COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

P (303) 866-3441
F (303) 866-4474

Jared Polis, Governor

Dan Gibbs, DNR Executive Director

Lauren Ris, CWCB Acting Director

TO: Colorado Water Conservation Board Members

FROM: Robert Viehl, Chief
Brandy Logan, Water Resource Specialist
Stream and Lake Protection Section

DATE: July 19, 2023

AGENDA ITEM: 9a. Request for Final Action on Uncontested ISF Water Rights on Cottonwood Creek, Monitor Creek, and Potter Creek (Water Division 4)

Staff Recommendation

Staff requests that the Board make the following determinations and take the following actions on each instream flow (ISF) water right listed in Table 1.

(1) Determine, pursuant to section 37-92-102(3), C.R.S., that for the ISF appropriations identified in Table 1:

  (a) There is a natural environment that can be preserved to a reasonable degree with the recommended water rights, if granted;

  (b) The natural environment will be preserved to a reasonable degree by the water available for the recommended appropriation; and

  (c) Such natural environment can exist without material injury to water rights.

(2) Pursuant to ISF Rule 5f., establish July 19, 2023 as the appropriation date for these ISF water rights.

(3) Include in this appropriation and in future water court applications and decrees the terms and conditions agreed upon between the CWCB and the Colorado River Water Conservation District and contained in paragraphs 3.A-3.I of the attached stipulation and agreement (Attachment A).

(4) Include in this appropriation and in future water court applications and decrees the water development allowance identified for each appropriation as identified in Tables 2-5 and in the attached SGM Report (Attachment B).

(5) Request staff to work with the Attorney General's office to file applications for these water rights in water court by the end of the calendar year.

Table 1. ISF Water Rights

Stream	Watershed	County	Length (miles)	Upper Terminus	Lower Terminus
Cottonwood Creek *(Increase)*	Lower Gunnison	Delta, Montrose	23.3	Hawkins Ditch headgate	confluence Roubideau Creek
	ISF protection initiates at 183 cfs and protects all unappropriated streamflow until flow rates recede to the existing 3.6 cfs ISF rate or 9/30, whichever occurs first.				
Monitor Creek *(Increase)*	Lower Gunnison	Montrose	8.29	confluence Little Monitor Creek	confluence Potter Creek
	ISF protection initiates at 111 cfs and protects all unappropriated streamflow until flow rates recede to the pending ISF of 4.6 cfs (4/1 – 5/31), 3.6 cfs (6/1 - 6/30) or 3.6 cfs if outside of these times or until 9/30, whichever occurs first.				
Potter Creek *(Increase)*	Lower Gunnison	Montrose	8.10	USFS property boundary	confluence Monitor Creek
	ISF protection initiates at 177 cfs and protects all unappropriated streamflow until flow rates recede to the existing ISF of 4 cfs (4/1 - 6/15), 1.8 cfs (6/16 - 7/31), 1.4 cfs (8/1 - 2/29), or until 9/30, whichever occurs first.				
Potter Creek *(Increase)*	Lower Gunnison	Montrose	1.72	confluence Monitor Creek	confluence Roubideau Creek
	ISF protection initiates at 225 cfs and protects all unappropriated streamflow until flow rates recede to the existing ISF of 4 cfs (4/1 - 6/15), 1.8 cfs (6/16 - 7/31), 1.4 cfs (8/1 - 2/29), or until 9/30, whichever occurs first.				

Table 2. Cottonwood Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Water Use on Private Parcels (1)	557.2	2.06	Irrigation, domestic, stock watering, recreation, wildlife, piscatorial, fire protection, and storage
BLM	2.0	0.22	
USFS	2.0	0.22	
CPW	1.0	0.1	
Total	**562.2**	**2.6**	

Notes:

(1) Assumes a total new water demand associated with residential, livestock, and irrigation for 87, 35-acre parcels. Only 65 of those parcels would require new irrigation water supply.

Table 3. Monitor Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Future Irrigation [1]	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire protection, and storage
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**1,627.1**	**7.29**	

Notes:

(1) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

Table 4. Upper Potter Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Water Use on Private Parcels [1]	0.5	0.001	Irrigation, storage, recreation, wildlife, fire protection, domestic, and stock
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**4.5**	**0.441**	

Notes:

(1) – Assumes a total new water demand associated with residential, livestock, and irrigation for one, 5-acre parcels.

Table 5. Potter Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Future Irrigation [1]	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire protection, and storage
BLM	4.0	0.44	
USFS	4.0	0.44	
Total	**1,631.1**	**7.73**	

Notes:

(1) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

Introduction

On March 16, 2023, the CWCB formed its intent to appropriate ISF water rights recommended by BLM on four stream segments located in Water Division 4. During the notice and comment period, no notices to contest were filed on any of these streams. Pursuant to ISF Rule 5h., these four stream segments described in Table 1 are being recommended to the Board for Final Action. The information necessary to support the CWCB's statutory determinations, pursuant to section 37-92-102(3), C.R.S., is contained in this memo, the recommendation letters and documentation submitted by the Bureau of Land Management (BLM), and in staff's memo and oral presentation provided at the March 16, 2023, Board meeting.

Technical Investigations

The Board was provided detailed information regarding all field data, studies, and analyses for each stream segment at its March 16, 2023, Board meeting. A brief overview of the analyses is provided below.

Natural Environment

The BLM conducted field surveys and studies of the natural environment resources on these streams and found natural environments that can be preserved. The BLM's findings on the natural environment are fully documented in the BLM recommendation letter for each stream reach.

Riparian Community

The BLM found Cottonwood, Monitor, and Potter Creeks suitable for inclusion in the National Wild and Scenic Rivers System based in part on the presence of rare riparian communities that qualified as ORVs[1]. This finding was informed by surveys conducted by the Colorado Natural Heritage Program (CNHP)[2] which determined these streams contained rare plant communities that are imperiled and warrant conservation. The plant communities vary by stream but include assemblages of species that are rarely found in the same location, such as narrowleaf cottonwood and skunkbush sumac or narrowleaf cottonwood, strapleaf willow, and silvery buffaloberry. The streams also contain extensive areas of non-imperiled riparian communities, and all have high to very high biodiversity with few non-native species and minimal anthropogenic disturbance.

1 The suitability determination for Cottonwood Creek was finalized as part of the Dominguez-Escalante National Conservation Area (NCA) Resource Management Plan in 2017. The suitability determinations for Monitor and Potter Creeks were finalized as part of the BLM's Uncompahgre Field Office Resource Management Plan in 2020.

2 The Colorado Natural Heritage Program is Colorado's only comprehensive source of information on the status and location of Colorado's rarest and most threatened species and plant communities. CNHP is a non-academic department of the Warner College of Natural Resources at Colorado State University. It is also a member of the NatureServe Network, "which is an international network of partners that use the same scientific methodology to enable scientists to monitor the status of species and natural plant communities from state, national, and global perspectives."

Preserving these rare riparian communities will provide important functions including maintaining overall system resiliency. Riparian areas help mitigate the impacts of floods by reducing water velocity, attenuating peak flows, and stabilizing streambanks. They also provide shade to reduce water temperatures and organic matter which provides habitat and food for the aquatic ecosystem. This diverse riparian community of native species is uniquely adapted to the Uncompahgre Plateau making it better able to rebound following disturbances such as severe storms, flooding, landslides, mudslides, and wildfires. Resiliency also mitigates the impact of those disturbances on the surrounding communities, which improves outcomes for both people and ecosystems.

Native Fish

Although not the primary basis for the proposed ISF, these creeks also provide important habitat for the three-species: Flannelmouth Sucker, Bluehead Sucker, and Roundtail Chub. These species are identified as Species of Greatest Conservation Need in Colorado and are part of a multi-state conservation agreement designed to prevent a listing of the species under the Endangered Species Act (Utah DNR, 2006). According to native fish research in the Roubideau Creek basin conducted by Colorado Parks and Wildlife (CPW), upwards of 25,000 fish use the Roubideau Creek drainage to spawn annually, with potentially thousands of fish using these proposed ISF reaches. High-flow events are critical because they allow fish to migrate into these tributaries to spawn. The fish also need gradually receding flow which allows for successful egg development and hatching, provides habitat for juvenile fish to grow and mature, and allows adult fish to move back into larger river systems before they become stranded. This highlights the importance of preserving high-flow events for these creeks, especially because few other accessible and flowing tributary networks remain in the region.

ISF Quantification

Flow Needs of Riparian Communities

The BLM reviewed scientific literature to identify the flow regime needed to support the riparian communities for these streams. This assessment found that these communities are highly dependent on infrequent flood or high-flow events that create disturbed areas and wet sediment deposits where plants can germinate by seed, root, or branch fragment propagation. Research also concludes that slowly receding flow rates after the event are important for maintaining water levels in the alluvial aquifer. This allows the roots of new seedlings to grow and remain in contact with the receding groundwater levels.

HEC-RAS Modeling

The BLM identified that bankfull, which is typically the elevation where streams start to access the floodplain and riparian vegetation, was an appropriate threshold necessary to preserve the riparian community. When streamflow is at bankfull conditions or above, the important processes required for the long-term survival of the plants can occur, including creating areas where wet sediment is deposited, seeds and branches are dispersed, nutrients are deposited

on the floodplain, and recharge of the alluvial aquifer takes place. The flow rate associated with bankfull was determined based on field surveys and HEC-RAS modeling for each reach. HEC-RAS was developed by the U.S. Army Corps of Engineers and is widely used for hydraulic modeling of floods.

Water Availability

Staff conducted water availability assessments by evaluating streamflow data from USGS, CWCB, and CPW temporary gages operated on all three streams. This data was used to describe the hydrologic regime and assess the potential frequency and duration of high-flow events that reached the identified bankfull thresholds or higher. In addition, staff analyzed the water rights tabulation for each stream to identify existing water uses and consulted with DWR staff. Unlike other ISF water rights, these ISF increases will only be in effect when the bankfull threshold is reached and only during a limited portion of the year. These proposed ISFs are not structured to occur year-round and are not expected to occur every year or even in most years. Therefore, median flow was not assessed in this analysis because the high-flow events necessary for the riparian community are not anticipated to occur on a median basis. The water availability assessments show that the bankfull threshold has been reached on each recommended stream reach. Staff concludes that water is available for the appropriations listed in Table 1 to preserve the natural environment to a reasonable degree.

Appropriation Date

Staff recommends establishing July 19, 2023, as the appropriation date for the water rights identified above in Table 1. CPW has identified a need for a surface water diversion and a storage water right on Cottonwood Creek. The purpose of these water rights is to create several small brood ponds to improve growth of native fish. Staff from CPW has taken overt acts to establish an appropriation date which is before July 19, 2023, and will file a water court application before the end of 2023. While the water rights sought by CPW are very small, by establishing the July 19, 2023, appropriation date, CPW may apply for these water rights without using any of the amounts described in the water development allowances.

Relevant Instream Flow Rules

5f. Date of Appropriation. The Board may select an appropriation date that may be no earlier than the date the Board declares its intent to appropriate. The Board may declare its intent to appropriate when it concludes that it has received sufficient information that reasonably supports the findings required in Rule 5i.

5h. Final Board Action on an ISF Recommendation. The Board may take final action on any uncontested Staff Recommendation(s) at the May Board meeting or any Board meeting thereafter. If a Notice to Contest has been filed, the Board shall proceed under Rule 5j-5q.

5i. Required Findings. Before initiating a water right filing to confirm its appropriation, the Board must make the following determinations:

(1) Natural Environment. That there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted.

(2) Water Availability. That the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made.

(3) Material Injury. That such environment can exist without material injury to water rights.

These determinations shall be subject to judicial review in the water court application and decree proceedings initiated by the Board, based on the Board's administrative record and utilizing the criteria of section 24-4-106(6) and (7), C.R.S.

Attachments:

(A) Stipulation and Agreement Between the Colorado Water Conservation Board and the Colorado River Water Conservation District, and Exhibit 1 to same; and
(B) SGM Final Draft Delta Area Water Development Allowance

BEFORE THE COLORADO WATER CONSERVATION BOARD
STATE OF COLORADO

IN THE MATTER OF PROPOSED INSTREAM FLOW APPROPRIATIONS IN WATER DIVISION NO. 4:

COTTONWOOD CREEK, MONITOR CREEK, AND POTTER CREEK, (Increases)

MONTROSE AND DELTA COUNTIES, COLORADO.

STIPULATION AND AGREEMENT BETWEEN THE COLORADO WATER CONSERVATION BOARD AND THE COLORADO RIVER WATER CONSERVATION DISTRICT

The Colorado Water Conservation Board ("CWCB") and the Colorado River Water Conservation District ("River District") (collectively, the "Parties") hereby stipulate and agree as follows:

1. Staff of the CWCB recommended increases to the instream flow water right appropriations for Cottonwood Creek ("Cottonwood Creek ISF"), Monitor Creek ("Monitor Creek ISF"), and Potter Creek ("Upper Potter Creek ISF" and "Potter Creek ISF")[1] as follows:

A. The proposed Cottonwood Creek ISF represents an increase to the existing instream flow water right on Cottonwood Creek as decreed in Case No. 06CW166, Water Division No. 4, in the amount of 3.6 c.f.s. (4/1 – 6/15) with an upper terminus located at the Hawkins Ditch headgate at UTM North: 4267895.51, UTM East: 206860.73 and with a lower terminus at the confluence with Roubideau Creek at UTM North: 4289842.88, UTM East: 226016.62. The proposed increase in the Cottonwood Creek ISF would result in additional instream flow protection initiating at 183 c.f.s. to protect all unappropriated streamflow until flow rates recede to the existing 3.6 c.f.s. instream flow water right. The flow protection will only be in effect from 4/1 to 9/30 if the 183 c.f.s. threshold amount is reached. Flows will be protected as they recede to a 3.6 c.f.s. flow rate or until 9/30, whichever occurs first.

B. The proposed Monitor Creek ISF represents an increase to the pending[2] instream flow water right on Monitor Creek in Water Division No. 4, in the amount of 4.6

[1] For purposes of this Stipulation and Agreement, the Upper Potter Creek ISF described in paragraph 1.C, and the Potter Creek ISF described in paragraph 1.D, may be collectively referred to as the "Potter Creek ISF".

[2] The CWCB formed its intent to appropriate the initial Monitor Creek ISF at its regular meeting held on January 24, 2023. Final action by the CWCB with respect to the initial Monitor Creek ISF shall not occur until the CWCB's May 2023 meeting, at the earliest.

c.f.s. (4/1 – 5/31), and 3.6 c.f.s. (6/1 – 6/30), with an upper terminus located at the confluence with Little Monitor Creek at UTM North: 4270075.83, UTM East: 212258.00 and with a lower terminus at the Potter Creek confluence at UTM North: 4279535.32, UTM East: 220671.03. The proposed increase in the pending Monitor Creek ISF would result in additional instream flow protection initiating at 111 c.f.s. to protect all unappropriated streamflow until flow rates recede to the pending instream flow water right of 4.6 c.f.s. (4/1 – 5/31), 3.6 c.f.s. (6/1 – 6/30), and 3.6 c.f.s. (7/1 – 9/30). The flow protection will only be in effect from 4/1 to 9/30 if the 111 c.f.s. threshold amount is reached. Flows will be protected as they recede to the pending ISF rates and to a 3.6 c.f.s. flow rate from 7/1 to 9/30 or until 9/30, whichever occurs first.

C. The proposed Upper Potter Creek ISF represents an increase to the existing instream flow water right on Potter Creek as decreed in Case No. 04CW161, Water Division No. 4, in the amount of 4 c.f.s. (4/1 – 6/15), 1.8 c.f.s. (6/16 – 7/31), 1.4 c.f.s. (8/1 – 2/29), and 1.8 c.f.s. (3/1 – 3/31), with an upper terminus located in the vicinity of the United States Forest Service boundary at UTM North: 4269972.26, UTM East: 216078.92 and with a lower terminus located at the confluence with Monitor Creek at UTM North: 4279535.32, UTM East: 220671.03. The proposed increase in the Upper Potter Creek ISF would result in additional instream flow protection initiating at 177 c.f.s. to protect all unappropriated streamflow until flow rates recede to the existing instream flow water right or until 9/30, whichever occurs first. The proposed Upper Potter Creek ISF would only be in effect from 4/1 to 9/30.

D. The proposed Potter Creek ISF represents an increase to the existing instream flow water right on Potter Creek as decreed in Case No. 04CW161, Water Division No. 4, in the amount of 4 c.f.s. (4/1 – 6/15), 1.8 c.f.s. (6/16 – 7/31), 1.4 c.f.s. (8/1 – 2/29), and 1.8 c.f.s. (3/1 – 3/31), with an upper terminus located at the confluence with Monitor Creek at UTM North: 4279535.32, UTM East: 220671.03, and with a lower terminus located at the confluence with Roubideau Creek at UTM North: 4281496.83, UTM East: 221904.86. The proposed increase in the Potter Creek ISF would result in additional instream flow protection initiating at 225 c.f.s. to protect all unappropriated streamflow until flow rates recede to the existing instream flow water rights or until 9/30, whichever occurs first. The proposed Potter Creek ISF would only be in effect from 4/1 to 9/30.

2. Subject to the terms and conditions of this Stipulation and Agreement, including the applicable uses, volumes, and flow rates of the water development allowances ("WDAs") for the subject instream flow appropriations as set forth in Tables 1 through 4 (attached and incorporated hereto as "**Exhibit 1**"), the River District supports the increases to the Cottonwood, Monitor, and Potter Creek ISF appropriations as described in paragraph 1, above.

3. The CWCB conditionally approves the following terms and conditions[3] for inclusion in the appropriations for each of the proposed increases to the decreed and pending

[3] The specific terms and conditions set forth in subparagraphs 3.A through 3.I shall be included in the appropriations for each of the proposed instream flow water rights, in the applications to be filed with the Water Court to adjudicate the Cottonwood, Monitor, and Potter Creek ISFs, and in any decrees to be entered by the Water Court in and for

instream flow water rights described herein, in any applications filed with the Water Court to adjudicate the Cottonwood, Monitor, and Potter Creek ISFs, and in any decrees to be entered by the Water Court in and for Water Division No. 4 for the aforementioned instream flow water rights in the event the CWCB takes final action to move forward with adjudication of the water rights at its July 2023 meeting:

A. The CWCB is provided with the authority to adopt conditions attached to an appropriation and to enter into stipulations for decrees or other forms of contractual agreements that the CWCB determines will preserve the natural environment to a reasonable degree. § 37-92-102(4)(a), C.R.S.

B. The CWCB determines that the instream flow water right appropriated by the CWCB and claimed in this Case No. [XXXXX] shall be subject to the terms and conditions identified in paragraphs [XXXX, below], and further determines that the inclusion of such terms and conditions as a component of the claimed instream flow water right will preserve the natural environment to a reasonable degree.

C. This instream flow appropriation is unique in that it is the result of a consensus of various stakeholders with diverse interests, that the appropriation seeks to protect a range of flows between base and peak flows that were determined important to maintain the unique and rare riparian habitat, and that the appropriation was designed in part, and is intended in part, to be an alternative for protecting resources identified by the Bureau of Land Management to be "outstanding remarkable value" as defined by the 1968 Wild and Scenic Rivers Act, in lieu of a formal designation of the subject stream segment by the United States Congress into the National Wild and Scenic Rivers System. The terms and conditions of this agreement, below, are part of a compromise and settlement and are unique circumstances that shall not establish any precedent and shall not be construed as a commitment to include any specific findings of fact, conclusions of law or administrative practices in future appropriations.

D. Pursuant to section 37-92-102(3)(b), C.R.S., this instream flow appropriation shall be subject to the present uses or exchanges of water being made by other water users pursuant to appropriation or practices in existence on the date of this appropriation whether or not previously confirmed by court order or decree.

E. The CWCB agrees that the instream flow appropriation in this Case No. XXXX shall be subject to a future water development allowance of [XXXX AF/CFS] and that water rights decreed subsequent to the priority date of the instream flow that are within the applicable volume or flow rate of the development allowance do not result in injury or adverse impact to the instream flow. New water uses that fall within the development

Water Division No. 4 for the aforementioned instream flow water rights. Individual appropriations, water court applications, and water court decrees will be necessary for each of the three proposed instream flow water rights described in this Stipulation and Agreement, As such, the parties hereto acknowledge that placeholders have been incorporated where necessary (e.g., "[XXXX]" to represent currently undefined case numbers, paragraphs, etc.), and the parties further acknowledge and agree that the terms and conditions contained in paragraph 3 hereto will be subsequently modified as needed to include specific information relative to each of the specific instream flow water rights.

allowance provided in this paragraph [XXXX], shall not be subject to curtailment by a water rights priority call placed by the instream flow water right decreed herein. The CWCB shall install and maintain suitable and proper measuring devices and keep such records as the Division Engineer may require for administration of the instream flow water right decreed herein.

F. Any decree for this instream flow water right must indicate that the State Engineer finds the decree administrable.

G. In addition to the water development allowance provided for in paragraph [XXXX], above, the CWCB agrees not to file a statement of opposition to applications for water rights filed after XXXX, 2023 that: (1) are for changes of existing senior water rights in the XXXX Creek basin for a change in point of diversion so long as there is no change in the type of use, and provided that the diversion and use of the changed senior water right continues to occur within the XXXX Creek basin as originally decreed; or (2) are for new junior water rights with decreed diversion amounts that do not result in an exceedance of the future water development allowance of [XXXX AF/CFS] within the subject instream flow basin. This paragraph [XXXX] applies only to water court applications for water rights and does not preclude the Board from enforcing its instream appropriation in accordance with the priority system against such water rights, provided, however, that new water rights decreed subsequent to the priority date of the instream flow that fall within the development allowance set forth in paragraph [XXXX], above, shall not be subject to curtailment by a water rights priority call placed by the instream flow water right decreed herein.

H. It is the intent of the CWCB that the instream flow water right decreed herein provide protection of the natural environment only to the extent authorized by state statute against adjudications of water rights made after the date of this filing. The CWCB intends that the instream flow water right decreed herein is not intended to be used as a stream flow standard in other administrative or regulatory permitting contexts.

I. The findings of fact, conclusions of law and decree in this matter were completed as a result of substantial discussions, negotiations, and compromises by, between and among the CWCB and stakeholders pertaining to all parts of the findings, conclusions and decree. It is specifically understood and agreed by the parties hereto, and found and concluded by the Court, that the acquiescence of the parties to a stipulated decree under the specific factual and legal circumstances of this matter and upon the numerous and interrelated compromises reached by the parties shall never give rise to any argument, claim, defense or theory of acquiescence, waiver, bar, merger, stare decisis, res judicata, estoppel, laches, or otherwise, nor to any administrative or judicial practice or precedent, by or against any of the parties hereto in any other matter, case or dispute, nor shall testimony concerning such acquiescence of any party to a stipulated decree herein be allowed in any other matter, case or dispute. All parties stipulate and agree that they do not intend the findings, conclusions, and decree to have the effect of precedent or preclusion on any factual or legal issue in any other matter. The parties further stipulate and agree that they each reserve the right to propose or to challenge any legal or factual position in any

other matter filed in this or any other court without limitation by these Findings, Conclusions and Decree.

4. The Parties hereto acknowledge and agree that the CWCB's conditional approval of the terms and conditions set forth in subparagraphs 3.A through 3.I of this Stipulation and Agreement shall not be construed as a predisposition by the CWCB in favor of the appropriations for the Cottonwood, Monitor, and Potter ISFs. Final action by the CWCB with respect to those appropriations shall not occur until the CWCB's July 2023 meeting, at the earliest. The Parties further acknowledge and agree that the CWCB's conditional approval of the terms and conditions set forth in subparagraphs 3.A through 3.I of this Stipulation and Agreement is expressly conditioned upon the CWCB taking final action to approve the appropriations and authorize the filing of applications for the Cottonwood, Monitor, and Potter Creek ISFs at the CWCB meeting to be held in July 2023. In the event that no notice to contest is filed by another party prior to the deadline for submitting such notices to contest, but the CWCB nevertheless defers final action on the subject instream flow appropriations at its July 2023 meeting, and tables final action on the subject appropriations for a future date, this Stipulation and Agreement shall remain in full force and effect until such time that the CWCB does take final action with respect to the subject appropriations. If, at its July 2023 meeting, the CWCB's final action on the subject instream flow appropriations is a decision to not file water court applications for the subject instream flow appropriations, this Stipulation and Agreement shall be null and void. Finally, in the event that a notice to contest is filed by another party with respect to the subject instream flow appropriations, the provisions of paragraph 7, below, shall control.

5. In consideration of the mutual promises contained herein, the River District agrees that upon the CWCB's conditional approval of the terms and conditions set forth in subparagraphs 3.A through 3.I, above, which approval is conditioned on the CWCB taking final action on any uncontested appropriations at the CWCB 's meeting to be held on July 19 and July 20, 2023 as set forth in paragraph 4 above, the River District shall not oppose or contest appropriation of the Cottonwood, Monitor, or Potter Creek ISFs in the administrative proceedings, provided, however, that the River District reserves the right to participate as a Party in any administrative proceeding in the event a notice to contest is filed by another party solely to defend the terms and conditions described herein in accordance with paragraph 7, below. Furthermore, the River District shall not oppose the aforementioned instream flow water rights in any water court proceeding to adjudicate any of the proposed instream flow water rights described in paragraph 1 above and consistent herewith, provided, however, that the River District reserves the right to file a statement of opposition in any such water court adjudication to ensure that the CWCB remains in compliance with the terms and conditions agreed upon by the Parties hereto.

6. The CWCB Staff shall provide counsel for the River District copies of the following for the purposes of ensuring consistency with the terms and conditions of this Stipulation and Agreement: (a) the CWCB's proposed applications to the Water Court to adjudicate the Cottonwood, Monitor, and Potter Creek ISFs before those applications are filed; and (b) the final versions of any proposed rulings and decrees before they are filed with the Water Court.

7. If, at the CWCB meeting to be held in July 2023, the CWCB does not take final action to file water court applications for the subject instream flow appropriations because a notice

to contest the subject instream flow appropriations has been submitted by another party, then: (a) with the exception of this paragraph 7, this Stipulation and Agreement shall be null and void, (b) the River District may late file a Notice to Contest; (c) the CWCB Staff and the River District (including any other parties, as the case may be) will proceed to coordinate with the CWCB Board and its Hearing Officer to schedule the deadline for prehearing statements and rebuttal statements, and schedule the prehearing conference; and (d) the River District will not have waived any of its rights, claims or defenses regarding the proposed instream flow appropriations.

8. This Stipulation and Agreement shall be binding upon and inure to the benefit of the Parties and their successors and assigns and shall be enforceable.

9. The Parties shall each bear their own costs and attorneys' fees associated with this matter.

10. The Parties hereto represent and affirm that the signatories to this Stipulation and Agreement are legally authorized to bind the Parties in this matter.

11. This Stipulation and Agreement may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

Stipulated and agreed to this 31st day of May, 2023.

THE COLORADO WATER CONSERVATION BOARD

Rebecca Mitchell

Rebecca Mitchell, Director
1313 Sherman Street, Room 718
Denver, Colorado 80203
(303) 866-3441

THE COLORADO RIVER WATER CONSERVATION DISTRICT

Peter C. Fleming (#20805)
201 Centennial Street, Suite 200
Glenwood Springs, CO 81601
(970) 945-8522
pfleming@crwcd.org
Counsel for the Colorado River Water Conservation District

EXHIBIT 1

Table 1. Cottonwood Creek Water Development Allowance			
WDA Uses	**Annual Amount (AF)**	**Diversion Amount (cfs)**	**Uses**
Water Use on Private Parcels (1)	557.2	2.06	Irrigation, domestic, stock watering, recreation, wildlife, piscatorial, fire-protection, and storage
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USFS	2.0	0.22	
CPW	1.0	0.1	
Total	**562.2**	**2.6**	

Notes:

(1) Assumes a total new water demand associated with residential, livestock, and irrigation for 87, 35-acre parcels. Only 65 of those parcels would require new irrigation water supply.

Table 2. Monitor Creek Water Development Allowance			
WDA Uses	**Annual Amount (AF)**	**Diversion Amount (cfs)**	**Uses**
Future Irrigation (1)	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire-protection, and storage
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**1,627.1**	**7.29**	

Notes:

(1) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

Table 3. Upper Potter Creek Water Development Allowance			
WDA Uses	**Annual Amount**	**Diversion Amount**	**Uses**
	(AF)	**(cfs)**	
Water Use on Private Parcels [(1)]	0.5	0.001	Irrigation, storage, recreation, wildlife, fire-protection, domestic, and stock
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**4.5**	**0.441**	

Notes:

(1) Assumes a total new water demand associated with residential, livestock, and irrigation for one, 5-acre parcels.

Table 4. Potter Creek [(1)] Water Development Allowance			
WDA Uses	**Annual Amount**	**Diversion Amount**	**Uses**
	(AF)	**(cfs)**	
Irrigation [(2)]	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire-protection, and storage
BLM	4.0	0.44	
USFS	4.0	0.44	
Total	**1,631.1**	**7.73**	

Notes:

(1) Area not included in Monitor or Upper Potter Creek watersheds.

(2) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

FINAL DRAFT

Colorado Water Conservation Board

Delta Area Water Development Allowance

Roubideau Creek, photo by Raquel Flinker, Colorado River District

February 2023

Prepared by

SGM

555 RiverGate Lane, Suite B4-82
Durango, CO 81301
970.385.2340

FINAL DRAFT

Delta Area Water Development Allowance

COLORADO WATER CONSERVATION BOARD

Prepared By

Amanda Webb

Reviewed By

Jordan Dimick, PE

SGM Project 2022-160.004

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1.0 Introduction

The Colorado Water Conservation Board (CWCB) is considering an instream flow (ISF) appropriation that protects all available flow for a portion of the year when threshold streamflow conditions are met, minus a development allowance, within Cottonwood, Monitor, and Potter Creeks. These creeks are located approximately five miles west of Delta, Colorado. The proposed ISFs would only be in effect if bank full conditions are met, to allow flooding conditions to occur in the riparian zone, during the months of April through September. These flooding events may not occur every year, and when they do, may only last for a few days or weeks. Since 2000, Colorado has generally experienced an extended drought, and while in some years these basins have seen greater than normal streamflows, the riparian corridor adjacent to streams have been negatively impacted by low streamflow during drought periods.

Within each creek basin, there are private landowners whose properties are surrounded by large portions of public lands managed by the U.S. Forest Service (USFS), Bureau of Land Management (BLM), and Colorado Parks and Wildlife (CPW). The purpose of this project was to consider the ownership of lands, possible future water demands, the available water supplies, and then to establish a water development allowance (WDA) in each creek basin for private and federal/state water rights. The future demands identified in the WDA would thereby allow for the development of water rights for private uses and would allow the USFS, BLM, and CPW to support their management operations. Ultimately, the ISF appropriations would seek to permanently protect and preserve the natural environment in each of the aforementioned creeks.

1.1 Study Area

The study area is located along the northeastern portion of the Uncompahgre Plateau between Sawmill Mesa, Monitor Mesa, and 7N Mesa, and includes the basins of Cottonwood Creek, Monitor Creek, and Potter Creek (Study Area) (see Figure 1). These basins are tributary to Roubideau Creek, which is tributary to the Gunnison River and ultimately the Colorado River. The majority of these basins are located within Montrose County, approximately five miles west of Delta, Colorado; with small portions of the Cottonwood Creek Basin located within Delta County and Mesa County.

The Study Area creeks are perennial in nature. They are characterized by a relatively short duration, high-flow runoff driven by snowmelt during the spring to early summer followed by low baseflows in late fall and winter months. During portions of normal and dry years, some locations in the Study Area creeks can become dry in the lower reaches, which is generally understood to be associated with upstream diversions for irrigation within the Study Area.

1.2 Project Purpose and Goals

CWCB currently has decreed ISF water rights on Cottonwood and Potter Creeks to protect aquatic habitat. The BLM recommended a seasonal ISF on Monitor Creek to protect the native fish population. In addition, BLM recommended additional ISF water rights on all three streams to protect the riparian communities. This recommendation is structured to protect higher flow events that reach bank full or greater flow conditions between April 1 and September 30. The purpose of these recommended ISF rights would be to preserve and protect high flow events resulting in flow within the floodplain and riparian vegetation. These flows are critical for creating conditions necessary for riparian vegetation to become established and recharging of the shallow aquifers adjacent to the stream. These aquifers ultimately supply water to the pristine, intact, and rare riparian communities adjacent to Cottonwood, Monitor, and Potter Creeks. See Figure 2 for the location of each existing and recommended ISF on Cottonwood, Monitor, and Potter Creeks.

Currently, the existing ISF on Cottonwood Creek extends 23.29 miles from the headgate of the Hawkins Ditch at the upstream terminus to the confluence with Roubideau Creek at the downstream terminus. The existing ISF is for 3.6 cubic feet per second (cfs) from April 1 through June 15. On Potter Creek, the existing ISF extends 9.8 miles from the BLM – USFS boundary at the upstream terminus to the confluence with Roubideau Creek at the downstream terminus. Potter Creek's existing ISF is for 4.0 cfs from April 1 through June 15, 1.80 cfs from June 16 through July 31, 1.0 cfs from August 1 through February 29, and 1.80 cfs from March 1 through March 31.

The recommended seasonal ISF on Monitor Creek for aquatic habitat would extend 8.29 miles from the confluence with Little Monitor Creek at the upstream terminus to the confluence with Potter Creek at the downstream terminus. BLM completed a R2Cross evaluation and recommended 4.6 cfs from April 1 through May 31 and 3.6 cfs from June 1 to June 30. This recommendation will work similar to all other ISF appropriations.

This project is focused on the recommended ISFs to protect riparian vegetation for each creek. These riparian based ISFs do not identify a specific flow rate. Instead, the proposed ISF recommendation for each drainage is to protect all unappropriated flow when threshold flow rates (bank full conditions) occur between April 1 and September 30. These ISF protections would be in effect once the threshold flow occurred until flows return to the lower ISF flow rates or September 30, whichever happens first. If the threshold flows did not occur in a given year, the additional riparian ISF flow rates would not be in effect for that year.

The purpose of this report was to identify reasonable water uses that may occur within the Study Area in the future. The identified future uses would be included within a WDA for each drainage in the Study Area. The identified uses within the WDA would then be allowed to divert water from the creeks during times when the riparian based ISF was triggered to protect all unappropriated flows. The individual WDAs will allow for future water use on both private lands located within each basin and the development of water within publicly owned lands managed by USFS, BLM, and CPW. SGM evaluated the potential for future water development on privately owned parcels within the Study Area to estimate the future demands of each basin.

In addition to recommending the appropriation of new ISFs for these three creeks, the BLM has determined that a 14.41-mile segment of Cottonwood Creek on BLM land is suitable for Wild and Scenic River designation. Per Appendix O of the Dominguez – Escalante National Conservation Area Proposed Resource Management Plan and Final Environmental Impact Statement Report, "Designation of this segment would enhance current recreational uses along the segment by providing long-term protection of flows and the scenic landscapes adjacent to the creek." This document is included as Appendix A to this report.

In the June 2018 Final Wild and Scenic River Suitability Report for the BLM Uncompahgre Planning Area, the BLM determined that a 9.4-mile segment of Monitor Creek and a 9.8-mile segment of Potter Creek are suitable for Wild and Scenic River designations, both specifically classified as a Wild River. BLM's suitability evaluation of these two streams as Wild Rivers, if designated, would protect streamflow to mimic natural seasonal changes required to sustain a healthy riparian vegetation community. The BLM noted that protection of the riparian community could be achieved through Wild and Scenic River designation, or as an alternative approach, could be achieved by relying on a new CWCB ISF water right to protect the riparian community, combined with the land use protections afforded by the BLM's suitability determination. This document is included as Appendix B to this report.

2.0 Approach and Methodology

SGM completed the following analyses using the methodologies described in the following sections to estimate the potential for future new water development in the Study Area.

1. Delineated basin boundaries using the United States Geological Survey (USGS) StreamStats application (StreamStats), a USGS 10-meter digital elevation model (DEM), and a USGS topographic base map.
2. Collected and analyzed publicly available spatial data within each basin including ISF reaches and termini points, water right structures, Colorado Decision Support System (CDSS) 2020 delineated irrigated area, permitted and constructed wells, land ownership, stream gages, DEMs, hydrology, soil, topographic base map, and aerial imagery.
3. Identified the location of private and public lands within the individual basins. Calculated the total acreage, slope, and mean elevation of private lands in each basin.
4. Identified the location of decreed water rights structures and permitted and constructed wells in each basin.
5. Cross-referenced water rights with the December 2021 Final Revised Abandonment List of Water Rights in Water Division 4 and calculated the total volumes or flow rates of existing water rights.
6. Queried and defined soil characteristics of private land in each basin.
7. Identified existing irrigated areas and potentially irrigable lands.
8. Conducted a CDSS StateCU analysis of pasture grass using the Upper Gunnison High Altitude Coefficients to estimate pasture demands.
9. Estimated the water yield in the Study Area based on historical stream gage data and the BLM modified approach of the USGS regional streamflow equation for the Uncompahgre Plateau to constrain physical water supply.
10. Evaluated the potential and/or impacts of water exportation from Cottonwood, Monitor, and Potter Creek basins.
11. Conducted a telephone interview with District 41 water commissioner, Luke Reschke, regarding transbasin diversions between the Study Area basins.
12. Estimated future water demands and evaluated limitations based on the potential future use of private parcels, physical supply, topography, legal supply, potential irrigated area, and other developmental constraints to determine a future WDA.

2.1 Geographic Information Systems (GIS)

Project mapping was completed in the Study Area displaying Cottonwood Creek, Monitor Creek, and Potter Creek basins to their confluence with Roubideau Creek. Detailed water rights structures, land ownership, and potentially irrigable land maps were also prepared. Geographic Information Systems (GIS) spatial data were obtained from various publicly available sources, as shown in Table 1.

Table 1. GIS Data Sources	
Data Source	**GIS Layers and other information**
Montrose County	Property ownership
Delta County	Property ownership
Mesa County	Property ownership
DWR CDSS	Water rights structures, 2020 irrigated land, stream gages, ISF reaches and termini, permitted and/or constructed wells, climate stations, precipitation contours, livestock water tanks
United States Geological Survey	National Hydrography Dataset (NHD) (streams, rivers, canals, ditches), 10-meter Digital Elevation Model (DEM), topographic base map, StreamStats delineated basins
National Resource Conservation Service	Soil type and classes, irrigation capability
United States Forest Service	Grazing Allotments
United States Department of the Interior - Bureau of Land Management	Grazing Allotments
ESRI	County boundaries, towns, roads
Maxar	2018 and 2021 imagery

2.1.1 Basin Delineation

Basins were delineated using StreamStats and verified using a USGS topographic map and 10-meter DEM. Potter Creek was delineated into an upper and lower basin. The term Upper Potter Creek Basin refers to the basin upstream of Potter Creek's confluence with Monitor Creek, and the term Potter Creek Basin refers to the entire Potter Creek basin upstream of its confluence with Roubideau Creek. In effect, the Potter Creek Basin includes Monitor Creek Basin, Upper Potter Creek Basin, and the area below Potter Creek's confluence with Monitor Creek down to Roubideau Creek (see Figure 1). Further, general information for each basin was tabulated including the mean, minimum, and maximum basin elevations, total drainage area, estimated average annual precipitation, and estimated flow data provided by StreamStats. These data were cross-referenced using 10-meter DEMs, CDSS average annual precipitation contours from 1951 – 1980, and historical gage data provided to SGM by the CWCB. Mean, minimum, and maximum basin elevations and total drainage area for each basin are shown in Table 2, below.

Table 2. Basin Characteristics				
Basin	**Max. Elevation (FAMSL)**	**Min. Elevation (FAMSL)**	**Mean Elevation (FAMSL)**	**Area (Acres)**
Cottonwood Creek	9,370	4,921	7,214	29,952
Monitor Creek	9,370	7,711	5,349	19,264
Upper Potter Creek	9,337	7,659	5,348	16,448
Potter Creek (1)	9,370	7,646	5,202	36,480

Notes:
FAMSL = Feet above mean sea level
(1) – Includes Monitor Creek Basin, Upper Potter Creek Basin, and area below Potter Creek's confluence with Monitor Creek

Using the USGS StreamStats tool, SGM estimated the mean annual precipitation for Cottonwood, Monitor, Upper Potter, and Potter Creek basins to be 16.09-inches (in), 19.1-in, 19.32-in, and 18.99-in, respectively. SGM cross-referenced these data with the CDSS average annual precipitation contours (1951-1980) and found that precipitation is variable depending upon elevation within each basin and ranges between 16 – 20 inches at the headwaters of the basins to 8 inches at the mouth of Cottonwood Creek, where it enters Roubideau Creek (see Figure 3).

2.1.2 Existing ISF Reaches

ISF reaches and termini points were downloaded from the CDSS HydroBase database (HydroBase) and are shown in Figures 2 and Figures 4 through 7. The CWCB has the following decreed ISF water rights:

- Cottonwood Creek:
  - 3.6 cfs from April 1 through June 15
- Potter Creek:
  - 4.0 cfs from April 1 through June 15.
  - 1.80 cfs from June 16 through July 31.
  - 1.0 cfs from August 1 through February 29.
  - 1.80 cfs from March 1 through March 31.

The Cottonwood Creek ISF has an appropriation date of 1/25/2006 (Case No. 06CW166) and extends 23.29 miles from the headgate of Hawkins Ditch at the upstream terminus to the confluence with Roubideau Creek at the downstream terminus. The Potter Creek ISF has an appropriation date of 1/28/2004 (Case No. 04CW161) and extends 9.8 miles from the BLM – USFS boundary at the upstream terminus to the confluence with Roubideau Creek at the downstream terminus.

2.1.3 Water Rights and Structures

Spatial information regarding water rights structures and exempt wells were downloaded from the CDSS HydroBase. Data were exported to ArcGIS and clipped to the Study Area basins. Most of the permitted and exempt wells do not have a decreed water right. Information regarding water rights appropriations and water uses were collected from HydroBase and tabulated for each basin. Decreed water rights were cross-referenced with the December 2021 Final Revised Abandonment List of Water Rights in Water Division 4 (Final 2021 Abandonment List). A total of 9.0 cubic feet per second (cfs) was included on the 2021 Abandonment List for the Everlasting Ditch and a total of 10.0 cfs was included on the 2021 Abandonment List for the Hawkins Ditch. During 2022, the owners of these water rights protested the abandonments, so the total absolute decreed amount was not reduced for the tabulation shown on Figure 4. In 2022, the Division Engineer did not find the owner of the Long Park Ditch conditional water rights had completed adequate diligence; therefore, those rights were cancelled. Therefore, the Long Park Ditch water rights were not considered in this study. See Figures 2 and Figures 4 through 7 for water rights maps, summary decreed water rights tables, and permitted well tables.

Cottonwood Creek Basin water rights structures, shown in Figure 4, consist of ditches, springs, stock ponds, and reservoirs. The decreed reservoirs were characterized as stock ponds if their decreed storage amount was less than or equal to 1.0 acre-foot (AF). Twelve out of the 28 ponds and reservoirs were characterized as reservoirs, with the remaining 16 characterized as stock ponds. Most diversions within the Cottonwood Creek Basin are decreed for fire protection, stock-watering, and/or federal reserved uses. Other uses include irrigation, domestic, storage, wildlife, and/or recreational uses. One permitted well (Permit No. 19-GX) exists within this basin, which is a geoexchange system loop field and is considered non-consumptive.

Monitor Creek Basin water rights structures, shown in Figure 5, consist of ditches, a pipeline, springs, wells, stock ponds, and reservoirs. The decreed reservoirs were characterized as stock ponds if their decreed storage amount was less than or equal to 1.0 AF. Six out of the 34 ponds and reservoirs were characterized as reservoirs, with the remaining 28 characterized as stock ponds. Most diversions in the Monitor Creek Basin are decreed for irrigation, domestic, fire-protection, stock-watering, and/or federal reserved uses. Other uses include storage and wildlife uses. Seven constructed wells exist in this basin and one permit has been issued for a future well. See the Division of Water Resources (DWR) wells table in Figure 5 for their location and permit number.

Upper Potter Creek Basin (above the confluence with Monitor Creek) water rights structures, shown in Figure 6, consist of springs, ponds, and reservoirs. Two out of the 18 ponds and reservoirs were characterized as reservoirs, with the remaining 16 characterized as stock ponds. Most diversions in the Upper Potter Creek Basin are decreed for fire protection, stock-watering, and federal reserved uses. Other uses include domestic, storage, and/or wildlife uses. One permitted well (Permit No. 19-GX) exists within this basin, which is a geoexchange system loop field and is considered non-consumptive.

Figure 7 shows Monitor Creek Basin water rights, Upper Potter Creek Basin water rights, and includes the Potter Creek Basin segment below the confluence of Monitor and Potter Creeks, collectively referred to as Potter Creek Basin. For detailed water rights tabulation, refer to Figures 5 and 6.

It is important to note that the Study Area is remote, and the equipment used to measure diversions does not record real-time diversions. Rather, DWR staff make periodic visits to record the diversion at a given point in time. Therefore, the available diversion records for

the water rights in the Study Area may not fully represent the actual diversions which occur. For instance, many of the absolute decreed water rights do not have records where they have diverted their full decreed amount. While diversion records indicate that several of the senior ditches have not diverted their full water right, owners of those water rights could improve their existing infrastructure to fully divert and use the physically and legally available supply for the irrigation of additional lands under those ditches. These decreed water rights are senior to any future ISF appropriation. Additionally, there is only one conditional water right in Cottonwood Creek Basin (Table Rock Reservoir) which could be made absolute in the future.

2.1.4 Livestock Water Tanks

Livestock water tanks were queried using the online CDSS Map Viewer. According to the Colorado Revised Statute Sections 35-49-101 to 35-49-116, livestock water tanks may exist on waterways that are normally dry and may not exceed 10 AF of capacity. They cannot be used for irrigation purposes and are only used for stock watering purposes. Approximately nine livestock water tanks exist in Cottonwood Creek Basin, six in Monitor Creek Basin, and three in Potter Creek Basin. Private landowners and the BLM utilize the existing livestock water tanks. Livestock water tanks are considered exempt and do not require a water right.

2.1.5 Land Ownership

Private parcel boundaries, ownership information, and land use codes for each parcel within the study area were accessed from the Montrose, Delta, and Mesa Counties' Assessor's Offices online databases. Parcels of interest included private land parcels that intersect Cottonwood, Monitor, or Potter Creek basins' boundaries, or that are completely within those basins' boundaries. The total private land ownership in acres and as a percent of each basin is shown in Table 3, below. See Figure 8 for detailed land ownership and parcel acreage information.

Table 3. Basin Areas and Land Ownership

Basin	Total Area (acres)	Private Property (1) (acres)	Private Property Percent of Basin	Public Land (2) (acres)
Cottonwood Creek	29,952	3,285.7	11.0%	BLM: 15,505 CPW: 2,175 USFS: 9,583
Monitor Creek	19,264	2,474.1	12.8%	BLM: 6,920 USFS: 10,008
Upper Potter Creek	16,448	4.4	0.02%	BLM: 6,013 USFS: 10,415
Potter Creek (3)	36,480	2,631.0	7.2%	BLM: 13,684(4) USFS: 20,423

Notes:

(1) Acreage represents the total acreage of parcels, including portions that extend outside of the basin boundary

(2) Acreage represents public land within the basin boundary.

(3) Includes Monitor Creek Basin, Upper Potter Creek Basin, and area below Potter Creek's confluence with Monitor Creek.

(4) Includes Monitor Creek Basin and Upper Potter Creek Basin area plus 751 acres of BLM land below confluence with Monitor Creek.

2.1.6 Existing Irrigated Area

The HydroBase includes current (as of 2020) delineated irrigated areas within each basin, which were downloaded and are shown in Figure 9. As of 2020, CDSS delineated 182.4 acres of irrigated land in the Cottonwood Creek Basin and 184.7 acres of irrigated land in the Monitor Creek Basin. Based upon the HydroBase shapefile information, the irrigated acreage in the Study Area is categorized as grass pasture and primarily flood irrigated. No irrigated lands were delineated in the Upper Potter Creek Basin nor below its confluence with Monitor Creek.

2.1.7 Soil Types

Soil data were downloaded from the National Resource Conservation Service (NRCS) Web Soil Survey. Soil types on private land are shown in Figure 9. Various soil types exist in the private lands within the Study Area. Each soil type was analyzed for its NRCS Irrigated Soil Capability Class (Soil Class). The Soil Class defines each soil's potential to be irrigated. A summary of soil type and Soil Class is included in Table 4, below. Please note that soil types that comprised less than 1% of total private irrigated acreage were not included in Table 4. A description of each Soil Class is provided in Section 3.1.9 and Table 5-A. Due to the wide range of slopes identified for each NRCS listed soil type, SGM refined each soil's irrigation potential using slope data as described in the next section (2.1.8), and shown in Table 5-B.

Table 4. Private Land Soil Types

Map Unit Symbol	Soil Type	% Of Private Land	Irrigated Soil Capability Class
13	Chilson-Delson, moderately deep-Beenom families complex, 1-20% slopes	7.69%	Class 6, Class 7
16	Delson, moderately deep-Sharrott families complex, 1-15% slopes	1.69%	Class 6
24	Kubler-Delson-Cerro families complex, 3-15% slopes	3.39%	Class 6, Class 7
29	Supervisor-Cebone families complex, 1-15% slopes	14.52%	Class 6
49	Lazear-Rock outcrop complex, 3-30% slopes	1.49%	Class 6
67	Rock outcrop	2.13%	Class 8
73	Shavano-Leazear complex, 3-12% slopes	3.87%	Class 6
75	Torriorthents-Rock outcrop, sandstone, complex	3.31%	Class 7
76	Torriorthents-Rock outcrop, shale, complex	2.29%	Class 7
262	Arabrab-Evpark-Parkelei complex, 3-20% slopes	36.97%	Class 6, Class 8
B31	Barx-Lazear, very flaggy-Rock outcrop complex, 3-35% slopes	2.14%	Class 6
R3	Lazear, extremely flaggy-Rock outcrop-Wellsbasin, extremely stony complex, 20-75% slopes	7.57%	Class 8
X31M	Walknolls-Rock outcrop complex, 20-60% slopes	4.01%	Class 7

X61	Moento-Beje, extremely stony complex, 10-35% slopes	4.83%	Class 7
Total		**95.90%**	

Notes:

- Soil Units that comprised <1.0% of total acreage not shown on the table or map
- Total private land acreage = 5,916.7 acres
- The remaining 4.1% of private acreage is characterized by other soil types that comprise <1% each of overall private land acreage. The remaining soil types all have an irrigation class of 4.

2.1.8 Irrigated Soil Potential Classification

To assess the potential to irrigate lands within private land parcels, SGM calculated the slope throughout the study area using a USGS 10-meter DEM and weighted the results with NRCS Non-Irrigated Soil Capability Class data accessed from the Soil Data Viewer 6.2 ArcGIS add-in analyst tool. SGM assigned score values to each Soil Class and each slope range, as shown in Tables 5-A and 5-B, respectively. Class 4 soils received a score of 2, Class 6 soils received a score of 1, and Class 7 and Class 8 soils received a score of 0 (see Table 5-A). Similarly, slopes of less than 8-percent received a score of 2, slopes between 8 and 10-percent received score of 1, and slopes greater than 10-percent received a score of 0 (see Table 5-B).

Table 5-A. Irrigation Potential Classification Scoring System (NRCS Soil Class)

NRCS Soil Class[1]	Score Value	Irrigation Potential
Class 4 – soils have very severe limitations that reduce the choice of plants or require very careful management, or both.	2	Irrigable
Class 6 – soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.	1	Marginally Irrigable
Class 7 – soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.	0	Not Irrigable
Class 8 – soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, basin, or aesthetic purposes.	0	Not Irrigable

Notes:

(1) NRCS Soil Class data gathered from Soil Data Viewer 6.2 ArcGIS add-in analyst tool.

Table 5-B. Irrigation Potential Classification Scoring System (Slope Range)

Slope Range	Score Value	Irrigation Potential
0-8%	2	Irrigable
8-10%	1	Marginally Irrigable
>10%	0	Not Irrigable

After defining a score value for each Soil Class and slope range, weighted scores were assessed using the ArcGIS Raster Times tool. The Raster Times tool multiplied the score values assigned to the Soil Class and slope range of a pixel, as described in Tables 5-A and 5-B, into weighted values that incorporated each attribute. For instance, a portion of private property with slopes less than 2% (value of 2) and Class 6 soils (value of 1) would receive an overall score of 2 (Score of 2 x Score of 1 = Weighted Score of 2). The greatest possible weighted score that can be assigned would be a numeric score of 4, if the Soil Class was assigned a value of 2 and the slope was assigned a score of 2 (2 x 2 = 4). If a pixel had slopes greater than 10% or Class 7 or 8 soils, the weighted score was assigned a 0, meaning the area is not suitable for irrigation. The weighted slope and NRCS Soil Class values are shown in Table 6.

Table 6. Weighted Irrigation Capability Values and Descriptions

Weighted Score Value (1)	Irrigation Potential
2 or 4	Irrigable - slope range is favorable for irrigation and soils are able to sustain choice crops with careful management.
1	Marginally irrigable – slope range is not favorable, and soils may sustain choice crops with careful management.
0	Not Irrigable – slope range is unable to irrigate, and soils are not suitable to sustain crops.

Notes:

(1) Weighted score value was calculated for each pixel by multiplying the Non-Irrigated Soil Capability Class (Table 5-A) with the slope range (Table 5-B).

The proximity of irrigable and marginally irrigable lands within private parcels to CDSS mapped canals/ditches were analyzed within a quarter mile (1,320 feet) buffer to assess the physical ability to divert and deliver irrigation supplies to potential lands for future irrigation (see Figures 10 and 11). Total acres of future potentially irrigable lands within the quarter-mile buffer were calculated in ArcGIS. Lands that fell outside of the delineated basins and lands delineated by CDSS as being currently irrigated were not considered. Based upon the conditions listed in Tables 5-A, 5-B, and 6, a total of 2,248 acres of private land were classified as irrigable, 173 acres of private land were considered marginally irrigable, and 2,241 acres were considered not irrigable (see Figure 10). These values do not include the limited area within the single 4-acre private parcel in Upper Potter Creek Basin, as future irrigation is unlikely due to the limited water rights and water supply in this area of the basin.

After discussions with the BLM and CWCB staff, it was determined that the estimate of potentially irrigable soils within the Study Area was much greater than what could practically be irrigated given the overall elevation of the Study Area and the extremely limited water supply available in the upper portion of each basin. Therefore, SGM examined aerial photography near the existing irrigated areas and within the irrigable and potentially irrigable areas delineated in the weighted classification of irrigated soils. Much of the irrigated area that was deemed suitable was heavily wooded or had dense vegetation. Thus, irrigation would require significant efforts by landowners to remove vast amounts of forest prior to irrigation. Therefore, SGM outlined potentially irrigable area polygons that appeared most reasonable to be irrigated in the future by assessing vegetation cover, soil irrigation capabilities, proximity to existing ditches, and waterways that could potentially be diverted in the future with the construction of new canals or storage ponds (see Figure 11). A total of 420.6 acres of potential future irrigated land was

delineated after analyzing aerial imagery and the irrigation potential of soils, which includes the sum of soils that are classified as irrigable and marginally irrigable, as described above and in Table 6. Specifically, 68.8 acres of irrigated lands were delineated in the Cottonwood Creek Basin and 351.8 acres were delineated in the Monitor Creek Basin (see Table 7). For clarification, the values listed in Table 7 do not include land that is currently irrigated, as denoted by the 2020 CDSS irrigated area shapefile.

SGM did not delineate any future potential irrigated land in the Upper Potter Creek Basin, due to the limited amount of private land and lack of existing ditches with decreed uses for irrigation purposes.

Table 7. Potential Future Irrigated Area by Basin

Basin	SGM Delineated Future Irrigated Area *(Weighted Score of 2 or 4)* **(Acres)**	SGM Delineated Future Marginally Irrigated Area *(Weighted Score <2)* **(Acres)**	Basin Total Future Irrigated Area (Acres)
Cottonwood	62.5	6.3	**68.8**
Monitor	287.2	64.6	**351.8**
Upper Potter	0	0	**0**

Note:
No irrigable lands on private property were identified in Upper Potter Basin nor Potter Creek below its confluence with Monitor Creek.

From a water rights perspective, it is important to consider that many of the senior ditches within Cottonwood Creek Basin have decreed water rights that allow for the irrigation of many more acres than are currently being irrigated. While diversion records indicate that several of the senior ditches have not diverted their full water right, owners of those water rights could improve their existing infrastructure to fully divert and use the physically and legally available supply for the irrigation of additional lands under those ditches. Again, these decreed water rights are senior to any new riparian based ISF appropriation.

2.1.9 Grazing Allotments

Grazing allotments on BLM managed lands were provided by the BLM. USFS grazing allotments were downloaded from the USFS Geospatial Data Discovery ArcGIS Hub. Additional grazing and animal unit month (AUM) data were provided by the USFS for their grazing allotments. All USFS and BLM allotments are active within the Study Area basins. The BLM allotments support cattle grazing and the USFS allotments support cattle and horse grazing. The AUM value for each allotment is provided in Table 8 below and shown in Figure 12.

Table 8. Grazing Allotment Animal Unit per Month (AUM)	
Allotment	**AUM**
USFS Active Grazing Allotments (Cattle & Horse)	
25 Mesa C&H	2,893
Boyden/Monitor C&H	5,612
Dry Fork C&H	3,140
BLM Active Grazing Allotments (Cattle)	
Joker	46
Lee Bench	41
Sawmill Mesa	618
Twenty-Five Mesa North	644
White Ranch	10
Winter	774
Total	13,779

2.2 Basin Yield Analysis

2.2.1 Historical Gages

To our knowledge, no long-term gaging efforts have been conducted on the creeks within the Study Area. Two historical gages exist on Potter Creek: Potter Creek near Columbine Pass, CO (POTCOLCO) and Potter Creek near Olathe, CO (POTOLACO). These historical gages have recorded data from 1980 and 1981, and 1979 through 1981, respectively. No historical gages exist on Cottonwood Creek.

For the purpose of this project, CWCB has completed temporary gaging of all three creeks over the past seven years. SGM received the available temporary gage data from CWCB within the Study Area for the following periods.

- Potter Creek data were available from 4/8/2015 through 7/1/2019.
- Monitor Creek data were available from 6/8/2017 through 6/30/2020 and from 4/1/2021 through 9/14/2021.
- Cottonwood Creek data were available from 5/12/2015 through 5/14/2020.

These data were analyzed and tabulated into monthly gaged volumes as shown in Appendix C. It is important to consider that the gaged records represent the available streamflows after the historical diversions by upstream decreed water users, exempt users (i.e., exempt livestock uses), and resulting return flows, and do not represent the total water available within each watershed. Finally, SGM considered a nearby gage station with a period of record that extended from 1938 through present to determine years with wet, dry, and average hydrology to correlate the historical gage data within the Study Area as years with wet, dry, or average hydrology. For the purpose of this project, the closest gage with a sufficiently long period of record was the Uncompahgre River at Delta, CO (Station ID: UNCDELCO). The entire Uncompahgre River at Delta period of record was used to determine normal, wet, and dry years, given the limited duration of stream gaging in the Study Area (see Appendix D).

2.2.2 StreamStats

SGM considered the USGS StreamStats Monthly Flow Statistics Flow Report, which estimated each basin's yield (see Appendix E for StreamStats Reports). The StreamStats estimated total basin yield for the Cottonwood Creek, Monitor Creek, Upper Potter Creek, and Potter Creek basins are shown in Table 9. The mean annual yield of each basin is dependent upon mean basin elevation and total area of each basin.

Table 9. StreamStats Estimated Basin Yield (AF)

Basin	Mean Annual Yield (AF)
Cottonwood Creek	2,876
Monitor Creek	3,058
Upper Potter Creek	2,741
Potter Creek (1)	5,688

Notes:
(1) – Includes Monitor Creek Basin, Upper Potter Creek Basin, and area below Potter Creek's confluence with Monitor Creek

Based on the historical streamflow gaging records, SGM believes that the StreamStats basin yield is too low and does not represent historical yields. While StreamStats can provide useful estimates of streamflow characteristics, the mismatch between StreamStats and historical data indicated that an alternative basin yield methodology was necessary for this project.

2.2.3 Elevation-adjusted Basin Yield Analysis

Due to the limited available gage data and potentially underestimated yield provided by StreamStats, SGM employed a methodology to estimate the available flow within each creek. SGM's methodology can be described as an elevation-adjusted basin yield analysis that considers historical stream gaging records for nearby streams with similar characteristics (area, slope, and aspect) to extrapolate basin yields for ungauged streams. Specific for this project, SGM considered the following historical gage records:

- Spring Creek near Montrose, CO (1977 – 1981) (Station ID: 09149420)
- Roubideau Creek Mouth near Delta, CO (1939 – 2010) (Station ID: 09150500)
- Dry Creek at Bergonia Rd, near Delta, CO (1996 – 1998) (Station ID: 09149480)
- Escalante Creek (1977 – 1989) (Station ID: 09151500)

SGM used Streamstats to calculate the basin tributary to each of the historical gages and utilized the mean basin elevation and calculated basin area of each basin in the Study Area. These calculations were cross-checked by using a USGS 10-meter DEM clipped to each basin's perimeter. SGM then calculated the historical monthly and annual gaged volumes for the historical stream gages and picked a year within that record that corresponded to a normal year within the Uncompahgre River at Delta's gaged records. For each historical gaged basin, the normal annual gaged volume was then divided by the total acreage of the basin tributary to the historical gage location. A linear regression equation was then developed between the four historical gages to estimate the relationship between the average yield per acre and the mean elevation of the basin (see Appendix F). The resulting elevation-adjusted basin yield equation developed for this project was:

Basin Yield = (0.00081 * (Mean Basin Elevation)) – 5.42925

For the developed linear regression equation, the R^2 value (correlation factor) was equal to 0.84. The closer the correlation factor is to 1.0, the more correlated the compared data are to each other. The calculated R^2 value of 0.84 indicates the relationship between elevation and yield is significant (well correlated) and therefore reasonable to use to estimate the average annual yield of the Study Area basins. See Table 10 for calculated elevation adjusted basin yields of the Study Area basins.

Table 10. Elevation-adjusted Basin Yield (AF)

Basin	Drainage Area (acres)	Mean Basin Elevation (FAMSL)	Mean Annual Yield (AF)
Cottonwood Creek	29,952	7,213	12,379
Monitor Creek	19,264	7,710	15,717
Upper Potter Creek	16,448	7,658	12,736
Potter Creek (1)	36,480	7,645	27,842

Notes:
(1) – Includes Monitor Creek Basin, Upper Potter Creek Basin, and area below Potter Creek's confluence with Monitor Creek

Appendix F shows the summary tables and figures for this analysis, as well as the historical gage records considered.

It is important to note that the estimated mean annual yields, shown in Table 10, represent the entire natural flow within the basin and do not account for water rights and subsequent diversions. SGM reviewed historical diversion records but understands that the available diversion records are based on periodic inspections of remote flumes, and while representative of diversion rates, do not accurately account for total diversions. In accounting for the recorded diversions, we believe that the elevation-adjusted basin yield analysis over-estimates the annual yields in Cottonwood, Monitor, and Potter creeks, but the volumes are more representative than the StreamStats estimates considering the recent CWCB gaged streamflow in the Study Area. Due to the over-estimation of this method, SGM relied on a regional equation developed by the USGS and utilized by the BLM, as discussed below in Section 2.2.4.

2.2.4 Uncompahgre Plateau and Glade Park Annual Hydrograph Estimation

BLM staff provided SGM with a hydrologic analysis of the Uncompahgre Plateau using historic gage data (see Appendix G). The BLM noted that most available streamflow gage data is "severely impacted by diversions and irrigation use." Therefore, it is "difficult to estimate the natural flow regime for the basins on the [Uncompahgre] Plateau." The BLM relied upon a regional equation, developed by the USGS, to estimate the annual flow characteristics of the Uncompahgre Plateau. The regional equation used in their report is provided below:

$$\mathbf{Q_{ann} = 9.7 \times 10^{-2}(A^{0.888})(E_b^{1.74})(1.98)(365)}$$

Q_{ann} = mean annual volume in acre-feet
A = drainage area in square miles
E_b = (mean basin elevation – 5,000) / 1,000

The BLM considered nearby gages in their study including:

- Spring Creek near Beaver Hill (1978 – 1980)
- Potter Creek near Olathe, CO (1980)
- Hay Press Creek above Fruita Reservoir #3 (1984 – 1987)
- Escalante Creek near Delta, CO (1977 – 1988)
- Tabeguache Creek near Nucla, CO (1947 – 1952)

The BLM concluded that the comparison between actual gaged volumes and estimated volumes using the regional equation developed by the USGS provided a reasonably accurate estimate of the total annual flow volume. Therefore, SGM utilized the BLM's modified approach of the USGS regional equation to calculate the annual basin yields for the Study Area basins. The calculated mean annual volumes of each basin are provided in Table 11.

Table 11. BLM Study of Estimated Mean Annual Basin Yield (AF)

Basin	Drainage Area (mi^2)	Mean Basin Elevation (FAMSL)	(Mean Basin Elevation – 5,000 FT) / 1000 FT	Mean Annual Yield (AF)
Cottonwood Creek	46.8	7,213	2.213	8,495.2
Monitor Creek	30.1	7,710	2.710	8,167.0
Upper Potter Creek	25.7	7,658	2.658	6,862.4
Potter Creek (1)	57.0	7,645	2.645	13,802.8

Notes:
(1) – Includes Monitor Creek Basin, Upper Potter Creek Basin, and area below Potter Creek's confluence with Monitor Creek

It is important to note that the estimated mean annual yields shown in Table 11 represent the entire natural flow within the basin and do not account for water rights and subsequent diversions. SGM considered the historical diversion records and believe the USGS regional equation methodology is generally representative of the basin yields for the Study Area because it most closely resembles recent CWCB gaged streamflow for the Study Area creeks after considering historical diversions; therefore, this methodology was relied upon for the subsequent analyses in developing the WDA for each watershed.

2.2.5 Estimated Physical Water Supply

In order to estimate the monthly streamflow volumes in Cottonwood, Monitor, and Potter Creeks, SGM considered the USGS developed regional equation used by the BLM in their hydrologic analysis of the Uncompahgre Plateau (Appendix G). The BLM calculated a mean annual monthly distribution using the annual hydrographs from the historical Potter Creek, Spring Creek, and Hay Press Creek gage records. These creeks were used because they best represent the natural flow regime of the Plateau. SGM relied upon the BLM monthly distribution percentages and calculated the mean monthly flows of each creek in the Study Area (see Table 12). Based on the BLM's monthly distribution percentages, the normal peak flow would occur in May. SGM notes that based on the historical and recent CWCB streamflow gage records, the peak runoff can occur in May, but oftentimes occurs in April. The timing of runoff is dependent upon the snowpack, spring

storms, and warming spring temperatures. Although the monthly distribution model reasonably estimates flows within each creek, SGM notes that the actual monthly streamflow volumes and timing of peak runoff vary greatly from year-to-year.

Table 12. Monthly Distribution of Flows													
Watershed		**Cottonwood**			**Monitor**			**Upper Potter**			**Potter**		
Annual Basin Yield (AF)		**8,495.2**			**8,167.0**			**6,862.4**			**13,802.8**		
Month	**% of Flow**	**AF/Month**	**AF/Day**	**Mean Monthly Flow (cfs)**	**AF/Month**	**AF/Day**	**Mean Monthly Flow (cfs)**	**AF/Month**	**AF/Day**	**Mean Monthly Flow (cfs)**	**AF/Month**	**AF/Day**	**Mean Monthly Flow (cfs)**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
Jan	0.32%	27.18	0.88	0.44	26.13	0.84	0.43	21.96	0.71	0.36	44.17	1.42	0.72
Feb	0.65%	55.22	1.97	0.99	53.09	1.90	0.96	44.61	1.59	0.80	89.72	3.20	1.62
Mar	1.00%	84.95	2.74	1.38	81.67	2.63	1.33	68.62	2.21	1.12	138.03	4.45	2.24
Apr	14.70%	1,248.79	41.63	20.99	1,200.55	40.02	20.18	1,008.77	33.63	16.95	2,029.01	67.63	34.10
May	55.41%	4,707.19	151.84	76.55	4,525.33	145.98	73.60	3,802.46	122.66	61.84	7,648.13	246.71	124.38
Jun	24.61%	2,090.67	69.69	35.13	2,009.90	67.00	33.78	1,688.84	56.29	28.38	3,396.87	113.23	57.09
Jul	1.30%	110.44	3.56	1.80	106.17	3.42	1.73	89.21	2.88	1.45	179.44	5.79	2.92
Aug	0.50%	42.48	1.37	0.69	40.84	1.32	0.66	34.31	1.11	0.56	69.01	2.23	1.12
Sep	0.40%	33.98	1.13	0.57	32.67	1.09	0.55	27.45	0.91	0.46	55.21	1.84	0.93
Oct	0.39%	33.13	1.07	0.54	31.85	1.03	0.52	26.76	0.86	0.44	53.83	1.74	0.88
Nov	0.37%	31.43	1.05	0.53	30.22	1.01	0.51	25.39	0.85	0.43	51.07	1.70	0.86
Dec	0.35%	29.73	0.96	0.48	28.58	0.92	0.46	24.02	0.77	0.39	48.31	1.56	0.79
	Average			**11.68**			**11.22**			**9.43**			**18.97**

Notes:

(1) Month

(2) BLM monthly distribution percentages using annual hydrographs from the historical Potter Creek, Spring Creek, and Hay Press Creek gage records.

(3) Annual Basin Yield multiplied by BLM monthly distribution percentage (Column 2)

(4) Column 3 divided by days per month

(5) Column 4 converted to cfs (Column 4/1.9835)

(6) Annual Basin Yield multiplied by BLM monthly distribution percentage (Column 2)

(7) Column 6 divided by days per month

(8) Column 7 converted to cfs (Column 7/1.9835)

(9) Annual Basin Yield multiplied by BLM monthly distribution percentage (Column 2)

(10) Column 9 divided by days per month

(11) Column 10 converted to cfs (Column 10/1.9835)

(12) Annual Basin Yield multiplied by BLM monthly distribution percentage (Column 2)

(13) Column 12 divided by days per month

(14) Column 13 converted to cfs (Column 13/1.9835)

2.3 Interview with District 41 Commissioner – Luke Reschke

To verify our understanding of the historical streamflow and water rights administration in the Study Area, SGM completed a phone interview with the Division 4, District 41 Water Commissioner, Luke Reschke. More specifically, SGM wanted to understand the extent to which diversions from one watershed in the Study Area are delivered (or can be delivered) to an adjacent watershed. This operation would be considered a transbasin diversion. Mr. Reschke informed SGM that limited transbasin diversions occur within the Study Area. In summary:

- The 25 Mesa Upper Little Monitor Ditch diverts water from Little Monitor Creek and delivers water into Bullfrog Reservoir within the Cottonwood Creek Basin (see Figures 4 and 5 for structure locations).
- The Davis Brothers Ditch diverts water from the Dry Fork of Escalante Creek and delivers the supply into the Cottonwood Creek Basin through the North Fork Ditch (see Figure 4 for the location of the North Fork Ditch).
- Mr. Reschke was not able to recall any structures that directly diverted water out of Cottonwood Creek Basin.
- At the time of the interview, Mr. Reschke indicated that the Long Park Ditch Nos.1 through 5 conditional water rights could divert from Cottonwood Creek and are conditionally decreed to irrigate land in the Monitor Creek Basin in the future. As previously mentioned, in September 2022 the Long Park Ditch system water rights were cancelled by the court; therefore, any future transbasin irrigation from Cottonwood Basin to Monitor Basin would require a new water right.

Mr. Reschke indicated that within the Cottonwood Creek Basin, the Hawkins Ditch and Everlasting Ditch are senior water rights that are capable of diverting the majority of streamflow within Cottonwood Creek. Mr. Reschke indicated that the overall irrigation season within these basins is short due to the quick runoff and limited supply availability. Given the remote location of the Study Area, the administration of water rights in Cottonwood, Monitor, and Potter creeks are generally limited to periodic field visits to verify diversion rates. Finally, Mr. Reschke has often observed downstream reaches of the Study Area creeks running dry during late fall and winter months. We understand these dry conditions are a result of the predominant drought conditions that have generally persisted in Colorado from 2000 through the present. While there have been a few normal and wet years since 2000, the number of dry years along with continued irrigation diversions have resulted in extremely dry conditions in the lower portions of the Study Area creeks. These observations further corroborate our understanding of the limited amount of water supply and the relatively short duration of runoff. Therefore, additional ISF water rights in the Study Area would help to protect and preserve high flow flood events to benefit the riparian vegetation.

3.0 Water Demand Estimation and Development Scenarios

SGM worked with stakeholders to determine viable future scenarios that may occur in the Study Area. These future scenarios and respective water uses would require additional water rights to secure a future water supply. Conceptually, the future diversions and uses would be allowed under each specific basin's WDA. Stakeholders identified three conceptual water development scenarios. First, landowners could seek to adjudicate new

junior surface diversion water rights for supplemental irrigation. Second, the current parcels could be subdivided into 35-acre parcels, which would increase domestic demands, while maintaining irrigation on a portion of the subdivided parcels. Finally, the current parcels could be subdivided into 5-acre parcels, which would significantly increase domestic demands, while maintaining irrigation on a portion of the subdivided parcels

In order to determine what the future water demands would be for each scenario, SGM evaluated the current water demands and developed representative unit water demands for the specific types of water uses that may occur in the future.

3.1 Unit Water Demand Estimation

In order to estimate the future WDAs for each basin within the Study Area, SGM considered the existing and potential future water uses within the basins to estimate reasonable water demands for this project. Future water uses included irrigating additional private land, future grazing on public lands, and subdividing private land parcels for future small-scale farms that would rely on new water supplies and junior water rights. These analyses are discussed below.

3.1.1 State CU Analysis

To estimate the potential water demands of the irrigated areas on private parcels within the Study Area, SGM conducted a Climate Station Scenario analysis in the CDSS StateCU program. The average monthly irrigation water requirement (IWR) for pasture grass was calculated using the Upper Gunnison High Altitude (UGHA) crop coefficient from 1992 through 2021. SGM relied upon nearby climate station data to complete the analysis. Precipitation data were gathered from the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021 and temperature data were gathered from the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted based on the elevation at a rate of 3.6° Fahrenheit (F) per thousand feet. Precipitation data were orthographically adjusted based on the CDSS average annual precipitation contours from 1951 through 1980. See Figure 3 for precipitation ranges and locations of climate stations used in the analysis.

The average elevations of the existing and potential future irrigated areas were calculated using a USGS 10-meter DEM. SGM created two scenarios to calculate an irrigation water requirement for pasture grass, shown in Table 13. Scenario 1 estimated the IWR for irrigated lands at approximately 7,000 FAMSL to be 2.3 AF/acre. Scenario 2 estimated the IWR for irrigated lands at approximately 8,400 FAMSL to be 2.0 AF/acre. All of the existing irrigated areas and potential future irrigated areas exist at or near these elevations.

Table 13. Average Monthly Irrigation Water Requirement for Grass Pasture		
Month	Scenario 1 - 7,000'	Scenario 2 - 8,400'
	Acre-feet/acre	Acre-feet/acre
January	0.000	0.000
February	0.000	0.000
March	0.000	0.000
April	0.043	0.045
May	0.492	0.403
June	0.562	0.509
July	0.492	0.440
August	0.388	0.340
September	0.312	0.265
October	0.000	0.000
November	0.000	0.000
December	0.000	0.000
Total	**2.289**	**2.003**

General Notes:

- Values generated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1)
- Irrigation Water Requirement as calculated by StateCU for 1.0 acre of pasture grass. Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient.
- Precipitation based on the Montrose No 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021.
- Temperature data were orthographically adjusted based on the elevation at a rate of 3.6° F per thousand feet.

Column Notes:

- Scenario 1:
  - Analysis assumes fields are located at an elevation of 7,000 FAMSL and latitude of 38.55° N.
  - Precipitation data were orthographically adjusted by a factor of 1.55.
- Scenario 2:
  - Analysis assumes fields are located at an elevation of 8,400 FAMSL and latitude of 38.50° N.
  - Precipitation data were orthographically adjusted by a factor of 1.55.

3.1.2 Stock Water and Grazing Demand

To estimate the current grazing water demands with the Study Area, SGM analyzed the USFS and BLM grazing allotment data on federal lands. Nearly all of the public lands within the Study Area are under active grazing allotments. For the BLM grazing allotments, SGM estimated current water demands for grazing based on AUM values and a typical livestock demand per day, which considers the equivalent amount of vegetation consumed by a calf-cow combination. For the USFS grazing allotments, SGM estimated current water demands for grazing based on the number of animals (cattle and horses) within

each allotment, the grazing period, and a typical livestock demand per day. SGM reviewed the available literature and determined a reasonable water demand for an open range cow-calf pair to be 34.2 gallons per day (gpd).

The current range of water demands per allotment are provided in Tables 14a and 14b. The spatial extent of each allotment does not match basin boundaries and some of the allotments extend outside the Study Area boundary. Therefore, it is difficult to estimate the exact grazing demand within each basin. Conservatively, the overall grazing demand for each allotment was used. Across all of the grazing allotments near the Study Area, the estimated stock water demand was estimated to be 34.95 AF (6.72 AF for BLM and 28.2 for USFS) (see Tables 14a and 14b).

We understand the BLM grazing allotments are close to their maximum achievable grazing density, and therefore BLM does not anticipate needing a significant increase in the amount of stock water demands in the future. The USFS do not currently have any proposed ranged improvements; however, water developments could occur in the future based on needs.

Based on conversations with the BLM and USFS staff, those agencies believe that a future total water supply demand estimate of 2.0 AF per year per basin is adequate for each of the BLM and USFS various future water demands and uses. For planning purposes, the BLM and USFS future water developments may include spring development and exempt stock uses that could potentially occur in the future, such as livestock watering tanks.

Table 14a. USFS Annual Stock Water and Grazing Demands

Allotment	Cattle		Horses		Unit Grazing Demand			Total Grazing Demand	
	No. of Cattle	No. of Grazing Days	No. of Horses	No. of Grazing Days	Livestock Water Demand (gpd)	Annual Cattle Grazing Demand (gal/yr)	Annual Horse Grazing Demand (gal/yr)	Total Grazing Demand (gal/yr)	Total Grazing Demand (AF)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
USFS Active Grazing Allotments (Cattle & Horse)									
25 Mesa C&H	481	137	4	148	34.2	2,253,677	20,246	2,273,924	7.0
Boyden/Monitor C&H	936	137	14	137		4,385,534	65,596	4,451,130	13.7
Dry Fork C&H	522	137	6	142		2,445,779	29,138	2,474,917	7.6
					Total	**9,084,991**	**114,980**	**9,199,971**	**28.2**

Notes:

(1) Grazing allotment name

(2) Number of permitted cattle within grazing allotment. Assumes Cow/Calf pair.

(3) No. of days of active grazing allowed in permit

(4) Number of permitted horses within grazing allotment.

(5) No. of days of active grazing allowed in permit

(6) Typical water demand for cow/calf pair per day

(7) Column 2 * Column 3 * Column 6

(8) Column 4 * Column 5 * Column 6

(9) Sum of Columns 7 + 8

(10) Column 9 converted to acre-feet (325,851 gallons in one acre-foot)

Table 14b. BLM Stock Water and Grazing Demands				
Allotment	Animal Unit Month (AUM)	Livestock Water Demand (gpd)	Daily Livestock Water Demand (gpd)	Annual Livestock Water Demand (AF)*
(1)	(2)	(3)	(4)	(5)
BLM Active Grazing Allotments (Cattle)				
Joker	46	34.2	1,573.2	0.14
Lee Bench	41		1,402.2	0.13
Sawmill Mesa	618		21,135.6	1.95
Twenty-Five Mesa North	644		22,024.8	2.03
White Ranch	10		342.0	0.03
Winter	774		26,470.8	2.44
		Total	374,686	6.72

Notes:

(1) Grazing allotment name

(2) Number of permitted AUMs in grazing allotment

(3) Average gallons used per day per cow/calf pair

(4) Column 2 * Column 3

(5) Column 4 * 30 days / 325851

3.1.3 Subdivision and Small-Scale Farm Demand

Colorado law allows parcels of 35.0 acres or larger to obtain an exempt well permit with a total diversion amount of 3.0 AF/year, which typically allows for a domestic supply for up to 3 residences, irrigation of 1 acre, and allows for stock water usage. Under Colorado's Revised Statute (C.R.S.), exempt wells do not currently need a decreed water right, so long as the uses and annual volumetric restrictions comply with the general permit requirements. Therefore, any future subdivision and development of parcels 35.0 acres or larger could be completed without a decreed water right. However, if the exempt well statute were to go away in the future, new water rights would need to be obtained for subdivided parcels. To conservatively account for the new water demands associated with the subdivision of larger parcels, SGM calculated the maximum demands that would be incurred under the exempt well statute. In the future, should the exempt well statute be removed from Colorado law, new junior water rights (or a decreed augmentation plan) would be required to provide a legal water supply for domestic, irrigation, and stock water uses of 35.0-acre parcels. These potential future demands and modeled assumptions are discussed in detail in Sections 3.2.2 and 3.2.3.

3.2 Water Development Scenarios

For the purpose of determining the future WDA for each basin, SGM worked with the stakeholders to determine various development scenarios that could likely be realized in the future and would require additional water supplies to be developed. Based upon the information gathered, stakeholder input, and the analyses completed for this project, SGM considered three potential water demand scenarios that could occur within these basins in the future. The scenarios are generally independent of one another and could not fully occur concurrently; but portions of each scenario could occur simultaneously. Since we are not able to determine what development will occur in the future and the realized water

demand associated with future development, if any, it is prudent to identify and select the maximum future water demand from all three scenarios for the future WDA in each basin. Accordingly, the maximum future water demand scenario for each specific basin was considered for the future water development allowance, as shown in Section 5.1, 5.2, 5.3, and 5.4, for all identified types of water use.

3.2.1 Scenario A: Continued Irrigation and Potential Future Irrigation

Scenario A considers the amount of additional water that would need to be developed if additional portions of private properties were irrigated. Under Scenario A, SGM considered the amount of existing decreed water rights within a basin that could continue to irrigate existing lands and, in addition, irrigate any future lands. Many ditches have decrees that allow for the irrigation of more land than they are currently irrigating. In addition, this scenario models any future water right that would need to be obtained to irrigate lands that would not be covered under an existing water right.

For this scenario, SGM analyzed proximity to existing waterways and ditches, potential future irrigable lands, and assessed current irrigated area and existing decreed water rights.

3.2.1.1 **Cottonwood Creek Basin**

In Cottonwood Creek Basin, the North Fork Ditch, Everlasting Ditch, Hawkins Ditch, and Pug White Ditch lie upstream of all private land within the basin. The Horton and Davis Seep Ditch is near the upstream portion of the private land as well. Per the USGS National Hydrology Dataset, these ditches extend into the private parcels in the central portion of the basin. Additionally, the 2020 CDSS irrigated area shapefile indicates that these ditches are used to irrigate approximately 183.2 acres of land within the central portion of the basin. SGM reviewed these ditches' decrees and found that collectively they are decreed for the irrigation of over 2,700 acres. The existing ditches in Cottonwood Creek Basin are decreed to divert 87 cfs, of which 67 cfs is decreed for irrigation uses.

SGM reviewed the extent of the potentially irrigated area, as discussed in Section 2.1.8, and found that much of these areas are heavily wooded; therefore, after further analysis, SGM reduced the total amount of potentially irrigable land within the Cottonwood Creek Basin to 68.8 acres. Given these lands' proximity to the decreed water rights and irrigated lands, SGM generally believes that 48.8 acres of land could be irrigated by current absolute water rights in the central portion of the basin with the construction of new infrastructure, and 20.0 acres would require junior water rights with the construction of new infrastructure near the furthest downstream portion of the basin.

As stated above, a total of 20.0 acres would require new junior water rights. These lands lie at an elevation of approximately 7,000 FAMSL. Using an IWR of 2.3 AF/acre, flood irrigation efficiency of 50-percent, and ditch loss of 15-percent, SGM calculated additional demands of 107.7 AF of water (see Table 15). In SGM's experience, a flood efficiency of 50% and ditch efficiency of 85% are reasonable planning values for water supply limited areas, such as the Study Area. In addition, construction of future surface water irrigation systems would be completed using modern mechanical equipment and construction practices. If desired, landowners could construct more efficient irrigation systems by lining ditches and storage ponds, and using gated irrigation pipe, or by piping the whole irrigation system for a highly efficient pressurized irrigation system.

Since, increased water efficiency cannot be guaranteed, SGM relied on a flood efficiency of 50% and ditch efficiency of 85%.

To determine a representative diversion rate for new irrigation water rights on Cottonwood Creek, SGM estimated the average daily diversion demand (which includes ditch loss and irrigation inefficiencies) during the peak irrigation demand month (June). For Cottonwood Creek, the maximum average daily demand to irrigate an additional 20.0 acres of land would be 0.44 cfs. To account for the limited duration of time that the water supply is physically available in Cottonwood Creek during the runoff, SGM anticipates that future irrigation demands would be best met through the combination of new surface water rights and storage facilities. SGM believes it would be reasonable to allow the maximum monthly diversion rate shown in Table 15 into future storage facilities anytime the water was physically and legally available in Cottonwood Creek.

Table 15 Cottonwood Creek Basin								
Month	Days	Future Irrigation at 7,000 FAMSL (acres)	Demand per Acre at 7,000 FAMSL (AF/acre)	Irrigation Demand (AF)	Ditch Efficiency (%)	Irrigation Efficiency (%)	Irrigation Diversion Demand (AF)	Daily Diversion Demand (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
January	31	20.0	-	-			-	-
February	28	20.0	-	-			-	-
March	31	20.0	-	-			-	-
April	30	20.0	0.04	0.9	0.85	0.50	2.02	0.03
May	31	20.0	0.49	9.8	0.85	0.50	23.15	0.38
June	30	20.0	0.56	11.2	0.85	0.50	26.45	0.44
July	31	20.0	0.49	9.8	0.85	0.50	23.15	0.38
August	31	20.0	0.39	7.8	0.85	0.50	18.26	0.30
September	30	20.0	0.31	6.2	0.85	0.50	14.68	0.25
October	31	20.0	-	-			-	-
November	30	20.0	-	-			-	-
December	31	20.0	-	-			-	-
Total	**365**		**2.29**	**45.78**			**107.72**	

Notes:

AF = acre-feet; cfs = cubic feet per second

Highlighted value indicates month with maximum diversion rate

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Potential future irrigated area in Cottonwood Creek Basin that lies at approximately 7,000 FAMSL

(4) Average monthly irrigation water requirement (AF/acre) for grass pasture at 7,000 feet above mean sea level and latitude of 38.55° N. Calculated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1). Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient. Precipitation data based on the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted basin on the

(5) Column 3 x Column 4

(6) Assumed ditch transit to be 85% efficient

(7) Assumed flood irrigation efficiency of 50%

(8) Column 5 divided by Column 6 divided by Column 7

(9) Column 8 divided by no. of days in month divided by 1.9835 (conversion factor from AF to cfs)

3.2.1.2 **Monitor Creek Basin**

In Monitor Creek Basin, no ditches exist upstream of the private parcels located near the headwaters of the basin. However, several water ways tributary to Monitor Creek exist near, or within, these private parcels. In order to irrigate the private parcels in the headwaters of Monitor Creek, new junior water rights would need to be filed and infrastructure would need to be constructed.

The 2020 CDSS irrigated area shapefile denotes that there are currently 184 acres of land being irrigated within Monitor Creek Basin. SGM reviewed the Monitor Creek Basin ditches' decrees and found that the ditches are decreed to irrigate over 900 acres combined. The existing ditches in Monitor Creek Basin are decreed to divert 71.9 cfs for irrigation and other uses. SGM reviewed future potentially irrigated areas, as discussed in Section 2.1.8, and after further analysis found that some of these areas are heavily wooded; therefore, SGM believes 351.8 acres are potentially irrigable in the future. Some of these lands are either upstream of any existing water rights or are not in the vicinity of existing water rights, therefore, SGM believes 328.5 acres of these lands would likely require new junior water rights. The remaining 23.3 acres of

potentially irrigable land are near existing irrigated lands and could be irrigated by senior water rights.

As stated above, a total of 328.5 acres would require new water rights. 112.1 acres lie at an elevation of approximately 7,000 FAMSL. Using an IWR of 2.3 AF/acre, flood irrigation efficiency of 50-percent, and ditch loss of 15-percent, SGM calculated additional demands of 603.8 AF of water for the 112.1 acres of land. In addition, 216.4 acres of the future potential irrigated area lies at approximately 8,400 FAMSL. Using an IWR of 2.0 AF/acre, a flood irrigation efficiency of 50-percent, and a 15-percent ditch loss, SGM calculated future irrigation demands to be 1,019.4 AF. The sum of these demands totals 1,623.1 AF of new water demand (see Table 16). SGM analyzed the physical supply for these areas and determined that there is an available supply during normal and wet years to irrigate additional lands, discussed later in this report in Section 4.2.

To determine a representative diversion rate for new irrigation water rights on Monitor Creek, SGM estimated the average daily diversion demand (which includes ditch loss and irrigation inefficiencies) during the peak irrigation demand month (June). For Monitor Creek, the maximum average daily demand to irrigate an additional 328.5 acres of land would collectively be 6.8 cfs. To account for the limited duration of time that the water supply is physically available in Monitor Creek during the runoff, SGM anticipates that future irrigation demands would be best met through the combination of new surface water rights and storage facilities. SGM believes it would be reasonable to allow the maximum monthly diversion rate shown in Table 16 into future storage facilities anytime the water was physically and legally available in Monitor Creek.

Table 16

Monitor Creek Basin

Month	Days	Future Irrigation at 7,000 FAMSL (acres)	Demand per Acre at 7,000 FAMSL (AF/acre)	Irrigation Demand (AF)	Ditch Efficiency (%)	Irrigation Efficiency (%)	Irrigation Diversion Demand (AF)	Future Irrigation at 8,400 FAMSL (acres)	Demand per Acre at 8,400 FAMSL (AF/acre)	Irrigation Demand (AF)	Ditch Efficiency (%)	Irrigation Efficiency (%)	Irrigation Diversion Demand (AF)	Total Irrigation Diversion Demand (AF)	Daily Diversion Demand (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
January	31	112.1	-	-			-	216.4	-	-			-	-	-
February	28	112.1	-	-			-	216.4	-	-			-	-	-
March	31	112.1	-	-			-	216.4	-	-			-	-	-
April	30	112.1	0.04	4.8	0.85	0.50	11.34	216.4	0.05	9.7	0.85	0.50	22.91	34.3	0.58
May	31	112.1	0.49	55.2	0.85	0.50	129.77	216.4	0.40	87.2	0.85	0.50	205.20	335.0	5.45
June	30	112.1	0.56	63.0	0.85	0.50	148.24	216.4	0.51	110.1	0.85	0.50	259.17	407.4	6.85
July	31	112.1	0.49	55.2	0.85	0.50	129.77	216.4	0.44	95.2	0.85	0.50	224.04	353.8	5.75
August	31	112.1	0.39	43.5	0.85	0.50	102.34	216.4	0.34	73.6	0.85	0.50	173.12	275.5	4.48
September	30	112.1	0.31	35.0	0.85	0.50	82.29	216.4	0.27	57.3	0.85	0.50	134.93	217.2	3.65
October	31	112.1	-	-			-	216.4	-	-			-	-	-
November	30	112.1	-	-			-	216.4	-	-			-	-	-
December	31	112.1	-	-			-	216.40	-	-			-	-	-
Total	**365**		**2.29**	**256.60**			**603.76**		**2.00**	**433.23**			**1,019.37**	**1,623.13**	

Notes:

AF = acre-feet; cfs = cubic feet per second

Highlighted value indicates month with maximum diversion rate

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Potential future irrigated area in Monitor Creek Basin that lies at approximately 7,000 FAMSL

(4) Average monthly irrigation water requirement (AF/acre) for grass pasture at 7,000 feet above mean sea level and latitude of 38.55° N. Calculated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1). Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient. Precipitation data based on the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted basin on the elevation at a rate of 3.6° F per thousand feet. Precipitation data were orthographically adjusted by a factor of 1.55.

(5) Column 3 x Column 4

(6) Assumed ditch transit to be 85% efficient

(7) Assumed flood irrigation efficiency of 50%

(8) Column 5 divided by Column 6 divided by Column 7

(9) Potential future irrigated area in Monitor Creek Basin that lies at approximately 8,400 FAMSL, near the headwaters of Little Monitor Creek

(10) Average monthly irrigation water requirement (AF/acre) for grass pasture at 8,400 feet above mean sea level and latitude of 38.50° N. Calculated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1). Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient. Precipitation data based on the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted basin on the elevation at a rate of 3.6° F per thousand feet. Precipitation data were orthographically adjusted by a factor of 1.55.

(11) Column 9 x Column 10

(12) Assumed ditch transit to be 85% efficient

(13) Assumed flood irrigation efficiency of 50%

(14) Column 11 divided by Column 12 divided by Column 13

(15) Column 8 + Column 14

(16) Column 15 divided by no. of days in month divided by 1.9835 (conversion factor from AF to cfs)

3.2.1.3 Potter Creek Basin

There is no irrigation currently occurring in Upper Potter Creek Basin nor below its confluence with Monitor Creek. In addition, no diversion ditches exist within the basin. Due to the very limited amount of private land (4 acres in Upper Potter Creek Basin and 157 acres below confluence with Monitor Creek), lack of suitable soils and slopes, and lack of ditches, SGM did not delineate any potential irrigated land in the Upper Potter Creek Basin nor downstream from Potter Creek's confluence with Monitor Creek. Therefore, there are no future irrigation demands for Potter Creek Basin under Scenario A.

3.2.2 Scenario B: Subdivision of 35.0-Acre Parcels for Small-scale Farms

While exempt well permits can currently be issued for parcels that are at least 35.0 acres without a decreed water right, SGM considered the amount of junior water rights (or decreed augmentation plans) that would be required for the subdivision of land if the exempt well permit statute were revoked under Scenario B. For the purpose of this analysis, SGM assumed a demand comparable to that allowed under an exempt well permit (3.0 AF/year) for the future subdivision of private property into 35.0-acre parcels.

To estimate the future water demands that could be realized in the Study Area for the future subdivision of larger parcels into 35.0-acre small-scale farms, SGM analyzed the number of private parcels over 35.0-acres and estimated the maximum number of 35.0-acre parcels that they could be subdivided into. Of the existing private parcels in the Study Area, a total of 87, 35.0-acre parcels could be created in the Cottonwood Creek Basin, 61, 35.0-acre parcels could be created in the Monitor Creek Basin, and 4, 35.0-acre parcels could be created in the Potter Creek Basin below the confluence with Monitor Creek.

For planning purposes, an indoor use daily demand of 195 gpd per single-family residence was considered for this scenario. SGM assumed each 35.0-acre parcel would have three single-family residences, which equates to an annual indoor demand of approximately 0.66 AF/year. SGM assumed a stock water demand of 10 animals, which would have an average daily demand of 32.4 gpd, totaling 324 gpd, for an annual demand of 0.36 AF/year. The annual stock water demand (0.36 AF/year) and indoor demand (0.66 AF/year) totals 1.02 AF/year per 35.0-acre parcel. This leaves a remaining 1.98 AF/year available of the 3.0 AF/year allowed for irrigation demands. Using a calculated irrigation demand of 2.29 AF/acre, as listed in Table 13, each 35.0-acre parcel would be able to irrigate approximately 0.85 acres of land. To be conservative, SGM increased 0.85 acres of land to 1.0 acres, which would increase the overall water demand on the stream systems. Absent an exempt well statute, landowners would likely rely on groundwater supply for domestic and stock water uses and would seek to divert water for irrigation use through a surface diversion for irrigation of 1.0 acre. Currently the exempt well statute allows for the irrigation of 1 acre. A new surface diversion water right would need to account for ditch losses and irrigation inefficiencies. After accounting for an 85% ditch efficiency and 50% irrigation efficiency, each 35.0-acre parcel would have a stream diversion demand of approximately 5.39 AF/year to irrigate 1 acre of land (see Table 17a). This would result in an average daily diversion rate of 0.023 cfs per 35.0-acre parcel for the maximum irrigation demand month of June.

In practice the future surface diversions would occur primarily during runoff and would need to capture the total irrigation demand plus anticipated losses. Runoff also coincides

with when the riparian based ISFs are most likely to be in effect. Therefore, SGM assumed that the highest monthly demand diversion rate could be diverted and captured in storage.

SGM assumed that the senior decreed water rights that are currently used for irrigation could continue to be used for irrigation in the same areas, regardless of if the parcels had been subdivided into 35.0-acre parcels. While unlikely that a future developer would sever senior water rights historically used to irrigate parcels of land once those same parcels were subdivided into 35.0-acre ranches, it would increase the WDA for each basin to assume that future residential development would require completely new water rights. Therefore, to be conservative, SGM excluded these senior water rights as being available for future irrigation on future 35.0-acre parcels in the Cottonwood Creek Basin and Monitor Creek Basin. Based on the number of 35.0-acre parcels that could be created in each basin, the maximum diversion demand occurs in June and equates to 2.06 cfs in Cottonwood Basin, 1.44 cfs in Monitor Creek Basin, and 1.54 cfs in Potter Creek Basin (see Table 17b).

Assuming a maximum water demand of 6.40 AF/year for domestic, stock water, and irrigation uses per 35.0-acre parcel, the resultant future potential future subdivision water demand would be approximately 557.2 AF in the Cottonwood Creek Basin, 390.6 AF in the Monitor Creek Basin, 416.3 AF in Potter Creek Basin (see Table 17b). Only one private parcel existed in the Upper Potter Creek Basin and was less than 35.0-acres; therefore, no new 35.0-acres parcel development would be able to occur.

Table 17a																
Month	Days	Houses per 35-acre Parcel	Demand Per House (gpd)	Monthly Domestic Demand (AF)	Livestock Units	Demand per Animal (gpd)	Monthly Livestock Demand (AF)	Irrigated Area (acres)	Demand per Acre (AF/acre)	Irrigation demand (AF)	Ditch Efficiency (%)	Irrigation Efficiency (%)	Irrigation Diversion Demand (AF)	Total Well Demand (AF)	Total Surface Diversion Demand (AF)	Total Monthly Demand per 35-acre Parcel (AF)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
January	31	3	195	0.06	10	32.4	0.03	1	0.00	0.00			0.00	0.09	0.00	**0.09**
February	28	3	195	0.05	10	32.4	0.03	1	0.00	0.00			0.00	0.08	0.00	**0.08**
March	31	3	195	0.06	10	32.4	0.03	1	0.00	0.00			0.00	0.09	0.00	**0.09**
April	30	3	195	0.05	10	32.4	0.03	1	0.04	0.04	85%	50%	0.10	0.08	0.10	**0.18**
May	31	3	195	0.06	10	32.4	0.03	1	0.49	0.49	85%	50%	1.16	0.09	1.16	**1.24**
June	30	3	195	0.05	10	32.4	0.03	1	0.56	0.56	85%	50%	1.32	0.08	1.32	**1.41**
July	31	3	195	0.06	10	32.4	0.03	1	0.49	0.49	85%	50%	1.16	0.09	1.16	**1.24**
August	31	3	195	0.06	10	32.4	0.03	1	0.39	0.39	85%	50%	0.91	0.09	0.91	**1.00**
September	30	3	195	0.05	10	32.4	0.03	1	0.31	0.31	85%	50%	0.73	0.08	0.73	**0.82**
October	31	3	195	0.06	10	32.4	0.03	1	0.00	0.00			0.00	0.09	0.00	**0.09**
November	30	3	195	0.05	10	32.4	0.03	1	0.00	0.00			0.00	0.08	0.00	**0.08**
December	31	3	195	0.06	10	32.4	0.03	1	0.00	0.00			0.00	0.09	0.00	**0.09**
Total	**365**			**0.66**			**0.36**			**2.29**			**5.39**	**1.02**	**5.39**	**6.40**

Notes:

gpd: gallons per day; AF = acre-feet

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Number of houses assumed for 35-acre parcel

(4) Standard assumped indoor demand of 195 gpd

(5) (Column 2 x Column 3 x Column 4)/325,851 - [1 AF = 325,851 gallons]

(6) Number of livestock animals per 35-acre parcel assumed

(7) Assumed average demand of 32.4 gpd per animal

(8) (Column 2 x Column 6 x Column 7)/325,851

(9) Assumed irrigated acreage per 35-acre parcel

(10) Average monthly irrigation water requirement (AF/acre) for grass pasture at 7,000 feet above mean sea level and latitude of 38.55° N. Calculated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1). Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient. Precipitation data based on the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted basin on the elevation at a rate of 3.6° F per thousand feet. Precipitation data were orthographically adjusted by a factor of 1.55.

(11) Column 9 x Column 10

(12) Assumed ditch transit to be 85% efficient

(13) Assumed flood irrigation efficiency of 50%

(14) Column 11 divided by Column 12 divided by Column 13

(15) Assumes domestic and livestock demands are met by a well (Column 5 + 8)

(16) Assumes irrigation demands are met by a future surface diversion (Column 14)

(17) Sum of Columns 5 + 8 + 14

Table 17b										
Basin		Cottonwood			Monitor			Potter (Combined Monitor and Potter)		
Month	Days	No. of 35-acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)	No. of 35-acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)	No. of 35-acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
January	31	87	7.5	0.12	61	5.3	0.09	65	5.6	0.09
February	28	87	6.8	0.12	61	4.8	0.09	65	5.1	0.09
March	31	87	7.5	0.12	61	5.3	0.09	65	5.6	0.09
April	30	87	16.1	0.27	61	11.3	0.19	65	12.0	0.20
May	31	87	108.2	1.76	61	75.9	1.23	65	80.9	1.32
June	30	87	122.3	2.06	61	85.8	1.44	65	91.4	1.54
July	31	87	108.2	1.76	61	75.9	1.23	65	80.9	1.32
August	31	87	86.9	1.41	61	61.0	0.99	65	65.0	1.06
September	30	87	71.1	1.20	61	49.9	0.84	65	53.2	0.89
October	31	87	7.5	0.12	61	5.3	0.09	65	5.6	0.09
November	30	87	7.3	0.12	61	5.1	0.09	65	5.4	0.09
December	31	87	7.5	0.12	61	5.3	0.09	65	5.6	0.09
Total	**365**		**557.2**		**390.6**			**416.3**		

Notes:

AF = acre-feet; cfs = cubic feet per second

Highlighted value indicates month with maximum diversion rate

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Number of 35-acre parcels that could potentially be subdivided from existing private parcels in Cottonwood Basin and require new junior water rights to irrigate 1.0-

(4) Column 3 x total monthly demand factor per 35-acre parcel (see Column 17, Table 16a)

(5) (Column 4/Column 2)/1.9835 - [1.935 AF/day = 1 cfs)

(6) Number of 35-acre parcels that could potentially be subdivided from existing private parcels in Monitor Basin and require new junior water rights to irrigate 1.0 acre

(7) Column 6 x total monthly demand factor per 35-acre parcel (see Column 17, Table 16a)

(8) (Column 7/Column 2)/1.9835

(9) Number of 35-acre parcels that could potentially be subdivided from existing private parcels in Potter Basin and require new junior water rights to irrigate 1.0-acre(s) (Includes Sum of Monitor Basin and Upper Potter Basin). All future subdivided 35.0-acre parcels are located in Potter Creek Basin below its confluence with Monitor Creek. No potential 35-acre parcels exist within Potter Creek above its confluence with Monitor Creek.

(10) Column 9 x total monthly demand factor per 35-acre parcel (see Column 17, Table 16a)

(11) (Column 10/Column 2)/1.9835

3.2.3 Scenario C: Subdivision of 5.0-Acre Parcels for Small-scale Farms

Scenario C is similar to Scenario B in that SGM considered the diversion demand associated with the development of private land if each parcel were subdivided into 5.0-acre plots of land for small-scale farms.

To estimate the future water demand that could be realized in the Study Area for the future subdivision of larger parcels into 5.0-acre small-scale farms, SGM analyzed the number of private parcels over 5.0-acres and estimated the maximum number of 5.0-acre parcels that could be subdivided. Of the existing private parcels in the Study Area, a total of 649, 5.0-acre parcels could be created in the Cottonwood Creek Basin, 481, 5.0-acre parcels could be created in the Monitor Creek Basin, 1, 5.0-acre parcel could be created in Upper Monitor Creek Basin, and 31, 5.0-acre parcels could be created in the Potter Creek Basin below the confluence with Monitor Creek.

Similar to Scenario B, an indoor daily use demand of 195 gpd for each single-family residence was considered for this scenario. SGM assumed each 5.0-acre parcel would only have one single-family residence, which would equate to a water demand of 0.22 AF/year. SGM assumed a stock water demand for 5 animal units using an average daily demand of 32.4 gpd per animal, totaling 162 gpd, or 0.18 AF/year. SGM assumed a maximum of 2,000 square feet (0.046 acres) of irrigation would occur on each 5.0-acre parcel, which equates to 0.11 AF/year. Given the subdivision of land into smaller parcels and limited irrigation, SGM assumed that all demands for a 5.0-acre parcel could be met by a well. Therefore, a sprinkler irrigation efficiency of 85% was used, which resulted in an irrigation diversion demand of 0.12 AF/year per 5.0-acre parcel. The total combined annual diversion demand would therefore be 0.52 AF/year (see Table 18a).

Assuming this maximum water demand of 0.52 AF/year per 5.0-acre parcel, the potential future water demand would be approximately 339.8 AF in the Cottonwood Creek Basin, 251.8 AF in the Monitor Creek Basin, 0.5 AF in Upper Potter Creek Basin, and 268.6 AF in the Potter Creek Basin (combined Monitor and Potter Creeks) (see Table 18b). Only one private parcel existed in the Upper Potter Creek Basin and was less than 5.0-acres; however, SGM accounted for future development on this parcel.

Given that the potential water supply for future 5.0-acre small-scale farms would come from individual wells, which would have delayed depletions to Cottonwood, Monitor, and Potter Creeks, SGM considered the entire annual demand for the future development may need to be augmented to protect the existing vested water rights, including CWCB's ISFs in Cottonwood Creek and Monitor Creek. While a basin-wide augmentation plan could be difficult to implement, for the purpose of this project, SGM recommends considering the maximum demand that could be realized through the development of larger parcels into smaller 5.0-acre small-scale farms (Table 18b).

Similar to Scenario B, SGM excluded the use of any decreed senior water rights as being available for future irrigation on future 5.0 acre parcels in the Cottonwood Creek, Monitor Creek, and Potter Creek basins.

Table 18a															
Month	Days	Houses per 5-acre Parcel	Demand Per House (gpd)	Monthly Domestic Demand (AF)	Livestock Units	Demand per Animal (gpd)	Monthly Livestock Demand (AF)	Irrigated Area (acres)	Demand per Acre (AF/acre)	Irrigation demand (AF)	Sprinkler Efficiency (%)	Irrigation Diversion Demand (AF)	Total Well Demand (AF)	Total Surface Diversion Demand (AF)	Total Demand per 5-acre Parcel (AF)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
January	31	1	195	0.02	5	32.4	0.02	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
February	28	1	195	0.02	5	32.4	0.01	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
March	31	1	195	0.02	5	32.4	0.02	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
April	30	1	195	0.02	5	32.4	0.01	0.05	0.04	0.00	85%	0.00	0.03	0.00	**0.04**
May	31	1	195	0.02	5	32.4	0.02	0.05	0.49	0.02	85%	0.03	0.03	0.03	**0.06**
June	30	1	195	0.02	5	32.4	0.01	0.05	0.56	0.03	85%	0.03	0.03	0.03	**0.06**
July	31	1	195	0.02	5	32.4	0.02	0.05	0.49	0.02	85%	0.03	0.03	0.03	**0.06**
August	31	1	195	0.02	5	32.4	0.02	0.05	0.39	0.02	85%	0.02	0.03	0.02	**0.05**
September	30	1	195	0.02	5	32.4	0.01	0.05	0.31	0.01	85%	0.02	0.03	0.02	**0.05**
October	31	1	195	0.02	5	32.4	0.02	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
November	30	1	195	0.02	5	32.4	0.01	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
December	31	1	195	0.02	5	32.4	0.02	0.05	0.00	0.00		0.00	0.03	0.00	**0.03**
Total	**365**			**0.22**			**0.18**			**0.11**		**0.12**	**0.40**	**0.12**	**0.52**

Notes:

gpd: gallons per day; AF = acre-feet

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Number of houses assumed for 5-acre parcel

(4) Standard assumped indoor demand of 195 gpd

(5) (Column 2 x Column 3 x Column 4)/325,851 - [1 AF = 325,851 gallons]

(6) Number of livestock animals per 5-acre parcel

(7) Assumed average demand of 32.4 gpd per animal

(8) (Column 2 x Column 6 x Column 7)/325,851

(9) Assumed irrigated acreage per 5-acre parcel to be 2,000 square-feet

(10) Average monthly irrigation water requirement (AF/acre) for grass pasture at 7,000 feet above mean sea level and latitude of 38.55° N. Calculated using a Climate Station Scenario analysis in StateCU (Interface Version 7.1.2, FORTRAN Version 13.1). Analysis used Upper Gunnison High Altitude (UGHA) crop coefficient. Precipitation data based on the Montrose No. 2 NOAA Climate Station (USC00055722) between 1992 and 2021. Temperature based on the Cottonwood Basin Colorado NOAA Climate Station (USR0000CCOT) between 1992 and 2021. Temperature data were orthographically adjusted basin on the elevation at a rate of 3.6° F per thousand feet. Precipitation data were orthographically adjusted by a factor of 1.55.

(11) Column 9 x Column 10

(12) Assumed sprinkler efficiency of 85%

(13) Column 11 / Column 12

(14) Assumes domestic and livestock demands are met by a well (Column 5 + 8)

(15) Assumes irrigation demands are met by a future surface diversion (Column 13)

(17) Sum of Columns 5 + 8 + 13

Table 18b													
Basin		Cottonwood			Monitor			Upper Potter			Potter (Combined Monitor and Potter)		
Month	Days	No. of 5 acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)	No. of 5 acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)	No. of 5 acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)	No. of 5 acre Parcels	Total Demand (AF)	Average Daily Diversion Rate (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
January	31	649	22.0	0.36	481	16.3	0.27	1	0.0	0.001	513	17.4	0.28
February	28	649	19.9	0.36	481	14.8	0.27	1	0.0	0.001	513	15.7	0.28
March	31	649	22.0	0.36	481	16.3	0.27	1	0.0	0.001	513	17.4	0.28
April	30	649	22.8	0.38	481	16.9	0.28	1	0.0	0.001	513	18.1	0.30
May	31	649	39.3	0.64	481	29.1	0.47	1	0.1	0.001	513	31.1	0.51
June	30	649	41.0	0.69	481	30.4	0.51	1	0.1	0.001	513	32.4	0.55
July	31	649	39.3	0.64	481	29.1	0.47	1	0.1	0.001	513	31.1	0.51
August	31	649	35.6	0.58	481	26.4	0.43	1	0.1	0.001	513	28.2	0.46
September	30	649	32.3	0.54	481	23.9	0.40	1	0.0	0.001	513	25.5	0.43
October	31	649	22.0	0.36	481	16.3	0.27	1	0.0	0.001	513	17.4	0.28
November	30	649	21.3	0.36	481	15.8	0.27	1	0.0	0.001	513	16.9	0.28
December	31	649	22.0	0.36	481	16.3	0.27	1	0.0	0.001	513	17.4	0.28
Total	**365**		**339.8**			**251.8**			**0.5**			**268.6**	

Notes:

AF = acre-feet; cfs = cubic feet per second

Highlighted value indicates month with maximum diversion rate

Column Notes:

(1) Month

(2) Number of Days in Month

(3) Number of 5-acre parcels that could potentially be subdivided from existing private parcels in Cottonwood Basin

(4) Column 3 x total monthly demand factor per 5-acre parcel (see Column 16, Table 17a)

(5) (Column 4/Column 2)/1.9835 - [1.935 AF/day = 1 cfs)

(6) Number of 5-acre parcels that could potentially be subdivided from existing private parcels in Monitor Basin

(7) Column 6 x total monthly demand factor per 5-acre parcel (see Column 16, Table 17a)

(8) (Column 7/Column 2)/1.9835

(9) Number of 5-acre parcels that could potentially be subdivided from existing private parcels in Upper Potter Creek Basin only.

(10) Column 9 x total monthly demand factor per 5-acre parcel (see Column 16, Table 17a)

(11) (Column 10/Column 2)/1.9835

(12) Number of 5-acre parcels that could potentially be subdivided from existing private parcels in Potter Basin. (Includes Sum of Monitor Basin and Upper Potter Basin)

(13) Column 12 x total monthly demand factor per 5-acre parcel (see Column 16, Table 17a)

(14) (Column 13/Column 2)/1.9835

3.2.4 Scenario Overview by Basin

Table 19, below, summarizes the total future demand per basin in each scenario. The highlighted value in yellow indicates the maximum demand in each basin.

Table 19. Scenario Demands Overview

Scenario / Basin	Cottonwood		Monitor		Potter (Combined Monitor and Potter)	
	(AF)	(cfs)	(AF)	(cfs)	(AF)	(cfs)
A [1]	107.72	0.44	1623.13	6.85	1623.13	6.85
B [2]	557.16	2.06	390.65	1.44	416.27	1.54
C [3]	339.77	0.69	251.82	0.51	268.57	0.55

Notes:

(1) Scenario A considers future irrigation demands for potentially future irrigable areas. See section 3.2.1 for more information.

(2) Scenario B assumes domestic, stock, and irrigation demands per subdivision into 35-acre parcels. See Section 3.2.2 for more information.

(3) Scenario C assumes domestic, stock, and irrigation demands per subdivision into 5-acre parcels. See Section 3.2.3 for more information.

Highlighted value indicated maximum future demand in respective Basin.

4.0 Constraints on Future Water Development

Many factors may limit the ability to develop future water rights within the three Study Area basins, including the suitability of native soils for irrigation based on soil condition and slope, the timing and availability of the physical water supply, and the legal availability of water. These factors are discussed in detail below.

4.1 Irrigated Soil Potential

The irrigated soil potential was discussed in Sections 2.1.7 and 2.1.8, which was based on the irrigation class of the soils in combination with slopes of the private parcels. A total of 68.8 acres of future irrigable lands were delineated in the Cottonwood Creek Basin and 351.8 acres were delineated in the Monitor Creek Basin. After further review, SGM believes that the 48.8 acres of future irrigable lands in Cottonwood Creek Basin could be met by senior water rights. Similarly, 23.3 acres of future irrigable lands in Monitor Creek Basin could be met by senior water rights. SGM notes that irrigation in Monitor Creek Basin could possibly be increased if future ditches were constructed on federally managed lands; however, given the remote location and the BLM's determination that these stream segments are eligible for a Wild and Scenic designation, which would allow for only minor development, we do not believe it would be likely that parties who wish to construct ditches would be able to obtain a right-of-way grant from the BLM for that purpose. Therefore, SGM only considered the irrigation of private lands near existing waterways and ditches through private parcels.

4.2 Physical Supply

The three Study Area basins are reliant on snowmelt runoff and summer rainstorms for the majority of their physical water supply. These drainages have a relatively short runoff period and the physical availability of supplies to irrigate land and/or store for subsequent irrigation is typically limited to a three-to-four-month period between early spring and early summer. Further, it would require a significant amount of effort to construct ditches upstream of potentially irrigable lands. Most of the delineated potential future irrigated land in the Monitor Creek Basin resides at approximately 8,400 FAMSL, near the headwaters of Little Monitor and Monitor creeks. This area would have a short growing season due to its elevation and a very limited window of spring runoff, given its proximity to the Basin's

headwaters. Based on the data shown in Tables 12 and 13, the physical supply (both timing and amount) in the headwaters would be the limiting factor. Given the relatively short runoff duration and high streamflow rates, it is reasonable to assume that future irrigators would consider storing their diversions when the water was physically available to better manage their water application to meet the crops' irrigation water requirement in subsequent months. Future decrees could be obtained for small catchments that would have non-jurisdictional embankments constructed to allow for the storage of irrigation supplies. While evaporation and/or seepage would occur on these ponds, SGM believes the calculated future irrigation diversion demands are adequate to allow for storage prior to application.

Further downstream, there is potential to irrigate new lands, however, senior rights would convey the majority of streamflow in dry and normal years. There is potential for there to be physical supply during wet years. As noted by the District 41 Water Commissioner, the creeks in the Study Area can become dry in some locations in downstream reaches or have very low baseflow during late fall and winter months.

Based on the estimated future irrigated area of 328.5 acres in Monitor Creek Basin and the calculated IWR for pasture grass at 7,000 feet and 8,400 feet, as discussed in Section 2.2.1, SGM assumed a 50-percent flood irrigation efficiency and a 15-percent ditch loss for a calculated maximum daily diversion demand of 6.8 cfs, as shown in Table 15.

SGM delineated a 5.45 square-mile subbasin within the headwater area of Monitor Creek Basin, where a majority of the potential future irrigated area lie, to estimate the available physical supply in the upper portion of the basin. Using the USGS regional equation (see Section 2.2.4), SGM found that approximately 2,882.7 AF would be available in a normal year. However, as shown in Table 12, approximately 55.41% of the annual supply is generally estimated to flow in May. For this delineated 5.45 square-mile subbasin, that would equate to 1,597.3 AF, at an average daily flow of 25.98 cfs. Assuming a maximum diversion rate of 6.8 cfs, the available supply could reasonably irrigate a maximum area of 328.5 acres. Therefore, SGM believes that enough water is physically available during high flow for all of the delineated future irrigated areas within the upper portion of the Monitor Creek Basin. Given this analysis, SGM believes there is also an adequate physical water supply in the lower portions of Monitor Creek Basin for the future irrigated areas.

It is also important to consider that many of the existing water rights that are decreed for irrigation are currently irrigating less acreages than listed in their original decrees. Therefore, SGM understands that owners of existing decreed water rights could improve their diversion structures to increase the amount of diversions up to their decreed diversion rates. This could result in the senior water rights holders in this area placing a call on the river, which would reduce the amount of water legally available to future junior irrigation water rights filed in the Monitor Creek Basin.

4.3 Legal Supply

Given the number of water rights in the Cottonwood and Monitor basins, SGM anticipates that junior water rights would only be legally entitled to divert supplies during the peak of runoff in some normal years and in wet years. The legal availability of water rights would be greatly diminished during dry years and some normal years. SGM was unable to find any historical administrative calls using the CDSS HydroBase, and the District 41 Water Commissioner confirmed that water rights are generally not administered within the Study Area. Further, the existing CWCB ISF water rights on Cottonwood and Potter creeks, when administered, would be senior to future water rights filing in the Study Area and

would limit the ability of upstream structures to divert native streamflow. Currently, most of the water rights on Cottonwood Creek are senior to the CWCB ISF on Cottonwood Creek, with the exception of Hawkins Spring No.1, Hawkins Spring No. 3, and Jones Spring No. 2, which have a total decreed flow rate of 0.0132 cfs (see Figure 4). All water rights that divert on Monitor Creek and Potter Creek are senior to the existing CWCB ISF on Potter Creek. If future water development were to occur, their operations may be limited by the existing ISF water rights in these drainages.

5.0 Findings

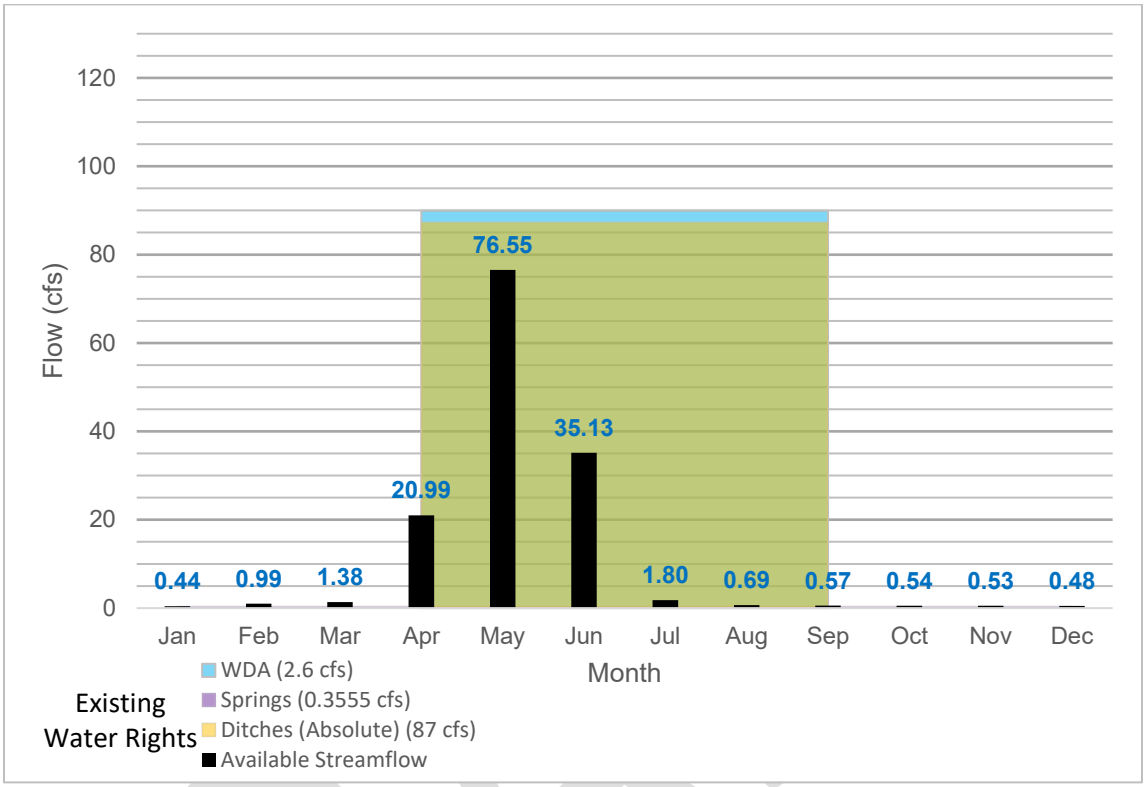
Based on our analysis, SGM has developed the following conclusions for the Study Area basins.

5.1 Cottonwood Creek Basin

5.1.1 Water Availability

Using the BLM modified USGS regional equation to calculate the basin yield of Cottonwood Creek Basin, SGM calculated an average basin yield of 8,495.2 AF/year. Using the monthly distribution factors, SGM calculated the monthly volume and flows for Cottonwood Creek Basin, as shown in Figure 13. It is important to note that the BLM modified USGS regional equation estimates peak flows occurring in May. However, SGM notes that based on the historical and recent CWCB streamflow gage records, the peak runoff can occur in May, but oftentimes occurs in April. Additionally, Figure 13 is overlaid with existing decreed water rights in Cottonwood Creek Basin, as shown by the shaded areas. The aggregated decreed water rights often exceed the available streamflow calculated from the USGS regional equation. However, SGM notes that the values shown in Figure 13 represent an estimate of the average monthly streamflow and are not representative of the maximum daily streamflow rates. Further, the physical availability of water in some tributaries or stream segments may not allow for decreed water rights to achieve their absolute rates each year.

Figure 13 – Cottonwood Creek Basin Mean Monthly Flow Distribution



5.1.2 Existing Water Rights and Associated Water Demands

SGM tabulated the absolute water rights, existing irrigated area, exempt wells, exempt livestock watering tanks, and grazing allotments within Cottonwood Creek Basin and estimated the current water demands. SGM did not consider changes of water rights nor possible restrictions for water uses outside of irrigation months, as the proposed riparian based ISF on Cottonwood Creek would only be in effect from April through September.

- SGM calculated the existing absolute water rights diversions to be: 791.6 AF for reservoirs and stock ponds, 87.0 cfs for ditches, and 0.3555 cfs for springs.
- A total of 183.2 acres of irrigated area lie within Cottonwood Creek Basin. Using an IWR of 2.3 for lands at approximately 7,000 FAMSL and an irrigation efficiency of 50-percent for flood irrigation, SGM calculated an irrigation demand of 842.7 AF to irrigate existing lands. Including a 15-percent ditch loss, the diversion demand would be 991.4 AF.
- The conditional water rights in the Cottonwood Creek Basin total 62.0 AF for reservoirs.
- One exempt, non-consumptive geoexchange well exists within Cottonwood Creek Basin.
- The grazing allotments are difficult to estimate demand per basin due to the extent of the grazing allotment boundaries extending outside the basin boundaries. It is

estimated that existing grazing demands total 34.95 AF for all basins within the Study Area.

- 9 livestock water tanks exist within Cottonwood Creek Basin. In order to have an exempt livestock use, the volume of the storage vessel must be less than 10 AF each, and the actual demand would be commensurate with the amount of stock water and grazing demand 34.95 AF for the entire Study Area).

5.1.3 Future Water Development Allowance

SGM calculated the future Cottonwood Creek Basin water demands by using the future water demand scenario that would require the most diversions. For Cottonwood Creek Basin, the largest water development allowance would occur if all private parcels were subdivided into 35.0-acre parcels (see Scenario B in Section 3.2.2). In addition to the development of 35.0-acre parcels, SGM included demands for the management of USFS, BLM, and CPW lands.

- Under the assumption that the exempt well statute would no longer be available, SGM assumed that each 35.0-acre parcel would have a total demand of 6.40 AF/year. SGM calculated a potential future demand of 87 subdivided parcels. This equates to a maximum annual demand of 557.2 AF/year with a maximum diversion rate of 2.06 cfs.
- Based on the discussions with BLM and USFS staff, SGM understands that each agency estimated a total future potential demand of 2.0 AF per year. Additionally, the BLM and USFS have requested a maximum diversion rate of 0.22 cfs each.
- Based on the discussions with CPW staff, SGM understands the CPW estimated total future potential demand to be 1.0 AF for future porous log structures, which would be used to support native fisheries. CPW staff have requested a maximum diversion rate of 0.1 cfs to fill and offset evaporation from the porous log structures.
- The Cottonwood Creek water development allowance will be allocated for future water right development under the following uses:
    - Storage
    - Recreation
    - Wildlife
    - Stock watering
    - Irrigation
    - Fire-protection
    - Domestic
    - Piscatorial

Accordingly, the Cottonwood Creek WDA was developed as shown in Table 20.

Table 20. Cottonwood Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Water Use on Private Parcels (1)	557.2	2.06	Irrigation, domestic, stock watering, recreation, wildlife, piscatorial, fire-protection, and storage
BLM	2.0	0.22	
USFS	2.0	0.22	
CPW	1.0	0.1	
Total	**562.2**	**2.6**	

Notes:

(1) Assumes a total new water demand associated with residential, livestock, and irrigation for 87, 35-acre parcels. Only 65 of those parcels would require new irrigation water supply.

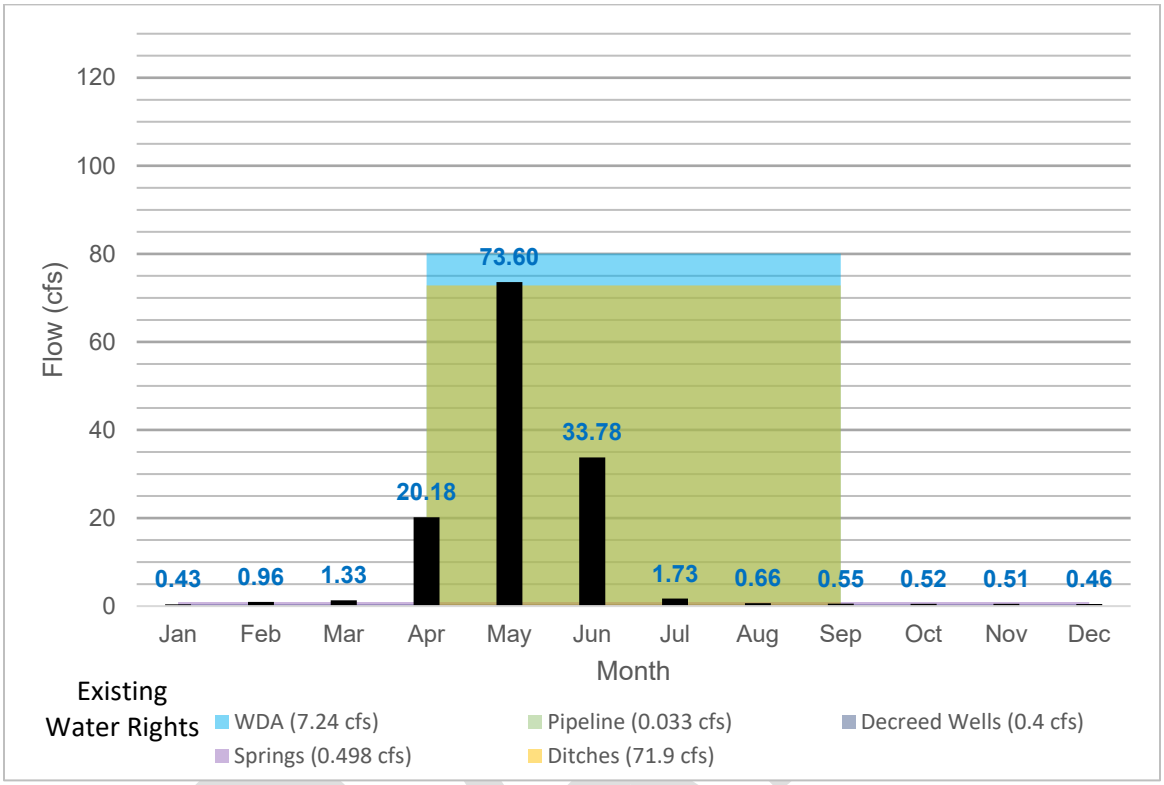
When the riparian based ISF is in effect, all senior uses and all future uses that occurred under the WDA would be allowed to continue. The remaining water within Cottonwood Creek would be protected as part of the riparian based ISF.

5.2 Monitor Creek Basin

5.2.1 Water Availability

Using the BLM modified USGS regional equation to calculate the basin yield of Monitor Creek Basin, SGM calculated an average basin yield of 8,167.0 AF/year. Using the monthly distribution factors, SGM calculated the monthly volume and flows for Monitor Creek Basin. See Figure 14. It is important to note that the BLM modified USGS regional equation estimates peak flows occurring in May, however, SGM notes that based on the historical and recent CWCB streamflow gage records, the peak runoff can occur in May, but oftentimes occurs in April. Additionally, Figure 14 is overlaid with existing decreed water rights in Monitor Creek Basin, as shown by the shaded areas. The aggregated decreed water rights often exceed the available streamflow calculated from the USGS regional equation. However, SGM notes that the values shown in Figure 14 represent an estimate of the average monthly streamflow and are not representative of the maximum daily streamflow rates. Further, the physical availability of water in some tributaries or stream segments may not allow for decreed water rights to achieve their absolute rates each year.

Figure 14 – Monitor Creek Basin Mean Monthly Flow Distribution



5.2.2 Existing Water Demands

SGM included absolute water rights, existing irrigated area, exempt wells, exempt livestock watering tanks, and grazing allotments in current water demand calculations. SGM did not consider changes of water rights nor possible restrictions for water uses outside of irrigation months, as the proposed Monitor Creek riparian based ISF would only be in effect from April through September.

- Using data gathered from the CDSS HydroBase, SGM calculated the existing absolute water rights diversions to be 452.5 AF for reservoirs and stock ponds, 71.9 cfs for ditches, 0.4 cfs for decreed wells, and 0.498 cfs for springs.
- A total of 184.0 acres of irrigated area lie within Monitor Creek Basin. Using an IWR of 2.3 for lands at approximately 7,000 FAMSL and an irrigation efficiency of 50% for flood irrigation, SGM calculates a demand of 846.4 AF required to irrigate. Including a 15-percent ditch loss, the diversion demand would be 995.8 AF.
- Seven constructed exempt wells exist within Monitor Creek Basin. Assuming a maximum of 3 AF per exempt well, 21 AF of water is allocated for exempt well demands.
- The grazing allotments are difficult to estimate demand per basin due to the extent of the grazing allotment boundaries extending outside the basin boundaries. It is estimated that existing grazing demands total 34.95 AF for all basins within the Study Area.

- 6 livestock water tanks exist within Monitor Creek Basin. In order to have an exempt livestock use, the volume of the storage vessel must be less than 10 AF each, and the actual demand would be commensurate with the amount of stock water and grazing demand (34.95 AF for the entire Study Area).

5.2.3 Future Water Development Allowance

SGM calculated the future Monitor Creek Basin water demands by using the future water demand scenario that would require the most diversions. For Monitor Creek Basin, the largest water development allowance would occur if new water rights were filed to irrigate approximately 328.5 acres of additional lands (see Scenario A in Section 3.2.1). In addition to future irrigation demand, SGM included demands for the management of USFS, BLM, and CPW lands.

- One permitted exempt well application has been filed within Monitor Creek Basin. Assuming a maximum of 3 AF per exempt well, SGM calculated a total demand of 3 AF for this one permitted exempt well.
- SGM delineated an estimated future irrigated area in Monitor Creek Basin to be 351.8 acres. Approximately 328.5 acres of this would require a new water right. 26.4 acres lies at an elevation of 8,400 FAMSL. Using an IWR of 2.0 AF/acre, flood irrigation efficiency of 50-percent, and ditch loss efficiency of 15-percent, SGM calculated additional demands of 1,019.4 AF of water. In addition, 112.1 acres of the future potential irrigated area lie at approximately 7,000 FAMSL. Using an IWR of 2.3 AF/acre, a flood irrigation efficiency of 50-percent, and a 15-percent ditch loss, SGM calculated future irrigation demands to be 603.8 AF. The sum of these demands totals 1,623.1 AF of new water demand. SGM analyzed physical supply for these areas and determined that there is an available supply during normal and wet years to irrigate additional lands.
- Based on the discussions with BLM and USFS staff, SGM understands that each agency estimated a total future potential demand of 2.0 AF per year. Additionally, the BLM and USFS have requested a maximum diversion rate of 0.22 cfs each.
- The Monitor Creek water development allowance will be allocated for future water right development under the following uses:
    - Irrigation
    - Storage
    - Recreation
    - Wildlife
    - Fire-protection
    - Domestic
    - Stock

Accordingly, the Monitor Creek WDA was developed as shown in Table 21. Please note, SGM did not include any exempt uses in the WDA calculations as the exempt uses would not require a future water rights application. Should the exempt well permit statute be revoked and the private parcels within Monitor Creek subdivided and developed, the overall demand of the subdivision under Scenarios B and C would be less than the identified potential irrigation water demand developed for Scenario A. Should the private parcels in Monitor Creek be subdivided, the need for large supplemental irrigation water rights would be diminished.

Table 21. Monitor Creek Water Development Allowance			
WDA Uses	**Annual Amount**	**Diversion Amount**	**Uses**
	(AF)	**(cfs)**	
Future Irrigation	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire-protection, and storage
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**1,627.1**	**7.29**	

Notes:

(1) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

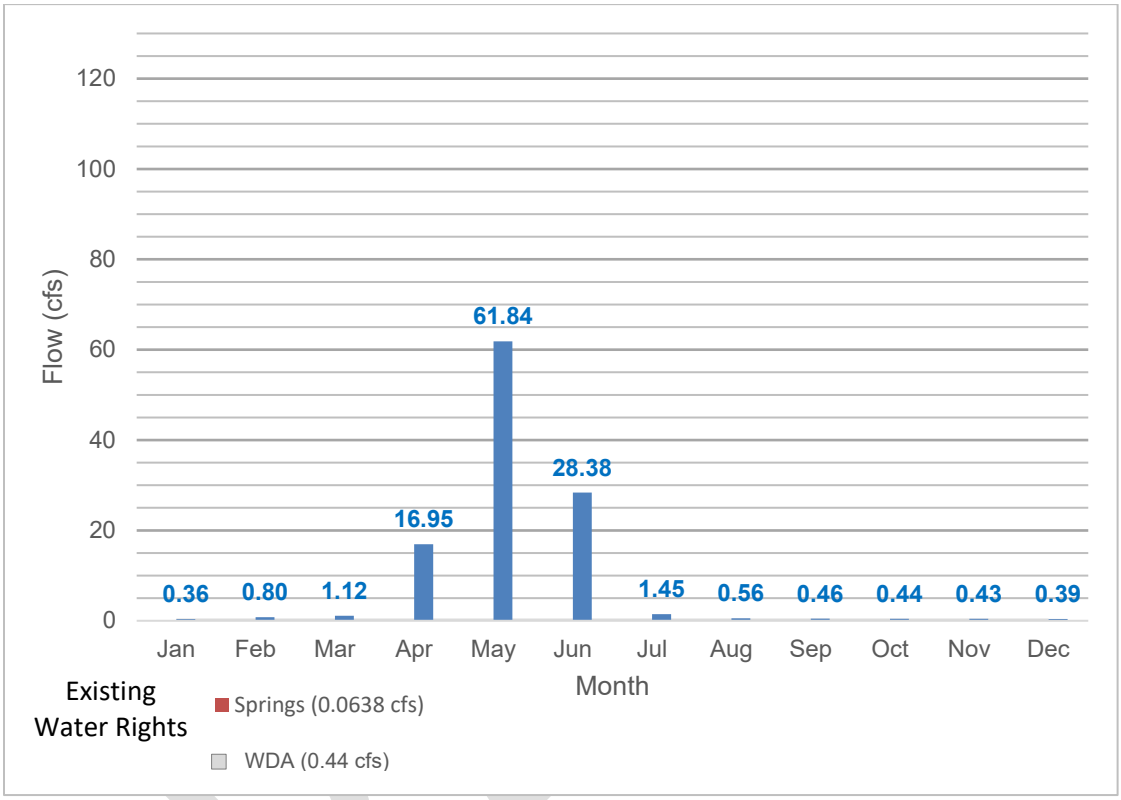
When the riparian based ISF is in effect, all senior uses and all future uses that occurred under the WDA would be allowed to continue. The remaining water within Monitor Creek would be protected as part of the riparian based ISF.

5.3 Upper Potter Creek Basin

5.3.1 Water Availability

Using the BLM modified USGS regional equation to calculate the basin yield of Upper Potter Creek Basin, SGM calculated an average basin yield of 6,862.4 AF/year. Using the monthly distribution factors, SGM calculated the monthly volume and flows for Upper Potter Creek Basin. See Figure 15. It is important to note that the BLM modified USGS regional equation estimates peak flows occurring in May, however, SGM notes that based on the historical and recent CWCB streamflow gage records, the peak runoff can occur in May, but oftentimes occurs in April. Similar to Figures 13 and 14, Figure 15 shows the existing decreed water rights in Upper Potter Creek Basin. However, the magnitude of the diversion rates is much smaller than the estimated monthly mean streamflows, so they are not readily visible in Figure 15.

Figure 15 – Upper Potter Creek Basin Mean Monthly Flow Distribution



5.3.2 Existing Water Demands

SGM included absolute water rights, exempt wells, exempt livestock watering tanks, and grazing allotments in current water demand calculations.

- Using data gathered from the CDSS HydroBase, SGM calculated the existing absolute water rights diversions to be 9.8 AF for reservoirs and stock ponds and 0.0638 cfs for springs.
- One exempt, non-consumptive geoexchange well exists within Upper Potter Creek Basin.
- The grazing allotments are difficult to estimate demand per basin due to the extent of the grazing allotment boundaries extending outside the basin boundaries. It is estimated that existing grazing demands total 34.95 AF for all basins within the Study Area.
- 3 livestock water tanks exist within Potter Creek Basin. In order to have an exempt livestock use, the volume of the storage vessel must be less than 10 AF each, and the actual demand would be commensurate with the amount of stock water and grazing demand (34.95 AF for the entire Study Area).

5.3.3 Future Potential Water Demands and Water Development Allowance

SGM calculated the future Upper Potter Creek Basin water demands by using the future water demand scenario that would require the most diversions. For Upper Potter Creek Basin, the largest water development allowance would occur if the one existing private parcel would have future domestic, stock water, and irrigation demands as described in Scenario C (see Section 3.2.3). In addition to the development of one 5.0-acre parcel, SGM included demands for the management of USFS, BLM, and CPW lands. SGM did not consider changes of water rights for this analysis.

- Based on the discussions with BLM and USFS staff, SGM understands that each agency estimated a total future potential demand of 2.0 AF per year. Additionally, the BLM and USFS have requested a maximum diversion rate of 0.22 cfs each.
- The Upper Potter Creek water development allowance will be allocated for future water right development under the following uses:
    - Irrigation
    - Storage
    - Recreation
    - Wildlife
    - Fire-protection
    - Domestic
    - Stock watering

Accordingly, the upper Potter Creek WDA was developed as shown in Table 22.

Table 22. Upper Potter Creek Water Development Allowance

WDA Uses	Annual Amount (AF)	Diversion Amount (cfs)	Uses
Water Use on Private Parcels (1)	0.5	0.001	Irrigation, storage, recreation, wildlife, fire-protection, domestic, and stock
BLM	2.0	0.22	
USFS	2.0	0.22	
Total	**4.5**	**0.441**	

Notes:
(1) – Assumes a total new water demand associated with residential, livestock, and irrigation for one, 5-acre parcels.

When the riparian based ISF is in effect, all senior uses and all future uses that occurred under the WDA would be allowed to continue. The remaining water within Upper Potter Creek would be protected as part of the riparian based ISF..

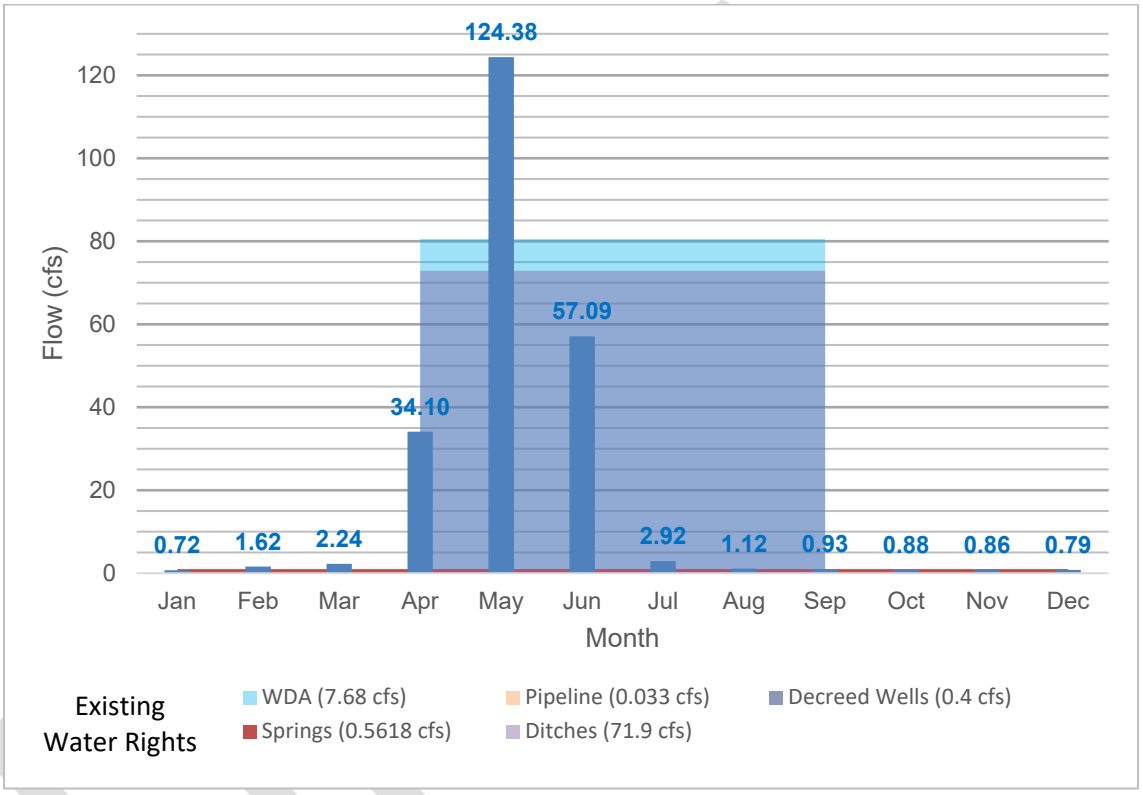
5.4 Potter Creek Basin

5.4.1 Water Availability

Using the BLM modified USGS regional equation to calculate the basin yield of Potter Creek Basin, SGM calculated an average basin yield of 6,862.4 AF/year. Using the

monthly distribution factors, SGM calculated the monthly volume and flows for Potter Creek Basin. See Figure 16. The aggregated decreed water rights often exceed the available streamflow calculated from the USGS regional equation in some months. However, SGM notes that the values shown in Figure 16 represent an estimate of the average monthly streamflow and are not representative of the maximum daily streamflow rates. Further, the physical availability of water in some tributaries or stream segments may not allow for decreed water rights to achieve their absolute rates each year.

Figure 16 – Potter Creek Basin Mean Monthly Flow Distribution



5.4.2 Existing Water Demands

Refer to Sections 5.2.2 and 5.3.2 for existing water demands of Monitor Creek Basin and Upper Potter Creek Basin.

5.4.3 Future Potential Water Demands and Water Development Allowance

SGM calculated the future Potter Creek Basin water demands by using the future water demand scenario that would require the most diversions. For Potter Creek Basin, the largest water development allowance would occur if new water rights were filed to irrigate approximately 328.5 acres of additional lands in Monitor Creek Basin (see Scenario A in Section 3.2.1). Refer to Sections 5.2.3 and 5.3.3 for future potential water demands of Monitor Creek Basin and Upper Potter Creek Basin.

Accordingly, the Potter Creek WDA was developed as shown in Table 23. Please note, SGM did not include any exempt uses in the WDA calculations as the exempt uses would not require a future water rights application.

Table 23. Potter Creek Water Development Allowance			
WDA Uses	**Annual Amount (AF)**	**Diversion Amount (cfs)**	**Uses**
Irrigation [(1)]	1,623.1	6.85	Irrigation, domestic, stock watering, recreation, wildlife, fire-protection, and storage
BLM	4.0	0.44	
USFS	4.0	0.44	
Total	**1,631.1**	**7.73**	

Notes:

(1) The total amount for irrigation includes a 15-percent ditch loss and overall irrigation efficiency of 50-percent. This total volume could also be stored in relatively small irrigation ponds throughout the runoff to help extend the water availability to meet the irrigation water requirement. No additional storage amount was allocated above the total diversion demand.

Based upon the information reviewed, methodologies described, and work completed SGM believes the WDA values tabulated in Tables 20 through 23 are reasonable for the described uses. Further, based upon the remote location of the private properties, surrounding public lands, limited infrastructure, and availability of streamflow throughout the irrigation season for Cottonwood, Monitor, and Potter basins, we believe that water development in the future will be very limited. Finally, based on the available gage data and analyses completed, we believe there is water physically and legally available to support a future ISF water right appropriation as sought by the CWCB.

6.0 References

The following documents and information were relied upon and/or considered in the preparation of this water development allowance report.

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Colorado Water Conservation Board. (2017 – 2021). Monitor Creek temporary stream gage measurements

Colorado Water Conservation Board. (2015 – 2019). Potter Creek temporary stream gage measurements

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DECREES

Cottonwood Creek

- W2524
- W2523
- CA5873
- CA4808
- CA3503
- CA2563
- CA2030

Monitor Creek

- CA5873
- CA3503
- CA2563
- 96CW0150