | 12.64 | 4.73 | 19.89 | 2.81 |
| 149 | 32.07 | 8.85  | 16.33 | 7.92 | 15.74 | 0.93 |
| 150 | 32.13 | 7.71  | 16.19 | 7.21 | 15.94 | 0.50 |
| 151 | 32.47 | 9.06  | 17.31 | 8.84 | 15.16 | 0.22 |
| 152 | 32.37 | 8.93  | 17.08 | 8.42 | 15.29 | 0.52 |
| 153 | 32.20 | 9.65  | 13.33 | 6.98 | 18.87 | 2.67 |
| 154 | 32.19 | 8.85  | 16.12 | 7.30 | 16.07 | 1.55 |
| 155 | 32.07 | 7.24  | 14.09 | 5.82 | 17.98 | 1.42 |
| 156 | 32.37 | 8.34  | 17.60 | 7.82 | 14.77 | 0.51 |
| 157 | 32.25 | 10.13 | 20.08 | 9.53 | 12.17 | 0.60 |
| 158 | 32.29 | 9.96  | 17.70 | 9.34 | 14.59 | 0.62 |
| 159 | 32.16 | 9.11  | 18.98 | 8.88 | 13.18 | 0.23 |
| 160 | 32.41 | 7.49  | 16.97 | 6.68 | 15.44 | 0.81 |
| 161 | 32.30 | 7.99  | 12.59 | 4.78 | 19.71 | 3.22 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 162 | 32.27 | 8.50  | 16.53 | 6.78  | 15.74 | 1.72 |
| 163 | 32.12 | 8.09  | 17.50 | 7.55  | 14.62 | 0.54 |
| 164 | 32.41 | 8.24  | 16.13 | 7.85  | 16.28 | 0.39 |
| 165 | 32.12 | 8.76  | 17.88 | 8.66  | 14.24 | 0.10 |
| 166 | 32.14 | 9.87  | 17.95 | 8.86  | 14.19 | 1.01 |
| 167 | 32.05 | 7.68  | 14.78 | 7.11  | 17.27 | 0.58 |
| 168 | 32.46 | 9.64  | 18.89 | 9.51  | 13.57 | 0.13 |
| 169 | 32.19 | 9.41  | 16.89 | 8.78  | 15.30 | 0.63 |
| 170 | 32.48 | 9.67  | 20.49 | 9.58  | 11.99 | 0.09 |
| 171 | 32.02 | 9.15  | 18.11 | 8.68  | 13.91 | 0.47 |
| 172 | 32.38 | 7.77  | 15.06 | 6.54  | 17.32 | 1.23 |
| 173 | 32.16 | 7.20  | 15.59 | 5.98  | 16.57 | 1.22 |
| 174 | 32.19 | 11.37 | 19.97 | 10.84 | 12.22 | 0.53 |
| 175 | 32.37 | 8.85  | 15.43 | 7.03  | 16.94 | 1.82 |
| 176 | 32.28 | 9.12  | 15.45 | 6.99  | 16.83 | 2.13 |
| 177 | 32.22 | 7.58  | 12.65 | 4.50  | 19.57 | 3.08 |
| 178 | 32.17 | 9.57  | 14.66 | 6.58  | 17.51 | 2.99 |
| 179 | 32.43 | 8.83  | 15.68 | 5.74  | 16.75 | 3.09 |
| 180 | 32.52 | 9.39  | 18.27 | 8.50  | 14.25 | 0.89 |
| 181 | 32.20 | 8.98  | 17.67 | 8.00  | 14.53 | 0.98 |
| 182 | 32.35 | 9.12  | 14.41 | 7.76  | 17.94 | 1.36 |
| 183 | 32.09 | 9.91  | 15.56 | 7.71  | 16.53 | 2.19 |
| 184 | 32.44 | 9.90  | 17.66 | 8.27  | 14.78 | 1.64 |
| 185 | 32.15 | 10.18 | 19.22 | 9.77  | 12.93 | 0.41 |
| 186 | 32.49 | 8.05  | 17.65 | 7.74  | 14.84 | 0.31 |
| 187 | 32.24 | 8.47  | 14.39 | 7.45  | 17.85 | 1.02 |
| 188 | 32.45 | 9.95  | 17.15 | 8.57  | 15.30 | 1.38 |
| 189 | 32.10 | 7.98  | 13.62 | 6.63  | 18.48 | 1.35 |
| 190 | 31.98 | 8.20  | 14.66 | 6.81  | 17.32 | 1.39 |
| 191 | 32.26 | 8.59  | 16.64 | 8.16  | 15.62 | 0.43 |
| 192 | 32.31 | 9.93  | 18.73 | 9.43  | 13.58 | 0.49 |
| 193 | 32.18 | 7.32  | 14.04 | 6.51  | 18.14 | 0.81 |
| 194 | 32.24 | 8.47  | 13.73 | 6.21  | 18.51 | 2.26 |
| 195 | 32.44 | 9.49  | 13.85 | 6.97  | 18.59 | 2.52 |
| 196 | 32.25 | 9.83  | 17.11 | 8.55  | 15.14 | 1.28 |
| 197 | 32.48 | 9.03  | 15.48 | 7.30  | 17.00 | 1.72 |
| 198 | 32.36 | 8.12  | 14.57 | 6.43  | 17.79 | 1.69 |
| 199 | 32.24 | 7.12  | 15.93 | 6.94  | 16.31 | 0.18 |
| 200 | 32.30 | 7.67  | 17.17 | 7.35  | 15.13 | 0.32 |

**Table 22. SWB output for SDSM simulations of 34 inches of annual precipitation.**

| Simulated Run | Ann. prec. (in.) | Ann. rech. (in.) | Non-growing prec.(in.) | Non-growing rech.(in.) | Growing prec.(in.) | Growing rech.(in.) |
|---------------|------------------|------------------|------------------------|------------------------|--------------------|--------------------|
| 1             | 34.26            | 10.02            | 17.09                  | 8.24                   | 17.17              | 1.78               |
| 2             | 34.02            | 10.55            | 17.92                  | 9.34                   | 16.10              | 1.21               |
| 3             | 34.29            | 9.50             | 17.63                  | 8.67                   | 16.66              | 0.83               |
| 4             | 34.39            | 10.10            | 15.75                  | 8.02                   | 18.64              | 2.08               |
| 5             | 34.53            | 9.23             | 15.98                  | 7.34                   | 18.55              | 1.89               |
| 6             | 34.17            | 8.98             | 15.03                  | 6.89                   | 19.14              | 2.09               |
| 7             | 34.22            | 10.32            | 19.55                  | 10.14                  | 14.67              | 0.18               |
| 8             | 34.19            | 10.24            | 13.59                  | 6.21                   | 20.60              | 4.03               |
| 9             | 34.44            | 9.44             | 13.35                  | 6.04                   | 21.09              | 3.39               |
| 10            | 34.14            | 10.17            | 16.65                  | 8.33                   | 17.49              | 1.84               |
| 11            | 34.27            | 9.51             | 15.62                  | 6.42                   | 18.65              | 3.09               |
| 12            | 34.18            | 9.58             | 15.34                  | 6.89                   | 18.84              | 2.68               |
| 13            | 34.3             | 8.28             | 15.55                  | 6.64                   | 18.75              | 1.64               |
| 14            | 34.38            | 10.15            | 18.39                  | 9.23                   | 15.99              | 0.92               |
| 15            | 34.13            | 9.32             | 15.60                  | 6.98                   | 18.53              | 2.35               |
| 16            | 34.12            | 9.34             | 14.71                  | 6.81                   | 19.41              | 2.52               |
| 17            | 34.46            | 12.04            | 17.23                  | 9.48                   | 17.23              | 2.56               |
| 18            | 34.35            | 8.95             | 12.25                  | 5.11                   | 22.10              | 3.84               |
| 19            | 34.07            | 10.11            | 20.16                  | 9.17                   | 13.91              | 0.93               |
| 20            | 34.19            | 11.62            | 21.16                  | 11.38                  | 13.03              | 0.24               |
| 21            | 34.43            | 9.90             | 16.71                  | 7.62                   | 17.72              | 2.28               |
| 22            | 34.05            | 9.66             | 16.94                  | 8.39                   | 17.11              | 1.27               |
| 23            | 34.31            | 10.42            | 20.62                  | 9.14                   | 13.69              | 1.27               |
| 24            | 34.26            | 9.69             | 16.97                  | 7.76                   | 17.29              | 1.93               |
| 25            | 34.25            | 9.48             | 16.03                  | 8.07                   | 18.22              | 1.41               |
| 26            | 34.21            | 10.18            | 20.74                  | 10.06                  | 13.47              | 0.12               |
| 27            | 34.33            | 10.08            | 19.45                  | 8.90                   | 14.88              | 1.18               |
| 28            | 34.5             | 10.69            | 15.91                  | 8.56                   | 18.59              | 2.13               |
| 29            | 34.06            | 8.35             | 15.09                  | 6.16                   | 18.97              | 2.19               |
| 30            | 34.09            | 9.44             | 16.18                  | 7.99                   | 17.91              | 1.45               |
| 31            | 34.36            | 9.16             | 14.59                  | 6.95                   | 19.77              | 2.21               |
| 32            | 34.38            | 8.90             | 13.47                  | 6.56                   | 20.91              | 2.34               |
| 33            | 34.35            | 10.06            | 15.97                  | 7.59                   | 18.38              | 2.47               |
| 34            | 34.33            | 8.85             | 16.87                  | 8.11                   | 17.46              | 0.74               |
| 35            | 34.39            | 9.12             | 13.19                  | 4.96                   | 21.20              | 4.15               |
| 36            | 34.33            | 10.21            | 14.89                  | 7.21                   | 19.44              | 2.99               |
| 37            | 34.37            | 9.05             | 15.21                  | 6.85                   | 19.16              | 2.20               |
| 38            | 34.26            | 8.92             | 15.68                  | 7.39                   | 18.58              | 1.54               |

|    |       |       |       |       |       |      |
|----|-------|-------|-------|-------|-------|------|
| 39 | 34.51 | 11.68 | 17.61 | 10.10 | 16.90 | 1.58 |
| 40 | 34.18 | 9.14  | 19.00 | 8.71  | 15.18 | 0.42 |
| 41 | 34.36 | 9.96  | 15.64 | 8.27  | 18.72 | 1.70 |
| 42 | 34.18 | 8.37  | 13.69 | 5.91  | 20.49 | 2.47 |
| 43 | 34.38 | 9.96  | 15.90 | 7.27  | 18.48 | 2.69 |
| 44 | 34.43 | 8.02  | 11.08 | 3.66  | 23.35 | 4.36 |
| 45 | 34.1  | 10.48 | 16.58 | 7.95  | 17.52 | 2.52 |
| 46 | 34.35 | 11.48 | 19.37 | 9.91  | 14.98 | 1.58 |
| 47 | 34.18 | 9.02  | 14.11 | 6.61  | 20.07 | 2.41 |
| 48 | 34.38 | 10.37 | 14.09 | 7.25  | 20.29 | 3.12 |
| 49 | 34.38 | 9.45  | 16.17 | 7.80  | 18.21 | 1.65 |
| 50 | 34.16 | 8.60  | 18.14 | 8.37  | 16.02 | 0.23 |
| 51 | 34.37 | 10.97 | 19.02 | 9.96  | 15.35 | 1.01 |
| 52 | 34.31 | 11.00 | 19.75 | 9.61  | 14.56 | 1.39 |
| 53 | 34.18 | 9.87  | 18.34 | 9.01  | 15.84 | 0.86 |
| 54 | 34.25 | 8.58  | 18.14 | 7.71  | 16.11 | 0.87 |
| 55 | 34.48 | 8.06  | 17.80 | 7.12  | 16.68 | 0.94 |
| 56 | 34.23 | 9.80  | 16.45 | 7.72  | 17.78 | 2.08 |
| 57 | 34.16 | 9.48  | 16.39 | 8.06  | 17.77 | 1.43 |
| 58 | 34.33 | 10.05 | 13.09 | 5.81  | 21.24 | 4.24 |
| 59 | 34.4  | 9.49  | 14.70 | 6.72  | 19.70 | 2.77 |
| 60 | 34.1  | 9.96  | 16.83 | 8.09  | 17.27 | 1.88 |
| 61 | 34.18 | 9.78  | 13.14 | 5.78  | 21.04 | 4.00 |
| 62 | 34.26 | 9.16  | 12.95 | 5.31  | 21.31 | 3.84 |
| 63 | 34.2  | 8.88  | 19.25 | 7.74  | 14.95 | 1.14 |
| 64 | 34.2  | 10.48 | 20.03 | 10.10 | 14.17 | 0.38 |
| 65 | 34.18 | 9.02  | 18.42 | 8.84  | 15.76 | 0.18 |
| 66 | 34.07 | 9.25  | 17.08 | 8.17  | 16.99 | 1.07 |
| 67 | 34.13 | 9.53  | 18.47 | 8.50  | 15.66 | 1.04 |
| 68 | 34.28 | 7.80  | 17.13 | 7.49  | 17.15 | 0.31 |
| 69 | 34.47 | 8.62  | 17.96 | 7.93  | 16.51 | 0.69 |
| 70 | 34.32 | 9.49  | 15.22 | 7.70  | 19.10 | 1.79 |
| 71 | 34.04 | 8.52  | 20.11 | 8.42  | 13.93 | 0.10 |
| 72 | 34.15 | 10.36 | 19.33 | 9.64  | 14.82 | 0.72 |
| 73 | 34.11 | 11.37 | 21.44 | 10.96 | 12.67 | 0.42 |
| 74 | 34.1  | 9.73  | 16.46 | 8.39  | 17.64 | 1.34 |
| 75 | 34.09 | 9.42  | 14.66 | 6.14  | 19.43 | 3.28 |
| 76 | 34.27 | 9.93  | 14.69 | 7.74  | 19.58 | 2.19 |
| 77 | 34.43 | 10.29 | 17.92 | 9.18  | 16.51 | 1.11 |
| 78 | 34.29 | 9.82  | 14.26 | 7.03  | 20.03 | 2.80 |
| 79 | 34.12 | 10.40 | 18.79 | 9.02  | 15.33 | 1.38 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 80  | 34.09 | 9.23  | 14.21 | 6.33  | 19.88 | 2.89 |
| 81  | 34.49 | 10.55 | 18.14 | 8.95  | 16.35 | 1.60 |
| 82  | 34.45 | 9.67  | 20.07 | 9.08  | 14.38 | 0.59 |
| 83  | 34.11 | 9.51  | 16.80 | 8.13  | 17.31 | 1.38 |
| 84  | 34.19 | 9.31  | 13.22 | 5.78  | 20.97 | 3.53 |
| 85  | 34.19 | 10.47 | 17.73 | 9.29  | 16.46 | 1.17 |
| 86  | 34.06 | 10.66 | 18.91 | 9.51  | 15.15 | 1.14 |
| 87  | 34.29 | 9.66  | 16.75 | 7.77  | 17.54 | 1.89 |
| 88  | 34.45 | 9.27  | 15.47 | 7.33  | 18.98 | 1.95 |
| 89  | 34.31 | 11.86 | 19.46 | 10.62 | 14.85 | 1.24 |
| 90  | 34.44 | 9.88  | 16.24 | 8.50  | 18.20 | 1.38 |
| 91  | 34.02 | 10.55 | 17.92 | 9.34  | 16.10 | 1.21 |
| 92  | 34.29 | 9.50  | 17.63 | 8.67  | 16.66 | 0.83 |
| 93  | 34.39 | 10.10 | 15.75 | 8.02  | 18.64 | 2.08 |
| 94  | 34.53 | 9.23  | 15.98 | 7.34  | 18.55 | 1.89 |
| 95  | 34.17 | 8.98  | 15.03 | 6.89  | 19.14 | 2.09 |
| 96  | 34.22 | 10.32 | 19.55 | 10.14 | 14.67 | 0.18 |
| 97  | 34.19 | 10.24 | 13.59 | 6.21  | 20.60 | 4.03 |
| 98  | 34.44 | 9.44  | 13.35 | 6.04  | 21.09 | 3.39 |
| 99  | 34.14 | 10.17 | 16.65 | 8.33  | 17.49 | 1.84 |
| 100 | 34.27 | 9.51  | 15.62 | 6.42  | 18.65 | 3.09 |
| 101 | 34.18 | 9.58  | 15.34 | 6.89  | 18.84 | 2.68 |
| 102 | 34.3  | 8.28  | 15.55 | 6.64  | 18.75 | 1.64 |
| 103 | 34.38 | 10.15 | 18.39 | 9.23  | 15.99 | 0.92 |
| 104 | 34.13 | 9.32  | 15.60 | 6.98  | 18.53 | 2.35 |
| 105 | 34.12 | 9.34  | 14.71 | 6.81  | 19.41 | 2.52 |
| 106 | 34.46 | 12.04 | 17.23 | 9.48  | 17.23 | 2.56 |
| 107 | 34.35 | 8.95  | 12.25 | 5.11  | 22.10 | 3.84 |
| 108 | 34.07 | 10.11 | 20.16 | 9.17  | 13.91 | 0.93 |
| 109 | 34.19 | 11.62 | 21.16 | 11.38 | 13.03 | 0.24 |
| 110 | 34.43 | 9.90  | 16.71 | 7.62  | 17.72 | 2.28 |
| 111 | 34.05 | 9.66  | 16.94 | 8.39  | 17.11 | 1.27 |
| 112 | 34.31 | 10.42 | 20.62 | 9.14  | 13.69 | 1.27 |
| 113 | 34.26 | 9.69  | 16.97 | 7.76  | 17.29 | 1.93 |
| 114 | 34.25 | 9.48  | 16.03 | 8.07  | 18.22 | 1.41 |
| 115 | 34.21 | 10.18 | 20.74 | 10.06 | 13.47 | 0.12 |
| 116 | 34.33 | 10.08 | 19.45 | 8.90  | 14.88 | 1.18 |
| 117 | 34.5  | 10.69 | 15.91 | 8.56  | 18.59 | 2.13 |
| 118 | 34.06 | 8.35  | 15.09 | 6.16  | 18.97 | 2.19 |
| 119 | 34.09 | 9.44  | 16.18 | 7.99  | 17.91 | 1.45 |
| 120 | 34.36 | 9.16  | 14.59 | 6.95  | 19.77 | 2.21 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 121 | 34.38 | 8.90  | 13.47 | 6.56  | 20.91 | 2.34 |
| 122 | 34.35 | 10.06 | 15.97 | 7.59  | 18.38 | 2.47 |
| 123 | 34.33 | 8.85  | 16.87 | 8.11  | 17.46 | 0.74 |
| 124 | 34.39 | 9.12  | 13.19 | 4.96  | 21.20 | 4.15 |
| 125 | 34.33 | 10.21 | 14.89 | 7.21  | 19.44 | 2.99 |
| 126 | 34.37 | 9.05  | 15.21 | 6.85  | 19.16 | 2.20 |
| 127 | 34.26 | 8.92  | 15.68 | 7.39  | 18.58 | 1.54 |
| 128 | 34.51 | 11.68 | 17.61 | 10.10 | 16.90 | 1.58 |
| 129 | 34.18 | 9.14  | 19.00 | 8.71  | 15.18 | 0.42 |
| 130 | 34.36 | 9.96  | 15.64 | 8.27  | 18.72 | 1.70 |
| 131 | 34.18 | 8.37  | 13.69 | 5.91  | 20.49 | 2.47 |
| 132 | 34.38 | 9.96  | 15.90 | 7.27  | 18.48 | 2.69 |
| 133 | 34.43 | 8.02  | 11.08 | 3.66  | 23.35 | 4.36 |
| 134 | 34.1  | 10.48 | 16.58 | 7.95  | 17.52 | 2.52 |
| 135 | 34.35 | 11.48 | 19.37 | 9.91  | 14.98 | 1.58 |
| 136 | 34.18 | 9.02  | 14.11 | 6.61  | 20.07 | 2.41 |
| 137 | 34.38 | 10.37 | 14.09 | 7.25  | 20.29 | 3.12 |
| 138 | 34.38 | 9.45  | 16.17 | 7.80  | 18.21 | 1.65 |
| 139 | 34.16 | 8.60  | 18.14 | 8.37  | 16.02 | 0.23 |
| 140 | 34.37 | 10.97 | 19.02 | 9.96  | 15.35 | 1.01 |
| 141 | 34.31 | 11.00 | 19.75 | 9.61  | 14.56 | 1.39 |
| 142 | 34.18 | 9.87  | 18.34 | 9.01  | 15.84 | 0.86 |
| 143 | 34.25 | 8.58  | 18.14 | 7.71  | 16.11 | 0.87 |
| 144 | 34.48 | 8.06  | 17.80 | 7.12  | 16.68 | 0.94 |
| 145 | 34.23 | 9.80  | 16.45 | 7.72  | 17.78 | 2.08 |
| 146 | 34.16 | 9.48  | 16.39 | 8.06  | 17.77 | 1.43 |
| 147 | 34.33 | 10.05 | 13.09 | 5.81  | 21.24 | 4.24 |
| 148 | 34.4  | 9.49  | 14.70 | 6.72  | 19.70 | 2.77 |
| 149 | 34.1  | 9.96  | 16.83 | 8.09  | 17.27 | 1.88 |
| 150 | 34.18 | 9.78  | 13.14 | 5.78  | 21.04 | 4.00 |
| 151 | 34.26 | 9.16  | 12.95 | 5.31  | 21.31 | 3.84 |
| 152 | 34.2  | 8.88  | 19.25 | 7.74  | 14.95 | 1.14 |
| 153 | 34.2  | 10.48 | 20.03 | 10.10 | 14.17 | 0.38 |
| 154 | 34.18 | 9.02  | 18.42 | 8.84  | 15.76 | 0.18 |
| 155 | 34.07 | 9.25  | 17.08 | 8.17  | 16.99 | 1.07 |
| 156 | 34.13 | 9.53  | 18.47 | 8.50  | 15.66 | 1.04 |
| 157 | 34.28 | 7.80  | 17.13 | 7.49  | 17.15 | 0.31 |
| 158 | 34.47 | 8.62  | 17.96 | 7.93  | 16.51 | 0.69 |
| 159 | 34.32 | 9.49  | 15.22 | 7.70  | 19.10 | 1.79 |
| 160 | 34.04 | 8.52  | 20.11 | 8.42  | 13.93 | 0.10 |
| 161 | 34.15 | 10.36 | 19.33 | 9.64  | 14.82 | 0.72 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 162 | 34.11 | 11.37 | 21.44 | 10.96 | 12.67 | 0.42 |
| 163 | 34.1  | 9.73  | 16.46 | 8.39  | 17.64 | 1.34 |
| 164 | 34.09 | 9.42  | 14.66 | 6.14  | 19.43 | 3.28 |
| 165 | 34.27 | 9.93  | 14.69 | 7.74  | 19.58 | 2.19 |
| 166 | 34.43 | 10.29 | 17.92 | 9.18  | 16.51 | 1.11 |
| 167 | 34.29 | 9.82  | 14.26 | 7.03  | 20.03 | 2.80 |
| 168 | 34.12 | 10.40 | 18.79 | 9.02  | 15.33 | 1.38 |
| 169 | 34.09 | 9.23  | 14.21 | 6.33  | 19.88 | 2.89 |
| 170 | 34.49 | 10.55 | 18.14 | 8.95  | 16.35 | 1.60 |
| 171 | 34.45 | 9.67  | 20.07 | 9.08  | 14.38 | 0.59 |
| 172 | 34.11 | 9.51  | 16.80 | 8.13  | 17.31 | 1.38 |
| 173 | 34.19 | 9.31  | 13.22 | 5.78  | 20.97 | 3.53 |
| 174 | 34.19 | 10.47 | 17.73 | 9.29  | 16.46 | 1.17 |
| 175 | 34.06 | 10.66 | 18.91 | 9.51  | 15.15 | 1.14 |
| 176 | 34.29 | 9.66  | 16.75 | 7.77  | 17.54 | 1.89 |
| 177 | 34.45 | 9.27  | 15.47 | 7.33  | 18.98 | 1.95 |
| 178 | 34.31 | 11.86 | 19.46 | 10.62 | 14.85 | 1.24 |
| 179 | 34.42 | 8.73  | 17.49 | 8.33  | 16.93 | 0.40 |
| 180 | 34.08 | 10.14 | 16.29 | 6.84  | 17.79 | 3.30 |
| 181 | 34.12 | 10.79 | 18.27 | 10.09 | 15.85 | 0.70 |
| 182 | 34.3  | 10.02 | 16.63 | 7.74  | 17.67 | 2.28 |
| 183 | 34.47 | 9.39  | 14.34 | 6.04  | 20.13 | 3.35 |
| 184 | 34.52 | 10.84 | 16.85 | 9.00  | 17.67 | 1.84 |
| 185 | 34.51 | 10.35 | 18.18 | 9.45  | 16.33 | 0.90 |
| 186 | 34.45 | 9.63  | 16.82 | 8.43  | 17.63 | 1.20 |
| 187 | 34.5  | 9.83  | 17.14 | 8.92  | 17.36 | 0.91 |
| 188 | 34.13 | 10.35 | 18.28 | 9.70  | 15.85 | 0.65 |
| 189 | 34.18 | 9.21  | 13.47 | 5.81  | 20.71 | 3.40 |
| 190 | 34.27 | 9.65  | 13.20 | 6.57  | 21.07 | 3.09 |
| 191 | 34.12 | 10.78 | 18.14 | 9.57  | 15.98 | 1.21 |
| 192 | 34.12 | 10.05 | 16.77 | 8.74  | 17.35 | 1.31 |
| 193 | 34.29 | 11.55 | 19.27 | 10.40 | 15.02 | 1.14 |
| 194 | 34.07 | 9.35  | 15.52 | 7.95  | 18.55 | 1.40 |
| 195 | 34.36 | 8.83  | 16.70 | 7.68  | 17.66 | 1.15 |
| 196 | 34.45 | 10.19 | 19.38 | 9.87  | 15.07 | 0.32 |
| 197 | 34.31 | 10.66 | 16.52 | 8.76  | 17.79 | 1.89 |
| 198 | 34.09 | 8.91  | 17.15 | 7.90  | 16.94 | 1.01 |
| 199 | 34.39 | 10.22 | 17.44 | 9.29  | 16.95 | 0.93 |
| 200 | 34.07 | 10.24 | 19.56 | 9.56  | 14.51 | 0.67 |

**Table 23. SWB output for SDSM simulations of 36 inches of annual precipitation.**

| Simulated Run | Ann. prec. (in.) | Ann. rech. (in.) | Non-growing prec.(in.) | Non-growing rech.(in.) | Growing prec.(in.) | Growing rech.(in.) |
|---------------|------------------|------------------|------------------------|------------------------|--------------------|--------------------|
| 1             | 36.42            | 11.62            | 22.33                  | 10.90                  | 14.09              | 0.72               |
| 2             | 36.46            | 11.64            | 19.75                  | 10.64                  | 16.71              | 1.00               |
| 3             | 36.42            | 11.17            | 18.80                  | 9.63                   | 17.62              | 1.53               |
| 4             | 36.27            | 12.37            | 17.20                  | 9.83                   | 19.07              | 2.54               |
| 5             | 36.38            | 10.53            | 21.10                  | 10.05                  | 15.28              | 0.48               |
| 6             | 36.1             | 10.47            | 17.28                  | 8.08                   | 18.82              | 2.40               |
| 7             | 36.1             | 11.65            | 16.71                  | 8.68                   | 19.39              | 2.98               |
| 8             | 36.03            | 11.29            | 20.86                  | 10.32                  | 15.17              | 0.97               |
| 9             | 36.02            | 10.01            | 18.16                  | 8.85                   | 17.86              | 1.16               |
| 10            | 36.2             | 10.32            | 15.80                  | 7.31                   | 20.40              | 3.01               |
| 11            | 36.19            | 11.77            | 22.62                  | 11.71                  | 13.57              | 0.06               |
| 12            | 36.06            | 11.69            | 20.51                  | 10.61                  | 15.55              | 1.08               |
| 13            | 36.46            | 10.99            | 19.70                  | 8.99                   | 16.76              | 2.00               |
| 14            | 36.17            | 12.63            | 17.61                  | 9.11                   | 18.56              | 3.51               |
| 15            | 36.26            | 10.74            | 20.60                  | 8.96                   | 15.66              | 1.79               |
| 16            | 36.11            | 11.27            | 16.85                  | 9.11                   | 19.26              | 2.16               |
| 17            | 36.38            | 11.12            | 17.48                  | 8.86                   | 18.90              | 2.26               |
| 18            | 36.14            | 10.81            | 17.07                  | 8.08                   | 19.07              | 2.73               |
| 19            | 36.35            | 12.60            | 20.20                  | 10.56                  | 16.15              | 2.04               |
| 20            | 36               | 10.21            | 19.89                  | 9.54                   | 16.11              | 0.66               |
| 21            | 36.41            | 11.18            | 21.37                  | 10.87                  | 15.04              | 0.31               |
| 22            | 36.44            | 10.23            | 19.52                  | 9.07                   | 16.92              | 1.15               |
| 23            | 35.98            | 10.16            | 16.61                  | 7.73                   | 19.37              | 2.43               |
| 24            | 36.45            | 10.37            | 17.20                  | 8.01                   | 19.25              | 2.35               |
| 25            | 36.43            | 9.60             | 16.88                  | 7.54                   | 19.55              | 2.06               |
| 26            | 36.42            | 12.29            | 16.39                  | 7.90                   | 20.03              | 4.39               |
| 27            | 36.06            | 10.22            | 16.06                  | 7.98                   | 20.00              | 2.25               |
| 28            | 36.03            | 10.26            | 12.35                  | 5.96                   | 23.68              | 4.30               |
| 29            | 36.44            | 11.70            | 15.65                  | 7.67                   | 20.79              | 4.02               |
| 30            | 36.15            | 11.76            | 16.34                  | 8.79                   | 19.81              | 2.96               |
| 31            | 36.22            | 10.94            | 19.00                  | 9.85                   | 17.22              | 1.09               |
| 32            | 35.99            | 9.76             | 13.33                  | 5.39                   | 22.66              | 4.37               |
| 33            | 36.06            | 11.13            | 16.05                  | 7.94                   | 20.01              | 3.19               |
| 34            | 36.32            | 11.07            | 15.33                  | 7.87                   | 20.99              | 3.20               |
| 35            | 36.07            | 10.61            | 17.56                  | 7.86                   | 18.51              | 2.75               |
| 36            | 36.19            | 11.91            | 14.84                  | 7.68                   | 21.35              | 4.23               |
| 37            | 36.29            | 11.04            | 17.28                  | 9.13                   | 19.01              | 1.91               |
| 38            | 36.23            | 10.81            | 16.56                  | 8.45                   | 19.67              | 2.36               |

|    |       |       |       |       |       |      |
|----|-------|-------|-------|-------|-------|------|
| 39 | 36.1  | 11.54 | 14.14 | 6.90  | 21.96 | 4.64 |
| 40 | 36.13 | 12.08 | 20.84 | 9.91  | 15.29 | 2.17 |
| 41 | 36.51 | 12.02 | 16.51 | 8.20  | 20.00 | 3.81 |
| 42 | 36.24 | 10.20 | 16.11 | 6.92  | 20.13 | 3.28 |
| 43 | 36.27 | 10.55 | 20.05 | 9.42  | 16.22 | 1.13 |
| 44 | 36.19 | 12.07 | 19.19 | 10.01 | 17.00 | 2.06 |
| 45 | 36.32 | 11.02 | 21.81 | 10.13 | 14.51 | 0.90 |
| 46 | 36.31 | 11.45 | 19.84 | 9.78  | 16.47 | 1.67 |
| 47 | 36.35 | 10.70 | 14.28 | 6.47  | 22.07 | 4.23 |
| 48 | 36.03 | 11.27 | 18.98 | 9.81  | 17.05 | 1.46 |
| 49 | 36.52 | 11.37 | 17.94 | 9.62  | 18.58 | 1.75 |
| 50 | 36.14 | 11.08 | 15.92 | 9.14  | 20.22 | 1.93 |
| 51 | 36.27 | 12.68 | 16.92 | 9.89  | 19.35 | 2.79 |
| 52 | 36.42 | 9.58  | 21.66 | 9.29  | 14.76 | 0.28 |
| 53 | 36.05 | 10.97 | 13.73 | 5.93  | 22.32 | 5.04 |
| 54 | 36.15 | 11.33 | 18.32 | 9.81  | 17.83 | 1.53 |
| 55 | 36.15 | 9.96  | 16.15 | 7.36  | 20.00 | 2.60 |
| 56 | 36.11 | 10.11 | 15.42 | 7.06  | 20.69 | 3.05 |
| 57 | 36.14 | 9.45  | 16.11 | 7.96  | 20.03 | 1.49 |
| 58 | 36.46 | 11.64 | 19.75 | 10.64 | 16.71 | 1.00 |
| 59 | 36.42 | 11.17 | 18.80 | 9.63  | 17.62 | 1.53 |
| 60 | 36.27 | 12.37 | 17.20 | 9.83  | 19.07 | 2.54 |
| 61 | 36.38 | 10.53 | 21.10 | 10.05 | 15.28 | 0.48 |
| 62 | 36.1  | 10.47 | 17.28 | 8.08  | 18.82 | 2.40 |
| 63 | 36.1  | 11.65 | 16.71 | 8.68  | 19.39 | 2.98 |
| 64 | 36.03 | 11.29 | 20.86 | 10.32 | 15.17 | 0.97 |
| 65 | 36.02 | 10.01 | 18.16 | 8.85  | 17.86 | 1.16 |
| 66 | 36.2  | 10.32 | 15.80 | 7.31  | 20.40 | 3.01 |
| 67 | 36.19 | 11.77 | 22.62 | 11.71 | 13.57 | 0.06 |
| 68 | 36.06 | 11.69 | 20.51 | 10.61 | 15.55 | 1.08 |
| 69 | 36.46 | 10.99 | 19.70 | 8.99  | 16.76 | 2.00 |
| 70 | 36.17 | 12.63 | 17.61 | 9.11  | 18.56 | 3.51 |
| 71 | 36.26 | 10.74 | 20.60 | 8.96  | 15.66 | 1.79 |
| 72 | 36.11 | 11.27 | 16.85 | 9.11  | 19.26 | 2.16 |
| 73 | 36.38 | 11.12 | 17.48 | 8.86  | 18.90 | 2.26 |
| 74 | 36.14 | 10.81 | 17.07 | 8.08  | 19.07 | 2.73 |
| 75 | 36.35 | 12.60 | 20.20 | 10.56 | 16.15 | 2.04 |
| 76 | 36    | 10.21 | 19.89 | 9.54  | 16.11 | 0.66 |
| 77 | 36.41 | 11.18 | 21.37 | 10.87 | 15.04 | 0.31 |
| 78 | 36.44 | 10.23 | 19.52 | 9.07  | 16.92 | 1.15 |
| 79 | 35.98 | 10.16 | 16.61 | 7.73  | 19.37 | 2.43 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 80  | 36.45 | 10.37 | 17.20 | 8.01  | 19.25 | 2.35 |
| 81  | 36.43 | 9.60  | 16.88 | 7.54  | 19.55 | 2.06 |
| 82  | 36.42 | 12.29 | 16.39 | 7.90  | 20.03 | 4.39 |
| 83  | 36.06 | 10.22 | 16.06 | 7.98  | 20.00 | 2.25 |
| 84  | 36.03 | 10.26 | 12.35 | 5.96  | 23.68 | 4.30 |
| 85  | 36.44 | 11.70 | 15.65 | 7.67  | 20.79 | 4.02 |
| 86  | 36.15 | 11.76 | 16.34 | 8.79  | 19.81 | 2.96 |
| 87  | 36.22 | 10.94 | 19.00 | 9.85  | 17.22 | 1.09 |
| 88  | 35.99 | 9.76  | 13.33 | 5.39  | 22.66 | 4.37 |
| 89  | 36.06 | 11.13 | 16.05 | 7.94  | 20.01 | 3.19 |
| 90  | 36.32 | 11.07 | 15.33 | 7.87  | 20.99 | 3.20 |
| 91  | 36.07 | 10.61 | 17.56 | 7.86  | 18.51 | 2.75 |
| 92  | 36.19 | 11.91 | 14.84 | 7.68  | 21.35 | 4.23 |
| 93  | 36.29 | 11.04 | 17.28 | 9.13  | 19.01 | 1.91 |
| 94  | 36.23 | 10.81 | 16.56 | 8.45  | 19.67 | 2.36 |
| 95  | 36.1  | 11.54 | 14.14 | 6.90  | 21.96 | 4.64 |
| 96  | 36.13 | 12.08 | 20.84 | 9.91  | 15.29 | 2.17 |
| 97  | 36.51 | 12.02 | 16.51 | 8.20  | 20.00 | 3.81 |
| 98  | 36.24 | 10.20 | 16.11 | 6.92  | 20.13 | 3.28 |
| 99  | 36.27 | 10.55 | 20.05 | 9.42  | 16.22 | 1.13 |
| 100 | 36.19 | 12.07 | 19.19 | 10.01 | 17.00 | 2.06 |
| 101 | 36.32 | 11.02 | 21.81 | 10.13 | 14.51 | 0.90 |
| 102 | 36.31 | 11.45 | 19.84 | 9.78  | 16.47 | 1.67 |
| 103 | 36.35 | 10.70 | 14.28 | 6.47  | 22.07 | 4.23 |
| 104 | 36.03 | 11.27 | 18.98 | 9.81  | 17.05 | 1.46 |
| 105 | 36.52 | 11.37 | 17.94 | 9.62  | 18.58 | 1.75 |
| 106 | 36.14 | 11.08 | 15.92 | 9.14  | 20.22 | 1.93 |
| 107 | 36.27 | 12.68 | 16.92 | 9.89  | 19.35 | 2.79 |
| 108 | 36.42 | 9.58  | 21.66 | 9.29  | 14.76 | 0.28 |
| 109 | 36.05 | 10.97 | 13.73 | 5.93  | 22.32 | 5.04 |
| 110 | 36.15 | 11.33 | 18.32 | 9.81  | 17.83 | 1.53 |
| 111 | 36.15 | 9.96  | 16.15 | 7.36  | 20.00 | 2.60 |
| 112 | 36.11 | 10.11 | 15.42 | 7.06  | 20.69 | 3.05 |
| 113 | 36.39 | 11.05 | 16.23 | 8.38  | 20.16 | 2.67 |
| 114 | 36.16 | 10.90 | 17.98 | 8.90  | 18.18 | 2.00 |
| 115 | 36.16 | 10.87 | 14.17 | 6.91  | 21.99 | 3.96 |
| 116 | 36.41 | 9.65  | 19.18 | 8.32  | 17.23 | 1.34 |
| 117 | 36.35 | 10.55 | 15.86 | 8.06  | 20.49 | 2.49 |
| 118 | 36.48 | 10.25 | 15.94 | 7.14  | 20.54 | 3.11 |
| 119 | 36.35 | 10.16 | 20.91 | 9.25  | 15.44 | 0.91 |
| 120 | 36.36 | 12.65 | 15.49 | 8.49  | 20.87 | 4.16 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 121 | 36.43 | 10.78 | 16.64 | 7.86  | 19.79 | 2.91 |
| 122 | 36.36 | 11.39 | 15.32 | 7.68  | 21.04 | 3.70 |
| 123 | 36.39 | 10.92 | 22.80 | 10.33 | 13.59 | 0.59 |
| 124 | 36.07 | 11.03 | 15.78 | 8.21  | 20.29 | 2.82 |
| 125 | 35.98 | 10.24 | 17.83 | 9.30  | 18.15 | 0.94 |
| 126 | 36.18 | 12.16 | 19.85 | 9.74  | 16.33 | 2.42 |
| 127 | 36.05 | 11.48 | 16.35 | 8.65  | 19.70 | 2.83 |
| 128 | 36.37 | 12.32 | 21.39 | 10.58 | 14.98 | 1.74 |
| 129 | 36.15 | 10.65 | 14.27 | 6.62  | 21.88 | 4.03 |
| 130 | 36.17 | 10.82 | 18.63 | 8.82  | 17.54 | 2.00 |
| 131 | 36.23 | 12.01 | 20.96 | 11.20 | 15.27 | 0.82 |
| 132 | 36.47 | 10.27 | 14.11 | 6.44  | 22.36 | 3.83 |
| 133 | 36.4  | 11.53 | 16.96 | 8.65  | 19.44 | 2.88 |
| 134 | 36.41 | 12.29 | 20.54 | 11.14 | 15.87 | 1.15 |
| 135 | 36.2  | 11.18 | 19.80 | 10.78 | 16.40 | 0.40 |
| 136 | 36.06 | 9.49  | 19.68 | 9.17  | 16.38 | 0.32 |
| 137 | 36.09 | 12.27 | 19.73 | 10.74 | 16.36 | 1.54 |
| 138 | 36.06 | 10.69 | 17.48 | 8.77  | 18.58 | 1.93 |
| 139 | 36.05 | 9.87  | 12.90 | 5.34  | 23.15 | 4.53 |
| 140 | 36.07 | 10.14 | 16.63 | 8.26  | 19.44 | 1.88 |
| 141 | 36.15 | 10.73 | 18.50 | 9.02  | 17.65 | 1.71 |
| 142 | 36.51 | 10.70 | 15.45 | 6.82  | 21.06 | 3.88 |
| 143 | 36.4  | 12.10 | 18.71 | 9.78  | 17.69 | 2.32 |
| 144 | 36.29 | 11.54 | 14.84 | 7.48  | 21.45 | 4.06 |
| 145 | 36.32 | 11.86 | 15.66 | 8.25  | 20.66 | 3.61 |
| 146 | 36.47 | 11.51 | 18.91 | 9.78  | 17.56 | 1.73 |
| 147 | 36.5  | 10.40 | 17.87 | 8.36  | 18.63 | 2.04 |
| 148 | 36.32 | 10.50 | 17.34 | 8.39  | 18.98 | 2.12 |
| 149 | 36.3  | 12.31 | 20.45 | 10.42 | 15.85 | 1.89 |
| 150 | 36.25 | 12.13 | 20.56 | 11.43 | 15.69 | 0.71 |
| 151 | 36.33 | 11.73 | 15.16 | 8.56  | 21.17 | 3.18 |
| 152 | 36.41 | 10.40 | 19.80 | 9.71  | 16.61 | 0.69 |
| 153 | 36.25 | 11.84 | 17.89 | 10.11 | 18.36 | 1.73 |
| 154 | 36.33 | 12.59 | 20.27 | 11.11 | 16.06 | 1.47 |
| 155 | 36.35 | 9.78  | 12.71 | 5.73  | 23.64 | 4.04 |
| 156 | 36.31 | 10.27 | 17.08 | 8.57  | 19.23 | 1.70 |
| 157 | 36.27 | 11.66 | 16.53 | 8.42  | 19.74 | 3.24 |
| 158 | 36.2  | 11.99 | 17.68 | 10.00 | 18.52 | 1.99 |
| 159 | 36.41 | 9.77  | 19.12 | 8.49  | 17.29 | 1.29 |
| 160 | 36.5  | 10.99 | 17.22 | 8.82  | 19.28 | 2.17 |
| 161 | 36.04 | 10.30 | 16.45 | 8.22  | 19.59 | 2.09 |

|     |       |       |       |       |       |      |
|-----|-------|-------|-------|-------|-------|------|
| 162 | 36.06 | 10.37 | 17.97 | 8.22  | 18.09 | 2.15 |
| 163 | 36.02 | 11.34 | 18.50 | 8.94  | 17.52 | 2.41 |
| 164 | 36.43 | 11.28 | 15.87 | 8.16  | 20.56 | 3.12 |
| 165 | 36.16 | 10.42 | 12.74 | 5.49  | 23.42 | 4.93 |
| 166 | 36.37 | 11.44 | 19.99 | 9.95  | 16.38 | 1.49 |
| 167 | 36.14 | 11.68 | 18.59 | 9.70  | 17.55 | 1.99 |
| 168 | 36.16 | 12.28 | 19.45 | 11.73 | 16.71 | 0.55 |
| 169 | 35.98 | 10.03 | 14.27 | 5.80  | 21.71 | 4.23 |
| 170 | 36.52 | 10.96 | 13.79 | 6.47  | 22.73 | 4.49 |
| 171 | 36.4  | 11.28 | 18.14 | 9.37  | 18.26 | 1.91 |
| 172 | 36.42 | 10.54 | 20.54 | 10.29 | 15.88 | 0.25 |
| 173 | 36.21 | 11.15 | 17.35 | 8.75  | 18.86 | 2.40 |
| 174 | 36.06 | 10.36 | 18.58 | 9.08  | 17.48 | 1.28 |
| 175 | 36.27 | 10.68 | 13.98 | 6.16  | 22.29 | 4.52 |
| 176 | 36.09 | 10.46 | 19.15 | 9.77  | 16.94 | 0.68 |
| 177 | 36.18 | 12.18 | 15.82 | 8.83  | 20.36 | 3.35 |
| 178 | 36.37 | 11.63 | 17.99 | 8.88  | 18.38 | 2.74 |
| 179 | 36.5  | 10.80 | 16.87 | 8.32  | 19.63 | 2.48 |
| 180 | 36.45 | 12.06 | 21.02 | 11.21 | 15.43 | 0.85 |
| 181 | 36.33 | 10.69 | 18.88 | 9.42  | 17.45 | 1.27 |
| 182 | 36.09 | 11.04 | 19.03 | 10.44 | 17.06 | 0.60 |
| 183 | 36.16 | 10.92 | 17.99 | 8.73  | 18.17 | 2.19 |
| 184 | 36.2  | 11.09 | 16.72 | 8.25  | 19.48 | 2.84 |
| 185 | 36.04 | 10.57 | 17.45 | 8.19  | 18.59 | 2.39 |
| 186 | 36.41 | 11.48 | 16.10 | 7.94  | 20.31 | 3.54 |
| 187 | 35.95 | 10.60 | 18.68 | 9.84  | 17.27 | 0.76 |
| 188 | 36.17 | 10.88 | 17.10 | 8.58  | 19.07 | 2.30 |
| 189 | 36.52 | 11.92 | 21.93 | 11.51 | 14.59 | 0.41 |
| 190 | 36.52 | 11.05 | 15.36 | 8.19  | 21.16 | 2.86 |
| 191 | 36.43 | 11.08 | 15.08 | 8.03  | 21.35 | 3.05 |
| 192 | 36.39 | 10.45 | 12.98 | 5.26  | 23.41 | 5.19 |
| 193 | 36.3  | 10.67 | 17.28 | 8.21  | 19.02 | 2.46 |
| 194 | 36.29 | 11.00 | 20.98 | 10.17 | 15.31 | 0.83 |
| 195 | 36.34 | 10.08 | 13.53 | 6.16  | 22.81 | 3.91 |
| 196 | 36.19 | 10.83 | 20.17 | 10.36 | 16.02 | 0.47 |
| 197 | 36.01 | 10.45 | 15.79 | 7.56  | 20.22 | 2.90 |
| 198 | 36.05 | 11.68 | 16.85 | 9.34  | 19.20 | 2.35 |
| 199 | 36.05 | 10.70 | 14.54 | 6.92  | 21.51 | 3.78 |
| 200 | 36.11 | 11.37 | 16.81 | 8.49  | 19.30 | 2.88 |

**Table 24. SIM file to run weather generator in SDSM.**

8      (Number of predictors)  
 12     (Months of data)  
 366    (Use of calendar years)  
 1/1/1963 (Beginning date of simulation)  
 10227   (Number of days in simulation)  
 #TRUE#   (Conditional)  
 100     (How many ensembles generated for each run of the model)  
 12      (Variance inflation)  
 2       (Fourth root transformation of predictand)  
 1       (Bias correction)  
 PRCPMERRILL1963-1990.txt (Predictand file name)  
 ncepp\_vna.dat      (Predictors)  
 ncepp\_zna.dat  
 ncepp8\_fna.dat  
 ncepp8\_zna.dat  
 ncepp8thna.dat  
 ncepr500na.dat  
 ncepr850na.dat  
 ncepshumna.dat

## **APPENDIX E**

### **EMISSION SCENARIOS ANNUAL DATA**

**Table 25. SWB annual output for three emission scenarios.**

| Scenario | Year | Ann. prec.(in.) | Ann.rech.(in.) | Ann. ET(in.) | Min.temp.(<br>°F) | Max. temp.(°F) |
|----------|------|-----------------|----------------|--------------|-------------------|----------------|
| A1B      | 2047 | 33.55           | 10.14          | 18.86        | 34.81             | 56.26          |
| A1B      | 2048 | 35.11           | 10.94          | 19.05        | 35.73             | 56.86          |
| A1B      | 2049 | 35.10           | 10.90          | 19.28        | 35.53             | 56.63          |
| A1B      | 2050 | 36.04           | 11.46          | 19.09        | 36.43             | 57.25          |
| A1B      | 2051 | 34.27           | 10.47          | 19.04        | 36.13             | 57.82          |
| A1B      | 2052 | 33.93           | 10.50          | 18.50        | 36.12             | 57.66          |
| A1B      | 2053 | 36.60           | 11.61          | 19.72        | 36.44             | 57.39          |
| A1B      | 2054 | 33.96           | 9.84           | 19.16        | 36.39             | 57.87          |
| A1B      | 2055 | 32.97           | 9.43           | 19.01        | 36.55             | 57.86          |
| A1B      | 2056 | 34.09           | 9.58           | 19.71        | 36.87             | 58.52          |
| A1B      | 2057 | 35.78           | 10.66          | 19.99        | 36.72             | 57.86          |
| A1B      | 2058 | 33.07           | 10.06          | 18.61        | 36.67             | 57.90          |
| A1B      | 2059 | 33.10           | 9.58           | 19.15        | 36.89             | 58.49          |
| A1B      | 2060 | 33.28           | 9.79           | 18.73        | 36.23             | 57.74          |
| A1B      | 2061 | 34.45           | 10.47          | 18.61        | 36.80             | 57.91          |
| A1B      | 2062 | 32.65           | 9.36           | 19.13        | 37.76             | 59.31          |
| A1B      | 2063 | 34.61           | 10.26          | 19.69        | 37.69             | 59.15          |
| A1B      | 2064 | 34.25           | 10.18          | 19.18        | 37.30             | 58.66          |
| A1B      | 2065 | 32.37           | 9.17           | 18.86        | 37.76             | 59.30          |
| A1B      | 2082 | 32.11           | 8.71           | 19.35        | 39.32             | 60.80          |
| A1B      | 2083 | 34.96           | 10.07          | 19.71        | 39.36             | 60.28          |
| A1B      | 2084 | 37.52           | 10.83          | 21.06        | 38.61             | 59.39          |
| A1B      | 2085 | 36.43           | 10.75          | 20.78        | 38.69             | 59.84          |
| A1B      | 2086 | 33.88           | 9.08           | 20.16        | 38.67             | 60.18          |
| A1B      | 2087 | 34.62           | 10.03          | 20.06        | 39.19             | 60.30          |
| A1B      | 2088 | 33.23           | 8.95           | 19.76        | 39.85             | 61.13          |
| A1B      | 2089 | 35.83           | 10.26          | 20.68        | 38.97             | 59.94          |
| A1B      | 2090 | 35.52           | 10.61          | 20.15        | 39.11             | 59.90          |
| A1B      | 2091 | 34.14           | 10.17          | 19.65        | 39.82             | 60.95          |
| A1B      | 2092 | 37.24           | 11.20          | 20.55        | 39.23             | 59.90          |
| A1B      | 2093 | 37.39           | 11.49          | 20.84        | 39.30             | 59.93          |
| A1B      | 2094 | 36.86           | 10.71          | 20.98        | 39.92             | 60.70          |
| A1B      | 2095 | 35.23           | 10.25          | 20.11        | 39.87             | 61.32          |
| A1B      | 2096 | 36.87           | 10.70          | 21.29        | 40.00             | 60.80          |
| A1B      | 2097 | 36.02           | 10.51          | 20.58        | 39.58             | 60.49          |
| A1B      | 2098 | 37.05           | 10.42          | 21.36        | 39.76             | 60.59          |
| A1B      | 2099 | 39.55           | 12.36          | 21.70        | 39.86             | 60.64          |
| A1B      | 2100 | 38.25           | 11.83          | 20.80        | 39.89             | 60.71          |
| A2       | 2047 | 31.88           | 9.69           | 17.89        | 33.36             | 55.14          |
| A2       | 2048 | 31.93           | 9.12           | 17.90        | 34.96             | 56.72          |
| A2       | 2049 | 34.12           | 11.27          | 17.78        | 35.60             | 56.77          |
| A2       | 2050 | 36.11           | 11.77          | 19.00        | 34.41             | 56.08          |
| A2       | 2051 | 31.17           | 8.84           | 18.20        | 36.19             | 58.02          |
| A2       | 2052 | 34.27           | 10.69          | 18.77        | 35.70             | 57.21          |
| A2       | 2053 | 33.91           | 10.96          | 18.61        | 36.05             | 57.18          |

|    |      |       |       |       |       |       |
|----|------|-------|-------|-------|-------|-------|
| A2 | 2054 | 34.24 | 9.87  | 19.00 | 35.60 | 57.25 |
| A2 | 2055 | 35.00 | 10.86 | 19.28 | 36.13 | 57.37 |
| A2 | 2056 | 34.49 | 10.69 | 18.88 | 35.63 | 56.66 |
| A2 | 2057 | 34.26 | 10.20 | 19.77 | 36.24 | 57.95 |
| A2 | 2058 | 34.04 | 9.89  | 19.26 | 36.51 | 58.14 |
| A2 | 2059 | 36.06 | 10.78 | 20.00 | 36.53 | 58.19 |
| A2 | 2060 | 32.79 | 10.01 | 18.49 | 36.20 | 57.86 |
| A2 | 2061 | 32.62 | 9.42  | 18.58 | 36.68 | 58.47 |
| A2 | 2062 | 33.33 | 10.34 | 18.38 | 36.36 | 57.96 |
| A2 | 2063 | 33.31 | 9.42  | 19.41 | 36.68 | 58.51 |
| A2 | 2064 | 34.14 | 9.58  | 19.29 | 36.86 | 58.47 |
| A2 | 2065 | 33.06 | 10.20 | 18.62 | 36.53 | 58.43 |
| A2 | 2082 | 37.54 | 11.06 | 21.37 | 39.47 | 60.70 |
| A2 | 2083 | 38.12 | 11.34 | 21.23 | 38.76 | 59.96 |
| A2 | 2084 | 34.17 | 10.17 | 19.42 | 38.73 | 59.78 |
| A2 | 2085 | 36.69 | 11.11 | 20.59 | 39.68 | 60.51 |
| A2 | 2086 | 34.41 | 9.60  | 20.54 | 39.66 | 61.02 |
| A2 | 2087 | 37.11 | 9.95  | 21.87 | 39.14 | 60.34 |
| A2 | 2088 | 35.12 | 10.41 | 20.06 | 39.36 | 60.17 |
| A2 | 2089 | 34.18 | 9.38  | 20.34 | 41.11 | 62.12 |
| A2 | 2090 | 36.22 | 9.84  | 21.44 | 41.73 | 63.18 |
| A2 | 2091 | 35.33 | 10.01 | 20.71 | 40.68 | 61.63 |
| A2 | 2092 | 34.91 | 9.50  | 20.90 | 41.41 | 62.53 |
| A2 | 2093 | 35.52 | 10.65 | 20.09 | 40.42 | 61.86 |
| A2 | 2094 | 37.11 | 10.35 | 21.90 | 41.83 | 63.04 |
| A2 | 2095 | 38.24 | 11.14 | 22.09 | 41.78 | 62.96 |
| A2 | 2096 | 37.10 | 10.42 | 21.88 | 41.31 | 62.40 |
| A2 | 2097 | 33.91 | 9.68  | 19.78 | 41.00 | 62.28 |
| A2 | 2098 | 36.01 | 9.96  | 21.55 | 40.71 | 62.14 |
| A2 | 2099 | 37.06 | 10.18 | 21.26 | 41.47 | 62.41 |
| A2 | 2100 | 36.39 | 9.82  | 22.14 | 41.84 | 63.06 |
| B1 | 2047 | 34.38 | 10.21 | 18.97 | 34.06 | 55.56 |
| B1 | 2048 | 31.83 | 9.43  | 18.09 | 33.56 | 55.06 |
| B1 | 2049 | 34.66 | 10.37 | 18.98 | 34.36 | 56.06 |
| B1 | 2050 | 30.48 | 8.80  | 17.89 | 34.35 | 56.12 |
| B1 | 2051 | 30.21 | 8.44  | 17.78 | 34.96 | 57.02 |
| B1 | 2052 | 34.93 | 10.86 | 18.91 | 35.53 | 57.03 |
| B1 | 2053 | 33.43 | 9.73  | 18.75 | 34.99 | 56.67 |
| B1 | 2054 | 34.46 | 10.07 | 19.10 | 34.95 | 56.38 |
| B1 | 2055 | 31.68 | 8.83  | 18.36 | 34.02 | 55.95 |
| B1 | 2056 | 33.18 | 10.21 | 18.49 | 34.93 | 56.44 |
| B1 | 2057 | 33.07 | 9.46  | 18.34 | 34.36 | 55.99 |
| B1 | 2058 | 34.14 | 10.88 | 18.76 | 34.91 | 56.32 |
| B1 | 2059 | 37.47 | 11.46 | 19.65 | 35.92 | 57.23 |
| B1 | 2060 | 34.24 | 10.64 | 19.21 | 35.49 | 56.90 |
| B1 | 2061 | 30.51 | 8.35  | 18.35 | 35.05 | 56.77 |
| B1 | 2062 | 31.41 | 8.78  | 18.17 | 35.32 | 57.33 |
| B1 | 2063 | 34.03 | 10.47 | 18.55 | 35.35 | 56.67 |

|    |      |       |       |       |       |       |
|----|------|-------|-------|-------|-------|-------|
| B1 | 2064 | 33.63 | 10.11 | 18.68 | 35.03 | 56.62 |
| B1 | 2065 | 32.76 | 9.29  | 18.95 | 35.28 | 56.84 |
| B1 | 2082 | 34.55 | 10.09 | 19.60 | 36.19 | 57.93 |
| B1 | 2083 | 35.90 | 10.19 | 20.52 | 36.77 | 58.17 |
| B1 | 2084 | 33.13 | 9.35  | 19.19 | 36.81 | 58.39 |
| B1 | 2085 | 33.94 | 10.19 | 19.06 | 36.57 | 57.94 |
| B1 | 2086 | 34.04 | 9.98  | 19.52 | 36.43 | 58.03 |
| B1 | 2087 | 34.85 | 10.17 | 19.67 | 36.67 | 58.03 |
| B1 | 2088 | 33.20 | 9.29  | 19.23 | 35.98 | 57.63 |
| B1 | 2089 | 33.16 | 9.80  | 18.82 | 35.96 | 57.78 |
| B1 | 2090 | 33.96 | 10.30 | 19.01 | 36.35 | 57.61 |
| B1 | 2091 | 34.83 | 10.47 | 19.11 | 36.84 | 58.00 |
| B1 | 2092 | 35.49 | 10.50 | 20.09 | 36.86 | 58.20 |
| B1 | 2093 | 32.26 | 8.53  | 19.53 | 37.61 | 59.16 |
| B1 | 2094 | 33.38 | 9.32  | 19.60 | 36.42 | 58.13 |
| B1 | 2095 | 33.58 | 9.54  | 19.48 | 36.85 | 58.52 |
| B1 | 2096 | 35.53 | 10.27 | 19.85 | 37.23 | 58.75 |
| B1 | 2097 | 35.56 | 10.44 | 20.21 | 36.36 | 57.65 |
| B1 | 2098 | 33.80 | 10.01 | 19.09 | 36.53 | 58.09 |
| B1 | 2099 | 34.36 | 10.67 | 18.66 | 36.43 | 57.91 |
| B1 | 2100 | 33.25 | 9.28  | 19.29 | 37.10 | 58.55 |

## **APPENDIX F**

### **MONTHLY MEANS FOR HISTORIC AND EMISSION SCENARIOS**

**Table 26. SWB output of monthly precipitation means of historical record and three emission scenarios.**

| Scenario | Year | Jan.<br>prec.<br>(in.) | Feb.<br>prec.<br>(in.) | Mar.<br>prec.<br>(in.) | Apr.<br>prec.<br>(in.) | May<br>prec.<br>(in.) | Jun.<br>prec.<br>(in.) | Jul.<br>prec.<br>(in.) | Aug.<br>prec.<br>(in.) | Sep.<br>prec.<br>(in.) | Oct.<br>prec.<br>(in.) | Nov.<br>prec.<br>(in.) | Dec.<br>prec.<br>(in.) |
|----------|------|------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Historic | 1954 | 0.34                   | 0.96                   | 1.36                   | 3.47                   | 3.77                  | 5.74                   | 2.76                   | 2.20                   | 6.39                   | 2.95                   | 0.81                   | 0.22                   |
| Historic | 1955 | 0.45                   | 1.13                   | 2.34                   | 2.35                   | 3.55                  | 5.48                   | 4.61                   | 6.86                   | 1.94                   | 3.27                   | 0.56                   | 0.81                   |
| Historic | 1956 | 0.40                   | 0.25                   | 1.92                   | 1.19                   | 2.97                  | 4.52                   | 3.48                   | 3.13                   | 1.27                   | 0.72                   | 3.32                   | 0.52                   |
| Historic | 1957 | 0.19                   | 0.45                   | 0.59                   | 1.80                   | 3.44                  | 2.29                   | 3.03                   | 3.27                   | 3.03                   | 1.50                   | 2.74                   | 0.44                   |
| Historic | 1958 | 0.21                   | 0.01                   | 0.50                   | 3.45                   | 2.88                  | 3.29                   | 5.39                   | 3.36                   | 3.92                   | 2.98                   | 1.95                   | 0.15                   |
| Historic | 1961 | 0.18                   | 1.87                   | 3.46                   | 1.83                   | 2.73                  | 3.76                   | 6.68                   | 3.73                   | 4.26                   | 4.01                   | 2.80                   | 1.37                   |
| Historic | 1964 | 1.25                   | 0.23                   | 1.35                   | 3.10                   | 4.17                  | 2.03                   | 2.94                   | 3.34                   | 7.42                   | 0.31                   | 3.47                   | 1.26                   |
| Historic | 1965 | 0.56                   | 2.47                   | 2.25                   | 3.86                   | 4.52                  | 4.11                   | 6.55                   | 3.06                   | 6.94                   | 0.97                   | 3.72                   | 2.38                   |
| Historic | 1966 | 0.91                   | 0.64                   | 3.67                   | 2.69                   | 1.13                  | 3.38                   | 2.44                   | 5.09                   | 1.50                   | 2.81                   | 1.20                   | 1.54                   |
| Historic | 1967 | 3.35                   | 0.93                   | 1.09                   | 4.35                   | 2.31                  | 8.36                   | 2.12                   | 3.93                   | 3.92                   | 3.60                   | 0.14                   | 0.78                   |
| Historic | 1970 | 0.86                   | 0.16                   | 1.54                   | 1.04                   | 5.63                  | 2.27                   | 4.85                   | 1.06                   | 6.54                   | 4.51                   | 2.64                   | 0.99                   |
| Historic | 1971 | 2.12                   | 2.43                   | 0.94                   | 0.81                   | 3.77                  | 1.26                   | 4.41                   | 2.87                   | 4.49                   | 3.48                   | 1.78                   | 2.85                   |
| Historic | 1974 | 0.38                   | 0.43                   | 0.72                   | 2.70                   | 2.88                  | 3.03                   | 2.97                   | 2.90                   | 3.64                   | 1.51                   | 2.58                   | 1.12                   |
| Historic | 1975 | 1.69                   | 0.74                   | 1.21                   | 4.38                   | 1.95                  | 4.90                   | 1.70                   | 3.66                   | 3.26                   | 3.23                   | 3.54                   | 1.71                   |
| Historic | 1976 | 1.42                   | 1.18                   | 4.35                   | 3.92                   | 3.11                  | 1.07                   | 3.52                   | 2.20                   | 1.71                   | 0.31                   | 0.17                   | 0.44                   |
| Historic | 1977 | 0.57                   | 1.06                   | 3.47                   | 3.54                   | 1.26                  | 3.55                   | 3.62                   | 3.58                   | 5.07                   | 1.82                   | 3.10                   | 1.45                   |
| Historic | 1978 | 0.52                   | 0.25                   | 0.23                   | 3.02                   | 4.21                  | 3.10                   | 9.41                   | 4.02                   | 4.80                   | 1.32                   | 1.92                   | 1.22                   |
| Historic | 1979 | 1.01                   | 1.65                   | 3.93                   | 1.15                   | 4.64                  | 7.01                   | 4.15                   | 5.13                   | 0.56                   | 5.11                   | 3.08                   | 0.67                   |
| Historic | 1980 | 1.59                   | 0.18                   | 0.53                   | 2.42                   | 3.20                  | 7.13                   | 2.20                   | 7.88                   | 7.67                   | 1.82                   | 0.69                   | 0.86                   |
| Historic | 1981 | 0.05                   | 2.30                   | 0.34                   | 4.33                   | 2.72                  | 4.08                   | 2.33                   | 4.11                   | 2.23                   | 2.74                   | 0.55                   | 0.92                   |
| Historic | 1982 | 1.39                   | 0.29                   | 1.82                   | 3.80                   | 4.76                  | 3.42                   | 3.69                   | 3.94                   | 6.19                   | 3.60                   | 1.74                   | 2.83                   |
| Historic | 1983 | 1.49                   | 1.18                   | 1.05                   | 1.98                   | 4.54                  | 1.86                   | 2.58                   | 4.76                   | 5.21                   | 3.51                   | 4.16                   | 1.15                   |
| Historic | 1984 | 0.42                   | 1.80                   | 1.32                   | 3.47                   | 1.77                  | 3.91                   | 3.56                   | 3.10                   | 3.71                   | 4.64                   | 2.06                   | 2.61                   |
| Historic | 1985 | 0.34                   | 1.26                   | 2.56                   | 2.18                   | 2.92                  | 4.27                   | 2.10                   | 6.48                   | 7.86                   | 3.04                   | 4.67                   | 1.58                   |
| Historic | 1986 | 0.54                   | 0.88                   | 1.88                   | 2.99                   | 1.10                  | 5.32                   | 6.49                   | 3.51                   | 8.69                   | 3.83                   | 0.97                   | 0.48                   |
| Historic | 1987 | 0.45                   | 0.05                   | 1.03                   | 1.28                   | 2.84                  | 1.70                   | 3.41                   | 2.74                   | 1.60                   | 2.04                   | 3.07                   | 1.64                   |
| Historic | 1988 | 1.04                   | 0.19                   | 2.27                   | 1.58                   | 1.64                  | 1.97                   | 4.79                   | 4.97                   | 3.86                   | 1.54                   | 4.08                   | 1.35                   |
| Historic | 1989 | 0.66                   | 0.97                   | 2.26                   | 1.35                   | 3.00                  | 2.33                   | 2.55                   | 2.22                   | 1.19                   | 1.93                   | 1.46                   | 0.54                   |
| Historic | 1990 | 0.72                   | 0.57                   | 2.59                   | 2.40                   | 4.66                  | 7.05                   | 3.76                   | 8.53                   | 4.63                   | 3.72                   | 1.45                   | 1.48                   |
| Historic | 1991 | 0.38                   | 0.99                   | 3.22                   | 4.46                   | 4.23                  | 4.01                   | 5.68                   | 4.60                   | 4.04                   | 2.27                   | 6.41                   | 1.45                   |
| Historic | 1992 | 0.68                   | 1.05                   | 2.42                   | 3.85                   | 1.90                  | 2.31                   | 2.16                   | 3.74                   | 6.27                   | 1.77                   | 4.31                   | 2.01                   |
| Historic | 1993 | 1.55                   | 0.11                   | 0.41                   | 3.65                   | 4.77                  | 8.17                   | 3.43                   | 3.59                   | 5.53                   | 2.05                   | 2.38                   | 0.64                   |
| Historic | 1994 | 1.03                   | 0.86                   | 0.71                   | 3.54                   | 1.50                  | 2.55                   | 4.93                   | 3.47                   | 6.11                   | 2.24                   | 2.42                   | 0.37                   |
| Historic | 1995 | 0.59                   | 0.35                   | 1.62                   | 1.90                   | 4.30                  | 1.18                   | 3.05                   | 12.4<br>7              | 1.83                   | 4.33                   | 1.86                   | 1.55                   |
| Historic | 1996 | 3.15                   | 0.47                   | 2.35                   | 2.71                   | 1.21                  | 5.67                   | 7.03                   | 3.59                   | 3.37                   | 4.04                   | 3.02                   | 2.31                   |
| Historic | 1997 | 2.60                   | 0.22                   | 2.00                   | 0.58                   | 3.19                  | 3.32                   | 4.17                   | 3.95                   | 4.65                   | 3.86                   | 0.48                   | 0.48                   |
| Historic | 1998 | 1.71                   | 1.42                   | 2.40                   | 1.49                   | 3.14                  | 7.16                   | 0.62                   | 1.34                   | 3.57                   | 2.38                   | 1.70                   | 0.76                   |

|          |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Historic | 1999 | 2.43 | 1.34 | 0.28 | 1.74 | 6.03 | 2.15 | 8.39 | 3.79 | 1.71 | 1.46 | 1.48 | 1.26 |
| Historic | 2000 | 2.10 | 1.07 | 1.70 | 2.00 | 3.75 | 7.17 | 2.12 | 4.03 | 5.24 | 0.63 | 2.68 | 1.11 |
| Historic | 2001 | 0.88 | 1.34 | 0.76 | 4.78 | 4.39 | 2.77 | 2.13 | 4.34 | 3.33 | 2.54 | 2.40 | 1.89 |
| Historic | 2002 | 0.38 | 2.19 | 3.29 | 4.54 | 4.84 | 5.41 | 3.19 | 5.23 | 5.31 | 4.21 | 0.27 | 0.56 |
| Historic | 2003 | 0.27 | 1.07 | 2.19 | 4.16 | 5.05 | 3.18 | 1.88 | 2.44 | 2.88 | 0.98 | 2.03 | 1.01 |
| Historic | 2004 | 0.97 | 1.97 | 2.90 | 2.01 | 5.26 | 4.66 | 1.67 | 2.16 | 2.58 | 5.38 | 1.56 | 1.66 |
| Historic | 2005 | 1.41 | 1.23 | 0.74 | 1.70 | 2.32 | 3.63 | 2.08 | 1.88 | 3.85 | 2.91 | 2.87 | 0.98 |
| Historic | 2006 | 1.22 | 0.67 | 2.06 | 1.01 | 3.21 | 1.93 | 5.32 | 6.57 | 2.34 | 2.24 | 2.02 | 2.68 |
| Historic | 2007 | 0.79 | 0.71 | 2.18 | 1.99 | 2.96 | 3.90 | 2.93 | 3.34 | 1.87 | 5.63 | 0.26 | 1.76 |
| Historic | 2008 | 0.78 | 0.87 | 0.38 | 4.79 | 4.22 | 2.96 | 2.62 | 1.80 | 1.55 | 1.61 | 1.08 | 2.03 |
| Historic | 2009 | 0.44 | 0.79 | 1.59 | 4.20 | 4.52 | 2.19 | 2.12 | 5.76 | 0.45 | 5.46 | 0.63 | 1.40 |
| A1B      | 2047 | 1.17 | 0.82 | 2.07 | 2.57 | 4.09 | 3.78 | 3.78 | 4.16 | 4.66 | 2.96 | 1.73 | 1.76 |
| A1B      | 2048 | 1.32 | 1.36 | 1.78 | 3.51 | 3.52 | 4.05 | 3.91 | 4.58 | 4.56 | 3.03 | 2.03 | 1.44 |
| A1B      | 2049 | 1.56 | 0.75 | 2.31 | 2.73 | 4.51 | 4.31 | 4.14 | 4.00 | 4.01 | 3.26 | 2.12 | 1.41 |
| A1B      | 2050 | 1.36 | 1.17 | 2.06 | 2.80 | 4.23 | 4.82 | 3.43 | 3.44 | 4.89 | 3.78 | 2.46 | 1.61 |
| A1B      | 2051 | 1.27 | 1.09 | 1.73 | 3.21 | 4.02 | 3.77 | 3.35 | 4.86 | 4.57 | 2.75 | 2.09 | 1.57 |
| A1B      | 2052 | 1.28 | 1.23 | 2.67 | 3.12 | 3.75 | 3.41 | 3.70 | 3.68 | 4.29 | 3.39 | 2.04 | 1.36 |
| A1B      | 2053 | 1.16 | 1.38 | 2.59 | 2.99 | 4.49 | 4.37 | 3.79 | 4.72 | 5.01 | 2.73 | 1.90 | 1.47 |
| A1B      | 2054 | 1.70 | 0.97 | 1.54 | 3.27 | 3.67 | 3.40 | 3.72 | 5.06 | 3.92 | 2.97 | 2.44 | 1.32 |
| A1B      | 2055 | 1.25 | 1.02 | 2.10 | 2.98 | 3.47 | 4.34 | 3.43 | 3.80 | 4.47 | 2.69 | 1.74 | 1.69 |
| A1B      | 2056 | 1.12 | 1.26 | 1.75 | 2.88 | 3.94 | 4.22 | 3.96 | 4.72 | 3.81 | 2.50 | 2.28 | 1.65 |
| A1B      | 2057 | 1.28 | 1.09 | 2.08 | 3.39 | 3.80 | 4.52 | 4.52 | 4.26 | 4.41 | 2.57 | 2.05 | 1.82 |
| A1B      | 2058 | 1.17 | 1.12 | 2.10 | 2.81 | 4.53 | 3.80 | 3.08 | 4.29 | 3.64 | 3.00 | 2.02 | 1.53 |
| A1B      | 2059 | 1.09 | 1.19 | 1.98 | 2.76 | 4.19 | 3.61 | 3.96 | 3.87 | 3.93 | 2.83 | 2.24 | 1.47 |
| A1B      | 2060 | 1.44 | 1.10 | 1.99 | 2.76 | 3.82 | 3.71 | 3.52 | 4.18 | 4.50 | 2.71 | 2.17 | 1.40 |
| A1B      | 2061 | 1.22 | 0.70 | 2.24 | 3.24 | 3.92 | 4.06 | 3.32 | 3.77 | 4.19 | 4.00 | 2.06 | 1.74 |
| A1B      | 2062 | 1.26 | 0.93 | 1.83 | 3.17 | 3.59 | 4.71 | 3.07 | 3.83 | 3.56 | 3.03 | 2.11 | 1.58 |
| A1B      | 2063 | 1.30 | 0.75 | 2.08 | 3.25 | 4.07 | 3.59 | 3.90 | 4.45 | 4.80 | 2.69 | 2.35 | 1.38 |
| A1B      | 2064 | 1.60 | 1.15 | 2.01 | 3.22 | 4.33 | 3.99 | 3.69 | 3.87 | 3.93 | 2.92 | 2.34 | 1.18 |
| A1B      | 2065 | 1.26 | 0.68 | 2.22 | 3.45 | 3.72 | 3.81 | 3.01 | 4.15 | 3.68 | 3.06 | 2.21 | 1.12 |
| A1B      | 2082 | 1.10 | 0.96 | 2.03 | 3.06 | 4.52 | 4.05 | 3.84 | 3.57 | 3.74 | 2.10 | 1.88 | 1.26 |
| A1B      | 2083 | 1.66 | 1.16 | 2.24 | 2.99 | 4.26 | 4.30 | 3.45 | 3.72 | 3.97 | 2.87 | 2.66 | 1.67 |
| A1B      | 2084 | 1.32 | 0.94 | 1.86 | 3.03 | 4.53 | 4.92 | 4.13 | 4.94 | 4.53 | 3.73 | 2.15 | 1.45 |
| A1B      | 2085 | 1.33 | 0.85 | 1.96 | 3.45 | 4.50 | 4.24 | 4.51 | 4.52 | 3.93 | 3.20 | 2.33 | 1.59 |
| A1B      | 2086 | 1.39 | 1.18 | 1.97 | 2.79 | 4.10 | 3.20 | 4.57 | 4.22 | 4.39 | 2.72 | 2.16 | 1.19 |
| A1B      | 2087 | 1.31 | 0.93 | 2.19 | 2.99 | 4.01 | 4.53 | 3.71 | 4.48 | 4.14 | 2.68 | 2.30 | 1.36 |
| A1B      | 2088 | 1.24 | 1.12 | 1.91 | 3.25 | 4.20 | 3.64 | 3.03 | 3.90 | 4.19 | 3.10 | 1.93 | 1.73 |
| A1B      | 2089 | 1.27 | 1.11 | 2.11 | 3.08 | 4.51 | 4.25 | 4.10 | 4.45 | 4.29 | 3.37 | 1.98 | 1.32 |
| A1B      | 2090 | 1.41 | 1.09 | 2.29 | 3.45 | 3.71 | 4.19 | 3.57 | 4.48 | 4.59 | 2.98 | 2.07 | 1.69 |
| A1B      | 2091 | 1.38 | 1.04 | 1.85 | 3.55 | 3.77 | 3.24 | 3.83 | 3.54 | 4.67 | 3.17 | 2.58 | 1.52 |
| A1B      | 2092 | 1.01 | 1.00 | 2.24 | 4.06 | 3.55 | 3.76 | 4.31 | 4.68 | 5.14 | 3.59 | 2.47 | 1.44 |

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A1B | 2093 | 1.19 | 1.03 | 2.42 | 3.08 | 3.44 | 4.52 | 4.08 | 5.25 | 5.08 | 3.52 | 2.15 | 1.65 |
| A1B | 2094 | 1.51 | 1.12 | 2.09 | 3.21 | 3.80 | 4.27 | 4.90 | 4.60 | 3.80 | 3.39 | 2.65 | 1.51 |
| A1B | 2095 | 1.33 | 0.99 | 2.42 | 3.36 | 3.90 | 4.13 | 3.38 | 3.57 | 5.07 | 3.30 | 2.11 | 1.66 |
| A1B | 2096 | 1.18 | 1.03 | 2.69 | 3.65 | 4.40 | 4.38 | 4.17 | 4.74 | 3.65 | 3.58 | 2.08 | 1.31 |
| A1B | 2097 | 1.39 | 1.19 | 2.17 | 3.09 | 4.55 | 3.64 | 3.46 | 4.77 | 5.35 | 2.99 | 2.03 | 1.39 |
| A1B | 2098 | 1.09 | 0.92 | 2.11 | 3.07 | 4.45 | 4.08 | 4.38 | 5.37 | 4.73 | 2.83 | 2.48 | 1.56 |
| A1B | 2099 | 1.35 | 1.35 | 2.19 | 3.80 | 4.07 | 4.91 | 4.27 | 5.30 | 5.04 | 3.33 | 2.20 | 1.75 |
| A1B | 2100 | 1.15 | 1.23 | 2.46 | 3.86 | 3.83 | 4.63 | 4.23 | 4.56 | 4.70 | 3.75 | 2.28 | 1.56 |
| A2  | 2047 | 1.01 | 0.96 | 1.53 | 2.21 | 3.38 | 3.42 | 3.81 | 4.82 | 4.69 | 2.70 | 1.93 | 1.41 |
| A2  | 2048 | 1.67 | 1.10 | 1.78 | 2.38 | 3.20 | 3.76 | 4.21 | 3.94 | 3.80 | 3.16 | 1.51 | 1.42 |
| A2  | 2049 | 1.14 | 1.02 | 2.18 | 2.39 | 3.99 | 4.11 | 3.05 | 4.43 | 4.16 | 2.79 | 3.11 | 1.77 |
| A2  | 2050 | 1.18 | 1.02 | 2.35 | 3.10 | 4.61 | 4.46 | 3.49 | 4.73 | 5.19 | 2.87 | 1.64 | 1.47 |
| A2  | 2051 | 0.96 | 0.95 | 1.82 | 2.86 | 3.39 | 3.85 | 3.57 | 3.82 | 3.52 | 2.67 | 2.13 | 1.64 |
| A2  | 2052 | 1.35 | 1.15 | 1.90 | 3.17 | 3.31 | 3.38 | 4.31 | 4.51 | 4.28 | 2.73 | 2.60 | 1.59 |
| A2  | 2053 | 1.07 | 1.32 | 2.04 | 3.16 | 3.83 | 3.77 | 3.90 | 4.34 | 4.74 | 2.55 | 1.97 | 1.22 |
| A2  | 2054 | 1.32 | 0.97 | 2.09 | 2.48 | 3.74 | 3.60 | 3.68 | 4.88 | 4.73 | 3.48 | 1.87 | 1.38 |
| A2  | 2055 | 1.29 | 1.05 | 2.03 | 2.91 | 3.19 | 4.87 | 3.49 | 4.79 | 4.73 | 3.21 | 1.92 | 1.52 |
| A2  | 2056 | 1.31 | 0.91 | 2.03 | 3.53 | 4.38 | 4.09 | 3.68 | 4.03 | 4.13 | 2.72 | 1.67 | 2.01 |
| A2  | 2057 | 1.06 | 0.86 | 2.71 | 3.05 | 3.73 | 4.18 | 4.21 | 3.94 | 5.57 | 2.20 | 1.74 | 1.02 |
| A2  | 2058 | 1.53 | 0.99 | 2.58 | 3.12 | 3.49 | 3.12 | 4.02 | 4.54 | 4.88 | 2.24 | 2.44 | 1.09 |
| A2  | 2059 | 1.40 | 1.23 | 2.51 | 2.24 | 3.94 | 4.32 | 4.11 | 3.42 | 4.50 | 3.69 | 3.26 | 1.45 |
| A2  | 2060 | 0.77 | 0.92 | 2.14 | 2.72 | 2.83 | 4.32 | 3.77 | 4.42 | 4.29 | 3.34 | 1.77 | 1.49 |
| A2  | 2061 | 1.11 | 1.13 | 2.21 | 3.10 | 2.80 | 3.66 | 3.51 | 4.95 | 3.33 | 2.61 | 2.30 | 1.90 |
| A2  | 2062 | 1.66 | 0.91 | 2.03 | 3.69 | 3.67 | 3.84 | 3.33 | 3.41 | 4.03 | 3.01 | 2.43 | 1.32 |
| A2  | 2063 | 1.09 | 1.00 | 2.25 | 2.93 | 3.05 | 4.44 | 3.70 | 4.70 | 4.04 | 2.43 | 2.42 | 1.25 |
| A2  | 2064 | 1.23 | 0.97 | 2.37 | 2.90 | 4.60 | 4.01 | 3.58 | 3.87 | 4.26 | 2.44 | 2.08 | 1.83 |
| A2  | 2065 | 1.12 | 1.01 | 2.24 | 3.55 | 3.59 | 4.23 | 3.60 | 2.89 | 4.26 | 2.83 | 2.37 | 1.37 |
| A2  | 2082 | 1.34 | 0.95 | 2.58 | 3.06 | 4.93 | 4.48 | 4.03 | 4.90 | 4.29 | 2.68 | 2.89 | 1.41 |
| A2  | 2083 | 1.42 | 1.35 | 2.96 | 2.75 | 5.10 | 4.00 | 4.48 | 4.66 | 4.72 | 3.19 | 1.84 | 1.64 |
| A2  | 2084 | 1.13 | 1.22 | 2.42 | 3.55 | 3.79 | 3.59 | 3.18 | 4.32 | 4.77 | 2.91 | 1.90 | 1.39 |
| A2  | 2085 | 1.24 | 1.21 | 1.95 | 3.31 | 4.22 | 3.95 | 4.08 | 4.82 | 4.91 | 3.41 | 2.70 | 0.88 |
| A2  | 2086 | 1.05 | 0.88 | 2.48 | 3.49 | 3.93 | 3.78 | 4.70 | 3.83 | 3.54 | 2.88 | 2.20 | 1.63 |
| A2  | 2087 | 1.38 | 0.88 | 2.26 | 3.64 | 4.70 | 4.55 | 4.66 | 5.18 | 4.39 | 2.64 | 1.59 | 1.25 |
| A2  | 2088 | 1.25 | 0.74 | 2.28 | 2.73 | 4.04 | 4.14 | 3.55 | 4.50 | 4.49 | 2.56 | 3.30 | 1.55 |
| A2  | 2089 | 1.44 | 1.31 | 2.33 | 3.26 | 4.35 | 2.64 | 3.95 | 4.18 | 4.35 | 2.66 | 2.17 | 1.54 |
| A2  | 2090 | 1.03 | 1.12 | 1.40 | 3.68 | 3.90 | 4.35 | 3.91 | 4.73 | 4.36 | 2.94 | 3.41 | 1.40 |
| A2  | 2091 | 0.93 | 1.05 | 2.20 | 3.51 | 3.83 | 3.90 | 3.64 | 3.93 | 4.68 | 3.44 | 2.23 | 1.97 |
| A2  | 2092 | 1.65 | 1.33 | 2.38 | 3.15 | 3.55 | 4.09 | 3.61 | 4.93 | 4.02 | 2.27 | 2.55 | 1.37 |
| A2  | 2093 | 1.40 | 1.53 | 2.38 | 3.62 | 3.23 | 4.42 | 3.42 | 3.75 | 4.65 | 3.36 | 2.14 | 1.61 |
| A2  | 2094 | 1.43 | 1.21 | 2.49 | 3.78 | 4.96 | 4.65 | 4.68 | 3.53 | 4.05 | 2.95 | 1.74 | 1.63 |
| A2  | 2095 | 1.33 | 1.19 | 2.43 | 3.31 | 5.29 | 3.79 | 4.00 | 5.26 | 3.49 | 3.74 | 2.54 | 1.87 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A2 | 2096 | 1.35 | 1.15 | 2.74 | 3.90 | 4.35 | 4.10 | 4.44 | 3.87 | 4.48 | 3.48 | 1.75 | 1.50 |
| A2 | 2097 | 1.41 | 1.46 | 2.08 | 2.92 | 4.43 | 4.56 | 3.39 | 2.89 | 3.62 | 2.93 | 2.59 | 1.63 |
| A2 | 2098 | 0.91 | 0.54 | 1.95 | 3.19 | 4.59 | 4.33 | 3.49 | 4.74 | 5.15 | 3.00 | 2.88 | 1.23 |
| A2 | 2099 | 1.36 | 1.49 | 2.00 | 3.55 | 4.42 | 4.61 | 3.11 | 5.10 | 4.99 | 3.12 | 1.73 | 1.57 |
| A2 | 2100 | 1.44 | 1.23 | 2.21 | 2.87 | 4.58 | 4.54 | 3.59 | 4.41 | 4.84 | 3.70 | 1.75 | 1.24 |
| B1 | 2047 | 0.99 | 1.04 | 1.92 | 2.80 | 4.31 | 4.47 | 4.04 | 4.35 | 4.11 | 2.78 | 2.51 | 1.06 |
| B1 | 2048 | 0.90 | 0.86 | 1.93 | 2.66 | 4.06 | 3.87 | 4.07 | 3.91 | 4.09 | 2.58 | 1.75 | 1.14 |
| B1 | 2049 | 1.23 | 0.94 | 2.21 | 2.86 | 2.97 | 4.19 | 4.60 | 3.68 | 4.72 | 3.11 | 2.13 | 2.02 |
| B1 | 2050 | 1.01 | 0.78 | 1.86 | 2.61 | 4.02 | 3.21 | 3.11 | 4.00 | 4.25 | 2.59 | 1.88 | 1.14 |
| B1 | 2051 | 0.97 | 0.89 | 1.78 | 2.27 | 4.08 | 3.28 | 3.60 | 3.45 | 3.46 | 3.17 | 2.11 | 1.13 |
| B1 | 2052 | 1.29 | 1.08 | 2.44 | 2.97 | 2.92 | 4.22 | 3.74 | 4.61 | 4.48 | 3.46 | 2.21 | 1.52 |
| B1 | 2053 | 1.24 | 0.74 | 1.49 | 3.39 | 4.46 | 4.07 | 3.61 | 4.22 | 3.57 | 3.01 | 1.96 | 1.68 |
| B1 | 2054 | 0.90 | 1.43 | 2.24 | 3.37 | 3.80 | 4.12 | 3.88 | 4.66 | 3.81 | 3.30 | 1.77 | 1.18 |
| B1 | 2055 | 1.18 | 0.73 | 1.84 | 2.94 | 3.79 | 3.29 | 4.01 | 3.15 | 4.46 | 2.96 | 2.08 | 1.25 |
| B1 | 2056 | 1.07 | 1.03 | 2.09 | 3.19 | 3.35 | 4.39 | 3.71 | 3.77 | 4.32 | 2.93 | 2.10 | 1.22 |
| B1 | 2057 | 0.99 | 0.93 | 1.97 | 3.49 | 3.87 | 4.36 | 4.12 | 3.61 | 3.53 | 2.61 | 2.07 | 1.53 |
| B1 | 2058 | 1.34 | 1.05 | 1.90 | 2.95 | 3.87 | 3.90 | 4.01 | 4.13 | 4.41 | 3.26 | 1.98 | 1.35 |
| B1 | 2059 | 1.44 | 1.01 | 2.22 | 2.93 | 4.45 | 3.73 | 4.97 | 4.66 | 4.32 | 2.94 | 3.09 | 1.71 |
| B1 | 2060 | 1.16 | 1.20 | 2.06 | 2.93 | 4.15 | 3.85 | 3.47 | 5.09 | 4.05 | 2.72 | 2.17 | 1.41 |
| B1 | 2061 | 1.19 | 1.05 | 1.96 | 2.80 | 3.46 | 3.76 | 3.31 | 4.23 | 3.81 | 2.19 | 1.53 | 1.22 |
| B1 | 2062 | 1.15 | 0.98 | 2.35 | 2.98 | 3.08 | 3.29 | 3.79 | 3.98 | 3.53 | 2.63 | 2.08 | 1.57 |
| B1 | 2063 | 1.06 | 1.43 | 1.77 | 3.15 | 3.43 | 4.02 | 3.26 | 4.95 | 4.45 | 3.22 | 2.14 | 1.16 |
| B1 | 2064 | 1.10 | 0.93 | 1.81 | 3.50 | 3.96 | 4.13 | 3.20 | 4.40 | 4.47 | 2.97 | 1.93 | 1.24 |
| B1 | 2065 | 1.11 | 0.79 | 2.19 | 2.55 | 4.13 | 4.59 | 3.99 | 4.20 | 3.70 | 2.57 | 1.63 | 1.33 |
| B1 | 2082 | 0.78 | 0.69 | 1.60 | 2.91 | 3.86 | 3.91 | 4.28 | 4.35 | 4.55 | 4.11 | 2.23 | 1.29 |
| B1 | 2083 | 1.62 | 1.06 | 2.28 | 2.42 | 3.98 | 4.44 | 4.60 | 4.27 | 4.65 | 2.60 | 2.49 | 1.49 |
| B1 | 2084 | 1.22 | 0.81 | 2.38 | 3.14 | 4.06 | 4.13 | 3.75 | 3.28 | 4.04 | 2.98 | 1.98 | 1.36 |
| B1 | 2085 | 1.20 | 0.68 | 1.92 | 3.00 | 3.82 | 4.09 | 3.56 | 4.19 | 4.68 | 3.01 | 2.08 | 1.71 |
| B1 | 2086 | 0.96 | 1.12 | 2.24 | 2.97 | 3.50 | 3.99 | 4.22 | 4.28 | 3.86 | 3.28 | 2.18 | 1.43 |
| B1 | 2087 | 0.96 | 0.89 | 2.22 | 3.03 | 4.22 | 3.80 | 4.39 | 4.61 | 4.50 | 2.86 | 1.88 | 1.50 |
| B1 | 2088 | 1.54 | 0.89 | 1.80 | 2.55 | 3.50 | 3.55 | 4.13 | 4.14 | 4.10 | 3.17 | 1.88 | 1.94 |
| B1 | 2089 | 1.58 | 0.98 | 2.49 | 2.49 | 3.65 | 3.76 | 3.56 | 4.26 | 3.79 | 3.03 | 2.02 | 1.55 |
| B1 | 2090 | 1.07 | 0.91 | 1.77 | 3.08 | 4.11 | 4.55 | 3.61 | 3.47 | 3.99 | 3.53 | 1.80 | 2.07 |
| B1 | 2091 | 1.17 | 1.31 | 2.31 | 2.50 | 3.15 | 4.23 | 3.35 | 4.19 | 5.14 | 3.44 | 2.46 | 1.57 |
| B1 | 2092 | 0.96 | 1.04 | 1.89 | 2.59 | 4.46 | 4.37 | 4.06 | 4.65 | 5.18 | 2.65 | 2.14 | 1.50 |
| B1 | 2093 | 0.96 | 0.88 | 2.03 | 2.61 | 3.75 | 3.83 | 4.01 | 4.11 | 3.34 | 2.75 | 2.67 | 1.34 |
| B1 | 2094 | 1.21 | 0.78 | 2.10 | 3.26 | 3.38 | 4.16 | 3.99 | 4.26 | 3.79 | 2.94 | 2.17 | 1.35 |
| B1 | 2095 | 1.24 | 0.79 | 2.16 | 3.45 | 3.61 | 3.97 | 3.54 | 4.33 | 3.72 | 3.11 | 2.42 | 1.23 |
| B1 | 2096 | 1.31 | 0.87 | 2.20 | 2.95 | 4.24 | 4.59 | 3.43 | 4.18 | 4.79 | 2.92 | 2.01 | 2.03 |
| B1 | 2097 | 0.82 | 0.89 | 2.21 | 2.47 | 3.71 | 4.82 | 4.30 | 5.10 | 4.49 | 3.21 | 2.00 | 1.53 |
| B1 | 2098 | 1.39 | 1.19 | 1.95 | 3.21 | 3.57 | 3.77 | 4.13 | 4.16 | 4.04 | 2.70 | 2.21 | 1.47 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| B1 | 2099 | 1.41 | 0.93 | 1.84 | 2.76 | 4.57 | 4.09 | 3.43 | 4.10 | 3.53 | 3.34 | 2.47 | 1.89 |
| B1 | 2100 | 1.15 | 1.18 | 2.04 | 3.05 | 3.94 | 4.80 | 3.01 | 4.24 | 3.92 | 2.26 | 1.92 | 1.73 |

**Table 27. SWB output of monthly recharge means of historical record and three emission scenarios.**

| Scenario | Year | Jan.<br>rech.<br>(in.) | Feb.<br>rech.<br>(in.) | Mar.<br>rech.<br>(in.) | Apr.<br>rech.<br>(in.) | May<br>rech.<br>(in.) | Jun.<br>rech.<br>(in.) | Jul.<br>rech.<br>(in.) | Aug.<br>rech.<br>(in.) | Sep.<br>rech.<br>(in.) | Oct.<br>rech.<br>(in.) | Nov.<br>rech.<br>(in.) | Dec.<br>rech.<br>(in.) |
|----------|------|------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Historic | 1954 | 0.00                   | 0.64                   | 0.74                   | 2.34                   | 2.01                  | 0.81                   | 0.00                   | 0.00                   | 0.98                   | 1.15                   | 0.07                   | 0.00                   |
| Historic | 1955 | 0.00                   | 0.00                   | 3.08                   | 1.75                   | 0.17                  | 1.62                   | 0.01                   | 1.76                   | 0.00                   | 0.45                   | 0.02                   | 0.00                   |
| Historic | 1956 | 0.00                   | 0.00                   | 1.74                   | 1.68                   | 0.69                  | 0.09                   | 0.07                   | 0.12                   | 0.00                   | 0.00                   | 0.06                   | 0.04                   |
| Historic | 1957 | 0.00                   | 0.20                   | 1.27                   | 0.94                   | 0.38                  | 0.00                   | 0.00                   | 0.01                   | 0.02                   | 0.00                   | 0.49                   | 0.31                   |
| Historic | 1958 | 0.00                   | 0.92                   | 0.43                   | 2.07                   | 0.28                  | 0.18                   | 1.32                   | 0.01                   | 0.19                   | 0.44                   | 0.69                   | 0.00                   |
| Historic | 1961 | 0.09                   | 0.86                   | 3.88                   | 1.26                   | 0.86                  | 0.11                   | 1.01                   | 0.05                   | 0.56                   | 1.83                   | 2.25                   | 0.09                   |
| Historic | 1964 | 0.29                   | 0.53                   | 1.47                   | 1.92                   | 1.20                  | 0.00                   | 0.00                   | 0.01                   | 2.09                   | 0.00                   | 1.23                   | 0.16                   |
| Historic | 1965 | 0.19                   | 0.22                   | 1.54                   | 5.95                   | 0.54                  | 0.80                   | 0.69                   | 0.13                   | 2.41                   | 0.00                   | 1.01                   | 2.16                   |
| Historic | 1966 | 0.00                   | 1.04                   | 4.14                   | 1.74                   | 0.00                  | 0.13                   | 0.00                   | 0.11                   | 0.00                   | 0.29                   | 0.45                   | 0.25                   |
| Historic | 1967 | 0.25                   | 0.00                   | 4.78                   | 2.72                   | 0.56                  | 1.84                   | 0.01                   | 0.07                   | 0.88                   | 1.21                   | 0.00                   | 0.18                   |
| Historic | 1970 | 0.00                   | 0.00                   | 1.79                   | 2.23                   | 1.36                  | 0.00                   | 0.01                   | 0.00                   | 1.02                   | 2.07                   | 0.68                   | 1.11                   |
| Historic | 1971 | 0.00                   | 0.64                   | 1.58                   | 2.94                   | 0.88                  | 0.00                   | 0.12                   | 0.03                   | 0.34                   | 0.97                   | 0.67                   | 0.29                   |
| Historic | 1974 | 0.00                   | 0.07                   | 1.59                   | 2.17                   | 0.22                  | 0.01                   | 0.00                   | 0.01                   | 0.17                   | 0.03                   | 0.97                   | 0.00                   |
| Historic | 1975 | 0.00                   | 0.00                   | 2.34                   | 4.93                   | 0.29                  | 0.10                   | 0.00                   | 0.08                   | 0.36                   | 0.97                   | 1.94                   | 0.91                   |
| Historic | 1976 | 0.00                   | 2.19                   | 3.39                   | 2.31                   | 0.87                  | 0.00                   | 0.02                   | 0.01                   | 0.00                   | 0.00                   | 0.00                   | 0.00                   |
| Historic | 1977 | 0.00                   | 0.00                   | 2.47                   | 2.04                   | 0.00                  | 0.00                   | 0.01                   | 0.03                   | 0.87                   | 0.81                   | 1.28                   | 0.88                   |
| Historic | 1978 | 0.00                   | 0.00                   | 1.57                   | 2.42                   | 0.56                  | 0.07                   | 2.58                   | 0.06                   | 0.89                   | 0.58                   | 0.00                   | 0.00                   |
| Historic | 1979 | 0.00                   | 0.00                   | 3.90                   | 3.34                   | 1.57                  | 2.10                   | 0.01                   | 0.45                   | 0.00                   | 1.46                   | 2.29                   | 0.57                   |
| Historic | 1980 | 0.55                   | 0.21                   | 1.25                   | 1.86                   | 0.01                  | 2.00                   | 0.00                   | 1.12                   | 3.20                   | 0.67                   | 0.37                   | 0.38                   |
| Historic | 1981 | 0.41                   | 1.39                   | 0.86                   | 2.27                   | 1.12                  | 0.01                   | 0.00                   | 0.05                   | 0.01                   | 0.75                   | 0.00                   | 0.00                   |
| Historic | 1982 | 0.00                   | 0.88                   | 2.72                   | 2.87                   | 1.39                  | 0.01                   | 0.01                   | 0.21                   | 2.32                   | 1.44                   | 1.04                   | 1.08                   |
| Historic | 1983 | 0.00                   | 3.01                   | 1.78                   | 1.62                   | 1.25                  | 0.01                   | 0.00                   | 0.02                   | 1.05                   | 1.31                   | 2.09                   | 0.00                   |
| Historic | 1984 | 0.00                   | 3.46                   | 1.13                   | 1.53                   | 0.64                  | 0.03                   | 0.01                   | 0.00                   | 0.03                   | 1.66                   | 1.78                   | 1.93                   |
| Historic | 1985 | 0.00                   | 1.41                   | 2.51                   | 1.04                   | 0.02                  | 0.06                   | 0.05                   | 0.81                   | 3.22                   | 1.73                   | 2.11                   | 0.00                   |
| Historic | 1986 | 0.00                   | 0.16                   | 4.38                   | 1.06                   | 0.13                  | 0.40                   | 1.19                   | 0.02                   | 2.99                   | 1.68                   | 0.30                   | 0.00                   |
| Historic | 1987 | 0.00                   | 0.00                   | 1.58                   | 0.36                   | 0.01                  | 0.00                   | 0.00                   | 0.00                   | 0.00                   | 0.04                   | 1.28                   | 0.53                   |
| Historic | 1988 | 0.49                   | 0.00                   | 3.09                   | 0.90                   | 0.00                  | 0.00                   | 0.15                   | 0.06                   | 0.52                   | 0.27                   | 2.61                   | 0.38                   |
| Historic | 1989 | 0.00                   | 0.00                   | 3.96                   | 0.58                   | 0.08                  | 0.08                   | 0.00                   | 0.00                   | 0.00                   | 0.00                   | 0.07                   | 0.00                   |
| Historic | 1990 | 0.00                   | 0.07                   | 2.48                   | 0.94                   | 1.96                  | 1.27                   | 0.01                   | 2.20                   | 0.96                   | 1.93                   | 0.63                   | 0.40                   |
| Historic | 1991 | 0.00                   | 1.26                   | 3.14                   | 2.89                   | 0.79                  | 0.69                   | 0.10                   | 0.73                   | 0.13                   | 0.73                   | 2.98                   | 0.19                   |
| Historic | 1992 | 0.26                   | 0.31                   | 4.84                   | 3.65                   | 0.00                  | 0.00                   | 0.00                   | 0.01                   | 1.50                   | 0.59                   | 1.94                   | 0.74                   |
| Historic | 1993 | 0.00                   | 0.45                   | 2.82                   | 2.61                   | 1.21                  | 3.32                   | 0.01                   | 0.00                   | 1.24                   | 0.73                   | 0.90                   | 1.40                   |
| Historic | 1994 | 0.00                   | 1.02                   | 1.05                   | 2.62                   | 0.07                  | 0.00                   | 0.05                   | 0.01                   | 1.46                   | 0.66                   | 0.85                   | 0.70                   |
| Historic | 1995 | 0.13                   | 0.54                   | 1.68                   | 1.51                   | 1.33                  | 0.00                   | 0.00                   | 3.18                   | 0.00                   | 1.73                   | 0.69                   | 0.00                   |

|          |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Historic | 1996 | 0.41 | 0.91 | 2.18 | 4.79 | 0.07 | 0.30 | 1.40 | 0.02 | 0.03 | 1.81 | 1.28 | 0.00 |
| Historic | 1997 | 0.41 | 0.73 | 2.95 | 2.63 | 0.30 | 0.07 | 0.01 | 0.08 | 0.73 | 1.16 | 0.27 | 0.35 |
| Historic | 1998 | 0.04 | 2.75 | 1.86 | 0.60 | 0.18 | 1.72 | 0.00 | 0.00 | 0.16 | 0.29 | 0.91 | 0.00 |
| Historic | 1999 | 0.00 | 1.04 | 2.59 | 0.88 | 1.85 | 0.00 | 0.66 | 0.49 | 0.00 | 0.00 | 0.09 | 0.38 |
| Historic | 2000 | 0.00 | 2.93 | 1.05 | 1.24 | 0.06 | 1.86 | 0.06 | 0.09 | 0.87 | 0.00 | 0.17 | 0.00 |
| Historic | 2001 | 0.21 | 0.00 | 1.86 | 4.99 | 0.56 | 0.00 | 0.00 | 0.54 | 0.15 | 0.19 | 0.95 | 1.34 |
| Historic | 2002 | 0.66 | 1.79 | 2.25 | 3.51 | 2.05 | 0.82 | 0.00 | 0.51 | 0.71 | 2.82 | 0.10 | 0.38 |
| Historic | 2003 | 0.17 | 0.41 | 1.58 | 3.77 | 1.67 | 0.39 | 0.00 | 0.00 | 0.01 | 0.00 | 0.32 | 0.38 |
| Historic | 2004 | 0.00 | 0.00 | 4.67 | 0.90 | 1.60 | 1.56 | 0.00 | 0.00 | 0.02 | 1.50 | 0.36 | 0.80 |
| Historic | 2005 | 0.00 | 2.17 | 1.84 | 0.47 | 0.26 | 0.03 | 0.00 | 0.00 | 0.12 | 0.65 | 1.82 | 0.35 |
| Historic | 2006 | 0.51 | 0.00 | 3.35 | 0.39 | 0.32 | 0.00 | 0.40 | 1.45 | 0.00 | 0.70 | 1.40 | 1.55 |
| Historic | 2007 | 0.81 | 0.24 | 2.40 | 1.36 | 0.01 | 0.07 | 0.00 | 0.01 | 0.00 | 1.73 | 0.00 | 0.00 |
| Historic | 2008 | 0.75 | 0.00 | 0.62 | 4.78 | 1.29 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 |
| Historic | 2009 | 0.00 | 0.21 | 2.22 | 2.39 | 0.96 | 0.24 | 0.00 | 0.10 | 0.00 | 1.69 | 0.06 | 0.02 |
| A1B      | 2047 | 0.62 | 0.83 | 2.06 | 1.64 | 1.04 | 0.39 | 0.13 | 0.31 | 0.52 | 0.98 | 0.75 | 0.88 |
| A1B      | 2048 | 0.85 | 0.77 | 2.21 | 2.13 | 0.90 | 0.37 | 0.18 | 0.47 | 0.67 | 0.90 | 0.83 | 0.65 |
| A1B      | 2049 | 0.71 | 0.82 | 2.61 | 1.56 | 0.96 | 0.53 | 0.27 | 0.29 | 0.49 | 0.77 | 1.12 | 0.76 |
| A1B      | 2050 | 0.69 | 0.98 | 2.24 | 1.57 | 0.87 | 0.55 | 0.16 | 0.27 | 0.90 | 1.25 | 1.24 | 0.74 |
| A1B      | 2051 | 0.50 | 1.40 | 2.01 | 1.70 | 0.96 | 0.26 | 0.13 | 0.59 | 0.72 | 0.64 | 0.78 | 0.80 |
| A1B      | 2052 | 0.56 | 1.23 | 2.64 | 1.66 | 0.86 | 0.30 | 0.16 | 0.13 | 0.59 | 0.86 | 0.83 | 0.69 |
| A1B      | 2053 | 0.79 | 0.94 | 2.31 | 1.93 | 1.14 | 0.45 | 0.18 | 0.44 | 1.19 | 0.70 | 0.90 | 0.64 |
| A1B      | 2054 | 0.69 | 0.68 | 1.90 | 2.11 | 0.71 | 0.13 | 0.26 | 0.37 | 0.55 | 0.74 | 0.98 | 0.72 |
| A1B      | 2055 | 0.60 | 1.09 | 2.16 | 1.60 | 0.64 | 0.42 | 0.14 | 0.19 | 0.64 | 0.56 | 0.72 | 0.65 |
| A1B      | 2056 | 0.52 | 0.90 | 2.13 | 1.55 | 0.67 | 0.47 | 0.21 | 0.43 | 0.52 | 0.63 | 0.84 | 0.72 |
| A1B      | 2057 | 0.70 | 0.95 | 1.99 | 2.13 | 0.77 | 0.56 | 0.27 | 0.39 | 0.56 | 0.60 | 0.87 | 0.86 |
| A1B      | 2058 | 0.71 | 1.09 | 2.24 | 1.54 | 1.23 | 0.35 | 0.11 | 0.17 | 0.43 | 0.79 | 0.86 | 0.54 |
| A1B      | 2059 | 0.70 | 0.97 | 1.96 | 1.52 | 0.92 | 0.28 | 0.25 | 0.16 | 0.59 | 0.61 | 0.97 | 0.65 |
| A1B      | 2060 | 0.72 | 1.07 | 2.15 | 1.46 | 0.91 | 0.21 | 0.16 | 0.34 | 0.65 | 0.71 | 0.68 | 0.73 |
| A1B      | 2061 | 0.65 | 0.66 | 2.17 | 1.73 | 0.84 | 0.38 | 0.13 | 0.33 | 0.44 | 1.50 | 0.85 | 0.79 |
| A1B      | 2062 | 1.06 | 1.00 | 1.76 | 1.66 | 0.59 | 0.55 | 0.12 | 0.19 | 0.30 | 0.58 | 0.78 | 0.77 |
| A1B      | 2063 | 0.82 | 0.88 | 2.02 | 1.75 | 0.86 | 0.32 | 0.21 | 0.31 | 0.74 | 0.72 | 1.02 | 0.62 |
| A1B      | 2064 | 0.86 | 1.08 | 2.15 | 1.64 | 0.99 | 0.27 | 0.16 | 0.26 | 0.43 | 0.70 | 0.95 | 0.68 |
| A1B      | 2065 | 0.88 | 0.85 | 1.66 | 1.90 | 0.77 | 0.22 | 0.05 | 0.29 | 0.39 | 0.58 | 0.95 | 0.63 |
| A1B      | 2082 | 0.76 | 0.83 | 1.91 | 1.27 | 1.24 | 0.50 | 0.15 | 0.22 | 0.44 | 0.30 | 0.58 | 0.54 |
| A1B      | 2083 | 0.81 | 1.17 | 2.07 | 1.44 | 0.83 | 0.55 | 0.11 | 0.15 | 0.52 | 0.57 | 1.13 | 0.73 |
| A1B      | 2084 | 0.82 | 0.67 | 1.98 | 1.49 | 1.02 | 0.57 | 0.27 | 0.48 | 0.57 | 1.12 | 1.05 | 0.80 |
| A1B      | 2085 | 1.00 | 0.78 | 1.76 | 1.84 | 1.10 | 0.38 | 0.37 | 0.36 | 0.51 | 0.89 | 1.06 | 0.71 |
| A1B      | 2086 | 0.89 | 0.89 | 1.80 | 1.35 | 0.72 | 0.16 | 0.25 | 0.29 | 0.70 | 0.44 | 0.95 | 0.63 |
| A1B      | 2087 | 0.80 | 0.94 | 1.97 | 1.51 | 0.85 | 0.57 | 0.23 | 0.34 | 0.61 | 0.54 | 0.94 | 0.72 |
| A1B      | 2088 | 0.68 | 0.97 | 1.83 | 1.46 | 0.75 | 0.30 | 0.04 | 0.16 | 0.46 | 0.77 | 0.62 | 0.91 |
| A1B      | 2089 | 0.65 | 0.92 | 2.09 | 1.48 | 1.02 | 0.50 | 0.27 | 0.36 | 0.55 | 0.88 | 0.90 | 0.64 |

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A1B | 2090 | 0.73 | 1.15 | 2.12 | 1.80 | 0.83 | 0.30 | 0.13 | 0.29 | 0.68 | 0.70 | 0.93 | 0.96 |
| A1B | 2091 | 0.85 | 0.93 | 1.89 | 1.70 | 0.68 | 0.12 | 0.20 | 0.18 | 0.60 | 0.79 | 1.15 | 1.08 |
| A1B | 2092 | 0.55 | 0.80 | 2.11 | 2.04 | 0.58 | 0.28 | 0.26 | 0.37 | 0.91 | 1.33 | 1.14 | 0.82 |
| A1B | 2093 | 0.65 | 1.21 | 1.94 | 1.56 | 0.63 | 0.47 | 0.22 | 0.65 | 0.97 | 0.99 | 1.07 | 1.13 |
| A1B | 2094 | 0.95 | 1.15 | 1.85 | 1.54 | 0.78 | 0.36 | 0.37 | 0.43 | 0.54 | 0.67 | 1.15 | 0.91 |
| A1B | 2095 | 0.94 | 0.95 | 1.94 | 1.66 | 0.64 | 0.25 | 0.19 | 0.10 | 0.92 | 0.86 | 0.89 | 0.93 |
| A1B | 2096 | 0.90 | 0.91 | 2.04 | 2.12 | 0.85 | 0.48 | 0.14 | 0.41 | 0.39 | 0.81 | 0.98 | 0.67 |
| A1B | 2097 | 1.06 | 0.85 | 1.92 | 1.54 | 1.11 | 0.35 | 0.13 | 0.42 | 0.87 | 0.82 | 0.69 | 0.74 |
| A1B | 2098 | 0.82 | 0.77 | 1.83 | 1.29 | 1.09 | 0.36 | 0.41 | 0.58 | 0.88 | 0.62 | 1.04 | 0.74 |
| A1B | 2099 | 0.81 | 1.39 | 2.05 | 1.93 | 0.86 | 0.56 | 0.25 | 0.54 | 1.02 | 1.08 | 0.93 | 0.92 |
| A1B | 2100 | 0.84 | 0.86 | 2.17 | 1.99 | 0.70 | 0.57 | 0.31 | 0.47 | 0.89 | 1.15 | 0.93 | 0.96 |
| A2  | 2047 | 0.44 | 0.73 | 1.89 | 1.71 | 0.59 | 0.28 | 0.23 | 0.45 | 0.83 | 0.96 | 0.79 | 0.80 |
| A2  | 2048 | 0.76 | 0.77 | 2.39 | 1.27 | 0.63 | 0.31 | 0.27 | 0.37 | 0.46 | 0.74 | 0.73 | 0.42 |
| A2  | 2049 | 0.84 | 1.13 | 1.99 | 1.48 | 1.03 | 0.49 | 0.25 | 0.43 | 0.49 | 0.60 | 1.48 | 1.07 |
| A2  | 2050 | 0.54 | 0.96 | 2.34 | 2.13 | 1.17 | 0.78 | 0.09 | 0.48 | 1.07 | 0.76 | 0.76 | 0.69 |
| A2  | 2051 | 0.76 | 0.64 | 1.90 | 1.46 | 0.77 | 0.24 | 0.10 | 0.29 | 0.33 | 0.62 | 0.92 | 0.82 |
| A2  | 2052 | 0.39 | 1.05 | 2.52 | 1.67 | 0.66 | 0.25 | 0.35 | 0.41 | 0.65 | 0.64 | 1.27 | 0.82 |
| A2  | 2053 | 0.65 | 1.22 | 2.28 | 1.97 | 0.90 | 0.34 | 0.15 | 0.42 | 0.80 | 0.65 | 0.80 | 0.79 |
| A2  | 2054 | 0.78 | 0.66 | 1.86 | 1.45 | 0.95 | 0.24 | 0.06 | 0.35 | 0.87 | 1.03 | 0.87 | 0.75 |
| A2  | 2055 | 0.83 | 0.81 | 1.58 | 2.42 | 0.82 | 0.51 | 0.29 | 0.23 | 0.69 | 0.98 | 0.83 | 0.87 |
| A2  | 2056 | 0.88 | 0.51 | 2.09 | 2.35 | 1.08 | 0.49 | 0.08 | 0.20 | 0.63 | 0.68 | 0.66 | 1.04 |
| A2  | 2057 | 0.47 | 0.87 | 2.85 | 1.41 | 0.77 | 0.49 | 0.26 | 0.22 | 1.12 | 0.45 | 0.72 | 0.58 |
| A2  | 2058 | 0.87 | 1.00 | 2.42 | 1.42 | 0.66 | 0.14 | 0.21 | 0.29 | 0.97 | 0.38 | 1.00 | 0.54 |
| A2  | 2059 | 0.72 | 1.11 | 2.29 | 1.31 | 0.49 | 0.42 | 0.18 | 0.13 | 0.58 | 1.17 | 1.73 | 0.64 |
| A2  | 2060 | 0.59 | 0.58 | 2.41 | 1.47 | 0.60 | 0.28 | 0.27 | 0.22 | 0.81 | 1.07 | 0.79 | 0.92 |
| A2  | 2061 | 0.32 | 1.17 | 2.12 | 1.64 | 0.44 | 0.30 | 0.13 | 0.48 | 0.41 | 0.47 | 0.87 | 1.06 |
| A2  | 2062 | 0.74 | 0.87 | 2.25 | 2.21 | 0.81 | 0.29 | 0.12 | 0.16 | 0.45 | 0.91 | 0.99 | 0.54 |
| A2  | 2063 | 0.49 | 1.01 | 1.87 | 1.89 | 0.60 | 0.47 | 0.12 | 0.52 | 0.49 | 0.38 | 0.98 | 0.59 |
| A2  | 2064 | 0.55 | 0.91 | 2.35 | 1.51 | 1.06 | 0.37 | 0.16 | 0.18 | 0.60 | 0.42 | 0.79 | 0.69 |
| A2  | 2065 | 0.53 | 0.90 | 2.62 | 1.73 | 0.87 | 0.38 | 0.09 | 0.08 | 0.42 | 0.63 | 1.15 | 0.78 |
| A2  | 2082 | 0.95 | 0.92 | 2.12 | 1.55 | 1.12 | 0.46 | 0.29 | 0.44 | 0.59 | 0.51 | 1.24 | 0.88 |
| A2  | 2083 | 0.71 | 1.03 | 2.97 | 1.28 | 1.17 | 0.33 | 0.37 | 0.37 | 1.00 | 0.59 | 0.60 | 0.91 |
| A2  | 2084 | 0.80 | 1.10 | 2.25 | 1.89 | 0.83 | 0.19 | 0.09 | 0.20 | 0.80 | 0.79 | 0.76 | 0.47 |
| A2  | 2085 | 0.74 | 0.97 | 2.04 | 1.51 | 0.79 | 0.32 | 0.34 | 0.32 | 1.18 | 1.08 | 1.40 | 0.42 |
| A2  | 2086 | 0.76 | 0.86 | 1.98 | 1.71 | 0.57 | 0.32 | 0.35 | 0.31 | 0.36 | 0.59 | 0.87 | 0.93 |
| A2  | 2087 | 0.68 | 0.64 | 2.18 | 1.89 | 1.09 | 0.50 | 0.17 | 0.40 | 0.71 | 0.71 | 0.51 | 0.47 |
| A2  | 2088 | 0.85 | 0.64 | 2.12 | 1.34 | 0.85 | 0.29 | 0.23 | 0.47 | 0.60 | 0.42 | 1.49 | 1.13 |
| A2  | 2089 | 0.88 | 1.03 | 2.13 | 1.33 | 0.62 | 0.10 | 0.11 | 0.23 | 0.54 | 0.71 | 0.90 | 0.79 |
| A2  | 2090 | 0.66 | 1.00 | 1.22 | 1.42 | 0.85 | 0.37 | 0.30 | 0.41 | 0.63 | 0.73 | 1.36 | 0.88 |
| A2  | 2091 | 0.73 | 0.76 | 1.98 | 1.81 | 0.56 | 0.30 | 0.09 | 0.17 | 0.43 | 1.00 | 1.05 | 1.12 |
| A2  | 2092 | 1.36 | 0.97 | 1.77 | 1.63 | 0.51 | 0.33 | 0.13 | 0.38 | 0.58 | 0.27 | 0.91 | 0.66 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A2 | 2093 | 0.65 | 1.04 | 2.37 | 2.06 | 0.52 | 0.43 | 0.11 | 0.22 | 0.51 | 1.01 | 1.00 | 0.75 |
| A2 | 2094 | 0.97 | 1.15 | 1.98 | 1.57 | 1.14 | 0.72 | 0.22 | 0.19 | 0.44 | 0.55 | 0.64 | 0.77 |
| A2 | 2095 | 0.84 | 1.16 | 1.99 | 1.50 | 1.13 | 0.41 | 0.11 | 0.50 | 0.39 | 1.04 | 0.98 | 1.09 |
| A2 | 2096 | 0.94 | 1.16 | 2.21 | 1.66 | 0.87 | 0.34 | 0.28 | 0.14 | 0.56 | 0.84 | 0.62 | 0.81 |
| A2 | 2097 | 0.91 | 1.46 | 1.82 | 1.34 | 0.91 | 0.57 | 0.17 | 0.03 | 0.25 | 0.51 | 0.95 | 0.75 |
| A2 | 2098 | 0.70 | 0.54 | 1.60 | 1.31 | 0.90 | 0.37 | 0.19 | 0.40 | 1.00 | 0.85 | 1.23 | 0.85 |
| A2 | 2099 | 1.07 | 0.99 | 1.77 | 1.60 | 1.03 | 0.53 | 0.10 | 0.34 | 0.96 | 0.61 | 0.60 | 0.57 |
| A2 | 2100 | 0.94 | 1.26 | 1.89 | 0.95 | 0.79 | 0.43 | 0.13 | 0.18 | 0.64 | 1.09 | 0.70 | 0.82 |
| B1 | 2047 | 0.41 | 0.92 | 2.29 | 1.51 | 1.00 | 0.63 | 0.36 | 0.34 | 0.59 | 0.74 | 1.01 | 0.42 |
| B1 | 2048 | 0.41 | 0.62 | 2.31 | 1.84 | 0.99 | 0.43 | 0.20 | 0.26 | 0.68 | 0.61 | 0.62 | 0.46 |
| B1 | 2049 | 0.25 | 0.65 | 2.81 | 1.60 | 0.47 | 0.36 | 0.38 | 0.28 | 0.69 | 0.84 | 0.92 | 1.13 |
| B1 | 2050 | 0.31 | 0.79 | 1.86 | 2.07 | 0.78 | 0.24 | 0.06 | 0.19 | 0.63 | 0.59 | 0.55 | 0.72 |
| B1 | 2051 | 0.58 | 0.77 | 1.89 | 1.15 | 1.10 | 0.14 | 0.18 | 0.14 | 0.45 | 0.75 | 0.67 | 0.61 |
| B1 | 2052 | 0.78 | 0.92 | 2.33 | 1.50 | 0.44 | 0.39 | 0.26 | 0.37 | 0.73 | 1.32 | 0.96 | 0.85 |
| B1 | 2053 | 0.52 | 0.83 | 1.74 | 1.96 | 1.02 | 0.43 | 0.21 | 0.29 | 0.43 | 0.80 | 0.85 | 0.65 |
| B1 | 2054 | 0.39 | 1.34 | 2.23 | 1.96 | 0.68 | 0.43 | 0.20 | 0.35 | 0.57 | 0.87 | 0.67 | 0.38 |
| B1 | 2055 | 0.33 | 0.65 | 2.42 | 1.76 | 0.71 | 0.10 | 0.26 | 0.12 | 0.57 | 0.65 | 0.73 | 0.54 |
| B1 | 2056 | 0.75 | 0.69 | 2.36 | 1.95 | 0.69 | 0.48 | 0.17 | 0.23 | 0.63 | 0.79 | 0.91 | 0.57 |
| B1 | 2057 | 0.33 | 0.75 | 2.12 | 2.03 | 1.08 | 0.56 | 0.29 | 0.16 | 0.43 | 0.41 | 0.74 | 0.56 |
| B1 | 2058 | 0.49 | 0.74 | 2.43 | 1.97 | 0.91 | 0.30 | 0.25 | 0.30 | 0.71 | 1.15 | 0.91 | 0.71 |
| B1 | 2059 | 0.73 | 0.88 | 2.31 | 1.44 | 1.10 | 0.33 | 0.59 | 0.45 | 0.86 | 0.87 | 1.30 | 0.61 |
| B1 | 2060 | 0.89 | 1.09 | 2.12 | 1.94 | 0.94 | 0.37 | 0.11 | 0.41 | 0.49 | 0.64 | 1.01 | 0.63 |
| B1 | 2061 | 0.56 | 0.90 | 1.86 | 2.09 | 0.60 | 0.28 | 0.14 | 0.23 | 0.46 | 0.32 | 0.46 | 0.44 |
| B1 | 2062 | 0.51 | 0.56 | 2.65 | 1.60 | 0.50 | 0.16 | 0.22 | 0.22 | 0.17 | 0.72 | 0.70 | 0.76 |
| B1 | 2063 | 0.42 | 1.21 | 1.90 | 2.12 | 0.78 | 0.36 | 0.12 | 0.43 | 0.75 | 0.95 | 0.93 | 0.51 |
| B1 | 2064 | 0.45 | 0.68 | 1.93 | 2.42 | 0.89 | 0.49 | 0.05 | 0.35 | 0.79 | 0.84 | 0.74 | 0.48 |
| B1 | 2065 | 0.42 | 0.64 | 2.54 | 1.42 | 0.97 | 0.72 | 0.22 | 0.37 | 0.40 | 0.56 | 0.56 | 0.47 |
| B1 | 2082 | 0.56 | 0.53 | 1.68 | 1.66 | 0.71 | 0.32 | 0.39 | 0.35 | 0.63 | 1.45 | 0.98 | 0.84 |
| B1 | 2083 | 0.94 | 1.01 | 2.36 | 0.95 | 0.73 | 0.41 | 0.28 | 0.34 | 0.66 | 0.56 | 1.07 | 0.88 |
| B1 | 2084 | 0.78 | 0.76 | 2.40 | 1.50 | 0.85 | 0.35 | 0.18 | 0.13 | 0.51 | 0.64 | 0.76 | 0.49 |
| B1 | 2085 | 0.56 | 0.77 | 2.15 | 1.65 | 1.08 | 0.27 | 0.12 | 0.30 | 0.70 | 0.89 | 0.93 | 0.78 |
| B1 | 2086 | 0.80 | 0.79 | 1.93 | 1.96 | 0.57 | 0.37 | 0.20 | 0.22 | 0.46 | 0.75 | 1.04 | 0.90 |
| B1 | 2087 | 0.60 | 0.73 | 2.01 | 1.74 | 1.08 | 0.24 | 0.36 | 0.56 | 0.79 | 0.60 | 0.79 | 0.68 |
| B1 | 2088 | 0.90 | 0.86 | 1.77 | 1.55 | 0.63 | 0.16 | 0.18 | 0.36 | 0.64 | 0.94 | 0.66 | 0.65 |
| B1 | 2089 | 0.53 | 1.00 | 2.70 | 1.52 | 0.71 | 0.32 | 0.19 | 0.42 | 0.39 | 0.61 | 0.95 | 0.46 |
| B1 | 2090 | 0.55 | 1.09 | 1.62 | 1.95 | 1.06 | 0.47 | 0.12 | 0.14 | 0.38 | 0.92 | 0.89 | 1.08 |
| B1 | 2091 | 0.48 | 1.29 | 2.04 | 1.42 | 0.54 | 0.34 | 0.11 | 0.20 | 1.01 | 1.07 | 1.23 | 0.74 |
| B1 | 2092 | 0.65 | 0.96 | 2.04 | 1.13 | 1.01 | 0.62 | 0.17 | 0.43 | 1.18 | 0.66 | 0.85 | 0.78 |
| B1 | 2093 | 0.57 | 0.93 | 1.93 | 1.27 | 0.50 | 0.33 | 0.11 | 0.19 | 0.38 | 0.49 | 1.03 | 0.79 |
| B1 | 2094 | 0.57 | 0.76 | 2.16 | 1.78 | 0.70 | 0.32 | 0.20 | 0.21 | 0.40 | 0.68 | 1.00 | 0.55 |
| B1 | 2095 | 0.64 | 1.00 | 1.91 | 1.74 | 0.86 | 0.17 | 0.25 | 0.25 | 0.39 | 0.64 | 1.05 | 0.65 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| B1 | 2096 | 0.93 | 0.81 | 2.07 | 1.65 | 0.72 | 0.47 | 0.20 | 0.30 | 0.83 | 0.68 | 0.77 | 0.83 |
| B1 | 2097 | 0.67 | 0.83 | 2.11 | 1.48 | 0.58 | 0.61 | 0.33 | 0.48 | 0.71 | 1.00 | 1.02 | 0.62 |
| B1 | 2098 | 0.84 | 0.75 | 2.08 | 1.97 | 0.67 | 0.37 | 0.35 | 0.24 | 0.54 | 0.68 | 0.98 | 0.55 |
| B1 | 2099 | 0.94 | 0.87 | 1.93 | 1.42 | 1.32 | 0.45 | 0.17 | 0.19 | 0.36 | 0.86 | 1.16 | 0.99 |
| B1 | 2100 | 0.58 | 1.23 | 1.92 | 1.64 | 0.69 | 0.64 | 0.07 | 0.30 | 0.57 | 0.36 | 0.61 | 0.65 |

**Table 28. SWB output of monthly temperature means of historical record and three emission scenarios.**

| Scenario | Year | Jan.<br>tmp.<br>(°F) | Feb.<br>tmp.<br>(°F) | Mar.<br>tmp.<br>(°F) | Apr.<br>tmp.<br>(°F) | May<br>tmp.<br>(°F) | Jun.<br>tmp.<br>(°F) | Jul.<br>tmp.<br>(°F) | Aug.<br>tmp.<br>(°F) | Sep.<br>tmp.<br>(°F) | Oct.<br>tmp.<br>(°F) | Nov.<br>tmp.<br>(°F) | Dec.<br>tmp.<br>(°F) |
|----------|------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Historic | 1954 | 12.4                 | 27.5                 | 25.7                 | 44.2                 | 49.0                | 66.5                 | 68.5                 | 64.9                 | 56.0                 | 44.5                 | 34.7                 | 20.4                 |
| Historic | 1955 | 12.3                 | 14.3                 | 22.7                 | 48.5                 | 57.6                | 63.2                 | 73.1                 | 70.9                 | 59.0                 | 48.6                 | 27.0                 | 13.6                 |
| Historic | 1956 | 15.2                 | 14.2                 | 22.8                 | 39.2                 | 54.0                | 66.9                 | 65.5                 | 66.7                 | 55.5                 | 52.8                 | 32.0                 | 21.0                 |
| Historic | 1957 | 7.5                  | 18.4                 | 28.8                 | 44.4                 | 54.0                | 64.1                 | 70.8                 | 66.3                 | 56.0                 | 46.0                 | 31.4                 | 20.0                 |
| Historic | 1958 | 18.6                 | 13.6                 | 29.6                 | 44.1                 | 54.1                | 59.4                 | 66.5                 | 65.9                 | 58.8                 | 49.7                 | 33.6                 | 11.9                 |
| Historic | 1961 | 14.0                 | 22.7                 | 30.0                 | 39.2                 | 50.8                | 64.0                 | 67.7                 | 67.3                 | 57.4                 | 47.1                 | 29.4                 | 15.8                 |
| Historic | 1964 | 18.8                 | 19.6                 | 26.0                 | 44.8                 | 60.5                | 65.3                 | 71.4                 | 65.0                 | 56.9                 | 45.3                 | 35.8                 | 14.3                 |
| Historic | 1965 | 10.9                 | 12.7                 | 21.8                 | 39.6                 | 59.9                | 63.4                 | 67.1                 | 65.3                 | 53.8                 | 48.1                 | 32.4                 | 25.8                 |
| Historic | 1966 | 5.7                  | 18.6                 | 32.1                 | 40.5                 | 51.2                | 66.6                 | 72.0                 | 64.7                 | 57.0                 | 45.4                 | 31.1                 | 18.8                 |
| Historic | 1967 | 16.4                 | 9.9                  | 27.8                 | 43.3                 | 50.1                | 65.3                 | 66.8                 | 64.2                 | 57.1                 | 45.6                 | 29.3                 | 20.0                 |
| Historic | 1970 | 6.5                  | 13.9                 | 24.0                 | 41.2                 | 57.5                | 67.9                 | 72.2                 | 68.2                 | 59.8                 | 49.7                 | 30.5                 | 18.2                 |
| Historic | 1971 | 6.1                  | 15.8                 | 23.4                 | 42.2                 | 52.0                | 67.9                 | 64.7                 | 64.2                 | 59.8                 | 53.7                 | 33.0                 | 19.5                 |
| Historic | 1974 | 12.5                 | 14.9                 | 27.7                 | 44.6                 | 49.1                | 70.3                 | 68.4                 | 63.1                 | 49.1                 | 43.9                 | 30.4                 | 20.3                 |
| Historic | 1975 | 12.4                 | 13.2                 | 22.3                 | 38.4                 | 60.1                | 64.8                 | 70.3                 | 65.9                 | 52.5                 | 48.2                 | 36.6                 | 17.6                 |
| Historic | 1976 | 7.4                  | 20.9                 | 25.7                 | 43.3                 | 50.7                | 64.5                 | 66.9                 | 63.2                 | 53.9                 | 38.8                 | 22.6                 | 5.5                  |
| Historic | 1977 | -2.4                 | 15.2                 | 33.5                 | 46.6                 | 61.7                | 60.8                 | 68.6                 | 60.0                 | 56.8                 | 44.3                 | 31.1                 | 15.0                 |
| Historic | 1978 | 7.5                  | 7.7                  | 24.0                 | 40.0                 | 55.1                | 61.2                 | 65.0                 | 65.3                 | 58.9                 | 42.6                 | 28.9                 | 10.8                 |
| Historic | 1979 | 0.6                  | 5.9                  | 25.7                 | 38.8                 | 49.2                | 60.7                 | 66.8                 | 62.7                 | 57.3                 | 43.3                 | 29.9                 | 22.4                 |
| Historic | 1980 | 12.6                 | 12.9                 | 22.6                 | 43.5                 | 55.9                | 61.1                 | 67.7                 | 64.7                 | 53.5                 | 40.3                 | 32.5                 | 15.8                 |
| Historic | 1981 | 12.7                 | 19.1                 | 31.2                 | 43.9                 | 51.9                | 62.1                 | 65.6                 | 64.6                 | 53.4                 | 41.5                 | 34.5                 | 17.1                 |
| Historic | 1982 | 1.3                  | 11.0                 | 24.8                 | 37.1                 | 58.7                | 56.3                 | 67.4                 | 61.9                 | 53.2                 | 46.0                 | 30.6                 | 24.2                 |
| Historic | 1983 | 17.7                 | 24.1                 | 31.4                 | 38.9                 | 48.2                | 62.8                 | 71.4                 | 68.9                 | 57.2                 | 45.6                 | 33.7                 | 6.0                  |
| Historic | 1984 | 10.0                 | 25.4                 | 21.5                 | 45.4                 | 49.8                | 64.6                 | 65.3                 | 67.3                 | 53.9                 | 48.4                 | 30.1                 | 17.7                 |
| Historic | 1985 | 9.9                  | 12.1                 | 31.8                 | 45.1                 | 57.4                | 59.1                 | 65.6                 | 63.6                 | 56.3                 | 44.2                 | 25.3                 | 5.2                  |
| Historic | 1986 | 12.2                 | 12.5                 | 28.1                 | 46.9                 | 57.1                | 62.6                 | 68.7                 | 61.8                 | 56.5                 | 43.9                 | 26.0                 | 20.3                 |
| Historic | 1987 | 17.6                 | 23.9                 | 33.4                 | 45.7                 | 56.3                | 66.3                 | 70.7                 | 65.3                 | 57.4                 | 38.7                 | 34.3                 | 24.5                 |
| Historic | 1988 | 6.9                  | 8.7                  | 27.9                 | 41.9                 | 57.9                | 66.2                 | 70.8                 | 69.6                 | 57.0                 | 39.3                 | 33.6                 | 16.0                 |
| Historic | 1989 | 17.4                 | 6.3                  | 21.2                 | 39.0                 | 53.3                | 61.6                 | 69.3                 | 66.3                 | 55.8                 | 46.9                 | 25.8                 | 5.0                  |
| Historic | 1990 | 20.9                 | 15.9                 | 30.3                 | 44.4                 | 50.5                | 63.1                 | 66.6                 | 65.5                 | 58.7                 | 43.2                 | 35.1                 | 16.4                 |
| Historic | 1991 | 8.1                  | 17.6                 | 29.0                 | 44.8                 | 58.4                | 68.0                 | 66.9                 | 67.5                 | 53.9                 | 43.4                 | 25.1                 | 17.7                 |
| Historic | 1992 | 18.1                 | 22.0                 | 26.6                 | 39.1                 | 55.1                | 59.9                 | 61.8                 | 61.6                 | 54.5                 | 43.5                 | 28.7                 | 18.9                 |

|          |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Historic | 1993 | 11.1 | 14.4 | 27.5 | 37.4 | 53.3 | 60.1 | 66.7 | 66.2 | 50.6 | 42.2 | 28.2 | 20.1 |
| Historic | 1994 | 1.5  | 9.9  | 28.8 | 40.3 | 54.0 | 65.6 | 65.8 | 62.9 | 59.9 | 47.8 | 35.3 | 23.8 |
| Historic | 1995 | 15.4 | 15.1 | 30.5 | 35.6 | 52.8 | 68.6 | 68.5 | 70.6 | 54.2 | 45.7 | 21.9 | 13.5 |
| Historic | 1996 | 8.1  | 12.3 | 19.8 | 36.9 | 50.7 | 63.1 | 64.0 | 65.8 | 57.2 | 45.3 | 24.7 | 17.0 |
| Historic | 1997 | 10.0 | 17.6 | 25.9 | 39.4 | 47.6 | 65.0 | 66.5 | 61.5 | 57.9 | 45.5 | 28.5 | 24.9 |
| Historic | 1998 | 18.3 | 30.0 | 29.2 | 46.4 | 60.7 | 63.0 | 68.6 | 68.2 | 61.6 | 47.7 | 35.6 | 22.8 |
| Historic | 1999 | 8.7  | 23.1 | 29.2 | 46.1 | 57.3 | 64.8 | 71.4 | 64.5 | 56.0 | 43.6 | 37.8 | 19.7 |
| Historic | 2000 | 11.5 | 21.2 | 36.6 | 41.3 | 55.9 | 61.6 | 66.8 | 66.4 | 56.7 | 48.5 | 31.0 | 7.9  |
| Historic | 2001 | 16.9 | 12.8 | 26.2 | 44.9 | 56.2 | 63.5 | 68.1 | 67.9 | 56.1 | 43.7 | 40.3 | 25.1 |
| Historic | 2002 | 21.7 | 23.7 | 22.1 | 41.0 | 49.5 | 65.9 | 72.6 | 66.8 | 60.1 | 40.6 | 29.7 | 22.3 |
| Historic | 2003 | 11.5 | 8.8  | 27.0 | 41.4 | 52.7 | 62.8 | 67.8 | 69.4 | 58.5 | 44.9 | 30.3 | 22.0 |
| Historic | 2004 | 7.1  | 16.8 | 30.3 | 42.0 | 50.9 | 60.9 | 65.8 | 60.5 | 61.4 | 45.7 | 34.0 | 17.6 |
| Historic | 2005 | 10.8 | 21.2 | 23.8 | 45.8 | 51.4 | 69.2 | 70.3 | 67.4 | 61.4 | 47.6 | 31.8 | 17.0 |
| Historic | 2006 | 24.9 | 14.0 | 29.2 | 47.6 | 55.2 | 64.5 | 72.0 | 66.4 | 54.5 | 41.1 | 34.8 | 25.0 |
| Historic | 2007 | 18.7 | 9.5  | 32.1 | 41.7 | 59.2 | 67.1 | 69.7 | 67.7 | 60.3 | 51.4 | 30.8 | 14.5 |
| Historic | 2008 | 13.5 | 10.1 | 21.7 | 41.8 | 51.1 | 63.6 | 68.6 | 66.4 | 60.1 | 45.2 | 31.3 | 10.4 |
| Historic | 2009 | 2.3  | 16.9 | 26.5 | 41.2 | 54.5 | 63.3 | 63.4 | 64.4 | 60.6 | 40.3 | 38.1 | 16.0 |
| A1B      | 2047 | 15.4 | 20.0 | 31.1 | 46.5 | 56.9 | 65.9 | 70.9 | 69.4 | 59.8 | 49.0 | 35.3 | 24.7 |
| A1B      | 2048 | 19.4 | 22.3 | 31.2 | 45.9 | 56.9 | 67.7 | 71.5 | 70.0 | 61.5 | 49.2 | 36.2 | 22.6 |
| A1B      | 2049 | 18.7 | 20.0 | 32.9 | 45.0 | 59.1 | 66.1 | 70.5 | 69.1 | 59.7 | 49.6 | 35.7 | 24.6 |
| A1B      | 2050 | 18.1 | 23.7 | 31.7 | 46.8 | 60.5 | 68.3 | 71.6 | 68.5 | 60.4 | 50.1 | 35.7 | 24.3 |
| A1B      | 2051 | 17.0 | 22.8 | 31.1 | 47.0 | 58.3 | 68.1 | 73.5 | 70.9 | 62.3 | 51.0 | 36.8 | 23.6 |
| A1B      | 2052 | 18.3 | 22.5 | 34.3 | 47.6 | 59.2 | 66.3 | 72.4 | 69.7 | 62.3 | 51.2 | 35.3 | 22.4 |
| A1B      | 2053 | 20.6 | 20.9 | 30.9 | 46.7 | 59.5 | 68.7 | 71.7 | 68.9 | 62.3 | 49.8 | 36.6 | 24.0 |
| A1B      | 2054 | 19.7 | 20.2 | 31.8 | 46.6 | 60.1 | 68.0 | 72.5 | 70.0 | 62.1 | 51.3 | 36.2 | 24.9 |
| A1B      | 2055 | 17.6 | 22.5 | 33.8 | 46.7 | 58.6 | 67.0 | 72.2 | 69.8 | 62.4 | 50.8 | 37.2 | 25.4 |
| A1B      | 2056 | 20.0 | 21.1 | 34.1 | 46.6 | 59.6 | 69.1 | 73.5 | 72.2 | 61.1 | 51.0 | 37.9 | 23.6 |
| A1B      | 2057 | 19.6 | 23.8 | 31.2 | 47.5 | 59.6 | 67.8 | 72.1 | 70.6 | 61.5 | 49.6 | 36.8 | 23.4 |
| A1B      | 2058 | 20.7 | 23.8 | 30.8 | 45.9 | 59.4 | 68.1 | 71.7 | 70.5 | 62.8 | 50.8 | 36.1 | 23.3 |
| A1B      | 2059 | 20.9 | 23.7 | 33.7 | 46.2 | 60.1 | 68.4 | 73.3 | 71.0 | 62.6 | 51.2 | 36.4 | 21.3 |
| A1B      | 2060 | 16.3 | 21.9 | 29.8 | 45.7 | 59.2 | 69.7 | 72.4 | 70.8 | 62.2 | 51.3 | 37.0 | 25.6 |
| A1B      | 2061 | 19.0 | 20.0 | 33.0 | 47.9 | 59.8 | 67.9 | 72.6 | 71.0 | 61.5 | 50.2 | 36.2 | 25.0 |
| A1B      | 2062 | 22.1 | 24.0 | 32.7 | 48.7 | 59.9 | 68.6 | 73.6 | 70.7 | 63.0 | 52.2 | 37.7 | 26.1 |
| A1B      | 2063 | 20.1 | 23.3 | 33.3 | 46.9 | 60.1 | 69.0 | 73.0 | 70.4 | 63.1 | 52.4 | 39.1 | 26.6 |
| A1B      | 2064 | 22.2 | 21.0 | 33.5 | 47.3 | 59.6 | 67.1 | 74.4 | 71.1 | 62.9 | 51.8 | 36.6 | 26.0 |
| A1B      | 2065 | 20.7 | 25.5 | 32.5 | 49.1 | 58.9 | 68.8 | 74.7 | 71.1 | 61.9 | 52.1 | 38.9 | 26.0 |
| A1B      | 2082 | 20.8 | 25.0 | 36.0 | 49.4 | 60.2 | 70.5 | 74.4 | 73.9 | 66.1 | 53.1 | 38.3 | 28.2 |
| A1B      | 2083 | 20.6 | 25.7 | 34.5 | 49.2 | 63.0 | 69.8 | 75.2 | 73.5 | 64.6 | 52.6 | 39.3 | 26.1 |
| A1B      | 2084 | 21.9 | 24.5 | 32.9 | 48.7 | 61.8 | 69.1 | 73.8 | 71.9 | 63.1 | 52.4 | 37.6 | 26.5 |
| A1B      | 2085 | 22.1 | 22.7 | 33.5 | 48.8 | 61.0 | 69.3 | 73.3 | 72.2 | 64.0 | 53.2 | 39.7 | 26.3 |
| A1B      | 2086 | 21.9 | 25.0 | 33.6 | 51.2 | 60.9 | 68.8 | 74.1 | 72.3 | 63.4 | 52.3 | 38.2 | 26.4 |

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A1B | 2087 | 22.8 | 23.7 | 33.4 | 48.8 | 61.4 | 70.9 | 74.9 | 71.8 | 63.9 | 53.9 | 38.8 | 28.9 |
| A1B | 2088 | 23.6 | 24.3 | 36.3 | 49.6 | 62.7 | 70.1 | 75.8 | 73.1 | 64.8 | 53.6 | 40.3 | 27.5 |
| A1B | 2089 | 21.7 | 24.8 | 34.7 | 48.3 | 62.0 | 68.6 | 72.7 | 72.4 | 65.1 | 53.3 | 38.2 | 27.1 |
| A1B | 2090 | 21.3 | 23.9 | 33.6 | 49.0 | 61.2 | 70.6 | 74.0 | 73.1 | 64.0 | 53.6 | 38.5 | 26.7 |
| A1B | 2091 | 23.5 | 25.4 | 34.1 | 50.7 | 61.7 | 69.6 | 75.2 | 73.4 | 64.0 | 54.8 | 39.4 | 29.1 |
| A1B | 2092 | 23.2 | 24.5 | 35.4 | 49.6 | 61.4 | 70.1 | 73.8 | 72.2 | 64.3 | 52.1 | 37.7 | 27.3 |
| A1B | 2093 | 19.8 | 24.0 | 35.3 | 50.8 | 62.5 | 70.6 | 74.7 | 72.9 | 63.5 | 53.1 | 38.6 | 27.2 |
| A1B | 2094 | 23.0 | 25.2 | 34.6 | 48.9 | 63.8 | 70.3 | 74.8 | 73.0 | 65.1 | 56.2 | 38.3 | 27.1 |
| A1B | 2095 | 24.1 | 26.3 | 35.2 | 50.2 | 62.1 | 70.8 | 75.2 | 73.2 | 65.4 | 53.3 | 38.8 | 27.8 |
| A1B | 2096 | 25.1 | 25.2 | 34.7 | 50.5 | 63.0 | 70.3 | 75.3 | 72.2 | 66.0 | 54.2 | 38.4 | 26.0 |
| A1B | 2097 | 24.8 | 22.5 | 33.9 | 49.4 | 62.4 | 69.4 | 74.3 | 73.0 | 64.5 | 54.3 | 40.3 | 28.0 |
| A1B | 2098 | 24.8 | 24.8 | 36.0 | 50.5 | 61.5 | 70.1 | 74.3 | 72.4 | 63.9 | 54.3 | 37.9 | 27.5 |
| A1B | 2099 | 21.7 | 26.5 | 34.3 | 48.8 | 61.0 | 69.7 | 74.4 | 72.8 | 64.0 | 55.3 | 41.9 | 30.0 |
| A1B | 2100 | 23.7 | 24.6 | 33.5 | 50.3 | 61.5 | 70.1 | 74.1 | 72.2 | 65.4 | 54.9 | 40.4 | 28.0 |
| A2  | 2047 | 13.9 | 17.9 | 25.8 | 43.4 | 57.1 | 65.1 | 70.8 | 68.4 | 58.7 | 46.4 | 35.6 | 26.1 |
| A2  | 2048 | 19.2 | 19.7 | 30.1 | 46.3 | 59.1 | 66.7 | 71.4 | 69.3 | 59.3 | 49.8 | 35.6 | 22.7 |
| A2  | 2049 | 20.8 | 23.2 | 31.7 | 44.0 | 56.2 | 63.5 | 71.0 | 70.5 | 62.5 | 48.9 | 36.0 | 24.5 |
| A2  | 2050 | 16.4 | 19.2 | 30.9 | 44.7 | 57.6 | 65.4 | 70.9 | 68.8 | 60.9 | 49.2 | 34.6 | 22.7 |
| A2  | 2051 | 22.5 | 20.9 | 31.7 | 47.4 | 60.3 | 68.7 | 70.9 | 70.0 | 61.7 | 50.3 | 35.3 | 23.8 |
| A2  | 2052 | 16.4 | 18.7 | 33.4 | 46.5 | 58.2 | 68.3 | 72.4 | 70.5 | 62.5 | 49.7 | 35.8 | 24.0 |
| A2  | 2053 | 20.6 | 24.0 | 30.7 | 43.5 | 57.5 | 67.6 | 71.9 | 70.4 | 59.9 | 51.0 | 35.9 | 24.9 |
| A2  | 2054 | 19.4 | 19.4 | 31.1 | 45.0 | 57.8 | 66.9 | 72.4 | 71.0 | 61.3 | 50.5 | 36.7 | 23.7 |
| A2  | 2055 | 18.3 | 23.7 | 30.2 | 44.7 | 57.8 | 67.6 | 72.1 | 70.6 | 61.5 | 50.8 | 37.5 | 24.8 |
| A2  | 2056 | 21.5 | 17.6 | 29.8 | 47.2 | 57.9 | 67.2 | 72.5 | 69.5 | 59.6 | 48.8 | 36.9 | 24.2 |
| A2  | 2057 | 16.5 | 19.3 | 33.4 | 48.9 | 60.0 | 68.5 | 72.9 | 70.2 | 61.3 | 50.2 | 35.7 | 26.2 |
| A2  | 2058 | 19.5 | 23.7 | 33.4 | 48.1 | 58.9 | 67.2 | 72.6 | 70.9 | 62.6 | 49.9 | 37.0 | 22.7 |
| A2  | 2059 | 18.8 | 18.5 | 33.7 | 48.5 | 60.5 | 68.1 | 72.3 | 70.6 | 62.1 | 50.4 | 37.9 | 25.0 |
| A2  | 2060 | 19.0 | 19.5 | 32.5 | 47.1 | 60.4 | 68.3 | 73.9 | 71.5 | 60.9 | 50.5 | 35.4 | 24.3 |
| A2  | 2061 | 16.0 | 25.8 | 32.5 | 45.7 | 60.1 | 69.1 | 72.4 | 71.6 | 61.9 | 51.6 | 37.4 | 25.6 |
| A2  | 2062 | 18.0 | 20.2 | 30.7 | 46.5 | 59.8 | 67.2 | 73.0 | 72.8 | 62.6 | 51.2 | 38.9 | 23.2 |
| A2  | 2063 | 17.5 | 21.3 | 31.3 | 45.9 | 59.4 | 69.9 | 72.8 | 71.8 | 61.7 | 52.6 | 40.8 | 24.8 |
| A2  | 2064 | 18.2 | 21.7 | 31.6 | 48.2 | 61.0 | 68.1 | 72.6 | 71.6 | 61.4 | 52.3 | 38.5 | 26.0 |
| A2  | 2065 | 18.1 | 21.9 | 34.9 | 47.4 | 59.0 | 67.9 | 73.1 | 72.7 | 62.9 | 50.8 | 36.6 | 22.9 |
| A2  | 2082 | 21.8 | 24.7 | 35.1 | 48.1 | 63.1 | 70.3 | 74.2 | 72.4 | 65.5 | 53.6 | 41.8 | 28.4 |
| A2  | 2083 | 20.5 | 23.4 | 33.1 | 49.4 | 63.4 | 67.9 | 75.0 | 72.9 | 63.7 | 55.4 | 38.4 | 27.4 |
| A2  | 2084 | 20.7 | 21.7 | 33.6 | 48.8 | 62.5 | 71.4 | 75.4 | 72.5 | 64.1 | 54.3 | 39.3 | 25.9 |
| A2  | 2085 | 20.7 | 25.7 | 35.2 | 51.1 | 62.2 | 70.4 | 76.9 | 75.2 | 64.6 | 52.1 | 38.7 | 26.9 |
| A2  | 2086 | 23.7 | 23.9 | 33.8 | 51.9 | 62.2 | 69.3 | 75.2 | 72.9 | 64.9 | 55.0 | 40.2 | 29.2 |
| A2  | 2087 | 20.0 | 22.6 | 35.7 | 49.2 | 62.9 | 69.4 | 74.8 | 74.9 | 64.5 | 53.4 | 39.0 | 28.5 |
| A2  | 2088 | 25.3 | 23.0 | 33.0 | 47.8 | 60.3 | 70.9 | 74.8 | 73.8 | 64.2 | 55.7 | 40.6 | 26.9 |
| A2  | 2089 | 23.7 | 28.8 | 35.9 | 52.3 | 65.4 | 71.0 | 77.2 | 76.1 | 65.7 | 53.9 | 40.2 | 27.8 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A2 | 2090 | 22.9 | 28.3 | 38.8 | 53.0 | 63.9 | 72.6 | 77.1 | 75.9 | 66.5 | 56.1 | 43.7 | 29.1 |
| A2 | 2091 | 25.5 | 25.8 | 34.3 | 49.4 | 64.3 | 72.1 | 74.9 | 73.8 | 66.2 | 55.0 | 41.3 | 29.7 |
| A2 | 2092 | 25.7 | 27.8 | 35.4 | 51.1 | 63.4 | 71.9 | 77.4 | 75.8 | 65.6 | 55.4 | 44.3 | 29.0 |
| A2 | 2093 | 21.7 | 22.6 | 31.0 | 49.6 | 64.6 | 74.8 | 78.1 | 74.2 | 66.7 | 55.9 | 41.7 | 31.1 |
| A2 | 2094 | 25.3 | 28.4 | 37.1 | 54.2 | 63.6 | 72.2 | 76.4 | 75.3 | 67.2 | 55.6 | 42.0 | 30.4 |
| A2 | 2095 | 24.4 | 25.8 | 35.6 | 53.1 | 65.3 | 71.7 | 78.3 | 74.9 | 67.2 | 57.3 | 42.5 | 30.6 |
| A2 | 2096 | 25.1 | 27.5 | 36.1 | 51.9 | 64.0 | 73.0 | 76.5 | 75.6 | 65.8 | 55.0 | 41.4 | 29.5 |
| A2 | 2097 | 24.4 | 27.2 | 35.0 | 49.8 | 63.4 | 72.2 | 78.2 | 75.7 | 66.6 | 54.0 | 44.1 | 27.6 |
| A2 | 2098 | 23.2 | 24.6 | 36.9 | 52.4 | 62.5 | 71.3 | 76.5 | 76.5 | 65.3 | 56.4 | 42.2 | 27.7 |
| A2 | 2099 | 23.3 | 27.4 | 34.9 | 50.1 | 63.4 | 72.0 | 77.3 | 75.2 | 67.7 | 56.2 | 43.9 | 30.3 |
| A2 | 2100 | 24.7 | 26.1 | 39.4 | 53.8 | 66.2 | 72.3 | 76.0 | 76.5 | 65.9 | 54.5 | 40.9 | 31.4 |
| B1 | 2047 | 16.0 | 19.5 | 31.2 | 44.9 | 57.1 | 64.2 | 70.0 | 68.3 | 60.2 | 48.2 | 35.4 | 21.1 |
| B1 | 2048 | 15.1 | 18.0 | 27.6 | 43.6 | 56.6 | 65.7 | 70.6 | 68.2 | 60.7 | 49.6 | 33.7 | 21.5 |
| B1 | 2049 | 14.3 | 18.0 | 31.2 | 44.7 | 58.7 | 66.0 | 70.3 | 69.2 | 60.6 | 50.4 | 33.0 | 24.2 |
| B1 | 2050 | 15.5 | 19.0 | 29.0 | 45.8 | 58.1 | 67.1 | 71.0 | 69.3 | 60.0 | 48.7 | 34.7 | 23.0 |
| B1 | 2051 | 17.1 | 20.6 | 32.5 | 44.7 | 57.4 | 67.9 | 70.7 | 68.4 | 61.0 | 51.6 | 35.5 | 22.9 |
| B1 | 2052 | 19.8 | 20.4 | 32.7 | 46.5 | 58.2 | 66.7 | 71.2 | 68.0 | 60.8 | 49.7 | 36.1 | 24.3 |
| B1 | 2053 | 18.8 | 19.3 | 29.0 | 45.8 | 59.2 | 67.2 | 71.0 | 69.2 | 60.0 | 49.4 | 36.8 | 22.5 |
| B1 | 2054 | 14.9 | 21.5 | 32.4 | 45.3 | 59.3 | 67.1 | 71.9 | 69.9 | 59.2 | 49.3 | 35.3 | 20.2 |
| B1 | 2055 | 16.1 | 16.5 | 29.1 | 45.9 | 59.2 | 66.2 | 70.1 | 68.5 | 59.7 | 50.1 | 35.8 | 20.7 |
| B1 | 2056 | 20.5 | 18.9 | 30.1 | 45.3 | 56.6 | 66.5 | 71.3 | 68.3 | 61.9 | 49.3 | 35.5 | 23.1 |
| B1 | 2057 | 16.3 | 19.0 | 30.6 | 44.9 | 56.6 | 66.2 | 71.2 | 68.4 | 60.2 | 50.4 | 35.3 | 21.2 |
| B1 | 2058 | 16.0 | 19.5 | 31.8 | 45.1 | 58.0 | 67.0 | 70.9 | 69.2 | 60.2 | 49.8 | 34.8 | 23.3 |
| B1 | 2059 | 20.9 | 21.5 | 32.2 | 47.6 | 59.3 | 66.2 | 71.5 | 68.9 | 61.4 | 49.8 | 36.4 | 21.6 |
| B1 | 2060 | 21.0 | 22.6 | 30.8 | 45.3 | 57.8 | 67.1 | 71.9 | 69.6 | 62.3 | 50.4 | 34.1 | 20.7 |
| B1 | 2061 | 17.8 | 21.0 | 28.4 | 45.9 | 59.3 | 67.3 | 71.2 | 69.6 | 60.4 | 50.0 | 34.7 | 23.7 |
| B1 | 2062 | 18.5 | 20.2 | 31.6 | 46.7 | 59.4 | 67.5 | 71.1 | 70.3 | 61.3 | 49.2 | 34.7 | 23.5 |
| B1 | 2063 | 16.1 | 23.0 | 30.0 | 45.3 | 59.2 | 67.3 | 72.1 | 70.3 | 60.3 | 50.0 | 35.2 | 21.8 |
| B1 | 2064 | 17.3 | 19.4 | 30.2 | 46.0 | 58.8 | 65.9 | 71.3 | 69.5 | 61.3 | 49.9 | 36.7 | 22.7 |
| B1 | 2065 | 16.5 | 19.7 | 30.7 | 45.5 | 58.4 | 68.6 | 71.7 | 69.1 | 61.3 | 50.7 | 35.4 | 23.3 |
| B1 | 2082 | 18.0 | 19.8 | 29.8 | 49.1 | 60.7 | 68.0 | 72.0 | 69.4 | 62.2 | 51.5 | 37.2 | 25.2 |
| B1 | 2083 | 21.1 | 22.6 | 33.1 | 47.8 | 60.5 | 67.7 | 72.2 | 69.6 | 61.0 | 51.2 | 36.5 | 24.7 |
| B1 | 2084 | 21.6 | 22.8 | 34.0 | 47.9 | 60.1 | 69.2 | 72.3 | 69.9 | 63.6 | 52.1 | 34.9 | 21.9 |
| B1 | 2085 | 18.5 | 21.6 | 32.2 | 46.6 | 58.7 | 69.3 | 72.7 | 71.1 | 61.6 | 50.0 | 37.2 | 25.9 |
| B1 | 2086 | 21.5 | 22.1 | 30.5 | 45.8 | 60.9 | 67.2 | 72.0 | 70.6 | 61.8 | 52.2 | 35.6 | 24.9 |
| B1 | 2087 | 20.9 | 21.4 | 33.2 | 47.5 | 60.2 | 67.6 | 72.6 | 69.2 | 60.9 | 52.6 | 37.1 | 23.3 |
| B1 | 2088 | 19.7 | 20.8 | 30.2 | 45.5 | 59.0 | 67.3 | 71.5 | 69.7 | 62.1 | 51.7 | 38.8 | 24.5 |
| B1 | 2089 | 16.8 | 20.9 | 31.4 | 47.2 | 59.2 | 67.0 | 73.5 | 71.8 | 62.7 | 51.8 | 36.3 | 22.3 |
| B1 | 2090 | 19.2 | 22.9 | 30.8 | 46.6 | 59.2 | 67.4 | 73.0 | 71.6 | 61.3 | 49.6 | 36.2 | 24.4 |
| B1 | 2091 | 17.3 | 22.3 | 34.4 | 48.0 | 60.4 | 67.5 | 72.1 | 70.6 | 61.6 | 50.7 | 37.6 | 24.8 |
| B1 | 2092 | 20.1 | 23.0 | 33.8 | 47.0 | 59.6 | 66.3 | 72.3 | 70.3 | 62.4 | 51.3 | 38.3 | 25.1 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| B1 | 2093 | 20.2 | 22.6 | 34.2 | 48.7 | 62.1 | 69.3 | 72.7 | 71.6 | 63.5 | 52.6 | 37.2 | 24.2 |
| B1 | 2094 | 17.6 | 20.9 | 33.8 | 47.9 | 59.8 | 68.2 | 72.0 | 70.9 | 62.5 | 51.0 | 36.4 | 24.7 |
| B1 | 2095 | 18.6 | 23.2 | 33.8 | 48.3 | 60.9 | 67.8 | 72.1 | 68.7 | 62.6 | 52.9 | 37.9 | 23.9 |
| B1 | 2096 | 20.6 | 23.5 | 32.4 | 46.9 | 61.7 | 68.1 | 73.6 | 70.4 | 62.9 | 52.5 | 38.4 | 24.0 |
| B1 | 2097 | 19.4 | 25.0 | 31.7 | 47.5 | 58.8 | 67.2 | 71.9 | 69.6 | 61.9 | 50.8 | 35.0 | 23.8 |
| B1 | 2098 | 21.2 | 21.9 | 31.7 | 47.6 | 59.3 | 67.2 | 71.9 | 70.4 | 62.1 | 50.5 | 38.9 | 23.5 |
| B1 | 2099 | 20.2 | 21.6 | 32.4 | 44.6 | 58.7 | 68.9 | 72.9 | 69.9 | 62.9 | 50.4 | 37.6 | 24.2 |
| B1 | 2100 | 19.9 | 22.2 | 32.1 | 48.6 | 60.6 | 67.4 | 72.7 | 70.9 | 61.7 | 51.7 | 37.4 | 27.1 |

**Table 29. SWB output of monthly ET means of historical record and three emission scenarios.**

| Scenario | Year | Jan.<br>ET<br>(in.) | Feb.<br>ET<br>(in.) | Mar.<br>ET<br>(in.) | Apr.<br>ET<br>(in.) | May<br>ET<br>(in.) | Jun.<br>ET<br>(in.) | Jul.<br>ET<br>(in.) | Aug.<br>ET<br>(in.) | Sep.<br>ET<br>(in.) | Oct.<br>ET<br>(in.) | Nov.<br>ET<br>(in.) | Dec.<br>ET<br>(in.) |
|----------|------|---------------------|---------------------|---------------------|---------------------|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Historic | 1954 | 0.00                | 0.00                | 0.00                | 1.09                | 2.02               | 4.16                | 3.40                | 2.74                | 2.20                | 1.26                | 0.29                | 0.00                |
| Historic | 1955 | 0.00                | 0.00                | 0.00                | 1.41                | 2.65               | 3.89                | 4.09                | 4.33                | 2.03                | 1.31                | 0.06                | 0.00                |
| Historic | 1956 | 0.00                | 0.00                | 0.00                | 0.45                | 2.82               | 3.70                | 3.98                | 3.17                | 1.34                | 0.91                | 0.24                | 0.00                |
| Historic | 1957 | 0.00                | 0.00                | 0.00                | 1.32                | 2.62               | 3.28                | 3.20                | 2.49                | 1.88                | 1.00                | 0.23                | 0.00                |
| Historic | 1958 | 0.00                | 0.00                | 0.00                | 1.03                | 2.73               | 3.39                | 4.16                | 3.03                | 2.50                | 1.50                | 0.48                | 0.00                |
| Historic | 1961 | 0.00                | 0.00                | 0.00                | 0.58                | 2.44               | 3.39                | 3.86                | 4.11                | 2.64                | 1.50                | 0.09                | 0.00                |
| Historic | 1964 | 0.00                | 0.00                | 0.00                | 1.02                | 3.59               | 2.90                | 2.68                | 2.34                | 2.57                | 1.09                | 0.68                | 0.00                |
| Historic | 1965 | 0.00                | 0.00                | 0.00                | 0.55                | 3.69               | 3.67                | 3.76                | 3.67                | 2.22                | 1.53                | 0.23                | 0.00                |
| Historic | 1966 | 0.00                | 0.00                | 0.00                | 0.87                | 2.30               | 3.71                | 3.04                | 3.23                | 1.77                | 1.00                | 0.03                | 0.00                |
| Historic | 1967 | 0.00                | 0.00                | 0.00                | 1.30                | 2.29               | 4.33                | 3.65                | 2.60                | 2.21                | 1.23                | 0.12                | 0.00                |
| Historic | 1970 | 0.00                | 0.00                | 0.00                | 0.84                | 3.19               | 3.75                | 3.72                | 2.26                | 2.21                | 1.49                | 0.24                | 0.00                |
| Historic | 1971 | 0.00                | 0.00                | 0.00                | 1.03                | 2.44               | 3.21                | 2.47                | 3.01                | 2.36                | 2.10                | 0.29                | 0.00                |
| Historic | 1974 | 0.00                | 0.00                | 0.00                | 0.99                | 2.15               | 4.21                | 2.84                | 2.71                | 1.52                | 1.04                | 0.17                | 0.00                |
| Historic | 1975 | 0.00                | 0.00                | 0.00                | 0.73                | 3.11               | 3.76                | 3.15                | 1.84                | 1.89                | 1.23                | 0.62                | 0.00                |
| Historic | 1976 | 0.00                | 0.00                | 0.00                | 1.20                | 2.49               | 2.52                | 2.25                | 2.74                | 1.37                | 0.43                | 0.00                | 0.00                |
| Historic | 1977 | 0.00                | 0.00                | 0.00                | 1.61                | 2.80               | 2.65                | 3.41                | 2.07                | 2.50                | 1.15                | 0.43                | 0.00                |
| Historic | 1978 | 0.00                | 0.00                | 0.00                | 0.63                | 3.10               | 3.70                | 4.56                | 3.26                | 2.76                | 1.07                | 0.28                | 0.00                |
| Historic | 1979 | 0.00                | 0.00                | 0.00                | 0.84                | 2.41               | 3.81                | 3.69                | 3.44                | 2.09                | 0.97                | 0.11                | 0.00                |
| Historic | 1980 | 0.00                | 0.00                | 0.00                | 0.87                | 2.60               | 3.79                | 3.75                | 3.80                | 2.45                | 0.85                | 0.17                | 0.00                |
| Historic | 1981 | 0.00                | 0.00                | 0.00                | 1.18                | 2.49               | 3.35                | 3.07                | 2.49                | 1.86                | 0.98                | 0.43                | 0.00                |
| Historic | 1982 | 0.00                | 0.00                | 0.00                | 0.45                | 3.57               | 2.88                | 3.98                | 2.41                | 2.42                | 1.51                | 0.17                | 0.00                |
| Historic | 1983 | 0.00                | 0.00                | 0.02                | 0.71                | 2.18               | 3.43                | 2.73                | 3.10                | 2.38                | 1.29                | 0.27                | 0.00                |
| Historic | 1984 | 0.00                | 0.00                | 0.00                | 1.11                | 2.23               | 3.74                | 3.55                | 2.81                | 1.94                | 1.55                | 0.05                | 0.00                |
| Historic | 1985 | 0.00                | 0.00                | 0.00                | 1.37                | 3.16               | 3.09                | 3.50                | 3.33                | 2.56                | 1.21                | 0.14                | 0.00                |
| Historic | 1986 | 0.00                | 0.00                | 0.00                | 1.79                | 2.71               | 3.08                | 4.58                | 3.19                | 2.50                | 1.15                | 0.07                | 0.00                |
| Historic | 1987 | 0.00                | 0.00                | 0.00                | 1.51                | 2.75               | 3.09                | 3.06                | 2.28                | 1.42                | 0.46                | 0.28                | 0.00                |
| Historic | 1988 | 0.00                | 0.00                | 0.00                | 0.67                | 2.94               | 2.35                | 3.48                | 3.98                | 2.43                | 0.66                | 0.13                | 0.00                |
| Historic | 1989 | 0.00                | 0.00                | 0.00                | 0.69                | 2.67               | 3.56                | 2.95                | 2.31                | 1.28                | 0.77                | 0.06                | 0.00                |

|          |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Historic | 1990 | 0.00 | 0.00 | 0.00 | 1.38 | 2.47 | 4.00 | 3.65 | 4.00 | 2.87 | 1.13 | 0.38 | 0.00 |
| Historic | 1991 | 0.00 | 0.00 | 0.00 | 1.13 | 3.40 | 4.13 | 3.81 | 4.14 | 2.25 | 1.08 | 0.02 | 0.00 |
| Historic | 1992 | 0.00 | 0.00 | 0.00 | 0.77 | 2.80 | 2.48 | 2.57 | 2.23 | 2.55 | 1.23 | 0.04 | 0.00 |
| Historic | 1993 | 0.00 | 0.00 | 0.00 | 0.70 | 2.84 | 3.94 | 3.99 | 2.77 | 1.83 | 1.10 | 0.00 | 0.00 |
| Historic | 1994 | 0.00 | 0.00 | 0.00 | 0.51 | 2.57 | 3.25 | 3.61 | 2.84 | 2.67 | 1.55 | 0.39 | 0.00 |
| Historic | 1995 | 0.00 | 0.00 | 0.00 | 0.24 | 2.71 | 3.25 | 2.85 | 4.52 | 2.11 | 1.32 | 0.02 | 0.00 |
| Historic | 1996 | 0.00 | 0.00 | 0.00 | 0.59 | 2.39 | 4.12 | 4.17 | 3.87 | 2.52 | 1.29 | 0.03 | 0.00 |
| Historic | 1997 | 0.00 | 0.00 | 0.00 | 0.71 | 2.19 | 4.13 | 3.89 | 2.73 | 2.75 | 1.36 | 0.16 | 0.00 |
| Historic | 1998 | 0.00 | 0.00 | 0.00 | 1.39 | 3.24 | 3.66 | 3.23 | 1.65 | 1.13 | 1.29 | 0.27 | 0.15 |
| Historic | 1999 | 0.00 | 0.00 | 0.00 | 1.51 | 3.16 | 3.00 | 5.07 | 3.95 | 1.82 | 0.89 | 0.37 | 0.00 |
| Historic | 2000 | 0.00 | 0.00 | 0.39 | 1.10 | 2.95 | 4.04 | 3.73 | 3.14 | 2.58 | 1.32 | 0.29 | 0.00 |
| Historic | 2001 | 0.00 | 0.00 | 0.00 | 1.30 | 3.12 | 3.62 | 2.47 | 3.30 | 1.97 | 0.94 | 0.68 | 0.07 |
| Historic | 2002 | 0.00 | 0.00 | 0.00 | 0.79 | 2.31 | 4.44 | 3.90 | 3.44 | 2.88 | 0.85 | 0.11 | 0.00 |
| Historic | 2003 | 0.00 | 0.00 | 0.00 | 0.67 | 2.62 | 3.69 | 2.82 | 2.40 | 1.36 | 0.81 | 0.06 | 0.00 |
| Historic | 2004 | 0.00 | 0.00 | 0.00 | 1.05 | 2.62 | 3.73 | 2.87 | 1.93 | 1.63 | 1.13 | 0.34 | 0.00 |
| Historic | 2005 | 0.00 | 0.00 | 0.00 | 1.17 | 2.42 | 4.26 | 2.46 | 2.22 | 1.60 | 1.35 | 0.26 | 0.00 |
| Historic | 2006 | 0.00 | 0.00 | 0.00 | 1.47 | 2.84 | 2.60 | 2.84 | 4.20 | 1.90 | 0.84 | 0.28 | 0.00 |
| Historic | 2007 | 0.00 | 0.00 | 0.00 | 0.93 | 2.99 | 3.28 | 3.71 | 2.57 | 1.78 | 1.78 | 0.18 | 0.00 |
| Historic | 2008 | 0.00 | 0.00 | 0.00 | 0.78 | 2.41 | 3.90 | 3.08 | 1.86 | 1.48 | 0.84 | 0.23 | 0.00 |
| Historic | 2009 | 0.00 | 0.00 | 0.00 | 0.85 | 2.86 | 3.40 | 2.26 | 3.44 | 1.87 | 0.77 | 0.54 | 0.00 |
| A1B      | 2047 | 0.00 | 0.00 | 0.05 | 1.40 | 2.98 | 3.65 | 3.54 | 3.05 | 2.32 | 1.44 | 0.37 | 0.04 |
| A1B      | 2048 | 0.00 | 0.00 | 0.07 | 1.37 | 2.95 | 3.68 | 3.69 | 3.15 | 2.42 | 1.34 | 0.37 | 0.02 |
| A1B      | 2049 | 0.00 | 0.00 | 0.05 | 1.28 | 3.26 | 3.80 | 3.79 | 3.01 | 2.25 | 1.45 | 0.38 | 0.01 |
| A1B      | 2050 | 0.00 | 0.00 | 0.06 | 1.44 | 3.36 | 3.95 | 3.59 | 2.63 | 2.20 | 1.43 | 0.40 | 0.02 |
| A1B      | 2051 | 0.00 | 0.00 | 0.07 | 1.41 | 3.04 | 3.81 | 3.45 | 3.07 | 2.40 | 1.39 | 0.40 | 0.02 |
| A1B      | 2052 | 0.00 | 0.00 | 0.17 | 1.55 | 3.09 | 3.31 | 3.41 | 2.95 | 2.25 | 1.39 | 0.35 | 0.02 |
| A1B      | 2053 | 0.00 | 0.01 | 0.12 | 1.40 | 3.22 | 4.01 | 3.66 | 3.10 | 2.46 | 1.31 | 0.36 | 0.06 |
| A1B      | 2054 | 0.00 | 0.00 | 0.07 | 1.41 | 3.25 | 3.51 | 3.49 | 3.24 | 2.44 | 1.34 | 0.37 | 0.04 |
| A1B      | 2055 | 0.00 | 0.02 | 0.13 | 1.40 | 3.04 | 3.69 | 3.60 | 3.02 | 2.32 | 1.35 | 0.40 | 0.04 |
| A1B      | 2056 | 0.00 | 0.01 | 0.17 | 1.36 | 3.21 | 4.00 | 3.70 | 3.19 | 2.25 | 1.32 | 0.44 | 0.05 |
| A1B      | 2057 | 0.00 | 0.00 | 0.08 | 1.49 | 3.16 | 3.86 | 3.89 | 3.34 | 2.35 | 1.35 | 0.41 | 0.05 |
| A1B      | 2058 | 0.00 | 0.00 | 0.11 | 1.27 | 3.23 | 3.70 | 3.33 | 3.07 | 2.11 | 1.41 | 0.34 | 0.04 |
| A1B      | 2059 | 0.00 | 0.02 | 0.17 | 1.34 | 3.25 | 3.69 | 3.62 | 3.05 | 2.25 | 1.36 | 0.39 | 0.02 |
| A1B      | 2060 | 0.00 | 0.00 | 0.01 | 1.20 | 3.17 | 3.76 | 3.44 | 2.97 | 2.30 | 1.45 | 0.41 | 0.03 |
| A1B      | 2061 | 0.00 | 0.00 | 0.14 | 1.50 | 3.19 | 3.69 | 3.46 | 2.88 | 2.02 | 1.32 | 0.38 | 0.03 |
| A1B      | 2062 | 0.00 | 0.01 | 0.11 | 1.55 | 3.17 | 3.96 | 3.47 | 2.85 | 2.16 | 1.39 | 0.44 | 0.04 |
| A1B      | 2063 | 0.00 | 0.00 | 0.08 | 1.42 | 3.22 | 3.75 | 3.52 | 3.03 | 2.58 | 1.54 | 0.50 | 0.06 |
| A1B      | 2064 | 0.00 | 0.00 | 0.14 | 1.44 | 3.21 | 3.83 | 3.69 | 2.84 | 2.19 | 1.44 | 0.36 | 0.02 |
| A1B      | 2065 | 0.00 | 0.00 | 0.08 | 1.61 | 3.06 | 3.72 | 3.37 | 2.95 | 2.17 | 1.39 | 0.49 | 0.03 |
| A1B      | 2082 | 0.01 | 0.03 | 0.23 | 1.62 | 3.19 | 3.95 | 3.58 | 2.95 | 2.10 | 1.25 | 0.38 | 0.06 |
| A1B      | 2083 | 0.00 | 0.00 | 0.24 | 1.59 | 3.44 | 3.84 | 3.53 | 3.02 | 2.17 | 1.38 | 0.45 | 0.04 |

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A1B | 2084 | 0.00 | 0.01 | 0.18 | 1.57 | 3.37 | 4.02 | 3.90 | 3.40 | 2.51 | 1.61 | 0.42 | 0.05 |
| A1B | 2085 | 0.01 | 0.01 | 0.11 | 1.56 | 3.32 | 3.98 | 3.96 | 3.35 | 2.44 | 1.46 | 0.50 | 0.09 |
| A1B | 2086 | 0.02 | 0.01 | 0.21 | 1.74 | 3.18 | 3.59 | 3.85 | 3.25 | 2.38 | 1.45 | 0.43 | 0.05 |
| A1B | 2087 | 0.00 | 0.01 | 0.16 | 1.48 | 3.36 | 4.01 | 3.58 | 3.05 | 2.38 | 1.50 | 0.44 | 0.09 |
| A1B | 2088 | 0.00 | 0.00 | 0.26 | 1.60 | 3.46 | 3.81 | 3.32 | 2.97 | 2.33 | 1.44 | 0.51 | 0.05 |
| A1B | 2089 | 0.00 | 0.04 | 0.18 | 1.53 | 3.47 | 3.86 | 3.71 | 3.32 | 2.51 | 1.58 | 0.44 | 0.04 |
| A1B | 2090 | 0.01 | 0.00 | 0.12 | 1.58 | 3.29 | 3.81 | 3.50 | 3.28 | 2.43 | 1.63 | 0.45 | 0.04 |
| A1B | 2091 | 0.00 | 0.00 | 0.14 | 1.75 | 3.31 | 3.55 | 3.57 | 2.75 | 2.41 | 1.61 | 0.50 | 0.05 |
| A1B | 2092 | 0.01 | 0.01 | 0.23 | 1.67 | 3.34 | 3.75 | 3.76 | 3.32 | 2.49 | 1.48 | 0.42 | 0.06 |
| A1B | 2093 | 0.00 | 0.01 | 0.20 | 1.77 | 3.23 | 3.81 | 3.75 | 3.40 | 2.58 | 1.55 | 0.50 | 0.04 |
| A1B | 2094 | 0.00 | 0.00 | 0.17 | 1.53 | 3.54 | 3.77 | 4.04 | 3.32 | 2.39 | 1.74 | 0.44 | 0.04 |
| A1B | 2095 | 0.01 | 0.00 | 0.23 | 1.68 | 3.36 | 4.02 | 3.67 | 2.88 | 2.32 | 1.39 | 0.48 | 0.06 |
| A1B | 2096 | 0.01 | 0.02 | 0.24 | 1.69 | 3.51 | 4.07 | 3.85 | 3.37 | 2.47 | 1.59 | 0.42 | 0.06 |
| A1B | 2097 | 0.00 | 0.00 | 0.17 | 1.60 | 3.51 | 3.69 | 3.40 | 3.22 | 2.72 | 1.66 | 0.54 | 0.08 |
| A1B | 2098 | 0.02 | 0.02 | 0.25 | 1.71 | 3.38 | 3.92 | 3.85 | 3.48 | 2.59 | 1.64 | 0.42 | 0.08 |
| A1B | 2099 | 0.00 | 0.01 | 0.23 | 1.53 | 3.28 | 4.04 | 4.11 | 3.55 | 2.54 | 1.70 | 0.61 | 0.10 |
| A1B | 2100 | 0.01 | 0.02 | 0.20 | 1.67 | 3.29 | 3.95 | 3.74 | 3.14 | 2.50 | 1.69 | 0.53 | 0.07 |
| A2  | 2047 | 0.00 | 0.00 | 0.01 | 0.98 | 2.92 | 3.31 | 3.55 | 3.09 | 2.38 | 1.20 | 0.38 | 0.08 |
| A2  | 2048 | 0.00 | 0.00 | 0.01 | 1.30 | 3.04 | 3.28 | 3.61 | 2.91 | 2.02 | 1.39 | 0.31 | 0.04 |
| A2  | 2049 | 0.00 | 0.00 | 0.09 | 1.10 | 2.88 | 3.54 | 3.29 | 2.97 | 2.21 | 1.28 | 0.37 | 0.05 |
| A2  | 2050 | 0.00 | 0.00 | 0.05 | 1.19 | 3.11 | 3.73 | 3.64 | 3.11 | 2.43 | 1.40 | 0.31 | 0.02 |
| A2  | 2051 | 0.00 | 0.00 | 0.09 | 1.45 | 3.09 | 3.57 | 3.48 | 2.92 | 2.07 | 1.24 | 0.28 | 0.01 |
| A2  | 2052 | 0.00 | 0.00 | 0.10 | 1.43 | 2.95 | 3.56 | 3.58 | 3.10 | 2.36 | 1.34 | 0.32 | 0.05 |
| A2  | 2053 | 0.00 | 0.00 | 0.03 | 1.08 | 3.01 | 3.70 | 3.65 | 2.94 | 2.35 | 1.48 | 0.36 | 0.02 |
| A2  | 2054 | 0.00 | 0.00 | 0.09 | 1.13 | 2.98 | 3.50 | 3.60 | 3.28 | 2.41 | 1.58 | 0.40 | 0.02 |
| A2  | 2055 | 0.00 | 0.00 | 0.03 | 1.17 | 2.94 | 3.70 | 3.68 | 3.29 | 2.50 | 1.53 | 0.43 | 0.01 |
| A2  | 2056 | 0.00 | 0.00 | 0.00 | 1.37 | 3.10 | 3.81 | 3.60 | 3.09 | 2.21 | 1.29 | 0.40 | 0.01 |
| A2  | 2057 | 0.00 | 0.00 | 0.06 | 1.63 | 3.22 | 3.78 | 3.90 | 2.85 | 2.55 | 1.41 | 0.34 | 0.03 |
| A2  | 2058 | 0.00 | 0.00 | 0.12 | 1.58 | 3.08 | 3.48 | 3.50 | 3.12 | 2.53 | 1.37 | 0.46 | 0.01 |
| A2  | 2059 | 0.00 | 0.00 | 0.10 | 1.60 | 3.27 | 3.93 | 3.79 | 2.96 | 2.41 | 1.41 | 0.51 | 0.04 |
| A2  | 2060 | 0.00 | 0.00 | 0.03 | 1.34 | 3.04 | 3.54 | 3.59 | 2.97 | 2.20 | 1.41 | 0.37 | 0.01 |
| A2  | 2061 | 0.00 | 0.00 | 0.17 | 1.20 | 3.14 | 3.56 | 3.25 | 3.27 | 2.13 | 1.39 | 0.44 | 0.03 |
| A2  | 2062 | 0.00 | 0.00 | 0.01 | 1.32 | 3.23 | 3.58 | 3.55 | 2.80 | 2.08 | 1.35 | 0.44 | 0.03 |
| A2  | 2063 | 0.00 | 0.00 | 0.07 | 1.25 | 2.99 | 3.89 | 3.54 | 3.27 | 2.27 | 1.51 | 0.59 | 0.05 |
| A2  | 2064 | 0.00 | 0.00 | 0.06 | 1.47 | 3.33 | 3.86 | 3.41 | 3.13 | 2.17 | 1.39 | 0.46 | 0.01 |
| A2  | 2065 | 0.00 | 0.00 | 0.19 | 1.49 | 3.05 | 3.75 | 3.69 | 2.55 | 2.13 | 1.39 | 0.33 | 0.05 |
| A2  | 2082 | 0.00 | 0.00 | 0.15 | 1.52 | 3.63 | 4.18 | 3.81 | 3.36 | 2.46 | 1.58 | 0.60 | 0.07 |
| A2  | 2083 | 0.00 | 0.00 | 0.12 | 1.64 | 3.59 | 3.66 | 3.96 | 3.50 | 2.49 | 1.74 | 0.47 | 0.06 |
| A2  | 2084 | 0.00 | 0.00 | 0.13 | 1.52 | 3.35 | 3.70 | 3.35 | 2.84 | 2.46 | 1.54 | 0.46 | 0.07 |
| A2  | 2085 | 0.00 | 0.01 | 0.23 | 1.76 | 3.43 | 3.89 | 3.78 | 3.21 | 2.42 | 1.39 | 0.41 | 0.05 |
| A2  | 2086 | 0.00 | 0.00 | 0.17 | 1.86 | 3.33 | 3.81 | 4.03 | 3.05 | 2.23 | 1.47 | 0.49 | 0.10 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| A2 | 2087 | 0.00 | 0.00 | 0.26 | 1.60 | 3.51 | 3.99 | 4.28 | 3.61 | 2.61 | 1.49 | 0.44 | 0.08 |
| A2 | 2088 | 0.00 | 0.00 | 0.13 | 1.39 | 3.21 | 4.10 | 3.56 | 3.02 | 2.40 | 1.64 | 0.57 | 0.04 |
| A2 | 2089 | 0.00 | 0.03 | 0.26 | 1.90 | 3.78 | 3.58 | 3.60 | 2.92 | 2.34 | 1.43 | 0.42 | 0.09 |
| A2 | 2090 | 0.00 | 0.03 | 0.43 | 1.90 | 3.45 | 4.02 | 3.63 | 3.27 | 2.42 | 1.54 | 0.68 | 0.06 |
| A2 | 2091 | 0.00 | 0.00 | 0.17 | 1.57 | 3.60 | 3.78 | 3.64 | 3.09 | 2.49 | 1.66 | 0.60 | 0.10 |
| A2 | 2092 | 0.00 | 0.03 | 0.34 | 1.69 | 3.35 | 3.90 | 3.65 | 3.29 | 2.43 | 1.46 | 0.68 | 0.07 |
| A2 | 2093 | 0.00 | 0.00 | 0.07 | 1.51 | 3.42 | 3.98 | 3.62 | 2.61 | 2.62 | 1.64 | 0.53 | 0.09 |
| A2 | 2094 | 0.01 | 0.02 | 0.36 | 2.05 | 3.48 | 4.14 | 4.21 | 3.27 | 2.25 | 1.43 | 0.55 | 0.12 |
| A2 | 2095 | 0.00 | 0.00 | 0.20 | 1.94 | 3.77 | 3.93 | 3.90 | 3.46 | 2.43 | 1.75 | 0.58 | 0.13 |
| A2 | 2096 | 0.00 | 0.00 | 0.22 | 1.92 | 3.58 | 4.21 | 3.99 | 3.28 | 2.47 | 1.57 | 0.58 | 0.06 |
| A2 | 2097 | 0.00 | 0.00 | 0.16 | 1.62 | 3.40 | 4.15 | 3.63 | 2.55 | 2.09 | 1.38 | 0.70 | 0.11 |
| A2 | 2098 | 0.00 | 0.00 | 0.19 | 1.88 | 3.48 | 4.21 | 3.64 | 3.38 | 2.42 | 1.70 | 0.58 | 0.06 |
| A2 | 2099 | 0.00 | 0.00 | 0.22 | 1.60 | 3.45 | 4.03 | 3.60 | 3.31 | 2.66 | 1.65 | 0.63 | 0.12 |
| A2 | 2100 | 0.00 | 0.01 | 0.36 | 2.02 | 3.74 | 4.04 | 3.89 | 3.28 | 2.50 | 1.66 | 0.51 | 0.14 |
| B1 | 2047 | 0.00 | 0.00 | 0.10 | 1.25 | 3.01 | 3.63 | 3.71 | 3.21 | 2.33 | 1.31 | 0.40 | 0.01 |
| B1 | 2048 | 0.00 | 0.00 | 0.00 | 1.05 | 2.98 | 3.56 | 3.57 | 3.04 | 2.21 | 1.35 | 0.30 | 0.01 |
| B1 | 2049 | 0.00 | 0.00 | 0.09 | 1.19 | 3.07 | 3.58 | 3.89 | 3.06 | 2.34 | 1.46 | 0.28 | 0.03 |
| B1 | 2050 | 0.00 | 0.00 | 0.02 | 1.25 | 3.13 | 3.49 | 3.21 | 2.94 | 2.22 | 1.28 | 0.35 | 0.01 |
| B1 | 2051 | 0.00 | 0.00 | 0.05 | 1.23 | 2.99 | 3.60 | 3.33 | 2.74 | 2.03 | 1.40 | 0.39 | 0.02 |
| B1 | 2052 | 0.00 | 0.00 | 0.13 | 1.42 | 3.01 | 3.60 | 3.41 | 3.13 | 2.42 | 1.38 | 0.39 | 0.02 |
| B1 | 2053 | 0.00 | 0.00 | 0.06 | 1.24 | 3.22 | 3.87 | 3.47 | 3.03 | 2.09 | 1.29 | 0.46 | 0.03 |
| B1 | 2054 | 0.00 | 0.00 | 0.10 | 1.28 | 3.17 | 3.80 | 3.73 | 3.17 | 2.12 | 1.37 | 0.36 | 0.01 |
| B1 | 2055 | 0.00 | 0.00 | 0.01 | 1.31 | 3.26 | 3.47 | 3.53 | 2.77 | 2.15 | 1.44 | 0.39 | 0.02 |
| B1 | 2056 | 0.00 | 0.00 | 0.08 | 1.26 | 2.92 | 3.75 | 3.70 | 2.89 | 2.26 | 1.31 | 0.33 | 0.00 |
| B1 | 2057 | 0.00 | 0.00 | 0.10 | 1.19 | 2.95 | 3.70 | 3.81 | 2.78 | 2.09 | 1.37 | 0.34 | 0.01 |
| B1 | 2058 | 0.00 | 0.00 | 0.15 | 1.25 | 3.08 | 3.61 | 3.61 | 3.12 | 2.22 | 1.37 | 0.34 | 0.01 |
| B1 | 2059 | 0.00 | 0.00 | 0.13 | 1.50 | 3.19 | 3.62 | 3.88 | 3.30 | 2.23 | 1.35 | 0.40 | 0.04 |
| B1 | 2060 | 0.00 | 0.00 | 0.08 | 1.25 | 3.06 | 3.76 | 3.55 | 3.26 | 2.49 | 1.46 | 0.29 | 0.01 |
| B1 | 2061 | 0.01 | 0.00 | 0.06 | 1.24 | 3.18 | 3.69 | 3.29 | 3.08 | 2.19 | 1.29 | 0.29 | 0.03 |
| B1 | 2062 | 0.00 | 0.00 | 0.04 | 1.44 | 3.12 | 3.39 | 3.39 | 3.02 | 2.19 | 1.23 | 0.31 | 0.04 |
| B1 | 2063 | 0.00 | 0.00 | 0.04 | 1.21 | 3.08 | 3.57 | 3.40 | 3.21 | 2.26 | 1.41 | 0.37 | 0.01 |
| B1 | 2064 | 0.00 | 0.01 | 0.08 | 1.31 | 3.17 | 3.67 | 3.44 | 2.87 | 2.27 | 1.41 | 0.41 | 0.04 |
| B1 | 2065 | 0.00 | 0.00 | 0.05 | 1.24 | 3.06 | 3.91 | 3.68 | 3.00 | 2.30 | 1.34 | 0.36 | 0.01 |
| B1 | 2082 | 0.00 | 0.00 | 0.01 | 1.48 | 3.26 | 3.66 | 3.65 | 3.18 | 2.31 | 1.57 | 0.45 | 0.02 |
| B1 | 2083 | 0.00 | 0.00 | 0.12 | 1.52 | 3.31 | 3.80 | 4.19 | 3.29 | 2.39 | 1.49 | 0.39 | 0.02 |
| B1 | 2084 | 0.00 | 0.00 | 0.17 | 1.51 | 3.22 | 3.87 | 3.67 | 2.71 | 2.28 | 1.46 | 0.28 | 0.02 |
| B1 | 2085 | 0.00 | 0.00 | 0.11 | 1.35 | 3.03 | 3.80 | 3.62 | 3.04 | 2.30 | 1.37 | 0.41 | 0.04 |
| B1 | 2086 | 0.00 | 0.00 | 0.08 | 1.28 | 3.30 | 3.54 | 3.80 | 3.23 | 2.41 | 1.53 | 0.34 | 0.01 |
| B1 | 2087 | 0.00 | 0.00 | 0.15 | 1.48 | 3.19 | 3.71 | 3.89 | 3.02 | 2.24 | 1.52 | 0.45 | 0.02 |
| B1 | 2088 | 0.00 | 0.00 | 0.06 | 1.26 | 3.14 | 3.59 | 3.56 | 3.26 | 2.27 | 1.50 | 0.53 | 0.06 |
| B1 | 2089 | 0.00 | 0.02 | 0.11 | 1.40 | 3.00 | 3.61 | 3.55 | 3.11 | 2.23 | 1.44 | 0.35 | 0.01 |

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| B1 | 2090 | 0.00 | 0.01 | 0.09 | 1.36 | 3.13 | 3.82 | 3.63 | 2.93 | 2.26 | 1.37 | 0.37 | 0.04 |
| B1 | 2091 | 0.00 | 0.00 | 0.20 | 1.53 | 3.06 | 3.61 | 3.38 | 3.02 | 2.31 | 1.51 | 0.46 | 0.02 |
| B1 | 2092 | 0.00 | 0.00 | 0.10 | 1.46 | 3.28 | 3.75 | 3.93 | 3.25 | 2.43 | 1.40 | 0.45 | 0.04 |
| B1 | 2093 | 0.00 | 0.00 | 0.11 | 1.52 | 3.30 | 3.70 | 3.55 | 3.25 | 2.26 | 1.39 | 0.41 | 0.01 |
| B1 | 2094 | 0.00 | 0.00 | 0.15 | 1.50 | 3.08 | 3.70 | 3.75 | 3.23 | 2.35 | 1.44 | 0.36 | 0.04 |
| B1 | 2095 | 0.01 | 0.01 | 0.16 | 1.57 | 3.27 | 3.66 | 3.55 | 2.92 | 2.27 | 1.59 | 0.46 | 0.01 |
| B1 | 2096 | 0.00 | 0.00 | 0.07 | 1.37 | 3.45 | 3.90 | 3.71 | 2.84 | 2.48 | 1.51 | 0.49 | 0.03 |
| B1 | 2097 | 0.00 | 0.00 | 0.11 | 1.46 | 3.04 | 3.91 | 3.99 | 3.42 | 2.52 | 1.43 | 0.30 | 0.03 |
| B1 | 2098 | 0.00 | 0.01 | 0.10 | 1.48 | 3.06 | 3.62 | 3.64 | 3.00 | 2.35 | 1.30 | 0.47 | 0.05 |
| B1 | 2099 | 0.00 | 0.00 | 0.07 | 1.14 | 3.18 | 3.85 | 3.49 | 2.97 | 2.16 | 1.34 | 0.45 | 0.01 |
| B1 | 2100 | 0.00 | 0.00 | 0.10 | 1.54 | 3.32 | 3.84 | 3.58 | 3.01 | 2.12 | 1.33 | 0.42 | 0.04 |

## **APPENDIX G**

**T-VALUES COMPARING HISTORICAL RECORD TO GCMS FOR  
THREE EMISSION SCENARIOS FOR TIME SERIES, 2047-2065 AND 2082-2100**

**Table 30. T-values comparing means of time series, 1954-2009 to three emission scenarios for time series, 2047-2065. Pink shading denotes a significant increase in the mean. Blue shading denotes a significant decrease in the mean. Statistical significance is  $p < .05$**

| Scenario         | A2      |         |               | A1B     |         |               | B1      |         |               |
|------------------|---------|---------|---------------|---------|---------|---------------|---------|---------|---------------|
| Variable         | t-value | p-value | Stat. signif. | t-value | p-value | Stat. signif. | t-value | p-value | Stat. signif. |
| Annual prec.     | 1.64    | 0.11    | No            | 2.00    | 0.05    | No            | 1.20    | 0.24    | No            |
| Annual rech.     | 0.39    | 0.70    | No            | 0.45    | 0.66    | No            | -0.13   | 0.90    | No            |
| Annual temp.     | 12.84   | 0.00    | Yes           | 14.21   | 0.00    | Yes           | 10.50   | 0.00    | Yes           |
| Annual ET        | 4.20    | 0.00    | Yes           | 5.11    | 0.00    | Yes           | 3.83    | 0.00    | Yes           |
| Jan. prec.       | 1.19    | 0.24    | No            | 1.648   | .104    | No            | 0.63    | 0.53    | No            |
| Jan. rech.       | 8.71    | 0.00    | Yes           | 10.427  | .000    | Yes           | 6.32    | 0.00    | Yes           |
| Jan. mean temp.  | 4.88    | 0.00    | Yes           | 5.494   | .000    | Yes           | 4.05    | 0.00    | Yes           |
| Jan. ET          | NA      | NA      | NA            | 2.305   | .024    | Yes           | 2.03    | 0.05    | No            |
| Feb. prec.       | .539    | .592    | No            | .632    | .530    | No            | 0.34    | 0.73    | No            |
| Feb. rech.       | .791    | .432    | No            | 1.104   | .274    | No            | 0.47    | 0.64    | No            |
| Feb. mean temp.  | 3.603   | .001    | Yes           | 4.730   | .000    | Yes           | 2.93    | 0.00    | Yes           |
| Feb. ET          | 1.608   | .113    | No            | 4.395   | .000    | Yes           | 2.58    | 0.01    | Yes           |
| March prec.      | 1.453   | .151    | No            | 1.098   | .276    | No            | 0.87    | 0.39    | No            |
| March rech.      | -.486   | .629    | No            | -.813   | .419    | No            | -0.47   | 0.64    | No            |
| Mar. mean temp.  | 4.813   | .000    | Yes           | 5.759   | .000    | Yes           | 3.86    | 0.00    | Yes           |
| March ET         | 3.921   | .000    | Yes           | 6.197   | .000    | Yes           | 4.43    | 0.00    | Yes           |
| April prec.      | .625    | .534    | No            | 1.128   | .264    | No            | 0.80    | 0.43    | No            |
| April rech.      | -1.584  | .118    | No            | -1.548  | .126    | No            | -1.27   | 0.21    | No            |
| April mean temp. | 5.241   | .000    | Yes           | 6.245   | .000    | Yes           | 4.44    | 0.00    | Yes           |
| April ET         | 4.015   | .000    | Yes           | 5.297   | .000    | Yes           | 3.56    | 0.00    | Yes           |
| May prec.        | .747    | .458    | No            | 2.001   | .050    | No            | 1.36    | 0.18    | No            |
| May rech.        | .546    | .587    | No            | 1.172   | .246    | No            | 0.82    | 0.42    | No            |
| May mean temp.   | 5.297   | .000    | Yes           | 5.732   | .000    | Yes           | 4.65    | 0.00    | Yes           |
| May ET           | 3.658   | .001    | Yes           | 4.631   | .000    | Yes           | 3.86    | 0.00    | Yes           |
| June prec.       | .188    | .851    | No            | .288    | .774    | No            | 0.11    | 0.91    | No            |
| June rech.       | -.577   | .566    | No            | -.601   | .550    | No            | -0.54   | 0.59    | No            |
| June mean temp.  | 4.981   | .000    | Yes           | 5.829   | .000    | Yes           | 4.09    | 0.00    | Yes           |
| June ET          | .876    | .384    | No            | 1.876   | .065    | No            | 0.98    | 0.33    | No            |
| July prec.       | .088    | .930    | No            | -.129   | .898    | No            | 0.27    | 0.79    | No            |
| July rech.       | -.252   | .802    | No            | -.321   | .749    | No            | 0.14    | 0.89    | No            |
| July mean temp.  | 6.779   | .000    | Yes           | 7.236   | .000    | Yes           | 5.05    | 0.00    | Yes           |
| July ET          | 1.121   | .267    | No            | 1.059   | .293    | No            | 1.00    | 0.32    | No            |
| Aug. prec.       | .424    | .673    | No            | .341    | .734    | No            | 0.27    | 0.79    | No            |
| Aug. rech.       | .039    | .969    | No            | .059    | .953    | No            | -0.11   | 0.91    | No            |
| Aug. mean temp.  | 8.494   | .000    | Yes           | 8.039   | .000    | Yes           | 5.98    | 0.00    | Yes           |
| Aug. ET          | .195    | .846    | No            | .130    | .897    | No            | 0.20    | 0.84    | No            |
| Sept. prec.      | .863    | .391    | No            | .616    | .540    | No            | 0.26    | 0.80    | No            |
| Sept. rech.      | -.023   | .982    | No            | -.362   | .719    | No            | -0.43   | 0.67    | No            |
| Sept. mean temp. | 6.856   | .000    | Yes           | 7.704   | .000    | Yes           | 5.98    | 0.00    | Yes           |
| Sept. ET         | 1.669   | .100    | No            | 1.690   | .096    | No            | 1.20    | 0.23    | No            |
| Oct. prec.       | .178    | .859    | No            | .697    | .488    | No            | 0.40    | 0.69    | No            |
| Oct. rech.       | -.795   | .430    | No            | -.404   | .687    | No            | -0.51   | 0.61    | No            |
| Oct. mean temp.  | 6.248   | .000    | Yes           | 6.996   | .000    | Yes           | 5.83    | 0.00    | Yes           |
| Oct. ET          | 3.166   | .002    | Yes           | 3.230   | .002    | Yes           | 2.81    | 0.01    | Yes           |

|                 |       |      |     |       |      |     |       |      |     |
|-----------------|-------|------|-----|-------|------|-----|-------|------|-----|
| Nov. prec.      | -.016 | .987 | No  | -.156 | .877 | No  | -0.36 | 0.72 | No  |
| Nov. rech.      | .473  | .638 | No  | .145  | .885 | No  | -0.33 | 0.74 | No  |
| Nov. mean temp. | 5.859 | .000 | Yes | 5.913 | .000 | Yes | 4.31  | 0.00 | Yes |
| Nov. ET         | 3.949 | .000 | Yes | 4.113 | .000 | Yes | 3.07  | 0.00 | Yes |
| Dec. prec.      | 1.238 | .220 | No  | 1.366 | .177 | No  | 0.51  | 0.61 | No  |
| Dec. rech.      | 2.643 | .010 | Yes | 2.308 | .024 | Yes | 1.43  | 0.16 | No  |
| Dec. mean temp. | 5.438 | .000 | Yes | 5.468 | .000 | Yes | 3.92  | 0.00 | Yes |
| Dec. ET         | 4.129 | .000 | Yes | 5.100 | .000 | Yes | 2.57  | 0.01 | Yes |

**Table 31. T-values comparing means of time series, 1954-2009 to three emission scenarios for time series, 2082-2100. Pink shading denotes a significant increase in the mean. Blue shading denotes a significant decrease in the mean. Statistical significance is  $p < .05$ .**

| Scenario         | A2      |         |               | A1B     |         |               | B1      |         |               |
|------------------|---------|---------|---------------|---------|---------|---------------|---------|---------|---------------|
|                  | t-value | p-value | Stat. signif. | t-value | p-value | Stat. signif. | t-value | p-value | Stat. signif. |
| Annual prec.     | 3.50    | 0.00    | Yes           | 3.36    | 0.00    | Yes           | 1.98    | 0.05    | No            |
| Annual rech.     | 0.46    | 0.65    | No            | 0.77    | 0.44    | No            | 0.02    | 0.99    | No            |
| Annual temp.     | 23.50   | 0.00    | Yes           | 21.43   | 0.00    | Yes           | 15.26   | 0.00    | Yes           |
| Annual ET        | 9.62    | 0.00    | Yes           | 8.51    | 0.00    | Yes           | 5.92    | 0.00    | Yes           |
| Jan. prec.       | 1.55    | 0.12    | No            | 1.59    | 0.12    | No            | 0.98    | 0.33    | No            |
| Jan. rech.       | 12.39   | 0.00    | Yes           | 12.30   | 0.00    | Yes           | 9.71    | 0.00    | Yes           |
| Jan. mean temp.  | 8.39    | 0.00    | Yes           | 7.98    | 0.00    | Yes           | 5.76    | 0.00    | Yes           |
| Jan. ET          | 2.56    | 0.01    | Yes           | 6.53    | 0.00    | Yes           | 1.96    | 0.05    | No            |
| Feb. prec.       | 1.34    | 0.18    | No            | 0.81    | 0.42    | No            | -0.01   | 0.99    | No            |
| Feb. rech.       | 1.22    | 0.23    | No            | 1.10    | 0.28    | No            | 0.81    | 0.42    | No            |
| Feb. temp.       | 7.11    | 0.00    | Yes           | 6.59    | 0.00    | Yes           | 4.69    | 0.00    | Yes           |
| Feb. ET          | 4.29    | 0.00    | Yes           | 6.91    | 0.00    | Yes           | 4.31    | 0.00    | Yes           |
| March prec.      | 2.03    | 0.05    | Yes           | 1.54    | 0.13    | No            | 1.17    | 0.25    | No            |
| March rech.      | -1.19   | 0.24    | No            | -1.43   | 0.16    | No            | -1.12   | 0.27    | No            |
| Mar. mean temp.  | 8.82    | 0.00    | Yes           | 8.29    | 0.00    | Yes           | 5.86    | 0.00    | Yes           |
| March ET         | 11.20   | 0.00    | Yes           | 13.07   | 0.00    | Yes           | 6.93    | 0.00    | Yes           |
| April prec.      | 2.08    | 0.04    | Yes           | 1.99    | 0.05    | Yes           | 0.44    | 0.66    | No            |
| April rech.      | -2.13   | 0.04    | Yes           | -1.85   | 0.07    | No            | -2.02   | 0.05    | Yes           |
| April mean temp. | 11.11   | 0.00    | Yes           | 9.98    | 0.00    | Yes           | 6.80    | 0.00    | Yes           |
| April ET         | 8.82    | 0.00    | Yes           | 7.94    | 0.00    | Yes           | 5.53    | 0.00    | Yes           |
| May prec.        | 3.11    | 0.00    | Yes           | 2.44    | 0.02    | Yes           | 1.54    | 0.13    | No            |
| May rech.        | 1.02    | 0.31    | No            | 1.04    | 0.30    | No            | 0.59    | 0.56    | No            |
| May mean temp.   | 10.49   | 0.00    | Yes           | 8.74    | 0.00    | Yes           | 6.65    | 0.00    | Yes           |
| May ET           | 8.20    | 0.00    | Yes           | 6.78    | 0.00    | Yes           | 4.92    | 0.00    | Yes           |
| June prec.       | 0.55    | 0.58    | No            | 0.60    | 0.55    | No            | 0.60    | 0.55    | No            |
| June rech.       | -0.52   | 0.61    | No            | -0.42   | 0.68    | No            | -0.53   | 0.60    | No            |
| June mean temp.  | 10.61   | 0.00    | Yes           | 8.90    | 0.00    | Yes           | 5.71    | 0.00    | Yes           |
| June ET          | 3.56    | 0.00    | Yes           | 2.79    | 0.01    | Yes           | 1.71    | 0.09    | No            |
| July prec.       | 0.44    | 0.66    | No            | 0.69    | 0.49    | No            | 0.38    | 0.71    | No            |
| July rech.       | -0.09   | 0.93    | No            | 0.15    | 0.88    | No            | 0.01    | 1.00    | No            |
| July mean temp.  | 13.21   | 0.00    | Yes           | 10.50   | 0.00    | Yes           | 7.23    | 0.00    | Yes           |
| July ET          | 2.45    | 0.02    | Yes           | 2.08    | 0.04    | Yes           | 1.90    | 0.06    | No            |
| Aug. prec.       | 0.77    | 0.44    | No            | 0.90    | 0.37    | No            | 0.40    | 0.69    | No            |
| Aug. rech.       | -0.03   | 0.98    | No            | 0.35    | 0.73    | No            | -0.06   | 0.95    | No            |
| Aug. mean temp.  | 15.08   | 0.00    | Yes           | 12.27   | 0.00    | Yes           | 8.09    | 0.00    | Yes           |

|                  |       |      |     |       |      |     |       |      |     |
|------------------|-------|------|-----|-------|------|-----|-------|------|-----|
| Aug. ET          | 1.01  | 0.32 | No  | 1.24  | 0.22 | No  | 0.52  | 0.60 | No  |
| Sept. prec.      | 0.94  | 0.35 | No  | 1.07  | 0.29 | No  | 0.53  | 0.59 | No  |
| Sept. rech.      | -0.15 | 0.88 | No  | 0.07  | 0.94 | No  | -0.30 | 0.76 | No  |
| Sept. mean temp. | 13.39 | 0.00 | Yes | 11.75 | 0.00 | Yes | 8.28  | 0.00 | Yes |
| Sept. ET         | 3.01  | 0.00 | Yes | 3.04  | 0.00 | Yes | 1.95  | 0.06 | No  |
| Oct. prec.       | 0.85  | 0.40 | No  | 1.23  | 0.22 | No  | 0.86  | 0.39 | No  |
| Oct. rech.       | -0.68 | 0.50 | No  | -0.24 | 0.81 | No  | -0.50 | 0.62 | No  |
| Oct. mean temp.  | 12.17 | 0.00 | Yes | 10.64 | 0.00 | Yes | 7.83  | 0.00 | Yes |
| Oct. ET          | 5.48  | 0.00 | Yes | 5.20  | 0.00 | Yes | 3.97  | 0.00 | Yes |
| Nov. prec.       | 0.44  | 0.66 | No  | 0.21  | 0.84 | No  | -0.04 | 0.97 | No  |
| Nov. rech.       | 0.39  | 0.70 | No  | 0.47  | 0.64 | No  | 0.38  | 0.71 | No  |
| Nov. mean temp.  | 10.65 | 0.00 | Yes | 8.34  | 0.00 | Yes | 6.29  | 0.00 | Yes |
| Nov. ET          | 7.61  | 0.00 | Yes | 5.79  | 0.00 | Yes | 4.42  | 0.00 | Yes |
| Dec. prec.       | 1.29  | 0.20 | No  | 1.40  | 0.17 | No  | 1.82  | 0.07 | No  |
| Dec. rech.       | 2.89  | 0.01 | Yes | 3.12  | 0.00 | Yes | 2.45  | 0.02 | Yes |
| Dec. mean temp.  | 8.91  | 0.00 | Yes | 7.92  | 0.00 | Yes | 5.45  | 0.00 | Yes |
| Dec. ET          | 11.57 | 0.00 | Yes | 9.09  | 0.00 | Yes | 4.00  | 0.00 | Yes |