10825 Water Supply Study

Phase 1 Report
Screening of Water Supply Alternatives

July 2007

Upper Colorado River
Endangered Fish Recovery Program

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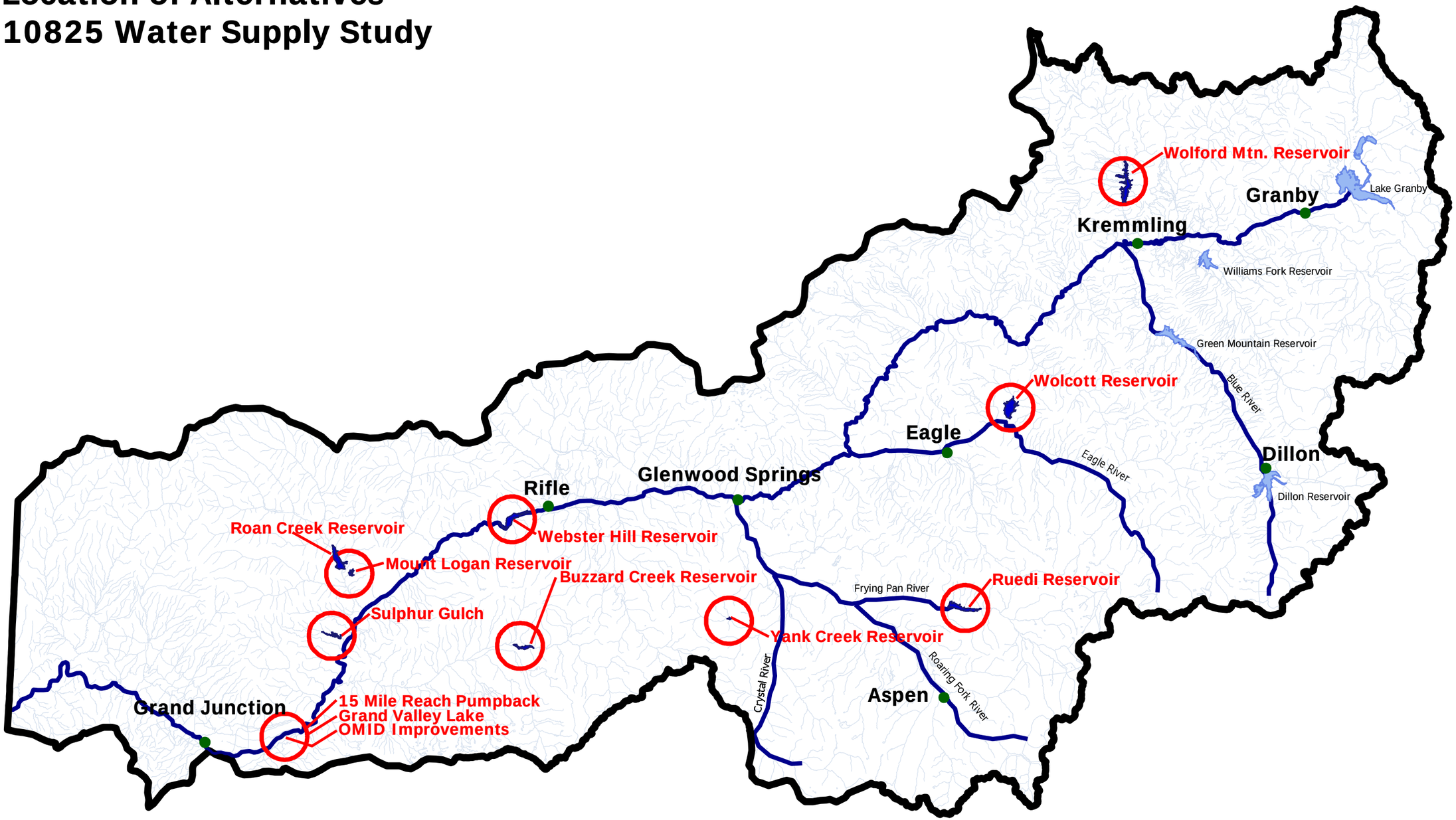
Location of Alternatives
10825 Water Supply Study



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COMPARISON OF ALTERNATIVES
10825 Water Supply Study
June 28, 2007 DRAFT

		ALTERNATIVES												MITIGATION FACILITIES	
		OMID Improvements	**Sulphur Gulch Reservoir**	**Buzzard Creek Reservoir**	**Wolford Mtn. Enhancemnts**	**Roan Creek Reservoir**	**Wolcott Reservoir**	**Mt. Logan Reservoir**	**Webster Hill Reservoir**	**Grand Valley Lake**	**15 Mile Reach Pumpback**	**Yank Creek Reservoir**	**Ruedi Reservoir**	**Synchronized Use of Multiple Facilities**	**Ruedi - Basalt Gravity Pipeline**	**Ruedi - Roaring Fork Tunnel**
Additional Consideration Recommended		Yes	Yes	Yes	Yes	Yes	Yes (No further study Required)	No	No	No	Yes	Yes	Yes	Yes	No	No
Description	Primary Facilities	Irrigation Pipeline Improvements Canal Check Structures Reservoir Regulating Facilities	16,000 AF Reservoir 150 cfs Colorado River Pump Station	16,800 AF Reservoir	6,400 AF Reservoir Enlargement 75 cfs Colorado River Pump Station	50,000 AF Reservoir 60 cfs Colorado River Pump Station	105,000 AF Reservoir 150 cfs Eagle River Pump Station	10,000 AF Reservoir 12 Mile Roan Creek Feeder Canal 60 cfs Colorado River Pump Station	28,900 AF Reservoir 10 MW Generating Station	200,000 AF Reservoir 60 Mile Gunnison River Feeder Canal Irrigation System Improvements	350 cfs Colorado River Pump Station	3,000 AF Reservoir	Maintain Existing Reservoir Operation Provide 10825 Water when 2012 Agreement expires	Use Multiple Facilities to Supply 10825 Water	Pipe line to keep 10825 Water out of Fryingpan River Combined with Ruedi Reservoir Alternative	Tunnel to keep 10825 Water out of Fryingpan River Combined with Ruedi Reservoir Alternative
	Pumping Lift	N/A	200 ft	N/A	160 ft	335 ft	370 ft	500 ft	N/A	N/A	150 ft	N/A	N/A	N/A	N/A	500 - 3100 ft
	Total Capital Costs (approx)	$8 MM	$40 MM	$28 MM	$14 MM	$127 MM	$200 MM	Unknown	$91 MM	$700 MM	Unknown	$8MM	N/A	N/A	$40 MM +	$100 MM +
	Relative Cost per Acre Foot for 10825 Use (1)	Low	Moderate	Moderate	Moderate	Moderate	High	High	Moderate	High+	Moderate	Moderate	Moderate	Moderate	High+	High+
	Cooperative Partners Required	OMID	Denver Water, Northern	Ute Water	Colorado River District	Energy Industry	Denver Water	No	No	Numerous	No	West Divide WCD	Colorado River District, SECWCD	Yes, Many	No	No
Primary Criteria	10825 Water Supply (acre feet)	Avg = 9500 Dry = 0	Avg= 10825 Dry = 10825	Avg= 10825 Dry = 6500	Avg= 6500 Dry = 6500	Avg= 10825 Dry = 10825	Avg= 10825 Dry = 10825	Avg= 5000 Dry = 1500	Avg= 10825 Dry = 10825	Avg= 10825 Dry = 10825	Avg= 10825 Dry = 10825	Avg= 3000 Dry = 1500	Avg= 10825 Dry = 10825	Yes	N/A	N/A
	Implementation Time (2)	Low	Moderate	Moderate	Low	High	High	Moderate	High	High+	Low	Moderate	Low	Unknown	Moderate	Moderate
	Permitting Issues	Low	Moderate	Moderate	Low	Moderate	Moderate	Moderate	High	High	Moderate	Moderate	Low	Unknown	Moderate	Moderate
Other Evaluation Criteria	Ability to Manage Flow in 15 Mile Reach	Low	High	Moderate	Moderate	High	Moderate	High	High	High	High	Moderate	Moderate	Unknown	N/A	N/A
	Institutional Issues	Low to High	Low	Low	Low	Low	Moderate	Low	Low	High	Low	Low	High	Unknown	Low	Low
	Water Rights	None Required	Pending Adjudication	Decreed; Change to add piscatorial use	Not Adjudicated	Decreed	Decreed	Decreed	Not Adjudicated	Not Adjudicated	Not Adjudicated	Decreed	Decreed	Adjudication of Exchanges is Likely Required	N/A	N/A
	Physical Obstacles	Low	Low	Low	Low	Low	Low	Moderate	High	Moderate	Moderate	Moderate	Low	Unknown	Low	Low
	Water Quality Issues	Low	Moderate	Low	Low	Moderate	Low	Moderate	Low	High (selenium)	High (selenium)	Low	Low	Unknown	Low	Low
	ESA Issues	N/A	Non-Native Fish	No	No	Non-Native Fish	No	Non-Native Fish	Non-Native Fish; Occupied Habitat	Non-Native Fish; Occupied Habitat	Selenium	No	No	Unknown	N/A	N/A
	Headwaters Benefits	Colo. River below Kremmling	No	No	Colo. River below Kremmling	No	Eagle River	No	No	No	No	Crystal River	Roaring Fork River; Basalt to Glenwood	Yes	Fryingpan River	Fryingpan River, Roaring Fork River
	Multi-Purpose Aspects	OMID Irrigation Improvements	No	Supply for Ute Water	No	Energy Industry Supply	East Slope & West Slope Supply	No	Water Supply	East Slope & West Slope Supply	No	Water Supply, Instream Flows	No	Unknown	No	No

(1) Low = Less than $100 per acre foot per year; Moderate = $100 to $200 per acre foot; High = more than $200 per acre foot per year
(2) Low = Less than 5 years; Moderate= 5 to 10 years; High = more than 10 years

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EXECUTIVE SUMMARY

Four warm water fish species that inhabit the lower reaches of the Colorado River watershed in western Colorado have been listed as endangered under the federal Endangered Species Act. The four fish are the Colorado pikeminnow (aka squawfish), razorback sucker, humpback chub and the bonytail chub.

East Slope and West Slope water providers in the Upper Colorado Basin have committed to permanently supply 10,825 acre-feet of water per year (10825 water) to assist with the recovery of the endangered fish. This water is supplied to the "15-Mile Reach" of the Colorado River near Grand Junction during the late summer months. During this time of year the stream flow of the Colorado River within the 15-Mile Reach is substantially impacted by upstream water diversions, and the supplemental 10825 water is beneficial to the endangered fish recovery program.

The commitment to provide 10825 water is divided equally between East Slope and West Slope water providers, with each responsible to supply 5,412.5 acre-feet per year on a permanent basis. Currently, the 10825 water is provided on a temporary and interim basis by Denver Water (from Williams Fork Reservoir) and by the Colorado River Water Conservation District (from Wolford Mountain Reservoir). The agreements to provide the temporary 10825 water supplies have drought provisions that allow reduced water deliveries during dry years.

The water providers must have permanent agreements in place that identify the permanent source of the 10825 water by December of 2009. Unlike the existing temporary 10825 agreements, the permanent agreements will require delivery of the 10825 water in all years, including drought years.

PURPOSE OF THIS STUDY

A broad coalition of East and West Slope water providers have agreed to cooperatively analyze and compare a wide range of alternatives to meet their obligations to provide summer and fall flow enhancements to the 15-Mile reach on a permanent basis. This report summarizes the first phase of an assessment that evaluates these alternatives to permanently supply the 10825 water.

Phase 1 of the alternatives assessment is a "screening" evaluation. Potential 10825 facilities or alternatives that have been identified to date are evaluated and compared at a reconnaissance level. Specific recommendations regarding the alternatives or facilities that warrant additional consideration in Phase 2 of the assessment are presented.

This Phase 1 alternatives study provides unbiased information regarding the viability, environmental impacts, issues and costs of 10825 water supply alternatives. More detailed technical information will be developed in Phase 2 of the study. This technical information is intended to support the selection of a preferred alternative or group of alternatives supported by both West Slope and East Slope water providers.

A range of 15 alternatives and facilities (including structural and non- structural components) are evaluated in this study. The location of each alternative is identified on the fold out vicinity map in the front of this report.

Each of these alternatives or facilities are described in detail in the body of this report. Additional information regarding the Upper Colorado Endangered Fish Recovery Program is also provided.

OBJECTIVES FOR 10825 ALTERNATIVES

Each 10825 alternative must satisfy the following objectives:

1) Permanently supply 10,825 acre feet of water during the late summer and fall months in all years, including dry years
2) Do not impair or reduce the water yield or water supply available to any West Slope or East Slope water provider

As outlined in this report, several of the facilities that are evaluated cannot supply 10,825 acre feet of water by themselves. Accordingly, it may ultimately be necessary to combine one or more of these facilities to meet the objectives outlined above.

EVALUATION CRITERIA

Specific evaluation criteria have been developed in coordination with the West Slope and East Slope water providers. These criteria are based upon Recovery Program requirements and upon other important considerations that influence the viability of 10825 water supply alternatives. This Phase 1 screening report reviews each of the 15 alternatives in light of these evaluation criteria. A fold out matrix comparing key information for each alternative or facility is located in this report.

Primary Evaluation Criteria
10825 Water Supply, Permitting Issues, Implementation Time

Other Evaluation Criteria
Ability to Manage Flow in 15-Mile Reach, Institutional Issues, Water Rights, Physical Obstacles, Water Quality, Endangered Species Act Issues, Headwater Benefits, Multi-Purpose Aspects

ALTERNATIVES RECOMMENDED FOR ADDITIONAL CONSIDERATION

Ten alternatives or facilities are recommended for additional consideration in Phase 2 of the alternatives study. Additional environmental investigations, including an assessment of impacts to stream flow and aquatic habitat, are recommended for all of these alternatives. The ten recommended alternatives, along with recommended topics for further analysis, are listed in Table 1 below:

Table 1. Recommended Alternatives

Alternative	Further Analyses
Orchard Mesa Irrigation Improvements	Water Supply, Cost
Sulphur Gulch Reservoir	Water Quality, Cost
Buzzard Creek Reservoir	Water Supply, Design, Cost
Wolford Mtn Reservoir Improvements	Water Supply, Cost
Roan Creek Reservoir	Design, Cost, Water Quality
Wolcott Reservoir	Cost
15-Mile Reach Pumpback	Water Quality, Design, Cost
Yank Creek Reservoir	Water Supply, Design, Cost
Ruedi Reservoir (2012 Backfill) Impacts	Water Supply, Operational
Synchronized Use of Multiple Facilities	Alternative Formulation

ALTERNATIVES NOT RECOMMENDED FOR ADDITIONAL CONSIDERATION

The following five facilities or alternatives are not recommended for consideration in Phase 2 of the alternatives assessment:

Mt. Logan Reservoir

This 10,000 acre foot reservoir site is located on an ephemeral tributary to Roan Creek near the Town of DeBeque. A pump station from the Colorado River would be required to provide an adequate yield of water for Recovery Program purposes.

The reservoir site is inferior when compared to other alternatives, with a large embankment required for a relatively small amount of storage. There is also a natural gas pipeline located beneath the proposed dam axis. Water quality issues associated with the reservoir are similar to those associated with the Sulphur Gulch site, and would be of concern to Grand Valley water users. The warm water reservoir may introduce non-native fish to the Colorado River, in competition with the endangered fish.

Webster Hill Reservoir

This 28,900 acre foot reservoir site is located on the mainstem of the Colorado River several miles downstream of the Town of Rifle.

Many physical obstacles would impair construction of this alternative. The reservoir would require relocation of Interstate 70, a railroad line, numerous natural gas wells, natural gas pipelines, and many other commercial facilities. In addition, the reservoir would inundate occupied habitat of several endangered fish species.

Grand Valley Lake

The Grand Valley Lake is a large scale water development concept that would be located in the vicinity of Grand Junction, Colorado. As proposed by Donald Clay, a retired USBR engineer, this concept would include a 200,000 acre foot off-channel reservoir south of the Colorado River near Palisade. The reservoir would be filled by a 60 mile aqueduct from the North Fork of the Gunnison River.

Many environmental and water quality issues (in particular selenium loading) may be associated with this concept. The timely permitting and construction of this concept is unlikely. Even if it is possible to permit and construct this project, it would require several decades or more, given the large size of the project, federal issues, environmental issues, and the multi-purpose nature of the project.

Ruedi Reservoir to Basalt Gravity Pipeline

This delivery facility would construct a 15 mile gravity pipeline from Ruedi Reservoir to the Roaring Fork River near Basalt. The pipeline would keep any 10825 water releases made from Ruedi Reservoir out of the Fryingpan River in order to facilitate sport fishing access. The pipeline would likely carry 10825 water only during isolated periods (perhaps several weeks per year) when 10825 releases may conflict with fisherman access. Preliminary cost estimates for the pipeline are about $40 million.

It is likely that sport fishing access issues associated with the use of Ruedi Reservoir can be resolved through continued reservoir management, without the large scale construction of this major facility.

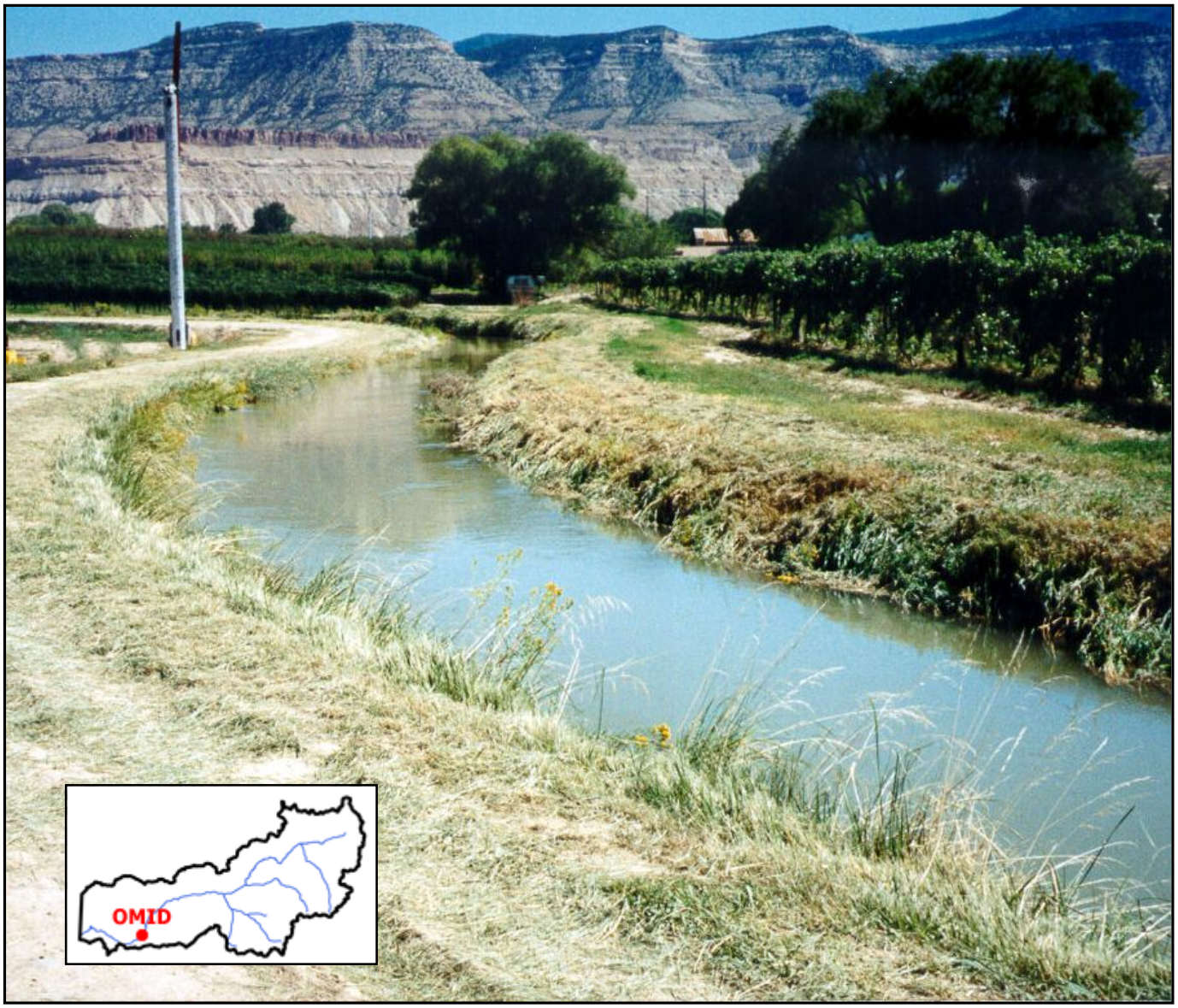
Ruedi Reservoir to Upper Roaring Fork Tunnels

As with the Ruedi to Basalt Pipeline, this facility would keep 10825 water out the Fryingpan River by delivering it to the upper Roaring Fork watershed instead. Two tunnel configurations were

considered; (1) a 12 mile tunnel with a pumping lift of 500 feet to the Salvation Ditch above Aspen, and (2) an 18 mile tunnel to the Twin Lakes Collection System with a lift of 3,100 feet. The tunnel systems would likely carry 10825 water only during isolated periods (perhaps several weeks per year) when 10825 release objectives conflict with sport fisherman access.

The costs of these tunnel systems and pump stations would likely be prohibitive ($100 million or more). Further, sport fishing access issues associated with the use of Ruedi Reservoir can likely be resolved through continued reservoir management.

ORCHARD MESA WATER MANAGEMENT IMPROVEMENTS



Description

- Efficiency Improvements to Orchard Mesa Irrigation District (OMID) system
- Improvements will reduce Colorado River diversions above 15 Mile Reach during portions of the irrigation season
- "Saved" water accrues to Historic Users Pool of Green Mountain Reservoir, and may be available for 10825 uses
- Average yield of about 9,500 AF per year
- Dry year yield may be minimal
- Cost: $8MM +

Summary

- Must be combined with other alternatives to fully supply 10825 water, particularly in dry years
- No new reservoir storage is required
- Modernized irrigation system will benefit OMID water users
- Minimal environmental issues
- Timely to construct and permit
- Institutional and legal issues may exist
- Recommended for further study

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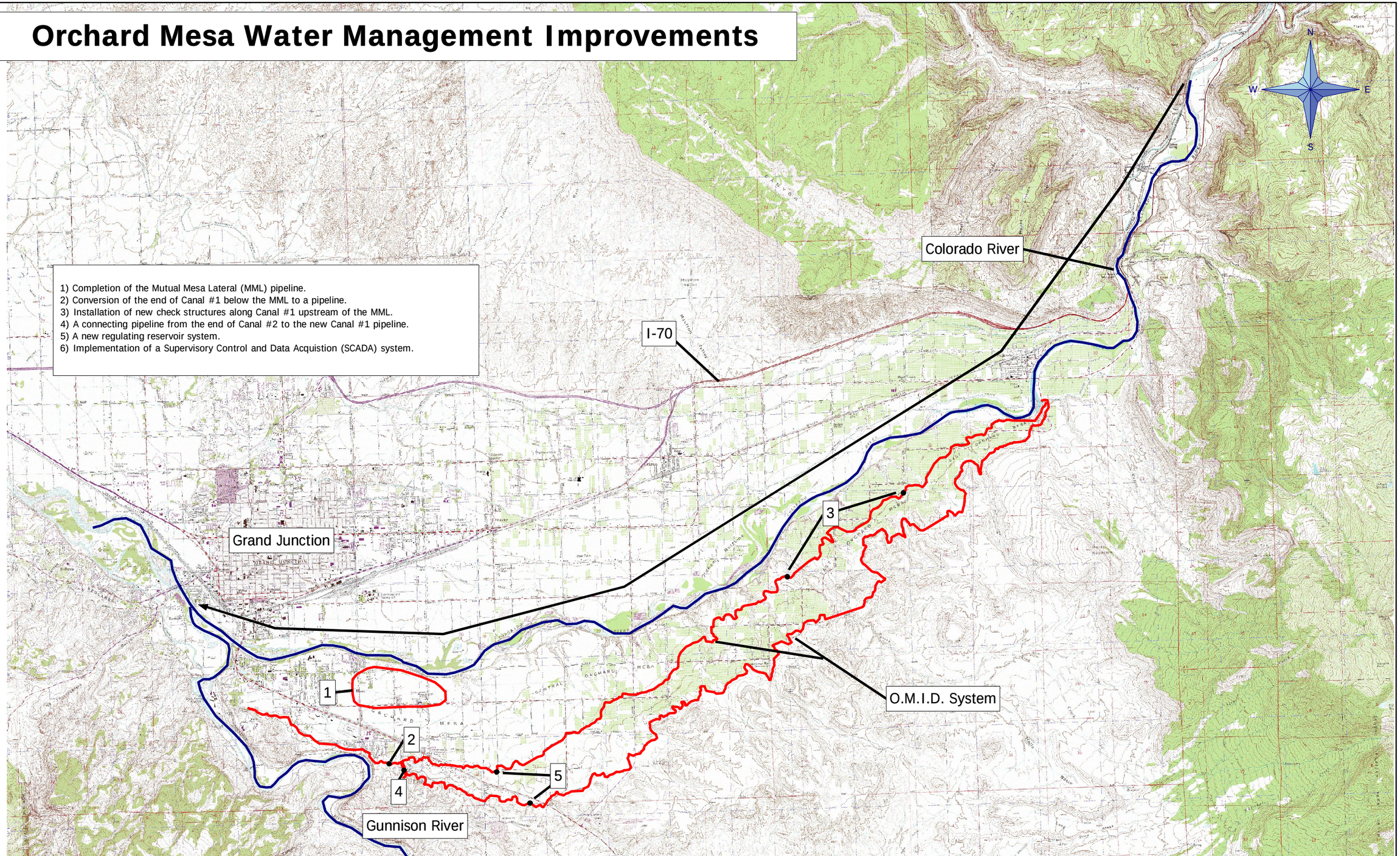
Orchard Mesa Water Management Improvements

1) Completion of the Mutual Mesa Lateral (MML) pipeline.
2) Conversion of the end of Canal #1 below the MML to a pipeline.
3) Installation of new check structures along Canal #1 upstream of the MML.
4) A connecting pipeline from the end of Canal #2 to the new Canal #1 pipeline.
5) A new regulating reservoir system.
6) Implementation of a Supervisory Control and Data Acquistion (SCADA) system.



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ORCHARD MESA

WATER MANAGEMENT IMPROVEMENTS

The Orchard Mesa Irrigation District (OMID) is a major supplier of irrigation water in the Grand Valley area, in a location just east of the City of Grand Junction. OMID provides irrigation water to a 9,200 acre area south of the Colorado River, adjacent to the 15-Mile Reach. This area includes popular wineries, peach orchards and other crop producing areas near Palisade.

This alternative would implement water management techniques to improve irrigation efficiency, and reduce irrigation spills to the Colorado River from the OMID canal system. The improvements could reduce OMID's Colorado River diversions during certain times of the irrigation season, without impacting water supplies for local crop production.

Reduced OMID diversions from the river may increase water flows in the 15-Mile Reach through the reduction of water releases from Green Mountain Reservoir. Currently, water is released from Green Mountain Reservoir to enhance OMID's water supply during the late irrigation season. The amount of water "saved" in Green Mountain Reservoir water could be subsequently released to provide 10825 water during the irrigation season.

The proposed water management improvements contemplated by OMID are very similar to the system upgrades made on the Grand Valley Water User's Highline Canal over the past several years.

A study of water management opportunities for the OMID system was originally completed in the year 2000 by California Polytechnic State University (CalPoly)[1]. This initial study recommended the following infrastructure improvements:

- Completion of the Mutual Mesa Lateral Pipeline
- Conversion of the end of OMID Canal #1 to a pipeline
- Installation of new check structure in Canal #1
- A connecting pipeline from Canal #2 to Canal #1
- A new regulating reservoir system
- Implementation of Supervisory Control and Data Acquisition operating system.

These water management improvements would improve irrigation efficiency, and modernize the OMID irrigation system to provide enhanced local water delivery in response to urbanization trends within the district's area. Like many agricultural areas across the west, land use in this area may feature increased residential development. Irrigation demand patterns will likely change as this occurs, increasing the need for a modern and efficient irrigation delivery system.

In 2000, the estimated capital cost of the irrigation management improvements was $6.3 million. With an annual escalation of 3%, capital construction costs in 2007 would be approximately $8 million. We expect that actual construction costs may substantially exceed this amount. More detailed estimates of capital costs, operation costs, and maintenance costs will be subsequently developed in Phase 2 of this study.

Unit costs for this alternative may be as low as $50 for every acre foot of water delivered. A more detailed assessment of unit costs will also be developed in the Phase 2 study.

10825 WATER SUPPLY

This alternative cannot supply the entire 10825 water demand, particularly in dry years. The 2000 CalPoly study estimated an average annual irrigation water

1 Irrigation Training and Research Center, California Polytechnic Institute. December 2000. ***Orchard Mesa Irrigation District (OMID) Water Management Study (For Improved Irrigation District Operation).*** Prepared for The U.S. Bureau of Reclamation Upper Colorado Region.

savings of 9,500 acre feet. In average and wet years most of this water savings may be available for 10825 water supplies. However in dry years, very little water may be available for 10825 uses. A description of the water supply associated with alternative is outlined below.

OMID System. The OMID system supplies irrigation water to approximately 5,000 landowners. Irrigation water is delivered through two primary canals that are supplied by the Colorado River at the upstream end of the 15-Mile reach. Canal #1 has a capacity of about 90 cfs and is approximately 20 miles in length. Canal #2 has a capacity of about 75 cfs, and a length of about 15 miles. The two canals divert an average of about 60,000 acre feet per year.

A substantial amount of water diverted by OMID is provided by releases from the Historic Users Pool (HUP) of Green Mountain Reservoir. The HUP releases occur primarily during portions of the summer and fall months when the flow of the river will not supply OMID's decreed water rights without releases from Green Mountain Reservoir.

Water is diverted into the canals at a fairly constant rate throughout the irrigation season. During periods of peak irrigation water demand, little or no excess water is available in the OMID system. However, during periods of reduced irrigation demand associated with summer rainfall events or with cropping practices, the OMID shareholders require less water.

Excess water that is not diverted into the laterals used by the OMID agricultural community flows to the west through the main canal system and is then spilled from the canals back to the Colorado River. With a more efficient delivery system, a portion of this "excess water" would not be diverted at the upstream end of the 15-Mile reach, only to be spilled back into the river without being used by the agricultural community.

With existing canal facilities, it is very difficult to modify canal diversions to coincide with actual irrigation demand. The actual demand of individual users cannot be accurately predicted in advance. Further, water transit time from the head to the end of the canals is over 12 hours and canal diversions cannot be readily altered in response to fluctuating demand conditions. Under current operating conditions, if canal diversions are reduced, a substantial likelihood of irrigation water shortages occurs. Accordingly, it is difficult to control or reduce spills from the OMID canals with the existing facilities that are in place.

In this alternative, irrigation management improvements would allow increased operational flexibility of the OMID system. Irrigation spills would be reduced and water may be available for Recovery Program uses in the following manner:

Reduction of Headgate Diversions and Spills. The irrigation system improvements illustrated on the OMID figure would allow the reduction of canal diversions during periods when excess water currently occurs in the OMID system. Canal diversions could be reduced without a substantial risk of water shortage to OMID irrigation users.

Additional Storage in Green Mountain Reservoir. The reduction in demand by the OMID system would reduce water releases from the HUP in Green Mountain Reservoir. When storage in the HUP exceeds the amount of water that is required to fully supply the HUP beneficiaries, a surplus condition occurs. The surplus water in the HUP may be available for Recovery Program purposes. Accordingly, a large portion of the OMID water management savings may be available for Recovery Program uses.

The potential reduction of OMID spills may vary substantially from year to year. At present, this potential variability is not well understood. It is likely that canal spills, and associated water savings in Green Mountain Reservoir, are the greatest in average and wetter than average years, and the least in dry years. In dry years, spills may be minimal because diversions to the OMID irrigation system are already reduced in response to water supply shortages in the Green Mountain Reservoir HUP Pool.

It is possible that any water savings in these dry years would increase the firm yield of the HUP and accrue to the beneficiaries of the HUP, but may not accrue to the Recovery Program. Green Mountain Reservoir can deliver water to the Recovery Program

only when surplus water is available in the HUP, and in dry years an excess may not occur.

On a real-time basis, it is often difficult to predict when surplus conditions in Green Mountain Reservoir will occur. Surpluses are often not identified until late in the summer. As a result, water savings that accrue to Green Mountain Reservoir may not be available for Recovery Program uses until very late in the irrigation season. Further study of the relationship between predictions of surplus Green Mountain water, and actual observed surplus conditions will be evaluated in Phase 2 of this study.

Water Yield. Canal spill estimates have been developed for the 1995 through 2000 period in the CalPoly study. In the year 2000, the estimated spill volume from the canals was 6,046 acre feet. In 1999, an estimated 15,150 acre feet of spills occurred. From 1995 to 1998, average annual spills of 10,600 acre feet were estimated, although actual spills were not fully measured in these years. The 2000 CalPoly study identifies that it may be possible to reduce canal diversions by about 90% of the total spill amounts, or an average of about 9,500 acre feet per year.

It should be noted that the nearby Government Highline Canal efficiency improvements have resulted in a "savings" that has ranged from 42,582 in 2002 to over 55,000 acres feet per year. The U.S. Bureau of Reclamation (USBR) reports that the Highline Canal savings have significantly exceeded CalPoly's original predicted savings of 29,000 acres feet per year for the Highline Project. However, the recently observed Highline Canal savings may not be solely related to USBR efficiency improvements, but may also be related to other factors such as weather, cropping choices and other variables that can play affect irrigation water demands.

For purposes of this assessment, we have assumed the average potential Recovery Program yield of this alternative to be 9,500 acre feet per year. It should be noted that the reliability of this yield is uncertain, and dry year yield may be less. The actual operation of this alternative requires additional evaluation in order to further understand this potential variability. Since this alternative can only provide a portion of the 10,825 water, it would be necessary to implement this alternative in conjunction with other Recovery Program water supply sources.

Under direction from OMID and the USBR, CalPoly will initiate an update of the 2000 OMID study during the summer of 2007. (The scope of work is currently being formulated by OMID and USBR with CalPoly.) The update will review phasing opportunities for system improvements, update implementation cost estimates, and update the estimate of potential water savings. This study will be used as the primary basis for a technical review of the OMID system in Phase 2 of the 10825 study.

We understand the CalPoly study may not be completed before mid 2008. However, the USBR has indicated Grand River can work closely with CalPoly to ensure an open flow of information between these two concurrent studies. If the necessary preliminary CalPoly study information is not available in 2007, other investigations may be required to better understand potential construction costs and the ability of the OMID improvements to meet 10825 objectives.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. Releases of water would originate from Green Mountain Reservoir located over 190 miles upstream of the 15-Mile Reach. It will typically take three days for reservoir releases to arrive at the 15-Mile Reach. Given this transit time, it may be difficult to rapidly adjust reservoir releases in response to changing stream flow conditions in the 15-Mile Reach (i.e. rain events or changes in irrigation use). However, the transit issues associated with this facility are similar to issues related to the use of Ruedi Reservoir, Williams Fork Reservoir, Wolford Mountain Reservoir and other upstream facilities.

Institutional Issues. Institutional issues may be minor if this alternative is operated simply as an irrigation efficiency project that enhances the yield of the Green Mountain Reservoir HUP. However, institutional issues may be significant if it is desired to directly "bookmark" the efficiency water savings

for subsequent 10825 uses. In this event congressional action involving Green Mountain Reservoir and the "Blue River Decree" may be required. Institutional issues will be explored in more depth in the Phase 2 report.

Water Rights. A significant water right issue is related to potential abandonment of water rights. OMID users require assurance that a periodic reduction in diversions by the project's existing senior water rights would not result in any abandonment of these rights. No water right actions are required unless it is desired to directly "bookmark" the efficiency water savings for subsequent 10825 uses. In this event, a change of water rights application, or other substantial water right proceedings, would be required.

Physical Obstacles. No physical obstacles related to the development of this alternative have been identified.

Water Quality. Grand Valley irrigators and municipal water providers are concerned that several of the 10825 alternatives may degrade water quality in the Grand Valley. Salinity and selenium concentrations have negative effects on crop production and other uses. Many in the Grand Valley believe any increase in concentrations of these constituents may negatively affect irrigators.

If improvements to the OMID system reduce Green Mountain Reservoir releases during the late summer months, a slight increase in salinity and other parameters in the Grand Valley could occur. This issue has not been studied in detail, however we anticipate that any change in water quality associated with this alternative would likely be minor.

Endangered Species Act Issues. It is anticipated that ESA issues associated with this alternative would be negligible.

Headwaters Benefits. Increased 10825 releases from Green Mountain Reservoir would enhance stream flow in the lower Blue River and in the Colorado River below Kremmling. The magnitude of this potential benefit has not been assessed. Dry year benefits are not anticipated.

Multi-Purpose Aspects. These water management improvements would improve irrigation efficiency, and modernize the OMID irrigation system to provide enhanced local water delivery in response to urbanization trends within the district's area.

PERMITTING

It is anticipated that the OMID Water Management improvements would not require any substantial permitting actions.

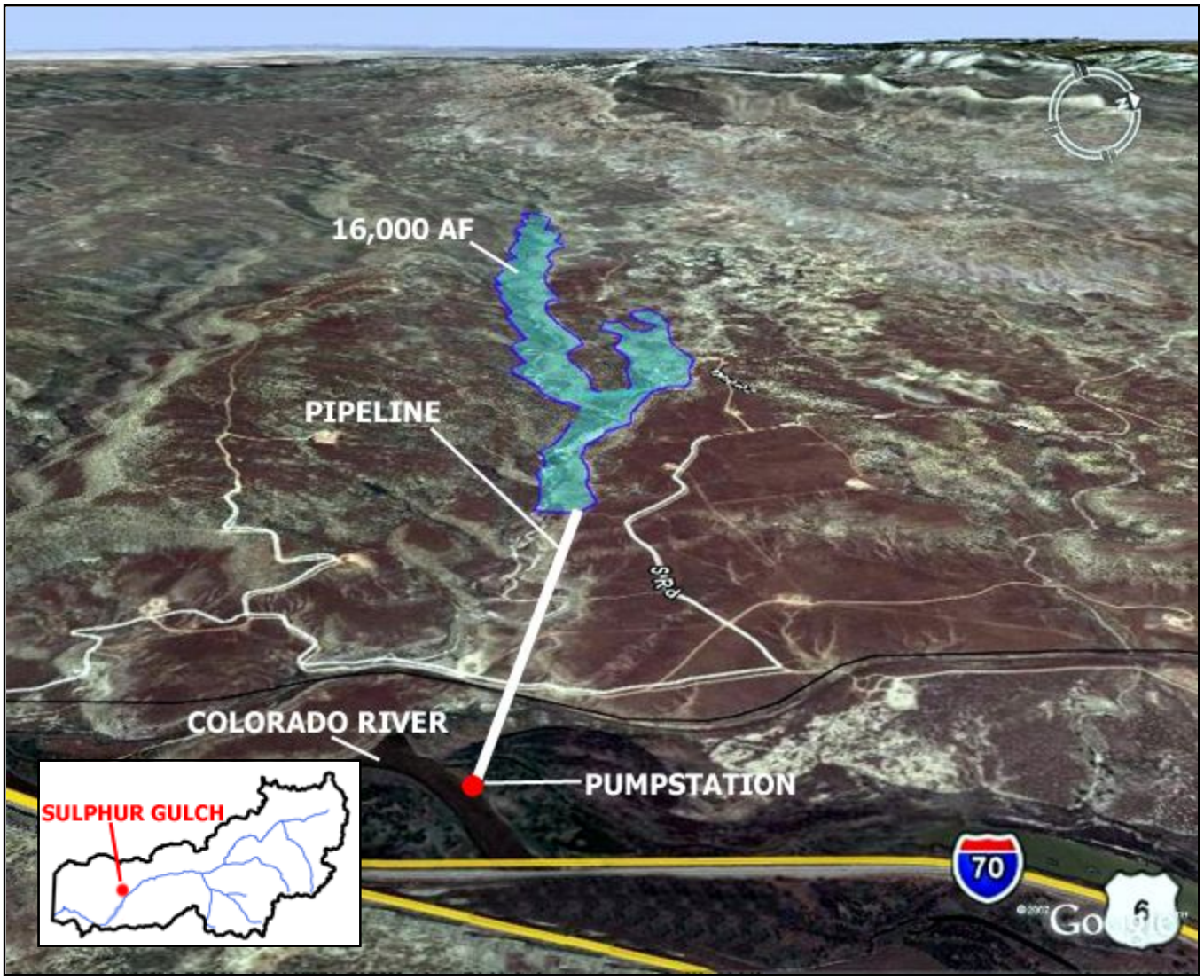
Permitting Issues. Environmental effects of this alternative are minor, and may be largely positive. The reduction of irrigation spills could affect wetland and riparian communities that have developed along the spill channels. A study of the potential loss of wetlands associated with the reduction of administrative irrigation spills may be warranted.

Estimated Time to Implementation. Permitting and construction of this alternative is likely to require lass than 5 years.

RECOMMENDATIONS

We recommend further study of this concept, in conjunction with other supplemental Recovery Program sources of water. The OMID alternative can provide a substantial amount of the 10825 Water without the construction of new diversion or storage facilities. This alternative may not provide any water to the Recovery Program in critical dry years such as 2002, since surplus water would not be available in the HUP in these types of years. Since it is necessary to supply all of the 10825 Water during all years, it is also necessary to combine the OMID alternative with other sources of Recovery Program water.

SULPHUR GULCH RESERVOIR



Description

- 16,000 AF off-channel reservoir on Sulphur Gulch near DeBeque Colorado
- Ephemeral tributary to Colorado River near 15 Mile Reach
- Primarily filled with 150 cfs Colorado River pump station
- 200 ft pumping lift
- Provides entire 10825 water supply in all years
- Water commonly available for storage from October through July
- Cost: $40MM+/-

Summary

- Grand Valley irrigators and municipal water providers are concerned that reservoir releases will degrade water quality of Colorado River
- The warm water reservoir may allow the introduction of non-native fishes to reaches of the Colorado River that are occupied by endangered fish
- Other permitting and environmental issues may not be substantial
- Multi-purpose benefits would be minor
- No headwater benefits (Grand County)
- Recommended for further study

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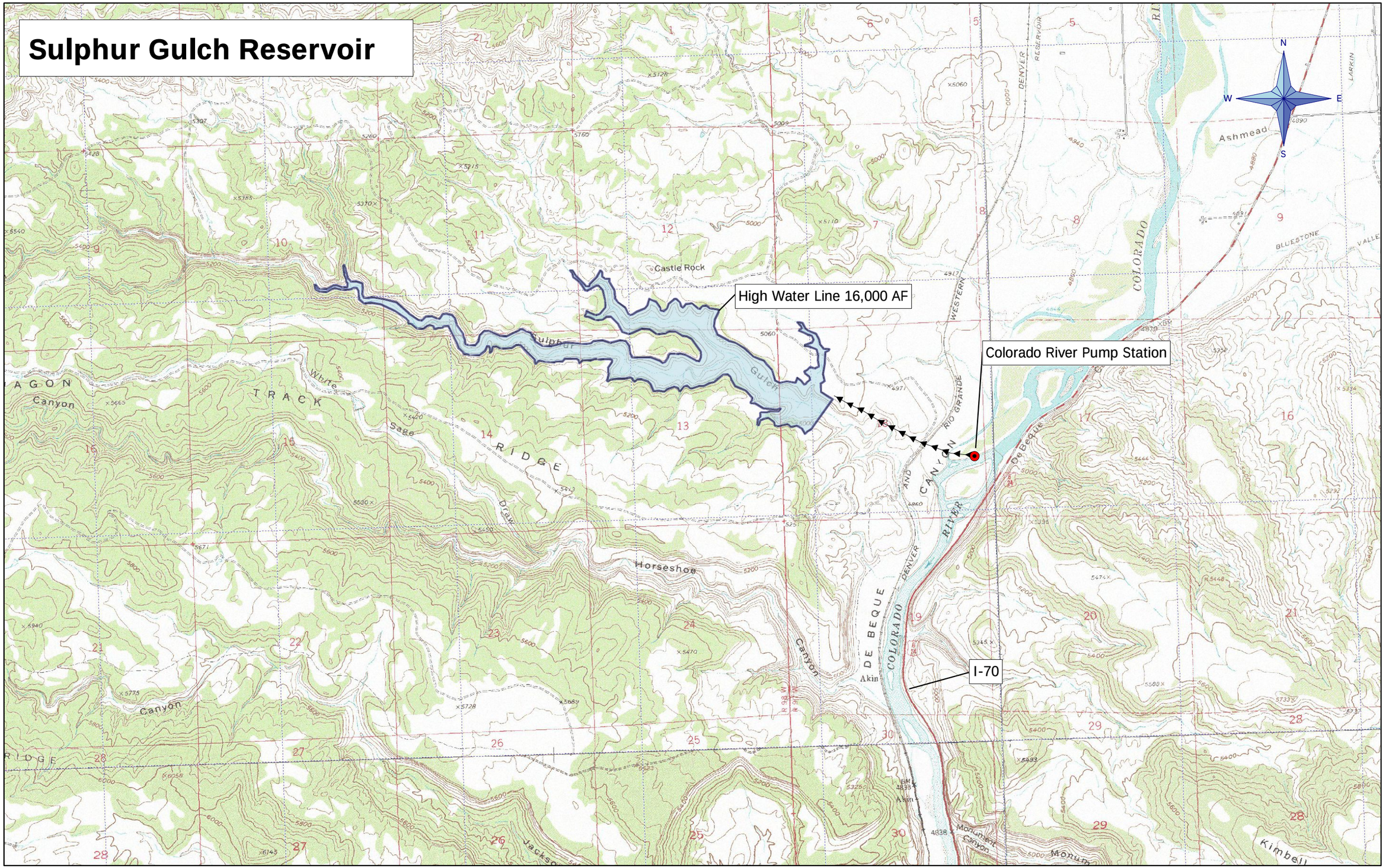
Sulphur Gulch Reservoir



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SULPHUR GULCH RESERVOIR

The Sulphur Gulch Reservoir site is located in Mesa County, approximately 12 miles upstream of the head of the 15-Mile Reach. The site is located on Sulphur Gulch, an ephemeral tributary to the Colorado River. The proposed dam location is situated about three-fourths of a mile upstream of the confluence of Sulphur Gulch and the Colorado River. This project site is currently being investigated as a source of 10825 water by project proponents Denver Water and Northern Colorado Water Conservancy District.

The reservoir site is arid and is characterized by sparsely vegetated sandstone mesas and cliffs, dissected by steep canyons. Most of the project area is located on Federal land managed by the U.S. Department of the Interior, Bureau of Land Management (BLM). Primary land uses in the region are recreation, grazing and natural gas development.

The proposed capacity of Sulphur Gulch Reservoir is 16,000 acre feet. The reservoir embankment would be approximately 165 feet high and about 1,500 feet long. Surface area of the reservoir would be about 260 acres.

The reservoir would be filled with Colorado River water delivered by a pumping station and a ¾ mile pipeline. Potential diversion facilities include a diversion canal, a pump station/valve house, and a pipeline connection to the reservoir. A pumping capacity of 150 cfs has been proposed. It is recognized that the necessary pumping capacity may be substantially less than 150 cfs under certain operating scenarios. Total lift for the pumping facility is approximately 200 feet. Reservoir releases back to the Colorado River would be controlled through a pump/valve station.

Preliminary geotechnical investigations reflect that bedrock and geologic conditions are suitable for embankment construction. These investigations included a subsurface boring program. No geologic conditions have been identified that would preclude construction of the facility. A zoned earthen embankment dam may be preferred at the site although other options such as a roller compacted concrete structure may be cost effective.

Total capital costs of $23.2 million were estimated for this project in 2001. At this time, the total capital cost of Sulphur Gulch Reservoir and related pumping station and pipeline is estimated to range between approximately $33.6 million and $46 million. We anticipate that energy costs for this alternative would be about $18 per acre foot of water pumped to the reservoir. More detailed estimates of capital costs, operation costs, and maintenance costs will be subsequently developed in Phase 2 of this study.

Unit costs for this alternative are estimated to range between $100 and $200 for every acre foot of water delivered. A more detailed assessment of unit costs will also be developed in the Phase 2 study.

10825 WATER SUPPLY

Sulphur Gulch Reservoir can supply all of the 10825 water in all years, including critically dry years.

A reliable water supply is available to fill the reservoir in all years. The total average stream flow of the Colorado River at the pump station site exceeds 2,000,000 acre feet per year. Water is available for diversion by the reservoir's pending junior water rights during most of the year, including the winter months and the snowmelt runoff period. We estimate that available in-priority inflows that could be pumped to the reservoir (with a 150 cfs pump station) vary from approximately 90,000 acre feet in dry years to approximately 110,000 acre feet in wet years. With a 150 cfs pump station, the reservoir would fill to capacity in about 55 days.

The large amount of water available for diversion provides flexibility in the operation of the reservoir. For example, the project could divert and store water from the Colorado River during the winter months (November through March) when downstream

water right calls have not historically occurred. Water availability studies indicate that the reservoir could reliably fill during the winter months, even during drought periods.

The reservoir could also store water during the spring and early summer months (primarily May, June and July) prior to the occurrence of senior downstream irrigation water right calls in the Cameo area. At this time of year, the quality of water pumped to the reservoir may be somewhat better than the quality of water that may be stored in the winter.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is in close proximity to the 15-Mile Reach, and water transit issues are minimal. Reservoir water would arrive in the 15-Mile Reach shortly after it is released. It would be possible to manage and adjust reservoir releases in response to local thunderstorms and changing stream flow conditions in the 15-Mile Reach. This operation would optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. An application for conditional water rights for the reservoir and the pumping station was made in 1999 by the City and County of Denver, the Northern Colorado Water Conservancy District, and the Municipal Sub-district of the Northern Colorado Water Conservancy District. The Colorado River District, and several Grand Valley irrigation and municipal water users, oppose the conditional water right application primarily on water quality related issues. The pending conditional water right application is scheduled for trial in July 2007. In the absence of a settlement between the East Slope and West Slope parties, a ruling on the conditional water right application is not expected until 2008 or later.

Physical Obstacles. The reservoir area is undeveloped and physical obstacles to the project are minor.

Water Quality. Grand Valley irrigation and municipal water providers are concerned that 10825 releases from Sulphur Gulch Reservoir may degrade water quality. Specifically, if the 10825 releases are of worse quality than the Colorado River at the time of release (typically August and September), water quality in the Grand Valley could be degraded. Also, water released from one of the headwater alternatives under consideration may actually improve existing water quality in the Grand Valley, and these headwater alternatives may be more favorable to Grand Valley water users.

Water quality in the Colorado River could potentially be degraded in several ways. First, the quality of water in the Colorado River is often worse in the winter baseflow period than during the irrigation season. If water is pumped into the reservoir during the winter months, the subsequent summertime reservoir releases may be of worse quality than ambient river conditions. Second, the shale formations that underlay the reservoir site are known sources of selenium. Selenium is a constituent of concern for irrigation, domestic and aquatic habitat uses. If substantial ground water leaching occurs from the reservoir site, selenium concentrations in the Colorado River may increase.

The possible increase of several dissolved water quality constituents is of concern to local irrigators and municipal water providers. In water quality studies conducted to date, potential changes in total dissolved solids concentrations in the Colorado River have been assessed as an indicator of possible water quality degradation.

Recent studies conducted by the U.S. Geological Survey (USGS), and by a consultant to Denver Water and the Northern Colorado Water Conservancy District, indicate that the probable changes in water quality caused by the proposed operation of Sulphur Gulch Reservoir are less than the field measurement error of salinity and selenium at downstream diversion points (Government Highline Canal and Grand Valley Irrigation Canal). Never the less, water quality issues are still of primary concern to the Grand Valley water users.

Water quality issues associated with Sulphur Gulch Reservoir may be addressed in the Water Court litigation that is scheduled for July of 2007. However, in the absence of a settlement between the East Slope

and West Slope parties, the water quality issues may not be resolved prior to any permitting activities that may be associated with this alternative. This issue will be more fully explored in the Phase 2 report and will incorporate appropriate information from the water court proceedings.

Endangered Species Act Issues. Sulphur Gulch would be a warm water reservoir that would likely support non-native fishes. Competition from non-native fishes is a primary obstacle to the successful recovery of the four endangered (native) fishes. The ability to limit the introduction of non-native fishes and larvae from the reservoir to the Colorado River is unknown at this time. This issue is present at all warm water reservoir sites being considered in this evaluation.

Headwaters Benefits. Since the reservoir is located within the lower reaches of the Colorado River, 10825 water releases would not enhance stream flow at other upstream sites that could also benefit from supplemental water.

Multi-Purpose Aspects. Given the proposed size of this reservoir, the use of the facility for purposes other than the Recovery Program may be limited. However, to a minor extent, the reservoir could possibly be used to regulate and maintain stream flow in the Cameo area, which could benefit water users throughout the upper Colorado River basin. Releases from storage in the summer months when a Cameo water right call is in place could reduce demands from the Green Mountain Reservoir Historic Users Pool (HUP), which in turn would enhance the yield of Green Mountain Reservoir and other diversion facilities in the headwaters of the Colorado River watershed.

Multi-use operation of Sulphur Gulch may concern West Slope stakeholders. If the reservoir were operated to reduce water right calls that originate from the Grand Valley, stream flow in several headwater rivers may be reduced during low flow times of the year when traditional senior water right calls have curtailed upstream diversions. This potential impact may be limited because of the limited size of the reservoir. If this reservoir is ONLY used for 10825 purposes, the above changes in water right administration would not be a concern.

The reservoir is capable of supplying over 10,000 acre feet of additional peak flow releases in those years when supplemental flows may enhance fish habitat. With this type of concurrent operation, the reservoir would be filled to capacity during the winter months. The releases would occur at the height of snowmelt runoff. The reservoir would subsequently be refilled prior to the occurrence of summer irrigation season water right calls. After summer and fall releases of the 10825 water, the reservoir would again be filled.

PERMITTING

This alternative would require substantial Federal and state permitting. Mesa County does not currently have 1041 regulations, although it is our understanding that the County is contemplating the adoption of 1041 authority. In the absence of a land exchange, a Special Use Permit would be required from the BLM. A 404 Permit would be required from the U.S. Army Corps of Engineers (COE). The preparation of an Environmental Impact Statement (EIS) or an Environmental Assessment (EA) would be associated with the Federal review process pursuant to the National Environmental Policy Act. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA.

Permitting Issues. At this time we believe that the potential water quality impacts and the introduction of non-native fishes are the key environmental issues associated with this alternative. Other environmental issues that have been identified to date are:

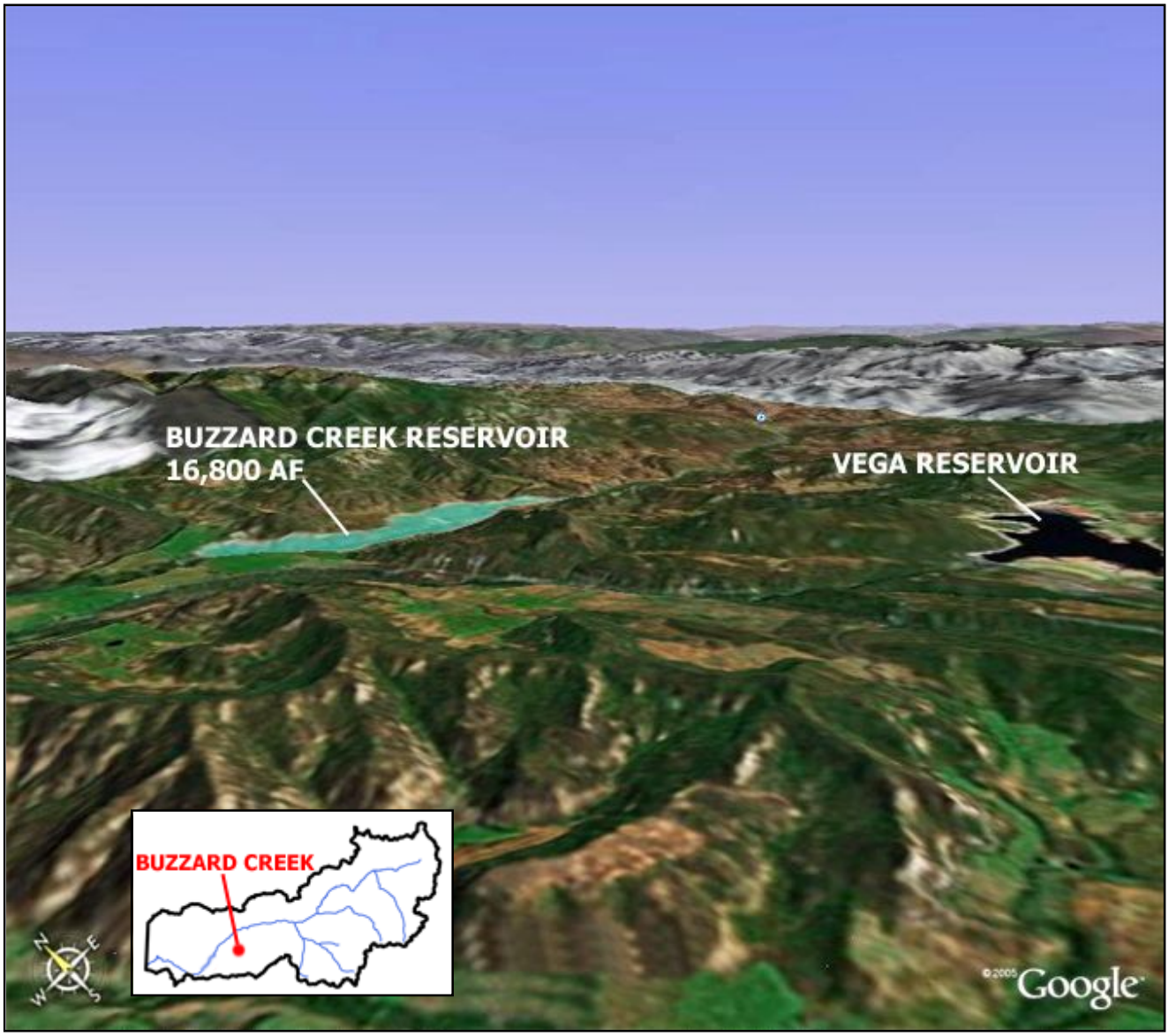
- The project would inundate a wetland/riparian area beneath the reservoir.
- The project area is suitable habitat for the three other federally listed wildlife species (whooping crane, Mexican spotted owl, and the southwestern willow flycatcher), although these species are not known to inhabit the site.
- A great blue heron rookery exists in the vicinity of the pump station.
- The federally listed Uinta Basin hookless cactus exists in the project area.

Estimated Time to Implementation. Permitting and construction of this alternative is likely to require 5 to 10 years at a minimum. Further, the outcome of any permitting process is uncertain. Successful resolution of water quality issues may be required to avoid litigation in conjunction with the NEPA process. Litigation would further delay project implementation.

RECOMMENDATIONS

We recommend that this alternative be studied in additional detail. Existing information supports the finding that Sulphur Gulch Reservoir may be a viable alternative to supply the 10825 water.

BUZZARD CREEK RESERVOIR



Description

- 16,800 AF reservoir on Buzzard Creek near Collbran, Colorado
- Perennial tributary to Plateau Creek
- Cooperative project w/ Ute Water Conservancy District
- 140' earthen embankment
- Located on private land
- Average yield greater than 10,825 AF
- Dry year yield less than 10,825 AF
- Cost: $28MM +

Summary

- In dry years, must be combined with other alternatives to fully supply 10825 water
- Multi-purpose reservoir
- Use of reservoir for 10825 purposes may diminish yield available to Ute Water
- Environmental issues do not appear to be significant
- Potential for seepage through glacial tills at dam axis should be investigated
- No benefit to upstream areas (Grand County)
- Recommended for further study

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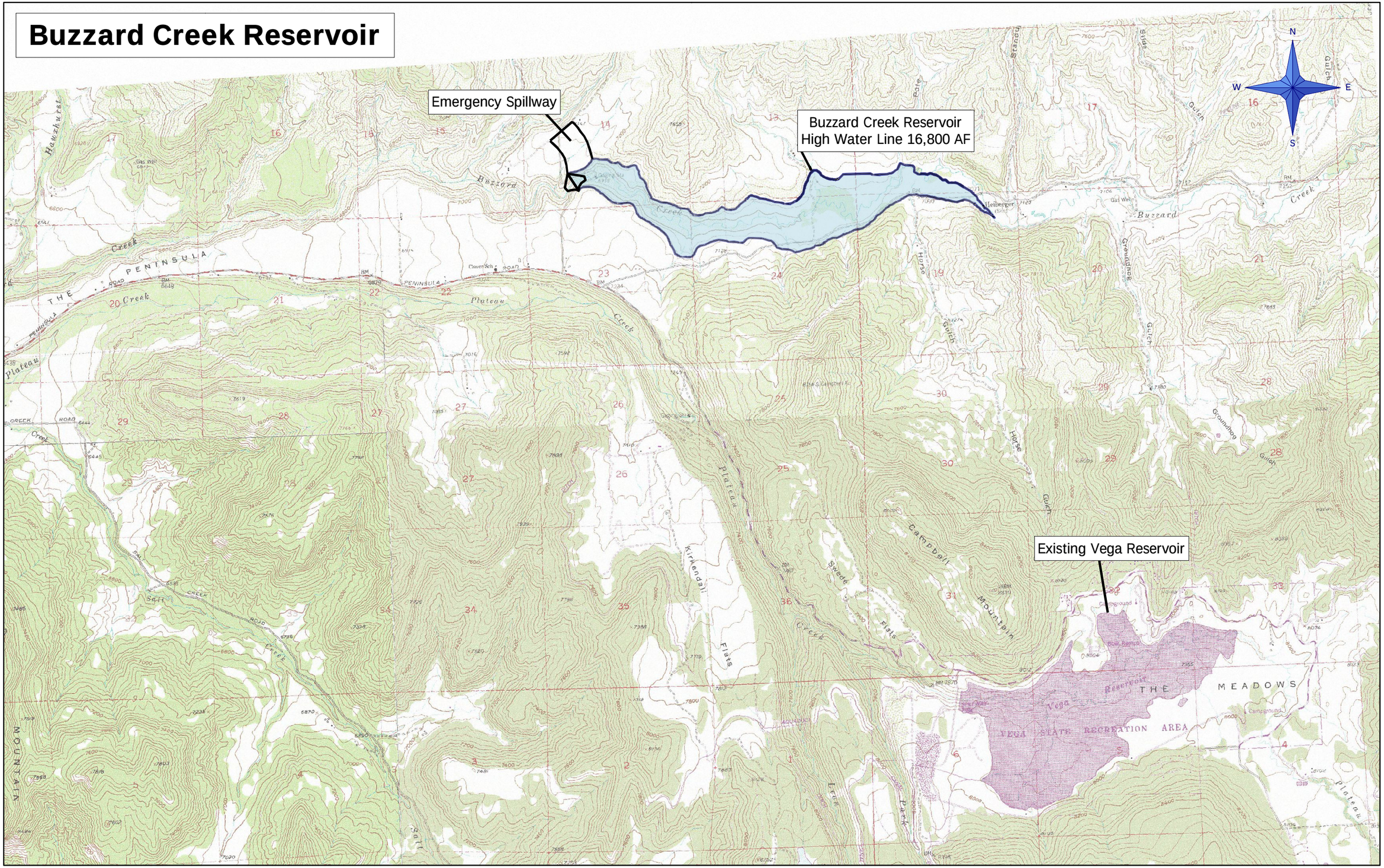
Buzzard Creek Reservoir



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BUZZARD CREEK RESERVOIR

The Buzzard Creek Reservoir site is located on Buzzard Creek, a tributary to Plateau Creek. The reservoir site is about four miles north of the existing Vega Reservoir and approximately six miles east of the Town of Collbran. Collbran is 25 miles south of Rifle.

The proposed reservoir is located in a relatively steep valley incised into a broad alluvial terrace known as the Peninsula. At the location of the proposed embankment, the Buzzard Creek valley is about 140 feet deep and 700 feet wide. The steep valley hill slopes are densely vegetated with brush and occasional confiners. Irrigated pastures exist in the upper portion of the reservoir basin. The reservoir would be located entirely on private land.

Buzzard Creek Reservoir was originally considered as a component of the Battlement Mesa Project. This project was intended to supply irrigation water to areas north of Plateau Creek and Buzzard Creek. Water rights for the project were decreed to the Battlement Mesa Conservancy District in 1972, with a 1964 appropriation date. Storage decrees for the reservoir total 20,000 acre feet.

In recent years, the Ute Water Conservancy District has evaluated the feasibility of constructing a 16,800 acre foot reservoir at the Buzzard Creek site. In 2004, GEI Consultants conducted a preliminary evaluation of the project. A zoned earthen embankment with a height of 137 feet and a width of 650 feet was considered in the GEI study.

The GEI study included a feasibility level design of the reservoir. Subsurface conditions were evaluated with five drill holes developed along the proposed dam axis. The abutments would be located on glacial till. High permeability and seepage through the glacial tills are possible. This issue will be addressed in more detail in Phase 2 of this evaluation.

Reconnaissance level costs estimates of $25.6 million were estimated by GEI in 2004. Based on an annual escalation of 3%, capital construction costs in 2007 would be approximately $28 million.

Unit costs for this alternative are estimated to range between $100 and $200 for every acre foot of water delivered. A more detailed assessment of unit costs will be developed in the Phase 2 study.

For purposes of this study, the Buzzard Creek Reservoir is viewed as a cooperative project with the Ute Water Conservancy District. The reservoir would be used for water supply purposes by Ute Water and would also be used to supply the 10825 water.

10825 WATER SUPPLY

The reservoir would be filled with water from Buzzard Creek. The local Water Commissioner indicates that the water rights for the reservoir would not be subject to a call originating from either Buzzard Creek or Plateau Creek. The reservoir would be subject to curtailment by the Cameo Call on the Colorado River.

In many average and wetter than average years, the reservoir could store water in-priority on a year-round basis. In dry years, the Cameo call may curtail diversions in the spring and from mid-summer through the end of October.

A long-term stream gage with almost 60 years of record was operated near the Buzzard Creek site. Records from this gage provide reliable information regarding water availability for the reservoir.

We have completed a preliminary estimate of water availability based upon historical stream gage data, the estimated duration of a Cameo Call, and an instream flow bypass to maintain 16 cfs in Plateau Creek. Results of this preliminary study reflect that storable inflow to the reservoir averages over 20,000 acre feet per year. In critically dry years, the storable inflow would be less than 6,500 acre feet.

With the use of reservoir carryover storage, it may be possible to provide a full supply of 10825 water in all years. However, this method of operation may eliminate or reduce dry year yield available to the Ute Water Conservancy District or others.

A more likely method of operation would allocate reservoir yield between the Recovery Program and other uses. With multi-purpose uses, Buzzard Creek Reservoir by itself could not supply all of the 10825 water demands. However, the reservoir could be paired with other alternatives to provide a full supply of the 10825 water.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is in relatively close proximity to the 15-Mile Reach, and water transit issues are minimal. It is possible to manage and adjust reservoir releases to optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. A change of water rights to include piscatorial and environmental uses may be required. Substantial opposition to such an action is not likely.

Physical Obstacles. Acquisition of private property would be required. Several private residences and farms buildings would be inundated.

Water Quality. A preliminary review of available water quality data suggests that the quality of water released from the reservoir would be good.

Endangered Species Act Issues. Buzzard Gulch would be a cold water reservoir. Competition from non-native fishes is not anticipated.

Headwaters Benefits. Since the reservoir is located within the lower reaches of the Colorado River, 10825 water releases would not enhance stream flow at other upstream sites that could also benefit from supplemental water.

Multi-Purpose Aspects. The reservoir could be used as a water supply project that would benefit local water users in the Grand Valley, as well as the Recovery Program.

PERMITTING

The site is located on private land and Federal permitting issues may be simplified. A 404 Permit would be required from the COE. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Mesa County does not currently have 1041 regulations, although it is our understanding that the County is contemplating the adoption of 1041 authority.

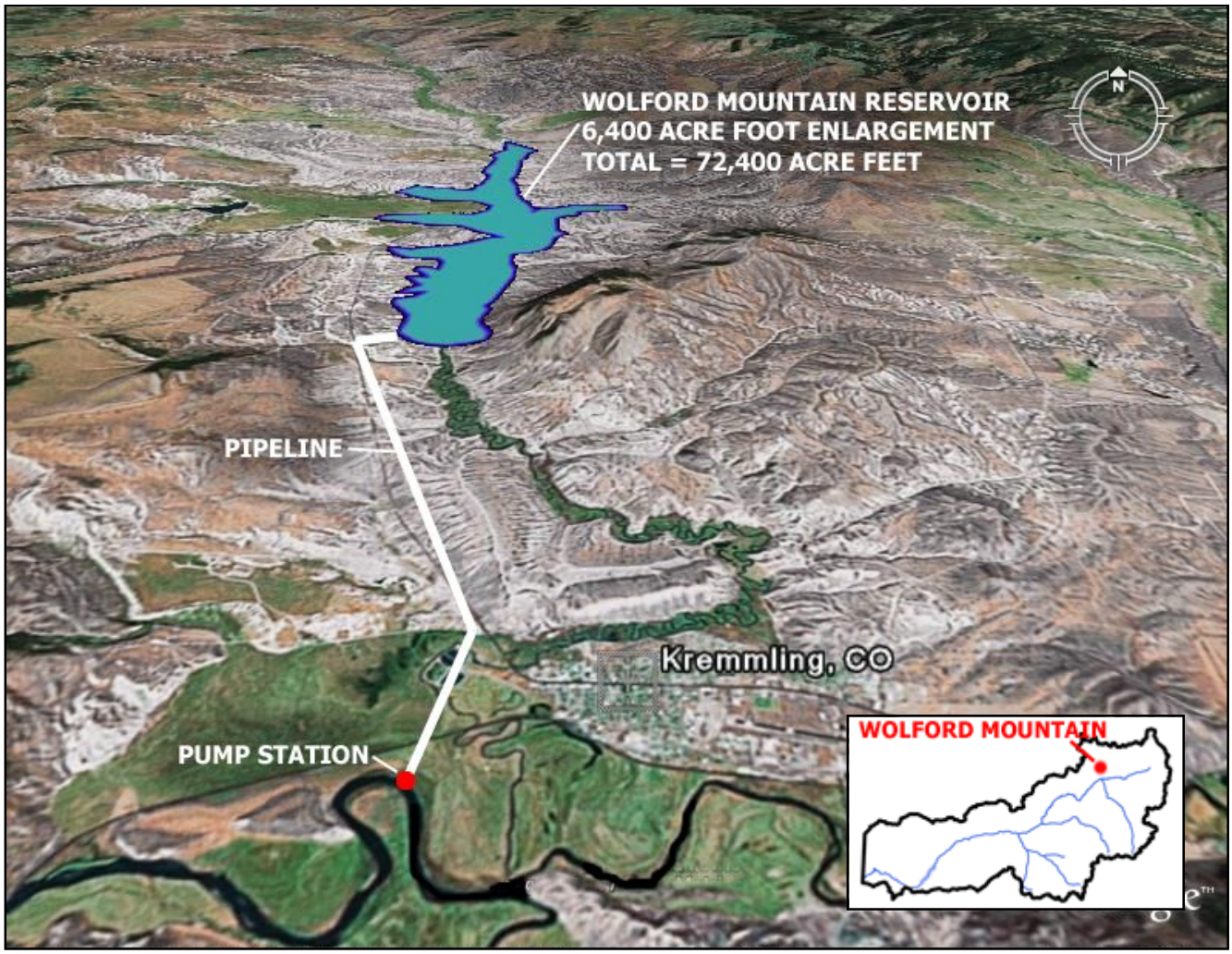
Permitting Issues. Environmental issues associated with Buzzard Creek Reservoir have not yet been evaluated. However, based on a site review, we do not anticipate substantial environmental concerns. Wetland areas appear to be limited in extent.

Estimated Time to Implementation. Environmental permitting and construction of this alternative is likely to require 5 to 10 years at a minimum.

RECOMMENDATIONS

We recommend that this alternative be studied in additional detail. Additional studies of this reservoir should include a review of environmental issues, a cost update for the facility, and an evaluation of potential embankment seepage issues. It is necessary to combine this alternative with other sources of Recovery Program water, particularly in dry years.

WOLFORD MOUNTAIN RESERVOIR
River Pump/Reservoir Enlargement



Description

- 75 cfs pump station from Colorado River to existing reservoir
- Optional 6,400 AF reservoir enlargement w/ 4 foot spillway raise
- 160 ft pumping lift
- Pump station enhances yield of existing reservoir as well as potential enlargement
- Increased yield available for 10825 purposes
- Yield approximately 6,500 AF per year
- Cost: $14MM +

Summary

- Must be combined with other alternatives to fully supply 10825 water
- No new reservoir is required
- Pump station diversions may adversely affect flow of upper Colorado River (below Kremmling) in springtime
- Headwaters benefit: 10825 releases will increase stream flow of upper Colorado River in late summer
- Timely to construct and permit
- Recommended for further study

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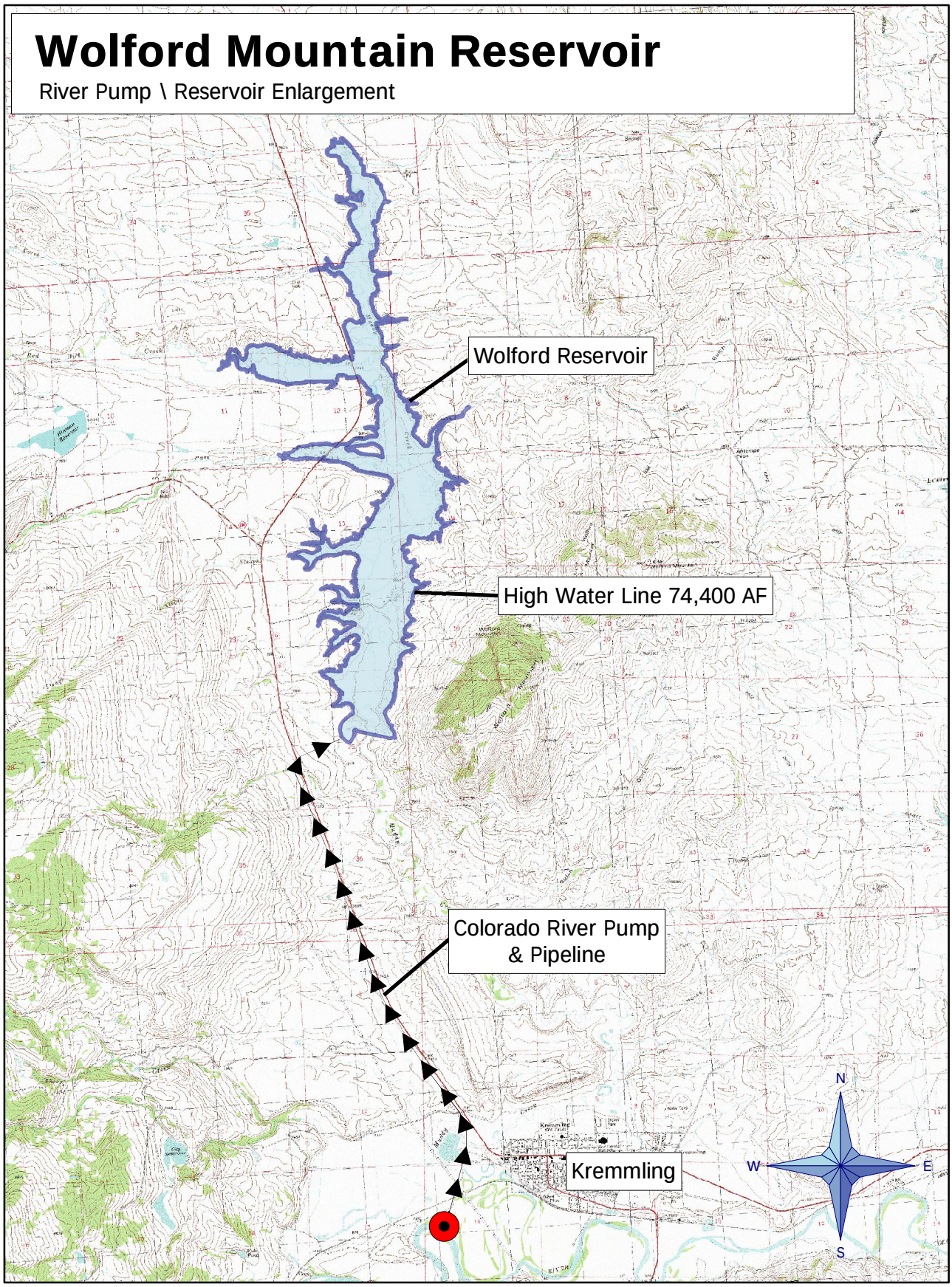
Wolford Mountain Reservoir

River Pump \ Reservoir Enlargement



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WOLFORD MOUNTAIN RESERVOIR

River Pump / Reservoir Enlargement

Wolford Mountain Reservoir is an existing storage facility located on Muddy Creek, near the Town of Kremmling. The reservoir was originally completed in 1995 with a capacity of about 60,000 acre feet. The original reservoir pool is cooperatively used by the CRWCD and Denver Water. In 1996, a 6,000 acre foot first enlargement of the reservoir became available and was dedicated to the USFWS for Recovery Program uses (the fish pool).

Wolford Mountain Reservoir does typically not fill to capacity in drier than average years. Neither the original reservoir pool, nor the 6,000 acre foot fish pool fill in these dry years. The water supply available to the existing 6,000 acre foot fish pool is ten percent of the storable inflow to the reservoir. As a result, the USFWS pool currently provides a dry year yield that is substantially less than 6,000 acre feet, but is proportional to the total reservoir yield.

Two separate Wolford Mountain Reservoir enhancements have been considered to enhance the yield of the reservoir for 10825 purposes. The first concept studied would increase reservoir capacity by about 6,400 acre feet (the Second Enlargement). This second reservoir enlargement would be accomplished by raising the elevation of the existing spillway by about four feet. Water in the second enlargement pool would be available for Recovery Program purposes; specifically for the release of a portion of the 10825 Water. As outlined below, a Colorado River pump station would be required to provide a reliable source of water supply for the reservoir enlargement.

A second concept studied would be to build a pumping station from the Colorado River to the reservoir. This pumping station would increase water supplies to the existing reservoir in dry years, and would also provide an additional supply of water to the second enlargement pool, if the spillway is raised. Several pump station alternatives have been evaluated. For purposes of this study we have estimated that the pumping station would have a capacity of approximately 75 cfs, with a pumping lift of about 160 feet.

The Colorado River pump station could be constructed as a stand-alone improvement that would enhance yield of the existing reservoir, including the yield of the existing 6,000 acre foot fish pool. The pump station is a required element associated with the potential second enlargement of 6,400 acre feet. Natural inflow of Muddy Creek to the reservoir is insufficient to fill this enlargement pool on a regular basis, and the Colorado River pump station would be required to provide a reliable supply of water to the enlargement.

Total capital costs of about $13 million were estimated for this alternative in 2004. These costs included $3.5 million for spillway improvements and $9.5 million for the construction of pump and conveyance facilities. Energy costs, or pumping costs, were estimated to be $31 per acre foot of water pumped to the reservoir. Based on a 3% escalation rate, 2007 construction costs may exceed $14.2 million.

Unit costs for this alternative are estimated to range between $100 and $200 for every acre foot of water delivered. A more detailed assessment of unit costs will be developed in the Phase 2 study.

10825 WATER SUPPLY

The pump station and reservoir enlargement would operate under new junior water rights. These rights would be in-priority during the spring runoff period only. In typical years, the rights may be in-priority most of May, June and the first half of July. In the recent drought year of 2002, the junior rights associated with the pump station would have been in-priority from about May 1 through the first week of June (about 35 days).

The proposed second enlargement pool of 6,400 acre feet would be filled with water from both Muddy Creek and the Colorado River. Gravity inflow from Muddy Creek would be available for storage in years when the existing reservoir will fill to capacity and spill. Simulation studies based on the historical 1956 through 2003 period reflect that Muddy Creek water may be available to completely fill the second enlargement pool in about 50% of the study years. In drier than average years, or in years following dry years when the existing reservoir will not fill, the Colorado River pump station would be used to supply water to the existing reservoir, the first enlargement and to the second enlargement pool.

This alternative would supply a substantial portion of the 10,825 water in most years. In wet years, the existing Wolford Mountain Reservoir fills to capacity and the increased yield associated with this alternative would be limited to the capacity of the second enlargement pool, or about 6,400 acre feet. In critical dry periods such as 2002 and 2003, it is projected that pump station diversions, coupled with the use of the first and second reservoir enlargement pools (a total of about 12,400 acre feet of storage) would increase existing yield of the reservoir by about 6,500 acre feet. It would be necessary to combine this alternative with other water supply sources to fully meet Recovery Program objectives.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is located a substantial distance upstream of the 15-Mile Reach. It will typically take three days for reservoir releases to arrive at the 15-Mile Reach. Given this transit time, it may be difficult to adjust reservoir releases in response to thunderstorm or other events that change stream flow conditions in the 15-Mile Reach. However, the transit issues associated with this facility are similar to issues related to existing releases of water for 10825 water purposes.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. Water rights have not been decreed for either the Colorado River pump station or the second enlargement of the reservoir.

Physical Obstacles. The enlargement pool area is undeveloped and physical obstacles to the potential improvements are minor.

Water Quality. Operations of the reservoir for 10825 purposes would decrease dissolved solids of the lower Colorado River during late summer low flow periods when water is released for fish habitat in the 15-Mile Reach. However, this change in water quality would likely be negligible.

Endangered Species Act Issues. Wolford Mountain Reservoir is a cold water reservoir. Competition from non-native fishes is not anticipated.

Headwaters Benefits. It is anticipated that this alternative may have certain environmental benefits in addition to the provision of Recovery Program water. These potential benefits are primarily related to recreation and aquatic habitat. The reservoir would likely improve late summer aquatic habitat in the Colorado River between Kremmling and Dotsero by increasing flows and lowering stream temperatures. Increased stream flow and lower water temperatures during the late summer months would enhance habitat. Increased flows may also enhance recreation opportunities in the Colorado River including fishing and float boating during the late summer.

Multi-Purpose Aspects. In addition to providing water for Recovery Program purposes, the Colorado River pump station may increase the marketable yield of the existing reservoir.

PERMITTING

The construction of the Colorado River pumping station would require a 404 Permit from the COE, which would necessitate the preparation of an EIS or an EA. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. It may also be necessary to amend BLM authorization for the existing reservoir. Also, a Grand County 1041 permit would be required for this alternative. It is anticipated that all environmental consequences at the reservoir site can be successfully mitigated, and that required Federal and State permits can be obtained.

Permitting Issues. Construction impacts associated with this alternative would be relatively minor. No new reservoir would be constructed. Physical impacts at the reservoir site would be related to the increase in elevation of the existing reservoir by about four feet, and to the construction of a pump station and pipeline.

An important impact potentially associated with this alternative is the reduction of stream flow of the Colorado River when the pump station is operating during the snowmelt runoff period. The Colorado River pump station would decrease flow in the Colorado River by about 75 cfs during snowmelt runoff. We believe that the impact of pump station diversions may not be substantial in average and wetter than average years. However in dry years, the operation of the pump station would have a larger impact on environmental conditions of the Colorado River.

During the in-priority period (early May through early June) in the 2002 drought year, the stream flow of the Colorado River at the pump station site ranged from a high of 652 cfs to a low of 200 cfs. The diversion of 75 cfs through the pump station in these drought years would have a substantial effect on stream flow and environmental conditions of the Colorado River. Flow and habitat changes that are anticipated in the Colorado River between Kremmling and Dotsero require further investigation to better understand the potential impacts to this reach of the river. There is no minimum instream flow protection on this segment of the Colorado River and significant reductions in spring runoff may be having negative effects according to fishing guides who regularly fish these waters.

Colorado Trout Unlimited and the Eagle River Watershed Council have expressed concerns that the cumulative impacts of water diversions have not been adequately studied in this reach.

Estimated Time to Implementation. Environmental permitting and construction of this alternative is likely to require 5 to 10 years at a minimum.

RECOMMENDATIONS

We recommend additional study of this concept. Enhancements associated with Wolford Mountain Reservoir provide a viable source of supply for a portion of the 10825 water. The Colorado River pump station in particular, may increase the yield of the existing reservoir for Recovery Program purposes.

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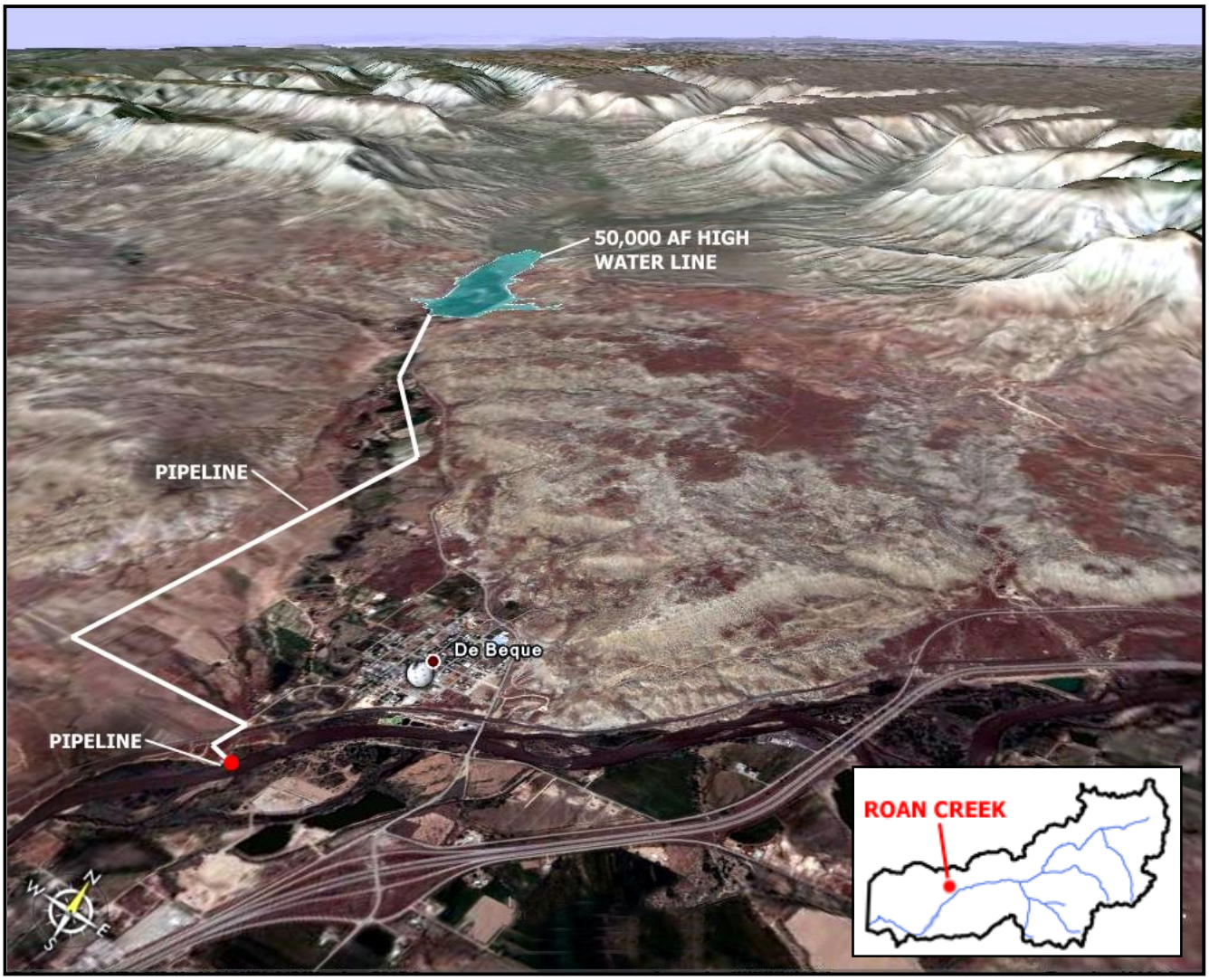
ROAN CREEK RESERVOIR



Description

- 50,000 AF Reservoir on Roan Creek near DeBeque, Colorado
- Reservoir enlargement to 140,000 AF is possible
- Multi-purpose reservoir in cooperation with the energy industry (oil shale)
- 60 cfs pump station from Colorado River
- 335 ft pumping lift
- Firm 10825 supply in all years
- Cost: $127MM +

Summary

- Coordinated development with energy industry is required; current interest level of other stakeholders in unknown
- The warm water reservoir may introduce non-native fishes to reaches of the Colorado River that are occupied by endangered fish
- Water quality issues may be similar to those associated with Sulfur Gulch Reservoir
- Multi-purpose aspect of this alternative may prolong implementation time
- No headwater benefits (Grand County)
- Recommended for further study

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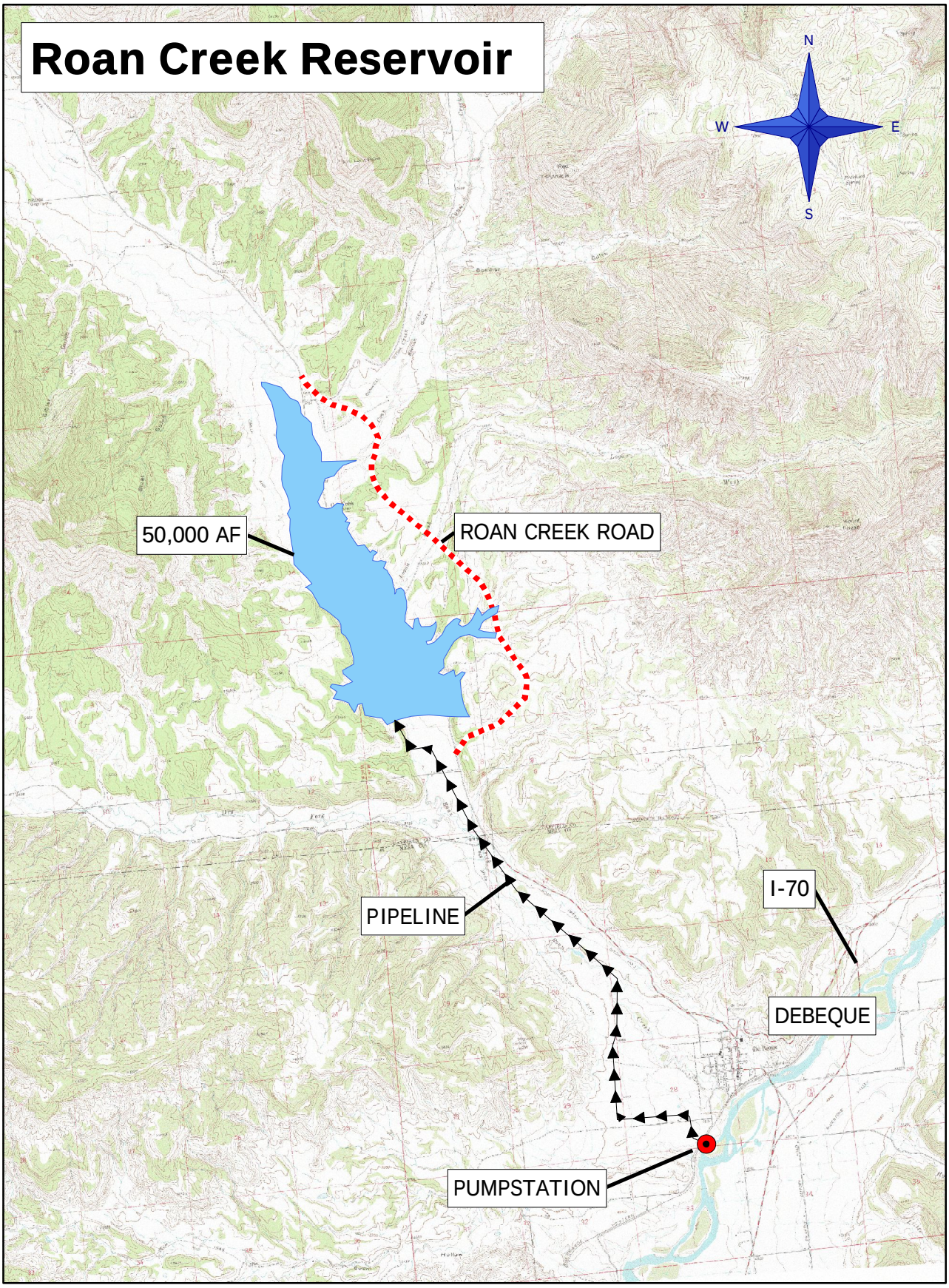
Roan Creek Reservoir
N
W
E
S
50,000 AF
ROAN CREEK ROAD
PIPELINE
I-70
DEBEQUE
PUMPSTATION

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ROAN CREEK RESERVOIR

(The DeBeque Partnership Project)

The Roan Creek Reservoir site is located about five miles north of the Town of DeBeque and Interstate 70. The reservoir site is located in Garfield County about 20 miles upstream of the 15-Mile reach.

The Chevron Shale Oil Company and the Getty Oil Exploration Company (Project Sponsors) have been investigating a water development project at this site for several decades. In 2002, they studied a multi-purpose water supply project at this site with a focus on the benefits of providing 10825 water for the Recovery Program. The project would involve the construction of a 50,000 acre foot reservoir on Roan Creek, along with related Colorado River pump facilities and outlet works. The storage site is referred to as the Roan Creek Reservoir in this evaluation. It is also known as the "DeBeque Partnership Project" by energy industry proponents.

A 2002 report prepared by Stantec Consulting, Inc. provides a detailed overview of the Roan Creek Reservoir. Much of the information summarized below was developed and presented in the Stantec Report.

This alternative would construct an earthen dam embankment about 180 feet in height. The surface area of the reservoir would be approximately 1,150 acres and total reservoir capacity would be about 50,000 acre feet. A 60 cfs pumping plant and conveyance channel would be constructed from the Colorado River to nearby de-silting ponds (96 feet of static head). A 60 cfs capacity pump and pipeline would be constructed from the de-silting ponds to the reservoir site. The pipeline would be about 6 miles long and 42 inches in diameter, with a static head of about 335 feet.

This project would supply water for a variety of uses including the energy industry and the Recovery Program, and as proposed, would be cooperatively constructed by participating interests.

The sponsors own nearly all of the land that would be required for the project, from the Colorado River diversion works to the reservoir on Roan Creek. A small amount of land managed by the BLM would be impacted through County Road relocation and inundation of some areas by the shoreline of the reservoir.

The Roan Creek Reservoir is planned for construction in two possible stages. The first stage has a 50,000 acre foot capacity as described herein. The second stage would increase reservoir capacity to 140,000 acre feet.

In 2001, Stantec Consultants estimated the construction costs of the entire project to be $106.6 million. Of this total, $82 million was associated with the reservoir and about $24 million was associated with the Colorado River water delivery facilities. Based on an annual escalation of 3%, capital construction costs in 2007 would be approximately $127 million.

Unit costs for this alternative are estimated to range between $100 and $200 for every acre foot of water delivered. A more detailed assessment of unit costs will also be developed in the Phase 2 study.

10825 WATER SUPPLY

The Roan Creek Reservoir would supply the entire 10825 water demand each and every year. The reservoir would be filled with native inflow from Roan Creek and with a pumping station from the Colorado River. Stantec Consulting estimates that storable inflow from Roan Creek may range from as little as 3,000 acre feet in dry years, to over 30,000 acre feet in wet years. Average annual Roan Creek storable inflow has been estimated to range from 12,000 to 16,000 acre feet.

In addition to Roan Creek native stream flow, about 1,500 acre feet of irrigation consumptive use credits may be available pursuant to the inundation of historically irrigated pastures.

The sponsors also control about 300 cfs of water rights to support pumping from the Colorado River. These water rights were generally appropriated in the early 1950's. The Colorado River pump station would typically be in-priority from mid-October through mid-July. The 60 cfs pumping facilities can deliver about 3,600 acre feet of water into storage each month.

A phased water supply development may be possible. For example, the 50,000 acre foot reservoir, coupled with irrigation consumptive use credits and native Roan Creek inflow, can likely supply the 10825 water demand without use of the Colorado River pumping station. The Colorado River supply would be required as other cooperative uses are made of the reservoir (i.e. energy industry demands). A small amount of Colorado River pumping may also be needed to provide the 10825 water supply in critical drought periods.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is in relatively close proximity to the 15-Mile Reach, and water transit issues are minimal. It is possible to manage and adjust reservoir releases to optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. The Roan Creek Reservoir is decreed for over 71,000 acre feet of storage with appropriation dates ranging from 1961 to 1967. About 300 cfs of water rights are decreed to support pumping from the Colorado River. Changes of water rights may be required to accommodate piscatorial use of the facilities.

Physical Obstacles. Several private residences and farm buildings would be inundated by the proposed reservoir. These facilities are located on private land owned by the project sponsors.

Water Quality. The potential water quality impacts associated with a Roan Creek Reservoir require investigation. The Roan Creek watershed is primarily underlain by the highly erodible shales and sandstones of the Wasatch formation, similar to the Sulphur Gulch watershed. Native reservoir inflow from Roan Creek may have relatively high total dissolved solids, particular outside of the runoff period. This native inflow would be a primary source of water to the reservoir. Colorado River water pumped into the reservoir may serve to dilute the native Roan Creek runoff, however this reservoir has the potential to increase total dissolved solids concentrations in the lower Colorado River during the late summer months, concurrent with 10825 releases.

Endangered Species Act Issues. Roan Creek Reservoir would be a warm reservoir that would likely support non-native fishes. Competition from non-native fishes is a primary obstacle to the successful recovery of the four endangered (native) fishes. The ability to limit the introduction of non-native fishes and larvae from the reservoir to the Colorado River is unknown at this time. This issue is present at all proposed warm water reservoir sites being considered.

Headwaters Benefits. Since the reservoir is located within the lower reaches of the Colorado River, 10825 water releases would not enhance stream flow at other upstream sites that could also benefit from supplemental water.

Multi-Purpose Aspects. This project would provide water supplies for the energy industry (primarily oil shale development) in addition to the 10825 water. The interest of the energy industry partners in pursuing this project on a rapid timetable has not been established. Water providers are not the primary stakeholders for the Roan Creek Reservoir and this may limit the flexibility for coordinated reservoir operations as well as the timetable for implementation. This issue requires further investigation.

The reservoir is capable of supplying over 10,000 acre feet of additional peak flow releases in those years when supplemental flows may enhance fish habitat. With this type of concurrent operation, the reservoir would be filled to capacity during the winter months. The releases would occur at the height of snowmelt runoff. The reservoir would subsequently be refilled prior to the occurrence of summer irrigation season water right calls. After

summer and fall releases of the 10825 water, the reservoir would again be filled.

PERMITTING

This alternative would require substantial Federal and State permitting. In the absence of a land exchange or acquisition, a Special Use Permit would be required from the BLM. A 404 Permit would be required from the COE. The preparation of an EIS or an EA would be associated with the Federal review process pursuant to the National Environmental Policy Act. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Garfield County does not currently have 1041 regulations, and a 1041 permit would not be required.

Permitting Issues. A variety of environmental studies have been completed by the project sponsors. These studies include cultural resource inventories, threatened and endangered plant surveys, vegetation surveys, aquatic habitat studies, and others. These environmental investigations have not yet been reviewed.

At this time, we believe that primary permitting issues may relate to the potential introduction of non-native fishes, and potential water quality impacts in the Grand Valley.

Estimated Time to Implementation. Environmental permitting and construction of this alternative is likely to require more than 10 years. Cooperation of the project sponsors would be required.

RECOMMENDATIONS

We recommend that the Roan Creek Reservoir alternative be studied in additional detail. The reservoir and related facilities can supply all of the 10825 water. We recommend the review of the Project Sponsor's cultural resource inventories, threatened and endangered plant surveys, vegetation surveys, aquatic habitat studies and other environmental investigations. Following this review, additional studies be undertaken as necessary, focusing on environmental issues, construction cost updates and partnership opportunities.

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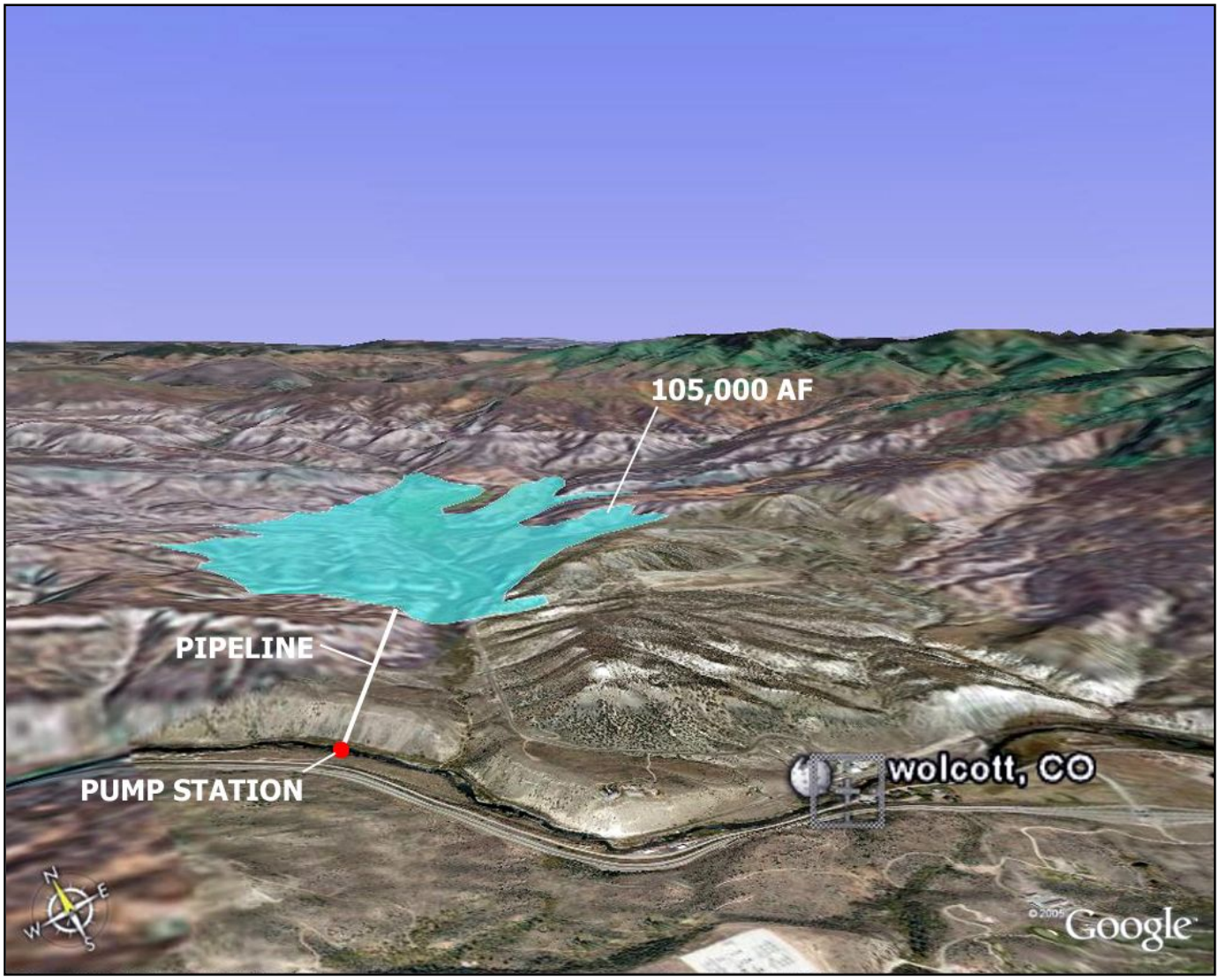
WOLCOTT RESERVOIR



Description

- 105,000 AF reservoir on Alkali Creek
- Tributary to Eagle River near Wolcott, Colorado
- Located primarily on private land owned by Denver Water
- 150 cfs pump station from Colorado River
- 370 ft pumping lift
- Firm yield of about 47,000 AF
- Multi-purpose project with many staging opportunities
- Cost: $200MM +

Summary

- Multi-purpose aspect of this alternative raises substantial East Slope / West Slope issues (i.e. Green Mountain Pumpback)
- The large size and the multi-purpose aspect of this alternative will prolong implementation time
- Grand Valley water providers are concerned that reservoir releases will degrade water quality of lower Colorado River
- 10825 releases will improve stream flow and water quality of Eagle River in late summer
- Recommended for further consideration

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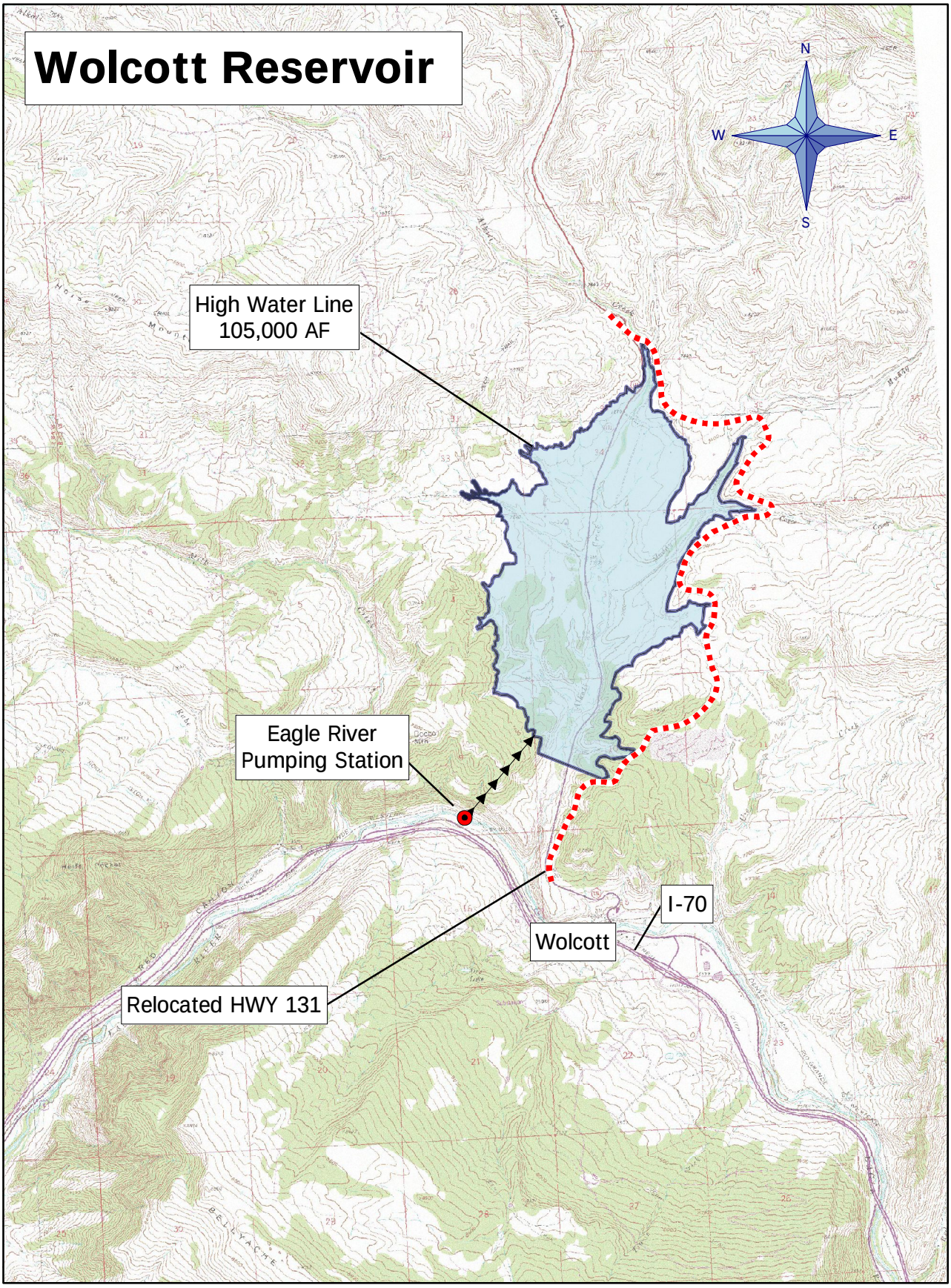
Wolcott Reservoir
N
W
E
S
High Water Line
105,000 AF
Eagle River
Pumping Station
I-70
Wolcott
Relocated HWY 131

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WOLCOTT RESERVOIR

The Wolcott Reservoir site is located on Alkali Creek, an ephemeral tributary to the Eagle River. The site is located about 20 miles west of Vail in a large natural basin about one mile north of Interstate 70 near Wolcott, Colorado. Wolcott Reservoir would not provide water solely for Recovery Program purposes. Instead, as proposed by Eagle River water providers to Denver Water, this facility would be developed as a multiple use reservoir that would supply additional water for other West Slope and East Slope purposes.

A variety of water storage configurations and diversion facilities have been proposed at this site over the past 30 years. The reservoir facility evaluated in this study would divert water from Alkali Creek and the Eagle River. The project would not directly divert any water to the East Slope. A portion of the reservoir may be used for East Slope purposes including the provision of the 10825 water and the use of the reservoir for exchanges and substitution purposes.

Reservoir's as large as 350,000 acre feet have been proposed for the Wolcott site. This study evaluates a reservoir with a capacity of 105,000 acre feet. A reservoir smaller than 105,000 acre feet may not accomplish the multiple-purpose objectives of this alternative. Also, topographic site conditions may not warrant the construction of a smaller reservoir.

The Wolcott dam and reservoir would be located at an elevation of approximately 7,200 feet, and would be situated mainly on private land owned by Denver Water (the 4-Eagle Ranch) and upon Federal land managed by the BLM. A small tract of land owned by Eagle County is also present at the reservoir site.

The reservoir area is primarily occupied by sagebrush communities, and by partially irrigated hay meadows. Cattle grazing occurs on the site. Narrow riparian corridors also occur in limited areas of the site. State Highway 131 and several county roads dissect the area. Approximately 5 miles of Highway 131 must be relocated about one mile to the east of the current alignment.

Key facilities associated with this alternative are:

- 220-foot high earthen dam
- Reservoir capacity of 105,000 acre feet
- Eagle River diversion dam
- 200 cfs Eagle River pump station with an 87 inch diameter pipeline
- 370 feet of pumping head
- 5.2 miles of State Highway 131 relocation

Preliminary geotechnical investigations reflect that bedrock and geologic conditions are suitable for embankment construction. These investigations included a subsurface boring program. No geologic conditions have been identified that would preclude construction of the facility.

Total capital construction costs of $180 million were estimated in 2004 for this alternative. These costs include $158 million for embankment construction and $22 million for the construction of conveyance and spillway facilities. Based on an annual escalation rate of 3%, 2007 construction costs would be approximately $200 million. Energy costs, or pumping costs, were estimated (in 2004) to be $37 per acre foot of water pumped to the reservoir.

Unit costs for this alternative are estimated to exceed $200 for every acre foot of water delivered. A more detailed assessment of unit costs will also be developed in the Phase 2 study.

10825 WATER SUPPLY

This alternative would provide all of the 10825 water each and every year. Further, the reservoir can provide peak stream flow augmentation releases of 20,000 acre feet in all years in which this demand may occur. Most of the water supply for the reservoir would be pumped from the Eagle River. Storable inflow from Alkali Creek would be relatively minor.

This multi-purpose reservoir may also provide water supplies for other uses including West Slope municipal purposes and East Slope substitution and exchange. The reservoir is projected to provide a total firm yield of about 47,000 acre feet per year. Accordingly, it is estimated that a firm yield of about 36,000 acre feet per year may be available for uses other than Recovery Program purposes.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir site is located about 110 miles upstream of the 15-Mile Reach. It will typically take two to three days for reservoir releases to arrive at the 15-Mile Reach. Given this transit time, it may be difficult to operate reservoir releases in response to changing stream flow conditions in the 15-Mile Reach (i.e. rainfall events or changes in irrigation use). However, the transit issues associated with this facility are similar to issues related to the use of Ruedi Reservoir, Williams Fork Reservoir, Wolford Mountain Reservoir and other upstream facilities.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. Storage water rights at this site were originally decreed to Denver Water in the 1970's. A change in water rights to allow piscatorial uses may be required.

Physical Obstacles. Several private residences and farms buildings would be inundated by the proposed reservoir. These facilities are located on private land owned by Denver Water. Approximately 5 miles of Highway 131 must be relocated.

Water Quality. The reservoir would typically improve the quality of the Eagle River from Wolcott to Dotsero. The reservoir would reduce silt in the river, decrease water temperature, and reduce the concentration of dissolved solids in the Eagle River.

On the Colorado River downstream of the Eagle River, operations of the reservoir may decrease dissolved solids and improve water quality during certain low flow periods when water is released for fish habitat in the 15-Mile Reach. However, Grand Valley water suppliers are concerned that releases from Wolcott Reservoir would be of poorer quality than the current releases of 10825 water, and that water quality in the Grand Valley may degrade from current conditions. Any changes in water quality in the Grand Valley area would likely be minor.

Endangered Species Act Issues. Wolcott Reservoir would be a cold-water facility. Competition from non-native fishes is not anticipated.

Headwaters Benefits. The reservoir would likely improve aquatic habitat in the Eagle River downstream of Wolcott. Habitat would be improved for the following reasons:

- Stream flow would be increased during critical low flow periods. Water temperature would be decreased in the late summer months when ambient conditions have exceeded aquatic life standards.
- The impoundment would retain sediments transported by Alkali Creek. This reduction in sediment loading would decrease sediment deposition on the bed of the Eagle River. Thunderstorm related suspended sediment delivery to the Eagle River from local tributaries, primarily Milk Creek, will continue.

Multi-Purpose Aspects. Wolcott Reservoir is a multi-use facility that as proposed, would require the participation of multiple water users. Without this participation, the costs of water supplies from Wolcott Reservoir may substantially increase, and the viability of the project would be diminished.

If the project is operated for East Slope substitution or exchange purposes, stream flow of the Colorado River between Kremmling and Dotsero would be diminished. A portion of the irrigation season releases that are currently provided from Green Mountain Reservoir would instead be supplied from Wolcott Reservoir. The amount and timing of depletions to the Colorado River above Dotsero would vary in response to specific operational objectives. These potential changes have not been evaluated. Stream flow downstream of Dotsero would not likely be diminished.

The use of the reservoir for East Slope exchange or substitution may cause changes that are negatively perceived at other locations in the upper Colorado River watershed. As a result, the reservoir project may be difficult to construct without providing additional benefits in a variety of other stream reaches. Many East Slope / West Slope issues involving the multiple use aspect of the project remain unresolved.

The reservoir is capable of supplying over 10,000 acre feet of additional peak flow releases in those years when supplemental flows may enhance fish habitat. With this type of concurrent operation, the reservoir would be filled to capacity during the winter months. The releases would occur at the height of snowmelt runoff. The reservoir would subsequently be refilled prior to the occurrence of summer irrigation season water right calls. After summer and fall releases of the 10825 water, the reservoir would again be filled.

PERMITTING

Wolcott Reservoir would require substantial Federal, state and local permitting activities. A Special Use Permit would be required from the BLM. A 404 Permit would also be required from the COE. The preparation of an EIS would be associated with the Federal review process pursuant to NEPA. In addition, Section 7 Consultation with the USFWS would be required pursuant to the ESA. An Eagle County 1041 permit would also be required.

Permitting Issues. Key environmental issues related to reservoir construction are:

- The project would inundate minor wetland areas near Alkali Creek.
- The area is an important winter range and migration corridor for large populations of mule deer and elk.
- The project area is suitable habitat for the Greater Sage Grouse, a species that the U.S. Fish and Wildlife Service recently decided NOT to list as an endangered species.

The recent decision regarding Sage Grouse is controversial and could be reviewed again under a future administration. While these on-site environmental issues are important, it is anticipated that all on-site environmental consequences can be successfully mitigated.

Estimated Time to Implementation. Permitting and construction of this alternative is likely to take a decade or more, given the large size of Wolcott Reservoir, the headwater issues, and the multi-purpose nature of the project. The reservoir project is controversial and many East Slope and West Slope issues remain unresolved. Further, the outcome of any permitting process is uncertain. Few projects of this magnitude have avoided litigation, which often further delays project implementation.

RECOMMENDATIONS

We recommend additional consideration of this alternative. However, because of the substantial information that is available regarding this alternative, we do not believe that a significant amount of additional study of Wolcott Reservoir is required in Phase 2 of the alternatives assessment. Existing information is adequate to disclose the viability, environmental impacts, and issues associated with this alternative. Additional study should focus on updating potential costs of this alternative.

Also, if available, the results from a pending collaborative process known as the Colorado River Basin Proposal, should be integrated into Phase 2 of the 10825 study. Many of the participants in the 10825 Water Supply Study are also involved in this confidential mediation process. It is our understanding that the Colorado River Basin Proposal investigation will assess changes in stream flow associated with the operation of Wolcott Reservoir and other facilities. We propose to utilize available information from this process as it becomes available as many of the same issues are identified by the stakeholders in both processes.

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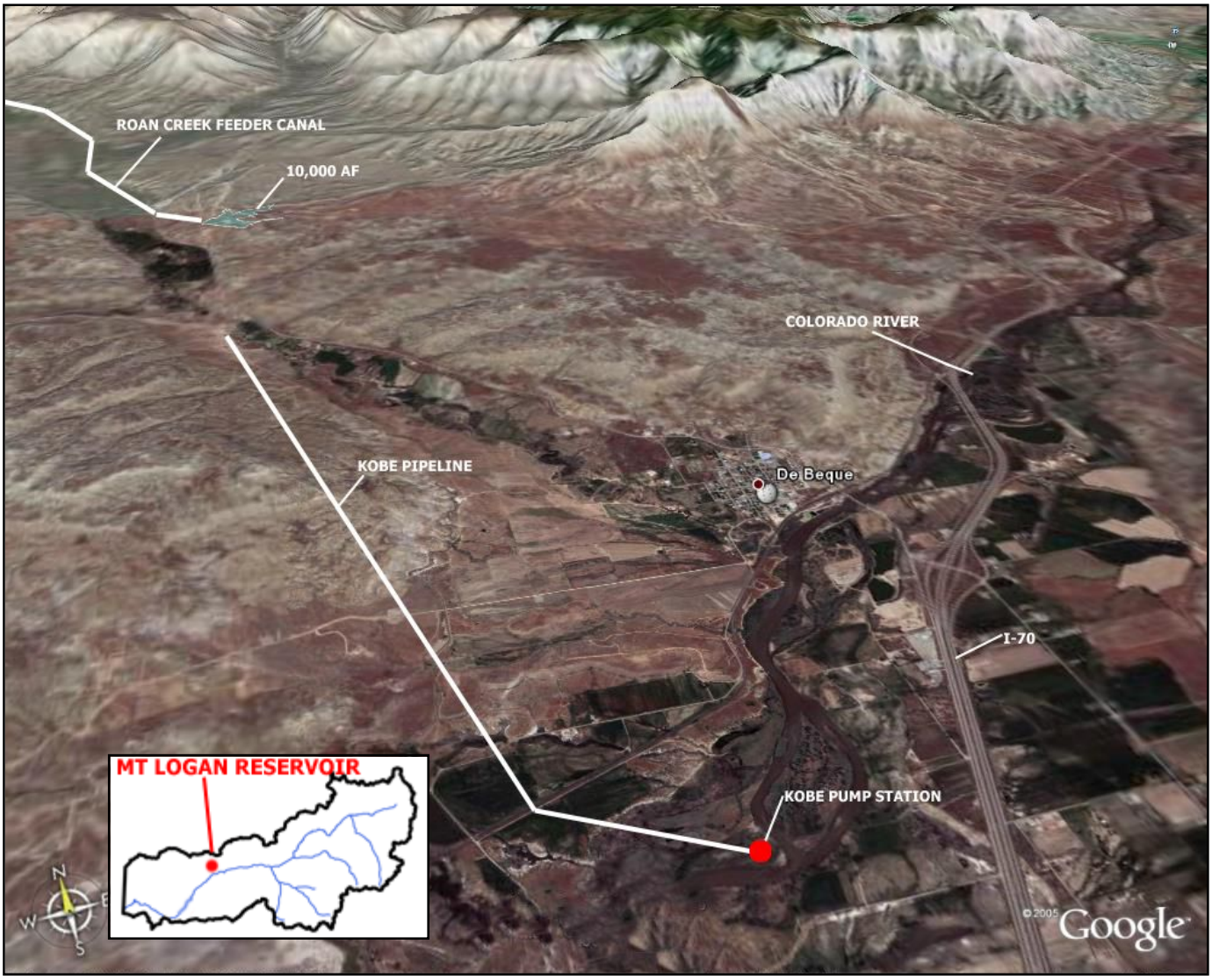
MT LOGAN RESERVOIR



Description

- 10,000 AF reservoir on intermittent tributary to Roan Creek
- Filled with 12 mile long Roan Creek Feeder Canal or with 60 cfs Kobe pump station from Colorado River
- 500 ft pumping lift for Colorado River pump station alternative
- Yield w/ Roan Creek Feeder Canal is about 5,000 AF
- Yield w/ Kobe Pumping Plant is about 10,000 AF
- Cost: Unknown

Summary

- Must be combined with other alternatives to fully supply 10825 water
- Poor embankment site (large embankment for relatively small amount of storage)
- Land use conflicts; natural gas pipeline at dam axis
- Reservoir releases may degrade water quality of Colorado River within the Grand Valley
- The warm water reservoir may introduce non-native fishes to reaches of the Colorado River that are occupied by endangered fish
- No headwater benefits (Grand County)
- Not recommended for further study

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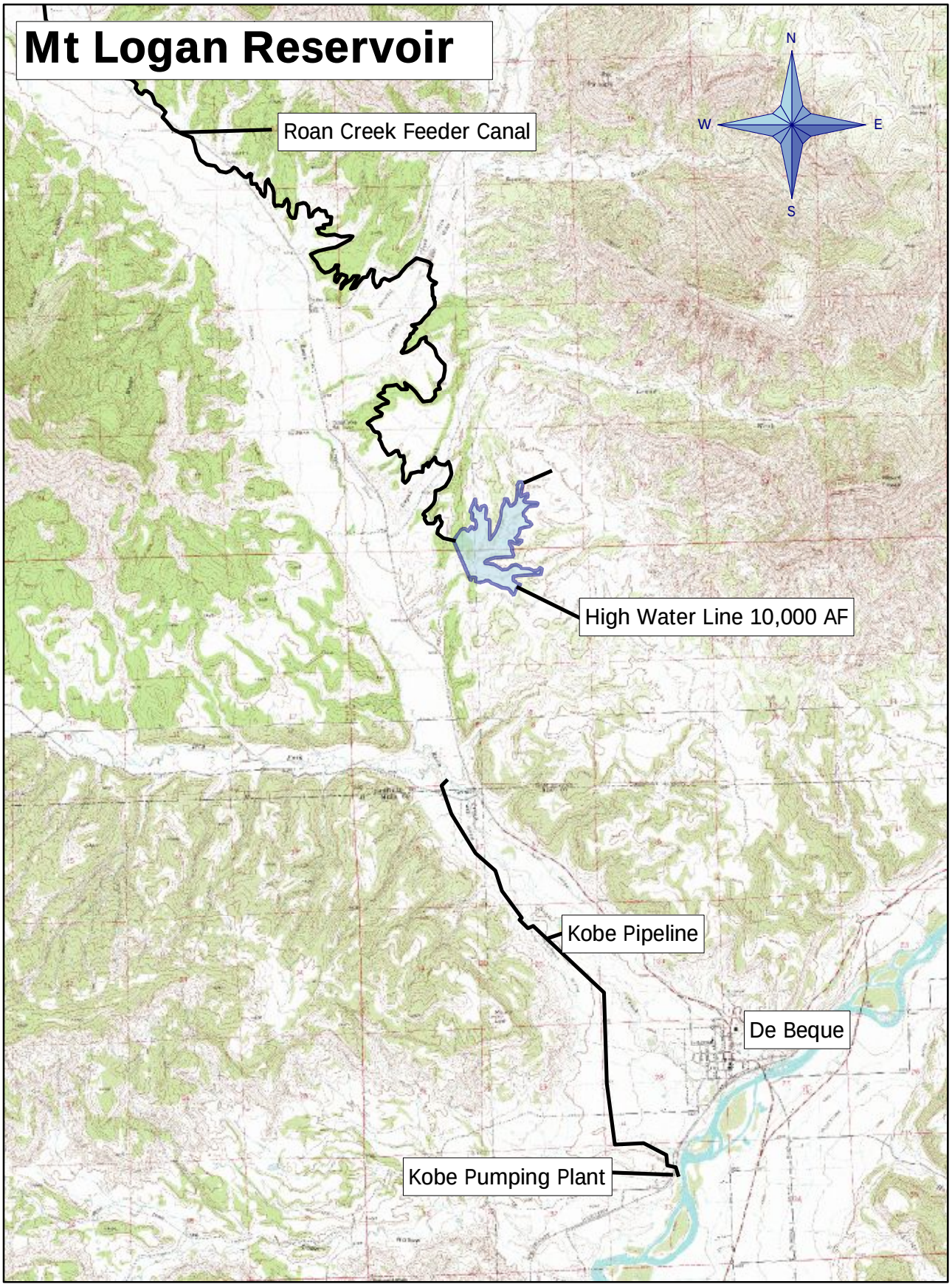
Mt Logan Reservoir
Roan Creek Feeder Canal
N
W
E
S
High Water Line 10,000 AF
Kobe Pipeline
De Beque
Kobe Pumping Plant

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MT. LOGAN RESERVOIR

The Mt. Logan Reservoir site is located on an intermittent tributary to Roan Creek, about five miles north of the Town of DeBeque and Interstate 70. The reservoir site is located in Garfield County about 20 miles upstream of the 15-Mile reach, and seven miles upstream of the proposed Sulphur Gulch reservoir site.

The reservoir site is arid and is characterized by sparsely vegetated benches and pediments. The reservoir embankment and much of the reservoir itself would be located on Federal land managed by the BLM. Approximately one-half of the area that would be inundated by the reservoir is privately owned by the Getty Oil Exploration Company. Primary land uses in the region are grazing and natural gas development. A natural gas pipeline is buried directly beneath the proposed embankment location. This pipeline must be relocated prior to the construction of the embankment.

The reservoir would have a capacity of approximately 10,000 acre feet. An embankment about 125 feet in height and 1900 feet in length would be required. No substantial amount of water is available from the intermittent tributary that dissects the reservoir site. Water stored in the reservoir would be supplied from the Roan Creek feeder canal, the Colorado River, or both locations.

Mt. Logan Reservoir is similar to the Sulphur Gulch Reservoir alternative in many ways. The reservoir may be primarily filled with water pumped from the Colorado River as would Sulphur Gulch, and the two sites are underlain by similar geology. The Mt. Logan reservoir basin is relatively steep and a large embankment would be required for a relatively modest amount of storage. The required length of delivery pipeline, and the pumping head, is considerably larger for the Mt. Logan site.

Of these two comparable alternatives, Sulphur Gulch is a superior reservoir site. The Sulphur Gulch site is larger and can provide the entire 10825 water supply, while Mt. Logan cannot. The Mt. Logan site is likely to have similar environmental impacts as the Sulphur Gulch site, yet would cost substantially more to construct and operate.

10825 WATER SUPPLY

Mt. Logan Reservoir would not supply all of the 10825 water demands, especially in dry years. Two alternatives to deliver water to the reservoir have been investigated.

Roan Creek Feeder Canal. The first alternative would construct the twelve mile long Roan Creek Feeder Canal. This canal would divert water from upper Roan Creek and deliver it by gravity to the off-channel reservoir site. The canal would dissect almost a dozen small tributaries that are prone to frequent flooding and debris flows during thunderstorm events. It may be desirable to pipe the entire length of the canal in response to these flooding events and the potential for substantial canal seepage. The Roan Creek Feeder Canal would be in-priority for limited periods of time within the snowmelt runoff period.

The feeder canal would operate in conjunction with the Kobe Pump Station and Pipeline located on the Colorado River below DeBeque. The Kobe Pipeline would divert water from the Colorado River and discharge this water into lower Roan Creek immediately upstream of two senior irrigation ditches (the Town Ditch and the Reservoir Ditch). This imported water would reduce the frequency and duration of water right calls and would increase the amount of water available for diversion by the gravity Roan Creek Feeder Canal.

The Colorado River intake for the Kobe Pump Station was recently constructed by the Chevron Shale Oil Company. Three phase electrical power has also been extended to the site, although pumping facilities have not been purchased or installed. Only a minor portion of the pipeline has

been completed. It is our understanding that Chevron has no interest in pursuing the use of the pump station and the pipeline, and that these facilities are available for use for 10825 purposes.

We have completed a preliminary assessment of water availability to the Roan Creek Feeder Canal. This assessment was based upon limited daily USGS stream gage records for Roan Creek, and upon water right call estimates developed in a workshop with the local Water Commissioner. We conclude that with a 75 cfs capacity feeder canal, and a 20 cfs irrigation season bypass for water users located between the feeder canal inlet and the Kobe Pipeline outlet, average annual Roan Creek diversions into the reservoir may be about 5,000 acre feet. Dry year diversions into storage would be less than 1,500 acre feet. This amount of water supply would provide only a portion of the 10825 water demand.

Colorado River Pump Station. An alternative delivery system would pump water from the Colorado River directly into the Mt. Logan Reservoir via the Kobe Pump and Pipeline. This alternative would function in a manner similar to Sulphur Gulch Reservoir; the 50 cfs Kobe Pump and Pipeline would fill the 10,000 acre foot reservoir in about 100 days. The Colorado River water supply option is preferable and would easily fill the 10,000 acre foot reservoir each and every year.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is in close proximity to the 15-Mile Reach, and water transit issues are minimal. Reservoir water would arrive in the 15-Mile Reach shortly after it is released. It would be possible to manage and adjust reservoir releases in response to local thunderstorms and changing stream flow conditions in the 15-Mile Reach. This operation would optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. The Mt. Logan Reservoir was decreed 10,000 acre feet in Case No. CA6404. This water right has a 1936 appropriation date. Within the Roan Creek watershed, this water right would be in-priority for limited periods of time within the snowmelt runoff period. A change in water rights to allow piscatorial uses may be required.

Physical Obstacles. A natural gas pipeline that currently dissects the dam axis must be relocated.

Water Quality. Water quality issues associated with Mt. Logan Reservoir are similar to those associated with the Sulphur Gulch Reservoir site. The Sulphur Gulch Reservoir site is located about 7 miles west of the Mt. Logan site. The Mt. Logan site is underlain by shales that are similar to those beneath Sulfur Gulch Reservoir. These shale formations are known sources of selenium. Further, the quality of Colorado River water that would be stored in the reservoir is essentially the same for both Sulphur Gulch and Mt. Logan. We believe that the Mt. Logan site would have similar effects to water quality as the Sulphur Gulch site.

Endangered Species Act Issues. Mt. Logan Reservoir would be a warm reservoir that would likely support non-native fishes. Competition from non-native fishes is a primary obstacle to the successful recovery of the four endangered (native) fishes. The ability to limit the introduction of non-native fishes and larvae from the reservoir to the Colorado River is unknown at this time. This issue is present at all proposed warm water reservoir sites being considered.

Headwaters Benefits. Since the reservoir is located within the lower reaches of the Colorado River, 10825 water releases would not enhance stream flow at other upstream sites that could also benefit from supplemental water.

Multi-Purpose Aspects. This alternative would not provide water for purposes other than the Recovery Program.

PERMITTING

This alternative would require substantial Federal and State permitting. A Special Use Permit would be required from the BLM and a 404 Permit would be required from the U.S. Army Corps of Engineers.

The preparation of an Environmental Impact Statement or an Environmental Assessment would be associated with the Federal review process pursuant to the National Environmental Policy Act. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Garfield County does not currently have 1041 regulations, and a 1041 permit would not be required.

Permitting Issues. Key environmental issues associated with this reservoir are likely similar to the issues associated with Sulphur Gulch Reservoir. Introduction of non-native warm water fish and water quality concerns of downstream water users are likely the primary issues of concern.

Estimated Time to Implementation. Permitting and construction of this alternative is likely to require 5 to 10 years at a minimum.

RECOMMENDATIONS

Further consideration of this proposed reservoir site for 10825 purposes is not recommended. The embankment site is poor and a natural gas pipeline must be relocated. The water quality and warm-water fishery issues associated with Mt. Logan Reservoir are similar to those associated with Sulphur Gulch; yet Sulphur Gulch is a substantially superior reservoir site.

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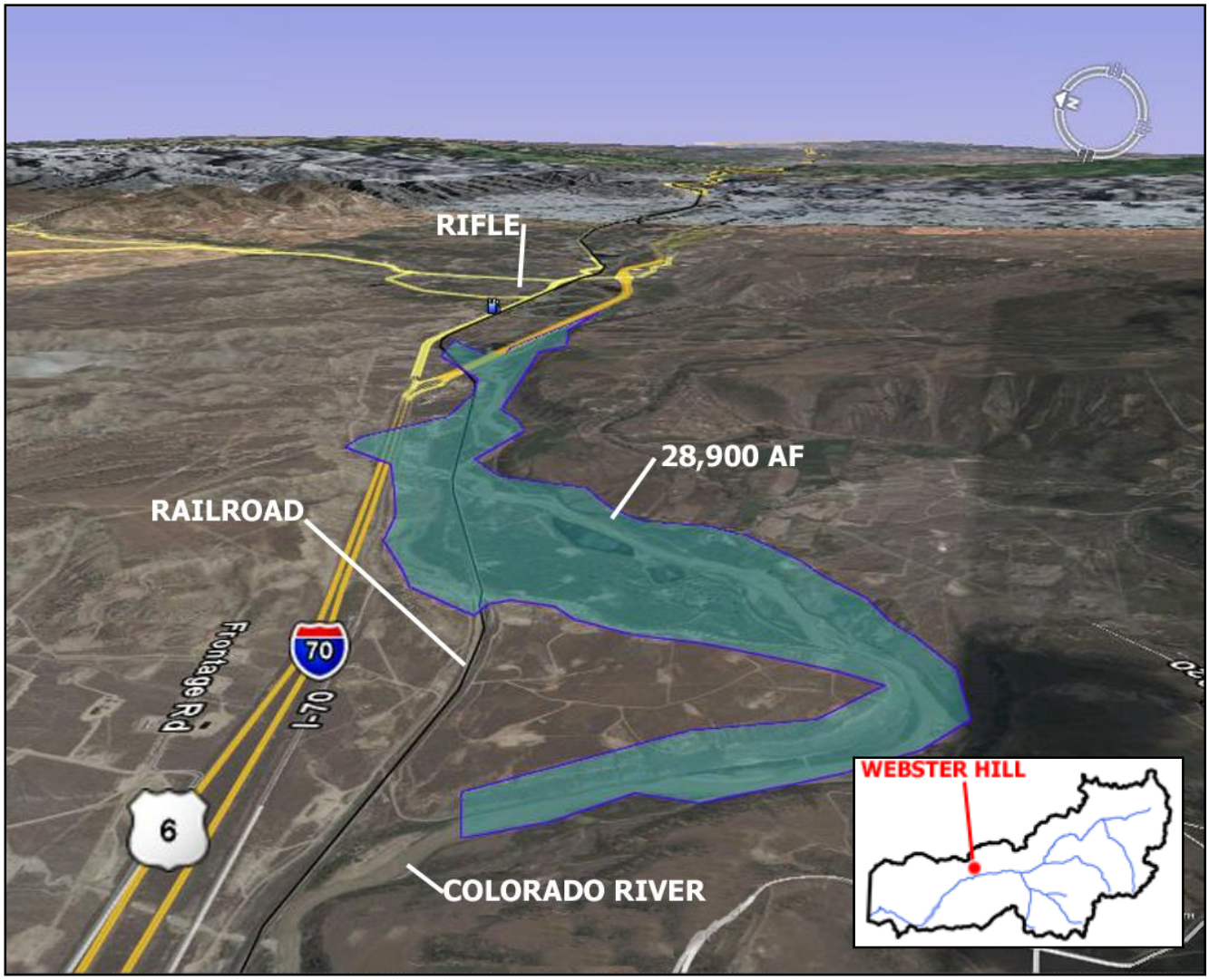
WEBSTER HILL RESERVOIR



Description

- 28,900 AF reservoir on Colorado River below Rifle, Colorado
- 68 foot high concrete gravity embankment
- 1,100 surface acres
- Occupies private land intensively used for industrial purposes
- 10MW hydroelectric generating unit
- Multi-purpose reservoir (10825, CFOPS & water supply)
- Annual yield in excess of 28,000 AF (fill and refill reservoir each year)
- Relocation of Interstate 70 (one mile) and railroad (5 miles) is required
- Cost: $91MM+

Summary

- Reservoir would inundate critical habitat of endangered fish species
- The warm water reservoir may introduce non-native fishes to downstream reaches of the Colorado River that are occupied by endangered fish
- Land use conflicts are substantial; many producing natural gas wells will be inundated, as well as railroad and Interstate Highway
- Multi-purpose aspect of this alternative will prolong implementation time
- Not Recommended for further study

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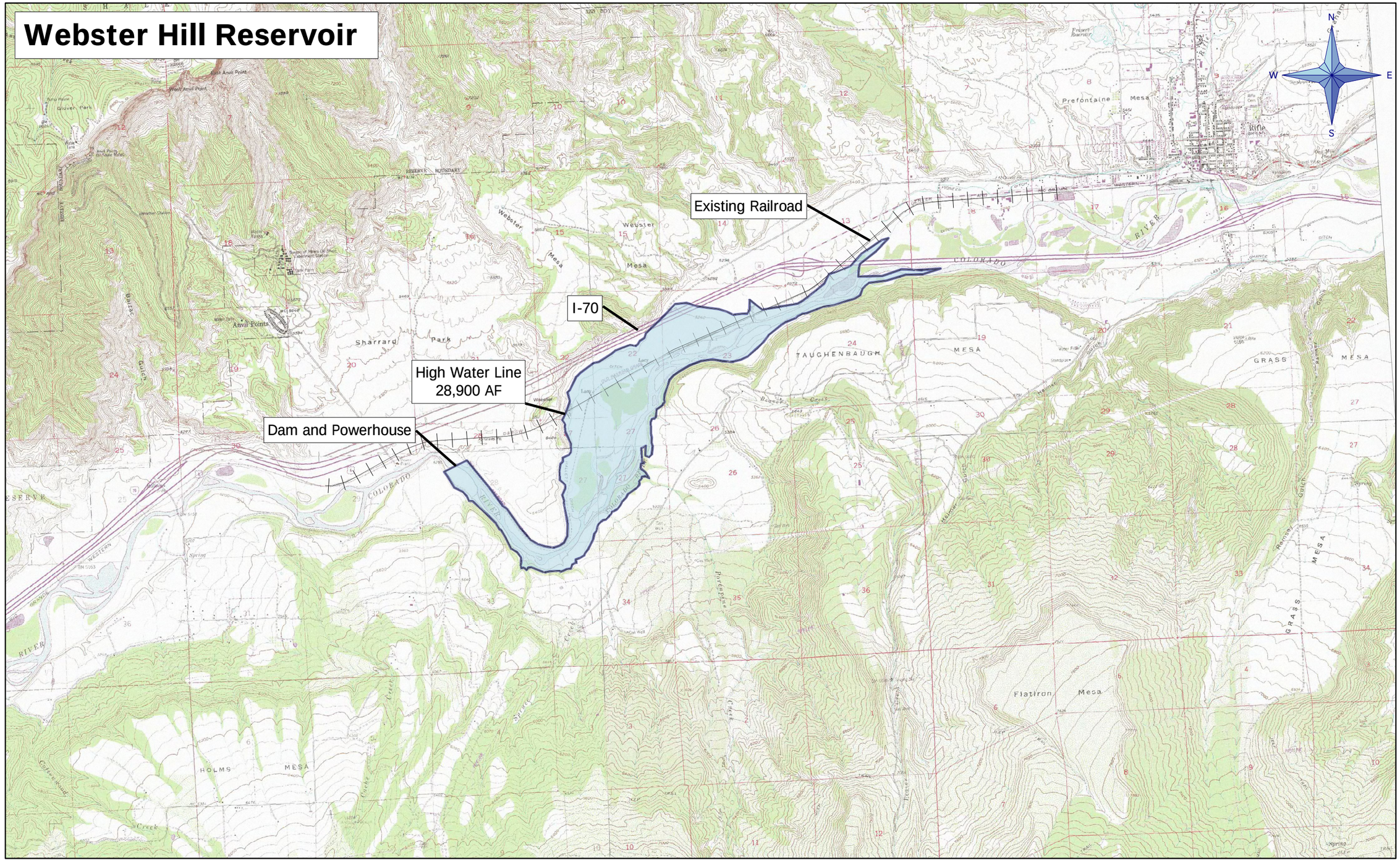
Webster Hill Reservoir



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WEBSTER HILL RESERVOIR

The Webster Hill Reservoir site is located on the main stem of the Colorado River about 5 miles downstream of Rifle, Colorado in the broad valley to the south of Interstate 70. The reservoir site was initially evaluated for hydroelectric purposes in 1976. In 2001, a subsequent reconnaissance level assessment of the site was completed for the Colorado Water Conservation Board (CWCB).

The CWCB considered the construction of a 28,900 acre foot reservoir at the site. A 68-foot high concrete gravity dam would impound water on the Colorado River. Water would be stored on-channel and no separate diversion or pumping facilities would be required. The surface area of the reservoir would be approximately 1,100 acres.

The site is located primarily on private land. The private land is heavily used for commercial and industrial purposes. Many relatively new producing natural gas wells and gas delivery pipelines exist within the footprint of the reservoir.

In addition to construction of the dam, this reservoir alternative would require the relocation of about five miles of railroad and the vertical realignment of approximately one mile of Interstate 70.

A 10 megawatt hydroelectric generating unit could be located on the outlet of the dam. Previous studies have anticipated that the flow capacity of the hydroelectric unit would be 2,000 cfs.

The Webster Hill site is within the upper reach of the Colorado River designated by the USFWS as critical habitat for razorback sucker and Colorado pikeminnow. This reach extends upstream to Rifle.

Development costs for the reservoir were estimated to be $76.4 million in 2001. Assuming a 3% annual escalation factor, 2007 capital costs would be in excess of $91 million. Hydroelectric revenues would offset a portion of the development costs of the reservoir. If power from the project is sold at prevailing Western Area Power Association rates, net annual power revenue may exceed $3 million.

Unit costs for this alternative are estimated to range from between $100 and $200 for every acre foot of water delivered.

10825 WATER SUPPLY

This reservoir would supply the entire amount of 10825 water in all years, including drought years. The reservoir would likely be operated pursuant to a junior water right that has not yet been decreed. Even with a junior water right, Webster Hill Reservoir could fill and refill in-priority several times each year, similar to Sulphur Gulch Reservoir.

Run-of-the river hydroelectric generation would occur at the site. It is estimated that the generating unit would produce at its capacity of 2,000 cfs approximately 75 percent of the time.

A firm yield of about 40,000 acre feet would be provided by the fill and refill operation outlined above. Of this total yield, 10,825 acre feet of Recovery Program water could be released each and every year. It is anticipated that the remaining yield could be utilized for a variety of purposes including augmentation and water supplies for West and East Slope water users, and additional water for the Recovery Program.

The market demand for the remaining reservoir yield is unknown. The reservoir would provide water to a market area similar to that of Ruedi Reservoir. Currently, a demand for the excess water supplies in Ruedi Reservoir has not materialized. However, in the future if available Ruedi Reservoir supplies are committed, an increased demand for water from Webster Hill Reservoir would occur.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is less than 50 miles upstream of the 15-

Mile Reach, and water transit issues are minimal. It is likely possible to manage and fluctuate reservoir releases to optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. The reservoir would likely be operated pursuant to a junior storage water right that has not yet been decreed.

Physical Obstacles. Many physical obstacles exist at the Webster Hill Reservoir site. The private land is heavily used for commercial and industrial purposes. Many relatively new producing natural gas wells and gas delivery pipelines exist within the footprint of the reservoir. This reservoir alternative would require the relocation of about five miles of railroad and the vertical realignment of approximately one mile of Interstate 70.

Water Quality. Water released for 10825 purposes would likely be of similar quality to the water diverted by water users in the Grand Valley. However, water quality impacts associated with the inundation of numerous producing natural gas wells may be a concern.

Endangered Species Act Issues. The reservoir would inundate about five miles of critical habitat for the Colorado pikeminnow and the razorback sucker, as well as five miles of the known distribution range for the razorback sucker.

The reservoir may also support a non-native warm water fishery. Competition from non-native species is perhaps the primary obstacle to recovering the endangered fishes. This main stem reservoir would spill water for several months each year, and it may not be possible to exclude the introduction of non-native fishes into the Colorado River. The Recovery Program is actively engaged in removing non-native fish from the Colorado River in order to ensure the recovery of the endangered fishes and any projects that do not support that effort are likely to be opposed by the USFWS.

Headwaters Benefits. Since the reservoir is located within the lower reaches of the Colorado River, 10825 water releases would not enhance stream flow at other upstream sites that could also benefit from supplemental water.

Multi-Purpose Aspects. The reservoir could possibly be used to regulate and maintain stream flow in the Cameo area, which could benefit water users throughout the upper Colorado River basin. Releases from storage in the summer months when a Cameo water right call is in place could reduce demands from the Green Mountain Reservoir Historic Users Pool, which in turn would enhance the yield of Green Mountain Reservoir and other diversion facilities upstream of Webster Hill Reservoir.

It is anticipated that as much as 30,000 acre feet of annual yield could available for a variety of purposes including augmentation and water supplies for West and East Slope water users, and additional water for the Recovery Program.

PERMITTING

Even though the Webster Hill Reservoir site is located primarily on private land, a Federal review of the project would be required in association with a COE 404 permit. The preparation of a NEPA compliance document would be required for the Federal review. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Garfield County does not currently have 1041 regulations, and a 1041 permit would not be required.

Permitting Issues. Key environmental issues are related to the inundation of wetland habitat, reservoir sedimentation, and ESA issues. Sedimentation and fish migration issues may be mitigated with a containment dike to allow the majority of Colorado River water to bypass the reservoir. This containment dike may also eliminate the need to relocate substantial sections of railroad.

Estimated Time to Implementation. Permitting and construction of this alternative is likely to take a decade or more, given the large size of the reservoir and the substantial issues outlined above. Further, the outcome of any permitting process is uncertain. Few projects of this magnitude have avoided

litigation, which often further delays project implementation.

RECOMMENDATIONS

We do not recommend any additional consideration of this alternative. The Webster Hill Reservoir is unfavorable for the following reasons:

- Critical habitat of endangered fishes would be inundated.
- As a warm water impoundment, the reservoir may introduce non-native fishes into critical habitat for endangered fishes.
- Many existing natural gas wells and pipelines must be relocated or mitigated. Water quality impacts associated with the inundation of numerous producing natural gas wells may also be a concern.
- Private land must be acquired, mainly from the Energy Industry.
- Portions of Interstate 70 and the existing railroad line must be relocated.
- The reservoir would impound the main stem of the Colorado River.

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GRAND VALLEY LAKE

The Grand Valley Lake is a large scale water development concept that would be located in the vicinity of Grand Junction, Colorado. As proposed by Donald Clay, a retired USBR engineer, this concept would include a 200,000 acre foot off-channel reservoir on Sink Creek, south of the Colorado River near Palisade. The reservoir would be filled by a 60 mile aqueduct from the North Fork of the Gunnison River to the reservoir. The aqueduct would have a capacity of about 300 cfs. Numerous improvements to local irrigation projects would also be required.

The project would use water from the North Fork of the Gunnison River to irrigate lands in the Grand Valley that are currently supplied with Colorado River water. Existing Colorado River diversions facilities of the Grand Valley Irrigation Company (GVIC), the Orchard Mesa Irrigation District (OMID), and others would be removed from the Colorado River.

The Grand Valley Lake proposal would benefit the Recovery Program by significantly reducing irrigation diversions upstream of the 15-Mile Reach, and by facilitating fish passage with the removal of irrigation dams downstream of the Roller Dam. The proposal would substantially reduce demands upon the Green Mountain Reservoir HUP Pool, which may provide additional water for the Recovery Program and for East Slope water users.

In April 2006, Donald Clay, now of Professional Engineers and Associates estimated the total construction cost of the project to be about $670 million. Operating costs of about $20 million per year were also projected. Unit costs for this alternative are estimated to exceed $200 for every acre foot of water delivered. We are unaware of any funding partners that might be interested in pursuing the project in the near term.

10825 WATER SUPPLY

This alternative would supply all of the 10825 water in all years, including drought years.

The project proponents estimate that the project would divert an average of about 178,000 acre feet per year from the North Fork of the Gunnison River. Stakeholders in the North Fork River Improvement Association would likely present significant opposition to a diversion of this size from the Gunnison watershed.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The project is adjacent to the 15-Mile Reach, and water transit issues are minimal. It is likely possible to operate the project to optimize Recovery Program benefits.

Institutional Issues. The project would require cooperation and agreement by many stakeholders including each primary irrigation facility that operates in the Grand Valley. Modification of Federal irrigation projects would require support of the USBR, and would possibly require congressional approval.

Water Rights. Water rights for the project have not been adjudicated.

Physical Obstacles. Given the magnitude of this project, numerous physical obstacles are anticipated.

Water Quality. This project would divert water from the Gunnison River watershed. The lower reaches of the Gunnison River are listed by the EPA as impaired with high concentrations of selenium. The lower Gunnison River is also identified as critical habitat for the endangered fish. Diverting substantial amounts of dilution flows from the North Fork may have a significant negative effect on the concentrations of selenium in the lower Gunnison River.

A Total Maximum Daily Load (TMDL) standard is currently being developed for the lower Gunnison River. The TMDL process recognizes the need to

reduce existing selenium concentrations in order to meet aquatic life standards. With any proposed diversion of water upstream, the proposed TMDL goals that have been negotiated may need to be significantly revised. This revision of the TMDL goals would likely be opposed by the Grand Valley Selenium task force members.

Additional water quality impacts from reservoir seepage would likely be a significant negative concern for Grand Valley stakeholders.

Endangered Species Act Issues. This project would support a non-native warm water fishery. Competition from non-native species is perhaps the primary obstacle to recovering the endangered fishes. The Recovery Program is actively engaged in removing nonnative fish from the Colorado River in order to ensure the recovery of the endangered fishes and any projects that do not support that effort are likely to be opposed by the USFWS.

Headwaters Benefits. The potential for headwater benefits is unknown at this time.

Multi-Purpose Aspects. As proposed, this project would remove senior water right calls on the Colorado River near Cameo. This would allow water users within and downstream of the Roaring Fork River watershed to significantly increase their in priority trans-basin and in-basin diversions during periods that diversions would have otherwise been curtailed.

PERMITTING

The Grand Valley Lake Proposal would require substantial Federal and State permitting activities. A Special Use Permit would be required from the BLM. A 404 Permit would also be required from the COE. The preparation of an EIS would be associated with the Federal review process pursuant to NEPA. In addition, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Mesa County does not currently have 1041 regulations, although it is our understanding that the County is contemplating the adoption of 1041 authority.

Permitting Issues. Potential environmental impacts associated with this proposal have not been studied in detail. Given the magnitude of the proposal, we expect that numerous environmental issues must be addressed.

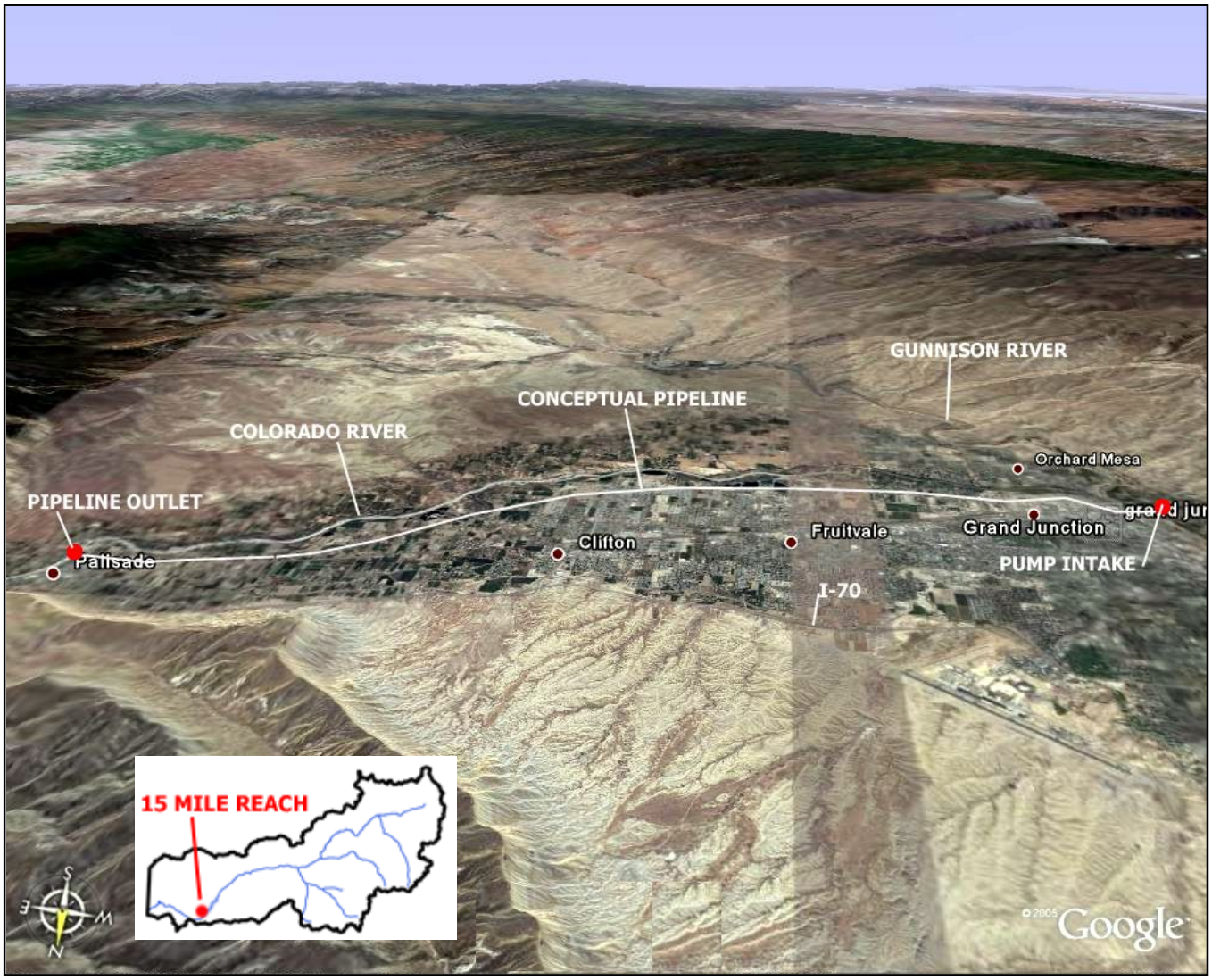
Estimated Time to Implementation. Permitting and construction of this concept is questionable. Even if it was possible to permit and construct the project, it would require several decades or more, given the large size of the project, federal issues, environmental issues, and the multi-purpose nature of the project. Financial participation from many stakeholders in the Grand Valley area would also be required. This financial support does not currently exist.

Few projects of this magnitude have avoided litigation, which often further delays project implementation. This implementation schedule does not meet 10825 water delivery objectives.

RECOMMENDATIONS

We do not recommend any additional consideration of this alternative. The Grand Valley Lake Proposal cannot be implemented in a timely manner that would satisfy 10825 program objectives. As outlined above, other substantial issues are also associated with this alternative.

15 MILE REACH PUMPBACK



Description

- 15 mile long pumpback / pipeline from Colorado River below Gunnison River to Colorado River below GVIC diversion dam
- maximum pumping capacity of 350 to 400 cfs
- 150 ft pumping lift
- Pump station operated during late summer months to enhance flow within 15 Mile Reach
- Buried pipeline located along existing recreation / utility corridors
- Yield 10,825+ AF per year
- Cost: Unknown

Summary

- No new reservoir is required
- High selenium concentrations in the Gunnison River may increase selenium concentrations within the 15 Mile reach
- Timely to construct and permit, if water quality issues can be addressed
- No headwaters benefit (Grand County)
- Could be combined with other alternatives to reduce capacity of pumpback and reduce construction costs
- Recommended for further study, with emphasis on water quality and construction costs

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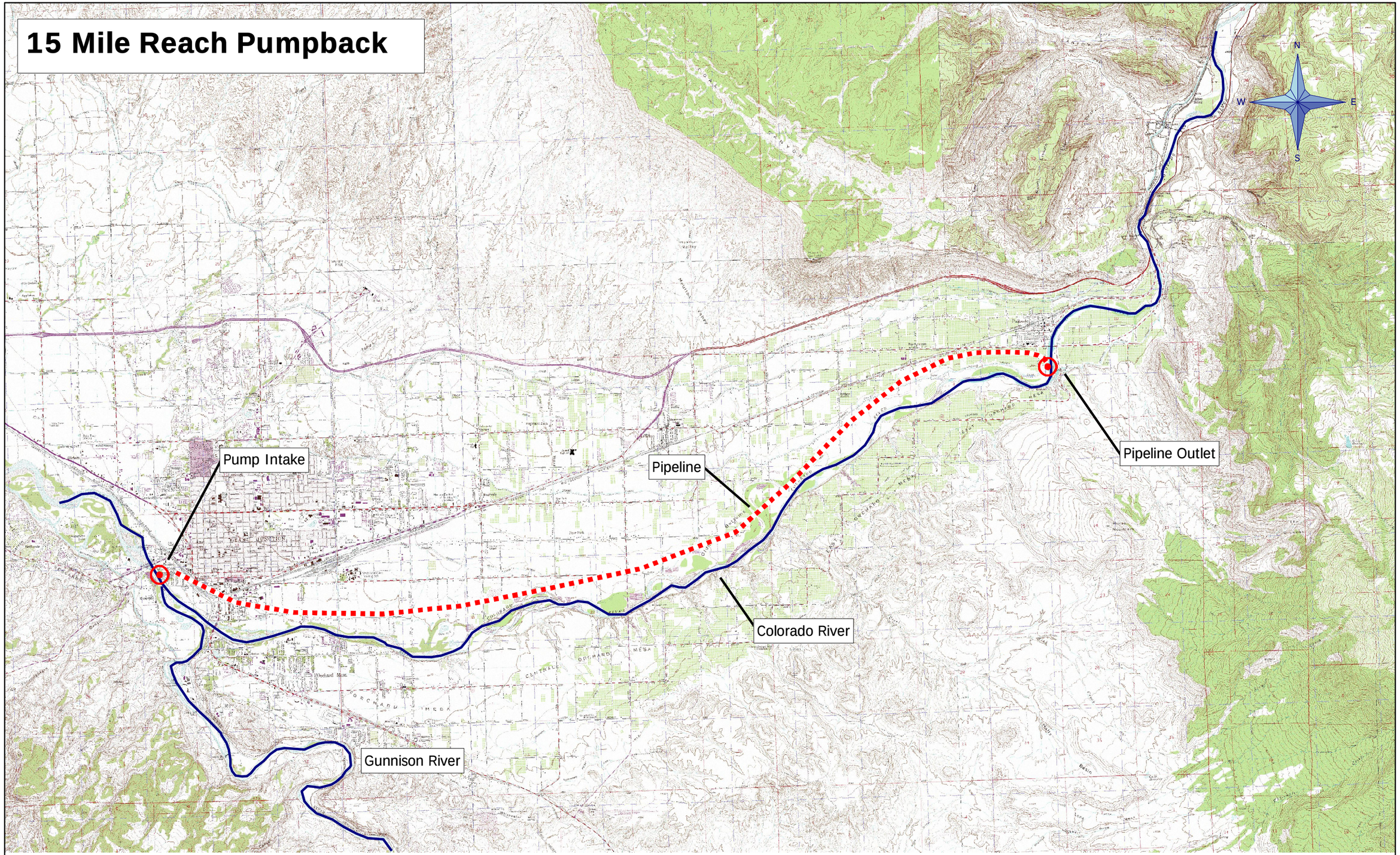
15 Mile Reach Pumpback



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15-MILE REACH PUMPBACK

This alternative would pump water from the Colorado River in Grand Junction, from a site below the confluence with the Gunnison River, upstream to the beginning of the 15-Mile Reach. Pumped water would be discharged to the Colorado River immediately downstream of the GVIC diversion dam.

The pumpback would only operate in the late summer months when additional flow is desired within the 15-Mile reach. The pumpback would essentially deliver a portion of the inflow of the Gunnison River to an upstream location at the head of the 15-Mile Reach. No reservoir construction would be required.

It is our understanding that the historical cumulative, instantaneous 10825 release demands of the USFWS are often as high as 350 cfs or 400 cfs. Accordingly, it may be necessary to size the pumpback deliver water at these high rates of flow. The actual instantaneous delivery demand for the 10825 water will be assessed in Phase 2 of this study. It may be possible to design this alternative for a pumping capacity that is considerably less than 350 cfs.

Structural facilities would likely consist of an intake facility in the Colorado River below the Gunnison River, a single large pump station with multiple pumps, a buried pipeline about 15 miles in length, and a pipeline discharge to the river below the GVIC diversion dam. Static head for the pump station would be about 150 feet. Pumping would typically occur during the late summer, when suspended sediment concentrations of the Colorado River are the lowest. Accordingly, a de-silting basin may or may not be required.

Neither a design nor a cost for this alternative has been developed. If a large capacity pump station is required, it is anticipated that construction and operation costs would be substantial. If the delivery capacity of this alternative can be reduced, construction and operational costs will also be substantially reduced.

10825 WATER SUPPLY

Downstream of the Gunnison River, water is available for diversion year round, even in critically dry years. This alternative could fully supply all 10825 water demands.

Streamflow downstream of the Gunnison River confluence would be unaffected as the pumped water would continue to flow down this reach as it exits the 15-Mile reach.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir is in close proximity to the 15-Mile Reach, and water transit issues are minimal. Reservoir water would arrive in the 15-Mile Reach shortly after it is released. It would be possible to manage and adjust reservoir releases in response to local thunderstorms and changing stream flow conditions in the 15-Mile Reach. This operation would optimize Recovery Program benefits.

Institutional Issues. No significant institutional issues have been identified at this time.

Water Rights. Water rights have not been adjudicated for this concept. We anticipate that a decree could be readily obtained for this alternative.

Physical Obstacles. We anticipate that the proposed pipeline facilities can be sited to avoid any critical physical obstacles.

Water Quality. A primary issue associated with this alternative is related to water quality. Both the Gunnison River and the Colorado River downstream of the Gunnison to the state line are on the EPA's list of impaired waters for selenium.

It may be possible to site the pump station at a location on the north bank of the Colorado River that is upstream of the mixing zone with the Gunnison River. In this instance it may be possible to avoid the pumping of selenium impaired water.

The pumped water would not be delivered to any irrigation facilities. However, if the pumped water has elevated concentrations of selenium, the impaired water quality may affect the listed fish species and other aquatic life within the 15-Mile Reach.

The impact of selenium on aquatic and avian species is disputed. However, according to biologists with the U.S. Fish and Wildlife Service in Grand Junction, high selenium concentrations in the water can negatively affect the reproductive cycle of both aquatic and avian species. Mallard deformations have been attributed to selenium toxicity from ponds in the Grand Junction area.

Concentrations of selenium in the Colorado River in the general vicinity of the proposed pump station are at their highest during late summer (from 7 to 11 parts per billion) while concentrations within the receiving reach of the Colorado River near Palisade are lower (from 2-3 parts per billion). Adding water with high concentrations of selenium to the 15-Mile Reach may increase the likelihood of adding the 15-Mile Reach to the state's list of impaired waters.

The water quality issues regarding selenium concentrations must be fully understood to determine if the 15-Mile Reach Pumpback is a viable alternative. Again, it may be possible to reduce potential water quality issues by locating the intake of the pumping plant at a location upstream of the mixing zone with the Gunnison River.

Endangered Species Act Issues. Primary ESA issues are related to potential selenium impacts as outline above.

Headwaters Benefits. This alternative would not provide any headwaters benefits.

Multi-Purpose Aspects. As proposed, this alternative would not provide benefits for purposes other than the Recovery Program.

PERMITTING

A 404 Permit would be required from the U.S. Army Corps of Engineers. It may be possible to locate the pipeline along existing trail corridors. However, easements from local landowners would likely be required. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. Mesa County does not currently have 1041 regulations, although it is our understanding that the County is contemplating the adoption of 1041 authority.

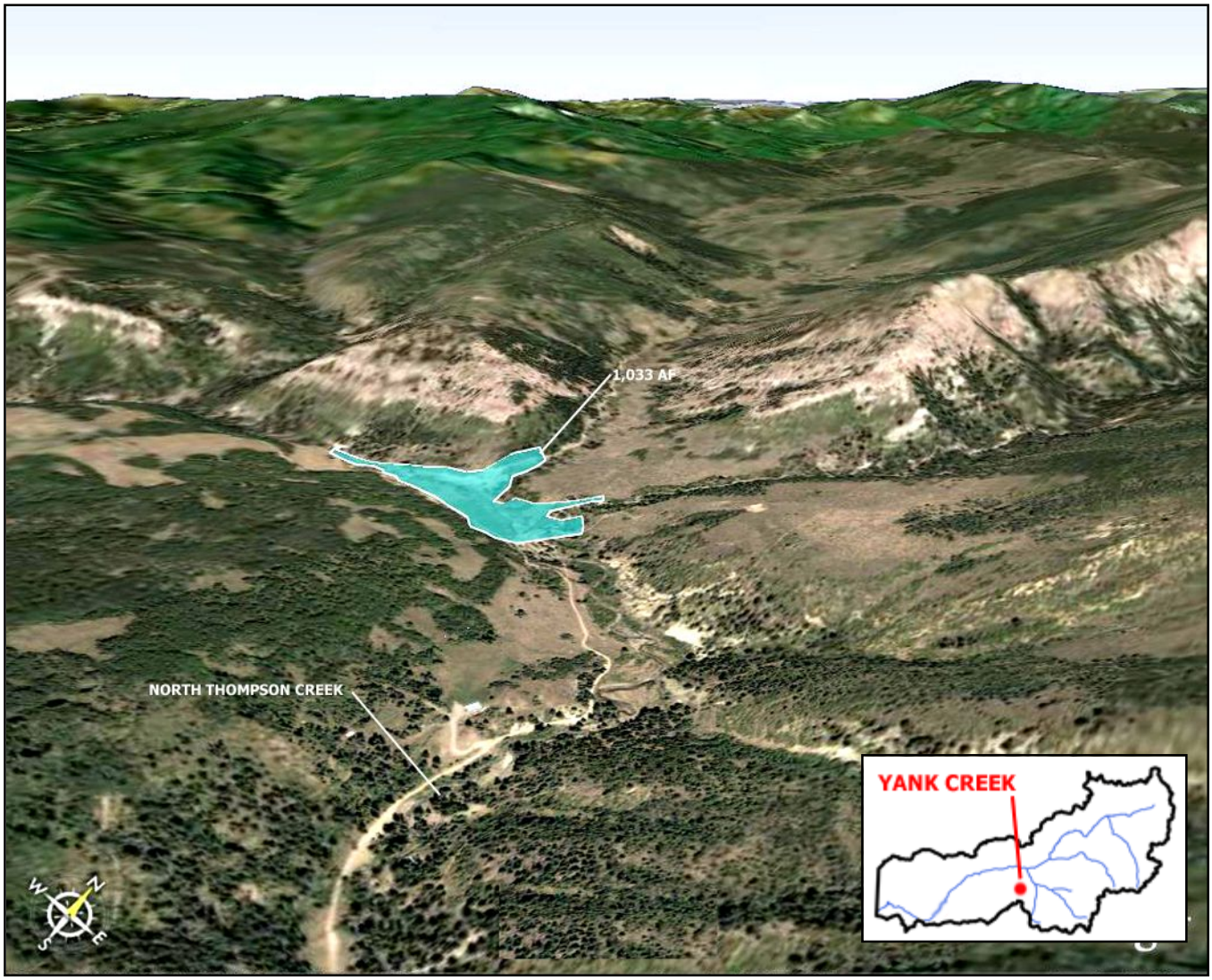
Permitting Issues. Primary permitting issues may be related to water quality.

Estimated Time to Implementation. Environmental permitting and construction of this alternative may occur more rapidly than for other alternatives. Permitting and construction is still likely to require 5 years at a minimum.

RECOMMENDATIONS

We recommend additional consideration of this alternative. If water quality issues can be resolved, this alternative may provide a timely, cost effective, and efficient source of 10825 water. Water quality issues associated with the delivery of water from below the Gunnison River should be studied to determine if this is a fatal flaw for the pumpback alternative. Pumpback design and costs estimates should be developed for several delivery capacities.

YANK CREEK RESERVOIR



Description

- 3,000 AF +/- reservoir on Yank Creek, tributary to Crystal River and Roaring Fork River
- 160 ft earthen embankment
- Yield approximately 1,500 AF per year
- Located on private land in-holding within National Forest
- Cooperative project with West Divide Water Conservancy District
- Cost: $8MM +

Summary

- Must be combined with other alternatives to fully supply 10825 water
- Multi-purpose reservoir
- Late summer releases would enhance flow of lower Crystal River which is substantially impaired by irrigation diversions
- No substantial environmental issues have been identified to date
- Minor water supply opportunities within Crystal River watershed
- Recommended for further study

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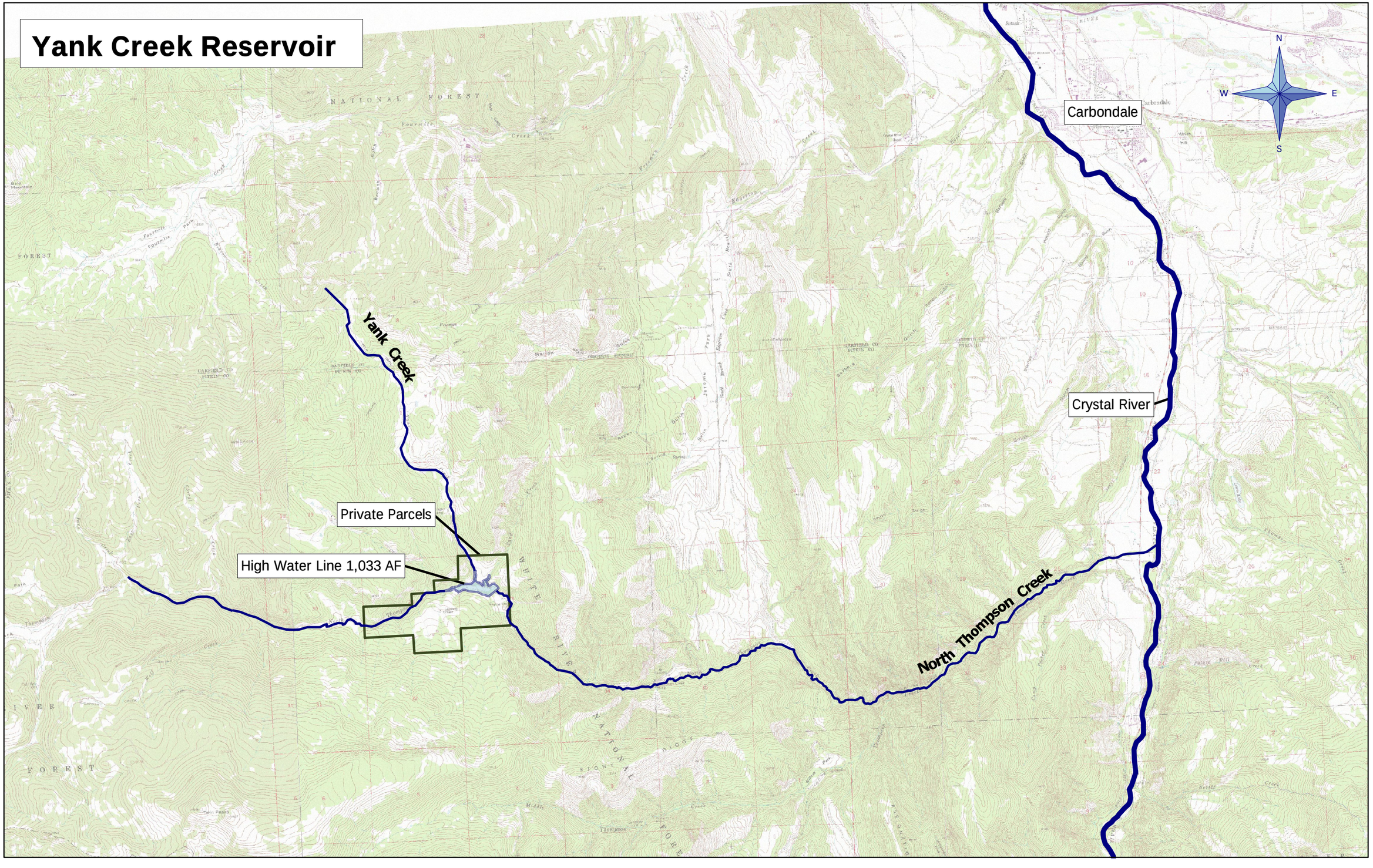
Yank Creek Reservoir



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YANK CREEK RESERVOIR

The Yank Creek Reservoir site is located on North Thompson Creek, a tributary to the Crystal River in the Roaring Fork watershed near Carbondale. The reservoir site was first considered by the USBR in 1966, as a component of the West Divide Project. The reservoir site is at an elevation of about 8,200 feet.

The capacity of the reservoir may be as great as 13,000 acre feet. In 1998, a preliminary feasibility assessment of reservoir sizes ranging from 200 acre feet to 13,000 acre feet was completed by Resource Engineering. An embankment height of 80 feet was estimated for a 1,000 acre foot reservoir, and an embankment height of 160 feet was estimated for a 6,700 acre foot reservoir.

The reservoir site is located on private land that is an in-holding within the White River National Forest. The embankment and reservoir would solely inundate private land at a storage capacity of about 3,000 acre feet. A larger reservoir, or potential borrow areas, would likely encroach upon National Forest land.

Preliminary construction costs estimates were developed for the reservoir in 1998. At that time the implementation cost of a 1,000 acre foot reservoir was estimated to be $3.2 million, and the cost of a 3,000 acre foot reservoir was estimated at $5.6 million. We expect that existing construction costs would exceed these estimates by 50% or more.

Unit costs for this alternative are estimated to range from between $100 and $200 for every acre foot of water delivered.

10825 WATER SUPPLY

This reservoir cannot supply the full 10825 water demand. It would be necessary to combine this alternative with other water supply sources to fully meet Recovery Program objectives.

The reservoir would be filled with native inflow from North Thompson Creek and Yank Creek. A USGS stream gage was operated at the reservoir site from 1964 through 1980. When considering the gage data, downstream water right calls, and instream flow bypass requirements, we estimate that average storable inflow to the reservoir is as much as 10,000 acre feet. However, in critically dry years, storable inflow would be less than 500 acre feet.

With the use of carry-over storage from a 3,000 acre foot reservoir, we preliminarily estimate that a firm annual delivery of about 1,500 acre feet could be made from the reservoir. Firm yield would increase with a larger reservoir.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. The reservoir site is located over 100 miles upstream of the 15-Mile Reach. It will typically take two to three days for reservoir releases to arrive at the 15-Mile Reach. Given this transit time, it may be difficult to operate reservoir releases in response to changing stream flow conditions in the 15-Mile Reach (i.e. rainfall events or changes in irrigation use). However, the transit issues associated with this facility are similar to issues related to the use of Ruedi Reservoir, Williams Fork Reservoir, Wolford Mountain Reservoir and other upstream facilities.

Institutional Issues. No significant institutional issues have been identified to date.

Water Rights. The reservoir was conditionally decreed a volume of 13,695 acre feet in 1971. The water rights are held by the Colorado River District for the benefit of the West Divide Water Conservancy District.

Physical Obstacles. The reservoir would inundate a local unimproved access road.

Water Quality. Water quality of the reservoir will likely be good. No substantial water quality issues are anticipated.

Endangered Species Act Issues. Yank Creek Reservoir would be a cold-water facility. Competition from non-native fishes is not anticipated.

Headwaters Benefits. Releases from Yank Creek Reservoir would accrue to the lower six miles of the Crystal River. This portion of the Crystal is severely impacted by senior irrigation diversions and the river can dry up during the late summer of dry years. 10825 water releases from Yank Creek Reservoir could substantially enhance aquatic resources in the Crystal River during the late summer months. The reservoir would also provide water right augmentation supplies to an area that has a substantial need for this supply.

Multi-Purpose Aspects. The reservoir would also provide water right augmentation supplies to an area that has a substantial need for this supply.

PERMITTING

Even though this alternative is located largely on private land, Federal and State permitting would be required. A 404 Permit would be required from the U.S. Army Corps of Engineers. A special use permit from the Forest Service may also be required if any access roads or borrow areas are located on National Forest Land. The preparation of an Environmental Impact Statement or an Environmental Assessment would be associated with the Federal review process pursuant to the National Environmental Policy Act. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA. A Pitkin County 1041 permit would be required.

Permitting Issues. Little is known about environmental conditions at the site therefore additional site investigation is needed during Phase 2 of the study. Potential impacts in the stream reach below the reservoir may largely be positive due to the increased flows during releases from the reservoir. The quality of water released from this high elevation site would likely be good. Late summer releases from the reservoir would enhance aquatic habitat in the Crystal River and would improve water quality in the Grand Valley.

Aerial photography indicates that wetland areas are confined to a narrow riparian corridor. Acquisition of private land would be required for this reservoir.

Estimated Time to Implementation. Environmental permitting and construction of this alternative is likely to require 5 to 10 years at a minimum.

RECOMMENDATIONS

We recommend that Yank Creek Reservoir be studied in additional detail. Additional studies should focus on a reservoir capacity of 5,000 acre feet or less. The limited storable inflow would not likely justify the construction of a larger reservoir. Design considerations and project costs require updating. Also, an assessment of on-site environmental conditions is needed.

RUEDI RESERVOIR – BACKFILL 2012 AGREEMENT

Description

- Permanently supply the 10825 Water from Ruedi Reservoir when the temporary "2012 Agreement" expires
- "2012 Agreement" provides for the temporary release of 10825 acre feet pursuant to Round II water marketing from Ruedi Reservoir
- Contract for the 10825 Water from West Slope Market Pool of Ruedi Reservoir
- Supply 10825 Water from existing sources (Wolford Mtn or Williams Fork) until expiration of 2012 agreement
- Firm supply of 10,825 acre feet

Summary

- No new reservoir is required
- May reduce West Slope market supply from Ruedi Reservoir, although remaining supply is estimated to exceed near-term demand
- Instantaneous 10825 releases could approach 350 to 400 cfs for short periods
- The short-term high releases could conflict with sport fishing in the Fryingpan River.
- Permanent use of Ruedi Reservoir may require congressional authorization
- Timely to permit
- Could be combined with other alternatives to provide benefits in other stream reaches
- Recommended for Further Study

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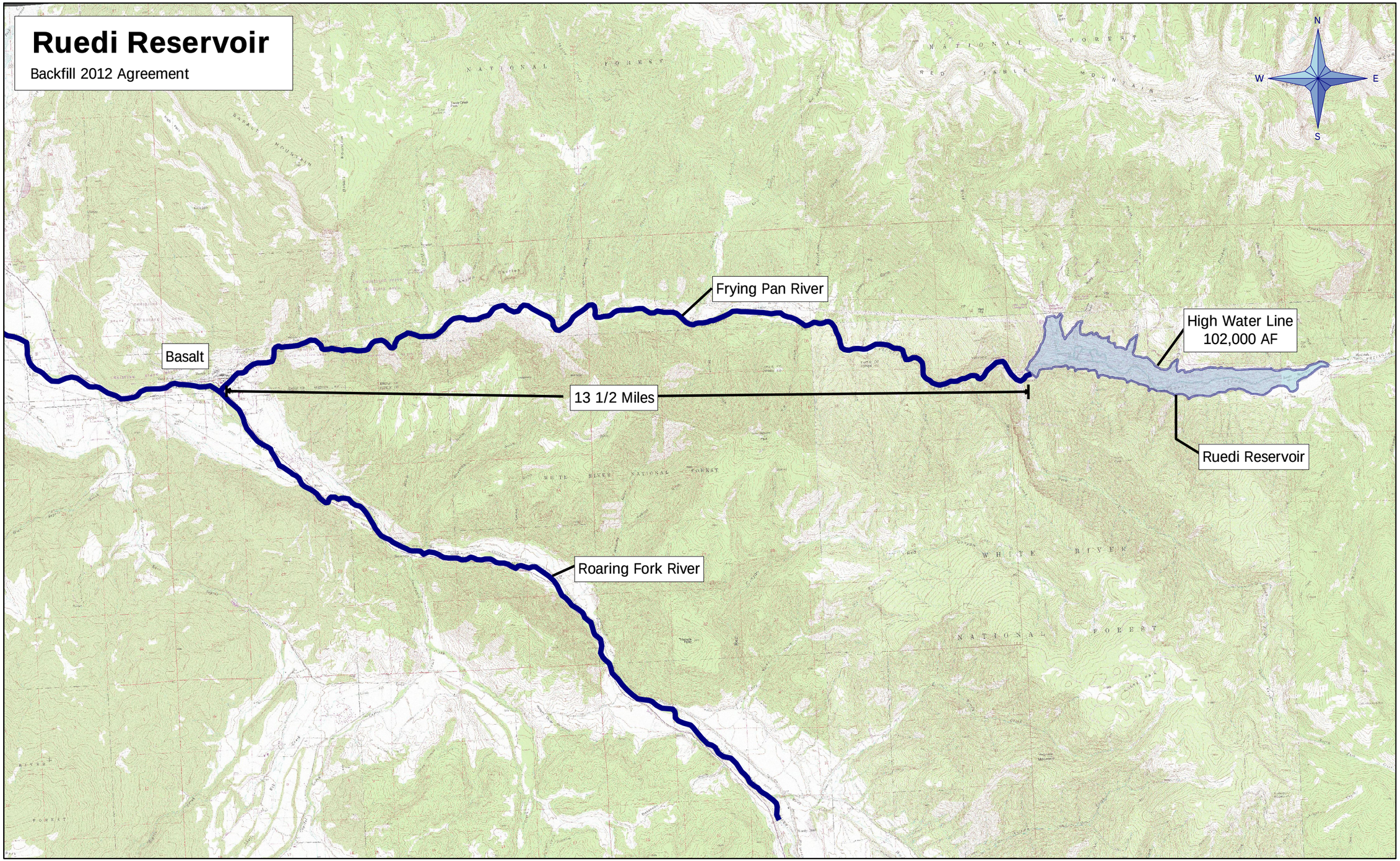
Ruedi Reservoir

Backfill 2012 Agreement



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RUEDI RESERVOIR

Backfill 2012 Agreement

In the year 2012, an existing obligation to temporarily release 10,825 acre feet of Recovery Program water from Ruedi Reservoir will expire. At that time, less water will be released for the Recovery Program; summer releases from Ruedi Reservoir may decrease from existing conditions, and winter releases may increase a corresponding volume.

This alternative would permanently provide the 10825 water from Ruedi Reservoir starting in 2012, and would "back fill" the temporary water supply agreement. The volume of water released from Ruedi Reservoir would remain the same as under current conditions.

This is a non-structural alternative. No new diversion or storage facilities would be constructed.

Background. Ruedi Reservoir is an existing 102,000 acre foot storage facility located on the Fryingpan River about 13 miles upstream of the Town of Basalt. The reservoir was completed in 1968 as a component of the U.S. Bureau of Reclamation's (USBR) Fryingpan-Arkansas Project. Active storage capacity of the reservoir is about 101,280 acre feet.

Currently, a substantial amount of water is released from Ruedi Reservoir for Recovery Program objectives. A permanent supply of 5,000 acre feet is available for use by the USFWS each and every year. This water is supplied from the West Slope Pool of the reservoir. Also, an additional 5,000 acre feet is available to the Recovery Program in four out of five years but is not available in dry years. These two obligations, commonly referred to as the 5 plus 5 water, are associated with mitigation for Round II water contracts from the reservoir.

An additional 10,825 acre feet of water from Ruedi Reservoir is available to the Recovery Program on a temporary basis. The USBR, in an agreement with the CWCB and the USFWS, has committed to supply 10,825 acre feet of water for the 15-Mile Reach through the year 2012. This agreement was also associated with mitigation for Round II water contracts from Ruedi Reservoir. The agreement for this 10,825 acre feet of water will expire in the year 2012. This temporary agreement to supply water to the 15-Mile Reach is known as "2012 Water".

In total, 15,825 acre feet are currently available for delivery to the 15-Mile Reach each and every year, with an additional 5,000 acre feet of water available in 4 out of 5 years. In the year 2012, firm dry year releases for Recovery Program purposes will decline to 5,000 acre feet.

As previously outlined, this alternative would permanently provide the 10,825 water from Ruedi Reservoir, upon expiration of the 2012 water supply agreement. Until expiration of the 2012 agreement, the water providers would no longer supply the 10825 water from existing reservoir facilities such as Wolford Mountain Reservoir and Williams Fork Reservoir. No reservoir construction would be required for this alternative.

With this alternative, the annual volume of water released from Ruedi Reservoir for Recovery Program purposes would not decline after 2012, but would permanently remain the same as the current volume of water released from the reservoir. The amount of water currently released from Wolford and Williams Fork reservoirs would be replaced by the releases from Ruedi Reservoir in this alternative.

The cost of this alternative has not been determined, but will be evaluated in Phase 2 of the study. We anticipate that unit costs for this alternative will range from between $100 and $200 for every acre foot of water delivered.

10825 WATER SUPPLY

This alternative would supply all of the 10825 water in all years, including drought years. A brief overview of the operation of Ruedi Reservoir is provided below.

Three primary pools exist within Ruedi Reservoir: the Replacement Pool, the Recreation Pool and the West Slope Pool.

The Replacement Pool is up to 28,000 acre feet in capacity and is available to replace out-of-priority diversions associated with the upstream Fryingpan-Arkansas trans-basin collection system. Historical releases from the Replacement Pool have been considerably less than the capacity of this pool. If replacement demands were to exceed 28,000 acre feet in the future, the capacity of the replacement pool may be increased. Replacement demands in excess of 28,000 acre feet are not anticipated.

The Recreation Pool, or permanent pool, is comprised of 20,000 acre feet of storage permanently withdrawn for recreation uses.

The West Slope Pool is the remainder of the active storage in the reservoir. Water from the West Slope Pool is marketed solely for west slope purposes. The USBR has determined that the marketable yield of the West Slope Pool is 51,500 acre feet of water per year.

Water from the reservoir has been marketed through Round I and Round II contracting processes. A total of 7,850 acre feet of water was originally contracted in Round I. Of this total, 6,000 acre feet is contracted to Exxon/Mobil for oil shale development. Exxon/Mobile has no current use for this water. The remaining 1,850 acre feet of Round I contracts were granted to west slope water users, primarily for water right augmentation purposes.

Pursuant to the on-going Round II process, a total of 6,114 acre feet of water has been contracted. An additional 5,038 acre feet of water is pending USBR approval for contracting. Of this pending amount, 5,000 acre feet of water is sought by the Colorado River District for anticipated future growth and development on the west slope.

Assuming the pending Round II contracts are approved, a total of 19,002 acre feet of water will have been contracted for use by west slope entities (7,850 acre feet in Round I, 6,114 acre feet in Round II, and 5,038 acre feet pending in Round II). Over 11,000 acre feet of this contract demand is associated with anticipated future growth and development and is not currently used.

As previously discussed, an additional 5,000 acre feet of Round II mitigation water is committed from the West Slope Pool for permanent supply to the 15-Mile Reach. Accordingly, total anticipated demands from the West Slope Pool after the year 2012 are currently 24,002 acre feet.

If the water providers 10825 water obligation is permanently supplied from the West Slope Pool, a total of about 34,800 acre feet of water will be permanently obligated from this pool. Given a total marketable yield of 51,500 acre feet from the West Slope Pool, as much as 16,700 acre feet of yield may remain available for future contracting from the pool, contingent upon approval from the USBR.

The permanent supply of the 10825 water from Ruedi Reservoir would be entirely supplied from the contract pool, and should not affect the ability of the Replacement Pool to completely replace all out-of-priority depletions associated with upstream trans-basin diversions.

ALTERNATIVE ASSESSMENT

Ability to Manage Flow in 15-Mile Reach. Ruedi Reservoir is located over 100 miles upstream of the 15-Mile Reach. It will typically take two to three days for reservoir releases to arrive at the 15-Mile Reach. Given this transit time, it may be difficult to operate reservoir releases in response to changing stream flow conditions in the 15-Mile Reach (i.e. rainfall events or changes in irrigation use). However, Recovery Program water is currently released from this reservoir, and the use of the reservoir has been acceptable to the USFWS.

Institutional Issues. The use of Ruedi Reservoir for 10825 Purposes may require congressional approval. This issue will be studied in additional detail in the Phase 2 study.

Water Rights. Water rights for the existing reservoir are decreed. We do not anticipate that a change in water rights would be required for 10825 uses.

Physical Obstacles. No physical obstacles are associated with this non-structural alternative.

Water Quality. The reservoir releases would be of high quality and would benefit water quality for irrigators in the Grand Valley.

Endangered Species Act Issues. No ESA issues are likely to occur with this alternative.

Headwaters Benefits. Reservoir releases would increase late summer stream flow of the Roaring Fork River between Basalt and Glenwood Springs. This increase in river discharge is projected to improve aquatic habitat in this reach of the river. Without this alternative, late summer stream flow of the Roaring Fork River will decline if current projections of demand for contract water are accurate.

Since the reservoir is located within the middle part of the Colorado River basin, 10825 water releases would not enhance stream flow at other upstream sites in Grand and Eagle County that could also benefit from supplemental water.

Multi-Purpose Aspects. This alternative would not provide benefits for purposes other than the Recovery Program.

PERMITTING

This alternative is non-structural, and no construction activities would be required. Accordingly, on-site impacts would be minimal.

Even though this alternative would not require any construction activities, Federal approval would be required. Specifically, the USBR must complete a NEPA review of any proposed contract from the West Slope Pool. The preparation of an Environmental Assessment (EA) would be associated with the Federal review process pursuant to the National Environmental Policy Act. Also, Section 7 Consultation with the USFWS would be required pursuant to the ESA.

Permitting Issues. A primary issue with this alternative relates to sport fishing access along the Fryingpan River. When stream flow of the Fryingpan River exceeds the 250 cfs to 300 cfs range, it is difficult for sport fisherman to safely access the river. Sport fishing provides an important economic benefit in the Basalt area and significant efforts have been made to manage releases from Ruedi Reservoir to accommodate sport fishing interests. It is possible that 10825 releases, coupled with other reservoir releases and bypasses, will cause the stream flow of the Fryingpan River to exceed 300 cfs during isolated periods of time.

It is our understanding that the historical cumulative, instantaneous Recovery Program release demands of the USFWS are periodically as high as 350 cfs or 400 cfs. Accordingly, it may be necessary to periodically release 350 cfs or more from Ruedi Reservoir. These releases would be in addition to the release of water for contract purposes, and in addition to native reservoir inflow which is bypassed when the reservoir is out-of-priority.

It is important to assess the operation of this alternative to determine if conflicts between reservoir releases for the Recovery Program, and sport fish wading can be avoided or mitigated. The actual instantaneous delivery demand for the 10825 water will be assessed in Phase 2 of this study. It may be possible to configure this alternative for a release demand that is considerably less than 350 cfs. This would reduce the potential for sport fishing access issues.

Other potentially important issues that require investigation are:

- Impact on yield of the Fryingpan-Arkansas trans-mountain collection system or the east slope replacement pool of Ruedi Reservoir
- Changes in hydroelectric production in the Ruedi Water and Power Authority power plant on Ruedi Reservoir
- Changes in flat water recreation opportunities on the reservoir
- Flooding potential in the Basalt area

Estimated Time to Implementation. It should be possible to permit this non-structural alternative prior to the time that the 2012 agreement expires.

RECOMMENDATIONS

We recommend further study of this alternative. Further study of institutional and legal issues, operational opportunities, and impacts to the Fryingpan River are of particular importance.

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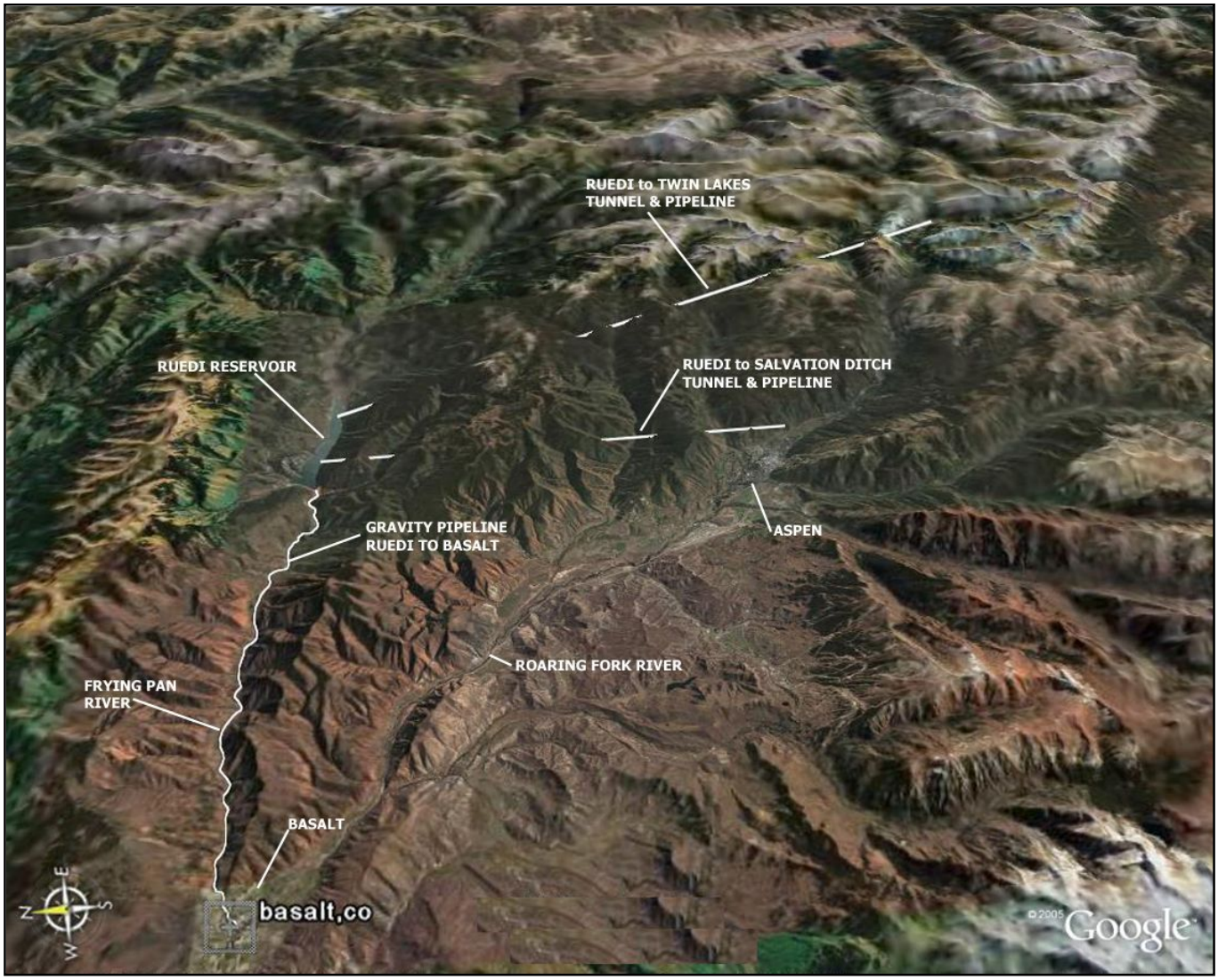
RUEDI RESERVOIR

Pipe and Pump Mitigation Facilities



Description

- Three alternate Ruedi Reservoir delivery facilities to keep 10825 Water "out of Fryingpan River" and reduce sport fishing issues:
  1) Gravity pipeline from Ruedi Reservoir to Roaring Fork River at Basalt
  2) Tunnel and Pipeline from Ruedi Reservoir to Salvation Ditch on Roaring Fork River (500 ft pumping head, 12 mile conduit)
  3) Tunnel and Pump station from Ruedi Reservoir to Twin Lakes Project (3,100 ft pumping head, 18 mile conduit)
- Cost: Unknown

Summary

- Cost prohibitive
- Difficult to permit and construct
- Sport fishing conflicts can likely be avoided with appropriate reservoir management criteria
- Not Recommended for Further Study

Sport Fishing on the Fryingpan River

RUEDI RESERVOIR:

Pipe and Pump Mitigation Facilities

The use of Ruedi Reservoir for 10825 purposes may periodically cause the stream flow of the Fryingpan River to exceed the desired 250 cfs to 300 cfs limit for sport fisherman access and wading. As previously described, sport fishing is economically important in the Basalt area and significant efforts have been made in the coordinated reservoir operations management to successfully accommodate sport fishing interests. Two specific delivery facilities have been suggested for the remediation of this issue.

One facility would construct a gravity pipeline from Ruedi Reservoir to Basalt. A portion of the 10825 releases would be conveyed in this pipeline. The pipeline would keep 10825 water out of the Fryingpan River in order to facilitate wade sport fishing access.

The second delivery alternative would construct a pipeline or tunnel from Ruedi Reservoir to the upper Roaring Fork River. Again 10825 releases would be "kept out" of the Fryingpan River, and would instead be discharged to the upper Roaring Fork River where late summer stream flow is significantly impacted by historical senior water right diversions high in the watershed.

RUEDI TO BASALT BURIED PIPELINE

This delivery alternative would construct a 15 mile gravity pipeline from Ruedi Reservoir to the Roaring Fork River near Basalt. We estimate that a pipeline capacity of as much as 250 cfs to 350 cfs would be constructed to completely alleviate fisherman access issues. The pipeline would likely carry 10825 water only during isolated periods (perhaps several weeks per year) when 10825 release objectives conflict with wade sport fishing access.

A hydroelectric power plant may be feasible at the outlet of the gravity pipeline. The total elevation head between the Roaring Fork River at Basalt, and the outlet facility of Ruedi Reservoir is about 900 feet. In order to economically justify a hydroelectric plant, it would be necessary to deliver other Ruedi Reservoir water releases (contract releases, bypasses, ect.) through the pipeline. This could substantially reduce the flow of the Fryingpan River and may result in adverse impacts to aquatic habitat.

Preliminary construction costs estimates reflect that the gravity pipeline could cost approximately $40 million or more.

RUEDI TO UPPER ROARING FORK PIPELINE/TUNNEL

Late summer stream flow in the upper Roaring Fork River above Aspen is substantially reduced by two primary diversion facilities; the Independence Pass Trans-mountain Diversion System (Twin Lakes) and the Salvation Ditch. The Twin Lakes system is located in the headwaters of the Roaring Fork watershed at an elevation of about 10,600 feet. The Salvation Ditch diverts water from the river at a downstream location which is at an elevation of about 8,000 feet.

This alternative would construct a pipeline/tunnel system from Ruedi Reservoir (7,500 elevation) to the Roaring Fork River. A 12 mile pipeline and tunnel would deliver water to the Roaring Fork River at the Salvation Ditch diversion. A pressurized system with a pumping station would be required to lift the water about 500 feet from Ruedi Reservoir to the Salvation Ditch headgate.

An 18 mile pipeline and tunnel would deliver water to the Roaring Fork River at the Twin Lakes diversion system. A pressurized system with multiple pumping stations would be required to lift the water about 3,100 feet from Ruedi Reservoir to the Twin Lakes system.

These pressurized systems would likely carry 10825 water only during isolated periods (perhaps several

weeks per year) when 10825 release objectives conflict with sport fisherman access.

Cost estimates for these delivery facilities have not been developed. It is our estimate that the cost of each of these options would exceed $100 million.

RECOMMENDATIONS

We do not recommend any additional consideration of these mitigation concepts at this time. It is likely that sport fishing access issues associated with the use of Ruedi Reservoir can be resolved through continued reservoir management without the large scale construction large scale delivery systems. Further, the cost of these delivery systems would likely be prohibitive. Assuming that required federal and state permits could actually be obtained, the permitting and construction of a tunnel system would require a decade or more. This implementation schedule does not meet 10825 water delivery objectives.

SYNCHRONIZED USE OF MULTIPLE FACILITIES

Description

- Synchronized operation of existing and new facilities
- Multiple synchronized alternatives to be developed in Phase 2 Study
- Yield: 10,825 AF per year
- Cost: Unknown

Summary

- Synchronized operation to address secondary objectives:
  - Streamflow enhancement in headwater streams
  - Maintenance of water quality in Grand Valley
  - Continued operational flexibility associated with Recovery Program releases
- Recommended for further study

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SYNCHRONIZED USE OF MULTIPLE FACILITIES
aka "Mix and Match" Alternatives

The primary objective of each 10825 alternative is to provide a reliable supply of 10825 water to the 15-Mile Reach without impairing the yield available to any water provider. In addition, several important secondary issues and concerns have been identified through communication with the 10825 Work Group and project stakeholders. These secondary issues and concerns are:

1. Enhancement of stream flow in impacted headwater streams through the release of 10825 water
2. Maintenance of water quality for irrigation and municipal use in the Grand Valley
3. Maintain maximum flexibility for synchronized reservoir operations

No single alternative or facility addresses all of these secondary issues. However, alternatives that provide 10825 water from several or more sources may optimize the benefits associated with 10825 releases. In addition, any negative impacts associated with a particular alternative may be diminished if this type of synchronized approach is cooperatively implemented in conjunction with other facilities.

Enhance Headwater Stream Flow. Areas of concern that have been identified are:
- Grand County streams
- Colorado River below Windy Gap to Dotsero
- Roaring Fork River above Aspen
- Lower Crystal River

Stream flow in these reaches is significantly reduced by diversions associated with senior water rights. If it is possible to improve stream flow in any of these reaches through the delivery of the 10825 water, multiple benefits would occur.

Maintain Water Quality for Grand Valley Irrigation. Grand Valley water providers are concerned that water quality of the Colorado River is not always the quality desired for superior crop production or for municipal water supplies. Concerns are primarily related to high salinity and selenium concentrations that may contribute to reduced crop production, as reflected by yellow tinted leaves on fruit trees and other crops. These concerns are heightened by the prospect of any future increase in salinity concentrations in the water that is delivered to the irrigators.

Currently, water is released from the headwater reservoirs in late summer for irrigators. This water is perceived to be of higher quality with lower salinity concentrations than might be delivered from lower elevation reservoirs. Any proposed reservoirs that are located in geologic regions that may contribute to higher concentrations of salinity and selenium are perceived as a threat to municipal water supplies and to the thriving fruit and vegetable growing region of the Grand Valley.

Alternatives that provide the highest quality water possible to the Grand Valley region are preferred by advocates of Grand Valley growers. These preferences include any combinations of 10825 water supply alternatives that ensure the lowest possible concentrations of salinity in the water available for irrigation and municipal use.

Provide maximum flexibility for operations. The current coordinated reservoir operating system for the Recovery Program includes a weekly phone conference with a broad range of East and West Slope water providers and others. The call participants discuss weather predictions, current flow conditions on each major tributary and determine the release schedule from each participating headwater reservoir for the coming week. This weekly call has evolved into a critical component of the flow management for the entire Upper Colorado basin and is highly valued by all of the members of the program who participate.

The most frequently cited benefit of the weekly call is the high level of flexibility in stream management

that results from the participants working together to coordinate releases for water quality and quantity objectives across the Upper Colorado basin. An understanding of the concerns for each region's individual issues has grown over the young life of the program. By offering a range of options available for delivery of the 10825 water from multiple existing or new facilities, the flexibility to respond to local concerns within specific watersheds is increased.

Maintaining and increasing the tools available to respond to a variety of flow conditions across the basin is of great value. This flexibility could be enhanced use of the "mix and match" alternatives that involve multiple facilities.

POTENTIAL SYNCHRONIZED ALTERNATIVES

Many "mix and match" alternatives may be possible. Denver Water has proposed the analysis of one such creative concept to enhance headwater stream flow. In this example, the operation of Ruedi Reservoir, Williams Fork Reservoir, and Denver's pool in Wolford Mountain Reservoir would be coordinated.

Denver Water currently releases "substitution water" from Williams Fork Reservoir and Wolford Mountain Reservoir during infrequent dry years in which Green Mountain Reservoir does not fill. These substitution releases benefit the Colorado River below Kremmling, but they do not occur every year. The 10825 water would be released every year.

Under this concept, a portion of Denver Water's substitution obligation would be released from Ruedi Reservoir during infrequent dry years. In return, a portion of the 10825 water would be released from either Williams Fork Reservoir or Wolford Mountain Reservoir each and every year.

This type of operation, would benefit the Colorado River below Kremmling every year, and would reduce the frequency and amount of releases from Ruedi Reservoir. Smaller Ruedi releases may diminish issues with sport fishing access on the Fryingpan River. High quality water would also be delivered to the Grand Valley. The viability of this synchronized option is not known, however the concept merits study.

Another concept involving existing reservoir facilities may include the OMID improvements which have previously been discussed. The OMID improvements would provide additional Recovery Program water in Green Mountain Reservoir, which may further enhance stream flow of the upper Colorado River. The additional Recovery Program water in Green Mountain Reservoir could be combined with 10825 releases from Ruedi Reservoir. In many years, this concept may reduce 10825 releases from Ruedi Reservoir and may reduce issues associated with sport fishing access.

RECOMMENDATIONS

We recommend that a range of synchronized operational concepts be developed and studied in additional detail in Phase 2 of the 10825 study. Several new coordinated operational concepts warrant consideration. A variety of concepts will be explored in workshop settings by key stakeholders during the next phase of the study. The following existing and proposed facilities have the potential to be operated in a coordinated manner to optimize benefits associated with the 10825 releases, and should be considered as potential components of "mix and match" alternatives:

- Ruedi Reservoir
- Williams Fork Reservoir
- Green Mountain Reservoir
- Wolford Mountain Reservoir
- Lake Granby
- The Twin Lakes Project
- Yank Creek Reservoir

This Phase 2 evaluation must be consistent with the primary objectives of the program, and no reduction of yield to any water provider may occur.

SAVING THE FISH

THE FOUR ENDANGERED FISH

Four warm water fish species that inhabit lower reaches of the major river basins in Western Colorado have been listed as endangered under the federal Endangered Species Act. The four fish are the Colorado pikeminnow (aka squawfish), razorback sucker, humpback chub and the bonytail chub. These fish were once found throughout the warm waters of the Colorado, Green, Yampa, White and Gunnison Rivers.

Critical habitat for these species has been designated in each of the river basins where the fish once flourished. For the Colorado pikeminnow and the razorback sucker, "critical habitat" on the Colorado River extends from Lake Powell upstream to Rifle, Colorado. This designation is made by the USFWS.

The Colorado River in the Grand Junction area is known as the "15-Mile Reach," a segment of the river that extends from the confluence of the Gunnison River upstream 15 miles to the Grand Valley Irrigation Company Diversion Dam near Palisade, Colorado. This segment of the river has been identified by USFWS as having particular significance in the effort to recover these fishes. All four of the endangered fish "occupy" the Colorado River near Grand Junction, while "critical habitat" for the Humpback and Bonytail Chub are located throughout other reaches of the Colorado River basin.

THE DECLINE OF THE SPECIES

Many factors have contributed to the decline of the native fish. Backwater pools and important flood plain habitat along the rivers have been altered by historical changes in flow regimes. Dams and diversions constructed across the Colorado River prevent fish from migrating up and down their

historical range. Warm water reservoirs are significant harbors of non-native fish, including small mouth bass and northern pike. Non-native fish have also been historically stocked in the river. Large populations of non-native fish eat the endangered fish, especially during early life stages. This is a particularly important factor that impedes recovery and de-listing of the endangered fish.

Water diversions have altered the amount and types of habitat available for all life stages of these endangered fish. Local irrigation diversion dams have reduced summer flows since the turn of the 20th century. Also, headwater diversion projects have reduced both spring runoff and summer flows.

In order to save these species from extinction, the USFWS has identified a number of important steps that can be taken to recover these endangered fish. One of many important steps taken to restore the fish is to increase flow of the river during spring peak flows and again in later summer when flows are often at their lowest due to upstream diversions. The 10825 Water is intended to mitigate changes in stream flow within the 15-Mile Reach that have occurred during the July to September period.

FIGURING OUT HOW TO HELP THE FISH

In 1999, the USFWS completed the "Final Programmatic Biological Opinion for Bureau of Reclamation's Operations and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River". This document is also referred to as the "15-Mile Reach Programmatic Biological Opinion" or the PBO.

The 15-Mile Reach Programmatic Biological Opinion was issued to provide specific Endangered Species Act compliance for the one million acre feet per year of existing depletions and up to 120,000 acre feet per year of anticipated future depletions from the Colorado River. This programmatic opinion describes what the Recovery Program must do to provide Endangered Species Act compliance for existing and future depletions.

The PBO requires the implementation of many recovery actions, including stocking of native fish from hatcheries, reduction in non-native fish populations, installation of fish screens at diversions and pump features, protection of backwater habitat, installation of fish ladders to enable migration and a variety of flow enhancements at different times of the year. The PBO also requires that the water providers supply 10,825 acre feet of water to the 15-Mile Reach during the July to September period. The PBO is based on the premise that as all of the elements of the Recovery Program are implemented, the endangered fish will recover and then will be "de-listed."

THE EFFECT ON WATER PROVIDERS

The initial listing of these fish had a substantial impact to Colorado River water providers. Any action by a federal agency, such as issuing a permit or a right of way, or funding of an expanded a diversion of water for a small municipal water provider, must now be done in consultation with the USFWS. The purpose of the consultation is to ensure that water development projects are done in a way that doesn't harm the potential recovery of these four endangered species.

Since the mid-1970's, the USFWS has held that ANY depletion of water, large or small, anywhere in the Upper Colorado Basin, even far upstream of where the fish once thrived, will adversely affect the endangered fish species and their designated critical habitat. Therefore, if any federal agency takes an action that allows a depletion of water to occur, or facilitates a depletion, the federal agency is required to consult with the USFWS. The USFWS prepares a biological opinion that identifies mitigation measures that avoid jeopardizing the species and /or minimizes harming the species. Endangered Species Act consultation is required for all historical and future depletions from the Upper Colorado River basin that require a federal action for their continuation or implementation.

THE RECOVERY PROGRAM

In light of the potential conflicts between the Endangered Species Act and water development /

management in the region, a broad group of key stakeholders came together over two decades ago to identify a way to work together to recover the four endangered fish species. The Upper Colorado River Endangered Fish Recovery Program, better known as the Recovery Program, was the result of the group's collaborative efforts and was formalized in 1988 with the signing of a cooperative agreement that has since been extended through September 2013.

The Recovery Program operates collaboratively under direction of the Recovery Program Implementation Committee representing Federal and state agencies, water users, power users and the environmental community. This group developed and oversees a wide variety of actions being taken to recover the fish. These actions include construction of fish passages, fish screens, habitat improvements, enhancing instream flows in accordance with state water law and interstate compacts, stocking, monitoring and research.

There are two primary components of the instream flow enhancement component of the Recovery Program:

- "Summer Flow" reservoir releases are delivered to the Colorado River between July and September each year to enhance summer base flow conditions and improve endangered fish habitat. From 1990-1999, about 19,000 AF of water per year was released. As of 2000, releases increased to 48,000 AF on average per year. These releases include the"10825 Water" as well as surplus water from Green Mountain Reservoir, Ruedi Reservoir releases, and water conserved by improvements in the Grand Valley Project canal system.

- "Flushing flow" water added to the peak flow during a 10 day period in high flow years to enhance the flushing flows to remove sediment from the river bottom. These "Coordinated Reservoir Operations" allow upstream reservoirs to voluntarily release water to enhance flows without affecting the yield of these facilities. In spring 2006, 28,460 acre feet of water was released, adding 1,800 cfs to the peak stream flow.

COLLECTIVE MITIGATION FOR WATER DEPLETIONS

The Recovery Program actions provide the mitigation for water depletions in the Upper Colorado River basin. In essence, rather than requiring individual water users to offset individual depletions, that responsibility has been shifted to the Recovery Program. In entering the agreement to establish the Recovery Program, the United States agreed that any water needed for endangered fish would be acquired in accordance with the state law and interstate compacts, and that there would be no taking or condemnation of water rights to meet Recovery Program goals.

In the Colorado River basin above Grand Junction, water users who want to benefit from the Recovery Program are required to sign a "recovery agreement." Under this agreement, the USFWS agrees to provide Endangered Species Act compliance for a water user's project and the water user "agrees not to take any action that would probably prevent the implementation of the Recovery Elements" under the Recovery Program.

The water user is NOT required to take any action that would change or violate water right decrees, the statutory authorization for any water project or the water user's legal authorities. None of the water users covered by the 1999 PBO, and who have signed the recovery agreements, have been found by the USFWS to have taken any action that would "probably prevent the implementation" of the Recovery Program.

PUBLIC / PRIVATE COLLABORATION

Given the large competing demands for Colorado River water, Recovery Program partners recognize that collaboration is necessary to accomplish the dual objectives of recovering endangered fish species while providing water for human needs. Each partner fully participates in developing and implementing management actions leading toward delisting of the endangered Colorado River fishes. The Recovery Program has earned accolades for its management approach, proven track record of

accomplishments and long term commitments of staff, time and money.

Congressional support and continued funding of agency involvement and program construction projects demonstrate the effectiveness of these public/private conservation partnerships. The Recovery Program's success is a direct result of the active commitment and participation of its partners. Implementation of the Recovery Program is complex and expensive, requiring a combination of actions that range from support by local water providers to major Congressional funding legislation. Partners include:

- State of Colorado
- State of Utah
- State of Wyoming
- Bureau of Reclamation
- Colorado River Energy Distributors Association
- Colorado Water Congress
- National Park Service
- The Nature Conservancy
- US Fish and Wildlife Service
- Utah Water Users Association
- Western Area Power Administration
- Western Resource Advocates
- Wyoming Water Association

Through the enactment of Federal law P.L. 106-392, in October 2000, Congress authorized funding of capital construction projects, and operation and maintenance for the recovery program, through the Bureau of Reclamation. The construction program has been extended through 2010. Construction funding is capped at $126 million with $108 million designated for the Upper Colorado. The remainder is for the San Juan River basin recovery program.

Revenue from power production also plays a major role in project funding. The Secretary of Energy, acting through the Western Area Power Administration is authorized to expend up to $17 million in Colorado River Storage power revenues for capital projects construction. There is also separate power revenue funding for operation and maintenance of the Recovery Program that adds up to over $6 million per year, of which $4 million goes to the Upper Colorado recovery program with $2 million for the San Juan.

The four participating states have collectively contributed $17 million, with over $9 million of that amount from Colorado. The Colorado legislature created a Native Species Conservation Trust Fund in 2000 through which an annual "Species Conservation Eligibility List," submitted by the Department of Natural Resources, is funded by a joint resolution of the State's General Assembly.

The obligation of funds by the Upper Colorado Basin water user's to determine how to best provide 10825 Water—and then provide it--is just one part of the immense undertaking to recover these endangered species. From 1989 through 2007, over $174,500,000 has been spent to recover the fish.

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