SOUTHEASTERN COLORADO
Water Conservancy District

"Your investment in water"

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT

PHASE 1 FEATURE VALUATION

FINAL
SEPTEMBER 17, 2020

Southeastern Colorado Water Conservancy District

PHASE 1 FEATURE VALUATION

SOUTHEASTERN COLORADO
Water Conservancy District
"Your investment in water"

9/17/2020

FINAL

TABLE OF CONTENTS

Table of Contents i
List of Appendices i
List of Figures ii
List of Tables iii
Abbreviations and Acronyms iv
Chapter 0 Executive Summary 1
Chapter 1 Introduction 3
Chapter 2 Fryingpan-Arkansas Project System Overview 5
2.1 West Slope Features 6
2.2 East Slope Features 12
Chapter 3 Feature Valuation Approach 14
3.1 Cost 14
3.2 Depreciation 14
3.3 Feature Condition 14
3.4 Use Value 14
3.5 U.S. Bureau of Reclamation 15
3.6 Selection of Feature Valuation Method 15
3.7 Replacement Cost Development 15
Chapter 4 Feature Valuation Results 18
4.1 West Slope Features 19
4.1.1 West Slope Dams 19
4.1.2 West Slope Diversion Structures 19
4.1.3 West Slope Tunnels 20
4.1.4 West Slope Conduits and Siphons 21
4.1.5 West Slope Control Facilities 21
4.2 East Slope Features 22
4.2.1 East Slope Dams 22
4.2.2 East Slope Diversion Structures 23
4.2.3 East Slope Conduits 23
4.2.4 East Slope Control Facilities 23
4.2.5 District and Enterprise Activity-Specific Features 23
Chapter 5 Conclusion and Future Efforts 25

LIST OF APPENDICES

Appendix A Feature Summary Sheets
Appendix B Expert Valuation Reports

LIST OF FIGURES

Figure 0-1: SECWCD Activities 1
Figure 0-2: SECWCD Phase 1 Feature Valuation (2020 dollars) 2
Figure 1-1: SECWCD Activities 3
Figure 2-1: Fryingpan-Arkansas Overview Map 5
Figure 2-2: Fryingpan-Arkansas Project, West Slope Schematic 7
Figure 2-3: Fryingpan-Arkansas Project, East Slope Schematic 12
Figure 4-1: SECWCD Phase 1 Feature Valuation (2020 dollars) 18
Figure 4-2: West Slope Features Valuation Breakdown 19
Figure 4-3: East Slope Features Valuation Breakdown 22

LIST OF TABLES

Table 2-1: West Slope Project Features Summary 6
Table 2-2: West Slope Project Feature Descriptions 7
Table 2-3: East Slope Project Features Summary 12
Table 2-4: East Slope Project Feature Descriptions 13
Table 3-1: Final Current Replacement (CRV) Cost Approach Summary 16
Table 4-1: West Slope Features Valuation Summary (2020 dollars) 19
Table 4-2: West Slope Diversion Structure Valuation Summary (2020 dollars) 20
Table 4-3: West Slope Tunnel Valuation Summary (2020 dollars) 20
Table 4-4: West Slope Conduit and Siphon Valuation Summary (2020 dollars) 21
Table 4-5: West Slope Control Facilities Valuation Summary (2020 dollars) 21
Table 4-6: East Slope Feature Valuation Summary (2020 dollars) 22
Table 4-7: East Slope Dam Valuation Summary (2020 dollars) 23
Table 4-8: East Slope Conduit Valuation Summary (2020 dollars) 23
Table 4-9: East Slope Control Facilities Valuation Summary (2020 dollars) 23
Table 4-10: SECWCD-Specific Features Valuation Summary (2020 dollars) 24

ABBREVIATIONS AND ACRONYMS

AACE	Association for the Advancement of Cost Engineering
CFS	cubic feet per second
CIP	Capital Improvement Plan
CRV	Current replacement value
ENR	Engineering News Record
Fry-Ark	Fryingpan-Arkansas
PIC	Providence Infrastructure Consultants
Reclamation	U.S. Bureau of Reclamation
SECWCD	Southeastern Colorado Water Conservancy District

CHAPTER 0 EXECUTIVE SUMMARY

This Phase 1 Feature Valuation (Study) was driven by the Southeastern Colorado Water Conservancy District's (SECWCD) 2019 adopted policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of District Fryingpan-Arkansas (Fry-Ark) Project, District Operations, and Enterprise features (also referred to as Assets). The SECWCD has two key Activities of fiscal responsibility, District and Enterprise, as shown below in Figure 0-1. These Activities rely on different features that the SECWCD is partially or solely responsible for. For the Study, these features were separated into District Fry Ark Project, District Operations, and Enterprise Activity features.

Figure 0-1: SECWCD Activities

The goals of this Study, including future Phases include:

Phase 1

- Prepare order-of-magnitude conceptual level replacement cost estimates for major features associated with the District Fry-Ark Project, District Operations, and Enterprise features.
- Complete feature valuations by "desktop" effort using feature information provided by SECWCD.

Future Phase(s)

- Complete more detailed reviews and condition assessments on major District Fry-Ark, District Operations, and Enterprise features.
- Develop a 20-year Capital Improvement plan (CIP) for major District Fry Ark, District Operations, and Enterprise features in support of financial planning efforts associated District and Enterprise Activities.

Working with SECWCD, Providence Infrastructure Consultants (PIC) developed and initiated the following Feature Valuation (Replacement Cost) approach:

1. Obtain original construction costs for each feature and escalate these costs to 2020 dollars using an industry accepted historical cost or market indices.
2. Have industry experts review and evaluate the initial escalated costs using existing feature information as well as their knowledge and experience; and provide critical feedback in refining the costs initially developed.
3. Apply a Class 5 Replacement Cost Range as defined by the Association for the Advancement of Cost Engineering (AACE) to the refined costs.
4. Using the refined Class 5 Replacement Cost range, develop a single replacement cost for each evaluated feature.

After performing detailed data searches and reviews, the Phase 1 feature valuation approach required modification due to:

- Historical construction cost data not being sufficiently defined and many sub-features such as roadways, support facilities, and restoration work not being broken down to allow for the development of accurate feature replacement costs.
- The absence of original construction costs.
- West Slope costs associated with the North and South Collections Systems not being broken down to the feature level. These two collection systems were built using funding packages that consolidated multiple features into single construction phases.

Based on the available data, a modified valuation approach was implemented that allowed certain features that lacked detailed historical information to be valued based on costs associated with recently completed projects that were similar in nature; and then adjusting these costs, as needed, based factors such as location, access, and limited construction seasons. The total consolidated Phase 1 Feature Valuation for the major features included in this Study is approximately $2.8 Billion in 2020 dollars.

Figure 0-2 below shows an overview of the valuation costs developed in this Study and how the costs breakdown based on feature type and location.

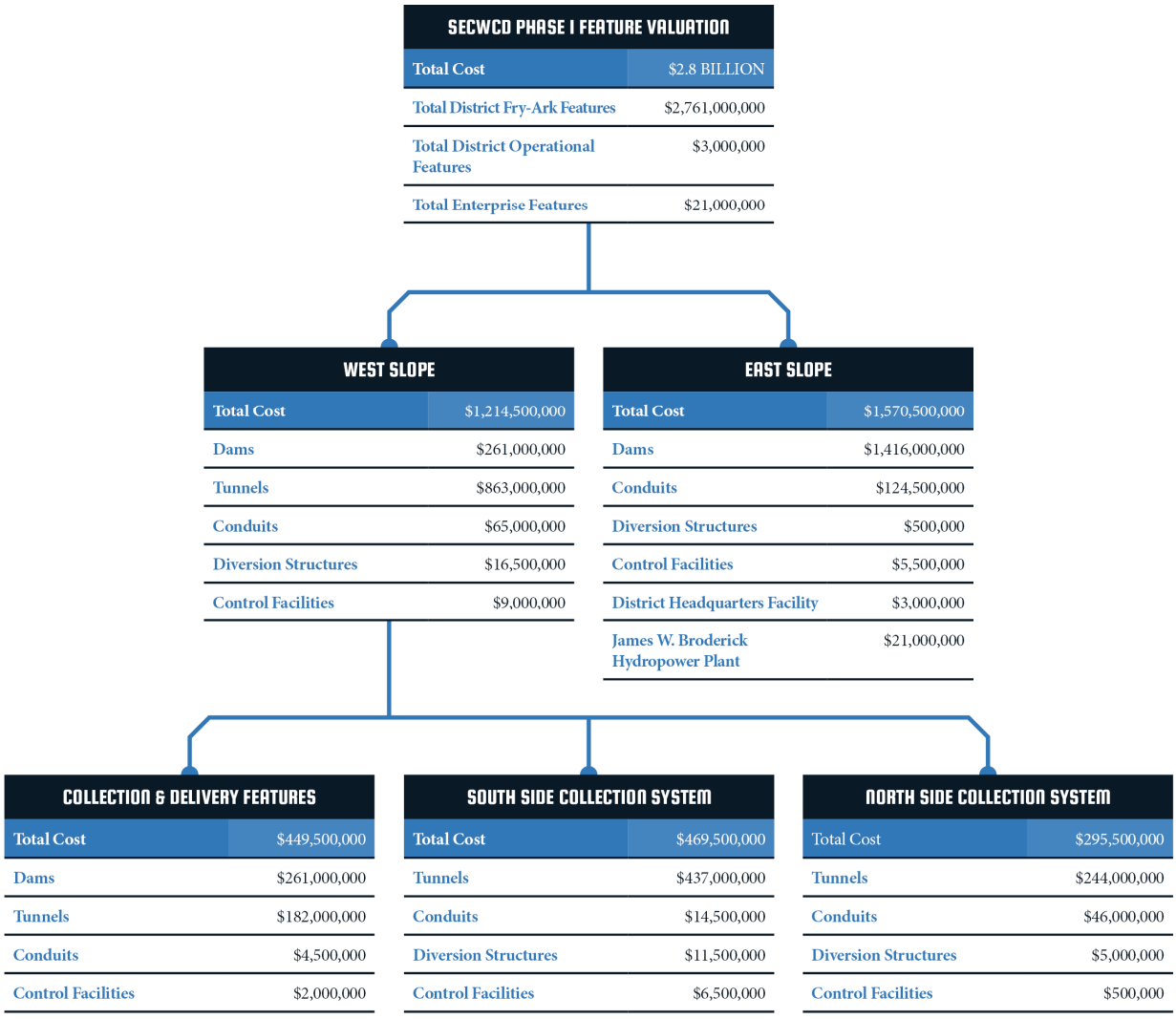


Figure 0-2: SECWCD Phase 1 Feature Valuation (2020 dollars)

CHAPTER 1 INTRODUCTION

The Fryingpan-Arkansas (Fry-Ark) Project (Project), constructed between 1964 and 1975, is a multipurpose trans-mountain, trans-basin water diversion and delivery project. The Fry-Ark Project allows for the annual diversion of up to 69,200 acre-feet of surplus water from Colorado's West Slope drainage basins of the Fryingpan River and Hunter Creek. Water diverted from the West Slope together with available water supplies in the East Slope's Arkansas River Basin, provides an average annual water supply of 80,400 acre-feet for both municipal/domestic use and supplemental irrigation. To facilitate the collection and delivery of water, the Fry-Ark Project consists of 5 jurisdictional dams, 18 river and creek diversion sites, over 27 miles of tunnels, nearly 11 miles of conduit, and several maintenance and control facilities. As a key participant and project sponsor of the Fry-Ark Project, the Southeast Colorado Water Conservancy District (SECWCD) is responsible for a portion of the repayment of the construction costs, annual operation, maintenance, and replacement of a majority of Project features (also referred to as Assets) within the Fry-Ark Project. In addition to participation in the Fry-Ark Project, the SECWCD is solely responsible for costs associated with several key features within the District Operations and Enterprise Activities.

In 2019, the SECWCD Board adopted a forward-looking policy that requires the establishment of reserves for the ongoing and future operations, maintenance, and replacement of features relied upon by the District and Enterprise Activities (Activities). These Activities and their subsets are broken out as shown in Figure 1-1 below.

Figure 1-1: SECWCD Activities

As such, the development of values associated with the Activities' various features is a first step in what is planned to be a multi-phase feature review, condition assessment, and feature/asset management program. The first phase, which is documented in this study report, involved the preparation of conceptual level cost estimates for major features associated with the various Activities. This first phase feature valuation was preformed using existing feature information and data provided by the SECWCD.

'Feature Valuation' is the process of assigning financial value to a feature and is a vital part of properly managing infrastructure assets by intergovernmental organizations, federal agencies, municipalities, and private industry. As a key participant in supporting the proper management of various major features, the SECWCD understands the importance of assigning values to these major features. To allow the SECWCD to proactively manage its resources, a data-driven valuation was needed so that responsible planning strategies can be developed for the preservation, maintenance, rehabilitation, and replacement of these major features.

At its foundation, feature valuation is part of a long-term management strategy. Valuation efforts along with subsequent study phase(s) will lead to the development of a 20-year Capital Improvement Plan (CIP). These current and future planning efforts are needed to support financial planning and allow the SECWCD to properly manage its fiscal responsibilities associated with aging District and Enterprise Activity features.

With fiscal responsibilities in mind, the SECWCD retained PIC, to evaluate a variety of valuation methodologies, develop an appropriate valuation strategy, and recommend order of magnitude costs associated with major

features associated with the various Activities. As documented in this Phase 1 valuation, the project team developed cost valuation results that are specific to each major feature and should be beneficial in helping the SECWCD gain initial order-of-magnitude feature replacement costs.

CHAPTER 2 FRYINGPAN-ARKANSAS PROJECT SYSTEM OVERVIEW

As part of the District Activity, the Fry-Ark Project is a complex and unique set of interconnected water delivery features that were constructed between 1964 and 1975. Operating together, these features are used to collect and transfer raw water from the Fryingpan River and Hunter Creek drainage basins across the Continental Divide and into the Arkansas River Basin. Once within the Arkansas Basin, a variety of conveyance, storage, and facility features are necessary for a variety municipal, agricultural, industrial, and environmental interests to beneficially use Fry-Ark Project water. Through a partnership with the U.S. Bureau of Reclamation (Reclamation), the SECWCD has joint financial responsibilities associated with owning, operating, and maintaining 4 jurisdictional dams, 18 river/creek diversion dams, over 27 miles of tunnels, and nearly 11 miles of conduits within the Project through the District Activity. In addition, the SECWCD solely owns and operates a 7.5-megawatt hydroelectric facility that is part of the Enterprise Activity along with the SECWCD Headquarters Facility that is part of the District Operations Activity. The Project features that fall under SECWCD's responsibilities are located on the west and east slopes of the Continental Divide. A summary of these features is concisely summarized in this chapter. Figure 2-1 provides an overview the Fry-Ark Project.

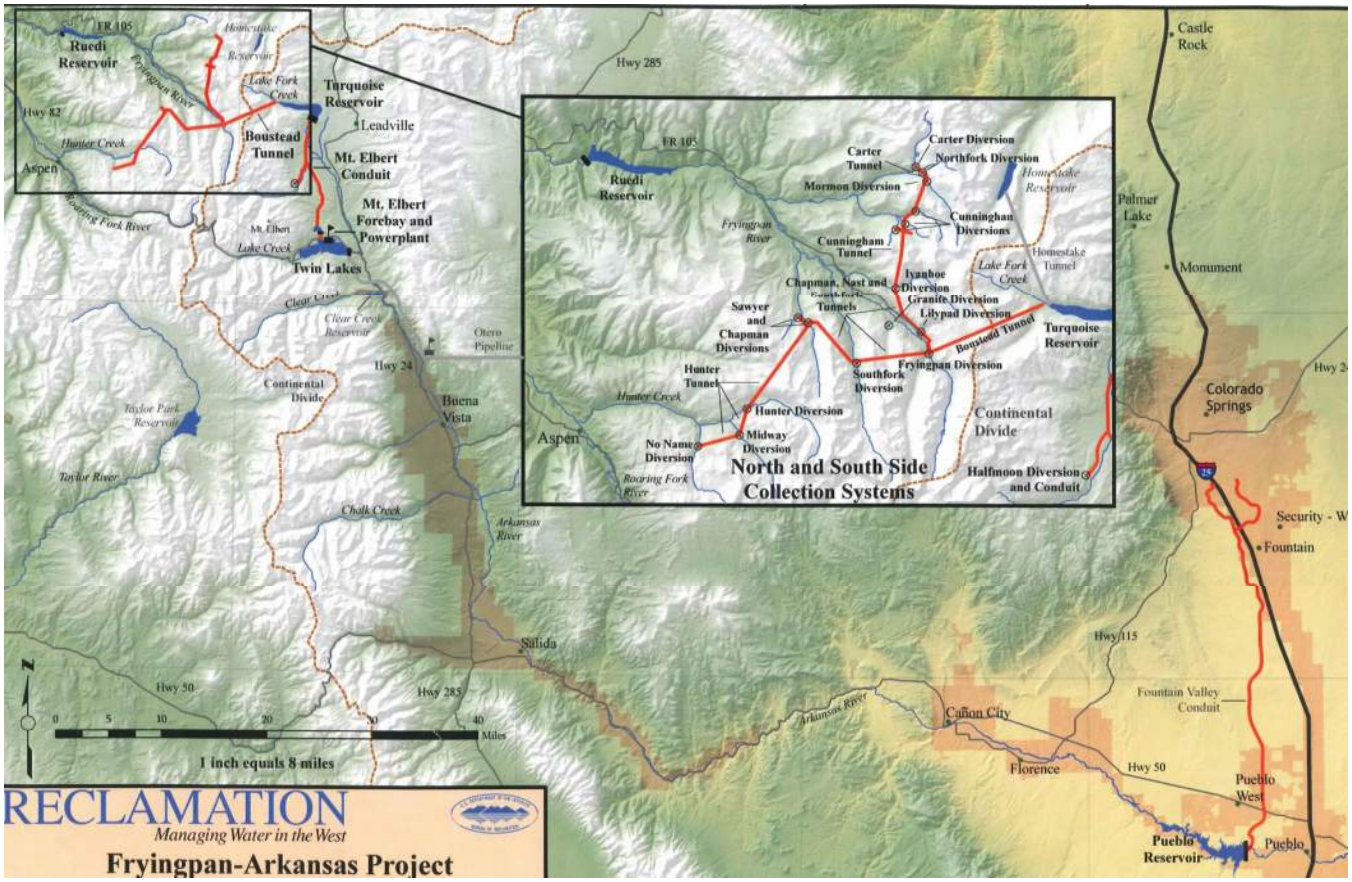


Figure 2-1: Fryingpan-Arkansas Overview Map

Source: Bureau of Reclamation

2.1 West Slope Features

All features evaluated on the West Slope are Fry-Ark features under the District Fry-Ark Activity. Most of the Fry-Ark Project's West Slope features are associated with the North Side and South Side Collection Systems. The West Slope project features include one jurisdictional dam, 17 diversion structures, 9 tunnels, 17 conduits with three being siphons, and three control facilities. Table 2-1 provides a list of the various West Slope features. Figure 2-2 provides general schematic overviews of the Fry-Ark Project's West Slope Systems. Table 2-2 provides concise descriptions of the West Slope Features.

Table 2-1: West Slope Project Features Summary

Dams	Diversion Structures[1]	Tunnels	Conduits	Facilities
Ruedi	Carter Creek NS	Carter NS	Carter Feeder NS	Meredith Control WS
	North Fork (Savage Lake) NS	Mormon NS	Mormon Feeder NS	Mormon Control NS
	Mormon Creek NS	Cunningham NS	Mormon Conduit NS	Chapman Control SS
	North Cunningham Creek NS	Granite Adit NS	North Cunningham Feeder NS	
	Middle Cunningham Creek NS	Nast NS	Middle Cunningham Feeder NS	
	South Cunningham Creek NS	Hunter SS	South Cunningham Conduit NS	
	Ivanhoe Creek NS	Chapman SS	Cunningham Conduit NS	
	Granite Creek NS	South Fork SS	Ivanhoe Diversion NS	
	Lily Pad Creek NS	Boustead WS	Ivanhoe Creek Crossing NS	
	No Name Creek NS		Granite Siphon NS	
	Midway Creek NS		Fryingpan Valley Conduit NS	
	Hunter Creek SS		Sawyer Conduit SS	
	Sawyer Creek SS		Chapman Feeder Conduit SS	
	Chapman Creek SS		South Fork Feeder Conduit SS	
	South Fork Creek SS		South Fork Siphon SS	
	Fryingpan River WS		Fryingpan River Siphon SS	
	Fryingpan Valley Control Structure WS		Fryingpan Feeder Conduit WS	

[1] *NS – North Side Collection System Feature / SS – South Side Collection Feature / WS – West Slope Collection and Delivery Feature*

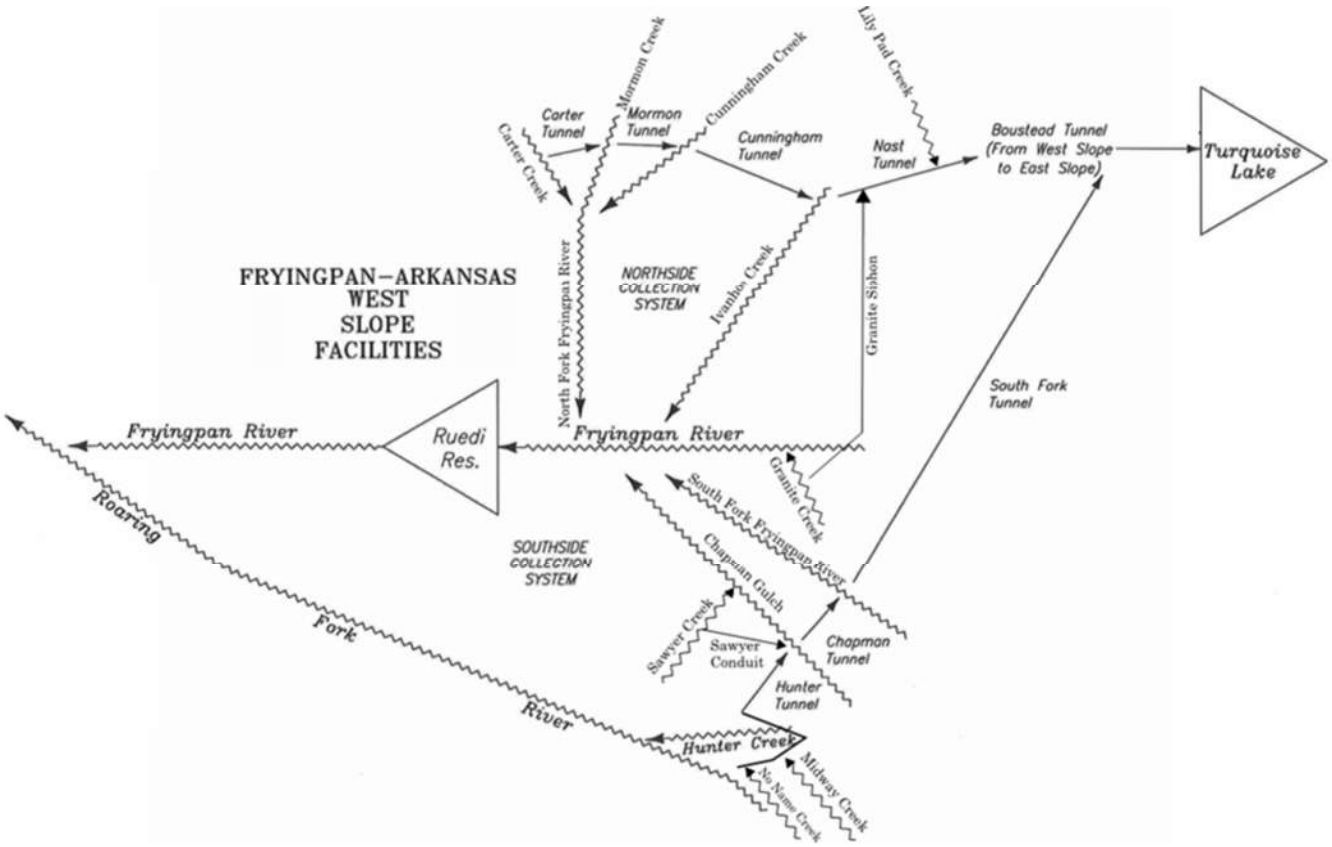


Figure 2-2: Fryingpan-Arkansas Project, West Slope Schematic

Table 2-2: West Slope Project Feature Descriptions

Feature	Description
Feature Type: Dams	
Ruedi	This dam is a 285-foot tall rock and earth-fill dam with a crest elevation of 7,788 feet and a crest length of 1042 feet. The dam includes an ogee crest spillway structure with a chute section, a stilling basin, and a bridge over the spillway. The dam also includes an 1,810 CFS outlet works, a 600 CFS auxiliary outlet works, and a 4,000 CFS concrete bypass chute and stilling basin to bypass Rocky Fork Creek flows past the dam spillway and auxiliary outlet works discharge.
Feature Type: Diversion Structures	
Carter Creek	This diversion structure consists of an inlet structure, a trash-rack structure, a diversion conduit with measuring weir, a 48-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluice-way, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 100 CFS into the Carter Tunnel. Access during the diversion season is by helicopter, horse, or foot. Access in the off-season can be through Carter Tunnel.
North Fork (Savage Lake)	This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring diversion flows, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 24- by 24-inch slide gate, and an equipment vault. The sluiceway also serves as the stream bypass. The diversion diverts up to 30 CFS into Carter Tunnel via the North Fork Intake. Access to the North Fork Diversion site is by foot from the outlet of Carter Tunnel

Feature	Description
Mormon Creek	This diversion structure consists of an inlet structure, a trash rack structure, a diversion conduit with measuring weir, a 36-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluiceway, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 60 CFS into the Mormon Tunnel. Access is by road.
North Cunningham Creek	This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring diversion flows, a 24-inch-diameter feeder conduit, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 30- by 30-inch slide gate, and an equipment vault. The sluiceway serves as the creek bypass. Through the feeder conduit, the diversion diverts up to 30 CFS into the Mormon Tunnel Outlet Structure. Access is by road.
Middle Cunningham Creek	This diversion structure consists of an inlet structure, a trash rack structure, a diversion conduit with measuring weir, a 30-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluiceway, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 50 CFS into the Cunningham Tunnel. Access is by road.
South Cunningham Creek	This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring flows, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 24- by 24-inch slide gate, and an equipment vault. The diversion diverts up to 20 CFS of water through South Cunningham Conduit into Middle Cunningham Creek upstream from Middle Cunningham Creek Diversion. Access is by road.
Ivanhoe Creek	This diversion structure consists of a concrete ogee gravity spillway, retaining walls, a head gate structure with 48- by 48-inch slide gates, a trash rack, a 4-foot wide sluiceway with 36- by 36-inch slide gate, a 15-inch diameter bypass pipe, a Parshall Flume, and an 84-inch diameter feeder conduit. The feeder conduit conveys water into the Ivanhoe Creek Crossing which connects Cunningham and Nast Tunnels. Access is by road.
Granite Creek	This diversion consists of a drop inlet with trash rack, a 36- by 36-inch diversion gate, a sluice pipe with an 18- by 18-inch slide gate, a cutoff wall, and an equipment vault. The diversion diverts up to 50 CFS of water through Granite Creek Siphon into the Siphon Outlet Structure, Granite Adit, and Nast Tunnel. Access to the diversion is by horse or foot along the siphon alignment or along trails.
Lily Pad Creek	This diversion structure is an interceptor ditch with the invert and downhill dike constructed of sacked concrete. The dike acts as a spillway crest when the head gate and sluice gate are closed. The interceptor ditch conveys water to the inlet structure, which consists of a transition, sluiceway, screening structure, measuring weir, and waste pipe. The diversion diverts up to 20 CFS into the Nast Tunnel via an intake shaft.
No Name Creek	This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.
Midway Creek	This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the

Feature	Description
	winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.
Hunter Creek	This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.
Sawyer Creek	This diversion structure works to divert up to 30 CFS of water from Sawyer Creek into the Sawyer Creek Conduit. The diversion is a concrete drop inlet structure with metal trash racks, an 18-inch-inside-diameter, sluiceway pipe, and a connection to the 27-inch-inside-diameter Sawyer Creek Conduit. Access is by the Hunter Tunnel access road.
Chapman Creek	This diversion structure has a concrete gravity spillway with retaining walls in combination with an earth embankment and a 5-foot sluiceway. Elements include a trash rack, tapered intake structure with ogee inlet leading to a Parshall flume section and the Chapman Feeder Conduit. Access is reasonable with an access road leading to the structure.
South Fork	This diversion structure spillway is a concrete gravity spillway with retaining walls in combination with earth embankment. The sluiceway is a 5-foot-square cast iron slide gate with a pedestal lift and 5-foot-wide overflow section adjacent to the gate structure. The headworks is comprised of four 3.5-foot-square cast iron slide gates with pedestal lifts located upstream of a tapered intake structure with ogee inlet leading to a Parshall flume section and the South Fork Feeder Conduit. Access is reasonable with an access road leading to the structure.
Fryingpan River	This diversion structure diverts Fryingpan River flow and has a concrete gravity spillway with retaining walls in combination with earth embankment. The sluiceway consists of a 5- by 6-foot cast iron slide gate with pedestal lift, and a 5-foot overflow section adjacent to the gate. The headworks consists of four 5- by 4-foot cast iron slide gates with pedestal lifts that are located upstream of a tapered intake structure with ogee inlet leading to a Parshall flume section and the Fryingpan Feeder Conduit. Access is reasonable with an access road leading to the structure.
Fryingpan Valley Control Structure	This diversion structure is at the inlet portal of the Boustead tunnel and regulates flow entering the tunnel. It is a concrete junction structure which contains two overflow weirs, one for the North and South collection systems, a baffled apron waste way drop structure to return the excess flows to the Fryingpan River, a connection and access hatchway structure to receive the flows from the Fryingpan Feeder Conduit, and a control structure housing a 10.5- by 12-foot radial gate. The entire structure is underground. Access is reasonable with an access road leading to the structure.
Feature Type: Tunnels	
Carter	This tunnel is 0.54 miles long with an 8-foot (lined) to 9'-10" (unlined) horseshoe cross section and has a 130 CFS capacity. The tunnel is the most upstream North Side Collection System tunnel. Water is diverted into the tunnel by the Carter Diversion Dam and the 300-foot, 42-inch Carter Feeder Conduit Tunnel as well as the North Fork Diversion Dam and the 280-foot-long North Fork Feeder Conduit and North Fork Intake. Water from Carter Tunnel flows to the Mormon Conduit. Inlet and outlet can be accessed by vehicle.

Feature	Description
Mormon	This tunnel is 1.4 miles long with an 8-foot (lined) to 9'-10" (unlined) horseshoe cross section and has a 190 CFS capacity. Water into the tunnel is a combination of flows from the Mormon Conduit and the Mormon Creek Diversion. Water conveyed through the Mormon Tunnel flows to the Cunningham Tunnel. Inlet and outlet can be accessed by vehicle.
Cunningham	The North, Middle, and South Cunningham diversion structures connect to the Cunningham Conduit which connects to the Cunningham Tunnel. The tunnel is 2.86 miles long and has a horseshoe shape of two sizes, 8.75 and 7.5 feet, and a capacity of 270 cubic feet per second. Water from the tunnel flows into the Nast Tunnel. The tunnel outlet can be accessed by vehicle.
Nast	This tunnel is 3 miles long, with a circular-shaped section with two diameters: 7.67 and 9.33 feet. The capacity of the tunnel is 360 cubic feet per second. Ivanhoe Diversion Dam diverts water from Ivanhoe Creek and the Cunningham Tunnel into the inlet of Nast Tunnel. The Granite Diversion Dam diverts water through the Granite Siphon to the Granite Adit, which drops the flow into the Nast Tunnel. The Lily Pad Diversion Dam drops flow into Nast Tunnel. Flow from the tunnel is conveyed into the Fryingpan Valley Conduit. The tunnel outlet can be accessed by vehicle.
Granite Adit	This tunnel / adit is a 700-foot-long, unlined horseshoe shaped tunnel that transitions to a 9'-4" concrete lined circular section and connects the Granite Siphon and the Nast Tunnel. The adit's capacity is 50 CFS.
Hunter[2]	This tunnel is 7.7 miles long, has three reaches, and conveys flows diverted at No Name, Midway, and Hunter Creeks to Chapman Gulch at the Chapman Diversion Dam. The tunnel capacity ranges from 90 CFS to 270 CFS. The tunnel is semi-horseshoe-shaped with two sizes: 8.5 (unlined) and 7.33 feet (lined). The tunnel outlet can be accessed by vehicle.
Chapman	This tunnel is a 2.8-mile-long, 7-foot horseshoe-shaped structure, with a capacity of 300 cubic feet per second. Water conveyed in the tunnel is diverted at the Sawyer Diversion dam and delivered to Chapman Gulch using the Sawyer Conduit where it is combined with flows in Chapman Gulch and diverted to the tunnel using the Chapman Diversion and Chapman Feeder Conduit.
South Fork	This tunnel is 3.1-miles long, 8-foot horseshoe-shaped, and has a capacity of 450 CFS. Water conveyed in the tunnel is diverted from the South Fork Diversion Dam to the South Fork Siphon using the South Fork Feeder Conduit where it combines with flow in the siphon and carried to the inlet of the tunnel.
Boustead	This tunnel is 5.4-miles long, 10.5-foot horseshoe-shaped, and has a capacity of 945 CFS. The tunnel conveys all West Slope collected water under the Continental Divide and into Turquoise Lake for further conveyance by East Slope features.
Feature Type: Conduits / Siphons	
Carter Feeder	This conduit is a 300-foot, 48-inch conduit used to convey up to 100 CFS of water from the Carter Diversion Dam to the inlet of the Carter Tunnel.
Mormon Feeder	This conduit is a 375-foot, 36-inch precast concrete pressure pipe used to convey water from the Mormon Creek Diversion Dam to an inlet portal on the Mormon Tunnel. The feeder conduit can convey up to 60 CFS to the inlet portal.
Mormon Conduit	This conduit is a 1,785-foot, 45-inch cement mortar lined and coated steel pipeline that conveys water from the from Carter Tunnel to the inlet of the Mormon Tunnel. The conduit capacity is 130 CFS.

[2] *The Hunter Tunnel is comprised of 3 reaches*

Feature	Description
North Cunningham Feeder	This conduit is a 350-foot-long, 24-inch conduit that conveys water from the North Cunningham Creek Diversion to the outlet structure of the Mormon Tunnel. The feeder conduit capacity is 30 CFS.
Middle Cunningham Feeder	This conduit is a 183-foot, 30-inch conduit that conveys water from the Middle Cunningham Creek Diversion to the inlet structure on the Cunningham Tunnel. The feeder conduit can convey up to 50 CFS to the inlet structure.
South Cunningham Conduit	This conduit is a 3,650-foot, 24-, 21-, and 18-inch conduit that conveys water from the South Cunningham Creek Diversion to Middle Cunningham Creek where flow is then diverted by the Middle Cunningham Creek Diversion. The feeder conduit can convey up to 20 CFS.
Cunningham Conduit	This conduit is a 4,035-foot, 60-inch cement lined and coated welded steel pipeline that connects the Mormon and Cunningham tunnels and has a capacity of 220 CFS of water.
Ivanhoe Diversion	This conduit is a 246-foot, 84-inch precast concrete pressure pipe with Parshall Flume section that conveys flows from the Ivanhoe Diversion Dam to the Ivanhoe Creek Crossing Conduit. The feeder conduit conveys up to 150 CFS.
Ivanhoe Creek Crossing	This conduit is a 420-foot, 84-inch precast concrete pressure pipe that conveys water from the Cunningham Tunnel and the Ivanhoe Diversion Conduit to the inlet of the Nast Tunnel. The conduit capacity is 360 CFS.
Granite Siphon	This siphon is about 4,000 feet long with 400 feet of 36-inch-inside-diameter pipe, and the remainder being 30-inch-inside-diameter. The siphon is steel pipe with field-welded lap joints. The interior of the pipe is lined with cement-mortar and the exterior is coated with a coal-tar enamel system. The siphon conveys flows from the Granite Creek Diversion to the Siphon Outlet Structure, Granite Adit and the Nast Tunnel. The siphon can convey up to 50 CFS.
Fryingpan Valley Conduit	This conduit is a 2,430-foot, 84-inch precast concrete pipe that connects the Nast Tunnel to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The conduit has a capacity of 360 CFS.
Sawyer Conduit	This conduit is a 3,098-foot, 27" precast concrete pressure pipe that conveys up to 30 CFS of water from the Sawyer Creek Diversion Structure to Chapman Gulch upstream of the Chapman Gulch Diversion Structure.
Chapman Feeder Conduit	This conduit is a 265-foot, 11- by 7-foot reinforced concrete box that conveys water from Chapman Diversion to the Chapman Tunnel. The feeder conduit capacity is 300 CFS and includes a Parshall Flume.
South Fork Feeder Conduit	This conduit is a 395-foot, 9.5- by 8-foot reinforced concrete box that conveys water from the South Fork Diversion Dam to an inlet located on the South Fork Siphon. The feeder conduit can convey 215 to 250 CFS.
South Fork Siphon	This siphon is a 711-foot, 75-inch diameter concrete siphon that connects the Chapman and South Fork tunnels. The siphon conveys flows from the Chapman Tunnel as well as flows from the South Fork Feeder Conduit. The siphon can convey up to 300 CFS.
Fryingpan River Siphon	This siphon is a 479-foot, 90-inch diameter concrete siphon that connects the South Fork Tunnel to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The siphon can convey up to 450 CFS.
Fryingpan Feeder Conduit	This conduit is a 400-foot, 12- by 12.5-foot reinforced concrete box that conveys flows from the Fryingpan River Diversion to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The feeder conduit has a capacity of 400 CFS.
Feature Type: Facilities	
Meredith Office / Maintenance Shop	The Meredith control facility is a 2,600 SF office / maintenance shop located on the east side of Ruedi Reservoir.
Mormon Control Building	This control facility is a 450 SF low-profile concrete operations building that houses the control and monitoring equipment for Carter, Mormon, Cunningham, and Nast Tunnel

Feature	Description
	Diversion facilities and is located between the Carter and Mormon Tunnels. The control facilities enclosed in the building control and monitor the gates at the Carter, North Fork, Mormon, North Cunningham, Middle Cunningham, South Cunningham, Ivanhoe, Lily Pad, and Fryingpan Diversion Structures along with the high-water surface probes in the Mormon and Cunningham Tunnels.
Chapman Control Building	This control facility is a 500 SF low-profile concrete operations building that houses the control and monitoring equipment for the Hunter and Chapman Tunnel diversion facilities and is located about 800 feet north of the Hunter Tunnel outlet portal. The control facilities enclosed in the building control and monitor the gates at the Hunter, Midway, No Name, Sawyer, and Chapman Diversion Structures along with the high-water surface probes in Hunter and Chapman Tunnels.

2.2 East Slope Features

The East Slope features evaluated include District Fry-Ark, District Operations, and Enterprise Activity features. The East Slope features include three jurisdictional dams, one river/creek diversion dam, two conduits, two control facilities, one hydropower plant, and the SECWCD Headquarters. Table 2-3 provides a list of the various East Slope features. Figure 2-3 provides general schematic overviews of the Fry-Ark Project's West System. Table 2-4 provides concise descriptions of the East Slope Features.

Table 2-3: East Slope Project Features Summary

Dams	Diversion Structures	Conduits	Facilities
Sugarloaf	Halfmoon Creek	Halfmoon Feeder	Sugarloaf Control
Twin Lakes		Mount Elbert	Twin Lakes Control
Pueblo			Broderick Hydropower Plant[3]
			SECWCD Headquarters[4]

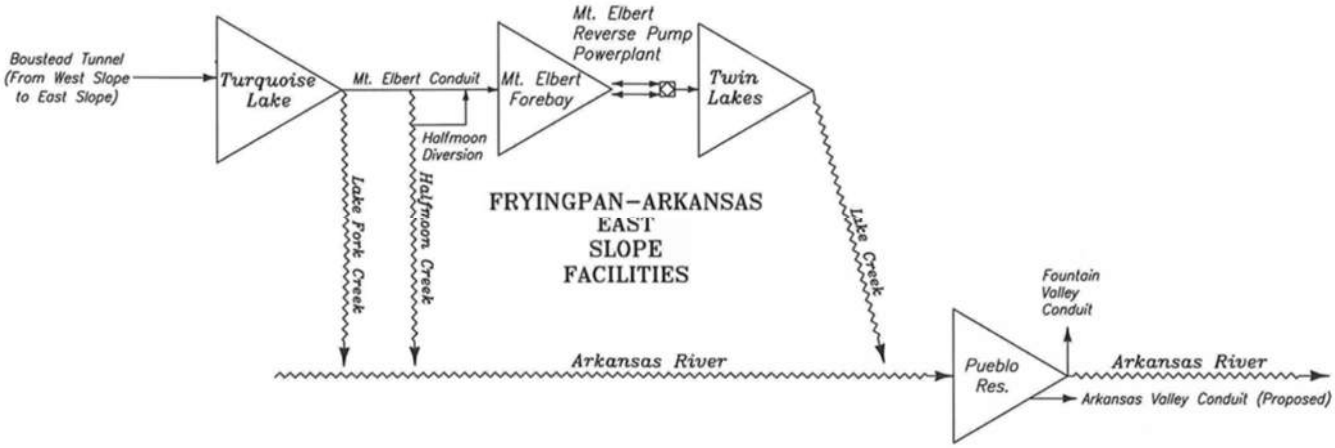


Figure 2-3: Fryingpan-Arkansas Project, East Slope Schematic

[3] *Enterprise Activity feature.*
[4] *District Operations Activity feature.*

Table 2-4: East Slope Project Feature Descriptions

Feature	Description
Feature Type: Dams	
Sugarloaf	This dam is a 135' tall zoned earth fill embankment dam with a crest elevation of 9,879' and a crest length of 2,020 feet. The spillway has a capacity of 2,920 CFS and consists of a morning-glory intake structure, a 16.5-foot-diameter concrete conduit, a chute, and a stilling basin. The outlet works can release 1,120 CFS to the Lake Fork of the Arkansas River and 370 CFS to the Mt. Elbert Conduit.
Twin Lakes	This dam is a 55' tall zoned earth fill embankment dam with a crest elevation of 9,210' and a crest length of 3,150 feet. The spillway, located on the left abutment, has a capacity of 1,400 CFS and consists of a morning-glory intake structure, a 12-foot-diameter concrete conduit, and a stilling basin. After the stilling basin, flows are conveyed to Lake Creek. The outlet works, located on the right abutment can release 3,465 CFS to the Lake Creek.
Pueblo	This dam is the terminal storage feature for the Fryingpan-Arkansas Project and is a concrete and earth-fill dam with massive head buttress-type spillway structure with a length of approximately 10,230 feet. The concrete section is 1,750 feet wide with a maximum structural height of 250 feet. The spillway has a crest width of 550 feet and was designed for a maximum spill discharge of 191,500 CFS. The dam has five separate outlet works. The River outlet works with a capacity of 600 CFS, the Spillway outlet works with a combined capacity of 4,400 CFS, the Fish Hatchery outlet works which conveys water about 2,000 feet to a fish hatchery, the South outlet works which contains three-level intake line, and the Bessemer Ditch outlet works located in the right earth embankment which provides water for irrigation.
Feature Type: Diversion Structures	
Halfmoon Creek	This diversion structure consists of a concrete drop inlet structure with metal trash racks, a 24-inch-inside-diameter sluiceway pipe, a 60-inch-inside-diameter feeder conduit, and a concrete electrical equipment house with a floatwell. The structure can divert up to 150 CFS. Access is by vehicle along Halfmoon Road (CR 11).
Feature Type: Conduits	
Halfmoon Feeder	This conduit is a 3,202-foot, 60-inch pipe that conveys flow from the Halfmoon Creek Diversion to an inlet on the Mount Elbert Conduit. The conduit capacity is 150 CFS.
Mount Elbert	This conduit is a 10.5-mile-long, 90-inch-diameter pipe that conveys water from the Sugarloaf Dam outlet works to the Mt. Elbert Forebay. The Halfmoon Diversion Dam intercept flows from Halfmoon Creek and diverts water into the Mt. Elbert Conduit. The conduit's capacity is 350 CFS.
Feature Type: Facilities	
Sugarloaf Office / Maintenance Shop	This facility is a 2,800 SF office / maintenance shop located at Turquoise Reservoir.
Twin Lakes Office / Maintenance Shop	This facility is a 4,800 SF office / maintenance shop located at Twin Lakes.
Broderick Hydropower Plant[5]	The 7.5-MW Broderick Hydropower Plant was commissioned in 2019. The plant derives power from flows leaving Pueblo Dam's north outlet works. Three turbines and two generators can be used individually or in combination to take advantage of releases from Pueblo Dam ranging from 35 to 810 CFS. Power generated is provided to the City of Fountain and Fort Carson Army Base through Colorado Springs Utilities.
SECWCD Headquarters[6]	The 8,300 SF SECWCD Headquarters is located east of Pueblo and south of Pueblo Memorial Airport. The SECWCD Headquarters is home to the management and operations of the SECWCD.

[5] *Part of the Enterprise Activity.*
[6] *Part of the District Operations Activity.*

CHAPTER 3 FEATURE VALUATION APPROACH

Implementing a feature valuation approach starts with defining what constitutes a feature value. It can be difficult to develop monetary values of infrastructure because there is neither a market mechanism that determines its price and components cannot be easily liquidated. However, there are several factors that can be part of developing a feature's value, including; cost of construction, depreciation, condition, and use value or economic importance. Because of the various value factors, there is no unifying standard that encompasses all these aspects of feature value, making both the upper and lower bounds of what a feature is worth difficult to determine.

Specific goals need to be established when approaching feature valuation, and the strategy adopted must be relevant to achieving these goals. Several potential methods were considered in developing feature valuations for this project and are discussed further in the sections below.

3.1 Cost

The cost of construction or replacement cost is a baseline metric for most of valuation methods. In most approaches, this is the full value of a newly constructed, restored, or acquired asset before depreciation. As a popular and simple valuation method, the feature value is simply equal to its replacement value. Cost, or estimated cost, may be the easiest and most understandable data to obtain, unfortunately problems can arise when a feature is considered obsolete or an asset contains a high degree of non-comparable characteristics such as size, material, design, location, etc.

3.2 Depreciation

Depreciation of feature value occurs as the feature is consumed or ages. To incorporate depreciation into feature valuation, it requires assumptions to be made about how depreciation occurs over time. Common methods of depreciation include linear (straight-line) depreciation and user cost. Linear depreciation assumes that the asset depreciates at a constant rate over time. User cost assumes that the depreciation of the asset depends on the cost of upkeep (i.e. capitalization). Depreciation according to various curves other than straight-line are also commonly used. These various depreciation curves assume that the asset does not depreciate at the same rate over its lifetime, typically a feature depreciates slower in early years and faster towards the end of its useful life.

3.3 Feature Condition

Feature condition is used as an engineering alternative or a complement to depreciation. This approach is based on the feature value being discounted based on current condition compared to optimal condition. Alternatively, discount of the feature value can also be determined by the cost of restoring it to optimal condition. While the feature condition approach requires less assumptions than the depreciation approach it does requires a reasonable understanding of how feature condition changes over time with and without ongoing maintenance and repair.

3.4 Use Value

Use value, or economic importance, is a valuation method that measures the intangible benefits of a feature. While this is a sophisticated approach, it can provide compelling information associated feature importance, potential risks, and optimally allocating value between high-use and low-use features. However, this approach is much more difficult and expensive to implement as it requires data that may not be readily available, combined with a specialized skillset to produce and interpret results.

3.5 U.S. Bureau of Reclamation

Reclamation's approach to feature valuation was also considered. Reclamation uses a cost-based method for feature / asset valuation referred to as Current Replacement Value (CRV) which is similar to the Cost approach noted in section 3.1 above. This CRV method values the feature at the cost to completely rebuild or reconstruct a feature in current dollars. While the CRV approach does not account for either depreciation or use value, it does work well associated with features that Reclamation manages, which are assets that are routinely maintained and not allowed to fall below a very high standard of condition. The same high standard that applies to the Fry-Ark Project features.

3.6 Selection of Feature Valuation Method

With the understanding the valuation approaches listed above are not mutually exclusive and often complementary; the type of method to adopt is often heavily dependent on data availability and quality; and the intended use of estimated feature values. Each of the valuation approaches above were evaluated. Based on the type of features to be valued, the high level of maintenance performed by Reclamation, available data, and overall critical nature of the features in conjunction with the goals of SECWCD (listed below), it was determined the best overall valuation approach for the evaluated features was the CRV approach used by Reclamation described in section 3.5 above.

- Prepare order-of-magnitude conceptual level replacement cost estimates for select District and Enterprise Activity features.
- SECWCD's 2019 adopted policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of District and Enterprise Activity features.
- Complete Phase 1 using existing feature information provided by SECWCD with no field investigations being performed.

3.7 Replacement Cost Development

Implementing the CRV approach was initially focused on the following process using a "desktop" method that relies on existing and available data with no field visits or current feature conditions:

1. Obtaining original construction costs from SECWCD for each feature and escalating these costs to a current dollar value using one of the following industry accepted market indices: Engineering News Record's (ENR) Indices (Construction, Building, Materials, Labor); RS Means Heavy Construction; U.S. Bureau of Reclamation Construction Cost Trends; or U.S. Army Corps of Engineer Civil Works Construction. After a thorough evaluation of available indices, the ENR Construction index was adopted as the preferred index for the valuation process.

2. Allowing engineering and construction industry area experts to evaluate the initial escalated costs using various factors and their knowledge and experience to perform a review of the initial escalated costs. Information that the area experts used in their evaluation included: actual costs on more recent similar projects; recent materials cost trends; construction environment (high altitude, limited construction seasons, etc.); and professional experience working on similarly sized and complex projects.

3. Leveraging the feedback from area experts to develop Class 5 Replacement Costs as defined by the Association for the Advancement of Cost Engineering (AACE). An AACE Class 5 estimate is defined by:

- Level of Project Definition: 0 to 2%
- Usage: Concept Screening
- Methodology: Capacity Factored, Parametric Models, Judgement, or Analogy.
- Accuracy: -50% to -20% (Low), +30 to +100% (High)

4. Using the cost ranges developed in the prior steps to recommend feature replacement costs.

The process described above was initiated to develop the recommended feature replacement cost for the Study features. However, after an exhaustive existing data review, search, and coordination effort with SECWCD staff; modifications to the overall approach were required. A modified approach was needed as the granularity of available information related to Fry-Ark Project feature types, locations, and construction costs presented unanticipated challenges and was not adequate for the initial valuation approach. Generally, the following issues with the existing data were discovered for a variety of features:

- Fry-Ark Project construction cost data was not sufficiently defined and many sub-features such as roadways, support facilities, and restoration were not broken down to allow for the development of accurate feature replacement costs.
- In many instances, the original Fry-Ark Project construction costs were not available.
- West Slope costs associated with the Fry-Ark Project's North and South Collections Systems not being broken down to the feature level. These two collection systems were built using funding packages that consolidated multiple features into single construction phases.

Based on the challenges associated with using the available construction cost data, modification valuation approach was necessary. Table 3-1 provides a summary, by general feature type, of the final approach used to develop the CRV costs.

Table 3-1: Final Current Replacement (CRV) Cost Approach Summary

Feature Category	General Description(s)	Replacement Cost Approach(s)
Dams	Four dams total, one on the West slope and three on the East Slope	Original Construction Cost data was determined to be adequate to develop the escalated costs which were then provided to the area expert(s) for review.
Tunnels	Nine tunnels total, all listed on the West Slope. All tunnels are in the North or South Collection Systems except for the Boustead Tunnel which crosses the Continental Divide.	The only available construction cost specific to tunnel construction was for the Boustead Tunnel. Based on the lack of additional tunnel construction data, the remainder of the Fry-Ark tunnel costs were developed from unit costs derived from other tunnels recently constructed in the Rocky Mountain region. These initial tunnel costs were then provided to tunnel expert(s) for review.
Conduits	19 total conduits with 17 on the West Slope and two on the East Slope. All conduits in the West Slope are in the North or South Collection Systems except for the Fryingpan Feeder Conduit which conveys flows directly to the inlet of the Fryingpan Valley Control Structure. The two East Slope conduits are the Mt. Elbert and Halfmoon Feeder Conduits.	The only available construction cost specific to conduit construction was for the Mt. Elbert Conduit. Based on the lack of additional Fry-Ark conduit construction data, the remainder of the conduit costs were developed using unit costs derived from other conduits built in the Rocky Mountain region. These initial conduit costs were provided to the area expert(s) for review.

Feature Category	General Description(s)	Replacement Cost Approach(s)
Diversion Structures	18 total diversion structures with 17 on the West Slope and one on the East Slope. All West Slope diversion structures are in the North or South Collection systems except the Fryingpan River Diversion Structure that diverts water directly to the Fryingpan Valley Control Structure. The one East Slope diversion is the Halfmoon Diversion Dam.	The only original construction cost specific to any of the diversion structures available was for the Halfmoon Diversion Dam and this cost including the Halfmoon Feeder Conduit. Based on the lack of diversion only construction costs, the Fry-Ark Diversion Structure costs were developed using unit costs derived from other diversion structures recently built in the Rocky Mountains. These initial diversion structure costs were provided to the area expert(s) for review.
Control Facilities	Five Control facilities with three on the West Slope and two on the East Slope. These facilities include both control buildings and general maintenance and office space.	There were no original construction costs available for these control facility features. As such reasonable per-square-foot unit costs plus any other significant cost additions were used to develop facility feature costs. No expert review was performed on these features.
SECWCD Headquarters	One feature.	Original construction costs were available for SECWCD Headquarters feature and was used to develop an escalated feature cost. No expert review was performed on this feature.
Broderick Hydropower Plant	One feature.	Accurate and recent original construction costs were available for the hydropower plant and were used to develop an escalated feature cost. No expert review was performed on this feature.

CHAPTER 4 FEATURE VALUATION RESULTS

The recommended replacement costs, as developed using the approach described in Chapter 3, results in a total feature valuation of approximately $2.8 billion in 2020 dollars for the major District Fry-Ark, District Operations, and Enterprise Activity Project features that were included in this Phase 1 study.

Figure 4-1 provides a general breakdown of the features evaluated and the cost values developed.

SECWCD PHASE I FEATURE VALUATION	
Total Cost	$2.8 BILLION
Total District Fry-Ark Features	$2,761,000,000
Total District Operational Features	$3,000,000
Total Enterprise Features	$21,000,000

WEST SLOPE	
Total Cost	$1,214,500,000
Dams	$261,000,000
Tunnels	$863,000,000
Conduits	$65,000,000
Diversion Structures	$16,500,000
Control Facilities	$9,000,000

EAST SLOPE	
Total Cost	$1,570,500,000
Dams	$1,416,000,000
Conduits	$124,500,000
Diversion Structures	$500,000
Control Facilities	$5,500,000
District Headquarters Facility	$3,000,000
James W. Broderick Hydropower Plant	$21,000,000

COLLECTION & DELIVERY FEATURES	
Total Cost	$449,500,000
Dams	$261,000,000
Tunnels	$182,000,000
Conduits	$4,500,000
Control Facilities	$2,000,000

SOUTH SIDE COLLECTION SYSTEM	
Total Cost	$469,500,000
Tunnels	$437,000,000
Conduits	$14,500,000
Diversion Structures	$11,500,000
Control Facilities	$6,500,000

NORTH SIDE COLLECTION SYSTEM	
Total Cost	$295,500,000
Tunnels	$244,000,000
Conduits	$46,000,000
Diversion Structures	$5,000,000
Control Facilities	$500,000

Figure 4-1: SECWCD Phase 1 Feature Valuation (2020 dollars)

The following sections of this Chapter provide additional detail associated with the cost valuation of the individual Study features. In addition, Appendix A provides individual feature summary sheets and Appendix B provides the engineering and construction industry expert review summary reports.

4.1 West Slope Features

Table 4-1 and Figure 4-2 provide valuation results for West Slope features of the Fry-Ark Project. West Slope features included one Dam, 17 diversion structures, 18 conduits, nine tunnels, and three control facilities which are all part of the District Fry-Ark Activity. Summaries for specific feature types and more detailed cost valuations by area experts and overviews are provided in Appendices A and B, respectively.

Table 4-1: West Slope Features Valuation Summary (2020 dollars)

Feature Type	Valuation	Percentage of Total
Dams	$261,000,000	21.5%
Diversion Structures	$16,500,000	1.4%
Conduits	$65,000,000	5.3%
Tunnels	$863,000,000	71.1%
Fry-Ark Facilities	$9,000,000	0.7%
Total	**$1,214,500,000**	**100.0%**

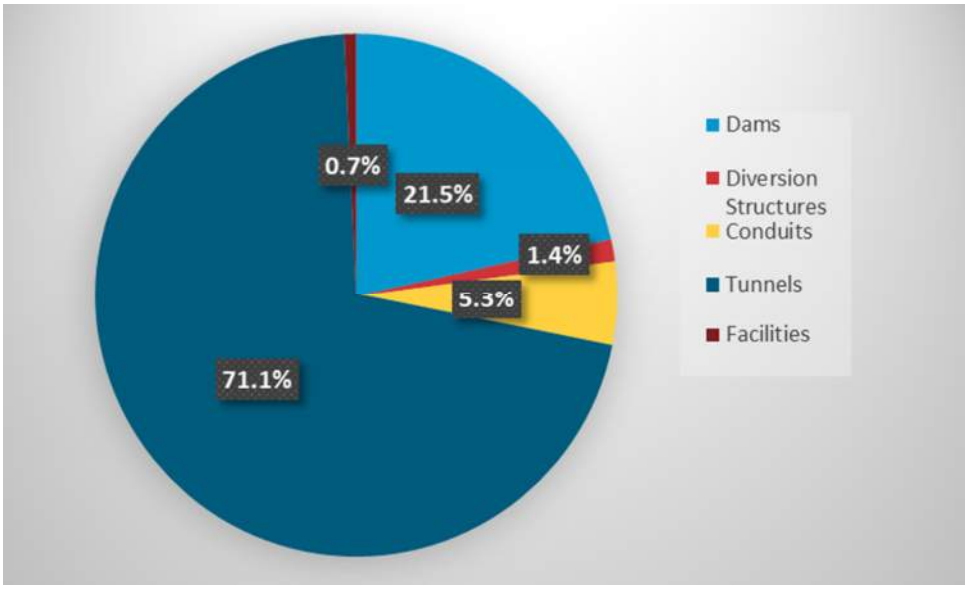


Figure 4-2: West Slope Features Valuation Breakdown

4.1.1 West Slope Dams

Ruedi Dam is the only Fry-Ark Project dam on the West Slope. In 2020 dollars, Ruedi Dam has been valued at approximately $261,000,000.

4.1.2 West Slope Diversion Structures

There are 17 West Slope diversion structures that have been valued a total cost of approximately $16,500,000 in 2020 dollars. Table 4-2 provides a summary of the West Slope diversion structure feature valuations.

Table 4-2: West Slope Diversion Structure Valuation Summary (2020 dollars)

Feature Name	Valuation	Description / Percentage of Total
Carter Creek Diversion	$840,000	West Slope - North Collection System
North Fork Diversion	$280,000	West Slope - North Collection System
Mormon Creek Diversion	$780,000	West Slope - North Collection System
North Cunningham Creek Diversion	$260,000	West Slope - North Collection System
Middle Cunningham Creek Diversion	$910,000	West Slope - North Collection System
South Cunningham Creek Diversion	$260,000	West Slope - North Collection System
Ivanhoe Diversion	$780,000	West Slope - North Collection System
Granite Creek Diversion	$350,000	West Slope - North Collection System
Lily Pad Inlet Diversion	$350,000	West Slope - North Collection System
Subtotal North Collection System (Rounded)	**$5,000,000**	**30%**
No Name Creek Diversion	$1,350,000	West Slope - South Collection System
Midway Creek Diversion	$1,500,000	West Slope - South Collection System
Hunter Creek Diversion	$1,500,000	West Slope - South Collection System
Sawyer Diversion	$130,000	West Slope - South Collection System
Chapman Diversion	$1,400,000	West Slope - South Collection System
South Fork Diversion	$2,100,000	West Slope - South Collection System
Fryingpan Diversion	$2,800,000	West Slope - South Collection System
Fryingpan Valley Control Structure	$650,000	West Slope - South Collection System
Subtotal South Collection System (Rounded)	**$11,500,000**	**70%**
Total (Rounded)	**$16,500,000**	**All West Slope diversion structures**

4.1.3 West Slope Tunnels

There are nine West Slope tunnels including the Boustead tunnel. The total valuation cost of the West Slope tunnels is approximately $863 million in 2020 dollars. Table 4-3 provides a summary of the West Slope tunnel feature valuations.

Table 4-3: West Slope Tunnel Valuation Summary (2020 dollars)

Feature Name	Valuation	Description
Carter Tunnel	$17,000,000	West Slope - North Collection System
Mormon Tunnel	$43,000,000	West Slope - North Collection System
Cunningham Tunnel	$88,000,000	West Slope - North Collection System
Granite Adit	$4,000,000	West Slope - North Collection System
Nast Tunnel	$92,000,000	West Slope - North Collection System
Subtotal North Collection System	**$244,000,000**	**28%**
Hunter Tunnel	$247,000,000	West Slope - South Collection System
Chapman Tunnel	$88,000,000	West Slope - South Collection System
South Fork Tunnel	$102,000,000	West Slope - South Collection System
Subtotal South Collection System	**$437,000,000**	**51%**
Boustead Tunnel [7]	**$182,000,000**	**21%**
Total	**$863,000,000**	**All West Slope tunnels**

[7] *For organization purposes, the Boustead Tunnel is assigned to the West Slope Features.*

4.1.4 West Slope Conduits and Siphons

There are 17 West Slope conduits / siphons. The total valuation of the West Slope conduits / siphons is approximately $65 million in 2020 dollars. Table 4-4 provides a summary of the West Slope conduit and siphon valuations.

Table 4-4: West Slope Conduit and Siphon Valuation Summary (2020 dollars)

Feature Name	Valuation	Description
Carter Feeder Conduit	$947,000	West Slope - North Collection System
Mormon Feeder Conduit	$761,000	West Slope - North Collection System
Mormon Conduit	$4,482,000	West Slope - North Collection System
North Cunningham Feeder Conduit	$474,000	West Slope - North Collection System
Middle Cunningham Feeder Conduit	$310,000	West Slope - North Collection System
South Cunningham Feeder Conduit	$4,179,000	West Slope - North Collection System
Cunningham Conduit	$13,068,000	West Slope - North Collection System
Ivanhoe Feeder Conduit	$1,316,000	West Slope - North Collection System
Ivanhoe Creek Crossing Conduit	$1,988,000	West Slope - North Collection System
Granite Siphon	$6,896,000	West Slope - North Collection System
Fryingpan Valley Conduit	$11,741,000	West Slope - North Collection System
Subtotal North Collection System (Rounded)	**$46,000,000**	**71%**
Chapman Feeder Conduit	$1,768,000	West Slope - South Collection System
Sawyer Conduit	$4,713,000	West Slope - South Collection System
South Fork Feeder Conduit	$2,628,000	West Slope - South Collection System
South Fork Siphon	$3,004,000	West Slope - South Collection System
Fryingpan River Siphon	$2,429,000	West Slope - South Collection System
Subtotal South Collection System (Rounded)	**$14,500,000**	**22%**
Fryingpan River Feeder Conduit [8] (Rounded)	$4,500,000	7%
Total (Rounded)	**$65,000,000**	**All West Slope conduits and siphons**

4.1.5 West Slope Control Facilities

The Fry-Ark Project has three control facilities located on the West Slope. These control facilities have various functions from system operations and control to offices and maintenance shops and storage. As shown in Table 4-5, the total valuation cost of the West Slope control facilities is approximately $8.6 million in 2020 dollars.

Table 4-5: West Slope Control Facilities Valuation Summary[9] (2020 dollars)

Feature Name	Description		Valuation	Percentage of Total
Meredith Office / Maintenance Shop	West Slope Delivery System		$2,000,000	22%
Chapman Control Building [10]	South Side Collection System		$6,500,000	72%
Mormon Control Building	North Side Collection System		$500,000	6%
Total			**$9,000,000**	**100%**

[8] The Fryingpan River Feeder Conduit is not connected directly to the North or South Collection Systems.
[9] Reference Appendix A for additional detail on Control Building features and cost development.
[10] Valuation Cost includes ~$6M in 2020 dollars for SCADA upgrades made in 2010.

4.2 East Slope Features

Table 4-6 and Figure 4-3 provide valuation results for East Slope features of the District Fry-Ark, District Operations, and Enterprise Activities. The East Slope features include three dams, one diversion structure, two conduits, two control facilities, SECWCD Headquarters Building, and the James W. Broderick Hydropower plant. Summaries for specific feature types and more detailed cost valuations by area experts are provided in Appendices A and B, respectively.

Table 4-6: East Slope Feature Valuation Summary (2020 dollars)

Feature Type	Valuation	Percentage of Total
Dams	$1,416,000,000	90.2%
Diversion Structures	$500,000	0.0%
Conduits	$124,500,000	7.9%
Control Facilities	$5,500,000	0.4%
SECWCD Headquarters[11]	$3,000,000	0.2%
Broderick Hydropower Plant[12]	$21,000,000	1.3%
Total	**$1,570,500**	**100.00%**

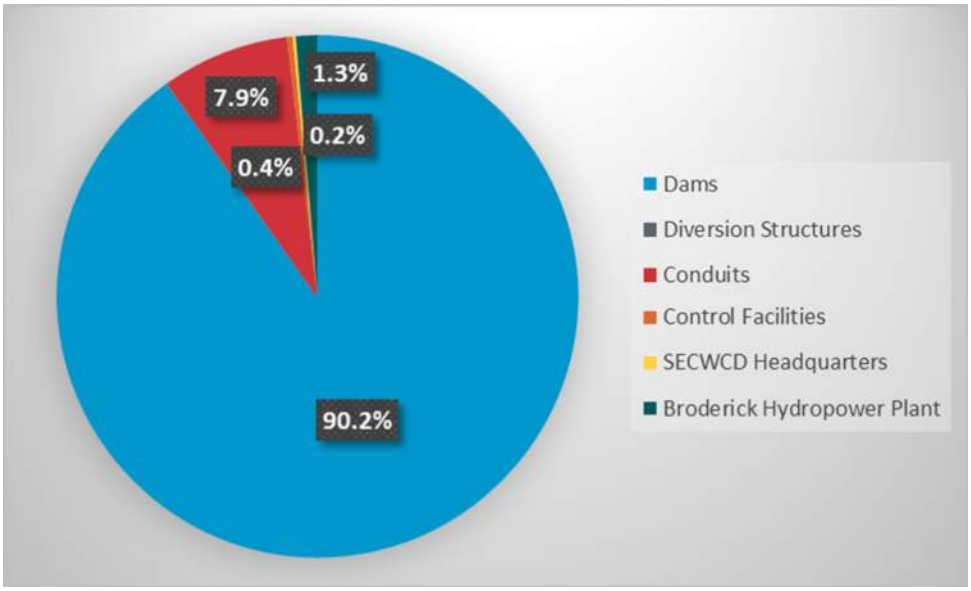


Figure 4-3: East Slope Features Valuation Breakdown

4.2.1 East Slope Dams

There are three Fry-Ark dams on the East Slope with an approximate valuation of $1.4 billion in 2020 dollars. From upstream to downstream, these dams include Sugarloaf Dam, Twin Lakes Dam, and the Pueblo Dam which

[11] *District Operations Activity feature.*
[12] *Enterprise Activity feature.*

functions as the Fry-Ark Project's terminal storage reservoir. Table 4-7 provides a summary of the East Slope dam feature valuations.

Table 4-7: East Slope Dam Valuation Summary (2020 dollars)

Feature Name	Valuation	Percentage of Total
Sugar Loaf Dam	$114,000,000	8%
Twin Lakes Dam	$173,000,000	12%
Pueblo Dam	$1,129,000,000	80%
Total	**$1,416,000,000**	**100%**

4.2.2 East Slope Diversion Structures

Halfmoon Creek Diversion Structure is the only Fry-Ark diversion structure on the East Slope. In 2020 dollars, diversion structure has been valued at approximately $390,000.

4.2.3 East Slope Conduits

There are two East Slope conduits. The total valuation cost of the East Slope conduits is approximately $124 million in 2020 dollars. Table 4-8 provides a summary of the West Slope conduit and siphon feature valuations.

Table 4-8: East Slope Conduit Valuation Summary (2020 dollars)

Feature Name	Valuation	Percentage of Total
Halfmoon Feeder Conduit	$4,275,000	3.4%
Mt. Elbert Conduit	$120,021,000	96.6%
Total (Rounded)	**$124,500,000**	**100.0%**

4.2.4 East Slope Control Facilities

The Fry-Ark Project has two control facilities located on the East Slope. These control facilities have various functions from system operations and control to offices to maintenance shops and storage. The total valuation cost of the West Slope control facilities is approximately $5.5 million in 2020 dollars. Table 4-9 provides a summary of the East Slope Control Build feature valuations.

Table 4-9: East Slope Control Facilities Valuation Summary[13] (2020 dollars)

Feature Name	Valuation	Percentage of Total
Twin Lakes Office/Maintenance Shop	$3,500,000	64%
Sugar Loaf Office/Maintenance Shop	$2,000,000	36%
Total	**$5,500,000**	**100%**

4.2.5 District and Enterprise Activity-Specific Features

There are two specific features included in the East Slope valuation that are not part of the District Fry-Ark Activity. These features include the SECWCD Headquarters facility as a District Operations Activity and the recently

[13] *Reference Appendix A for additional detail on Control Building features and cost development.*

completed James W. Broderick Hydropower Plant as an Enterprise Activity. The total valuation cost of these features is approximately $3,000,000 for the SECWCD Headquarters and $21,000,000 for the James W. Broderick Hydropower Plant in 2020 dollars. Table 4-10 provides a summary of the SECWCD-specific feature valuations.

Table 4-10: SECWCD-Specific Features Valuation Summary[14] (2020 dollars)

Feature Name	Valuation	Percentage of Total
District Headquarters Facility[15]	$3,000.000	12.5%
James W. Broderick Hydropower Plant[16]	$21,000,000	87.5%
Total	**$24,000,000**	**100.0%**

[14] Reference Appendix A for additional detail on SECWCD-specific features and cost development.
[15] Part of the District Operations Activity
[16] Part of the Enterprise Activity

CHAPTER 5 CONCLUSION AND FUTURE EFFORTS

The goal of this Phase 1 Study was to develop "order-of-magnitude" replacement cost for select District Fry-Ark, District Operations, and Enterprise Activity features. This has been accomplished through review of existing data from the original construction costs (where available), experience, expert valuations, and similar projects. Based on this Phase 1 Study, the total replacement cost for the major District Fry-Ark, District Operations, and Enterprise Activity features has been valued at approximately $2.8 Billion in 2020 dollars. This estimated replacement value validates the overall scale and importance of the SECWCD's District and Enterprise Activities in monetary terms.

This Study is intended to be a living document. It is recommended that the SECWCD revisit this Study and refine as necessary every 5 to 10 years. Although there are various cost indices that can be considered in escalating construction costs to develop current-day feature replacement costs, this Study relied on Engineering News Record's (ENR) Construction Market Index. This ENR Index covers heavy civil construction similar in nature to the constructed features evaluated in this Study. Should costs presented in this Study be refined in the future, it is recommended that SECWCD consider updating costs using ENR's current Construction Market Index.

The next step in this Feature Valuation process is to perform more focused feature reviews including condition assessments and potentially other infrastructure specific evaluations. These reviews will be used to further refine the feature valuations and develop a 20-year CIP that SECWCD can use in their ongoing financial planning activities.

APPENDIX A – FEATURE SUMMARY SHEETS

DAMS
- **WEST SLOPE**
  - RUEDI 1
- **EAST SLOPE**
  - SUGAR LOAF 2
  - TWIN LAKES 3
  - PUEBLO 4

DIVERSION STRUCTURES
- **WEST SLOPE**
  - **NORTH COLLECTION SYSTEM**
    - CARTER CREEK 5
    - NORTH FORK 6
    - MORMON CREEK 7
    - NORTH CUNNINGHAM 8
    - MIDDLE CUNNINGHAM CREEK 9
    - SOUTH CUNNINGHAM CREEK 10
    - IVANHOE DIVERSION 11
    - GRANITE CREEK 12
    - LILY PAD INLET 13
  - **SOUTH COLLECTION SYSTEM**
    - NO NAME CREEK 14
    - MIDWAY CREEK 15
    - HUNTER CREEK 16
    - SAWYER 17
    - CHAPMAN 18
    - SOUTH FORK 19
    - FRYINGPAN 20
    - FRYINGPAN VALLEY CONTROL STRUCTURE 21
- **EAST SLOPE**
  - HALFMOON CREEK 22

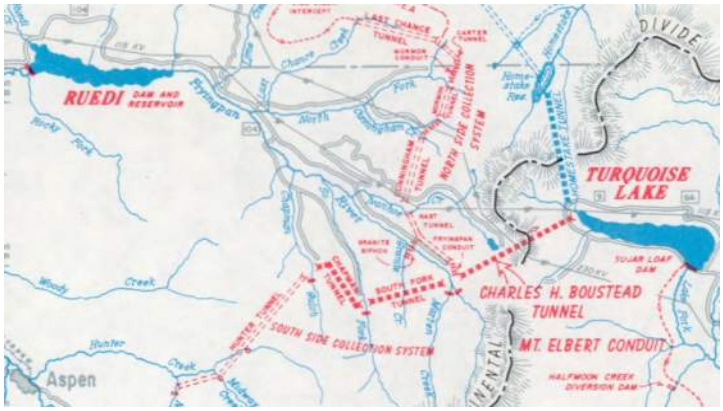
TUNNELS
- **WEST SLOPE**
  - **NORTH COLLECTION SYSTEM**
    - CARTER 23
    - MORMON 24
    - CUNNINGHAM 25
    - GRANITE ADIT 26
    - NAST 27
  - **SOUTH COLLECTION SYSTEM**
    - HUNTER 28
    - CHAPMAN 29
    - SOUTH FORK 30

BOUSTEAD 31
CONDUITS AND SIPHONS
WEST SLOPE
NORTH COLLECTION SYSTEM
CARTER FEEDER 32
MORMON FEEDER 33
MORMON 34
NORTH CUNNINGHAM FEEDER 35
MIDDLE CUNNINGHAM FEEDER 36
SOUTH CUNNINGHAM FEEDER 37
CUNNINGHAM 38
IVANHOE FEEDER 39
IVANHOE CREEK CROSSING 40
FRYINGPAN VALLEY 41
SOUTH COLLECTION SYSTEM
CHAPMAN FEEDER 42
SAWYER 43
SOUTH FORK FEEDER 44
SOUTH FORK SIPHON 45
FRYINGPAN RIVER SIPHON 46
FRYINGPAN RIVER FEEDER 47
EAST SLOPE
HALFMOON FEEDER 48
MT. ELBERT 49
CONTROL FACILITIES **50**
DISTRICT HEADQUARTERS **51**
JAMES W. BRODERICK HYDROPOWER PLANT **52**

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**RUEDI DAM**
FEATURE ID	**RD**
SLOPE	**WEST**
NATIONAL ID	**CO01664**
LOCATION 1	**PITKIN & EAGLE COUNTIES**
LOCATION 2	**15 MILES EAST OF BASALT, CO**
LOCATION 3	**39°21'46.53"N, 106°49'2.56"W**
ACCESS 1	**EASY**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**FRYINGPAN RIVER**
RESERVOIR	**RUEDI**
STRUCTURE TYPE	**ROCK AND EARTHFILL DAM**
CREST ELEVATION	**7788.0'**
CREST LENGTH	**1042'**
STRUCTURE HT	**285'**
STRUCTURE VOLUME	**3,745,200 yd^3**



FEATURE DESCRIPTION

This dam is a 285-foot tall rock and earth-fill dam with a crest elevation of 7,788 feet and a crest length of 1042 feet. The dam includes an ogee crest spillway structure with a chute section, a stilling basin, and a bridge over the spillway. The dam also includes an 1,810 CFS outlet works, a 600 CFS auxiliary outlet works, and a 4,000 CFS concrete bypass chute and stilling basin to bypass Rocky Fork Creek flows past the dam spillway and auxiliary outlet works discharge.

REPLACEMENT COST VALUATION

Ruedi Dam costs were initially evaluated using the existing information available and escalating these costs to today dollars. After further evaluation and taking into account area expert evaluations (see Appendix B of this report), the following results are provided for the replacement of the Ruedi Dam.

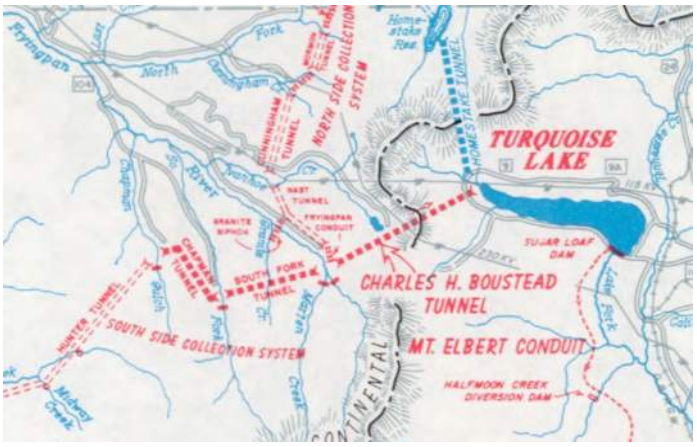
Recommended Replacement Cost = $261M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

DEVELOPED BY: DRC, DR

FEATURE	**SUGAR LOAF DAM**
FEATURE ID	**SLD**
SLOPE	**EAST**
NATIONAL ID	**CO01669**
LOCATION 1	**LAKE COUNTY**
LOCATION 2	**LEADVILLE, CO**
LOCATION 3	**39-15'12'' N, 106-22'20'' W**
ACCESS 1	**EASY**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**SAN ISABEL**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**LAKE FORK OF ARKANSAS RIVER**
RESERVOIR	**TURQUOISE LAKE**
STRUCTURE TYPE	**ZONED EARTH FILL EMBANKMENT**
CREST ELEVATION	**9879'**
CREST LENGTH	**2020'**
STRUCTURE HT	**135'**
STRUCTURE VOLUME	**1,833,700 YD^3**



FEATURE DESCRIPTION

This dam is a 135' tall zoned earth fill embankment dam with a crest elevation of 9,879' and a crest length of 2,020 feet. The spillway has a capacity of 2,920 CFS and consists of a morning-glory intake structure, a 16.5-foot-diameter concrete conduit, a chute, and a stilling basin. The outlet works can release 1,120 CFS to the Lake Fork of the Arkansas River and 370 CFS to the Mt. Elbert Conduit.

REPLACEMENT COST VALUATION

Sugar Loaf Dam costs were initially evaluated using the existing information available and escalating these costs to today dollars. After further evaluation and taking into account area expert evaluations (see Appendix B of this report), the following results are provided for the replacement of the Sugar Loaf Dam.

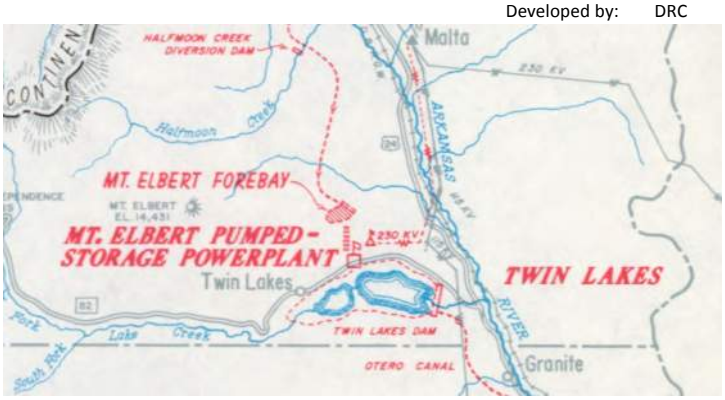
Recommended Replacement Cost = $114M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 52.54%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**TWIN LAKES DAM**
FEATURE ID	**TLD**
SLOPE	**EAST**
NATIONAL ID	**CO02045**
LOCATION 1	**LAKE COUNTY**
LOCATION 2	**13 MILES SOUTH OF LEADVILLE, CO**
LOCATION 3	**39° 4'39.55"N, 106°18'12.78"W**
ACCESS 1	**EASY**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**SAN ISABEL**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**LAKE CREEK**
RESERVOIR	**TWIN LAKES**
STRUCTURE TYPE	**ZONE, ROLLED EARTHFILL**
CREST ELEVATION	**9210'**
CREST LENGTH	**3150'**
CREST WIDTH	**30'**
STRUCTURE HT	**53'**



FEATURE DESCRIPTION

This dam is a 55' tall zoned earth fill embankment dam with a crest elevation of 9,210' and a crest length of 3,150 feet. The spillway, located on the left abutment, has a capacity of 1,400 CFS and consists of a morning glory intake structure, a 12-foot-diameter concrete conduit, and a stilling basin. After the stilling basin, flows are conveyed to Lake Creek. The outlet works, located on the right abutment can release 3,465 CFS to the Lake Creek.

REPLACEMENT COST VALUATION

Twin Lakes Dam costs were initially evaluated using the existing information available and escalating these costs to today dollars. After further evaluation and taking into account area expert evaluations (see Appendix B of this report), the following results are provided for the replacement of the Twin Lakes Dam.

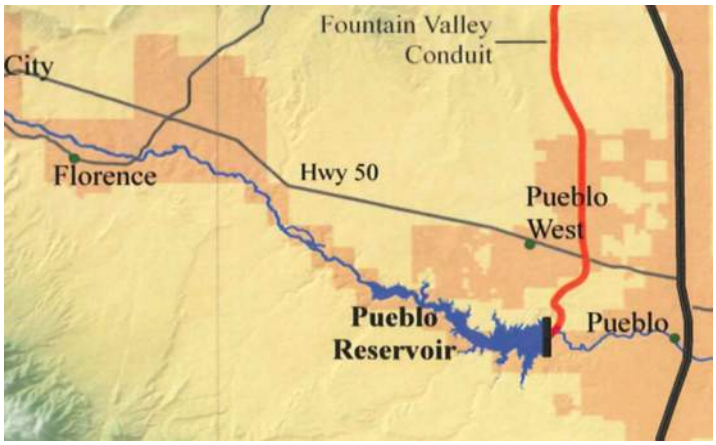
Recommended Replacement Cost = $173M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**PUEBLO DAM**
FEATURE ID	**PD**
SLOPE	**EAST**
NATIONAL ID	**CO00299**
LOCATION 1	**LAKE COUNTY**
LOCATION 2	**PUEBLO, CO**
LOCATION 3	**38°16'7.76"N, 104°43'31.00"W**
ACCESS 1	**EASY**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**N/A**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**ARKANSAS RIVER**
RESERVOIR	**PUEBLO RESERVOIR**
RESERVOIR SURFACE AREA	**5,664 ACRES**
CONSTRUCTION YEARS	**1970 - 1975**
STRUCTURE TYPE	**EARTHFILL WITH CONCRETE BUTTRESSES**
SPILLWAY DESCRIPTION	**UNCONTROLLED OVERFLOW CREST**
CREST ELEVATION	**4925'**
CREST LENGTH	**10,230'**
CREST WIDTH	**30'**
BASE WIDTH	**147'**
STRUCTURE HT	**250'**
HYDRAULIC HEIGHT (NORMAL OPERATING DEPTH AT DAM)	**191'**
VOLUME OF CONCRETE	**522,000 YD^3**
VOLUME OF EMBANKMENT	**12,000,000 YD^3**
VOLUME OF EXCAVATION	**2,800,000 YD^3**



FEATURE DESCRIPTION

This dam is the terminal storage feature for the Fryingpan-Arkansas Project and is a concrete and earth-fill dam with massive head buttress-type spillway structure with a length of approximately 10,230 feet. The concrete section is 1,750 feet wide with a maximum structural height of 250 feet. The spillway has a crest width of 550 feet and was designed for a maximum spill discharge of 191,500 CFS. The dam has five separate outlet works. The River outlet works with a capacity of 600 CFS, the Spillway outlet works with a combined capacity of 4,400 CFS, the Fish Hatchery outlet works which conveys water about 2,000 feet to a fish hatchery, the South outlet works which contains three-level intake line, and the Bessemer Ditch outlet works located in the right earth embankment which provides water for irrigation.

REPLACEMENT COST VALUATION

Pueblo Dam costs were initially evaluated using the existing information available and escalating these costs to today dollars. After further evaluation and taking into account area expert evaluations (see Appendix B of this report), the following results are provided for the replacement of the Pueblo Dam.

Recommended Replacement Cost = $1,129M
(in 2020 dollars)

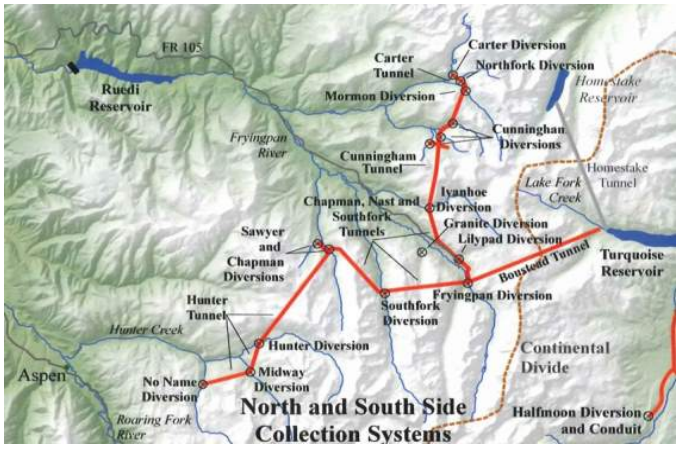
OM&R Cost Allocation for SECWCD = 55.79%
District Fry-Ark Activity

NOTE: SECWCD OM&R Cost for South Outlet works of Pueblo Dam only is 100%

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CARTER CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-CAR**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**EAGLE COUNTY**
LOCATION 2	**7 MI NE OF NORRIE, CO**
LOCATION 3	**39°21'58.99"N, 106°32'39.19"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**CARTER CREEK**
CREST ELEVATION	**10,133.75'**
STRUCTURAL HT	**8.75'**
CREST LENGTH	**46.0'**
HYDRAULIC HEIGHT (NORMAL)	**5.25'**
DIVERSION CAPACITY AT ELEVATIO	**100 CFS**



FEATURE DESCRIPTION

This diversion structure consists of an inlet structure, a trash-rack structure, a diversion conduit with measuring weir, a 48-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluice-way, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 100 CFS into the Carter Tunnel. Access during the diversion season is by helicopter, horse, or foot. Access in the off-season can be through Carter Tunnel.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $840K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**NORTH FORK / SAVAGE LAKE DIVERSION STRUCTURE**
FEATURE ID	**DIV-NF**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**UNKNOWN**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**6.75 MI NE OF NORRIE, CO**
LOCATION 3	**39°21'41.96"N, 106°32'16.01"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**NORTH FORK FRYING PAN RIVER**
CREST ELEVATION	**UNKNOWN**
STRUCTURAL HT	**UNKNOWN**
CREST LENGTH	**UNKNOWN**

FEATURE DESCRIPTION

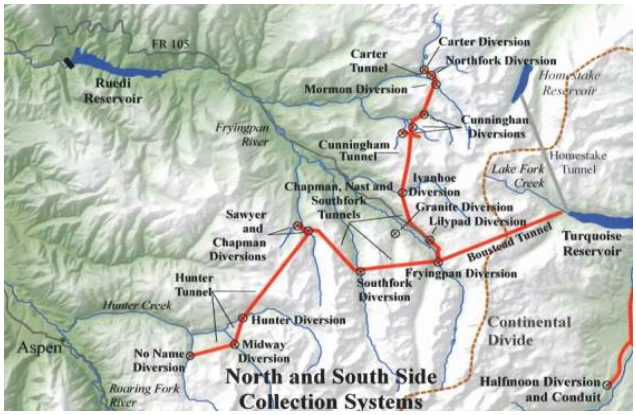
This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring diversion flows, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 24- by 24-inch slide gate, and an equipment vault. The sluiceway also serves as the stream bypass. The diversion diverts up to 30 CFS into Carter Tunnel via the North Fork Intake. Access to the North Fork Diversion site is by foot from the outlet of Carter Tunnel

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $280K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MORMON CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-MOR**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**7 MI NE OF NORRIE, CO**
LOCATION 3	**39°21'20.36"N, 106°32'3.56"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**MORMON CREEK**
CREST ELEVATION	**10,098.00'**
STRUCTURAL HT	**10.00'**
CREST LENGTH	**41.00'**
HYDRAULIC HEIGHT (NORMAL)	**6.65'**

FEATURE DESCRIPTION

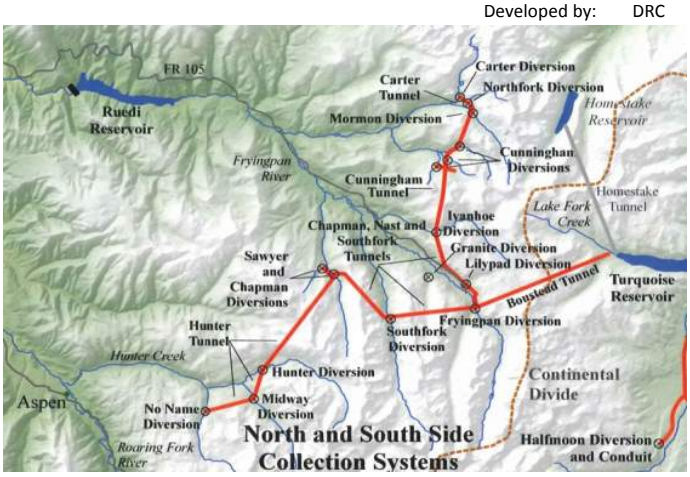
This diversion structure consists of an inlet structure, a trash rack structure, a diversion conduit with measuring weir, a 36-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluiceway, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 60 CFS into the Mormon Tunnel. Access is by road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $780K
(in 2020 dollars)

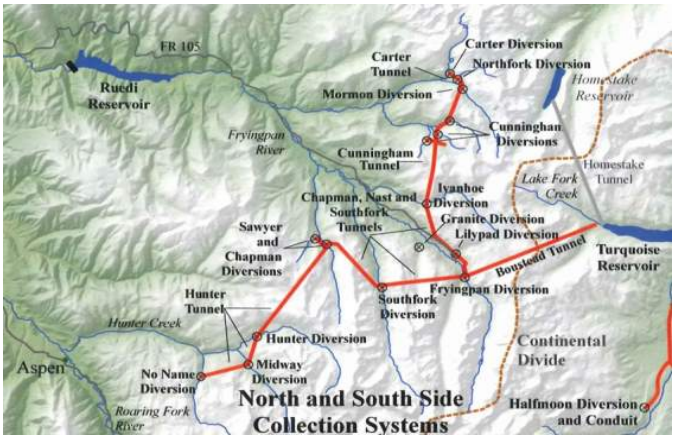
OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**NORTH CUNNINGHAM CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-NCU**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**6 MI NE OF NORRIE, CO**
LOCATION 3	**39°20'11.91"N, 106°32'35.20"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**CUNNINGHAM CREEK**
CREST ELEVATION	**10,087.50'**
CREST LENGTH	**38.60'**



FEATURE DESCRIPTION

This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring diversion flows, a 24-inch-diameter feeder conduit, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 30- by 30-inch slide gate, and an equipment vault. The sluiceway serves as the creek bypass. Through the feeder conduit, the diversion diverts up to 30 CFS into the Mormon Tunnel Outlet Structure. Access is by road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $260K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MIDDLE CUNNINGHAM CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-MCU**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**5.5 E OF NORRIE, CO**
LOCATION 3	**39°19'43.18"N, 106°33'6.01"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**MIDDLE CUNNINGHAM CREEK**
CREST ELEVATION	**10,055.00'**
STRUCTURAL HT	**10.00'**
HYDRAULIC HT (NORMAL)	**6.00'**
CREST LENGTH	**43.00'**

FEATURE DESCRIPTION

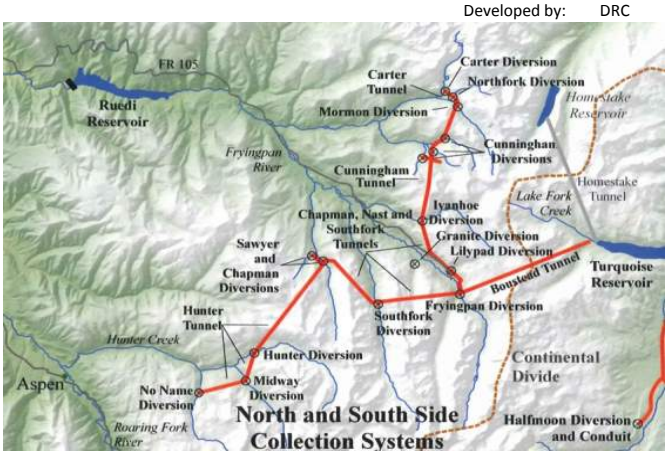
The diversion structure consists of an inlet structure, a trash rack structure, a diversion conduit with measuring weir, a 30-inch-diameter feeder conduit, a stream bypass with measuring weir, a winter bypass, a radial gated sluiceway, a side waste weir (spillway), and an electrical equipment vault. Through the feeder conduit, the diversion diverts up to 50 cfs into the Cunningham Tunnel. Access is by road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $910K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SOUTH CUNNINGHAM CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-SCU**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**5 MI E OF NORRIE, CO**
LOCATION 3	**39°19'28.64"N, 106°33'34.35"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**SOUTH CUNNINGHAM CREEK**
CREST ELEVATION	**10,539.00'**
CREST LENGTH	**20.00'**

FEATURE DESCRIPTION

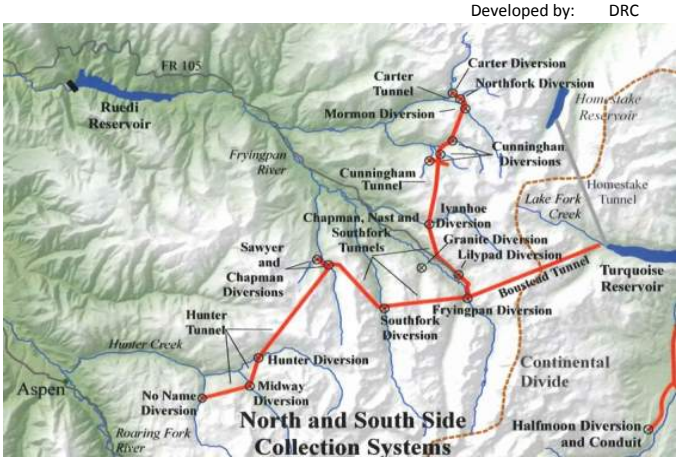
This diversion structure consists of a drop inlet with trash rack, a 30- by 30-inch diversion gate, a weir for measuring flows, a sluice pipe with a 12- by 12-inch slide gate, an auxiliary bypass channel with a 24- by 24-inch slide gate, and an equipment vault. The diversion diverts up to 20 CFS of water through South Cunningham Conduit into Middle Cunningham Creek upstream from Middle Cunningham Creek Diversion. Access is by road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $260K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**IVANHOE DIVERSION STRUCTURE**
FEATURE ID	**DIV-IVA**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1973-1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**6 MI SE OF NORRIE, CO**
LOCATION 3	**39°17'15.49"N, 106°33'32.09"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER NATIONAL FOREST**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**IVANHOE CREEK**
STRUCTURE HT	**19.75'**
HYDRUALIC HEIGHT (NORMAL)	**10.30'**
CREST LENGTH	**83.00'**
CREST ELEVATION	**10,015.25'**
SPILLWAY CAPACITY AT ELEVATION	**605 CFS @ 10,012.70'**

FEATURE DESCRIPTION

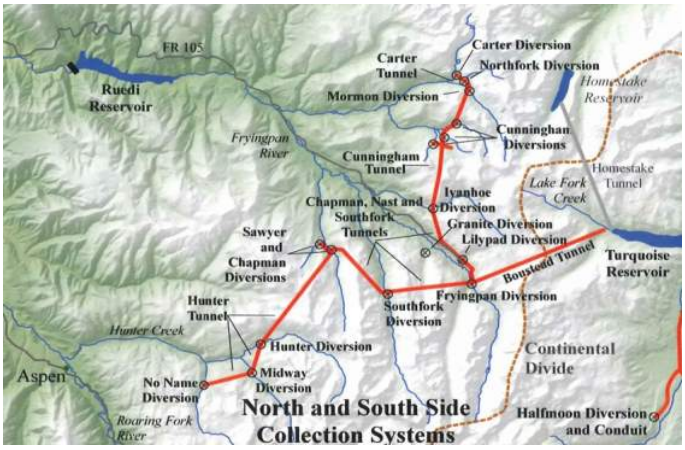
This diversion structure consists of a concrete ogee gravity spillway, retaining walls, a head gate structure with 48- by 48-inch slide gates, a trash rack, a 4-foot wide sluiceway with 36- by 36-inch slide gate, a 15-inch diameter bypass pipe, a Parshall Flume, and an 84-inch diameter feeder conduit. The feeder conduit conveys water into the Ivanhoe Creek Crossing which connects Cunningham and Nast Tunnels. Access is by road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $780K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**GRANITE CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-GRA**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**UNKNOWN**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**6.5 MI SE OF NORRIE, CO**
LOCATION 3	**39°15'44.46"N, 106°33'48.03"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER-FRYINGPAN**
DRAINAGE / WATERCOURSE	**GRANITE CREEK**

FEATURE DESCRIPTION

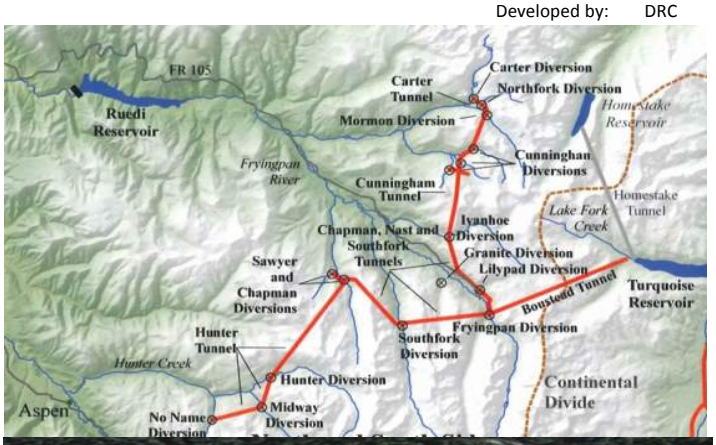
This diversion consists of a drop inlet with trash rack, a 36- by 36-inch diversion gate, a sluice pipe with an 18- by 18-inch slide gate, a cutoff wall, and an equipment vault. The diversion diverts up to 50 CFS of water through Granite Creek Siphon into the Siphon Outlet Structure, Granite Adit, and Nast Tunnel. Access to the diversion is by horse or foot along the siphon alignment or along trails.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $350K
(in 2020 dollars)

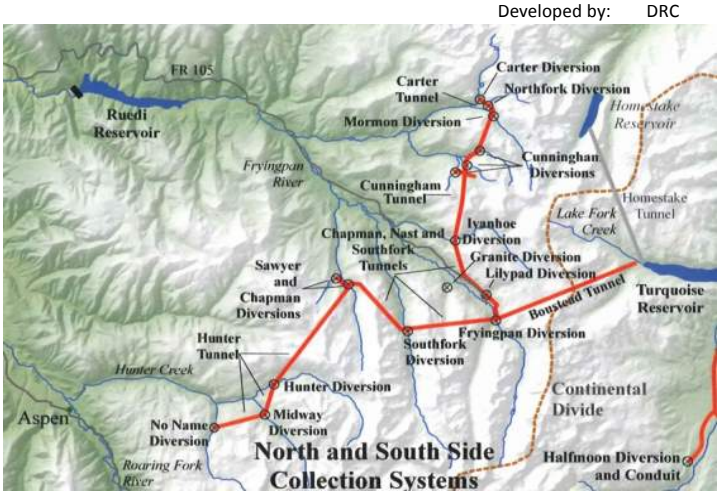
OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**LILY PAD DIVERSION INLET STRUCTURE**
FEATURE ID	**DIV-LIL**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1970-1973**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**8 MI SE OF NORRIE, CO**
LOCATION 3	**39°15'30.33"N, 106°32'13.82"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**LILY PAD CREEK**
STRUCTURE HT	**UNKNOWN**
CREST LENGTH	**UNKNOWN**
CREST ELEVATION	**10,207.00'**



FEATURE DESCRIPTION

This diversion structure is an interceptor ditch with the invert and downhill dike constructed of sacked concrete. The dike acts as a spillway crest when the head gate and sluice gate are closed. The interceptor ditch conveys water to the inlet structure, which consists of a transition, sluiceway, screening structure, measuring weir, and waste pipe. The diversion diverts up to 20 CFS into the Nast Tunnel via an intake shaft.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

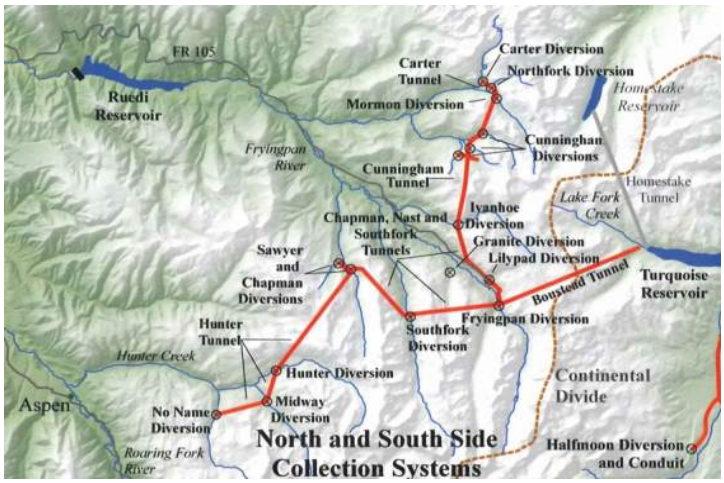
Recommended Replacement Cost = $350K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**NO NAME CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-NNC**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**5.5 M E OF ASPEN, CO**
LOCATION 3	**39°11'1.31"N, 106°43'10.03"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER-FRYINGPAN**
DRAINAGE / WATERCOURSE	**NO NAME CREEK**
CREST ELEVATION	**10,170.50'**
STRUCTURAL HT	**13.0'**
CREST LENGTH	**26.0'**



FEATURE DESCRIPTION

This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

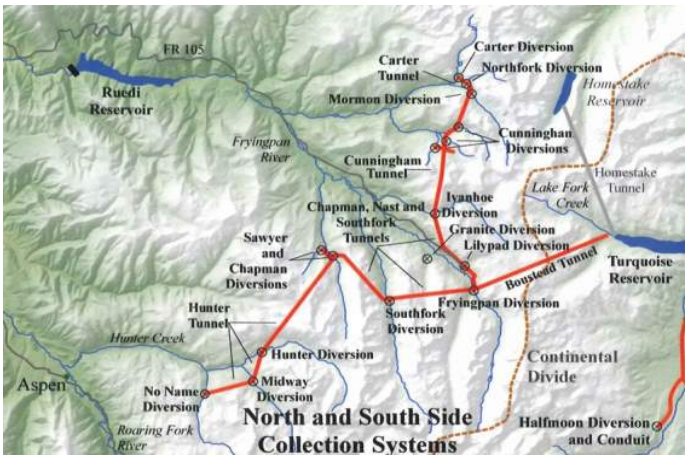
Recommended Replacement Cost = $1.35M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MIDWAY CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-MID**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**7 MI E OF ASPEN, CO**
LOCATION 3	**39°11'27.51"N, 106°41'7.99"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER-FRYINGPAN**
DRAINAGE / WATERCOURSE	**MIDWAY CREEK**
CREST ELEVATION	**10,190.20'**
STRUCTURAL HT	**12.0'**
CREST LENGTH	**50.0'**



FEATURE DESCRIPTION

This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

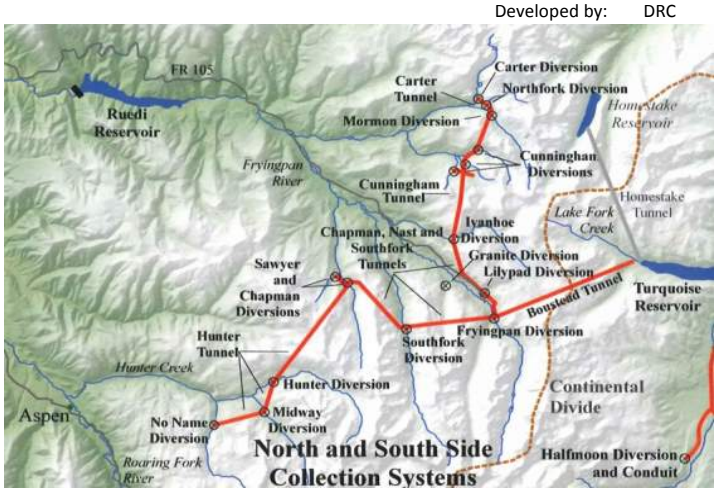
Recommended Replacement Cost = $1.5M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**HUNTER CREEK DIVERSION STRUCTURE**
FEATURE ID	**DIV-HUN**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1976**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**7.5 M E OF ASPEN, CO**
LOCATION 3	**39°12'26.54"N, 106°40'46.35"W**
ACCESS 1	**DIFFICULT**
ACCESS 2	**HIKE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER-FRYINGPAN**
DRAINAGE / WATERCOURSE	**HUNTER CREEK**
CREST ELEVATION	**10,179.0'**
STRUCTURAL HT	**52.0'**
CREST LENGTH	**60.0'**



FEATURE DESCRIPTION

This diversion structure consists of an inlet structure, a trash rack, headworks, a diversion conduit with slide gate control, a measuring weir, and an intake shaft to the Hunter Tunnel. For maintaining streamflow, the diversion has a sluice way with radial gate control and a stream bypass pipe to maintain minimum flows when the radial gate is closed. An additional winter bypass gate reduces ice buildup in the sluiceway during the winter season. A side waste way weir acts as a spillway for large floods. An electrical equipment vault houses all electrical equipment. The diversion diverts up to 90 CFS into the Hunter Tunnel. Access is during the non-operating season via the Hunter Tunnel.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $1.5M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SAWYER DIVERSION STRUCTURE**
FEATURE ID	**DIV-SAW**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1970-1973**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**4.5 MI S OF NORRIE, CO**
LOCATION 3	**39°15'57.46"N, 106°38'20.07"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE / HIKE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**SAWYER CREEK**
CREST ELEVATION	**10,084.5'**
STRUCTURAL HT	**6.0'**
CREST LENGTH	**20.0'**

FEATURE DESCRIPTION

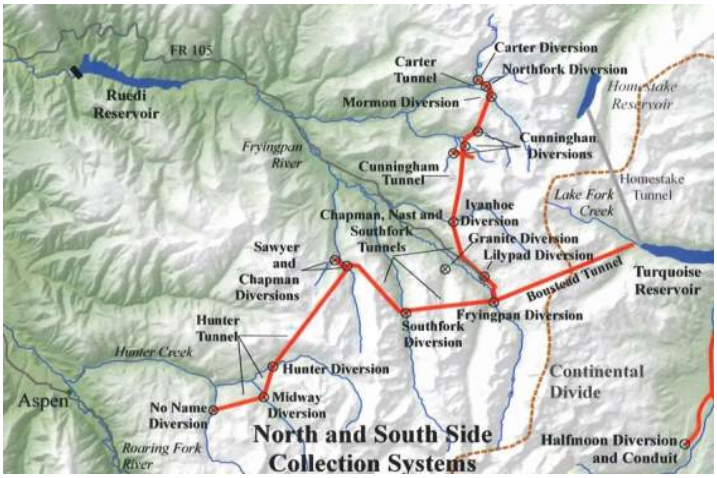
This diversion structure works to divert up to 30 CFS of water from Sawyer Creek into the Sawyer Creek Conduit. The diversion is a concrete drop inlet structure with metal trash racks, an 18-inch-inside-diameter, sluiceway pipe, and a connection to the 27-inch-inside-diameter Sawyer Creek Conduit. Access is by the Hunter Tunnel access road.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $130K
(in 2020 dollars)

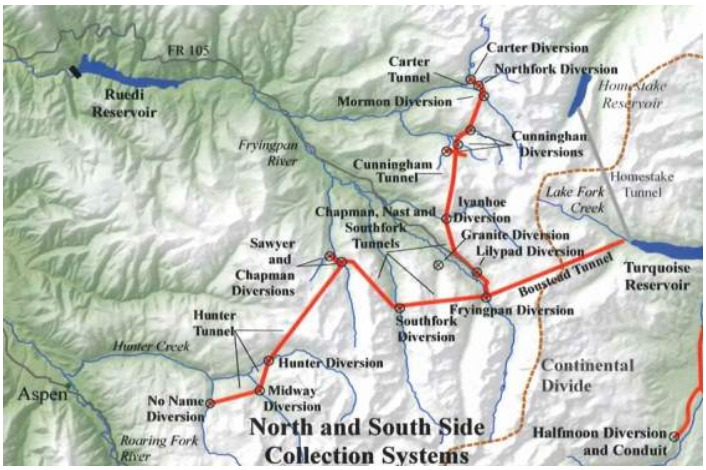
OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CHAPMAN DIVERSION STRUCTURE**
FEATURE ID	**DIV-CHA**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1965-1971**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**4.5 MI S OF NORRIE, CO**
LOCATION 3	**39°15'46.42"N, 106°37'50.41"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**CHAPMAN GULCH**
CREST ELEVATION	**10,045'**
STRUCTURAL HT	**15'**
HYDRAULIC HT (NORMAL)	**8'**
CREST LENGTH	**131'**
SPILLWAY CAPACITY AT ELEV	**810 CFS @ 10,043.35'**



FEATURE DESCRIPTION

This diversion structure has a concrete gravity spillway with retaining walls in combination with an earth embankment and a 5-foot sluiceway. Elements include a trash rack, tapered intake structure with ogee inlet leading to a Parshall flume section and the Chapman Feeder Conduit. Access is reasonable with an access road leading to the structure.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $1.4M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SOUTH FORK DIVERSION STRUCTURE**
FEATURE ID	**DIV-SF**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1965-1971**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**7.5 MI S OF NORRIE, CO**
LOCATION 3	**39°14'16.12"N, 106°35'24.59"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**SOUTH FORK FRYINGPAN RIVER**
CREST ELEVATION	**10,003'**
STRUCTURAL HT	**13.0'**
CREST LENGTH	**20'**

FEATURE DESCRIPTION

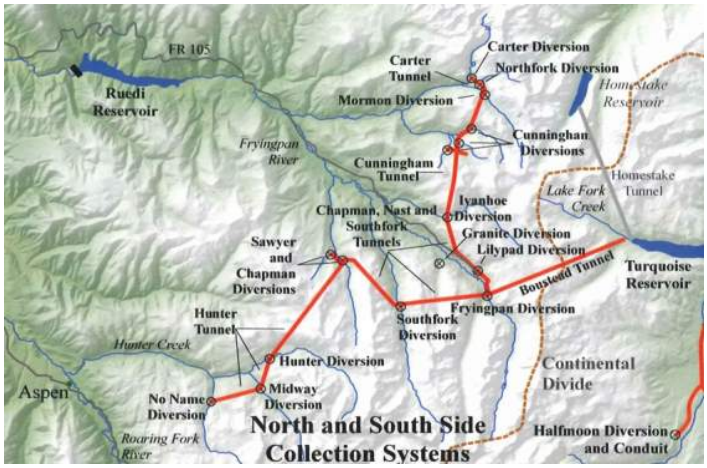
This diversion structure spillway is a concrete gravity spillway with retaining walls in combination with earth embankment. The sluiceway is a 5-foot-square cast iron slide gate with a pedestal lift and 5-foot-wide overflow section adjacent to the gate structure. The headworks is comprised of four 3.5-foot-square cast iron slide gates with pedestal lifts located upstream of a tapered intake structure with ogee inlet leading to a Parshall flume section and the South Fork Feeder Conduit. Access is reasonable with an access road leading to the structure.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $2.1M
(in 2020 dollars)

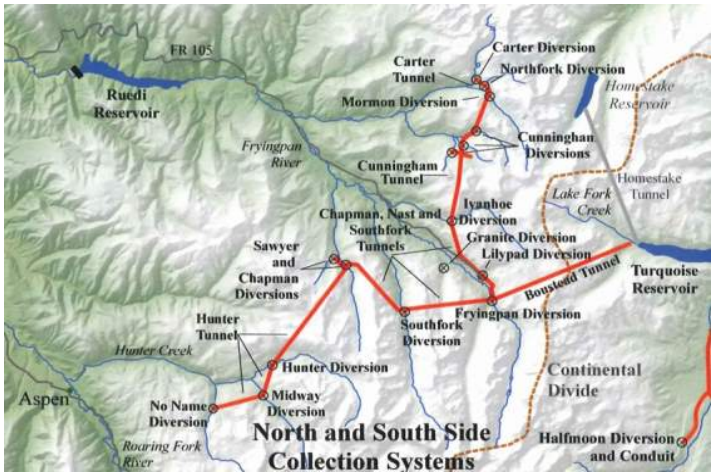
OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**FRYINGPAN DIVERSION STRUCTURE**
FEATURE ID	**DIV-FRY**
SLOPE	**WEST**
ORIGINAL CONSTRUCTION	**1965-1971**
LOCATION 1	**PITKIN COUNTY**
LOCATION 2	**9 MI S OF NORRIE, CO**
LOCATION 3	**39°14'40.17"N, 106°31'50.10"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER FRYINGPAN**
DRAINAGE / WATERCOURSE	**FRYINGPAN RIVER**
STRUCTURE HT	**9'**
CREST LENGTH	**25'**
CREST ELEVATION	**9961.9'**



FEATURE DESCRIPTION

This diversion structure diverts Fryingpan River flow and has a concrete gravity spillway with retaining walls in combination with earth embankment. The sluiceway consists of a 5- by 6-foot cast iron slide gate with pedestal lift, and a 5-foot overflow section adjacent to the gate. The headworks consists of four 5- by 4-foot cast iron slide gates with pedestal lifts that are located upstream of a tapered intake structure with ogee inlet leading to a Parshall flume section and the Fryingpan Feeder Conduit. Access is reasonable with an access road leading to the structure.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $2.8M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**FRYINGPAN CONTROL STRUCTURE**
FEATURE ID	**CS-FRYVAL**
SLOPE	**WEST**
BEGIN LOCATION	**FRYINGPAN SIPHON**
ENTER FEED	**N/A**
END LOCATION	**BOUSTEAD TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER FRYINGPAN**
DIAMETER	**12' X 12' - 6" BOX**
LENGTH	**335 FT**
DESIGN FLOWS (CFS)	**400**

FEATURE DESCRIPTION

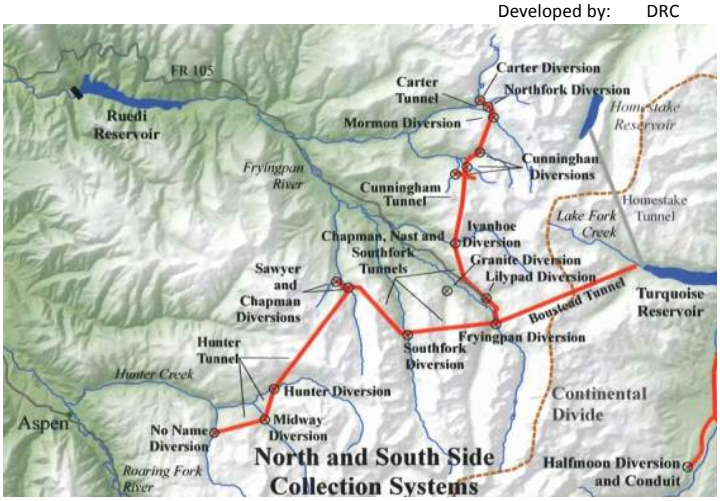
This diversion structure is at the inlet portal of the Boustead tunnel and regulates flow entering the tunnel. It is a concrete junction structure which contains two overflow weirs, one for the North and South collection systems, a baffled apron waste way drop structure to return the excess flows to the Fryingpan River, a connection and access hatchway structure to receive the flows from the Fryingpan Feeder Conduit, and a control structure housing a 10.5- by 12-foot radial gate. The entire structure is underground. Access is reasonable with an access road leading to the structure.

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $650K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**HALFMOON DIVERSION STRUCTURE**
FEATURE ID	**DIV-HAL**
SLOPE	**EAST**
ORIGINAL CONSTRUCTION	**1977**
LOCATION 1	**LAKE COUNTY**
LOCATION 2	**9 MI SW OF LEADVILLE, CO**
LOCATION 3	**39°11'8.61"N, 106°23'0.70"W**
ACCESS 1	**MODERATE**
ACCESS 2	**VEHICLE**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**N/A**
WILDERNESS	**N/A**
DRAINAGE / WATERCOURSE	**HALFMOON CREEK**
STRUCTURE HT	**15.00'**
CREST LENGTH	**50.00'**
CREST ELEVATION	**9,715.50'**

FEATURE DESCRIPTION

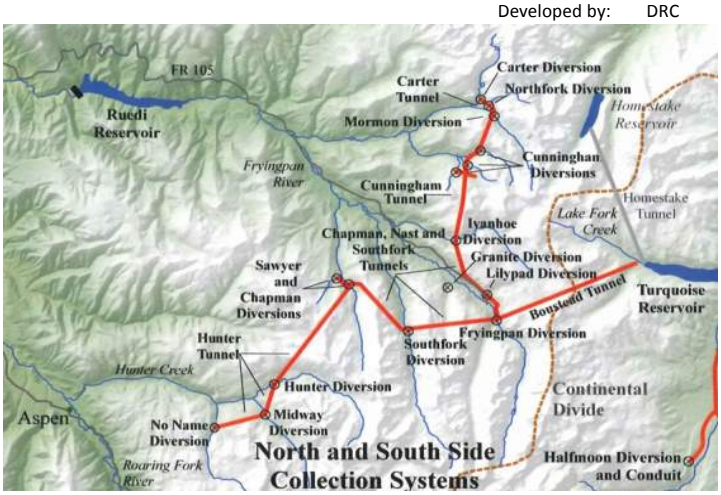
This diversion structure consists of a concrete drop inlet structure with metal trash racks, a 24-inch-inside-diameter sluiceway pipe, a 60-inch-inside-diameter feeder conduit, and a concrete electrical equipment house with a floatwell. The structure can divert up to 150 CFS. Access is by vehicle along Halfmoon Road (CR 11).

REPLACEMENT COST VALUATION

Diversion structure costs were initially evaluated by reviewing original drawings to determine approximate quanties and then applying unit costs developed from similar projects. Area experts reviewed and refined these costs (see Appendix B of this report) to provide the following results for replacement costs.

Recommended Replacement Cost = $390K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CARTER TUNNEL**
FEATURE ID	**T-CAR**
SLOPE	**WEST**
BEGIN	**CARTER FEEDER CONDUIT**
END	**MORMON CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8' / 7'**
LENGTH	**0.54**
DESIGN FLOWS (CFS)	**100 / 130**

FEATURE DESCRIPTION

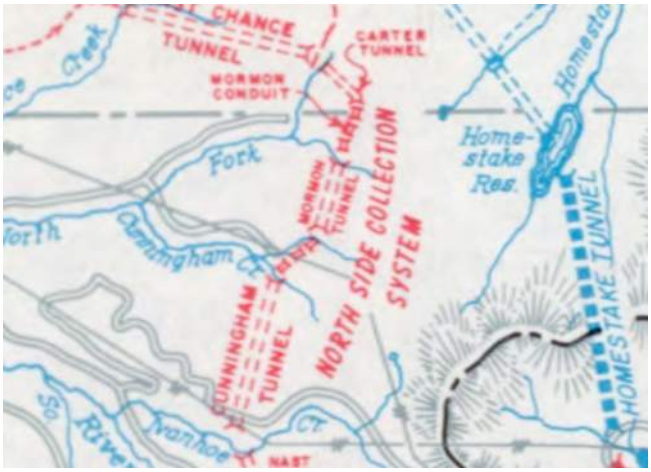
This tunnel is 0.54 miles long with an 8-foot (lined) to 9'-10" (unlined) horseshoe cross section and has a 130 CFS capacity. The tunnel is the most upstream North Side Collection System tunnel. Water is diverted into the tunnel by the Carter Diversion Dam and the 300-foot, 42-inch Carter Feeder Conduit Tunnel as well as the North Fork Diversion Dam and the 280-foot-long North Fork Feeder Conduit and North Fork Intake. Water from Carter Tunnel flows to the Mormon Conduit. Inlet and outlet can be accessed by vehicle.

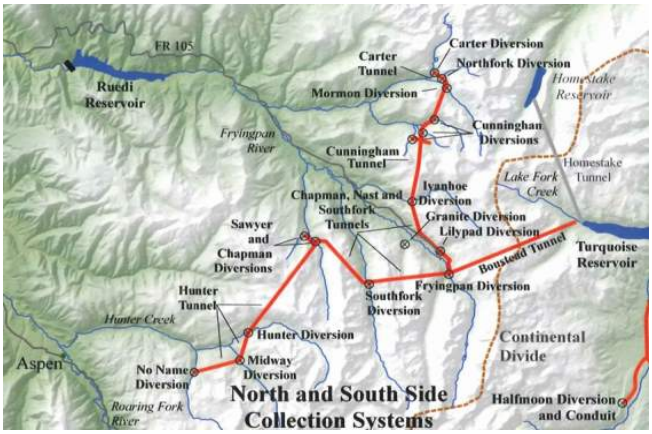
REPLACEMENT COST VALUATION

The Carter Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Carter Tunnel.

Recommended Replacement Cost = $17M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MORMON TUNNEL**
FEATURE ID	**T-MOR**
SLOPE	**WEST**
BEGIN LOCATION	**MORMON CONDUIT**
END LOCATION	**CUNNINGHAM TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8' / 7'**
LENGTH	**1.4 MI**
DESIGN FLOWS (CFS)	**190 CFS**

FEATURE DESCRIPTION

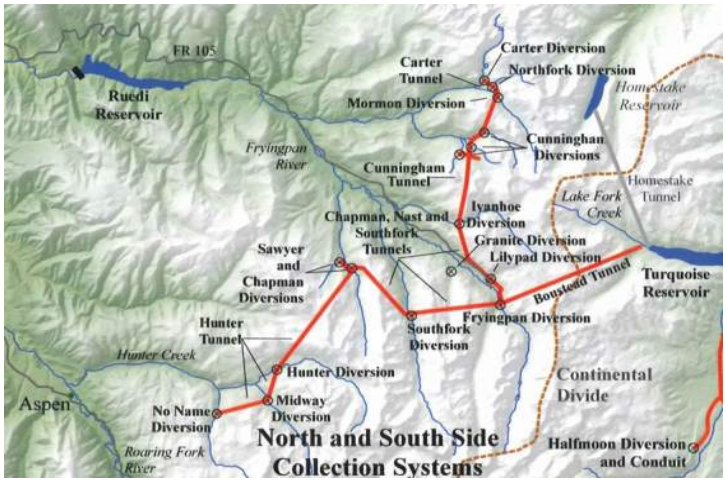
This tunnel is 1.4 miles long with an 8-foot (lined) to 9'-10" (unlined) horseshoe cross section and has a 190 CFS capacity. Water into the tunnel is a combination of flows from the Mormon Conduit and the Mormon Creek Diversion. Water conveyed through the Mormon Tunnel flows to the Cunningham Tunnel. Inlet and outlet can be accessed by vehicle.

REPLACEMENT COST VALUATION

The Mormon Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Mormon Tunnel.

Recommended Replacement Cost = $43M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CUNNINGHAM TUNNEL**
FEATURE ID	**T-CUN**
SLOPE	**WEST**
BEGIN LOCATION	**MORMON TUNNEL**
ENTER FEED	**CUNNINGHAM CONDUIT**
END LOCATION	**NAST TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8'9" / 7'6"**
LENGTH	**2.9**
DESIGN FLOWS (CFS)	**270**

FEATURE DESCRIPTION

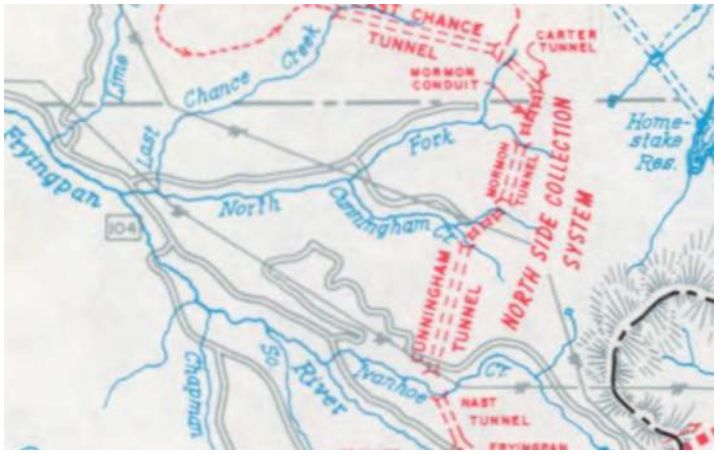
The North, Middle, and South Cunningham diversion structures connect to the Cunningham Conduit which connects to the Cunningham Tunnel. The tunnel is 2.86 miles long and has a horseshoe shape of two sizes, 8.75 and 7.5 feet, and a capacity of 270 cubic feet per second. Water from the tunnel flows into the Nast Tunnel. The tunnel outlet can be accessed by vehicle.

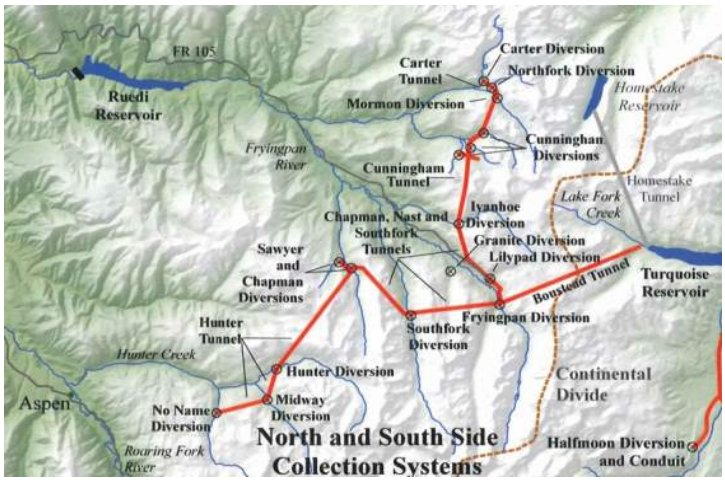
REPLACEMENT COST VALUATION

The Cunningham Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Cunningham Tunnel.

Recommended Replacement Cost = $88M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**GRANITE ADIT**
FEATURE ID	**S-GRA**
SLOPE	**WEST**
BEGIN LOCATION	**GRANITE CREEK DIVERSION STRUCTURE**
END LOCATION	**NAST TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**HUNTER-FRYINGPAN**
SIPHON	
LENGTH	**4000 FT**
DIAMETER	**36" / 30"**
CAPACITY (CFS)	**50**
ADIT	
LENGTH	**0.1 MI**
DIAMETER	**9'4" & 7'8"**
CAPACITY (CFS)	**50**

FEATURE DESCRIPTION

This tunnel / adit is a 700-foot-long, unlined horseshoe shaped tunnel that transitions to a 9'-4" concrete lined circular section and connects the Granite Siphon and the Nast Tunnel. The adit's capacity is 50 CFS.

REPLACEMENT COST VALUATION

The Granite Siphon & Adit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Granite Siphon & Adit.

Recommended Replacement Cost = $6.9M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**NAST TUNNEL**
FEATURE ID	**T-NAS**
SLOPE	**WEST**
BEGIN LOCATION	**IVANHOE DIVERSION STRUCTURE**
ENTER FEED	**GRANITE ADIT, LILY PAD DIVERSION STRUCTURES**
END LOCATION	**FRYINGPAN CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**9'4" / 7'8"**
LENGTH	**3**
DESIGN FLOWS (CFS)	**360**

FEATURE DESCRIPTION

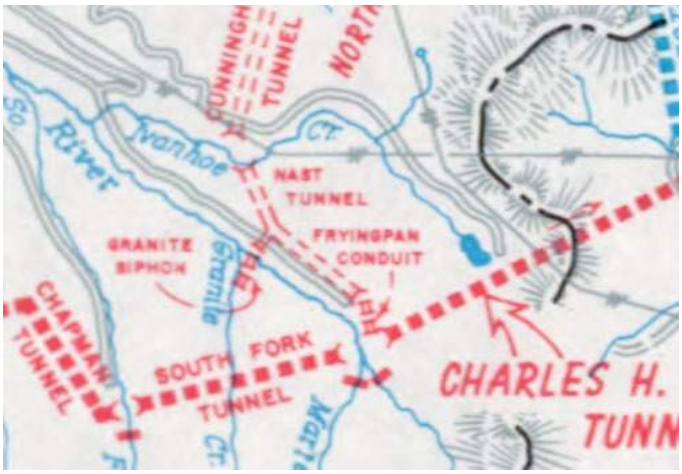
This tunnel is 3 miles long, with a circular-shaped section with two diameters: 7.67 and 9.33 feet. The capacity of the tunnel is 360 cubic feet per second. Ivanhoe Diversion Dam diverts water from Ivanhoe Creek and the Cunningham Tunnel into the inlet of Nast Tunnel. The Granite Diversion Dam diverts water through the Granite Siphon to the Granite Adit, which drops the flow into the Nast Tunnel. The Lily Pad Diversion Dam drops flow into Nast Tunnel. Flow from the tunnel is conveyed into the Fryingpan Valley Conduit. The tunnel outlet can be accessed by vehicle.

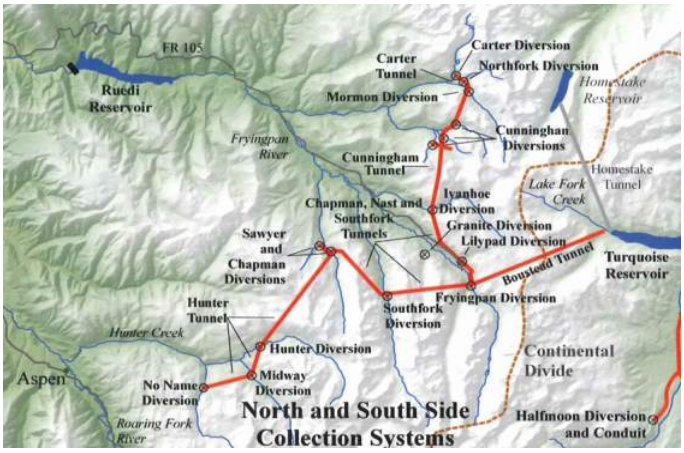
REPLACEMENT COST VALUATION

The Nast Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Nast Tunnel.

Recommended Replacement Cost = $92M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity





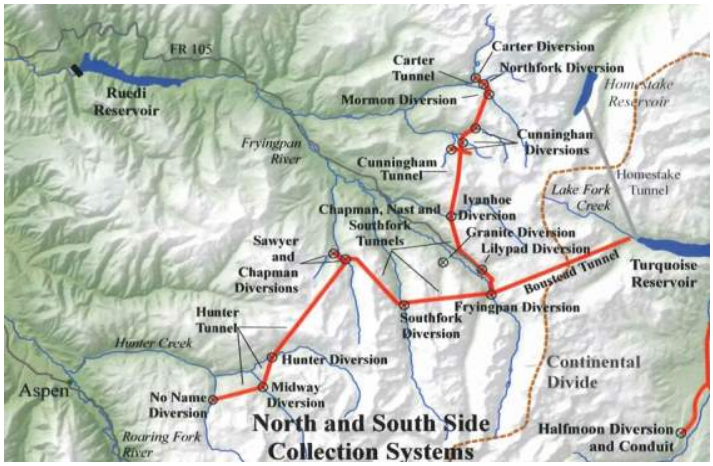
SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**HUNTER TUNNEL**
FEATURE ID	**T-HUN**
SLOPE	**WEST**
BEGIN LOCATION	**NO NAME DIVERSION STRUCTURE**
ENTER FEED	**MIDWAY & HUNTER DIVERSION STRUCTURES**
END LOCATION	**CHAPMAN DIVERSION STRUCTURE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8'6" / 7'4"**
LENGTH	**7.6 MI**
DESIGN FLOWS (CFS)	**85 / 175 / 270**

FEATURE DESCRIPTION

This tunnel is 7.7 miles long, has three reaches, and conveys flows diverted at No Name, Midway, and Hunter Creeks to Chapman Gulch at the Chapman Diversion Dam. The tunnel capacity ranges from 90 CFS to 270 CFS. The tunnel is semi-horseshoe-shaped with two sizes: 8.5 (unlined) and 7.33 feet (lined). The tunnel outlet can be accessed by vehicle.



REPLACEMENT COST VALUATION

The Hunter Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Hunter Tunnel.

Recommended Replacement Cost = $247M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CHAPMAN TUNNEL**
FEATURE ID	**T-CHA**
SLOPE	**WEST**
BEGIN LOCATION	**CHAPMAN DIVERSION STRUCTURE**
ENTER FEED	**MIDWAY & HUNTER DIVERSION STRUCTURES**
END LOCATION	**SOUTH FORK TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**7'0"**
LENGTH	**2.8 MI**
DESIGN FLOWS (CFS)	**300**

FEATURE DESCRIPTION

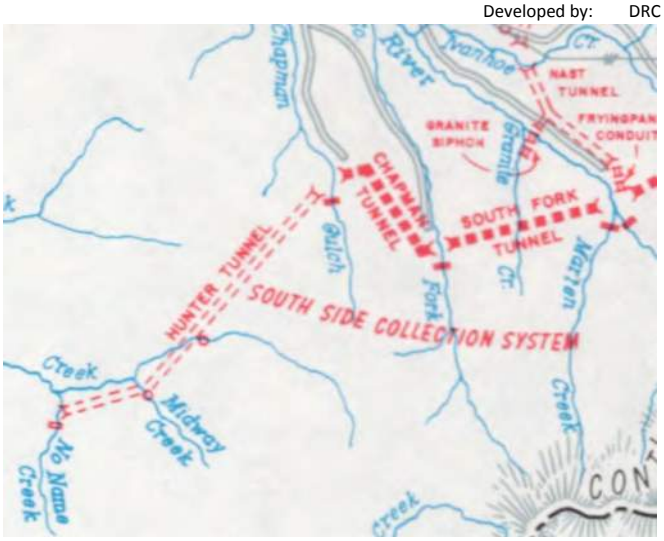
This tunnel is a 2.8-mile-long, 7-foot horseshoe-shaped structure, with a capacity of 300 cubic feet per second. Water conveyed in the tunnel is diverted at the Sawyer Diversion dam and delivered to Chapman Gulch using the Sawyer Conduit where it is combined with flows in Chapman Gulch and diverted to the tunnel using the Chapman Diversion and Chapman Feeder Conduit.

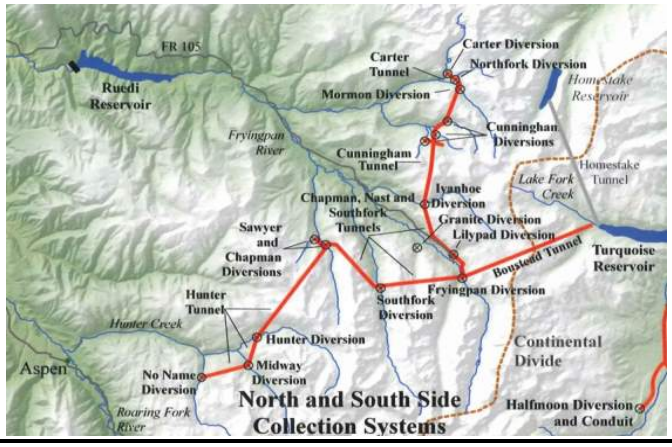
REPLACEMENT COST VALUATION

The Chapman Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Chapman Tunnel.

Recommended Replacement Cost = $88M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

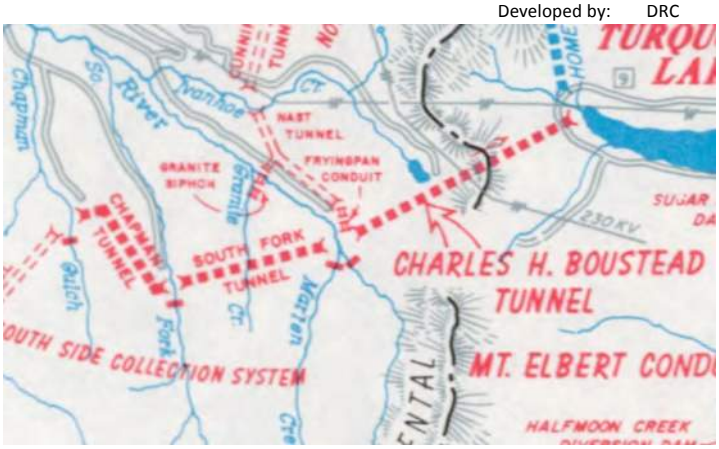




SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

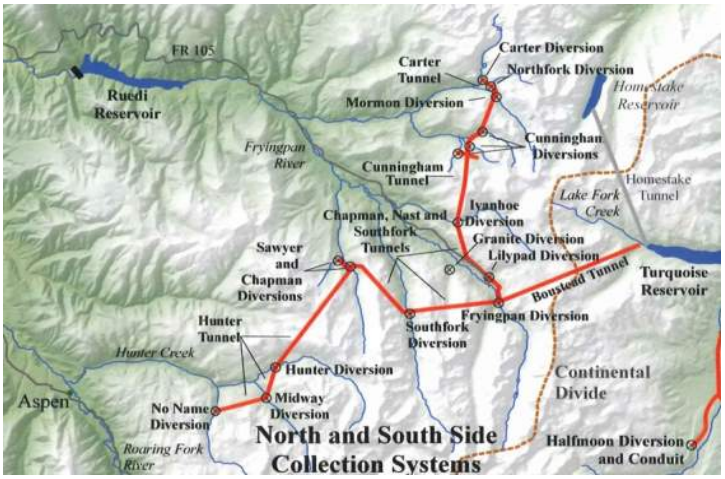
Developed by: DRC

FEATURE	**SOUTH FORK TUNNEL**
FEATURE ID	**T-SF**
SLOPE	**WEST**
BEGIN LOCATION	**SOUTH FORK FEEDER CONDUIT**
ENTER FEED	**N/A**
END LOCATION	**BOUSTEAD TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8'0"**
LENGTH	**3.1**
DESIGN FLOWS (CFS)	**450**



FEATURE DESCRIPTION

This tunnel is 3.1-miles long, 8-foot horseshoe-shaped, and has a capacity of 450 CFS. Water conveyed in the tunnel is diverted from the South Fork Diversion Dam to the South Fork Siphon using the South Fork Feeder Conduit where it combines with flow in the siphon and carried to the inlet of the tunnel.



REPLACEMENT COST VALUATION

The South Fork Tunnel costs were initially evaluated using the existing information available and escalating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the South Fork Tunnel.

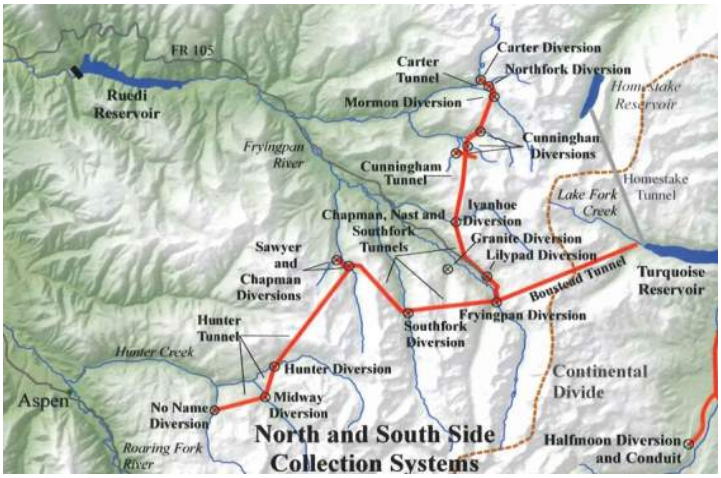
Recommended Replacement Cost = $102M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**BOUSTEAD TUNNEL**
FEATURE ID	**T-BOU**
SLOPE	**WEST**
BEGIN LOCATION	**FRYINGPAN DIVERSION STRUCTURE**
END LOCATION	**TURQUOISE RESERVOIR**
COLLECTION SYSTEM	**N/A**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**10 FT 6 IN**
LENGTH	**5.4 MI**
DESIGN FLOWS (CFS)	**945**



FEATURE DESCRIPTION

This tunnel is 5.4-miles long, 10.5-foot horseshoe-shaped, and has a capacity of 945 CFS. The tunnel conveys all West Slope collected water under the Continental Divide and into Turquoise Lake for further conveyance by East Slope features.

REPLACEMENT COST VALUATION

The Boustead Tunnel costs were initially evaluated using the existing information available and esculating these costs to today dollars which resulted in a cost that was not considered reasonable after futher review and comparison with other tunnel projects. After further evaluation and taking into account area expert evaluations (see Appendix B of this report) the following results are provided for the replacement of the Boustead Tunnel.

Recommended Replacement Cost = $182,000,000
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CARTER FEEDER CONDUIT**
FEATURE ID	**FC-CAR**
SLOPE	**WEST**
BEGIN	**CARTER DIVERSION STRUCTURE**
END	**CARTER TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**48 IN**
LENGTH	**300 FT**
DESIGN FLOWS (CFS)	**100**

FEATURE DESCRIPTION

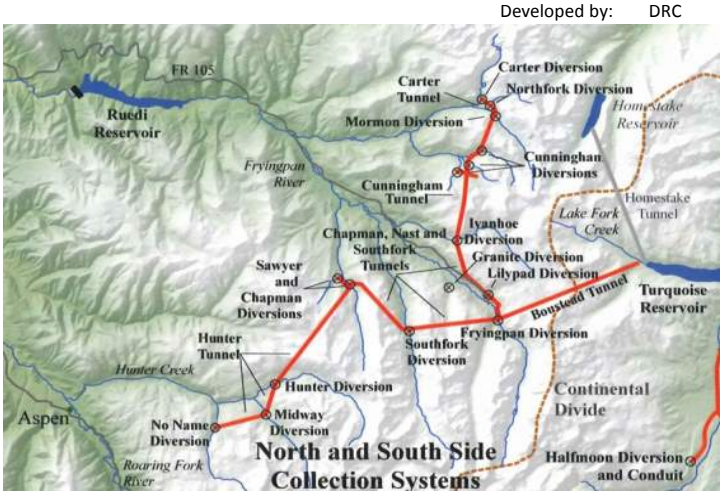
This conduit is a 300-foot, 48-inch conduit used to convey up to 100 CFS of water from the Carter Diversion Dam to the inlet of the Carter Tunnel.

REPLACEMENT COST VALUATION

The Carter Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Carter Feeder Conduit.

Recommended Replacement Cost = $947,000
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MORMON FEEDER CONDUIT**
FEATURE ID	**FC-MOR**
SLOPE	**WEST**
BEGIN LOCATION	**MORMON CREEK DIVERSION STRUCTURE**
END LOCATION	**MORMON TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**36"**
LENGTH	**375 FT**
DESIGN FLOWS (CFS)	**60**

FEATURE DESCRIPTION

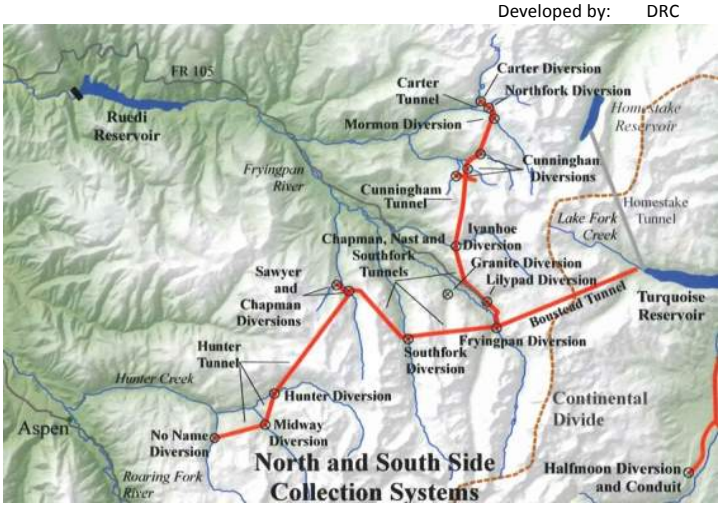
This conduit is a 375-foot, 36-inch precast concrete pressure pipe used to convey water from the Mormon Creek Diversion Dam to an inlet portal on the Mormon Tunnel. The feeder conduit can convey up to 60 CFS to the inlet portal.

REPLACEMENT COST VALUATION

The Mormon Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Mormon Feeder Conduit.

Recommended Replacement Cost = $761,000
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MORMON CONDUIT**
FEATURE ID	**CON-MOR**
SLOPE	**WEST**
BEGIN LOCATION	**CARTER TUNNEL**
ENTER FEED	**MORMON FEEDER CONDUIT**
END LOCATION	**MORMON TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**45"**
LENGTH	**1,785 FT**
DESIGN FLOWS (CFS)	**130**

FEATURE DESCRIPTION

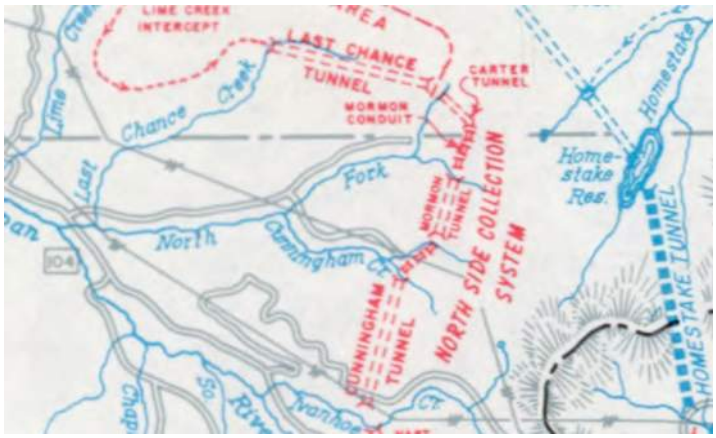
This conduit is a 1,785-foot, 45-inch cement mortar lined and coated steel pipeline that conveys water from the from Carter Tunnel to the inlet of the Mormon Tunnel. The conduit capacity is 130 CFS.

REPLACEMENT COST VALUATION

The Mormon Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Mormon Conduit.

Recommended Replacement Cost = $4.5M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**NORTH CUNNINGHAM FEEDER CONDUIT**
FEATURE ID	**FC-NCU**
SLOPE	**WEST**
BEGIN LOCATION	**NORTH CUNNINGHAM CREEK DIVERSION STRUCTURE**
END LOCATION	**CUNNINGHAM CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**24"**
LENGTH	**350 FT**
DESIGN FLOWS (CFS)	**30**

FEATURE DESCRIPTION

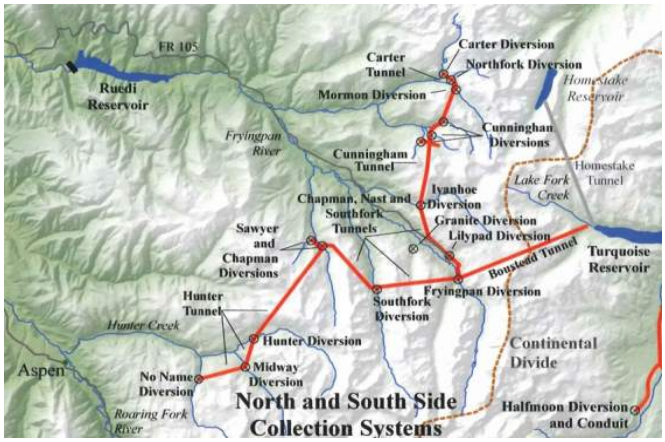
This conduit is a 350-foot-long, 24-inch conduit that conveys water from the North Cunningham Creek Diversion to the outlet structure of the Mormon Tunnel. The feeder conduit capacity is 30 CFS.

REPLACEMENT COST VALUATION

The North Cunningham Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the North Cunningham Feeder Conduit.

Recommended Replacement Cost = $474K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MIDDLE CUNNINGHAM FEEDER CONDUIT**
FEATURE ID	**FC-MCU**
SLOPE	**WEST**
BEGIN LOCATION	**MIDDLE CUNNINGHAM CREEK DIVERSION STRUCTURE**
END LOCATION	**CUNNINGHAM CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**30"**
LENGTH	**183 FT**
DESIGN FLOWS (CFS)	**50**

FEATURE DESCRIPTION

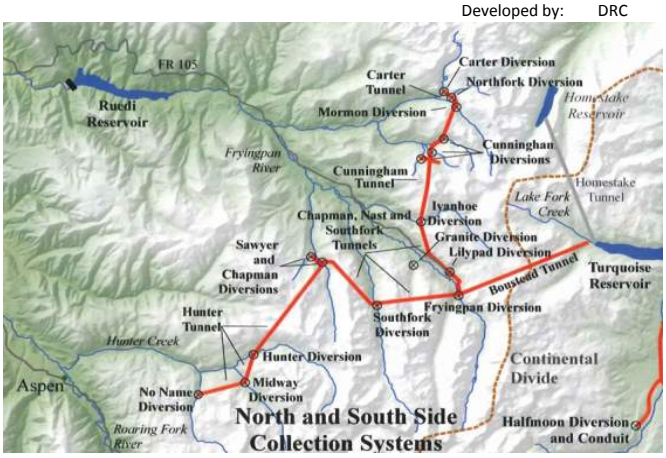
This conduit is a 183-foot, 30-inch conduit that conveys water from the Middle Cunningham Creek Diversion to the inlet structure on the Cunningham Tunnel. The feeder conduit can convey up to 50 CFS to the inlet structure.

REPLACEMENT COST VALUATION

The Middle Cunningham Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Middle Cunningham Feeder Conduit.

Recommended Replacement Cost = $310K
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SOUTH CUNNINGHAM FEEDER CONDUIT**
FEATURE ID	**FC-SCU**
SLOPE	**WEST**
BEGIN LOCATION	**MIDDLE CUNNINGHAM CREEK DIVERSION STRUCTURE**
END LOCATION	**CUNNINGHAM CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**24" / 21" / 18"**
LENGTH	**3,650 FT**
DESIGN FLOWS (CFS)	**20**

FEATURE DESCRIPTION

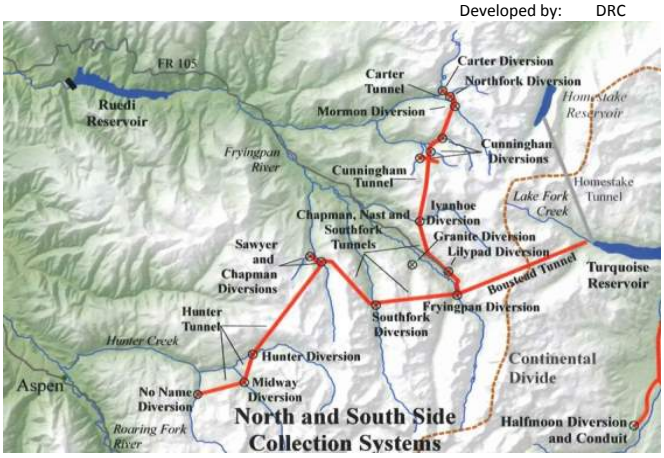
This conduit is a 3,650-foot, 24-, 21-, and 18-inch conduit that conveys water from the South Cunningham Creek Diversion to Middle Cunningham Creek where flow is then diverted by the Middle Cunningham Creek Diversion. The feeder conduit can convey up to 20 CFS.

REPLACEMENT COST VALUATION

The South Cunningham Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the South Cunningham Feeder Conduit.

Recommended Replacement Cost = $4.2M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CUNNINGHAM CONDUIT**
FEATURE ID	**CON-CUN**
SLOPE	**WEST**
BEGIN LOCATION	**NORTH CUNNINGHAM FEEDER CONDUIT**
ENTER FEED	**MIDDLE AND SOUTH CUN FC**
END LOCATION	**CUNNINGHAM TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**60"**
LENGTH	**4,035 FT**
DESIGN FLOWS (CFS)	**220**

FEATURE DESCRIPTION

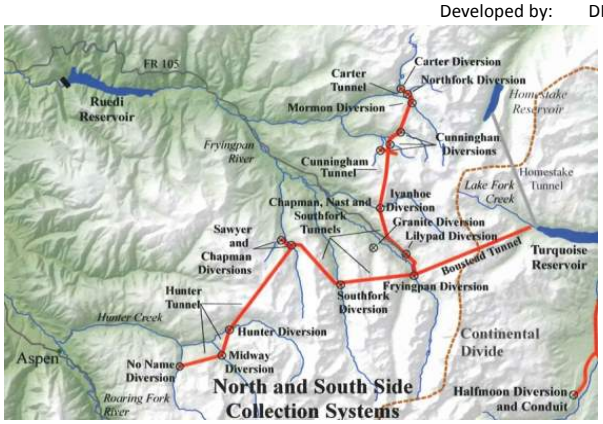
This conduit is a 4,035-foot, 60-inch cement lined and coated welded steel pipeline that connects the Mormon and Cunningham tunnels and has a capacity of 220 CFS of water.

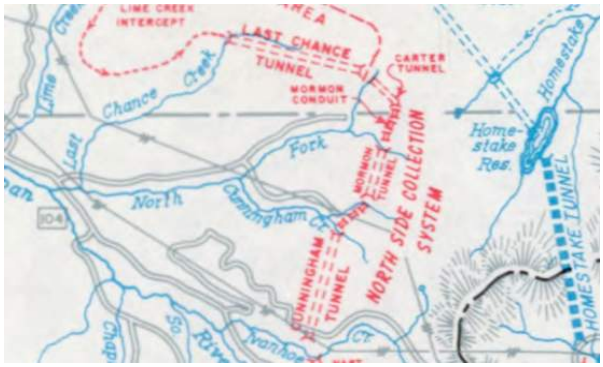
REPLACEMENT COST VALUATION

The Cunningham Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Cunningham Conduit.

Recommended Replacement Cost = $13M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**IVANHOE FEEDER CONDUIT**
FEATURE ID	**FC-IVA**
SLOPE	**WEST**
BEGIN LOCATION	**IVANHOE DIVERSION STRUCTURE**
END LOCATION	**IVANHOE CREEK CROSSING CONDUIT**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**84"**
LENGTH	**246 FT**
DESIGN FLOWS (CFS)	**150**

FEATURE DESCRIPTION

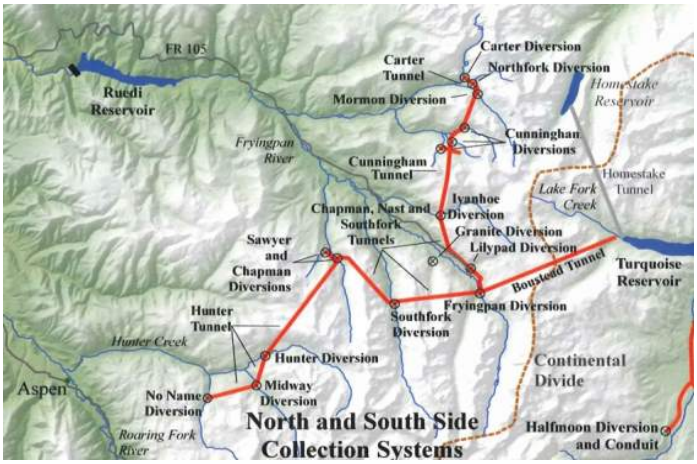
This conduit is a 246-foot, 84-inch precast concrete pressure pipe with Parshall Flume section that conveys flows from the Ivanhoe Diversion Dam to the Ivanhoe Creek Crossing Conduit. The feeder conduit conveys up to 150 CFS.

REPLACEMENT COST VALUATION

The Ivanhoe Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Ivanhoe Feeder Conduit.

Recommended Replacement Cost = $1.3M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**IVANHOE CREEK CROSSING CONDUIT**
FEATURE ID	**CON-IVA**
SLOPE	**WEST**
BEGIN LOCATION	**IVANHOE FEEDER CONDUIT**
END LOCATION	**NAST TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**84"**
LENGTH	**420 FT**
DESIGN FLOWS (CFS)	**360**

FEATURE DESCRIPTION

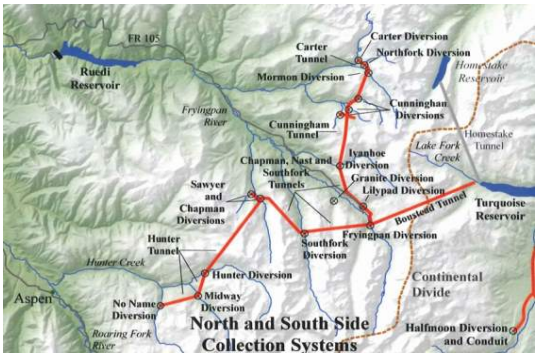
This conduit is a 420-foot, 84-inch precast concrete pressure pipe that conveys water from the Cunningham Tunnel and the Ivanhoe Diversion Conduit to the inlet of the Nast Tunnel. The conduit capacity is 360 CFS.

REPLACEMENT COST VALUATION

The Ivanhoe Creek Crossing Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Ivanhoe Creek Crossing Conduit.

Recommended Replacement Cost = $2M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**FRYINGPAN VALLEY CONDUIT**
FEATURE ID	**CON-FRY**
SLOPE	**WEST**
BEGIN LOCATION	**NAST TUNNEL**
ENTER FEED	**N/A**
END LOCATION	**BOUSTEAD TUNNEL**
COLLECTION SYSTEM	**NORTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**84"**
LENGTH	**2,430 FT**
DESIGN FLOWS (CFS)	**360**

FEATURE DESCRIPTION

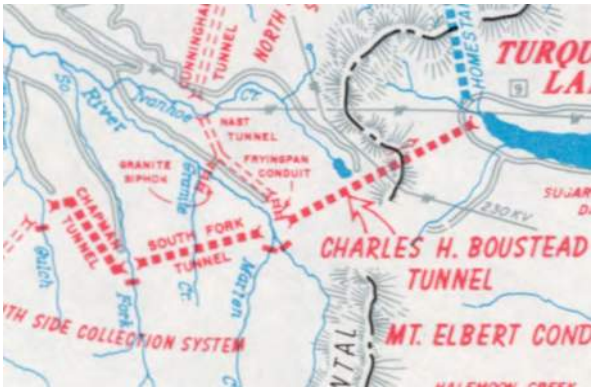
This conduit is a 2,430-foot, 84-inch precast concrete pipe that connects the Nast Tunnel to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The conduit has a capacity of 360 CFS.

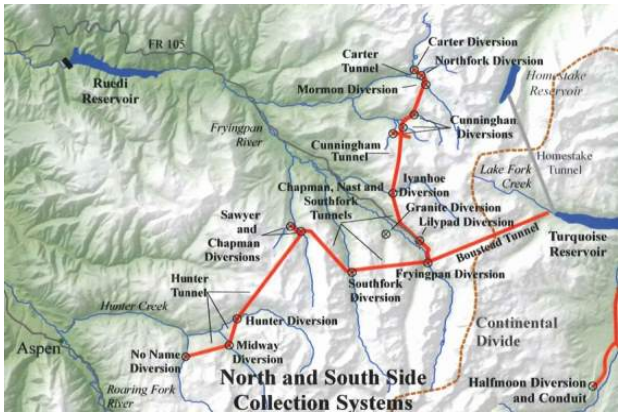
REPLACEMENT COST VALUATION

The Fryingpan Valley Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Fryingpan Valley Conduit.

Recommended Replacement Cost = $11.7M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**CHAPMAN FEEDER CONDUIT**
FEATURE ID	**FC-CHA**
SLOPE	**WEST**
BEGIN LOCATION	**CHAPMAN DIVERSION STRUCTURE**
ENTER FEED	**N/A**
END LOCATION	**CHAPMAN TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**11' X 7' - BOX**
LENGTH	**265 FT**
DESIGN FLOWS (CFS)	**300**

FEATURE DESCRIPTION

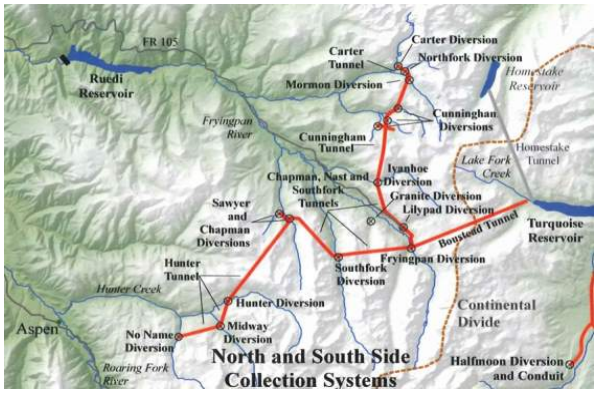
This conduit is a 3,098-foot, 27” precast concrete pressure pipe that conveys up to 30 CFS of water from the Sawyer Creek Diversion Structure to Chapman Gulch upstream of the Chapman Gulch Diversion Structure.

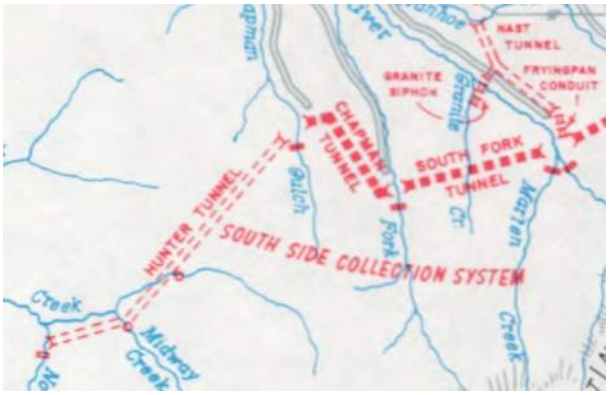
REPLACEMENT COST VALUATION

The Chapman Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Chapman Feeder Conduit.

Recommended Replacement Cost = $1.8M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SAWYER CONDUIT**
FEATURE ID	**CON-SAW**
SLOPE	**WEST**
BEGIN LOCATION	**SAWYER DIVERSION STRUCTURE**
ENTER FEED	**N/A**
END LOCATION	**CHAPMAN GULCH**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**27"**
LENGTH	**3,098 FT**
DESIGN FLOWS (CFS)	**30**

FEATURE DESCRIPTION

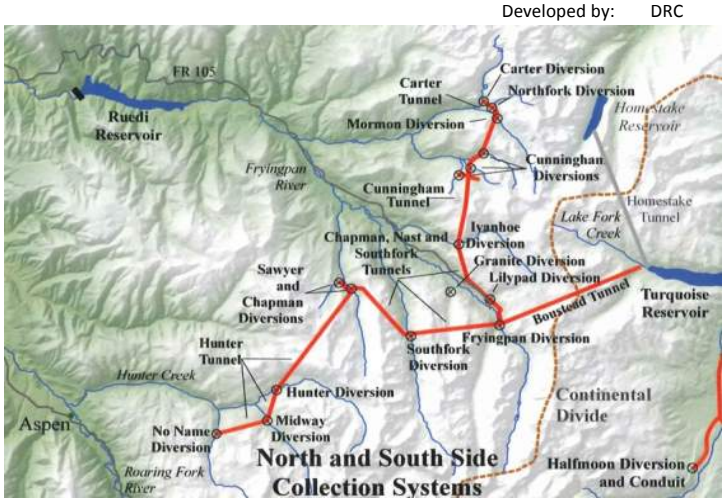
This conduit is a 3,098-foot, 27” precast concrete pressure pipe that conveys up to 30 CFS of water from the Sawyer Creek Diversion Structure to Chapman Gulch upstream of the Chapman Gulch Diversion Structure.

REPLACEMENT COST VALUATION

The Sawyer Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Sawyer Conduit.

Recommended Replacement Cost = $4.7M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SOUTH FORK FEEDER CONDUIT**
FEATURE ID	**FC-SF**
SLOPE	**WEST**
BEGIN LOCATION	**SOUTH FORK SIPHON**
END LOCATION	**SOUTH FORK TUNNEL**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
DIAMETER	**8' X 9' - 6" BOX**
LENGTH	**395 FT**
DESIGN FLOWS (CFS)	**215 to 250 CFS**

FEATURE DESCRIPTION

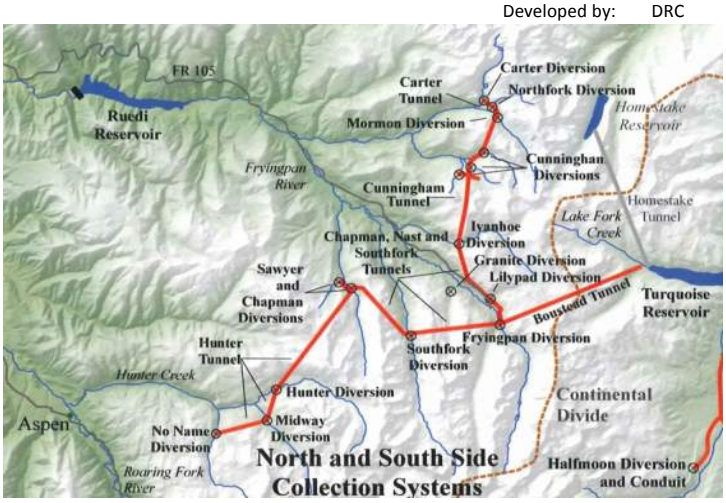
This conduit is a 395-foot, 9.5- by 8-foot reinforced concrete box that conveys water from the South Fork Diversion Dam to an inlet located on the South Fork Siphon. The feeder conduit can convey 215 to 250 CFS.

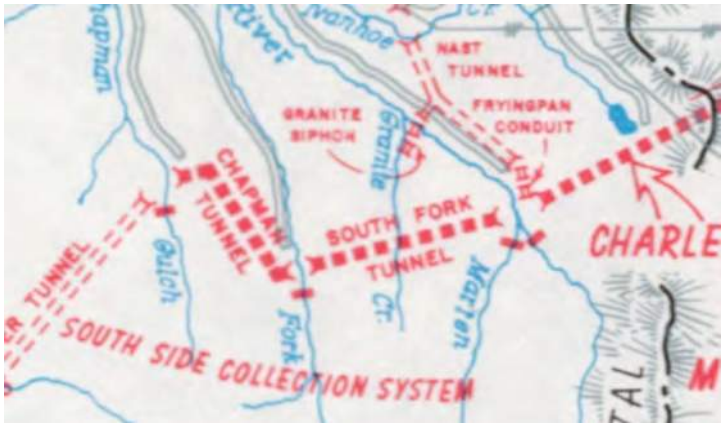
REPLACEMENT COST VALUATION

The South Fork Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the South Fork Feeder Conduit.

Recommended Replacement Cost = $2.6M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity





SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**SOUTH FORK SIPHON**
FEATURE ID	**S-SF**
SLOPE	**WEST**
BEGIN LOCATION	**SOUTH FORK DIVERSION STRUCTURE**
END LOCATION	**SOUTH FORK FEEDER CONDUIT**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
LENGTH	**711 FT**
DIAMETER	**75 IN**
CAPACITY (CFS)	**300**

FEATURE DESCRIPTION

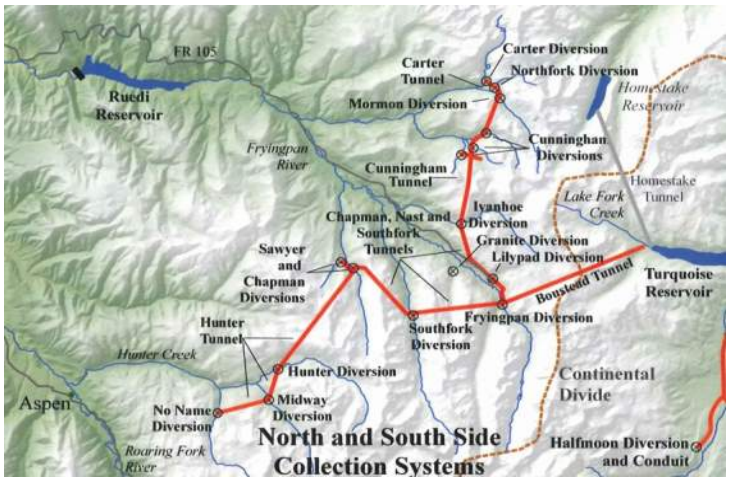
This siphon is a 711-foot, 75-inch diameter concrete siphon that connects the Chapman and South Fork tunnels. The siphon conveys flows from the Chapman Tunnel as well as flows from the South Fork Feeder Conduit. The siphon can convey up to 300 CFS.

REPLACEMENT COST VALUATION

The South Fork Siphon costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the South Fork Siphon.

Recommended Replacement Cost = $3M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**FRYINGPAN SIPHON**
FEATURE ID	**S-FRY**
SLOPE	**WEST**
BEGIN LOCATION	**FRYINGPAN DIVERSION STRUCTURE**
END LOCATION	**FRYINGPAN FEEDER CONDUIT**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
LENGTH	**479 FT**
DIAMETER	**90 IN**
CAPACITY (CFS)	**450**

FEATURE DESCRIPTION

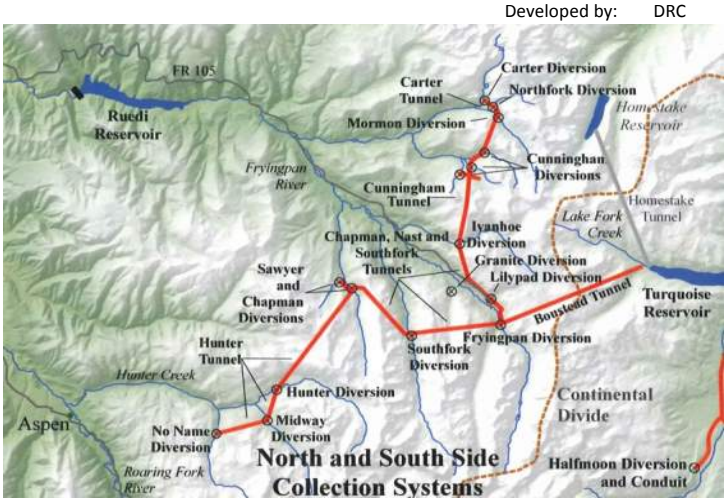
This siphon is a 479-foot, 90-inch diameter concrete siphon that connects the South Fork Tunnel to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The siphon can convey up to 450 CFS.

REPLACEMENT COST VALUATION

The Fryingpan Siphon costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Fryingpan Siphon.

Recommended Replacement Cost = $2.4M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**FRYINGPAN RIVER FEEDER CONDUIT**
FEATURE ID	**FC-FRY**
SLOPE	**WEST**
BEGIN LOCATION	**FRYINGPAN SIPHON**
END LOCATION	**FRYINGPAN VALLEY CONTROL STRUCTURE**
COLLECTION SYSTEM	**SOUTH**
NATIONAL FOREST	**WHITE RIVER**
WILDERNESS	**N/A**
LENGTH	**400 FT**
DIAMETER	**12'x12.5' Box**
CAPACITY (CFS)	**400**

FEATURE DESCRIPTION

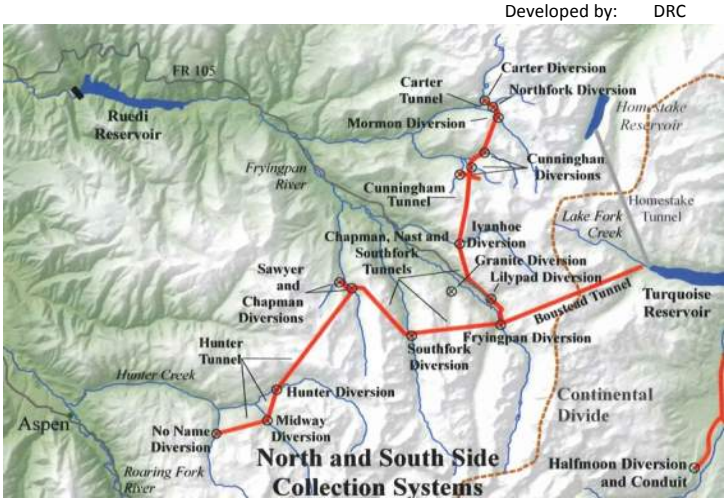
This conduit is a 400-foot, 12- by 12.5-foot reinforced concrete box that conveys flows from the Fryingpan River Diversion to the Fryingpan Valley Control Structure located immediately upstream of the Boustead Tunnel's inlet portal. The feeder conduit has a capacity of 400 CFS.

REPLACEMENT COST VALUATION

The Fryingpan River Feeder Conduit costs were developed using actual construction costs from similar conduit projects in the Rocky Mountain Region and further refined through expert evaluation (see Appendix B of this report). The following results are provided for the replacement of the Fryingpan River Feeder Conduit.

Recommended Replacement Cost = $4.4M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 47.67%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**HALFMOON FEEDER CONDUIT**
FEATURE ID	**FC-HAL**
COLLECTION SYSTEM	**EAST SLOPE**
BEGIN LOCATION	**HALFMOON DIVERSION STRUCTURE**
ENTER FEED	**N/A**
END LOCATION	**MT. ELBERT CONDUIT**
NATIONAL FOREST	**N/A**
WILDERNESS	**N/A**
DIAMETER	**60"**
LENGTH	**3,202 FT**
DESIGN FLOWS (CFS)	**150**

FEATURE DESCRIPTION

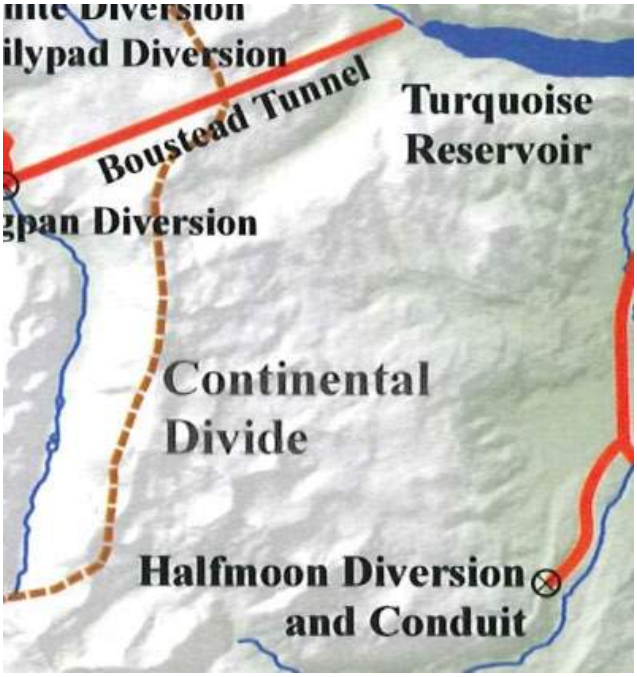
This conduit is a 3,202-foot, 60-inch pipe that conveys flow from the Halfmoon Creek Diversion to an inlet on the Mount Elbert Conduit. The conduit capacity is 150 CFS.

REPLACEMENT COST VALUATION

The Halfmoon Feeder Conduit costs were developed using original construction costs for the Mt. Elbert Conduit project escalated to current costs (see Appendix B of this report). The following results are provided for the replacement of the Halfmoon Feeder Conduit.

Recommended Replacement Cost = $4.3M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 54.17%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

Developed by: DRC

FEATURE	**MT. ELBERT CONDUIT**
FEATURE ID	**CON-ELB**
COLLECTION SYSTEM	**EAST SLOPE**
BEGIN LOCATION	**SUGAR LOAF DAM**
ENTER FEED	**HALFMOON FEEDER CONDUIT**
END LOCATION	**MT. ELBERT FOREBAY**
NATIONAL FOREST	**PIKE AND SAN ISABEL**
WILDERNESS	**N/A**
DIAMETER	**90"**
LENGTH	**56,150 FT**
DESIGN FLOWS (CFS)	**350**

FEATURE DESCRIPTION

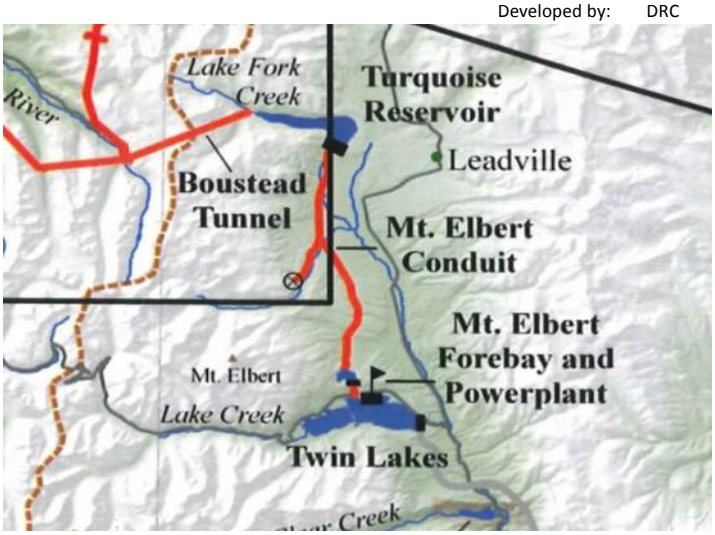
This conduit is a 10.5-mile-long, 90-inch-diameter pipe that conveys water from the Sugarloaf Dam outlet works to the Mt. Elbert Forebay. The Halfmoon Diversion Dam intercept flows from Halfmoon Creek and diverts water into the Mt. Elbert Conduit. The conduit's capacity is 350 CFS.

REPLACEMENT COST VALUATION

The Mt. Elbert Conduit costs were developed using original construction costs for the project escalated to current costs (see Appendix B of this report). The following results are provided for the replacement of the Mt. Elbert Conduit.

Recommended Replacement Cost = $120M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 52%
District Fry-Ark Activity



SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

CONTROL FACILITIES

FEATURE	LOCATION	SF	UNIT COST	REPLACEMENT COST (in 2020 dollars)	OM&R COST ALLOCATION FOR SECWCD[2]
Meredith Office / Maintenance Shop	West Slope - Ruedi	2600	$723	$1,880,000	54.17%
Chapman Control Building[1]	West Slope - SS Collection	500	$723	$6,360,000	47.67%
Mormon Control Building	West Slope - NS Collection	450	$723	$330,000	54.17%
Twin Lakes Office / Maintenance Shop	East Slope	4800	$723	$3,470,000	47.67%
Sugar Loaf Office / Maintenance Shop	East Slope	2800	$723	$2,020,000	52.54%

[1] Includes $6M for 2010 SCADA upgrades (See below)
[2] District Fry-Ark Activity

Chapman Control Building SCADA Cost Escalation			
Costing Year	**2020**		
Yearly Escalator (%)	**4.69%**		
Historical Cost	Year	Age	Replacement Value (in 2020 dollars)
$3,735,100	2010	10	$5,906,827
			$6,000,000

VALUATION DISTRIBUTION WITHIN SYSTEM (IN 2020 DOLLARS)	
Collection & Delivery Features	$1,880,000
South Side Collection	$6,360,000
North Side Collection	$330,000
West Slope Total Cost	**$8,570,000**
East Slope Total Cost	**$5,490,000**

Meredith Office / Maintenance Shop	The Meredith control facility is a 2,600 SF office / maintenance shop located on the east side of Ruedi Reservoir.
Chapman Control Building	This control facility is a 500 SF low-profile concrete operations building that houses the control and monitoring equipment for the Hunter and Chapman Tunnel diversion facilities and is located about 800 feet north of the Hunter Tunnel outlet portal. The control facilities enclosed in the building control and monitor the gates at the Hunter, Midway, No Name, Sawyer, and Chapman Diversion Structures along with the high-water surface probes in Hunter and Chapman Tunnels.
Mormon Control Building	This control facility is a 450 SF low-profile concrete operations building that houses the control and monitoring equipment for Carter, Mormon, Cunningham, and Nast Tunnel Diversion facilities and is located between the Carter and Mormon Tunnels. The control facilities enclosed in the building control and monitor the gates at the Carter, North Fork, Mormon, North Cunningham, Middle Cunningham, South Cunningham, Ivanhoe, Lily Pad, and Fryingpan Diversion Structures along with the high-water surface probes in the Mormon and Cunningham Tunnels.
Twin Lakes Office / Maintenance Shop	This facility is a 4,800 SF office / maintenance shop located at Twin Lakes.
Sugar Loaf Office / Maintenance Shop	This facility is a 2,800 SF office / maintenance shop located at Turquoise Reservoir.

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

FEATURE	**DISTRICT HEADQUARTERS BUILDING**
FEATURE ID	**HQ**
SLOPE	**EAST**
LOCATION	**31717 United Avenue - Pueblo, CO**

FEATURE DESCRIPTION

The 8,300 SF SECWCD Headquarters is located east of Pueblo and south of Pueblo Memorial Airport. The SECWCD Headquarters is home to the management and operations of the SECWCD.

REPLACEMENT COST VALUATION

Replacement costs for the District Headquarters Building were developed based on well-documented historical construction cost data. The costs were escalated to current values as shown below.

Costing Year	**2020**		
Yearly Escalator (%)	**4.69%**		
Historical Cost	Year	Age	Replacement Value
$936,497	2000	20	$2,342,127
$0	2001	19	$0
$0	2002	18	$0
$0	2003	17	$0
$0	2004	16	$0
$217,719	2005	15	$432,986
			$3,000,000

Recommended Replacement Cost = $3M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 100%
District Operations Activity (Separate from Fry-Ark)

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT
PHASE 1 FEATURE VALUATION

FEATURE	**BRODERICK HYDROPOWER PLANT**
FEATURE ID	**BHP**
SLOPE	**EAST**
LOCATION 1	**Pueblo Reservoir Dam**
LOCATION 2	**North Outlet Works**

FEATURE DESCRIPTION

The 7.5-MW Broderick Hydropower Plant was commissioned in 2019. The plant derives power from flows leaving Pueblo Dam's north outlet works. Three turbines and two generators can be used individually or in combination to take advantage of releases from Pueblo Dam ranging from 35 to 810 CFS. Power generated is provided to the City of Fountain and Fort Carson Army Base through Colorado Springs Utilities.

REPLACEMENT COST VALUATION

Replacement costs for the Broderick Hydropower Plant were developed based on well-documented historical construction cost data. The costs were escalated to current values as shown below.

Costing Year	**2020**		
Yearly Escalator (%)	**4.69%**		
Historical Cost	Year	Age	Replacement Value
$7,600,699	2017	3	$8,721,057
$9,688,860	2018	2	$10,618,987
$923,587	2019	1	$966,903
			$21,000,000

Recommended Replacement Cost = $21M
(in 2020 dollars)

OM&R Cost Allocation for SECWCD = 100%
Enterprise Activity

APPENDIX B – EXPERT VALUATION REPORTS

DAMS

DIVERSION STRUCTURES

TUNNELS

CONDUITS AND SIPHONS

SECWCD

Phase 1 – Feature Valuation Study

Providence Infrastructure Consultants
121 S. Tejon Street, Suite 201
Colorado Springs, CO 80903
(719) 757-1120
www.providenceic.com

SOUTHEASTERN COLORADO
Water Conservancy District
"Your investment in water"

Cost Review - Dams

To:	**Mark M. Scott, PE - Project Manager, Providence Infrastructure Consultants**
Lead Authors:	**Phil Martin**
Date:	**June 2, 2020**
Status:	**FINAL**
TM #:	**1**

Table of Contents

1. Introduction....1
2. Scope of Work....1
3. Evaluation....1
4. Recommendations....2

List of Tables

Table 1: Escalated and Evaluated Cost Summary
Table 2: Escalated and Class 5 Evaluated Costs
Table 3: Recommended Evaluated Dam Replacement Costs

Appendices

Appendix A: Comparative Dam Projects

1. Introduction

Phase 1 of the Feature Valuation Study includes the preparation of order-of-magnitude level replacement cost estimates for select features of the Southeastern Colorado Water Conservancy District (SECWCD) District and Enterprise select features. In 2019, the SECWCD adopted a policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of various SECWCD District and Enterprise features. Phase 1 asset valuation efforts were based on the use of existing feature information provided to PIC by SECWCD. No field investigations were performed as part of Phase 1 but are anticipated in potential later project phases.

This memorandum documents the Phase 1 professional cost review services performed for the SECWCD. The cost reviews were performed as part of developing and finalizing order of magnitude costs for the District Fry-Ark dams identified by the SECWCD as features to be assigned replacement costs.

The professional review of dam costs was performed by Mr. Phil Martin of Integrated Engineering & Construction. Mr. Martin brings over 35 years of construction experience working on large heavy civil projects ranging from $10 million to over $1 billion. He has a unique combination of design and construction experience working on complex projects in challenging environments with difficult site conditions. Over the course of his construction career Mr. Martin was involved in a variety of projects including dams, bridges, and drilled and driven foundations.

2. Scope of Work

Mr. Martin reviewed the initial cost data and feature descriptions provided by PIC using his industry experience and other available resources and information. Mr. Martin's cost evaluation was to provide a "reality check" of the order-of-magnitude conceptual level replacement cost estimates developed by PIC. The purpose of the professional cost evaluation was to more confidently arrive at conceptual level replacement costs that are in line with a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering (AACE). To support Mr. Martin's cost evaluations, PIC provided its initial cost estimates along with available descriptions of each dam feature and a general description of the District Fry-Ark Project. To develop its initial cost estimates, PIC used original construction cost data provided by the SECWCD and escalated this cost data using Engineering News Record's (ENR) Indices. Most of the dam features that were included in the estimating efforts were built in the 1960's to 1970's. The four dam features included in Mr. Martin's cost evaluation are:

- Ruedi Dam
- Sugarloaf Dam
- Twin Lakes Dam
- Pueblo Dam

3. Evaluation

Conceptual estimates were developed from brief descriptions of the dams and limited available information on quantities or the ability to obtain quantities. Other quantities were extrapolated from the basic dimensions available and assumed dimensions. Volume of excavation and embankment was available for Ruedi, Sugar Loaf and Pueblo dams, Twin Lakes dam volumes were ratioed from Sugar Loaf as they are similar projects. Costs for major items of work were developed from recent past projects and the Chimney Hollow project Schedule of Values that recently bid in Colorado. Bid items within the Schedule of Values were grouped and combined, then each group were compared as a percentage of the project total cost and then applied to the four dams under evaluation

for conceptual cost development. Another comparison developed was evaluating the entire project cost as a function of the total cubic yards of excavation and embankment.

Table 1 shows a summary of the conceptual costs for each dam, and the escalated cost of the original project to 2020 detailed information of costs, comparative projects and the Chimney Hollow Project costs are included in Appendix A.

Table 1: Escalated and Evaluated Cost Summary

Dam Feature	Escalated Costs ($Millions)	Evaluated Cost Range ($Million)
Ruedi Dam	$261	$193
Sugar Loaf Dam	$112	$99
Twin Lakes Dam	$173	$134
Pueblo Dam	$655	$959

4. Recommendations

A contingency of 20% for the low range and 50% for the high range should be applied to each dam to establish a cost range for each dam at this level of estimate and is presented in Table 2 [Range based on selecting low end (lowest percentage) of the under range and half of the high end of the over range of the Class 5 ranges].

Table 2: Escalated and Class 5 Evaluated Costs

Dam Feature	Escalated Costs ($Millions)	Evaluated Cost Range ($Million)
Ruedi Dam	$261	$154 to $289
Sugar Loaf Dam	$112	$79 to $149
Twin Lakes Dam	$173	$107 to $201
Pueblo Dam	$655	$762 to $1,495

The initial escalated costs initially provided by for Ruedi, Sugar Loaf and Twin Lakes dams are within or close to the contingency cost ranges of the evaluated costs. Pueblo Dam is the exception with the evaluated cost range being larger that the initial escalated costs. The large dam analysis performed for comparison did not have the concrete dam component of Pueblo Dam, which would be predominately mass concrete placements.

Table 3 presents the evaluated cost recommendations based on my evaluation:

Table 3: Recommended Evaluated Dam Replacement Costs

Dam Feature	Recommended Costs ($Millions)	Comments
Ruedi Dam	$261	Matches initial escalated cost within the evaluated cost range
Sugar Loaf Dam	$114	Middle of the evaluated cost range and close to the initial escalated cost
Twin Lakes Dam	$173	Matches initial escalated cost within the evaluated cost range
Pueblo Dam	$1,129	Middle of the evaluated cost range. initial escalated cost believed to be too low for the replacement of this Dam based on the information available.

The conceptual estimates could be further refined with as-built drawings to develop quantities for pricing.

The conceptual cost estimates could be further developed utilizing as-built, original drawings, and/or more extensive site investigations in order to get more accurate quantities.

Appendix A

Comparative Dam Projects

FRYINGPAN-ARKANSAS PROJECT

Ruedi Dam

Description	Quantity		Unit Price	Total	Notes
Mobe/Demobe	1.00	LS	$15,000,000	$15,000,000	Includes $ for craft subsitence,lodging, travel due to remote location
Water Diversion/Handing	1.00	LS	$3,600,000	$3,600,000	
Clearing, Grubbing , Fencing, Misc.	1.00	LS	$1,500,000	$1,500,000	
Access	1.00	LS	$6,000,000	$6,000,000	
Spillway	1.00	LS	$14,000,000	$14,000,000	Similar to Hebgen Dam Spillway, add additional basin cost
Hexagonal Intake w/ trash racks	1,000.00	CY	$1,800	$1,800,000	Hebgen did not have an Intake Tower
Tunnel, Portals & Outlet	650.00	LF	$35,000	$22,750,000	Similar to Crow Dam
Shaft House & Adit	1.00	LS	$2,000,000	$2,000,000	
Control House	1.00	LS	$1,000,000	$1,000,000	
Auxiliary Intake, Tunnel & Outlet	1.00	LS	$30,000,000	$30,000,000	Similar to Crow Dam plus intake and outlet features
Excavation/Foundation	675,000.00	CY	$29	$19,575,000	Narrow steep excavation, controlled blasting for spillway
Embankment	3,745,200.00	CY	$20	$74,904,000	Narrow embankment area, slower production
Testing/Startup Commissioning	1.00	LS	$250,000	$250,000	
		Total		**$192,379,000**	

Large Dam Analysis (Based on Embankment)

	Quantity		Unit Price	Total	
Earthwork + Embankment	4,420,200	CY	$26	$114,925,200	Probably low due to extra outlet works, project location

Sugar Loaf Dam

Description	Quantity		Unit Price	Total	Notes
Mobe/Demobe	1	LS	$5,000,000	$5,000,000	
Water Diversion/Handing	1	LS	$2,000,000	$2,000,000	
Clearing, Grubbing , Fencing, Misc.	1	LS	$1,000,000	$1,000,000	
Access	1	LS	$2,000,000	$2,000,000	
Spillway Shaft, Tunnel, Stilling Basin	1	LS	$30,000,000	$30,000,000	Crow Dam tunnel plus vertical shaft
Morning Glory Intake	750	CY	$2,800	$2,100,000	Hebgen did not have an Intake Tower
Outlet Works Tunnel and Structures	650	LF	$35,000	$22,750,000	Similar to Crow Dam
Shaft House & Adit	1	LS	$2,000,000	$2,000,000	
Control House	1	LS	$1,000,000	$1,000,000	
Excavation / Foundation	330,000	CY	$20	$6,600,000	
Embankment	1,833,700	CY	$13	$23,838,100	
Testing/Startup Commissioning	1	LS	$250,000	$250,000	
		Total		**$98,538,100**	

Large Dam Analysis (Based on Embankment)

Earthwork + Embankment	2,163,700	CY	$26	$56,256,200	Probably low compared to above due to morning glory spillway and tunnel versus surface spillway

Twin Lakes Dam

Description	Quantity		Unit Price	Total	Notes
Mobe/Demobe	1	LS	$6,000,000	$6,000,000	
Water Diversion/Handing	1	LS	$2,500,000	$2,500,000	
Clearing, Grubbing , Fencing, Misc.	1	LS	$1,000,000	$1,000,000	
Access	1	LS	$2,000,000	$2,000,000	
Spillway Shaft, Tunnel, Stilling Basin	1	LS	$30,000,000	$30,000,000	Crow Dam tunnel plus vertical shaft
Morning Glory Intake	400	CY	$2,800	$1,120,000	Hebgen did not have an Intake Tower
Outlet Works Tunnel and Structures	650	LF	$90,000	$58,500,000	Tunnel larger here, twin large diameter pipes
Shaft House & Adit	1	LS	$2,000,000	$2,000,000	
Control House	1	LS	$1,000,000	$1,000,000	
Excavation	216,000	CY	$20	$4,320,000	
Embankment	1,200,000	CY	$13	$15,600,000	
Upstream Concrete Lining	9,300	CY	$1,000	$9,300,000	
Testing/Startup Commissioning	1	LS	$250,000	$250,000	
			Total	**$133,590,000**	

Large Dam Analysis (Based on Embankment)

Earthwork + Embankment	1,416,000	CY	$26	$36,816,000	Probably substantially low compared to above due to morning glory spillway and tunnel versus surface spillway and upstream dam slope concrete lining

Pueblo Dam

Description	Quantity		Unit Price	Total	Notes
Mobe/Demobe	1	LS	$48,000,000	$48,000,000	
Water Diversion/Handing	1	LS	$11,000,000	$11,000,000	similar to large dam cost
Clearing, Grubbing , Fencing, Misc.	1	LS	$10,000,000	$10,000,000	
Access	1	LS	$9,000,000	$9,000,000	
Concrete Dam/Spillway	522,000	CY	$1,200	$626,400,000	Mass concrete, less form work, includes foundation prep
Intakes (Concrete Portion)	1	LS	$5,000,000	$5,000,000	
Control House	1	LS	$2,000,000	$2,000,000	
Excavation	2,800,000	CY	$20	$56,000,000	
Embankment	12,000,000	CY	$13	$156,000,000	
North Outlet Works	1	LS	$10,000,000	$10,000,000	dam portion only
Testing/Startup Commissioning	1	LS	$1,000,000	$1,000,000	
			Total Dam	**$934,400,000**	
Powerhouse	1	LS	$24,000,000	$24,000,000	
			Total Project	**$958,400,000**	

Large Dam Analysis (Based on Embankment)

Earthwork + Embankment	14,800,000	CY	$32	$473,600,000	This value would exclude the concrete section above, with concrete added = $1,100,000 (without powerhouse)

FRYINGPAN-ARKANSAS PROJECT

Asset Valuation Study, Phase 1

Comparative Projects

Project	Description	Major Volumes	Construction Year	Cost	Notes
Hebgen Dam Spillway Replacement	Concrete chute spillway with 4 actuator controlled gates, open intake to reservoir	6,000 CY concrete	2016	$7,000,000	Includes demolition of existing spillway
Crow Dam Spillway Replacement	Chute spillway with piano key weir	7,000 CY concrete	2020	$15,000,000	Includes excavation, road and bridge work
Crow Dam Tunnel (30% design estimate)	Horse tunnel, 10x12 & 14x14, 72" & 18" steel pipes, small intake structure and outlet structures	650 lf of tunnels, including portals	Estimate in 2020	$22,700,000	New tunnel alignment, with simple intake and outlet structures

FRYINGPAN-ARKANSAS PROJECT

Large Dam Comparative Costs

Chimney Hollow Bid Schedule

Description	Quantity		Total		% of Project Total	Notes
Mobe / Demobe	1	LS	$24,485,750			
			Subtotal	$24,485,750	*5.11%*	
Water Diversion & Handling						
Sediment/Erosion Control/Care of Water	1	LS	$9,154,000			
Cofferdam/Stream Diversion	1	LS	$1,500,000			
			Subtotal	*$10,654,000*	*2.22%*	
Clearing, Grubbing , Fencing, Misc.	1	LS	$3,513,000			
			Subtotal	*$3,513,000*	*0.73%*	
Access						
Larimer County / Access Road	1	LS	$2,945,880			
Larimer County and Pole Hill Culverts	1	LS	$1,260,231			
Multiplate Arch Bridge	1	LS	$1,000,000			
Saddle Dam Access	1	LS	$1,693,600			
Saddle Dam Access Road Drainage	1	LS	$1,608,914			
Internal Permanent Access Roads	1	LS	$7,291,145			
			Subtotal	$15,799,770	*3.30%*	
Main Dam Exc & Foundation Prep						
Main Dam Excavation & Foundation Prep	2,310,600	CY	$28,294,105			
Main Dam Curtain Grouting	1	LS	$13,231,000			
Main Dam Blanket Grouting	1	LS	$5,065,500			
			Subtotal	*$46,590,605*	*9.72%*	$20/per excavation yard volume, excavation volume is 18% of embankment, without asphalt core
Main Dam Embankment						
Main Dam Embankment (w/asphalt core)	12,608,000	CY	$196,331,250			
Main Dam Plinth	1	LS	$8,948,375			
Main Dam Drainage	1	LS	$1,012,500			
			Subtotal	*$206,292,125*	*43.05%*	$17 per embankment yard volume with asphalt core, $13 without asphalt core
Saddle / Auxiliary Dams						
Saddle Dam Exc & Foundation Prep	1	LS	$2,153,570			
Saddle Dam Curtain Grouting	1	LS	$1,535,750			
Saddle Dam Embankment	1	LS	$6,160,625			
			Subtotal	*$9,849,945*	*2.06%*	
I/O Tunnel						
Upstream Portal	1	LS	$1,847,783			
Upstream Tunnel	1	LS	$9,517,100			
Grout Chamber	1	LS	$461,675			
Valve Chamber	1	LS	$2,088,335			
Downstream Tunnel	1	LS	$13,621,340			
Misc. - Tunnel	1	LS	$1,753,390			
Downstream Portal	1	LS	$4,320,700			
			Subtotal	*$33,610,323*	*7.01%*	
I/O Works & Structures	1	LS	$4,592,800			
I/O Conduit - Valve Chamber to Tunnel Portal	1	LS	$3,250,000			
I/O Works Mechanical & Electrical Systems	1	LS	$4,750,000			
I/O Conduit from Downstream Tunnel Portal to Valve House	1	LS	$5,325,500			
			Subtotal	*$17,918,300*	*3.74%*	
Spillway						
Spillway (~4,000 LF)	1	LS	$23,266,330			
Spillway Outlet Channel	1	LS	$5,828,850			
Tunnel Connections			*Subtotal*	*$29,095,180*	*6.07%*	
Bald Mountain Tunnel Interconnection	1	LS	$5,639,500			
Chimney Hollow Conduit	1	LS	$24,496,000			
Valve House Release Channel	1	LS	$2,124,800			
Valve House	1	LS	$35,518,652			
Carter Lake Interconnection	1	LS	$9,652,050			
Additional Services	1	LS	$3,175,000			
Testing and Startup	1	LS	$750,000			
			Subtotal	*$81,356,002*	*16.98%*	
	Total			$479,165,000		$32 / Exc + Emb quantity
	Total w/o tunnel connections			$397,808,998		$26 / Exc + Emb quantity
Major Quantities						
Dam Excavation	2,414,100	CY				
Dam Embankment	12,773,110	CY				
Total Earthwork	15,187,210	CY				

SECWCD

Phase 1 – Feature Valuation Study

Providence Infrastructure Consultants
121 S. Tejon Street, Suite 201
Colorado Springs, CO 80903
(719) 757-1120
www.providenceic.com

SOUTHEASTERN COLORADO
Water Conservancy District
"Your investment in water"

Cost Review – Diversion Structures

To:	**Mark M. Scott, PE - Project Manager, Providence Infrastructure Consultants**
Lead Author:	**Mark D. Graeser, PE**
Date:	**June 8, 2020**
Status:	**FINAL**
TM #:	**D1**

Table of Contents

1. Introduction....1
2. Scope of Work....1
3. Evaluation....2
4. Recommendations....2

List of Tables

Table 1: Recommended Diversion Structure Replacement Costs....3

List of Attachments

Attachment 1 - Diversion Structure Cost Breakdown

Attachment 2 - Diversion Structure Documentation Review

1. Introduction

Phase 1 of the Feature Valuation Study includes the preparation of order-of-magnitude level replacement cost estimates for select features of the Southeastern Colorado Water Conservancy District (SECWCD) District and Enterprise select features. In 2019, the SECWCD adopted a policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of various SECWCD District and Enterprise features. Phase 1 asset valuation efforts were based on the use of existing feature information provided to PIC by SECWCD. No field investigations were performed as part of Phase 1 but are anticipated in potential later project phases.

This memorandum documents the Phase 1 professional cost review services performed for the SECWCD. The cost reviews were performed as part of developing and finalizing order of magnitude costs for the District Fry-Ark Diversion Structures identified by the SECWCD as features to be assigned replacement costs.

The professional review of Diversion Structure costs was led by Mark D. Graeser, P.E. Mr. Graeser is Director of Structural Engineering with Alden Research Laboratory with 19 years of experience in the analysis, design, and construction of hydraulic structures. He has extensive local experience and understands the unique environmental and weather conditions that impact design and construction in Colorado. Mr. Graeser has been project manager for construction projects as large as $35M and lead structural engineer for construction projects as large as $70M. His specific project experience includes diversion structures, hydropower facilities, dam appurtenances, and hydraulic gates. Mr. Graeser also specializes in the evaluation, retrofit, rehabilitation, and modernization of existing structures.

2. Scope of Work

Mr. Graeser reviewed the initial cost data and feature descriptions provided by PIC using his industry experience and other available resources and information. His cost evaluation provides a “reality check” of the order-of-magnitude conceptual level replacement cost estimates developed by PIC. The purpose of the professional cost evaluation was to more confidently arrive at conceptual level replacement costs that are in line with a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering (AACE). To support Mr. Graeser’s cost evaluations, PIC provided its initial cost estimates along with available descriptions of each Diversion Structure feature and a general description of the District Fry-Ark Project. To develop its initial cost estimates, PIC used original construction cost data provided by the SECWCD (where available) and escalated this cost data using Engineering News Record’s (ENR) Indices. Most of the Diversion Structure features that were included in the estimating efforts were built in the 1960’s to 1970’s. The Diversion Structure features included in Mr. Graeser’s cost evaluation are:

- Fryingpan River & Martin Creek
- Chapman Creek
- S. Fork Fryingpan River
- Ivanhoe Creek
- Carter Creek
- Mormon Creek
- N. Cunningham Creek
- Granite Creek
- S. Cunningham Creek
- M. Cunningham Creek
- Lily Pad Creek
- North Fork / Lake Savage
- Sawyer Creek
- Hunter Creek
- Midway Creek
- No Name Creek
- Halfmoon Creek

3. Evaluation

Mr. Graeser's cost evaluation was based on engineering experience and judgement. The cost evaluation included comparison with similar diversion structure construction costs in Colorado.

Mr. Graeser reviewed the reference documents and data to determine the size of the structures and primary design features. The nature of the construction (e.g. deeper structures are more expensive due to dewatering, excavation, and wall thickness) was considered in the cost evaluation. The cost evaluation also included consideration for structure features and large equipment, such as radial gates that typically require custom fabrication.

The 18 diversion structures were reviewed for general layout/type of structure and key features. Four structure types were identified:

- Type 1 – Intake structure, trash structure, sluiceway, no ogee
- Type 2 – Drop inlet
- Type 3 - Intake structure, trash structure, sluiceway, no ogee
- Type 4 – Tall/deep control structure

Structure type was also used to classify the complexity of the structure and to check for consistency in cost between the 18 diversion structures evaluated.

The Conceptual Evaluated Construction Costs were developed based on estimated construction costs for front-range Colorado. All of the diversion structures are located at remote locations in the mountains. Therefore, front-range Colorado construction costs were adjusted upward for difficult access and limited construction season.

Google Earth was used to review the project locations to determine the accessibility to the site. Site access was rated (1 = most difficult access, 2 = nearby access road, but no direct access, 3 = access road available). A short construction season is expected due to site location in the mountains and high elevation. General elevation for the diversion structures is approximately 10,000 feet. The cost evaluation assumed a construction season of 4 to 4.5 months (approximately June through September). This limited construction season will most likely require multiple construction seasons and multiple mobilization and demobilization for the larger diversion structures.

The construction cost estimate was adjusted based on site location, site access, and the number of construction seasons. Cost adjustments for site location, site access, and limited construction season ranged from 30% to 50%; with 50% representing a site with difficult access and two construction seasons for the project.

- Refer to Attachment 1 - Diversion Structure Cost Breakdown
- Refer to Attachment 2 - Diversion Structure Documentation Review

4. Recommendations

Prior to adjustments for site location, site access, and limited construction season, Mr. Graeser's estimated replacement costs for the diversion structures were in general agreement with the initial costs provided by PIC. Comparing the total costs for all diversion structures, Mr. Graeser was approximately 15% higher than the initial costs provided by PIC. The costs were in relatively good agreement; the following diversion structures had the largest difference:

- Middle Cunningham Creek Diversion Dam – cost is higher due to radial gate

- Granite Creek Diversion Dam – cost is higher because it is a small project where costs based on quantities will be too low due to higher percentage of construction costs for mobilization and demobilization
- Lily Pad Inlet Diversion Dam – cost is higher because it is a small project where costs based on quantities will be too low due to higher percentage of construction costs for mobilization and demobilization
- Sawyer Diversion Dam – cost is higher because it is a small project where costs based on quantities will be too low due to higher percentage of construction costs for mobilization and demobilization
- Chapman Diversion Dam – cost is higher due to ogee

The Recommended Diversion Structure Replacement Costs are summarized in Table 1. The Recommended Costs include adjustments for site location, site access, and limited construction season.

Table 1: Recommended Diversion Structure Replacement Costs

Diversion Structure Feature	Recommended Costs (Thousands $)	Comments
1. Carter Creek Diversion Dam	$840	• Location: West Slope North Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Nearby access road, but no direct access • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.
2. North Fork Diversion Dam	$280	• Location: West Slope North Collection System • Features: Drop inlet • Nearby access road, but no direct access • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.
3. Mormon Creek Diversion Dam	$780	• Location: West Slope North Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
4. North Cunningham Creek Diversion Dam	$260	• Location: West Slope North Collection System • Features: Drop inlet • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.

Table 1: Recommended Diversion Structure Replacement Costs		
5. Middle Cunningham Creek Diversion Dam	$910	• Location: West Slope North Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was higher than the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
6. South Cunningham Creek Diversion Dam	$260	• Location: West Slope North Collection System • Features: Drop inlet • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
7. Ivanhoe Diversion Dam	$780	• Location: West Slope North Collection System • Features: Intake structure, trash structure, sluiceway, ogee • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
8. Granite Creek Diversion Dam	$350	• Location: West Slope North Collection System • Features: Drop inlet • Access: Nearby access road, but no direct access • Assumed one construction season • Conceptual Evaluated Construction Cost was higher than the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.
9. Lily Pad Inlet Diversion Dam	$350	• Location: West Slope North Collection System • Features: Drop inlet • Access: Nearby access road, but no direct access • Assumed one construction season • Conceptual Evaluated Construction Cost was significantly higher than the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.

Table 1: Recommended Diversion Structure Replacement Costs		
10. No Name Creek Diversion Dam	$1,350	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Access: Nearby access road, but no direct access • Assumed two construction seasons • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 50% adjustment for site location, site access, and limited construction season.
11. Midway Creek Diversion Dam	$1,500	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Access: Nearby access road, but no direct access • Assumed two construction seasons • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 50% adjustment for site location, site access, and limited construction season.
12. Hunter Creek Diversion Dam	$1,500	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, radial gate • Access: Nearby access road, but no direct access • Assumed two construction seasons • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 50% adjustment for site location, site access, and limited construction season.
13. Sawyer Diversion Dam	$130	• Location: West Slope South Collection System • Features: Drop inlet • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was significantly higher than the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
14. Chapman Diversion Dam	$1,400	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, ogee • Access road available • Assumed two construction seasons • Conceptual Evaluated Construction Cost was significantly higher than the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.

Table 1: Recommended Diversion Structure Replacement Costs		
15. South Fork Diversion Dam	$2,100	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, ogee • Access road available • Assumed two construction seasons • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.
16. Fryingpan Diversion Dam	$2,800	• Location: West Slope South Collection System • Features: Intake structure, trash structure, sluiceway, ogee • Access road available • Assumed two construction seasons • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 40% adjustment for site location, site access, and limited construction season.
17. Fryingpan Valley Control Structure	$650	• Location: West Slope South Collection System • Features: Tall/deep control structure • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.
18. Halfmoon Diversion Dam	$390	• Location: East Slope Delivery System • Features: Drop inlet • Access road available • Assumed one construction season • Conceptual Evaluated Construction Cost was similar to the PIC initial cost. • Recommended Cost includes 30% adjustment for site location, site access, and limited construction season.

ATTACHMENT 1
DIVERSION STRUCTURE CONSTRUCTION COST BREAKDOWN
FRYINGPAN-ARKANSAS PROJECT ASSET VALUATION

Feature #	System	Feature (Diversion Structure)	Feature ID	Escalated Construction Cost	Conceptual Evaluated Construction Cost (Notes 1, 2, & 3)	Lower Bound Construction Cost (-20%)	Upper Bound Construction Cost (+50%)	Recommended Construction Cost (Notes 1, 2, & 3)
1	West Slope North Collection	Carter Creek Diversion Dam	DIV-CAR	$520,000	$600,000	$480,000	$900,000	$840,000
2	West Slope North Collection	North Fork Diversion Dam	DIV-NF	$180,000	$200,000	$160,000	$300,000	$280,000
3	West Slope North Collection	Mormon Creek Diversion Dam	DIV-MOR	$490,000	$600,000	$480,000	$900,000	$780,000
4	West Slope North Collection	North Cunningham Creek Diversion Dam	DIV-NCU	$170,000	$200,000	$160,000	$300,000	$260,000
5	West Slope North Collection	Middle Cunningham Creek Diversion Dam	DIV-MCU	$550,000	$700,000	$560,000	$1,050,000	$910,000
6	West Slope North Collection	South Cunningham Creek Diversion Dam	DIV-SCU	$200,000	$200,000	$160,000	$300,000	$260,000
7	West Slope North Collection	Ivanhoe Diversion Dam	DIV-IVA	$560,000	$600,000	$480,000	$900,000	$780,000
8	West Slope North Collection	Granite Creek Diversion Dam	DIV-GRA	$180,000	$250,000	$200,000	$375,000	$350,000
9	West Slope North Collection	Lily Pad Inlet Diversion Dam	DIV-LIL	$130,000	$250,000	$200,000	$375,000	$350,000
10	West Slope South Collection	No Name Creek Diversion Dam	DIV-NNC	$770,000	$900,000	$720,000	$1,350,000	$1,350,000
11	West Slope South Collection	Midway Creek Diversion Dam	DIV-MID	$820,000	$1,000,000	$800,000	$1,500,000	$1,500,000
12	West Slope South Collection	Hunter Creek Diversion Dam	DIV-HUN	$820,000	$1,000,000	$800,000	$1,500,000	$1,500,000
13	West Slope South Collection	Sawyer Diversion Dam	DIV-SAW	$55,000	$100,000	$80,000	$150,000	$130,000
14	West Slope South Collection	Chapman Diversion Dam	DIV-CHA	$770,000	$1,000,000	$800,000	$1,500,000	$1,400,000
15	West Slope South Collection	South Fork Diversion Dam	DIV-SF	$1,400,000	$1,500,000	$1,200,000	$2,250,000	$2,100,000
16	West Slope South Collection	Fryingpan Diversion Dam	DIV-FRY	$2,200,000	$2,000,000	$1,600,000	$3,000,000	$2,800,000
17	West Slope South Collection	Fryingpan Valley Control Structure	CS-FRYVAL	$430,000	$500,000	$400,000	$750,000	$650,000
18	East Slope Delivery	Halfmoon Diversion Dam	DIV-HAL	$320,000	$300,000	$240,000	$450,000	$390,000
			TOTALS	**$10,565,000**	**$11,900,000**	**$9,520,000**	**$17,850,000**	**$16,630,000**

Notes:

(1) Site access and site location adjustments are not included in the Conceptual Evaluated Construction Cost, but are included in the Recommended Construction Cost.

(2) Limited construction season adjustment is not included in the Conceptual Evaluated Construction Cost, but is included in the Recommended Construction Cost.

(3) Estimated construction cost is meant to be a comparative cost between the diversion structures.

Conceptual Evaluated Construction Cost is based on the following:

- Engineering experience and judgement.
- Comparison with similar diversion structure construction costs in Colorado.
- Review of the reference documents for size of structure and consideration for type of structure (Type 1, 2, 3, or 4).
- Consideration for the nature of the construction (e.g. deeper structures are more expensive due to dewatering, excavation, and wall thickness).
- Consideration for structure features and large equipment, such as radial gates that are larger and typically require custom fabrication.

ATTACHMENT 2
DIVERSION STRUCTURE - REVIEW DOCUMENTATION
FRYINGPAN-ARKANSAS PROJECT ASSET VALUATION

Feature #	Feature (Diversion Structure)	Feature Review and Notes								Google Earth (Map) Review and Notes	
		Structure Type	Number of Const. Seasons	Large (Radial) Gates	Ogee	Finish Grade EL.	Approx. Length	Approx. Width	Avg. Wall Height	Access Rating	Access Notes
1	Carter Creek Diversion Dam	Type 1	1	7 ft. x 8.5 ft. Radial gate	---	10134	83 ft.	15 ft.	8 ft.	2	Access road stops short of the structure
2	North Fork Diversion Dam	Type 2	1	---	---	10220	80 ft.	6 ft. to 10 ft.	10 ft.	2	Access road stops short of the structure
3	Mormon Creek Diversion Dam	Type 1	1	5 ft. x 10 ft. Radial gate	---	10098	90 ft.	15 ft.	10 ft.	3	Access road is visible
4	North Cunningham Creek Diversion Dam	Type 2	1	---	---	10090	45 ft.	6 ft.	10 ft.	3	Access road is visible
5	Middle Cunningham Creek Diversion Dam	Type 1	1	5 ft. x 9 ft. Radial gate	---	10055	90 ft.	20 ft.	12 ft.	3	Access road is visible
6	South Cunningham Creek Diversion Dam	Type 2	1	---	---	10539	50 ft.	12 ft.	10 ft.	3	Access road is visible
7	Ivanhoe Diversion Dam	Type 3	1	---	10 ft. high ogee	10013	40 ft.	20 ft. & 12 ft.	15 ft.	3	Access road is visible
8	Granite Creek Diversion Dam	Type 2	1	---	---	10078	40 ft.	10 ft.	11 ft.	2	Near an access road, but no direct access visible
9	Lily Pad Inlet Diversion Dam	Type 2	1	---	---	10210	36 ft.	7 ft.	12 ft.	2	Near an access road, but no direct access visible
10	No Name Creek Diversion Dam	Type 1	2	8 ft. x 12 ft. Radial gate	---	10175	90 ft.	18 ft.	12 ft.	1	Dense forest, no access visible
11	Midway Creek Diversion Dam	Type 1	2	10 ft. x 12 ft. Radial gate	---	10194	60 ft.	20 ft.	12 ft.	1	Dense forest, no access visible
12	Hunter Creek Diversion Dam	Type 1	2	8 ft. x 10 ft. Radial gate	---	10186	130 ft.	10 ft.	12 ft.	1	Dense forest, no access visible
13	Sawyer Diversion Dam	Type 2	1	---	---	10091	30 ft.	4 ft.	12 ft.	3	Access road is visible
14	Chapman Diversion Dam	Type 3	2	---	10 ft. high ogee	10045	60 ft.	24 ft.	15 ft.	3	Access road is visible
15	South Fork Diversion Dam	Type 3	2	---	10 ft. high ogee	10010	60 ft.	20 ft.	15 ft.	3	Access road is visible
16	Fryingpan Diversion Dam	Type 3	2	---	10 ft. high ogee	9969	60 ft.	25 ft.	15 ft.	3	Access road is visible
17	Fryingpan Valley Control Structure	Type 4	1	10.5 ft. x 12 ft. Radial gate	---	9965	45 ft.	10 ft.	30 ft.	3	Access road is visible
18	Halfmoon Diversion Dam	Type 2	1	---	---	9725	80 ft.	10 ft.	10 ft.	3	Access road is visible

Structure Type - Breakdown (Note 1)				
Type	**Definition/Description**	**Avg.**	**Min.**	**Max.**
Type 1	Intake structure, trash structure, sluiceway (no ogee)	$800,000	$600,000	$1,000,000
Type 2	Drop inlet	$215,000	$100,000	$300,000
Type 3	Intake structure, trash structure, sluiceway (with ogee)	$1,275,000	$600,000	$2,000,000
Type 4	Tall/deep control structure	$500,000	$500,000	$500,000

Site Access (Note 2)	
Rating	**Definition/Description**
1	Most difficult access
2	Nearby access road, but no direct access
3	Access road

Construction Season (Notes 3 & 4)
Expect a short construction season due to limited access and high elevation.
General elevation for the diversion structures is 10,000 feet.
Used Mt. Evans access road as a guide (typically open Memorial Day to first weekend in October.
→ Assumed construction season: 4 to 4.5 months (approximately June through September)

Notes:

(1) Estimated construction costs prior to applying adjustments for site access/site location and limited construction season.
(2) Recommend construction costs will apply a site access/site location adjustment based on the ratings (1, 2, or 3).
(3) Recommend construction costs will apply an adjustment for the limited construction season.
(4) Limited construction season will most likely require multiple construction seasons and multiple mob/demob for the larger diversion structures.

SECWCD

Phase 1 – Feature Valuation Study

Providence Infrastructure Consultants
121 S. Tejon Street, Suite 201
Colorado Springs, CO 80903
(719) 757-1120
www.providenceic.com

SOUTHEASTERN COLORADO
Water Conservancy District
"Your investment in water"

Cost Review - Tunnels

To:	**Mark M. Scott, PE - Project Manager, Providence Infrastructure Consultants**
Lead Authors:	**James Carroll, PE; Nate Soule, PE, PG**
Date:	**June 8, 2020**
Status:	**FINAL**
TM #:	**1**

Table of Contents

1. Introduction 1
2. Scope of Work 1
3. Evaluation 2
4. Recommendations 5

List of Figures

Figure 1: District Fry-Ark Tunnels with Fault Overlay (Ogden et. all, 1978) 4

List of Tables

Table 1: Reference Tunnels for Unit Cost Comparison 3
Table 2: Recommended Tunnel Replacement Costs 5

Abbreviations

D&B – Drill and Blast
LF – Linear Feet
TBM – Tunnel Boring Machine

Attachments

Attachment A: Detailed Evaluated Costs Analysis Table

1. Introduction

Phase 1 of the Feature Valuation Study includes the preparation of order-of-magnitude level replacement cost estimates for select features of the Southeastern Colorado Water Conservancy District (SECWCD) District and Enterprise select features. In 2019, the SECWCD adopted a policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of various SECWCD District and Enterprise features. Phase 1 asset valuation efforts were based on the use of existing feature information provided to PIC by SECWCD. No field investigations were performed as part of Phase 1 but are anticipated in potential later project phases.

This memorandum documents the Phase 1 professional cost review services performed for the SECWCD. The cost reviews were performed as part of developing and finalizing order of magnitude costs for the SECWCD District tunnels identified by the SECWCD as features to be assigned replacement costs.

The professional review of tunnel costs was led by Mr. Nate Soule, PE, PG and Mr. James Carroll, PE of Lithos Engineering. Over the last two decades, Mr. Soule has become one of the most experienced tunnel and trenchless professionals in the Rocky Mountain region. With nearly 20 years of experience in the fields of geotechnical exploration, planning, assessment, and design; Mr. Carroll has 15 years' experience in the tunnels and underground design. Educated as a mechanical engineer and trained as a Civil Engineering, Mr. Carroll has worked on water, wastewater, dam outfalls and transportation tunnels across North America. James has experience in the fields of geotechnical investigation for civil works, mechanical design, ventilation, planning, conditional assessment, and construction management. Both Mr. Soule and Mr. Carroll have encountered and overcome numerous challenges associated with various trenchless and underground projects. Both experts leverage their past experiences which have involved exploration strategies and programs, finalizing design packages, estimating construction costs, providing value engineering, and providing contractor support during construction.

2. Scope of Work

The initial escalated cost data and feature descriptions provided from the Phase 1 cost development were reviewed using the industry experience of Lithos Engineering and other available resources and information. The cost evaluation provides a "reality check" of the order-of-magnitude conceptual level replacement cost estimates developed by PIC. The purpose of the professional cost evaluation was to more confidently arrive at conceptual level replacement costs that are in line with a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering (AACE). The initial escalated cost estimates along with available descriptions of each tunnel feature and a general description of the SECWCD District and Enterprise features. To develop its initial cost estimates, PIC used original construction cost data provided by the SECWCD and escalated this cost data using Engineering News Record's (ENR) Indices. Most of the tunnel features that were included in the estimating efforts were built in the 1960's to 1970's. The tunnel features included in this cost evaluation are:

- Boustead Tunnel
- Carter Tunnel
- Mormon Tunnel
- Cunningham Tunnel
- Nast Tunnel
- Chapman Tunnel
- South Fork Tunnel
- Fryingpan Feeder Tunnel
- Hunter Tunnel
- Granite Syphon/Tunnel

3. Evaluation

The goal of this feature cost review is to provide conceptual level replacement costs in current dollars (Evaluated Costs) for each of the nine (9) District Fry-Ark tunnels in the SECWCD's system. The tunnels range from a few hundred feet in length to several miles in length. To evaluate a replacement cost of each tunnel a base unit cost of dollars per linear foot was calculated. Each base unit cost was then reviewed for each tunnel for the following factors: local geology, length, and construction access. Upon individual review of each tunnel, cost multipliers in the form of a percentage increase were added based on these three factors. The tunnel support systems, tunnel hydraulics and final tunnel linings were not reviewed as part of developing the Evaluated Costs because variations in these items are not expected to greatly influence the overall replacement cost at this Class 5 estimate level.

Initially the base evaluated unit cost of dollars per linear foot ($/lf) was established utilizing cost data from the Charles H. Boustead, Canyon, Mesa, Bellvue, Michigan Ditch, and Laramie Poudre Tunnels. After a more detailed review of these reference tunnels it was determined that the Boustead Tunnel unit cost was unreasonably high due to this cost being escalated from existing information on the original construction costs that included an undetermined number of addition feature costs beyond the tunnel construction costs alone. Table 1 below provides a summary of these tunnel features and associated Evaluated Cost. All tunnels except for the Bellvue tunnel, are located in the Rocky Mountains at elevations like the District Fry-Ark feature tunnels. It is for this reason that these tunnels were used for unit cost calculations as it considers the complicated nature of high-altitude construction. A cost factor including the tunnel diameters was initially reviewed as a factor in the unit cost, however the tunnel diameter was shown to provide only a minimal change in overall replacement cost of the system. This is to be explained, as the reference tunnels and the District Fry-Ark tunnels have a narrow tunnel diameter range between 7 to 10 Feet (ft). At this range traditional drill and blast (D&B) tunneling and mechanized tunneling such as with a tunnel boring machine (TBM) are viable excavation methods.

For a review of these excavation methods, typical production rate for TBM tunnels in the anticipated excavation diameter is on the order of 80 to 100 ft per day. For D&B tunneling, anticipated excavation rates are 20 to 40 ft per day. TBM excavated tunnels offer higher production rates due to the semi-automated excavation, removal of spoils and the installation of the initial support systems. However, there are large mobilization and equipment costs associated with TBM tunneling. The slower production rates associated with D&B tunneling are due to cycle times for D&B work activities. For D&B tunneling the work activities for each tunnel advance (typ. 5 to 8 ft) involves:

1. drilling and loading charges,
2. blasting,
3. ventilating exhaust gas,
4. muck out of spoils,
5. scaling face, wall and crown for loose rock,
6. install initial support, then repeating the cycle for the next advance.

In comparison, a typical cycle for a TBM tunnel involves:

1. advance machine (typ. 5-ft),
2. reset thrust grippers and repeat.

Note that mucking out of spoils and setting initial support can be completed while the machine is advancing, and the grippers are being reset; scaling for loose rock is not typically required in TBM tunneling.

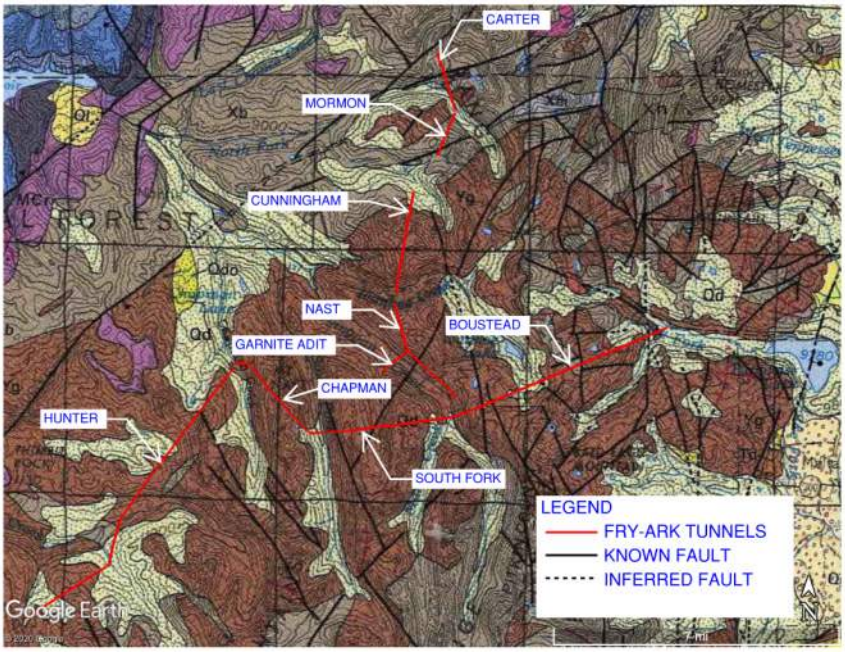
Table 1: Reference Tunnels for Unit Cost Comparison				
Tunnel	Length (feet)	Diameter	Year Built	Cost/LF
Canyon Tunnel	20000	10.5	1999	$2120
Mesa Tunnel	6800	10.5	1999	$2526
Greeley	2454	7	2016	$3865
Michigan Ditch Tunnel	764	7	2016	$4427
Laramie Poudre Tunnel (REHAB)	1516	8	2018	$5590
			Average Cost / LF	$3,706

Tunnel Geology

Geologic information from the Geologic Map of The Leadville 1° x 2° Quadrangle, Northwestern Colorado (Ogden et. all, 1978) was reviewed by the Lithos team. A review of the geology in the District Fry-Ark project area shows most tunnels to be primarily in Granitic, Biotic Gneisses and Migmatite rock. Soil units typically consisting of glacial tills can be expected at near surface elevations. The rock formations are considered hard rock for tunneling options and are excavatable by traditional D&B or mechanized excavation. Mechanized tunneling includes the use of a TBM and a roadheader, however due to the nature of the harder rock, a roadheader is not economical for longer tunnel reaches. For portal construction a 2.5% cost increase is added to each tunnel portal anticipated to be excavated through glacial tills. The reason for this is the increased ground support required at the portal location in soils and at the transition from soils to rock tunneling. Tunnel portals which start in rock are not given a cost multiplier at this stage of conceptual level replacement costs. Groundwater was not reviewed at this stage.

Faults within the bedrock mass can create complications and delays with tunneling for both D&B and TBM tunnels. Known faults marked on the Geologic Map of The Leadville 1° x 2° Quadrangle, Northwestern Colorado (Ogden et. all, 1978) were overlaid onto the District Fry-Ark tunnel alignments, see Figure 1. Typically, the rock mass around a fault is poor quality when compared to non-faulted areas. Additionally, faults can transmit higher levels of groundwater which affects construction performance. To account for faults on the District Fry-Ark tunnels, each fault is counted and assigned a value depending on how the tunnel crosses the fault. For tunnels which cross the fault at 90° a value of 1 is assigned, for tunnels which cross a fault at an angle a value of 2 is assigned, and for tunnel running parallel a value of 3 is assigned. Three (3) tunnels do not cross known faults. Five (5) tunnels cross one (1) to three (3) faults, and one (1) tunnel (Boustead) was assigned a value of ten (10) due to its crossing four (4) faults and running parallel with two (2) other faults. For each fault point assigned to a tunnel a cost multiplier of one (1) percent is added to the total tunnel cost.

Figure 1: District Fry-Ark Tunnels with Fault Overlay (Ogden et. all, 1978)



Tunnel Length Class

The District Fry-Ark tunnels were assigned a length class to determine the anticipated excavation method; D&B or TBM. The length classes are defined as: 1. Less than 1 mile, 2. More than 1 mile and less than 3 miles, and 3. More than 3 miles. There are two (2) Class 1 tunnels, three (2) Class 2 tunnels and five (5) Class 3 tunnels. For length Class 1 tunnels, it is assumed that the tunnel will be excavated by D&B methods. For tunnels in Class 2 it is assumed that D&B or TBM excavation are viable. For tunnels in Class 3 it is assumed that a TBM will be used to excavate the tunnel. There are two primary reasons to identify the excavation method at this stage. One is cost associated with the excavation method and the second is the cost associated with improving access to transport the construction equipment to the site. It is noted that for the purpose of this conceptual level replacement costs, a change in tunneling excavation methods is not directly related to unit cost or cost multipliers. A change in excavation methods is accounted for in the length cost multipliers.

Tunnel Access

Cost associated with providing construction access to District Fry-Ark tunnels was completed by identifying current access conditions and anticipated construction methods. Current access conditions were assigned based on a review of aerial images of the tunneling sites. Access conditions are defined as: No Access with no roads to tunnel portal area, Limited Access which includes gravel or forest road are available to the portal site, and Good Access which includes paved or county road available at the portal site. Most tunnels have Limited Access, one (1) tunnel has good access, and one (1) tunnel has no access to a portal. Additionally, one tunnel, the Hunter Tunnel, appears to have a mid-point surface access, but this mid-point access has no roads leading to it. To account for construction access cost, a 2.5% cost multiplier is added to all tunnels with No or Limited Access with a Length Class of 2, a 5% cost multiplier is added to all tunnels with a Limited Access and a length class of 3. No increased cost is associated with the Boustead tunnel (length class 3) where good access is available at the north portal. A 5% increase was added to the Granite Adit (length class 1) which has no current surface access. Note that the assigned access conditions did not consider the travel distance along the access road at this conceptual level replacement costs stage.

4. Recommendations

The total conceptual level replacement costs for all District Fry-Ark tunnels is $863,000,000. A unit cost of $3,706 per linear foot of tunnel was used to establish the base cost. The cost multipliers associated with the tunnel's geology, length class and construction access were added after the dollars per linear foot unit cost were multiplied by the length of each tunnel. A summary table titled "TUNNEL COST BREAKDOWN" is provided as an attachment to this section of the report which includes a breakdown of each tunnel. To refine these conceptual level replacement costs values future estimates should consider support systems, final tunnel linings, detailed access constraints, and groundwater. A visual inspection of the tunnels is recommended to gain a better understanding of the design and construction considerations that would affect cost in the event of a tunnel replacement.

Table 2 below represents the recommended replacement costs used for the District Fry-Ark tunnels based on this evaluation (see Attachment A for more details on these recommended costs). Comments provided within Table 2 reflect reviewed items associated with cost multipliers after the unit replacement cost was established on Linear foot basis as discussed above.

Table 2: Recommended Tunnel Replacement Costs

Conduit Feature	Recommended Costs (Thousand $)	Comments
Boustead Tunnel	$182,000	Crosses 4 faults, Runs parallel to 2 faults, Both portals located till/soft ground, TBM Excavation, Good access on north portal
Carter Tunnel	$17,000	Crosses 1 known fault, South portal in till/soft ground, Drill and Blast Excavation, No Access at north portal & limited access at south portal
Mormon Tunnel	$43,000	Crosses 1 fault at angle, North portal in till/soft ground, Drill and Blast or TBM Excavation, Limited access at both portals
Cunningham Tunnel	$88,000	No faults, North portal in till/soft ground, Drill and Blast or TBM excavation Limited access at both portals
Nast Tunnel	$92,000	Crosses 1 fault, Both portals in rock, Limited access at both portals, TBM Excavation, Work will be impacted by Granite Syphon/Tunnel
Chapman Tunnel	$88,000	No faults, Both portals in till/soft ground Limited access at both portals, Drill and Blast or TBM excavation
South Fork Tunnel	$102,000	Cross 1 fault, crosses 1 fault at an angle, Both portals in till/soft ground, TBM Excavation, Limited access at both portals
Hunter Tunnel	$247,000	Crosses 1 fault, Both portals in till/soft ground, Midpoint entry available with no access road, TBM Excavation, No access at south portal, limited access at north portal
Granite Syphon/Tunnel	$4,000	No faults No surface accesses Requires work from within Nast Tunnel and bulkheading. Drill and Blast Excavation

Attachment A

Detailed Evaluated Tunnel Costs Analysis Table

TUNNEL COST BREAKDOWN

FRYINGPAN-ARKANSAS PROJECT ASSET VALUATION

FEATURE #	COLLECTION SYSTEM	FEATURE	FEATURE ID	Brief Construction Details	Tunnel Base Evaluated Unit Cost ($/LF): $3,706.11			COMMENTS	EXPERT REVIEW COMMENTS	Length Class	Length and Excavation Assessment		Portal Geology		Construction Access	Faults		Total Percentage increase	Total Adjusted Evaluated Replacement Cost	Class 5 Evaluated Cost Range (-20% to +50%) (Thousand $)	Recommended Evaluated Cost (Thousand $)
					Tunnel Diameter (ft)	Tunnel Length (LF)	Total Base Tunnel Cost ($/LF)				Length Class	Anticipated Excavation	# of Portals in Soil	Cost Multiple 2.5%	Cost Multiple (varies)	Count	Cost Multiple (1%)				
1	NORTH	Carter Tunnel	T-CAR	Carter Tunnel is the first collection tunnel on the North Side Collection System. Water is diverted into the tunnel by the Carter Diversion Dam through the 300-foot, 42-inch Carter Feeder Conduit to the inlet of the Carter Tunnel. The North Fork Diversion Dam is a drop-inlet structure that diverts North Fork Creek water into the Carter Tunnel by the 280-foot-long North Fork Feeder Conduit. Carter Tunnel is 0.54 miles long and has an 8-foot horseshoe cross section with a capacity of 130 cubic feet per second. Water from Carter Tunnel flows to the Mormon Conduit. Source: U.S. Bureau of Reclamation	8	2895	$ 10,729,188	7' and 8' listed, cost difference for lined portion?	Crosses 1 known fault South portal in Till (Qd) Xb at north, Yg on south end No Access at north portal, Limited Access at south portal	0.548295	1	D&B	1	2.5%	2.5%	1	1%	6.0%	$ 11,372,940	$9,098 to $17,059	$17,000
2	NORTH	Mormon Tunnel	T-MOR	The tunnel is 1.4 miles long, with an 8.25-foot horseshoe-shaped section having a capacity of 190 cubic feet per second. The water from Mormon Tunnel flows to the Cunningham Tunnel. Source: U.S. Bureau of Reclamation	8	7374	$ 27,328,855	7' and 8' listed, lined vs unlined	Crosses 1 fault at angle, North Portal in Till (Qd) Primary Xb Limited Access at both portals	1.396591	2	D&B or TBM	1	2.5%	2.5%	2	2%	7.0%	$ 29,241,875	$23,937 to $43,862	$43,000
3	NORTH	Cunningham Tunnel	T-CUN	The Cunningham Tunnel is 2.86 miles long and has a horseshoe shape of two sizes: 8.75 and 7.5 feet. The capacity is 270 cubic feet per second. The Cunningham Tunnel flows into the Nast Tunnel. Source: U.S. Bureau of Reclamation	8.75	15082	$ 55,895,550	8.75 and 7.5 ft diameter, lined vs unlined	No Faults North portal in Till (Qd Limited access at both portals Primary Yg	2.856439	2	D&B or TBM	1	2.5%	2.5%	0	0%	5.0%	$ 58,690,328	$46,952 to $88,035	$88,000
4	NORTH	Granite Adit	A-GRA	The Granite Diversion Dam diverts water through the Granite Siphon to the Granite Adit, which drops the flow into the Nast Tunnel. Adit - 0.1 mi, 9'-4" & 7'8" Source: U.S. Bureau of Reclamation.	9.33	700	$ 2,594,277	Drawing 382-D-775 All sections show 9'4" diameter. Assume 7'8" is for short lined section Sta 36+63 to 38+79 (216 ft) 700 ft long per DOC	No faults No surface access Requires work from within Nast runnel and bulkheading. Primary Yg	0.132576	1	D&B	0	0.0%	5.0%	0	0%	5.0%	$ 2,723,991	$2,179 to $4,085	$4,000
5	NORTH	Nast Tunnel	T-NAS	Nast Tunnel: Ivanhoe Diversion Dam diverts water from Ivanhoe Creek and the Cunningham Tunnel through the Ivanhoe Creek crossing into the inlet of Nast Tunnel. The Granite Diversion Dam diverts water through the Granite Siphon to the Granite Adit, which drops the flow into the Nast Tunnel. The Lily Pad Diversion Dam drops the flow into Nast Tunnel. Nast Tunnel is 3 miles long, with a circular-shaped section with two diameters: 7.67 and 9.33 feet. The capacity of the tunnel is 360 cubic feet per second. Source: U.S. Bureau of Reclamation.	10	15699	$ 58,182,220	Per DOC Part 3, bored to a 10-ft diameter (design = 9.33-ft diameter), lined sections are 7 ft 8 in diameter	Crosses 1 fault Both Portals in Rock Limited Access at both portals Work will be impacted by Granite Adit	2.973295	3	TBM	0	0.0%	5.0%	1	1%	6.0%	$ 61,673,154	$49,388 to $92,509	$92,000
6	SOUTH	Hunter Tunnel (3 Reaches)	T-HUN	7.6 miles long. Transports flows diverted at No Name, Midway, and Hunter Creeks to Chapman Gulch at the Chapman Diversion Dam. Hunter Tunnel is a semihorseshoe-shaped structure with two sizes: 8.5 and 7.33 feet. Source: U.S. Bureau of Reclamation	8.33	40128	$ 148,718,781	Two sizes listed: 8.5 and 7.33 - lined vs unlined Semihorseshoe-shaped	Crosses 1 fault Both portals in Till (Qd) Primary Yg, Secondary Qd Midpoint entry available with No Access road No Access at South Portal, Limited access at North Portal	7.6	3	TBM	2	5.0%	5.0%	1	1%	11.0%	$ 165,077,846	$132,062 to $247,616	$247,000
7	SOUTH	Chapman Tunnel	T-CHA	The Sawyer diversion drop inlet diverts water from Sawyer Lake into Sawyer Feeder Conduit(3,098 feet in length), and drops the water at Chapman Gulch. The water then flows to Chapman Diversion Dam, with the flow from Hunter Tunnel, to be diverted into Chapman Tunnel. Chapman Tunnel is a 2.8-mile-long, 7-foot horseshoe-shaped structure, with a capacity of 300 cubic feet per second. Source: U.S. Bureau of Reclamation	7	14784	$ 54,791,130	horseshoe-shaped	No Faults Both Portals in Till (Qd) Primary Yg	2.8	2	D&B or TBM	2	5.0%	2.5%	0	0%	7.5%	$ 58,900,464	$47,120 to $88,350	$88,000
8	SOUTH	South Fork Tunnel	T-SF	The South Fork Diversion Dam diverts water from South Fork Creek to the South Fork Siphon, where it continues with the flow from the South Fork Creek and is conveyed by the South Fork Feeder Conduit to the inlet of the South Fork Tunnel. The South Fork Tunnel is a 3.1-mile-lone, 8-foot horseshoe-shaped section, and has a capacity of 450 cubic feet per second. The tunnel discharges water into the Charles H. Boustead Tunnel. Source: U.S. Bureau of Reclamation	8	16368	$ 60,661,608	horseshoe-shaped	Cross 1 fault, Crosses 1 fault at and angle Both portals in Till (Qd) Primary Yg, Secondary Qd Limited access at both portals	3.1	3	TBM	2	5.0%	5.0%	3	3%	13.0%	$ 68,547,617	$54,838 to $102,821	$102,000
9	N/A	Boustead Tunnel	T-BOU	The Charles H. Boustead Tunnel conveys all the water collected at the Fryingpan diversion and in the North and South Side Collection Systems under the Continental Divide and into Turquoise Lake. The 10.5-foot-diameter, horseshoe-shaped tunnel is approximately 5.4 miles long. The capacity of the tunnel is 945 cubic feet per second. The Fryingpan Valley control structure at the inlet portal of the tunnel will regulate flows entering the Charles H. Boustead Tunnel. It is a concrete junction structure which contains two overflow weirs, one for each of the collection systems, a baffled apron waterway drop structure to return the excess flows to the Fryingpan River, a connection and access hatchway structure to receive the flows from the Fryingpan Feeder Conduit, and a control structure housing a 10.5- by 12-foot radial gate. The entire structure is underground. Source: U.S. Bureau of Reclamation	10.5	28512	$ 105,668,607	horseshoe-shaped	Crosses 4 faults, Run parallel to 2 faults Both portals in Till (Qd) Primary Yg, Secondary Qd Limited assess on south portal, Good access on north portal	5.4	3	TBM	2	5.0%	0.0%	10	10%	15.0%	$ 121,518,898	$97,215 to $182,278	$182,000
				TOTAL BASE			$524,570,216								**Conceptual Level Tunnel Replacement Costs**				**$ 577,747,113**	**$462,197 to $866,620**	**$863,000**

Soil types
Qd - Young glacial drift (Bull Lake and younger) - Unsorted boulder glacial deposits (till) and associated sand and gravels
Xb - Biotitic Gneisses and Migmatite (Precambrian X) - Unit contains minor in interlayered hornblende gneiss and calc-silicate rocks. Parent materials mainly graywacke and shale.
Yg - Granitic Rocks (Precambrian Y- 1,400 m.y. Age Group) Includes Silver Plum and St. Kevin Granites and equivalents

Boustead Tunnel Cost Breakdown	
Length (mi):	5.4
Length (ft):	28,512
Diameter (ft):	10.50
Capacity (cfs):	945
Boustead Tunnel Cost (2020 Replacement Cost):	$219,000,000.00
Cost/LF	$7,680.98
Cost/LF/Dia	$731.52
PCP Tunnel Construction	
Canyon Tunnel	
Length	20000
Historical Cost	$16,200,096.00
Historical Cost Year	1999
Escalator	4.69%
Costing Year	2020
Age	21
Replacement Value	$42,415,714.19
Cost/LF	$2,120.79
Diameter (feet)	10.5
Cost/LF/Dia	$201.98
Mesa Tunnel	
Length	6800
Historical Cost	$6,560,827.68
Historical Cost Year	1999
Escalator	4.69%
Costing Year	2020
Age	21
Replacement Value	$17,177,811.28
Cost/LF	$2,526.15
Diameter (feet)	10.5
Cost/LF/Dia	$240.59
Greeley	
TOTAL	**$7,896,500.00**
Length	2454
Historical Cost Year	2016
Escalator	4.69%
Costing Year	2020
Age	4
Current Value	$9,485,395.39
Cost/LF	$3,865.28
Diameter (feet)	7
Cost/LF/Dia	$552.18
AVG COST ($/LF/Dia ft)	$465.22
AVG COST ($/LF)	$3,706.11

*Based on escalated construction costs

Lithos Tunnel Construction Experience	
Michigan Ditch Tunnel	
Length	764
Historical Cost	$2,815,743.00
Historical Cost Year	2016
Escalator	4.69%
Costing Year	2020
Age	4
Replacement Value	$3,382,313.14
Cost/LF	$4,427.11
Diameter (feet)	7
Cost/LF/Dia	$632.44
Laramie Poudre Tunnel (REHAB)	
Length	1516
Historical Cost	$7,733,850.00
Historical Cost Year	2018
Escalator	4.69%
Costing Year	2020
Age	2
Replacement Value	$8,476,296.58
Cost/LF	$5,591.22
Diameter (feet)	8
Cost/LF/Dia	$698.90

SECWCD

Phase 1 – Feature Valuation Study

Providence Infrastructure Consultants
121 S. Tejon Street, Suite 201
Colorado Springs, CO 80903
(719) 757-1120
www.providenceic.com

SOUTHEASTERN COLORADO
Water Conservancy District
"Your investment in water"

Cost Review - Conduits

To:	**Mark M. Scott, PE - Project Manager, Providence Infrastructure**
Lead Authors:	**Daniel Rice, PE**
Date:	**June 10, 2020**
Status:	**FINAL**
TM #:	**C-1**

Table of Contents

1. Introduction....1
2. Scope of Work....1
3. Evaluation....1
4. Recommendations....2

List of Figures

Figure 1: Granite Creek Siphon Installation

List of Tables

Table 1: Variability in Conduit Characteristics
Table 2: Reference Project Data
Table 3: Initial v. Reference Unit Cost
Table 4: East Slope Conduit Unit Cost
Table 5: West Slope Conduit Unit Cost
Table 6: Recommended Conduit Replacement Costs

1. Introduction

Phase 1 of the Feature Valuation Study includes the preparation of order-of-magnitude level replacement cost estimates for select features of the Southeastern Colorado Water Conservancy District (SECWCD) District and Enterprise select features. In 2019, the SECWCD adopted a policy to develop a long-term strategy for establishing reserves to address financial obligations associated with ongoing operation, maintenance, and replacement of various SECWCD District and Enterprise features. Phase 1 asset valuation efforts were based on the use of existing feature information provided to PIC by SECWCD. No field investigations were performed as part of Phase 1 but are anticipated in potential later project phases.

This memorandum documents the Phase 1 professional cost review services performed for the SECWCD. The cost reviews were performed as part of developing and finalizing order of magnitude costs for the Fry-Ark conduits identified by the SECWCD as features to be assigned replacement costs. The professional review of conduit costs was led by Mr. Daniel Rice, PE with Providence Infrastructure Consultants. Mr. Rice is an experienced water and wastewater conveyance professional in the Rocky Mountain region. Mr. Rice has over 20 years of engineering experience. He has a strong, proven background in design, budgeting, condition assessment and scheduling of conduit projects of various sizes and complexities. Most of Mr. Rice's engineering assignments have involved water and wastewater conveyance related projects including pipelines/conduits, lift/pump stations, tunnels, and planning efforts. Many of these projects have involved heavy civil construction with construction values ranging from several million dollars to over $65 million.

2. Scope of Work

Mr. Rice reviewed the initial cost data and feature descriptions provided by PIC using his industry experience and other available resources and information. His cost evaluation provided a "reality check" of the order-of-magnitude conceptual level replacement cost estimates developed by PIC. The purpose of the professional cost evaluation was to more confidently arrive at conceptual level replacement costs that are in line with a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering (AACE). To support Mr. Rice's cost evaluations, PIC provided its initial cost estimates along with available descriptions of each conduit feature and a general description of the SECWCD District and Enterprise features. To develop initial cost estimates, PIC used original construction cost data provided by the SECWCD and escalated this cost data using Engineering News Record's (ENR) Indices. Most of the conduit features that were included in the estimating efforts were built in the 1960's to 1970's. The conduit features included in Mr. Rice's cost evaluation were:

- Carter Feeder Conduit
- Mormon Feeder Conduit
- Mormon Conduit
- North Cunningham Feeder Conduit
- Middle Cunningham Feeder Conduit
- South Cunningham Feeder Conduit
- Cunningham Conduit
- Ivanhoe Feeder Conduit
- Ivanhoe Creek Crossing Conduit
- Granite Siphon
- Fryingpan Conduit
- South Fork Siphon
- South Fork Feeder Conduit
- Fryingpan Siphon
- Sawyer Conduit
- Chapman Feeder Conduit
- Mt. Elbert Conduit
- Halfmoon Feeder Conduit

3. Evaluation

The characteristic variability in the conduit features evaluated involved short to long installation lengths, small to large conduit diameters / dimensions, and reasonably easy access at moderate elevations to locations with challenging terrain at high elevations and access restrictions. Table 2 below shows an overview of the variability in the conduit characteristics:

Table 1: Variability in Conduit Characteristics		
Length	183 feet (Middle Cunningham Feeder Conduit)	56,150 feet (Mount Elbert Conduit)
Diameter	18 inches (South Cunningham Feeder Conduit)	90 inches (Mount Elbert Conduit)
Location (Elevation / Access)	10,100'+, Wilderness, National Forest (North & South Side Collection System)	9400 – 9800', (Mount Elbert Conduit, Halfmoon Feeder Conduit)

Because of the variability in characteristics, it was important to evaluate the conduits of the North and South Side Collection Systems (West Slope) in a different context than the Mount Elbert and Halfmoon Feeder Conduits (East Slope). In general comparison, the West Slope conduits are located at higher elevations with significant access challenges[1] and shorter installation lengths; characteristics that slow construction and increase costs.

To evaluate the reasonableness of the initial costs developed for the conduits, data was collected on a variety of projects with generally similar characteristics (i.e. length, diameter, and west and mid-west locations). Table 2 below shows a list of the reference projects where data was used to perform a review of the initial cost development.

Table 2: Reference Project Data					
Project	Bid Date	Size	Length (ft)	Location	Current or Escalated Cost[2] / LF/ Foot-Diameter
East Slope Conduit Reference Projects – Mt. Elbert Conduit + Halfmoon Feeder Conduit					
Devils Lake East End Outlet Conduit	2011	96"	28,816	Devils Lake, ND[3]	$188
Bellvue Pipeline, Northern Segment, Phase 1	2014	60"	28,667	Larimer County, CO	$180
Eastern Regional Pipeline Project	2018	24"	63,828	Douglas, CO	$250
Plum Creek Raw Water Return Pipeline	2018	30'	22,912	Douglas, CO	$280
				Average	***$230***
West Slope Conduit Reference Projects – North and South Side Collection System Conduits					
Otero / Homestake Pipeline[4]	2018	66"	1,633	Buena Vista, CO	$530
Otero / Homestake Pipeline	2019	66"	1,360	Buena Vista, CO	$510
Otero / Homestake Pipeline	2020	66"	1,694	Buena Vista, CO	$480
				Average	***$510***

4. Recommendations

The initial escalated cost developed for the Mt. Elbert Conduit and Halfmoon Feeder Conduit (East Slope) was based on escalating the original construction cost of the Mt. Elbert Conduit project by 4.69% (based on annual ENR "Construction Cost" indices) per year and converting the escalated cost to a "cost per linear foot per foot of diameter". The initial unit cost developed for the North and South Side Collection System conduits (West Slope) was based on costs associated with Colorado Springs Utilities' 2020 Homestake Pipeline work. Table 3 below shows a comparison of the initial unit cost development versus the reference costs.

[1] *Facilities located with the Hunter-Fryingpan Wilderness Area and White River National Forest*
[2] *Cost escalated by on 4.69% / year*
[3] *Low Elevation but cold weather construction and short construction window*
[4] *Short seasonal work, difficult construction corridor, short pipe installations*

Table 3: Initial v. Reference Unit Cost			
East Slope		West Slope	
Initial Escalated Unit Cost	Reference Unit Cost	Initial Escalated Unit Cost	Reference Unit Cost
$285	$230	$491	$510

Table 4 below shows a comparison of the initial and reference east slope unit costs and an Order of Magnitude Cost Range[5] applied to the east slope reference costs.

Table 4: East Slope Conduit Unit Cost			
Initial Escalated Unit Cost	Reference Unit Cost	Class 5 Order of Magnitude Variability[6] on Evaluated Cost	
		Low (-20%)	High (+50%)
$285	$230	$184	$345

When comparing the initial escalated unit costs to the reference unit costs for the east slope ($285 vs $230), it is recommended that the initial east slope unit cost of $285 continue to be used for developing total project costs for the Mt. Elbert Conduit and the Halfmoon Feeder Conduit. This recommendation is based on the differences in characteristics between the reference projects located along the front range of Colorado and the upper Midwest and the challenges that could be encountered with installing a large diameter pipeline within the Arkansas River valley. Challenges such as winter weather, difficult excavation (large cobbles), material transport to rural / high-country project site, and undulating terrain located along the west side of the river valley are characteristics that will increase costs.

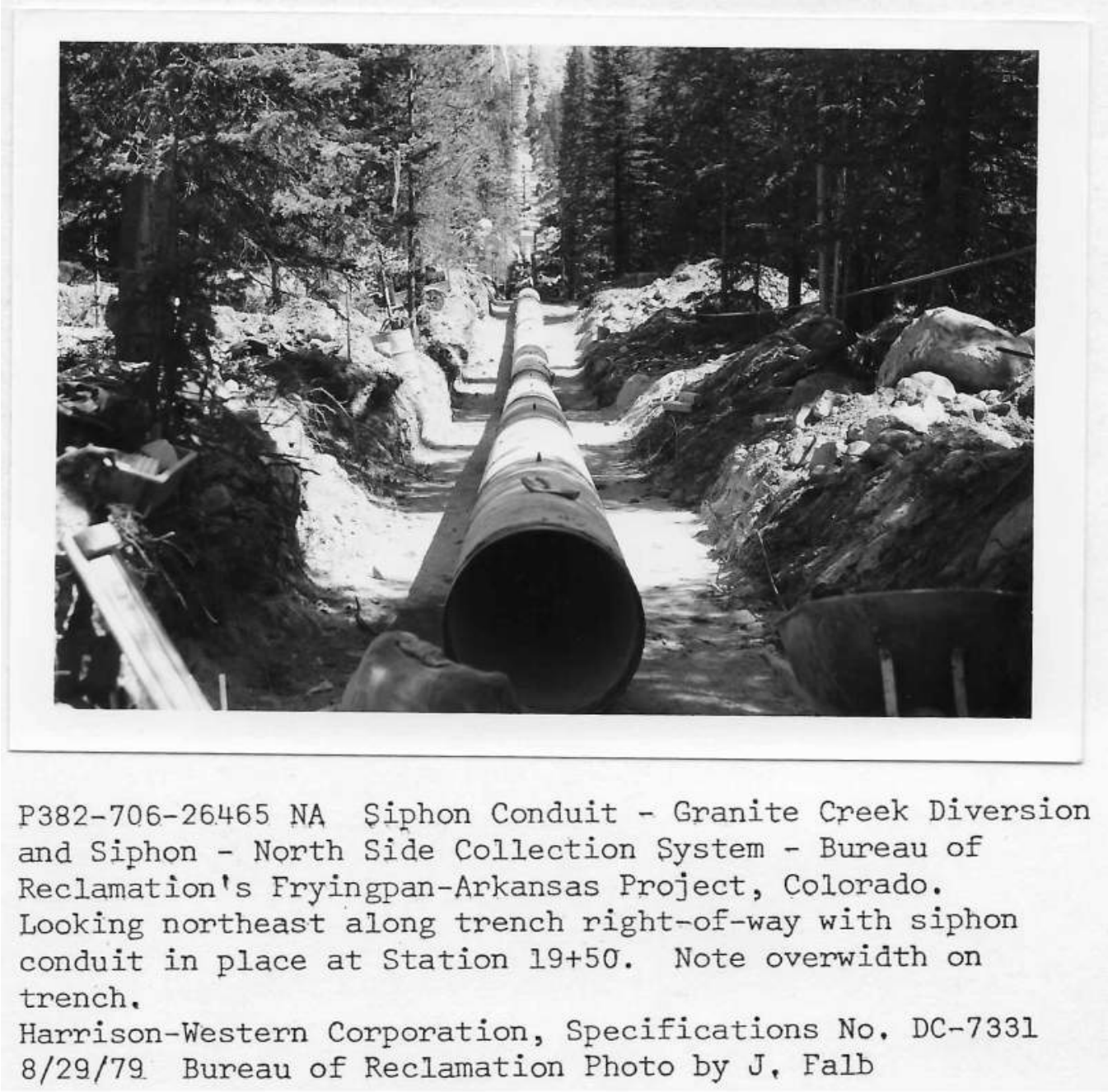
Table 5 below shows a comparison of the initial and reference west slope unit costs and an Order of Magnitude Cost Range applied to the west slope reference costs.

Table 5: West Slope Conduit Unit Cost			
Initial Escalated Unit Cost	Reference Unit Cost	Class 5 Order of Magnitude Variability[5] based on Reference Cost	
		Low (-20%)	High (+50%)
$491	$510	$408	**$765**

When comparing the initial, reference, and high Class 5 range for the west slope installations ($491 vs $510 vs $765), it is recommended that a unit cost of $676 be used for developing total project costs for west slope conduits of the North and South Collection Systems which represents 75% of the Class 5 reference cost range. This recommendation is based on the differences in characteristics between the referenced Homestake Pipeline's work along the Arkansas River valley and the challenges associated with installing conduits within the generally remote areas of west slope of the District Fry-Ark system, such as the Hunter-Fryingpan Wilderness and White River National Forest. While work in both locations would have complexities such as winter weather, difficult excavation (large cobbles), material transport to the rural / high-country project sites, and challenging terrain; work involved with constructing within the wilderness and national forest boundaries is considered substantially more difficult. Work on the west slope of the District Fry-Ark Project features would involve challenging access limitations, much shorter construction windows (snow), environmental precautions/restrictions, and likely the need to adjust construction techniques to accommodate project requirements such as using smaller equipment, shorter pipe lengths, and narrow construction corridors. For a visual representation of these challenges, a construction photo showing the installation of the Granite Creek Siphon is provided below as Figure 1.

[5] *-50% to -20% (low) to +30% to 100% (high), Ref - Association for the Advancement of Cost Engineering (AACE), Class 5 Estimate*
[6] *Range based on selecting low end (lowest percentage) of the under range and half of the high end of the over range of the Class 5 ranges*

Figure 1: Granite Creek Siphon Installation



P382-706-26465 NA Siphon Conduit - Granite Creek Diversion and Siphon - North Side Collection System - Bureau of Reclamation's Fryingpan-Arkansas Project, Colorado. Looking northeast along trench right-of-way with siphon conduit in place at Station 19+50. Note overwidth on trench.
Harrison-Western Corporation, Specifications No. DC-7331
8/29/79 Bureau of Reclamation Photo by J. Falb

Applying the evaluated unit cost recommendations to each feature the replacement costs for each Fry-Ark conduit feature are presented below.

Table 6: Recommended Conduit Replacement Costs		
Conduit Feature	**Recommended Costs**	**Comments**
Carter Feeder Conduit	$947,000	West Slope - North Collection System
Mormon Feeder Conduit	$761,000	West Slope - North Collection System
Mormon Conduit	$4,482,000	West Slope - North Collection System
North Cunningham Feeder Conduit	$474,000	West Slope - North Collection System
Middle Cunningham Feeder Conduit	$310,000	West Slope - North Collection System
South Cunningham Feeder Conduit	$4,179,000	West Slope - North Collection System
Cunningham Conduit	$13,068,000	West Slope - North Collection System
Ivanhoe Feeder Conduit	$1,316,000	West Slope - North Collection System
Ivanhoe Creek Crossing Conduit	$1,988,000	West Slope - North Collection System
Granite Siphon	$6,896,000	West Slope - North Collection System
Fryingpan Valley Conduit	$11,741,000	West Slope - North Collection System
Subtotal North Collection System (Rounded)	**$46,200,000**	
Chapman Feeder Conduit	$1,768,000	West Slope - South Collection System
Sawyer Conduit	$4,713,000	West Slope - South Collection System
South Fork Feeder Conduit	$2,628,000	West Slope - South Collection System
South Fork Siphon	$3,004,000	West Slope - South Collection System
Fryingpan River Siphon	$2,429,000	West Slope - South Collection System
Subtotal South Collection System (Rounded)	**$14,600,000**	
Fryingpan River Feeder Conduit	$4,392,000	West Slope System
Subtotal Fryingpan Feeder Conduit Rounded)	**$4,400,000**	
Halfmoon Feeder Conduit	$4,275,000	East Slope System
Mt. Elbert Conduit	$120,021,000	East Slope System
Subtotal East Slope (Rounded)	**$124,300,000**	
Total Cost for Conduits (Rounded)	**=**	**$189,500,000**

SOUTHEASTERN COLORADO

Water Conservancy District

"Your investment in water"

Providence Infrastructure Consultants
121 S. Tejon Street
Suite 201
Colorado Springs, CO 80903

(719) 757-1120
www.providenceic.com