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## Appendix 1

### Climate Data for Basalt and Redstone Stations, Colorado (source: Western Regional Climate Center, Desert Research Institute, Reno, Nevada)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	37.7	42.6	50.5	59.2	69.9	78.5	86.6	83.8	75.1	63.0	49.4	36.9	61.1
Average Min. Temperature (F)	7.4	12.2	19.7	25.6	34.4	40.0	46.9	45.4	36.4	25.8	18.7	10.0	26.9
Average (Mean) Temperature (F)	22.4	27.8	35.1	42.5	52.1	59.3	66.7	64.6	55.8	44.4	34.0	23.4	44.0
Average Total Precipitation (in.)	0.84	0.79	0.58	1.35	1.02	1.73	1.14	1.99	1.96	1.57	0.80	1.32	15.10
Average Total Snow Fall (in.)	15.2	12.0	6.3	3.4	0.0	0.0	0.0	0.0	0.6	5.2	5.7	17.9	66.3
Average Snow Depth (in.)	7	3	1	0	0	0	0	0	0	0	0	4	1

**Table A.1.1. Monthly Climate Summary for Basalt, Colorado [station 050514]  
for period 7/1/1965 to 5/31/1972.**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	38.0	43.8	53.4	61.2	68.8	81.2	86.7	85.0	75.2	66.3	45.0	32.9	61.6
Average Min. Temperature (F)	11.8	16.0	23.4	30.7	35.5	43.9	48.9	46.4	36.3	30.3	17.7	8.7	29.2
Average Total Precipitation (in.)	0.88	0.94	0.77	1.15	0.96	0.59	0.46	1.64	1.80	1.04	1.32	2.00	13.54

**Table A.1.2. Monthly Climate Summary for Basalt, Colorado [station 050514]  
for period 1/1/1971 to 12/31/2000.**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.1	36.2	42.7	51.1	60.5	71.8	76.4	74.6	67.0	55.3	39.2	31.5	53.3
Average Min. Temperature (F)	7.7	11.5	17.3	24.5	31.9	39.4	44.2	43.8	36.7	38.0	17.5	9.0	26.0
Average (Mean) Temperature (F)	20.5	23.9	30.0	37.8	46.2	55.6	60.3	59.2	51.8	41.7	28.3	20.2	39.6
Average Total Precipitation (in.)	1.78	2.41	3.09	2.04	2.30	1.48	2.23	1.67	2.98	3.02	2.64	2.03	27.66
Average Total Snow Fall (in.)	26.0	29.9	32.4	12.1	5.3	0.5	0.0	0.0	0.5	6.9	26.4	29.5	169.4
Average Snow Depth (in.)	21	16	5	1	0	0	0	0	0	0	3	11	5

**Table A.1.3. Monthly Climate Summary for Redstone, Colorado [station 056970] for period 6/1/1979 to 6/30/1994.**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	32.7	36.9	43.0	31.1	60.5	71.9	76.5	74.4	66.9	55.4	39.2	32.3	53.5
Average Min. Temperature (F)	7.7	11.8	17.5	24.3	32.0	39.2	44.2	43.4	36.6	27.9	17.1	9.5	26.0
Average Total Precipitation (in.)	1.96	2.68	2.89	2.16	2.44	1.51	1.94	1.99	3.00	3.15	2.77	2.25	28.72

**Table A.1.4. Monthly Climate Summary for Redstone, Colorado [station 056970] for period 1/1/1971 to 12/31/2000.**

## Appendix A2

### Data Fields of the Colorado Division of Water Resources Wells Database.

<http://www.water.state.co.us/pubs/welldata.asp> ).

<b>Field Header</b>	<b>Definition</b>
<b>receipt</b>	The receipt number is the number assigned when the fee is paid. The entire receipt number is eight numeric characters followed by one alphabetic character (if required).
<b>div</b> (Division)	Numeric identifier for Water Division (1-8) in which the well is located.
<b>cty</b> (County)	Numeric identifier for Colorado counties (1-63) in which the well is located:

*COLORADO COUNTIES NUMERICAL CODE:*

ADAMS.....	01	LAKE.....	33
ALAMOSA.....	02	LA PLATA.....	34
ARAPAHOE.....	03	LARIMER.....	35
ARCHULETA.....	04	LAS ANIMAS.....	36
BACA.....	05	LINCOLN.....	37
BENT.....	06	LOGAN.....	38
BOULDER.....	07	MESA.....	39
CHAFFEE.....	08	MINERAL.....	40
CHEYENNE.....	09	MOFFAT.....	41
CLEAR CREEK.....	10	MONTEZUMA.....	42
CONEJOS.....	11	MONTROSE.....	43
COSTILLA.....	12	MORGAN.....	44
CROWLEY.....	13	OTERO.....	45
CUSTER.....	14	OURAY.....	46
DELTA.....	15	PARK.....	47
DENVER.....	16	PHILLIPS.....	48
DOLORES.....	17	PITKIN.....	49
DOUGLAS.....	18	PROWERS.....	50
EAGLE.....	19	PUEBLO.....	51
ELBERT.....	20	RIO BLANCO.....	52
EL PASO.....	21	RIO GRANDE.....	53
FREMONT.....	22	ROUTT.....	54
GARFIELD.....	23	SAGUACHE.....	55
GILPIN.....	24	SAN JUAN.....	56
GRAND.....	25	SAN MIGUEL.....	57
GUNNISON.....	26	SEDGWICK.....	58
HINSDALE.....	27	SUMMIT.....	59
HUERFANO.....	28	TELLER.....	60
JACKSON.....	29	WASHINGTON.....	61
JEFFERSON.....	30	WELD.....	62
KIOWA.....	31	YUMA.....	63
KIT CARSON.....	32		

<b>permitno</b> (Permit Number)	The well permit number (numeric).
<b>permitsuf</b> (Permit Suffix)	A character field for the well suffix code that follows the permit number.
<b>Permitrpl</b>	Identifier indicating a well's replacement.

**actdate** Date well permit application received.

**actcode** The activity code states status of permit application file:

<i>Code</i>	<i>Description</i>
AP =	New application received.
AD =	Application denied. Denial number entered in permit number field and date entered in permit issued date field.
AW =	Application for a permit is withdrawn. Code and date also entered to status code and date fields.
AV =	Verbal approval granted to well construction contractor to construct a well without a permit in place (emergency only).
CA =	Canceled well permit. Code and date also entered to status code and date fields.
CD =	Change description of acres irrigated (designated basins). Entered to status and date fields of existing record upon receipt of application.
CO =	Application to commingle wells (designated basins). Entered to status and date fields of existing record upon receipt of application.
CP =	Amended household use permit to allow watering of user's noncommercial domestic animals.
EX =	Well permit expiration date extended.
MH =	Monitoring hole notice of construction. MH file number and date entered in permit number and permit date fields.
NP =	Well permit issued. Permit number and issue date entered in permit number and permit date fields.
TH =	Test hole notice. Replaced by MH notice in 1988.
TW =	Test well. Replaced by MH notice in 1988.

**wd** A character field which indicates the Water District in which the well is located (1-80). Defined as a basin on minor drainage within the Water Division.

**basin** When applicable, a character field indicating the Designated Groundwater Basin Number (1-8):

DESIGNATED BASINS

NORTHERN HIGH PLAINS	01
KIOWA-BIJOU	02
SOUTHERN HIGH PLAINS	03
UPPER BLACK SQUIRREL CREEK	04
LOST CREEK	05
CAMP CREEK	06
UPPER BIG SANDY	07
UPPER CROW CREEK	08

**md** A character field indicating the Designated Groundwater Basin Management District Number (1-13):

MANAGEMENT DISTRICTS (BASINS)

PLAINS	01
SAND HILLS	02
ARIKAREE	03
FRENCHMAN	04
CENTRAL YUMA	05
W - Y	06
NORTH KIOWA-BIJOU	07
EASTERN CHEYENNE	08
LOST CREEK	09
SOUTHERN HIGH PLAINS	10
MARKS BUTTE	11
UPPER BLACK SQUIRREL	12
UPPER BIG SANDY	13



<b>full name</b>	Applicant name (character field).
<b>address1</b>	A character field for the street portion of the primary mailing address of the permit holder.
<b>address2</b>	A character field for the street portion of a secondary mailing address, if submitted.
<b>city</b>	A character field for the City of the primary mailing address.
<b>state</b>	A character field for the State of the primary mailing address
<b>zip1</b>	A character field for the primary zip code.
<b>zip2</b>	A character field for a secondary zip code, if provided.
<b>phone_number</b>	A character field for Applicant's phone number.
<b>pm</b>	Principal Meridian in which well is located (S = Sixth, N = New Mexico, U = Ute, C = Costilla, B = Baca).
<b>rng (Range)</b>	Numeric field for the Range in which well is located.
<b>Rnga</b>	Identifies half ranges ("H")
<b>Rdir</b>	Identifies direction (E, W)
<b>ts (Township)</b>	Numeric field for Township in which well is located.
<b>Tsa</b>	Identifies half ranges ("H")
<b>Tdir</b>	Identifies direction (N, S)
<b>sec (Section)</b>	Numeric field for Section in which well is located (1-36).
<b>Seca</b>	Reserved for locations containing a U in the section number.
<b>QTR160</b>	Character field for quarter section (160 acre quarter) in which well is located.
<b>QTR40</b>	Character field for the quarter-quarter section (40 acre quarter of 160 acre quarter) in which well is located.
<b>QTR10</b>	Character field for the quarter-quarter section (10 acre quarter of 40 acre quarter) in which well is located.
<b>coordsns</b>	Distance (feet) from the north or south section line to the well location.
<b>coordsns_dir</b>	Identifies which section line (N,S) from which distance is measured.
<b>coordsew</b>	Distance (feet) from the east or west section line to the well location.

**coordsew\_dir**

Identifies which section line (E,W) from which distance is measured.

**AQUIFER1**

Aquifer in which well is located.

**AQUIFER CODES:**

GW	ALL UNNAMED AQUIFERS	
KA	ARAPAHOE	
UKA	UPPER ARAPAHOE	
LKA	LOWER ARAPAHOE	
JMB	BRUSHY BASIN	
KDB	BURRO CANYON	
KCH	CHEYENNE	
CON	CONFINED	SAN LUIS VALLEY
KD	DAKOTA	
TDW	DAWSON	
UTDW	UPPER DAWSON	
LTDW	LOWER DAWSON	
TKD	DENVER	
JE	ENTRADA	
TG	GREEN RIVER	
PH	HERMOSA	
KI	ILES	
KL	LARAMIE	
KLF	LARAMIE FOX HILLS	
ML	LEADVILLE LIMESTONE	
KM	MANCOS	
KMV	MESA VERDE GROUP	
JM	MORRISON	
TO	OGALLALA	
KP	PIERRE SHALE	
KPU	PURGATOIRE	
JMS	SALT WASH	
UNC	UNCONFINED	SAN LUIS VALLEY
TW	WASATCH	
TW	WHITE RIVER	
KW	WILLIAMS FORK	

**AQUIFER2**

name of second aquifer if well is known to be multiply completed.

**subdiv\_name**

Subdivision name.

**lot**

Lot number in subdivision.

**block**

Block number in subdivision.

**filing**

Filing number.

**engineer**

Engineer who approved permit.

**well\_name**

Owners's well designation number or name.

**Use1 & Use2**

**Codes for well Uses:**

Data Code	Use Description
1	Crop Irrigation
2	Municipal
3	COMMERCIAL
4	INDUSTRIAL
5	RECREATION
6	FISHERY
7	FIRE
8	DOMESTIC
9	LIVESTOCK
G	GEOTHERMAL
H	HOUSEHOLD USE ONLY
K	SNOWMAKING
O	OTHER
O	MONITORING HOLE/WELL
R	RECHARGE
E	EXCHANGE AND AUGMENTATION
Q	=O (Other, or Monitoring Hole/Well)

**Use3**

CODE	TYPE
A	AUGMENTATION. All wells in augmentation plans are coded with an "A" in the last position. First position is the actual use of the well.
M	MONITORING WELL (PERMITTED). The first position is "O" followed by "M" in the last position.
Z	HOUSEHOLD USE WELLS ISSUED PRIOR TO HB1111 THAT HAVE BEEN AMENDED PURSUANT TO (3)(b)(II)(b) BY \$25.00 APPLICATION. First position code is "H" followed by "Z" in the last position.
L	PERMIT ISSUED UNDER PRESUMPTION (3)(b)(II)(A) FOR DOMESTIC/LIVESTOCK USES AS THE ONLY WELL ON 35 ACRES. First position is either "8" domestic or "9" livestock", or both 1st and 2nd followed by "L" in the last position. PERMITS ISSUED UNDER (3)(b)(I) WHERE WATER IS AVAILABLE ARE CODED FIRST POSITIONS AS NECESSARY WITH THE ACTUAL USE. HB1111 does not apply to these wells.
G	GRAVEL PIT WELL PERMIT. This application (PERMIT) is coded as "O" in the first position with "G" in the last position.
C	CLOSED LOOP GEOTHERMAL WELL. First position is codes as "G" for geothermal. Last position is "C".
P	GEOTHERMAL PRODUCTION WELL. First position is coded "G" for geothermal. Last position is "P".
S	OTHER TYPES OF HOLES CONSTRUCTED-ESPECIALLY FOR CATHODIC PROTECTION. IDENTIFIES THAT THE PERMIT WAS ISSUED PURSUANT TO SENATE BILL 5 (137 (4). First positions are for the actual use(s) of the well.

**driller\_lic**

Water well contractor's license number.

**pump\_lic**

Pump installation contractor's license number.

**pidate**

Date the pump installation report is received by DWR.

**statute**

Statute under which the permit was issued using the last four numbers of chapter and paragraph, i.e. 37-92-602(3)..602(3). (see [www.intellinetusa.com/statmgr.htm](http://www.intellinetusa.com/statmgr.htm))

**statcode**

Interim status of the application or permit:

*Code Desc*  
AB = Abandoned well.  
AR = Date application for permit resubmitted to DWR.  
AU = Date application returned to applicant for correction or additional information.  
EP = Expired well permit.  
NS = Exempt wells where no statement of use is required (no longer used).  
PI = Pump Installation Report received (no longer used).  
PU = Pump Installation Report returned to responsible party for correction.  
RC = Record change. A portion of the file was modified.  
SA = Statement of beneficial use accepted (no longer used in statute code).  
SP = Statement of beneficial use received (no longer used in statute code).  
SR = Statement of beneficial use resubmitted to DWR.  
SU = Statement of beneficial use returned to owner for correction.  
WA = Well construction report received (no longer used).  
WU = Well construction report returned to responsible party for correction.  
WR = Well construction report resubmitted to DWR.  
ZZ = Transaction code indicates a portion of the file was updated with general review and update of records.

**statdate**

Date of the above status code action.

**npdate**

Date the permit, denial (AD) or monitoring hole was issued.

**wadate**

Date the Well Construction and Test Report was received in DWR.

**trancode**

Activity or status code. Last action updated.

**trandate**

Computer machine date of last update to the record.

**sadate**

Date of first beneficial use.

**sbudate**

Date statement of use received.

**exdate**

Expiration date of well permit.

**abrdate**

Date abandonment report received.

**abcodate**

Date well plugged and abandoned.

**abreq**

Flag if the well requires plugging and sealing upon construction of new well

**acreft**

Annual appropriation in acre feet.

**tperf**

Depth to top of first perforated casing.

**bperf**

Depth to base of last perforated casing.

**case\_no**

Water court case number.

**yield**

Yield in gallons per minute.

**depth**

Total depth of well.

**level**

Depth to static water level.

<b>elev</b>	Ground surface elevation.
<b>area_irr</b>	Acres irrigated.
<b>lrr_meas</b>	Acre irrigated units
<b>comment</b>	Comment field
<b>meter</b>	Totalizing flow meter reqd., installed.
<b>wellxno</b>	Cross reference to another well or record.
<b>Wellxsuf</b>	Cross reference character field for well suffix code (follows the permit number).
<b>Wellxrpl</b>	Cross reference identifier indicates well replacement.
<b>Nwccdate</b>	Notice of Well Construction Report received (Statewide nontributary rules).
<b>Nbudate</b>	Notice of Commencement of Beneficial Use received (Statewide nontributary rules).
<b>wccdate</b>	Date well construction completed.
<b>pcdate</b>	Date pump installation completed
<b>log</b>	Flag to indicate if a geophysical is required and received.
<b>qual</b>	Water quality information available, y or n.
<b>user1</b>	Initials of last staff member to update file.
<b>pyield</b>	Proposed yield of well in gpm.
<b>pdepth</b>	Proposed depth of well.
<b>pacreft</b>	Proposed annual appropriation.
<b>well_type</b>	Calculated value to determine if record is exempt, non exempt or geothermal.
<b>valid_permit</b>	Calculated value to determine if a well permit is valid. (must be verified)
<b>parcel_no</b>	Parcel identifier
<b>parcel_size</b>	Parcel size in acres. Number of acres on well site.
<b>noticedate</b>	Notice sent to owner indicating permit about to expire. (Not yet used)
<b>utm_x</b>	A numeric field for the UTM-X coordinate. Note some UTM values are calculated from legal description. All UTM values are Zone 13 based on NAD 27 and Clark 1866 projections.

<b>utm_x</b>	A numeric field for the UTM-X coordinate. Note some UTM values are calculated from legal description. All UTM values are Zone 13 based on NAD 27 and Clark 1866 projections.
<b>utm_y</b>	A numeric field for the UTM-X coordinate. Note some UTM values are calculated from legal description. All UTM values are Zone 13 based on NAD 27 and Clark 1866 projections.
<b>loc_source</b>	Identifies source of UTM coordinates. If blank, the applicant provided the coordinates otherwise the version of the program used to determine the coordinates is given.

## Appendix 3.

### Update Procedures for GIS Databases.

The GIS map for use with the ground water resources assessment procedure links to five groups of databases: 1) CDSS (Colorado Decision Support System) irrigated acreage databases; 2) HSA\_PCGIS hydrogeological databases prepared by HSA/HHI; 3) NRCS (Natural resources Conservation Service) precipitation database; 4) Pitkin County GIS geographic and hydrological databases; and 5) the DWRSC ( Colorado Division of Water Resources) wells database.

The CDSS databases contain the irrigated acreage information and may occasionally be updated when new surveys of irrigated acreage become available. CDSS database information can be found at: <http://165.127.23.116/website/cdss/> or the CDSS website at: <http://cdss.state.co.us/DNN/default.aspx>.

The HSA\_PCGIS hydrogeological databases are "as-is" and are not expected to be updated on a regular basis. For more information contact: [pvdh@heath-hydrology.com](mailto:pvdh@heath-hydrology.com).

Information regarding the NRCS precipitation database can be found at the NRCS Data Gateway: <http://datagateway.nrcs.usda.gov/GatewayHome.html>.

For information regarding the Pitkin County GIS databases contact the City of Aspen/Pitkin County GIS Department at: [gis@ci.aspen.co.us](mailto:gis@ci.aspen.co.us).

The CDWR wells database is updated on a quarterly basis. See: <http://water.state.co.us/pubs/welldata.asp>. To update the GIS well database included with this report use the following procedure:

- Step 1. Obtain the latest edition of the quarterly updated state well database from the Colorado Division of Water Resources for Pitkin County (county code 49).
- Step 2. Delete the old 'well.dbf' file from the 'Wells\_DWRSC\_Pitkin' subdirectory of the CRC ground water GIS file set and copy the 'well.dbf' file from the CDWR-provided disk to the 'Wells\_DWRSC\_Pitkin' subdirectory. Make sure that the name in the target directory is 'well.dbf'.
- Step 3. Modify the reference in the CWCB well layers in the GIS Table of Contents to reflect the date of the new well data.

Note: Some wells, identified in the CDWS well database with the Pitkin County code 49, lie outside the county boundary. This is caused by either incorrect coordinates in the database, or that no coordinates were provided to the state. In the latter case, UTM coordinates are shown as zero's. In the CSC GIS map, this latter issue is addressed by automatically excluding these zero-value coordinates using the *Definition Query* function of the wells' *Layer Properties* windows.





## Appendix 4

### **Stepwise Approach to Assessing Ground Water Availability, Sustainability, and Vulnerability in the Crystal River and West Sopris/Sopris Creek Study Area, Pitkin County, Colorado.**

*It should be noted that due to limitations in data availability and quality, this analysis is primarily qualitative in nature. It does not replace due diligence.*

**Steps 1 – 2 prompt the user to initiate the GIS and locate the site being evaluated.**

*Step 1.* Start ARCMAP™ (ESRI®, Redlands, California) and load the CSC GIS map [file: *PitkinCounty\_GWGIS\_CSC.mxd*].

*Step 2.* Determine the precise location or platting of the selected site. This site should be plotted on the GIS map using the appropriate layers in the GIS (e.g., using site coordinates or location information on streams, roads, parcels, etc.).

**Steps 3 – 6 allow the user to determine the potential availability of ground water for water supply at the site by identifying the areas covered by hydrogeologic formations that may be an aquifer (either unconsolidated surficial materials or bedrock) and evaluating the presence or absence of ground water in these formations.**

*Step 3.* Determine the potential unconfined surficial aquifer material at the site.

*Step 4.* Determine potential unconfined and confined bedrock aquifer material at site.

*Step 5.* Determine if the potential alluvial/colluvial aquifer is connected/not connected with a bedrock aquifer. This step determines if the alluvial/colluvial aquifer is sustained by a bedrock aquifer, or sustained solely by surface processes, such as a nearby river.

*Step 6.* Determine if the alluvial/colluvial material is saturated or unsaturated. This step shows the availability of ground water for the site. Identify one or more relevant nearby wells based on distance to site of interest and comparable hydrogeology and combine with layers identified as relevant in steps 3 through 5. Using the accompanying attribute table for the drilled well layer, well depth, depth to static water level at time of drilling, well production (gal per minute yield), and time of year of drilling can be found and a judgement be made with respect to pre-development saturated thickness. This step could be used to quantitatively determine the amount of ground water available, but requires professional judgment using standard practices.

**Steps 7 – 10 allow the user to determine the potential sustainability and vulnerability of ground water for use as a water supply for the site.**

*Step 7.* Determine amount of direct infiltration of precipitation into the alluvial/colluvial aquifer or the bedrock aquifer. This step is performed to determine recharge to the aquifer from precipitation. To assess the recharge potential from precipitation in the vicinity of the site, a

precipitation layer is included in the GIS map. Calculation of actual recharge amounts (a fraction of precipitation) requires professional judgment using standard practices.

*Step 8. Determine if the alluvial/colluvial aquifer is connected/not connected with a perennial stream.* This step is performed to determine recharge to the aquifer from any nearby surface water system. The attribute table of Pitkin County's waterline layer contains, among others, a field in the attribute table indicating intermittent stream flow (ephemeral stream) or continuous stream flow (perennial stream). By combining hydrogeologic information from the alluvial aquifer layer, or the information resulting from steps 3-6, with the county's streams layer, the existence of a hydraulic connection can be established. Calculation of actual recharge amounts and effect of new well on stream requires professional judgment using standard practices.

*Step 9. Determine if the saturated alluvial/colluvial aquifer is connected with an irrigation ditch or subject to return flow of irrigation water.* This step is performed to determine recharge to the aquifer from irrigation practices, which may not sustain a ground water supply if water uses and water rights ownership change. In order to establish if the saturated portion of the potential aquifer of interest is connected with an irrigation ditch, hydrogeologic information from the alluvial aquifer layer, or the information resulting from steps 3-6, is combined with the county's ditches layer. The potential effect of the return flow of irrigated acreage on recharge can be evaluated by plotting the site of interest on the 2000 or 1993 irrigated acreage layer. Calculation of actual recharge amounts requires professional judgment using standard practices.

*Step 10. Determine the vulnerability of ground water supplies to contamination from the surface for the site.* Natural protection from overlying confining units, such as the Mancos Shale, is important for maintaining natural water quality. However, all ground water in the area with unconsolidated sediments, and bedrock aquifer outcrops is vulnerable; natural protection is only available in areas with confining layers overlying bedrock aquifers. Calculation of actual risk (both qualitatively and quantitatively) requires professional judgment using standard practices.