SUNRISE ENGINEERING

Pine-Strawberry Water Improvement District

C.C. Cragin Water Source Supply Project – Feasibility Study

March 2023

PINE-STRAWBERRY WATER IMPROVEMENT DISTRICT

C.C. CRAGIN WATER SOURCE SUPPLY PROJECT

FEASIBILITY STUDY

March 2023

Prepared for:

BOARD OF DIRECTORS
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TABLE OF CONTENTS

SECTIONS

FIGURES

EXHIBITS

RESOURCES

Blue Ridge Reservoir Water Supply Pipeline & Treatment Plant
Black & Veatch, February 2006

Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study
Tetra Tech, January 2008

Pine-Strawberry Water Improvement District - Water System Master Plan
CH2MHill, December 2014

Town of Payson – C.C. Cragin Raw Water Penstock – Phase 1 – As-Built Plans
Sunrise Engineering, April 2019

1.0 INTRODUCTION

1.1 PURPOSE & SCOPE

The Pine-Strawberry Water Improvement District (PSWID) is a non-transient community water system in the northwest region of Gila County, Arizona and provides potable water service to the communities of Pine and Strawberry. The system encompasses approximately 10 square miles of service area and is entirely dependent on groundwater sources for water supply to the system.

Historically, the PSWID has experienced water source shortages, especially during the summer months. Previous investigations conducted by the District revealed that the water supply shortages caused by seasonal decreases in well yields are the result of limitations inherent in the hydraulic properties of the fractured rock aquifers that supply water to the existing shallow wells in the District area. This has been exacerbated by the long term drought conditions gripping the area. The on-going shortages currently jeopardize water supply to the existing customers and the future growth of the community.

The purpose of this study is to perform and analysis of the potential to bring surface water from the C.C. Cragin Reservoir to the PSWID to augment groundwater resources, meet the system demands and provide an opportunity to recharge the local aquifer. This includes conceptual design, preparing exhibits showing existing and proposed infrastructure, a conceptual cost estimate, summarize permitting requirements, summarize the long-lead items and develop a conceptual timeframe for the project. This information will be used by the District to begin discussions with project partners/stakeholders and funding sources for the infrastructure necessary to convey, treat and utilize this water for the PSWID.

1.2 BACKGROUND

The “Mogollon Rim” area of central Arizona, located in northern Gila County and surrounding the PSWID is known for its beauty, moderate four seasons, and abundant wildlife but also, unfortunately, the region is known for its general lack of sustainable water resources. In addressing the very real issues of water supply limits in this rural region, the Bureau of Reclamation approached the Town of Payson and Gila County to embark on a collaborative study. The Bureau completed a multi-year appraisal level study in 2008 entitled Mogollon Rim Water Resources Management Study, April 2008 “Appraisal Study”. This appraisal level study concluded that the rural region lacks sufficient water resources and diversity in supplies to meet future, and in some cases current, water demands. Nearly every community in the study area was projected to experience water shortages. Some shortages, as in the case of the PSWID, are already occurring. The report concludes that imported surface water is a viable option to achieve long-term water supply sustainability.

In 2004, Congress passed the 2004 Arizona Water Settlements Act. The Act formalized the availability of up to 3,500 acre/ft of surface water from Blue Ridge Reservoir (now “Cragin Reservoir”) to the Town of Payson and Northern Gila County communities. In 2019 the Town of Payson completed their C.C. Cragin Water Resource Project to utilize their surface water allotment and provide potential access to other communities in Northern Gila County, including the PSWID.

The PSWID may pursue a surface water allotment from the C.C. Cragin Reservoir to assist the District in meeting system water source demands. The reservoir is located approximately 20 miles away from the District and will require a combination of existing (SRP and Town of Payson) and new infrastructure to deliver and treat the water. This is illustrated in **Figure 1 – Overview Map** below. The District is in the early stages of discussing terms of an agreement and project funding options for this surface water opportunity and require a study to outline the size, scope and potential costs of a project to deliver, treat and use Cragin source water in the PSWID system.

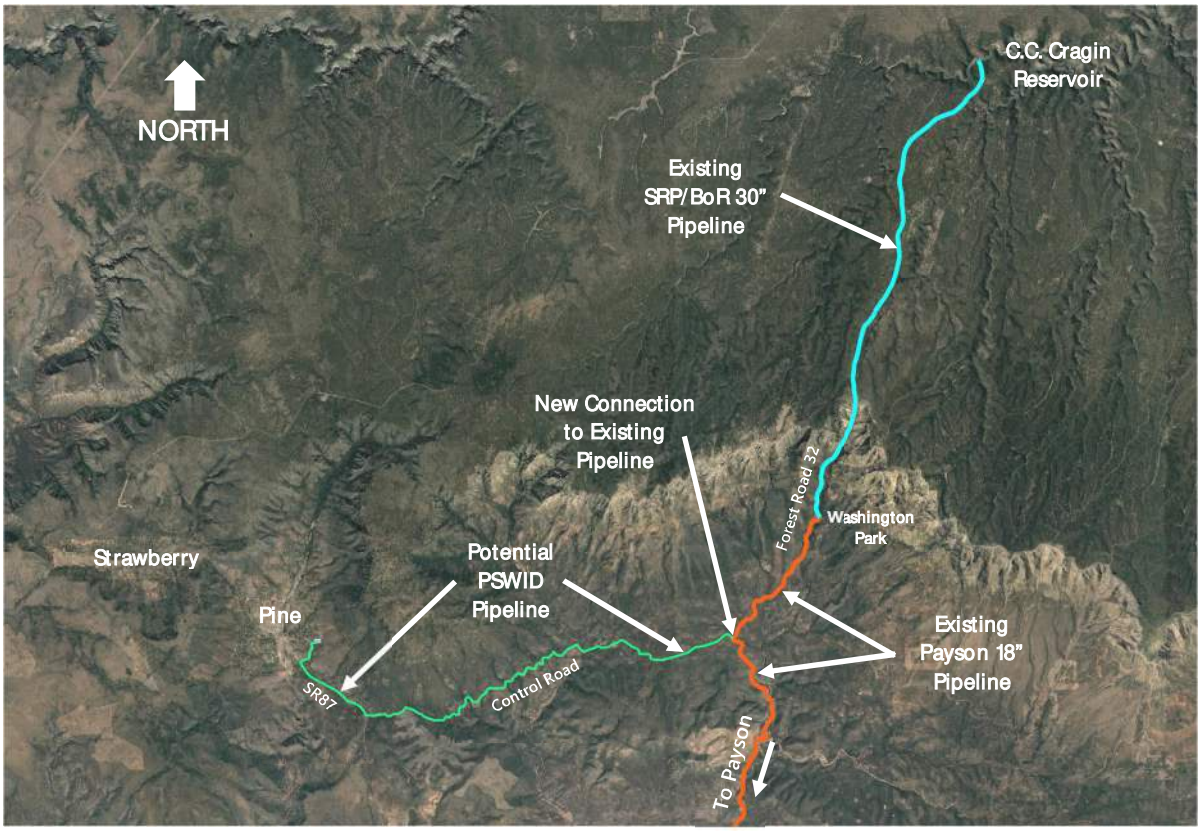

Figure 1 - Overview Map

In 2020, PSWID measured over 86 million gallons (265 acre-ft) of water use to serve its population of almost 8,000 customers through 3,200+ service connections. All of the water produced for the system is supplied exclusively by groundwater pumped from the District's wells or well water through several water share agreements. Without a renewable surface water source, the District will continue to experience the conditions and risks associated with solely using groundwater as a water source for the community.

With all of these existing conditions in mind, the Board of Directors believes that an investment in exploring this surface water allotment from the C.C. Cragin Reservoir opportunity is in the best interests of the District. The goal of this Feasibility Study is to provide an overview of the necessary infrastructure, permitting/agreements required, estimated costs and estimated schedule to allow the District to communicate with potential funding partners and make informed decisions on how to pursue this opportunity.

2.0 PROPOSED PROJECT OVERVIEW & CONCEPTUAL DESIGN

2.1 DATA COLLECTION

There have been numerous past studies of the groundwater conditions and master planning within the Pine-Strawberry area. In addition, there we several studies and detail design that were completed along the way to implement the Town of Payson's C.C. Cragin Water Resource Project. The major resources used in the development of this Feasibility Study are as follows:

- Blue Ridge Reservoir Water Supply Pipeline & Treatment Plant
  Black & Veatch, February 2006

- Blue Ridge (C.C. Cragin) Reservoir Drinking Water Source Financial Feasibility Study
  Tetra Tech, January 2008

- Pine-Strawberry Water Improvement District - Water System Master Plan
  CH2MHill, December 2014

- Town of Payson – C.C. Cragin Raw Water Penstock – Phase 1 – As-Built Plans
  Sunrise Engineering, April 2019

It should be noted that the February, 2006 Black & Veatch report included a study of a connection and new pipeline from the Town of Payson pipeline to the PSWID. Additionally, the PSWID provided system water use data for the year 2020 as an initial water allocation target. The information listed above was compiled and reviewed to provide background data as part of this Study.

2.2 TOPOGRAPHY & GEOLOGY

Topography: USGS maps were reviewed as part of this Study to provide a preliminary indication of the topography of the study area. The elevations vary between approximately 5,170 feet relative to mean sea level (MSL) at the lowest point (near Webber Creek) and 5,683 feet at the highest point near the intersection of Control Road and SR87. In general, the project area is located in a mountainous region with topography that undulates, but generally slopes from the from the north to south. Much of the project area is located within the Tonto National Forest along an unpaved roadway (Control Road) surrounded by primarily undeveloped forest land. Portions of the project located in Pine and Strawberry are similar topographically but traverse paved and unpaved rounds surrounded by mostly residential development.

Figure 2 - Hard Rock Trench

Geology: From a geologic standpoint, the project traverses mountainous region. Much of the project area contains rock (sandstone/limestone/dolomite/granite) outcroppings. The geology includes both alluvium and bedrock conditions, which are very important to identify to determine difficulty (cost) for trench excavations. Much of the proposed pipeline alignments will likely encounter hard rock excavation conditions.

2.3 EXISTING INFRASTRUCTURE

There are two sections of previously constructed infrastructure, located on Forest Service lands, that deliver C.C. Cragin water to the intersection of Control Road and Forest Road 32. Part of this infrastructure is owned by the Bureau of Reclamation (BoR) operated by Salt River Project (SRP). The other portion is owned by the Town of Payson. A brief description of the infrastructure is as follows:

BoR/SRP Infrastructure: An 11 mile long, 30 inch diameter pipeline diversion system which currently terminates near the headwaters of the East Verde River, about 15 miles north of the Town of Payson (originally known as the "Phelps Dodge Blue Ridge Pipeline"). This infrastructure brings surface water from the C.C. Cragin Reservoir to hydroelectric generator and tailrace diversion structure to the East Verde River. The Town of Payson facility connects to the tailrace to divert the Town's water allotment to their infrastructure.

Town of Payson Infrastructure: In 2019, the Town of Payson completed the C.C. Cragin Water Supply Project which added a new 12 mile long, 18-inch diameter raw water penstock, new hydroelectric generating station, new water treatment plant, a new 3 mile long, 18-inch diameter treated water pipeline, "in-Town" distribution system improvements and aquifer storage and recovery (ASR) wells to convey, treat and put to beneficial use this water for the Town of Payson.

During the installation of the Town's 18-inch raw water penstock, a tee was installed at the intersection of Control Road and Forest Road 32 in anticipation of potentially delivering raw water to Pine-Strawberry.

2.4 DESIGN CRITERIA & ASSUMPTIONS

Working with the TOF, the project team developed the following design criteria and assumptions provide the govern the analysis for this report, which are as follows:

Design Criteria:

1. PSWID will seek an allotment of surface water equal to 265 acre-feet of water.
2. Water allotment will be delivered to the District on a consistent flow rate over a 9 month period.

Assumptions:

1. The hydrogeology of the area in PSWID may support aquifer storage and recovery (ASR) wells to store excess water that is not used in lower demand months.
2. The treatment of raw water will be a similar process to the Town of Payson water treatment plant that treats the same water.
3. The new treatment facilities will be located in Pine near existing power.

3.0 PROJECT CONCEPTUAL DESIGN

3.1 PROJECT OVERVIEW

The necessary infrastructure to deliver water to the PSWID has been divided into several major components that generally follow the flow of the water from the existing Town of Payson C.C. Cragin pipeline to the District. An overview map of this existing and proposed infrastructure is shown in **Exhibit A – Project Overview Map**.

3.2 RAW WATER PIPELINE

The first portion of infrastructure required for the project will be a new 11.7 mile (61,800 foot) pipeline that delivers raw surface water from the existing Town of Payson C.C. Cragin to a new water treatment facility. This pipeline will predominantly follow Control Road from the connection point through the Tonto National Forest (TNF). This study recommends that the pipeline alignment follow Control Road for a number of reasons which include that the area is already disturbed with a roadway, which will likely reduce impacts to environmental/archaeological conditions and will be easier to construct/maintain within the existing roadway. A smaller segment of the pipeline will follow ADOT right-of-way along SR87. An overview of the pipeline alignment is shown below in Figure 3 – Raw Water Pipeline Profile.

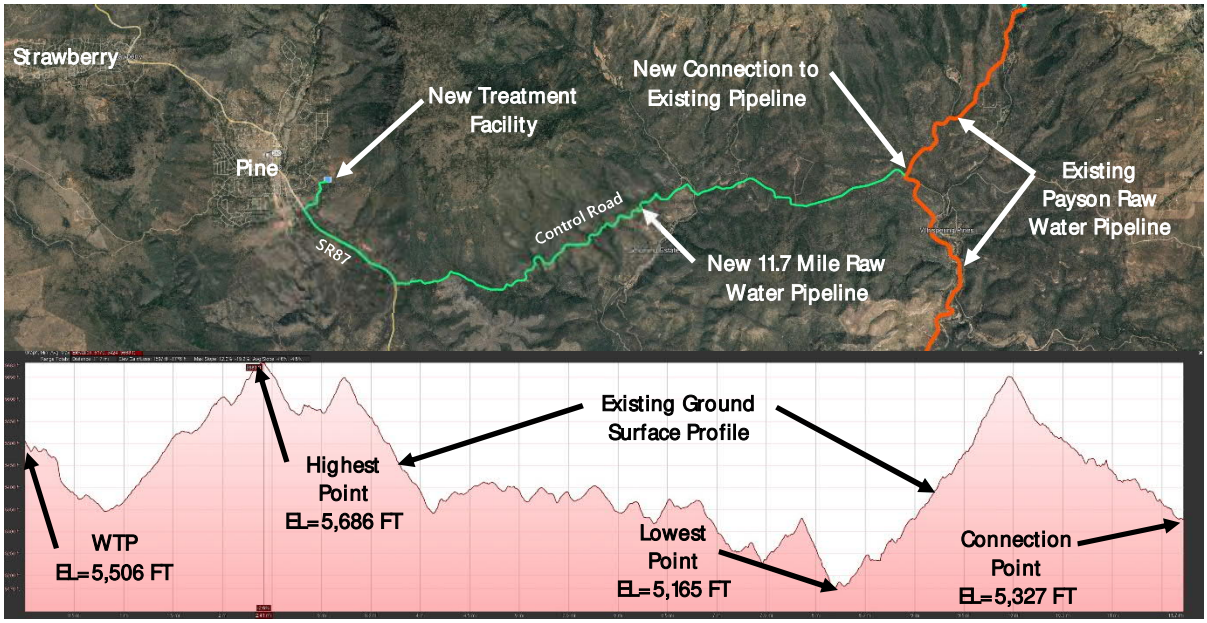

Figure 3 - Raw Water Pipeline Profile

Base on the design criteria of delivering 265 acre-feet over nine months, this equates to a flow rate of approximately 222 gallons per minute. For hydraulic analysis purposes this flow rate will be used to choose the pipe size.

The ground surface over the pipeline undulates significantly and includes two significant high points as shown in Figure 2 above. The highest is located at the intersection of SR87 and Control Road. The hydraulic design of the pipeline must include provisions be able to deliver the design flow from the connection point to the water treatment facility with enough pressure to convey flow over the highest point. The primary factor in pipeline design is the head loss experienced in the pipeline for the design flow. The smaller the pipe diameter the larger the amount of head loss will be experienced and vice versa.

When the Payson 18" pipeline is flowing at its design capacity of 3,798 acre-ft over 9 months (approximately 3,183 gal/min), the pressure at the PSWID connection point is about 172 psi. Based on a proposed pipe 12" pipe size for the new raw water pipeline, there would be approximately 12 psi of pressure remaining at the high point as the pipeline delivered 222 gallons per minute. Some of the early conceptual designs contemplated in the Black & Veatch study included smaller pipe diameter (8" or 10") but this would require booster pump(s) to overcome the increased head loss due to the smaller pipe diameters. Booster pumps are not recommended because there is no reliable power source along the pipeline alignment for a booster pump, they are very susceptible to vandalism and require long term operation and maintenance. For this reason, this study recommends a 12" pipe size be utilized to deliver the raw water to the treatment plant.

Another main component of pipeline design is material selection. The pipeline must have a pressure rating to withstand the static and dynamic pressures. The highest pressures normally occur at the low point of the pipeline. Based on a "static" condition (no water flowing) the pressure at the PSWID connection point would be approximately 196 psi. At the lowest point of the new pipeline the pressure would be 266 psi in a static condition. Dynamic pressures would have to be verified with a surge analysis, which is not included in the scope of work for this study. These dynamic pressures are significantly impacted by the water velocity in the pipe which, due to the increased pipe size and corresponding slower velocity, are not anticipated to be significant. For this reason, Class 300 or Class 350 ductile iron pipe is recommended for the pipeline. This pipe material is rugged and is a good application for the field conditions and will have a high enough pressure rating to withstand the static and dynamic pressures within the pipeline.

3.3 HYDROELECTRIC FACILITY

The hydraulic conditions of the raw water pipeline provide the project with a unique opportunity to generate hydroelectricity. As the raw water enters the water treatment plant site the pressure will range from 90 psi to as much as 114 psi. The energy in this water can be fed through a micro-hydro before it enters the treatment plant to generate electricity. This would be a "green energy" aspect to the project that could generate a portion of the electricity (approximately 200 kW hours per day) that powers the water treatment facility. If this is something that the District would like to pursue, a more extensive hydropower study and permitting discussions with the Federal Energy Regulatory Commission (FERC) will be required.

Figure 4 - Hydroelectric Generator

3.4 MAIN TREATMENT PROCESS

The main treatment process is anticipated to mimic the Town of Payson treatment process, only at a much smaller scale. Based on the flow delivery of 222 gallons per minute a new treatment plant must have a capacity of 0.32 million gallons per day (MGD). The treatment will have three main components which are as follows:

- Raw Water Storage Tank: This tank will serve a dual purpose of providing a reservoir for the main treatment process and allowing contact time for the addition of a pre-treatment chemical (poly-aluminum chloride) to assist the treatment process in contaminant removal. Estimated size of this tank is 50,000 to 100,000 gallons.
- Main Treatment Process: The process used by the Town of Payson is microfiltration (MF) in combination with granular activated carbon (GAC). This has worked very well over the past several years and is recommended for the PSWID. The first stage of this treatment includes strainers to remove larger particles from the water. The next stage of the process is the actual MF which provides an effective barrier to particles, bacteria, cryptosporidium and giardia. The MF process is fairly simple to operate and maintain and fits in a small footprint. Raw water is fed into the MF filters from the outside-in, leaving the particles on the outside and treated water is removed from within. The filters require periodic backwashing, air scrubbing and chemical cleaning. Lastly, GAC is employed to remove carbon elements from the treated water that could, after chlorine disinfection, create disinfection byproducts.

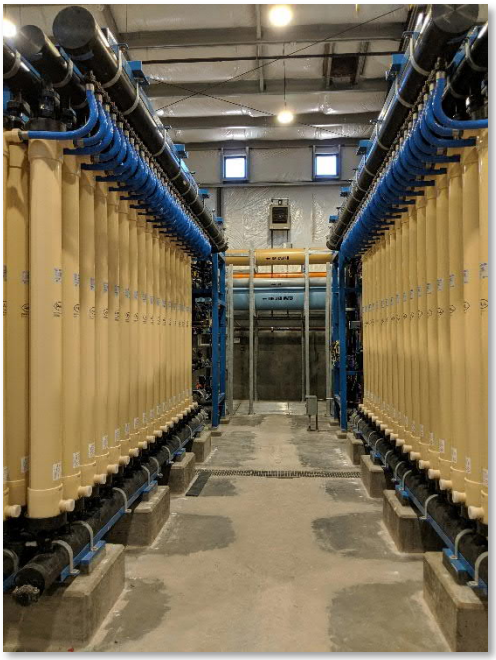

Figure 5 - Microfiltration Treatment

3.5 BACKWASH MANAGEMENT

The main treatment process requires periodic backwashing making the filters approximately 95% efficient. This means that there is a waste stream (based on 0.32 MGD) of 16,000 gallons per day that will have to managed. There are normally three options for the management of this backwash waste stream which are as follows:

- Discharge to Sanitary Sewer: This is normally the primary option for backwash management, but Pine-Strawberry does not have a sewer collection system and treatment system; therefore it is not an option for this project.

- Land Application: If a suitable amount of property can be identified to accept this water for irrigation purposes, the backwash water can be land applied (sprayed). This application would have to occur during the entire 9 months that water was flowing through the main treatment process, which may be difficult in non-irrigation months like March/April and October/November.
- Backwash Reuse: If land application and sewer are not an option, the backwash can be recycled to make the plant 99% efficient. This requires additional infrastructure such as a clarifier to treat the backwash and recycle the "clean" water to the head of the main treatment process. In addition, processing and disposal of the sludge for the clarifier requires drying beds and/or mechanical process equipment.

Figure 6 - Backwash Clarifier

The Payson plant currently uses a combination of land application and backwash reuse for backwash management.

3.6 STORAGE & BOOSTER PUMPS

After the water moves through the main treatment process it is ready to be delivered to the District customers. This study recommends a treated water tank that will provide a buffer for deliveries to the distribution system or recharge wells. Estimated size of this tank is 50,000 to 100,000 gallons. Preliminarily, the proposed location of the treatment site is at a high elevation in order to potentially deliver most of the water to the distribution system via gravity flow. If water from the plant cannot be delivered totally by gravity flow, booster pumps will be required at the plant to convey this flow.

Figure 7 - Booster Pumps

3.7 DISTRIBUTION SYSTEM IMPROVEMENTS

Currently, the water sources for the District's distribution system come from over 20 shallow wells distributed throughout the system. This non-point source delivery is opposite of how the new water treatment plant will deliver water to the system. We anticipate that distribution system upgrades (transmission mains) will be required to feed water from the treatment plant to both the Pine and Strawberry systems. This will distribute treated water to reach areas of the distribution system. Estimated locations and lengths of transmission mains have been included in Exhibit A – Project Overview Map. The next step to verify locations and sizes would be to perform study and modeling using the Districts existing water model.

3.8 GROUNDWATER STORAGE/ASR WELLS

The last element of infrastructure that has been included in this analysis is the opportunity for aquifer storage and recovery (ASR) wells. These ASR wells have a dual purpose. First, any treated water from the treatment plant that exceeds system demand can be injected into an ASR well which acts as storage. Second, when demand exceeds the treated water production capacity, the ASR well can be activated to withdraw water from the well and inject it into the system to keep up with demand. The storage portion of the ASR is useful during the spring and fall when demands are lower to store water that can be used during times of higher use like the summer. Two ASR wells (one for Pine and Strawberry each) have been included for the project. The next step to verify the validity of using these ASR wells it to perform a hydrogeology study to demonstrate that the wells/aquifer in the Pine-Strawberry geology can store water which can be withdrawn at a later time. The Town of Payson is currently using ASR wells very successfully in their water system to store and withdraw excess treated C.C. Cragin water.

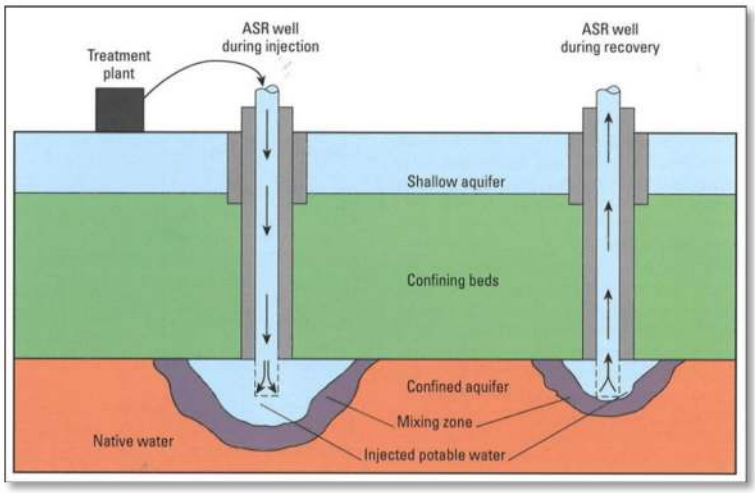

Figure 8 - ASR Well Schematic

4.0 PERMITTING, COST ESTIMATES & SCHEDULE

4.1 AGREEMENTS & PERMITTING

Agreements and permitting can impact the cost and schedule of projects. During the data collection and based on past experience with the Town of Payson C.C. Cragin project, we have identified the following entities that will require agreements or permitting in order to implement this project. A summary of these entities and agreement/permit types are shown in the table below:

Table 4.1.1 – Agreements & Permitting Summary

Entity	Comments
Salt River Project (SRP)	PSWID will have to develop and execute an agreement with SRP for a water allotment from C.C. Cragin Reservoir. This will establish the rights to the 265 acre-feet of water and use of the conveyance system from the reservoir to the Town of Payson system.
Town of Payson (ToP)	PSWID will have to develop and execute an agreement with the Town of Payson to "wheel" the water allocation from SRP through their C.C. Cragin project to the intersection of Control Road and Forest Service Road 32. This will likely include participation in the capital cost of the Town's system along with a share of the operation of maintenance.
Tonto National Forest (TNF)	Much of the length of the raw water pipeline is located on the Control Road through the Tonto National Forest. Because the project traverses federal land, the National Environmental Policy Act (NEPA) process will be required. This will likely include a full environmental assessment (EA) to determine the projects impact on the environment and what mitigations may be required to construct the project. This can take a significant portion of time (2 to 3 years) and should be started early in the project development. In addition, the TNF will probably require a Special Use Permit to implement the project which will require documents from the NEPA process and final plans, specifications and contract documents for the project.
Arizona Department of Environmental Quality (ADEQ)	The project includes conveying and treating drinking water. The Arizona Department of Environmental Quality (ADEQ) will have to review the studies, plans and specifications for the project in order for the District to obtain an "Approval to Construct" for the pipelines, wells, storage facilities, pumps and treatment facility. This can be accomplished in one permit, or the project can be divided into several phases.
Arizona Department of Transportation (ADOT)	A portion of the raw water pipeline and transmission mains run parallel or traverse the ADOT right-of-way for SR87. The District will have to submit plans and specifications for those portions of the project that are located within ADOT right-of-way to obtain an encroachment permit for the new utilities.

United States Army Corp of Engineers (USACE)	As the raw water pipeline traverses the TNF it crosses many small and large washes. Some of these washes may be defined as "Waters of the Unites States" (WOTUS) that would fall under the jurisdiction of the USACE. At the same time the NEPA process is followed, the District should perform a study to determine the location of WOTUS along the pipeline alignment. Once this is completed, the impact to WOTUS can be measured for permitting purposes. The end result could range from a fairly simple Nationwide Permit to a more complex and time consuming Individual Permit.
Arizona Department of Water Resources (ADWR)	Permitting for the ASR wells will be required by ADWR. This will include a hydrogeologic study that demonstrates no adverse impacts to the groundwater in the area and permission to receive credits for the recharge/withdrawal of the water.
Gila County	The project is located in Gila County. Permits may be required for construction in roadways with County jurisdiction. Also, the water treatment facility will likely have a building component; therefore, a building permit issued by Gila County will be required.

4.2 COST ESTIMATING

Based on the conceptual design, agreements and permitting required to implement the project an overall "Preliminary Engineer's Opinion of Probable Cost" has been prepared. This estimate is very early in the overall project lifecycle and should be revisited regularly for changes in labor/material costs, inflation and potential new items that are revealed during the project development. The Preliminary Engineer's Opinion of Probable Cost has been included as Exhibit D.

4.3 POTENTIAL SCHEDULE

At this early stage of the project, it is impossible to create a detailed (task by task) schedule because there is not enough detailed information. A conceptual timeframe schedule has been created in the table below to demonstrate the potential fast and slow tracks that the project may take to go from agreements to construction completion. At this point in time a funding source for this project has not been identified. This schedule assumes that project funding source is identified before the agreements portion of the schedule begins. As a benchmark, the Town of Payson C.C. Cragin project was developed over an approximately 10 year period of time.

Table 4.3.1 – Conceptual Timeframe Schedule

Project Stage	Fast Track (years)	Slow Track (years)
Agreements	1	2
NEPA, EA & USACE	2	3
Studies & Reports	1	2
Detail Design	1.5	2
Permitting	1	2
Construction	2.5	4
Estimated Total	**9**	**15**

5.0 SUMMARY & RECOMMENDATIONS

The PSWID should pursue a SRP surface water allotment from the C.C. Cragin Reservoir to assist the District in meeting system water source demands. The reservoir is located approximately 20 miles away from the District and will require a combination of existing and new infrastructure to deliver and treat the water. The District is in the early stages of seeking project funding and agreements for this renewable, surface water opportunity.

The purpose of this study was to perform some conceptual design, prepare an exhibit showing existing and proposed infrastructure, prepare a conceptual cost estimate, summarize permitting requirements, summarize the long-lead items and develop a conceptual timeframe for the project. This information contained in this Feasibility Study can now be used by the District to begin discussions with project partners/stakeholders and funding sources.

In summary, based on the findings of this Feasibility Study, C.C. Cragin Surface Water would be a valuable asset to the PSWID to meet their current and future water source needs. It also has the benefit of potentially providing the District with a renewable resource that can be used not only to meet demands, but also recharge/store groundwater water for future use. One other major advantage is that it eliminates the condition where they are solely dependent on the limited (diminishing) shallow groundwater wells in the area.

This Feasibility Study has demonstrated that there is a pathway to raw water delivery, treatment, distribution, groundwater storage/reuse for the PSWID to be able to use C.C. Cragin surface water to meet system demands for existing needs and future growth. The next steps for the District are to better understand the surface water allotment, agreement terms and identify funding sources that can be employed to implement this project.

EXHIBITS

Exhibit A Project Overview Map

Exhibit B Raw Water Pipeline/Water Treatment Plant Flow Analysis

Exhibit C Conceptual Hydraulic Grade & Pressure Calculations

Exhibit D Preliminary Engineer's Opinion of Probable Cost

Exhibit A

Project Overview Map


SCALE
0
2400'
4800'
HORIZ: 1" = 2400'
NORTH
PROPOSED DISTRIBUTION TRANSMISSION MAIN IMPROVEMENTS
NEW AQUIFER STORAGE & RECOVERY (ASR) WELL
EXISTING TRANSMISSION MAIN
NEW AQUIFER STORAGE & RECOVERY (ASR) WELL
NEW WATER TREATMENT FACILITY
- HYDROELECTRIC GENERATOR
- RAW WATER STORAGE TANK
- MICROFILTRATION TREATMENT PLANT
- TREATED WATER STORAGE TANK
- BOOSTER PUMPS
- BACKWASH TREATMENT & SLUDGE HANDLING
PROPOSED DISTRIBUTION TRANSMISSION MAIN IMPROVEMENTS
WTP
SR 87
PROPOSED 12" RAW WATER PIPELINE
CONTROL ROAD
PROPOSED 12" RAW WATER PIPELINE
PROPOSED 12" RAW WATER PIPELINE
EXISTING 18" RAW WATER PIPELINE (TOWN OF PAYSON)
CONNECT TO EXISTING TOWN OF PAYSON C.C. CRAGIN RAW WATER PIPELINE
TO SRP HYDRO
EXISTING 18" RAW WATER PIPELINE (TOWN OF PAYSON)
SR 87
TO TOWN OF PAYSON
Strawberry
Pine
TONTO NATIONAL FOREST
Whispering Pines
Washington Park
Beaver Valley
Freedom Acres
Flowing Springs
LEGEND
EXISTING 18" CRAGIN RAW WATER PIPELINE (PAYSON)
PROPOSED 12" CRAGIN RAW WATER PIPELINE (PSWID)
EXISTING 8" TRANSMISSION MAIN (MAGNOLIA)
PROPOSED PSWID TRANSMISSION MAIN
PROPOSED WATER TREATMENT FACILITY
PROPOSED AQUIFER STORAGE & RECOVERY (ASR) WELL

EXHIBIT A - PROJECT OVERVIEW MAP

PSWID

PINE-STRAWBERRY C.C. CRAGIN RESERVOIR WATER SUPPLY PROJECT

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Exhibit B

Raw Water Pipeline/Water Treatment Plant Flow Analysis

C.C. CRAGIN - PSWID

EXHIBIT B

RAW WATER PIPELINE/WATER TREATMENT PLANT FLOW ANALYSIS

Water Treatment Plant Flow Criteria		Units
Annual Flow (Acre-ft)	265	Acre-ft
Annual Flow (cu-ft)	11,543,400	cu-ft
Annual Flow (gallons)	86,356,175	gallons
Number of Months Flow Available	9	Months

Average Flow Calculations	Acre-ft	Cubic Feet	Gallons
Average Flow per Month	29.44	1,282,600	9,595,131
Average Flow per Day	0.98	42,753	319,838
Average Flow per Hour	0.04	1,781	13,327
Average Flow per Minute	0.0007	30	222
Average Flow per Second	0.00001	0.49	3.70

Raw Waterline Parameters		Units
Diameter	12	Inches
Pipe Area	0.785	sqft
Ch Factor (Hazen Williams)	130	Unitless
Total Length	61,800	Feet

Constant Flow Distribution Per Month — 9 Months = Same as Payson system

Month	Scenario #1 - Constant Flow Each Month (Initial Design)					Head Loss Calculations (Hazen Williams)		
	Percent	Gallons/Month	Mgal/Day	Gallons/Min	CuFt/Sec	Velocity (ft/sec)	HL/1,000-ft (ft)	Total HL (ft)
January	0.00%	-	0	0	0	0.00	0.00	0.00
February	0.00%	-	0	0	0	0.00	0.00	0.00
March	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
April	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
May	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
June	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
July	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
August	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
September	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
October	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
November	11.11%	9,594,171	0.32	222	0.49	0.63	0.16	9.76
December	0.00%	-	0	0	0	0.00	0.00	0.00
Total	100%	86,347,540						

Exhibit C

Conceptual Hydraulic Grade & Pressure Calculations

C.C. CRAGIN - PSWID
RAW WATER PIPELINE/WATER TREATMENT PLANT FLOW ANALYSIS

EXHIBIT C

Conceptual Hydraulic Grade and Pressure Calculation

Hydraulic Grade Calculations	Ground Surface Elevation	Hydraulic Grade @ 3798AF	Pressure (psi) @ 3728AF	Static Pressure (psi)
Tailrace Water Elevation		5780.26		
Connection Point	5327	5725.11	172.34	196.22
		Hydraulic Grade @ 265 AF & 12" Pipe*	Pressure (psi) @ 265AF & 12" Pipe	
Lowest Elevation	5165	5715.35	238.25	266.35
Highest Elevation	5686	5715.35	12.71	40.81
Proposed Treatment Plant	5506	5715.35	90.63	118.73

*Hydrulic grade assumes that all of the headloss for the entire length of pipe has been experienced at the location indicated which is a conservative assumption for this level of conceptual design

Exhibit D

Preliminary Engineer's Opinion of Probable Cost

EXHIBIT D

Engineer's Opinion of Probable Cost*

Project: C.C. Cragin Water Improvements

Owner: Pine Strawberry Water Improvement District

Date: 03-Jan-23

Item Description	Quantity	Unit	Unit Price	Total
12-inch Raw Water Penstock				
Intersection of Control Road & FS Road 32 to New WTP Site				
Mobilization	1	LS	$ 250,000.00	$ 250,000.00
Traffic Control	1	LS	$ 100,000.00	$ 100,000.00
12 inch Class 350, Restrained Joint, Ductile Iron Pipe & Fittings	61,800	LF	$ 300.00	$ 18,540,000.00
2 inch, Combination Air/Vacuum Release Valve Assembly	20	EA	$ 18,000.00	$ 360,000.00
System Drain Assembly	20	EA	$ 8,000.00	$ 160,000.00
Impressed Current Cathodic Protection System	1	LS	$ 150,000.00	$ 150,000.00
Forest Service General Conditions	1	LS	$ 100,000.00	$ 100,000.00
Roadway Surface Restoration (Gravel) - Control Road	84,500	SY	$ 25.00	$ 2,112,500.00
Sawcut, Remove, and Replace Pavement (ADOT)	9,400	SY	$ 50.00	$ 470,000.00
Solid Rock Excavation (80% of Excavation Length)	49,400	LF	$ 50.00	$ 2,470,000.00
Storm Water Pollution Prevention Plan	1	LS	$ 50,000.00	$ 50,000.00
			Construction Subtotal	**$ 24,762,500.00**
			Contingency (20%)	**$ 4,952,500.00**
			Construction Subtotal + Contingency	**$ 29,715,000.00**
Engineering & Administration				
Engineering Design & Permitting			10.0%	$ 2,971,500.00
Construction Observation & Administration			10.0%	$ 2,971,500.00
Design Contigencies			2.5%	$ 742,900.00
Project Management			2.5%	$ 742,900.00
			Estimated Raw Water Penstock Cost	**$ 37,143,800**
Hydroelectric Generator				
Mobilization	1	LS	$ 70,000.00	$ 70,000.00
Sitework	1	LS	$ 100,000.00	$ 100,000.00
Concrete Work	1	LS	$ 150,000.00	$ 150,000.00
Bypass Valve, Piping, Thrust Plate & Footings	1	LS	$ 50,000.00	$ 50,000.00
Powerhouse Construction	1	LS	$ 250,000.00	$ 250,000.00
Turbine and Control Package	1	LS	$ 350,000.00	$ 350,000.00
Water Level & Flow Instruments & Modulating Gate	1	LS	$ 65,000.00	$ 65,000.00
Electrical Installation	1	LS	$ 100,000.00	$ 100,000.00
Mechanical Installation	1	LS	$ 75,000.00	$ 75,000.00
Turbine & Embedments Installation	1	LS	$ 70,000.00	$ 70,000.00
			Subtotal	**$ 1,280,000.00**
			Contingency (20%)	**$ 256,000.00**
			Estimated Construction Subtotal	**$ 1,536,000.00**
Engineering & Administration				
Hydroelectric Study				$ 50,000.00
Engineering Design & Construction Documents			10.0%	$ 153,600.00
Construction Observation & Administration			10.0%	$ 153,600.00
FERC Permitting (Conduit Exemption)				$ 50,000.00
			Estimated Hydroelectric Cost	**$ 1,943,200.00**

EXHIBIT D

Engineer's Opinion of Probable Cost*

Project: C.C. Cragin Water Improvements

Owner: Pine Strawberry Water Improvement District

Date: 03-Jan-23

Item Description	Quantity	Unit	Unit Price	Total
Membrane Water Treatment Facility (0.32 MGD)				
Mobilization	1	LS	$ 250,000.00	$ 250,000.00
Treatment Plant Site Work	1	LS	$ 500,000.00	$ 500,000.00
Exterior Site Piping	1	LS	$ 500,000.00	$ 500,000.00
100K Gallon Storage Raw Water Reservoir + Mixing System	1	LS	$ 250,000.00	$ 250,000.00
Water Treatment Plant Building	1	LS	$ 750,000.00	$ 750,000.00
Membrane Treatment Equipment	1	LS	$ 750,000.00	$ 750,000.00
250K Gallon Storage Treated Water Reservoir	1	LS	$ 350,000.00	$ 350,000.00
Interior Building Plumbing & Mechanical	1	LS	$ 750,000.00	$ 750,000.00
Electrical & Controls	1	LS	$ 750,000.00	$ 750,000.00
Backup Generator	1	LS	$ 250,000.00	$ 250,000.00
Backwash Treatment Clarifier & Sludge Handling	1	LS	$ 800,000.00	$ 800,000.00
Granular Activated Carbon Units	1	LS	$ 250,000.00	$ 250,000.00
			Subtotal	**$ 6,150,000.00**
			Contingency (20%)	**$ 1,230,000.00**
			Estimated Construction Subtotal	**$ 7,380,000.00**
Engineering & Administration				
WTP Engineering Design			10.0%	$ 738,000.00
WTP Construction Observation & Administration			10.0%	$ 738,000.00
Design Contigencies			2.5%	$ 184,500.00
Project Management			2.5%	$ 184,500.00
			Estimated Water Treatment Plant Cost	**$ 9,225,000.00**
New Transmission Mains				
Mobilization	1	LS	$ 150,000.00	$ 150,000.00
Traffic Control	1	LS	$ 100,000.00	$ 100,000.00
Stormwater Pollution Prevention	1	LS	$ 50,000.00	$ 50,000.00
Sawcut, Remove & Replace Existing AC	29,333	SY	$ 60.00	$ 1,760,000.00
8-Inch Ductile Iron Pipe Installation (Pine)	19,800	LF	$ 200.00	$ 3,960,000.00
8-Inch Ductile Iron Pipe Installation (Strawberry)	13,200	LF	$ 200.00	$ 2,640,000.00
Solid Rock Excavation (50% of Excavation Length)	16,500	LF	$ 50.00	$ 825,000.00
Cathodic Protection	1	LS	$ 100,000.00	$ 100,000.00
8" Gate Valve Box & Cover	30	EACH	$ 2,500.00	$ 75,000.00
Air Release Valve Assembly	20	EACH	$ 2,600.00	$ 52,000.00
			Subtotal	**$ 9,712,000.00**
			Contingency (20%)	**$ 1,942,400.00**
			Total Construction Cost	**$ 11,654,400.00**
Engineering & Administration				
Engineering Design & Permitting			10.0%	$ 1,165,400.00
Construction Observation & Administration			10.0%	$ 1,165,400.00
Design Contigencies			2.5%	$ 291,400.00
Project Management			2.5%	$ 291,400.00
			Estimated Transmission Mains Cost	**$ 14,568,000.00**

EXHIBIT D

Engineer's Opinion of Probable Cost*

Project: C.C. Cragin Water Improvements

Owner: Pine Strawberry Water Improvement District

Date: 03-Jan-23

Item Description	Quantity	Unit	Unit Price	Total
Aquifer Storage Recovery (ASR) Wells				
ASR Phase I Testing	1	LS	$ 500,000.00	$ 500,000.00
ASR Phase II Well Modifications & Tests	1	LS	$ 1,750,000.00	$ 1,750,000.00
Well Equipping & Setup (Smart Valves & ASR Wells)	1	LS	$ 1,000,000.00	$ 1,000,000.00
Well SCADA Integration (Sensors & Programming)	1	LS	$ 200,000.00	$ 200,000.00
Well Program Implementation & Field Management	1	LS	$ 300,000.00	$ 300,000.00
Well Implementation Contingencies	1	LS	$ 300,000.00	$ 300,000.00
			Estimated ASR Wells Cost	**$ 4,050,000.00**
Previous Cragin Systems Cost Share (SRP + Town of Payson)				
Previously Constructed Cragin System Cost Share (SRP)	1	LS	$ 772,600.00	$ 772,600.00
Previously Constructed Cragin System Cost Share (Town of Payson)	1	LS	$ 422,400.00	$ 422,400.00
			Previous Cragin Systems Cost Share (SRP + Town of Payson)	**$ 1,195,000.00**
Miscellaneous Costs				
Environmental Assessment	1	LS	$ 500,000.00	$ 500,000.00
SCADA Improvements	1	LS	$ 750,000.00	$ 750,000.00
Property Acquisition (WTP + Hydro Site)	5	ACRES	$ 100,000.00	$ 500,000.00
Power Transmission Line (to APS Power)	1	LS	$ 200,000.00	$ 200,000.00
Legal Services	1	LS	$ 100,000.00	$ 100,000.00
Operation & Maintenance Manual	1	LS	$ 75,000.00	$ 75,000.00
USFS Monitoring (Control Road Construction)	1	LS	$ 150,000.00	$ 150,000.00
Miscellaneous Expenses	1	LS	$ 600,000.00	$ 600,000.00
			Miscellaneous Costs	**$ 2,875,000.00**
			ESTIMATED PROJECT TOTAL	$ 71,000,000.00

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.