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CITY OF Grand Junction COLORADO

GRAND JUNCTION CITY COUNCIL
MONDAY, NOVEMBER 29, 2021
WORKSHOP, 5:30 PM
FIRE DEPARTMENT TRAINING ROOM AND VIRTUAL
625 UTE AVENUE

1. Discussion Topics

a. Strategic Plan Discussion

b. Long-Term Water Supply and Infrastructure Planning

c. ARPA Committee Member Discussion

2. City Council Communication

An unstructured time for Councilmembers to discuss current matters, share ideas for possible future consideration by Council, and provide information from board & commission participation.

3. Next Workshop Topics

4. Other Business

What is the purpose of a Workshop?

The purpose of the Workshop is to facilitate City Council discussion through analyzing information, studying issues, and clarifying problems. The less formal setting of the Workshop promotes conversation regarding items and topics that may be considered at a future City Council meeting.

How can I provide my input about a topic on tonight's Workshop agenda?
Individuals wishing to provide input about Workshop topics can:

1. Send an email (addresses found here www.gjcity.org/city-government/) or call one or more members of City Council (970-244-1504);

2. Provide information to the City Manager (citymanager@gjcity.org) for dissemination to the City Council. If your information is submitted prior to 3 p.m. on the date of the Workshop, copies will be provided to Council that evening. Information provided after 3 p.m. will be disseminated the next business day.

3. Attend a Regular Council Meeting (generally held the 1st and 3rd Wednesdays of each month at 6 p.m. at City Hall) and provide comments during "Citizen Comments."

Grand Junction City Council

Workshop Session

Item #1.a.

Meeting Date: November 29, 2021

Presented By: Greg Caton, City Manager

Department: City Manager's Office

Submitted By: Greg LeBlanc, Sr. Asst. to the City Manager

Information

SUBJECT:

Strategic Plan Discussion

EXECUTIVE SUMMARY:

The City Council attended a strategic planning retreat on August 19 and 20, 2021. The purpose of the retreat was to identify key components of Grand Junction's 2-year strategic plan, including mission and vision for the strategic plan, along with designating priority areas for strategic goal development. The information gathered at the retreat informed the writing of the final strategic plan. The strategic plan will be specifically designed to align with the One Grand Junction Comprehensive Plan.

BACKGROUND OR DETAILED INFORMATION:

The City Council attended a strategic planning session on August 19 and 20, 2021. The purpose of the session was to identify key components of Grand Junction's 2-year strategic plan, including mission and vision for the strategic plan, along with designating priority areas for strategic goal development. The information gathered at the planning session informed the writing of the final strategic plan. The strategic plan will be specifically designed to align with the One Grand Junction Comprehensive Plan.

The purpose of this discussion item is for City Council to receive a status update from SBrand Solutions.

FISCAL IMPACT:

N/A

SUGGESTED ACTION:

This item is intended for discussion by City Council.

Attachments

1. City of Grand Junction FINAL Strategic Plan_11222021

CITY OF Grand Junction COLORADO

Strategic Plan

LETTER FROM THE CITY COUNCIL

To Our Community,

We are pleased to share the City of Grand Junction Strategic Plan. As a Council, we are committed to ensuring that Grand Junction continues to be livable, sustainable, and resilient. We are also committed to enhancing and preserving the high quality of life our community enjoys and we strive to offer a wide range of programs and services that make a positive difference every day in our community.

The Strategic Plan process was based upon the 2020 One Grand Junction Comprehensive Plan which was created in a collaboration with our community through extensive outreach, a robust analysis of needs and desires, review of local and national trends, and professional support. With that community vision and values as our base, Council met to create the Strategic Plan priorities, goals, and outcomes. Our Strategic Plan provides high-level direction to our leadership team and staff through an updated vision and mission, which will drive our goals and strategic outcomes, and provide priorities to ensure we continue to meet the evolving needs of our community. This plan is designed as a living document and a guiding road map to achieving our high standards.

We are committed to aligning our daily operations with this strategic direction to make them outcome-oriented, adaptive, and responsive to community needs and opportunities. As we implement these strategies, we will learn from our successes, adapt to our challenges, and we learn from failures as well .

We appreciate the input from our community, the support and dedication of our staff, and the relationships we have built with our business community and other partners. We encourage everyone to follow our progress and stay connected as we move forward on achieving our vision.

Rick Taggart, District A
Chuck McDaniel, Council President
Abe Herman, District E
Anna Stout, Council President Pro Tem
Randall Reitz, District at Large
Dennis Simpson, District D
Phillip Pe'a, District B

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INTRODUCTION

A Strategic Approach to Meeting Community Goals

OUTCOMES FOR OUR COMMUNITY

The citywide Strategic Plan is fully focused on driving meaningful outcomes for our community. The goals and objectives specified here are derived from community identified priorities. They are the result of a broad engagement process, and are intended as significant steps toward the achievement of our collective vision. Success measures provide quantifiable indicators to inform progress and guide continuous improvement. Taken together, the Strategic Plan articulates how we want our community to be in the years to come, and how we will get there.

VISION & STRATEGY ALIGNMENT

This plan provides city leadership with the highest level of policy direction. It defines a "North Star" vision for Grand Junction and five strategic priority goal areas around which all of the city's strategic initiatives are organized. With this overall Strategic Plan as guidance, specific, topical plans and initiatives can be intentionally designed to align with citywide strategy.

ACTIONABLE PLAN

By focusing on outcome-oriented goals and objectives, the Strategic Plan lays the groundwork for decisive action. On the pages that follow, goals and strategies have been identified that align with the Comprehensive Plan and support the intended outcomes. These goals and strategies outline types of work and investments that may be made in the next two to five years. Importantly, these potential actions will be prioritized, and funding requirements considered and approved, within each budget cycle – the result of which will be the creation of an annually updated strategic work plan.

ABOUT THE CITY OF GRAND JUNCTION

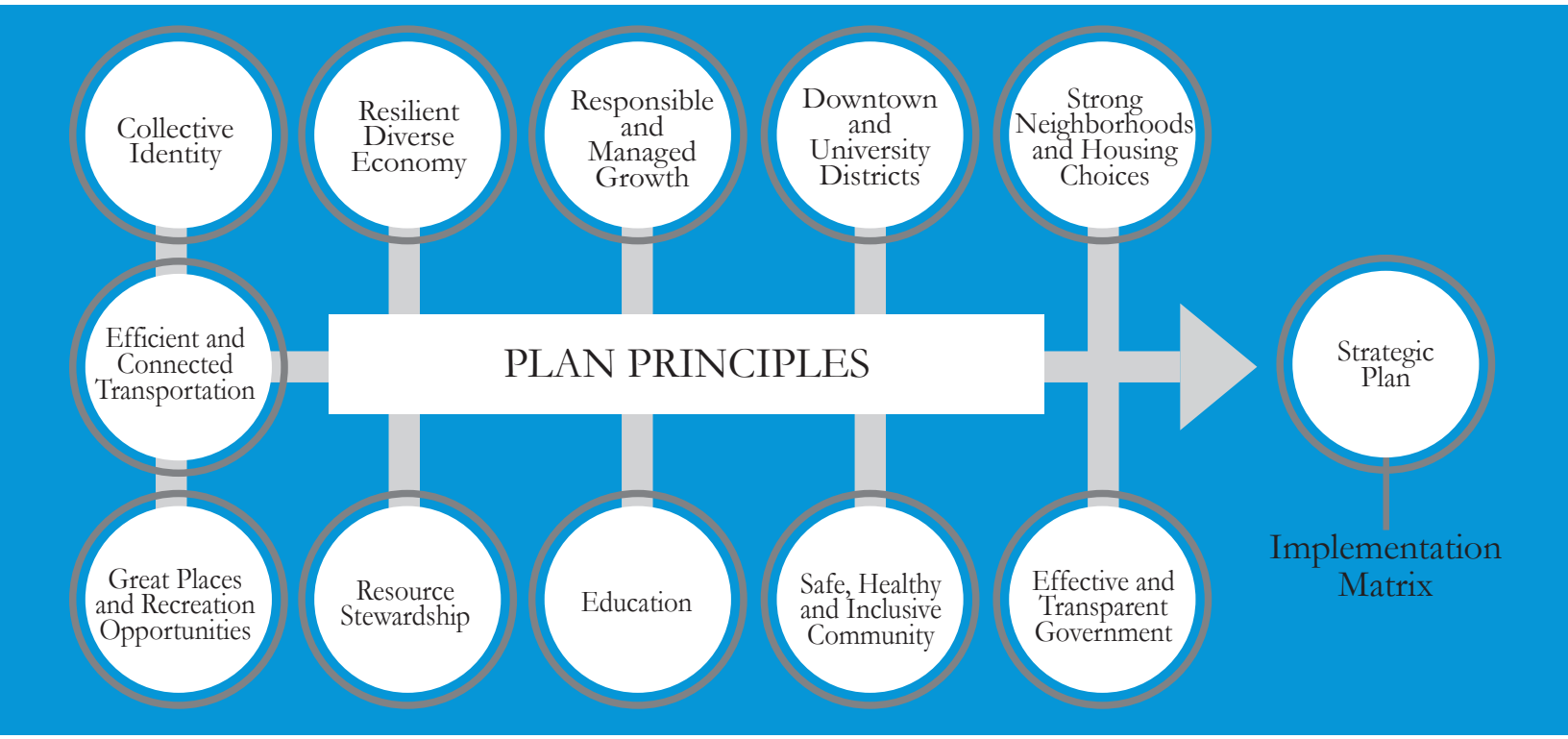
Colorado's Grand Valley, nestled between the snow-capped Colorado Rocky Mountains and the stunning deserts of the Colorado Plateau, embraces Western work ethic and new-age innovation, creating the New West, where small-town hospitality meets downtown accessibility. Unlike the gold rushes of the past, the rush to the New West isn't for gold. It's for a slice of the flourishing economy, nation-leading workforce, and housing you can actually afford.

What will you find during your visit to Grand Junction? Awe-inspiring natural beauty and the dramatic red rock landscape of the Colorado National Monument. Exhilarating outdoor adventures including hiking, camping, or skiing on the Grand Mesa. Hundreds of miles of world-class mountain biking trails. Incredible whitewater rafting on the Colorado River. Stunning golf courses whose green fairways are juxtaposed against the craggy desert landscape.

ONE GRAND JUNCTION

THE FOUNDATION OF THE STRATEGIC PLAN

The City of Grand Junction understands the importance of planning for the future. Over the years, the City has adopted long-range plans for the development of the community. The City's One Grand Junction Comprehensive Plan took 22 months to complete and was adopted by the City Council on December 16, 2020. The Plan supersedes and replaces the 2010 Joint Grand Junction Comprehensive Plan adopted in 2010. The One Grand Junction Comprehensive Plan is a blueprint for the City and the foundation of the Plan is the community's vision for its future. This vision guides the goals and strategies included in the plan that ultimately informs city priorities, future growth, services, and development in Grand Junction. The Plan was derived directly from ideas and themes generated during the community outreach process.



350
acres of developed parks

29,500
households

37,000
publicly owned trees

2 million
annual visitors

100+ miles
of multi modal trails

6
fire stations, 2 more planned

380 miles
of maintained roadway

1.6 million
acres of public land to explore

STRATEGIC PLAN FRAMEWORK

Grand Junction is an inclusive, diverse, healthy and accessible city that builds on its collective character to be a place where opportunity abounds, resources are well managed, and people are connected and engaged in their community.

PRIORITIES

Mobility & Infrastructure

Mobility & Infrastructure

Grand Junction places a high value on providing accessible and equitable transit options for our residents and visitors year-round with associated infrastructure that includes trails, non-motorized, and multi-modal services.

Economic Development

Economic Development

Grand Junction fosters the policies and environment to support a robust economic climate that is diverse and expansive and that draws and maintains a talented workforce, provides educational excellence, and enhances opportunity for all.

Housing

Housing

Grand Junction is committed to enacting effective and attainable housing policies and partnering with governmental organizations, e.g. DOLA, DOH. that seek to increase affordable housing options, create diverse housing choices, decrease the gap between need and housing inventory, and assist those without homes to be matched with supportive services.

Public Safety

Public Safety

The City of Grand Junction delivers to our residents and visitors the highest quality safety services around the clock every day of the year.

Quality of Life

Quality of Life

Grand Junction prioritizes the exceptional livability of our city. We are founded on clean air and water, responsible stewardship of natural resources, and sustainability practices alongside social and recreational opportunities that deepen connection and well-being.

THE STRATEGIC PLAN PROCESS

This plan is driven by the One Grand Junction Comprehensive Plan that identifies a community vision, community values, and community priorities. The One Grand Junction Comprehensive Plan was a multi phase planning process with broad community engagement, followed by careful guidance and refinement with community partners, by concluding with thoughtful deliberation by the city's subject matter experts.

In keeping with its importance as the core strategic policy document, the City Council dedicated numerous hours to reviewing and adjust the One Grand Junction Comprehensive Plan and used that information as the foundation for the Strategic Plan. This high degree of engagement ensures that the Strategic Plan remains community-based and forward-looking, while being responsive to multiple community check-ins along the way. The Strategic Plan process involved research, review, meetings with the Council and staff, and was focused on four strategic questions: 1) Where are we now, 2) Where do we want to be, 3) How will we get there, and 4) How will we know if we are successful?

PLANNING FOR RESULTS:

The Strategic Planning Process

1 Plan to Plan

- Kickoff Meeting
- Gather information
- Discuss logistics
- Create Project Plan
- Approve Engagement Plan
- Determine final outcomes
- Choose templates and documents

2 Research, Review and Analyze

- Review all relevant documents
- Conduct independent research
- Determine contact for individuals and groups
- Environmental scan
- Organizational assessment
- SWOT or SOAR analysis

3 Engagement and Outreach

- Craft interview and survey questions
- Conduct confidential personal interviews
- Release online survey
- Design engagement materials for print
- Facilitate stakeholder meetings for input
- Publish website
- Post social media graphics and text
- Write reports and summaries of all engagement data

4 Create the Framework

- Facilitate strategic planning meetings
- Guide strategic framework conversations
- Write language for **Strategic Plan**
- Design the **Strategic Plan** documents
- Facilitate meetings for implementation matrix
- Design implementation matrix
- Present strategic and implementation documents
- Submit Executive Report and Recommendations

5 Communicate and Implement

- Facilitate meetings to present the final plan
- Publish the plan
- Integrate the plan into budgets and master plans
- Design reporting and updating process and documents
- Create the dashboard tools
- Update the **Strategic Plan** annually

WHERE ARE WE NOW?

The community feedback received during the creation of the One Grand Junction Comprehensive Plan helps the City understand the needs and challenges of the community. City Council and staff used that information to better understand what actions and strategies were needed to preserve what is currently valued by the community and achieve the future vision of the Comprehensive Plan.

WHERE DO WE WANT TO BE?

The City Council determined the vision for the Strategic Plan and five priority areas as a focus for the next two years. Those five areas are: Economic Development, Housing, Mobility & Infrastructure, Public Safety, and Quality of Life. As the Strategic Plan is integrated with One Grand Junction Comprehensive Plan, with the budget, and other master plans adopted by the City Council, the focus on those priority areas will allow the city to achieve the desired vision for the future.

HOW WILL WE GET THERE?

The One Grand Junction Comprehensive Plan was used as the guiding document for the Strategic Plan. The Strategic Plan integrates the five priority areas with the eleven plan principles. Goals and strategies were identified within the One Grand Junction Comprehensive Plan that directly applied to the five priorities. With an implementation plan matrix, those priorities, goals and strategies will be further refined and developed for operational excellence.

HOW WILL WE KNOW IF WE ARE SUCCESSFUL?

The City of Grand Junction will measure its success through outcomes that have been identified across all priorities and goals. We recognize that these outcomes may take many years, even decades to achieve. To measure progress toward these outcomes, there are specific metrics and indicators that will be tracked collaboratively with our partners.

PURPOSE

The purpose of the Strategic Plan is to incorporate the community vision and values from the One Grand Junction Comprehensive Plan into City Council priorities, goals, and outcomes.

VISION

Grand Junction is an inclusive, diverse, healthy, and accessible city that builds on its collective character to be a place where opportunity abounds, resources are well managed, and people are connected and engaged in their community.

STRATEGIC PLAN ANCHORS

These Strategic Plan anchors were developed from One Grand Junction Comprehensive Plan and reflect the most important community values. As such, they anchor the Strategic Plan and serve as the lens through which all the work completed to achieve the vision will be viewed.

Accessibility
Choice
Collective
Collective Identity
Community Engagement
Connectedness
Connectivity
Diversity
Efficient and Transparent Government
Engagement
Environment
Equitable
History
Honoring History
Inclusion
Lands
Livability
Management
Partnerships
Pride
Public Lands
Resource Management
Stewardship
Transparency

STRATEGIC PLAN PRIORITIES, GOALS, STRATEGIES AND OUTCOMES

The following pages detail the priorities, strategic goals, and outcomes for the City of Grand Junction. Strategic priorities are the issues of most importance to the city, those areas that, if addressed through goals and measured by outcomes, will lead to achieving the vision of the city. They are very big picture and are most often long-term issues that will not change over the course of a few years, but will continue to be addressed across several years.

Goals are directly tied to priorities and are big, broad statements that, when accomplished, significantly move the needle in the areas of most importance. They can serve as milestones along the journey to achieving success with the priorities, which will then accomplish the vision. Goals are short statements that have a specific time frame. They are broad statements that focus on the desired results and do not describe the methods used to get the intended outcome.

An outcome is what the City of Grand Junction intends to create as a result of achieving the goals and addressing the priority. An outcome is the change that happens as a result of implementing this Strategic Plan. It is the desired end result of hard work, and while not a specific measurement, outcomes can have measurements that are directly tied to success.

MOBILITY & INFRASTRUCTURE

Grand Junction places a high value on providing accessible and equitable transit options for our residents and visitors year-round with associated infrastructure that includes trails, non-motorized, and multi-modal services.

ONE GRAND JUNCTION

The One Grand Junctions Comprehensive Plan for the City of Grand Junction served as the foundation for the Strategic Plan conversations, framework and content. The One Grand Junction Comprehensive Plan has eleven principles within the document, and many of those principles connect to, inform, and guide the Mobility & Infrastructure priority.

- Resilient and Diverse Economy
- Responsible and Managed Growth
- Downtown and University Districts
- Strong Neighborhoods and Housing Choices
- Efficient and Connected Transportation
- Great Places and Opportunities
- Education
- Effective and Transparent Government

Please refer to the One Grand Junction Comprehensive Plan for more information about the plan principles.

OUTCOMES

- Improve connectivity for walking and biking
- Better transportation systems
- Commuter option for economically disadvantaged residents
- Access to recreational trails (both paved and soft)
- Increase in commuters that bicycle
- Additional miles of bike lanes

GOALS AND STRATEGIES

The goals and strategies from One Grand Junction Comprehensive Plan that will be integrated into this Strategic Plan for Mobility & Infrastructure are detailed in our implementation plan, and the major themes can be categorized as:

Long-Range Planning

- Bicycle and pedestrian plan
- Identify opportunities for connectivity
- Future bus rapid transit corridors
- Update circulation plan
- Wireless master plan

Improvements

- Improving the urban trail system
- Acquire and develop remaining sections of the Colorado Riverfront Trail
- Increase Complete Streets Policy
- Riverfront destinations
- Street improvements

Education

- Around safety and right of way
- Partner with other agencies to improve outreach and communication

Partnerships with

- Grand Junction Regional Airport
- Transportation providers
- Property owners

ECONOMIC DEVELOPMENT

Grand Junction fosters the policies and environment to support a robust economic client that is diverse and expensive and that draws and maintains a talented workforce, provides educational excellence, and enhances opportunity for all.

ONE GRAND JUNCTION

The One Grand Junction Comprehensive Plan for the City of Grand Junction served as the foundation for the Strategic Plan conversations, framework and content. The One Grand Junction Comprehensive Plan has eleven Principles within the document, and many of those Principles connect to, inform, and guide the Economic Development Priority.

- Resilient and Diverse Economy
- Responsible and Managed Growth
- Downtown and University Districts
- Strong Neighborhoods and Housing Choices
- Efficient and Connected Transportation
- Great Places and Opportunities
- Education
- Effective and Transparent Government
- Resource Stewardship

Please refer to One Grand Junction Comprehensive Plane for more information about the Plan Principles.

OUTCOMES

- Improved collaboration among economic development organizations
- Secure employment that provides them with fulfillment and economic security
- Affordable quality child care
- Clear roles and responsibilities for economic development
- Good paying jobs
- Commercial and industrial development sites
- Incentives

GOALS AND STRATEGIES

The goals and strategies from One Grand Junction Comprehensive Plan that will be integrated into this Strategic Plan for economic development are detailed in our implementation plan, and the major themes can be categorized as:

Public Improvement Investments

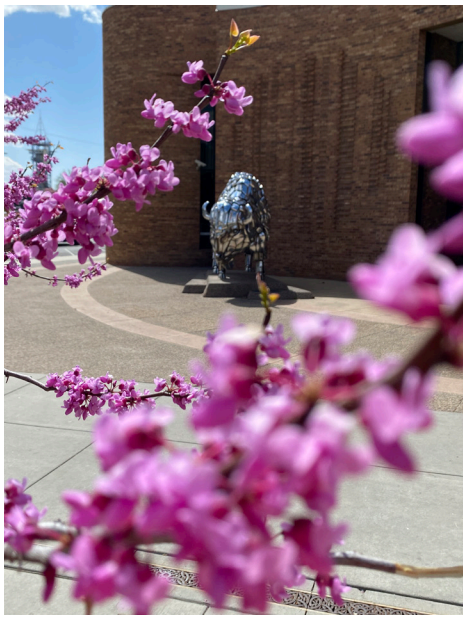
- Trail systems
- Roadways and streets
- Riverfront
- Community buildings

Long-Range Planning

- Master Plan updates
- New Master Plan adoption

Partnerships with

- Grand Junction Economic Partnership
- Grand Junction Regional Airport
- Visit Grand Junction
- The Grand Junction Chamber of Commerce
- Commissions and Committees
- Western Colorado Botanical Gardens
- Mesa County
- Regional and state partners
- Incentives



HOUSING

Grand Junction is committed to enacting effective and attainable housing policies and partnering with governmental organizations, e.g. DOLA, DOH. that seek to increase affordable housing options, create diverse housing choices, decrease the gap between need and housing inventory, and assist those without homes to be matched with supportive services.

ONE GRAND JUNCTION

The One Grand Junction Comprehensive Plan for the City of Grand Junction served as the foundation for the Strategic Plan conversations, framework and content. The One Grand Junction Comprehensive Plan has eleven principles within the document, and many of those principles connect to, inform, and guide the housing priority.

- Resilient and Diverse Economy
- Responsible and Managed Growth
- Downtown and University Districts
- Strong Neighborhoods and Housing Choices

Please refer to the One Grand Junction Comprehensive Plan for more information about the plan principles.

OUTCOMES

- Safe residents have access to adequate and comfortable shelter
- Implement housing plan
- Decreased gap in availability of affordable/ attainable housing

GOALS AND STRATEGIES

The goals and strategies from the One Grand Junction Comprehensive Plan that will be integrated into this Strategic Plan for housing are detailed in our implementation plan, and the major themes can be categorized as:

Long-Range Planning

- Targeted housing strategy
- Revise Persigo agreement to provide better decision-making in land use planning
- Monitor inventory of sites and land

Code Revisions and Improvements

- Review the code regarding density
- Amend the code to allow creativity and innovation in design
- Evaluate incentives

Partnerships with

- Downtown Grand Junction Development Authority
- Organizations that address homelessness and housing insecurity
- Property owners

PUBLIC SAFETY

The City of Grand Junction delivers our residents and visitors the highest quality and safety services around the clock every day of the year.

ONE GRAND JUNCTION

The One Grand Junction Comprehensive Plan for the City of Grand Junction served as the foundation for the Strategic Plan conversations, framework and content. The One Grand Junction Comprehensive Plan has eleven principles within the document, and many of those principles connect to, inform, and guide the public safety priority.

- Collective Identity
- Responsible and Managed Growth
- Strong Neighborhoods and Housing Choices
- Efficient and Connected Transportation
- Great Places and Opportunities
- Education
- Safe, Healthy and Inclusive Community

Please refer to One Grand Junction Comprehensive Plan for more information about the plan principles.

OUTCOMES

- Fully staffed Police Department
- Expansion of Fire/EMS services to meet the needs of our growing community
- Contributes to a safe community that fosters healthy economic, social, and physical conditions

GOALS AND STRATEGIES

The goals and strategies from the One Grand Junction Comprehensive Plan that will be integrated into this Strategic Plan for public safety are detailed in our implementation plan, and the major themes can be categorized as:

Long-Range Planning

- Identify and secure land for fire stations
- Implement elements of the Multi-jurisdictional Hazard Mitigation Plan
- Establish a comprehensive EMS Plan
- Update the Public Safety Technology Plan

Improvements

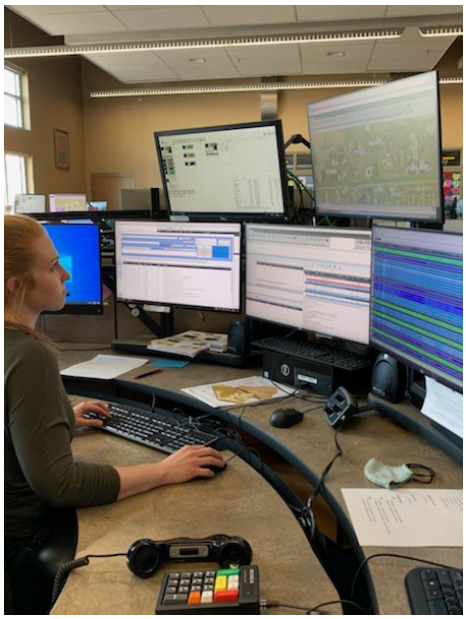
- Continue to improve the streetscape
- Identify tools
- Construct critical fire and police infrastructure
- Deploy a traffic unit

Data and Analysis

- Continue to track data for traffic enforcement and safety
- Partner with other agencies to improve outreach and communication

Engagement with

- The community to identify opportunities for a safe community
- Partner organizations around homelessness
- Identify tools to promote safety in public spaces
- Learning institutions
- Fire Departments and Districts in the surrounding area
- Dedicate resources to the CARES Program



QUALITY OF LIFE

Grand Junction prioritizes the exceptional livability of our city. We are founded on clean air and water, responsible stewsardship of natural resources, and sustainability practices alongside social and recreational opportunities that deepen connection and well-being.

ONE GRAND JUNCTION

The One Grand Junction Comprehensive Plan for the City of Grand Junction served as the foundation for the Strategic Plan conversations, framework and content. The One Grand Junction Comprehensive Plan has eleven principles within the document, and many of those principles connect to, inform, and guide the quality of life priority.

- Collective Identity
- Resilient and Diverse Economy
- Responsible and Managed Growth
- Downtown and University Districts
- Efficient and Connected Transportation
- Great Places and Opportunities
- Resource Stewardship
- Education
- Safe, Healthy and Inclusive Community

Please refer to the One Grand Junction Comprehensive Plan for more information about the plan principles.

OUTCOMES

- Safer and healthier community
- More opportunities
- A sustainable future that allows future generations to pursue their goals
- A recreation and community center that serves all
- Clean and healthy air, water, and land

GOALS AND STRATEGIES

The goals and strategies from One Grand Junction that will be integrated into this Strategic Plan for quality of life are detailed in our implementation plan, and the major themes can be categorized as:

Long-Range Planning

- Ensure new subdivisions dedicate parks and/or open spaces
- Explore options for long-term dedicated funding strategies
- Implement the Lincoln Park Stadium Master Plan
- Update Cultural Plan
- Sustainable BioSolids Master Plan
- Comprehensive Sustainability Plan

Improvements

- Preservation of open space
- Improving the urban trail system
- Acquire and develop remaining sections of the Colorado Riverfront Trail
- Parks and publicly owned spaces
- Riverfront destinations
- Construction of a multipurpose Community Center

Stewardship of

- Regarding landscaping, weed, and junk ordinances and nuisance codes
- Systems for use of reclaimed water
- Incentives for efficient water use and landscaping
- Water conservation educational programs
- Expand sewer improvement districts
- Sustainable ranch management programs
- Reduce waste and increase reuse, recycling, and repurposing
- Healthy urban forest

Partnerships with

- Community in the Childcare 8,000 initiative
- Mesa County Libraries for expansions and improvement
- The community to identify opportunities
- Regional efforts to preserve agricultural lands
- The Grand Junction Sports Commission
- Regional water districts
- Private property owners of key properties for conservation
- Arts and Culture Commission
- Western Colorado Botanical Gardens

ADAPTIVE STRATEGIES

Adaptive Strategies are methods or approaches used to accomplish goals. They are tools and techniques that will allow the City of Grand Junction to achieve success quickly and efficiently. Having an adaptive approach to strategy rests on the idea of being responsive to changing needs. In unpredictable or unknown environments, the emphasis is on real-time adjustments rather than solely on long-term analysis and planning.

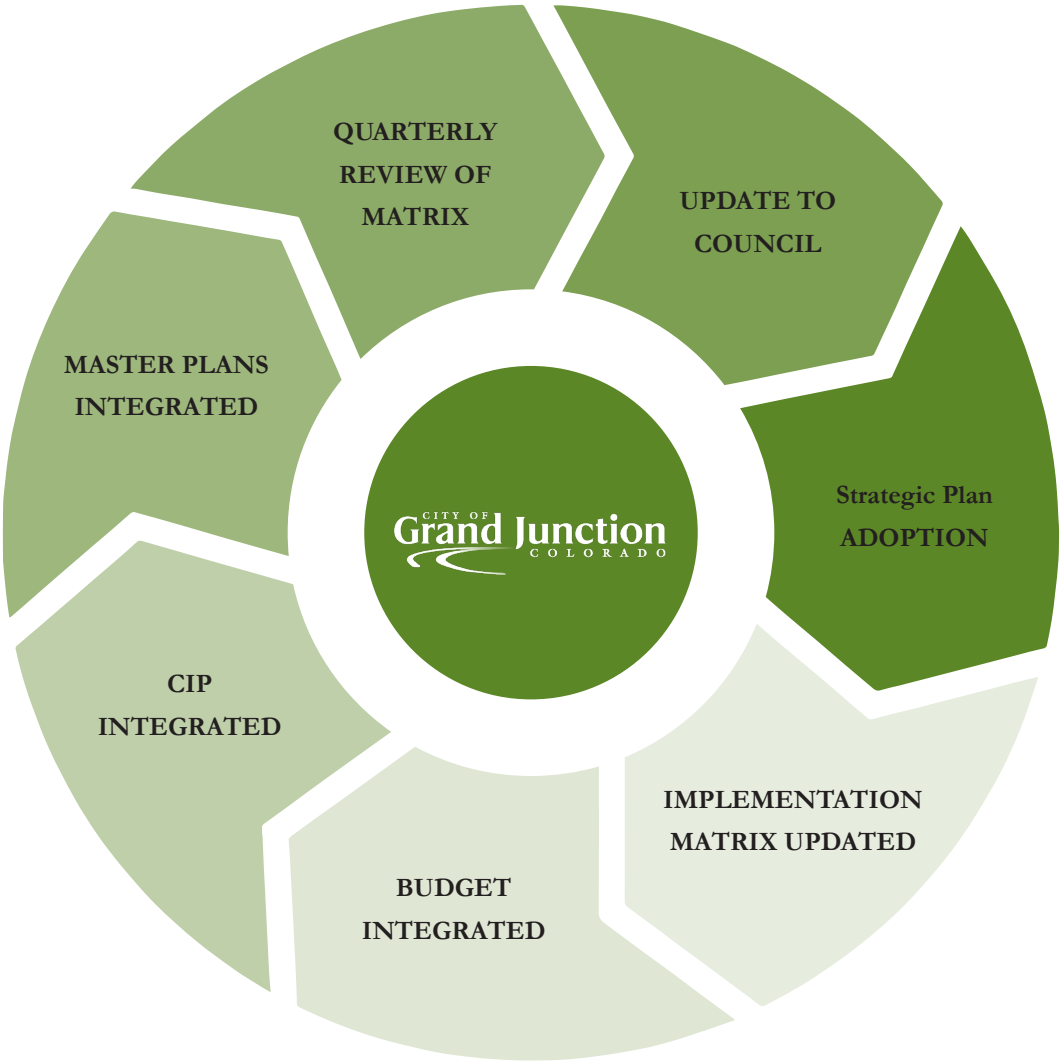
- Strengthen communication channels and outreach
- Invest in technology improvements within City government and the community
- Focus on environmental and fiscal sustainability
- Use the lens of diversity and inclusion in all actions/programs/decisions
- Continue to develop strong relationships with community partners to leverage resources
- Ensure fiscal transparency and accountability
- Utilize innovative approaches
- Promote safety in City operations and throughout the community
- Equitable delivery of services

THE PATH FORWARD

An annual cycle (illustrated in the accompanying diagram) will guide a deliberate process for implementing the Strategic Plan. Each year, a workshop will bring Council and Senior Leadership together to discuss available resources and to develop initial direction on priorities for the Strategic Plan. Staff will then prepare proposals for Council evaluation and refinement during the budget review process. Once complete, these proposals for actions become formally adopted into the budget as items and staff will commence implementation.

While implementation progresses, staff will work to evaluate performance on success measures which will also be tracked year-over-year. An implementation matrix will be used to track and report results. This "plan, do, check, and adjust" cycle will help to ensure who there is a focus on continuous improvement and that the actions, objectives, and goals are in alignment with current conditions and community priorities.

The majority of Strategic Plan actions are anticipated to be identified and selected through the annual Council and staff prioritization. However, as new strategic policies or additions to the city's budget develop outside of that process, items would be evaluated by staff for the strength of their linkage to the Strategic Plan and consideration as "timely opportunities". It is anticipated that only small modifications would be incorporated on an annual basis, and as needed the city will more formally update the overall Strategic Plan.



ACKNOWLEDGEMENTS

We would like to thank the community for feedback and input on our One Grand Junction Comprehensive Plan, which has informed and provided guidance for this Strategic Plan. Our focus is to meet the needs of our community while providing exceptional, responsive, and sustainable services. We truly appreciate everyone who completed our surveys, commented on social media, attended a community meeting, and wrote comments, as well as those members of our community who attend Council meetings.

We want to specifically recognize our staff — your hard work and dedication has made this Strategic Plan possible. The countless hours you spent to truly understand the community feedback and create a cohesive vision moving forward were much appreciated and valued.

STRATEGIC PLAN DEFINITIONS

These ten terms are used throughout the Strategic Plan. Here's what they mean:

Strategic Plan

A Strategic Plan is a working, living document that reflects the policy direction from the City Council, sets the vision for the City of Grand Junction, and drives and informs an implementation plan, which the staff will create to ensure progress and measurable results. The Strategic Plan will be updated regularly by the City Council and reported on quarterly by the city staff. The key components of a plan for the City Council to discuss include:

VISION

A Vision Statement describes the future of the City of Grand Junction. It is a clear vision that inspires long term change. The vision leads the organization - it guides the Strategic Goals, Outcomes, Adaptive Strategies, and Work Plans.

PRIORITIES

These Priorities are the most important areas of focus for the city in the coming years. They are broad areas of focus that will be used to guide the staff with Strategic Goals and Big Picture Outcomes. The Priorities are long term overarching concepts that convey what is most important to the City Council

BIG PICTURE OUTCOMES

The Outcomes are bigger picture and longer-term statements of achievement – they are the end result of the hard work on Priorities and Goals. An outcome is what the City will achieve, the change that happens as a result of implementing the Strategic Plan. They will drive the Key Performance Indicators, which are more specific and usually involve objective data such as numbers.

STRATEGIC GOALS

Strategic Goals are the larger, broader, often intangible concepts that will need to be accomplished to address the Priorities and be successful in the coming years. Strategic Goals are typically longer term in nature and have milestones along the way to measure success. Goals are big, broad statements that, when accomplished, significantly move the needle on your Priorities and focus on the vision.

ADAPTIVE STRATEGIES

Strategies are methods or overarching concepts used to accomplish a goal. They can be thought of as a broader tool or technique that will allow your organization to have success more quickly or efficiently. More than one strategy may be used concurrently. Think of strategies the high-level tools or techniques needed to accomplish the outcomes, factored into the everyday work of the city.

IMPLEMENTATION PLAN

The Implementation Plan is a spreadsheet or tracking document for the Strategic Plan that is based on the Priorities, Strategic Goals and Outcomes from the City Council. The Implementation Plan tracks several key issues: the SMART Objectives to accomplish the Goal, the Action Steps that will accomplish the SMART Objective, and the KPIs that will measure success for the Outcomes. Included will be who is responsible, specific timelines, and any resources needed to accomplish the work.

SMART OBJECTIVES

SMART Objectives are milestones along the road to achieving your bigger picture Strategic Goals. They are accomplishments that can be defined in quantifiable and measurable terms. SMART means Specific, Measurable, Actionable, Realistic, and Timebound. Objectives are specific, actionable targets that need to be achieved within a smaller time frame to accomplish your Strategic Goals. SMART Objectives typically take between 90 days – 1 year to complete.

ACTION STEPS

Action Steps are very specific tasks that need to be completed to achieve the SMART Objectives and Strategic Goals. They are very short term (30 – 90 days).

KEY PERFORMANCE INDICATORS

Key Performance Indicators are measurable values that demonstrate how effectively the organization is achieving Strategic Goals and Outcomes. KPIs are used to evaluate success at reaching targets metrics in budget, Strategic Planning, master plans, and more. A great KPI measures not just numbers, but the outcomes you wish to see because of your work.

For more information about our Strategic Plan,
please visit our website at:
https://www.gjcity.org/308/Strategic-Plan

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Grand Junction City Council

Workshop Session

Item #1.b.

Meeting Date: November 29, 2021

Presented By: Randi Kim, Utilities Director

Department: Utilities

Submitted By: Randi Kim

Information

SUBJECT:

Long-Term Water Supply and Infrastructure Planning

EXECUTIVE SUMMARY:

The primary water supply for the City of Grand Junction is the Kannah Creek watershed on the Grand Mesa. Water infrastructure includes a system of 19 reservoirs, two water supply pipelines that convey water from the Juniata Reservoir and Kannah Creek to the City, and the Grand Junction water treatment plant. In 2018, staff initiated water supply planning activities to address operational reliability, risk resiliency, and long-term water supply needs for the City. In addition, planning efforts included a review of the City's portfolio of water rights, which also include significant water rights on the Colorado and Gunnison rivers, to determine how they could be best utilized through a water marketing study co-funded by a $200,000 grant from the U.S. Bureau of Reclamation. Staff will provide an update of the planning activities and request input from Council on the shortlist of viable options identified for further development.

BACKGROUND OR DETAILED INFORMATION:

The primary water supply for the City of Grand Junction is the Kannah Creek watershed on the Grand Mesa. Water infrastructure associated with the Kannah Creek watershed includes a system of 19 reservoirs, two water supply pipelines that convey water from the Juniata Reservoir and Kannah Creek to the City, and the Grand Junction water treatment plant. The Kannah Creek water supply is sufficient to meet projected average water demands for the City's service area through 2039. Challenges associated with the Kannah Creek watershed and associated infrastructure include aging infrastructure; potential risks associated with drought, climate change, wildfires, or malevolent acts; and the capacity of the system to meet future water demands.

In 2018, staff initiated water supply planning activities to address operational reliability,

risk resiliency, and long-term water supply needs for the City. In addition, planning efforts included a review of the City's portfolio of water rights, which also include significant water rights on the Colorado and Gunnison rivers, to determine how they could be best utilized by the City or other partners through a water marketing study co-funded by a $200,000 grant from the U.S. Bureau of Reclamation.

In an April 23, 2021 memorandum to Council, staff provided an update on the progress of the water supply planning efforts. During this workshop, staff will provide an update on the water supply planning activities completed to date and request input from the Council on the shortlist of viable options identified for further development.

FISCAL IMPACT:

NA

SUGGESTED ACTION:

No action required.

Attachments

None

CITY OF Grand Junction COLORADO

CITY MANAGER'S OFFICE

Memorandum

TO: Mayor and Members of Council

FROM: Greg Caton, City Manager

Randi Kim, Utilities Director

DATE: April 23, 2021

SUBJECT: Update of Water Supply Options Assessment and Marketing Strategy

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This memo provides an update of the Water Supply Options Assessment and Marketing Strategy project that City staff initiated in June 2019. Staff completed an evaluation of options for water supply infrastructure with consultant Burns & McDonnell through a detailed engineering feasibility study. The purpose of the study is to address operational reliability, resiliency to drought and other incidents, and long-term supply to meet future growth. Attached is the report and accompanying memo issued by the consultant.

Current Water Supply Infrastructure – The City's primary water supply pipeline, the 17.5-mile Purdy Mesa Flow Line, conveys water from the Kannah Creek watershed via the Juniata Reservoir to the water treatment plant in Orchard Mesa. A capital project is currently underway to replace the remaining six miles of steel pipeline with PVC pipe to extend the life of this asset and improve operational reliability.

The City also operates a secondary water supply pipeline, the Kannah Creek Flow Line. The operational capacity of this pipeline is restricted due to the age and condition of the pipeline, a history of breaks, and air entrainment in the line. Due to the considerable cost associated with replacing the Kannah Creek Flow Line, several other options were evaluated to provide a redundancy to the Purdy Mesa Flow Line including treating Gunnison River water, relocating the water treatment plant in the Kannah Creek watershed, and cooperative projects with Clifton Water District and Ute Water Conservancy District.

Based on the results of the evaluation, Staff recommended replacement of the Kannah Creek Flow Line as the most cost-effective option to provide redundancy and improve operations reliability. A capital project was completed in 2020 to replace a 2-mile segment of the Kannah Creek Flow Line and replacement of a second 2-mile is currently underway. Further condition assessment is needed for the remaining segments of the flow line.

Resiliency Options – While the Kannah Creek Flow Line addresses operational redundancy, it does not provide resiliency should the City experience interruption to the Kannah Creek water supply in the event of a malevolent act, wildfire, or drought.

The City currently has interconnections with the Clifton Water District and the Ute Water Conservancy District that provide risk resiliency. Clifton Water District can provide full backup with existing infrastructure to meet average water demands through 2032. Beyond 2032, the Clifton water treatment plant would have to be expanded to fully backup the City. The

interconnection with Ute is limited because Ute uses a different disinfection process than the City presenting water quality compatibility issues. Alternately, the City would have to expand the City water treatment plant with a breakpoint chlorination station to accept treated water from the Ute Water Conservancy District. The third option would involve expanding the City water treatment plant to enable treatment of Gunnison River water. The estimated cost of these options is presented below:

Option	Estimated Capital Cost	Estimated Monthly Operations & Maintenance Costs
Expand Clifton Water Treatment Plant from 12 to 16 mgd utilizing City's Colorado River water rights	$25,300,000	$72,000
Expand City Water Treatment Plant with Breakpoint Chlorination Station and Purchase Treated Water from Ute Conservancy District	$2,900,000	$584,000
Expand City Water Treatment Plant with Lime Softening Process to Treat Gunnison River Water	$41,900,000	$233,000

With an anticipated project duration of four to five years from planning through construction, the earliest that any of the three projects would have to be initiated would be 2027.

Future Supplemental Water Supply Options – In addition to providing resiliency to address risk events, the options presented could also provide supplemental water to meet future demands. Burns & McDonnell evaluated when the City would need to supplement the Kannah Creek water supply to meet future growth of the City based on population projections presented in the City's 2020 Comprehensive Plan and anticipated water tap sales. Assuming a 1.3% annual population growth occurs within the City's water service area, demand would exceed supply in 2039. Under a scenario of successive drought years, demand would exceed supply as early as 2029.If more growth occurred in the undeveloped areas of the City served by the Ute Water District in the near term with infill in the City's water service area coming later as we are currently experiencing, supplemental water supplies would not be needed until after 2050.

Assuming a four to five-year project duration at the higher population growth with a drought scenario, a project to provide supplemental water would need to be initiated as early as 2024. Development patterns will need to be monitored closely to determine appropriate timing for an expansion project.

Water Marketing Strategy – The Options Assessment for the City's water supply is part of a broader water marketing strategy being developed for the City's water rights, co-funded by a Bureau of Reclamation grant. Now that the City has identified water rights that are needed to support the City's current and future needs, the City can evaluate water rights that could potentially be marketed through leasing or other mechanisms. Staff is working with DiNatale Water Consultants to evaluate how the City's water rights on the Colorado and Gunnison Rivers could be utilized by other parties. Another report will be issued documenting the water marketing strategy by September 2021.

Next Steps – As part of the water marketing strategy, City Staff will be conducting outreach with Clifton Water District and Ute Water Conservancy District to discuss potential cooperative projects for long-term water supply for the City. Staff will also be discussing potential utilization of water rights with the districts as well as other entities such as Redlands Water and Power. Once

the Marketing Strategy report is issued, Staff will schedule a workshop with City Council to present the recommendations.

Attachments: Options Assessment for the City of Grand Junction Water Supply

C: Department Directors

Memorandum

Date: April 22, 2021

To: Mark Ritterbush, Randi Kim (City of Grand Junction)

From: Burns & McDonnell
9785 Maroon Circle Suite 400
Centennial, CO 80112

Subject: Implementation Forecast, Options Assessment for the City of Grand Junction Water Supply

1.0 INTRODUCTION

The City of Grand Junction (City) provides potable water to its customers from its existing water treatment plant (WTP). The primary source of raw water for the WTP is the Kannah Creek Basin on the Grand Mesa. Water from this basin is accessed through the Purdy Mesa flow line (PMFL) and the Kannah Creek flow line (KCFL). The KCFL experienced a series of several breaks in 2019 and is not capable of providing peak day demands.

The City contracted with Burns & McDonnell Engineering Company, Inc. (BMcD) to investigate the feasibility of alternative water supplies in the event that the PMFL is not available. The City also has water rights to the Colorado and Gunnison Rivers, as well as an interconnection agreement with Clifton Water District (Clifton). The Ute Water Conservancy District (Ute) distribution system surrounds the City with several interconnections, but there is no formal agreement.

The final Options Assessment for the City of Grand Junction Water Supply was submitted to the City in April 2021. After presenting an earlier version of the Options Assessment to staff, the City requested that Burns & McDonnell prepare an implementation forecast for potential proposed capital projects based on the future water demand, existing water rights and the risk/resiliency scenarios of each of the City's potential water sources.

2.0 PROJECT OBJECTIVES

The objectives of this memo are:

1. Forecast when existing and potential water resources no longer meet average day water demands,
2. Identify the risk exposure for the City's existing water infrastructure and raw water sources as it relates to its availability during short and long term interruptions,
3. Present the risk exposure by water source and event in tabular format,
4. Summarize cost for capital works, as developed in the Options Assessment Study,
5. Identify when additional infrastructure is needed based on the City's risk tolerance for potential water demand as well as short and long term interruptions, and
6. Present implementation forecast for the identified resiliency options.

3.0 WATER SOURCES

The following water sources are available to the City:

1. **Kannah Creek Basin** – The Kannah Creek Basin comprises multiple water sources including Juniata Reservoir, the North Fork of Kannah Creek, Whitewater Creek, and several smaller reservoirs – referred to as the upper reservoirs. Two major pieces of infrastructure – the PMFL and KCFL – deliver raw water to the WTP from the Kannah Creek Basin. The Options Assessment report previously identified that repairs on the KCFL and an interconnection at the Juniata Reservoir must be completed to provide redundant access to the Kannah Creek Basin. This memo assumes that the KCFL replacement and the new Juniata Interconnection are complete.

   The Kannah Creek Basin can be considered as either a single, combined source or as separate sources based on how the City currently uses their water rights and existing infrastructure. Both approaches are considered in the risk scenarios discussed later in this document.

   The firm yield of the of the Kannah Creek Basin, when viewed as a single water source, is the amount of water delivered by the City's raw water collection system. The firm yield includes 44 acre-ft (AF) used by the Kannah Creek Water Treatment Plant and 300 AF used by non-potable customers. This results in a volume less than the firm yield sent to the Grand Junction WTP. Similar deductions must be made when looking at Juniata Reservoir and Kannah Creek as individual sources.

   The firm yield of the Kannah Creek Basin is 6,400 AF/year[1]. This results in approximately 6,056 AF available at customer's taps, when accounting for other uses described above. This converts to an average daily of flow of 5.41 million gallons per day (mgd) that the City can deliver throughout the year. This average daily flow accounts for peak flows in the summer and low flows in the winter.

   a. **Juniata Reservoir –** The Juniata Reservoir is a high quality mountain source and the primary raw water supply for the City. The PMFL conveys raw water from the Juniata Reservoir on the Grand Mesa to the WTP. The PMFL consists of approximately 18.2 miles of 18-inch steel, 20-inch steel and PVC and 24-inch PVC diameter gravity transmission main. Upgrades are proposed to replace sections that were at the end of their useful life, as well as upsizing segments to 20-inch diameter to reduce air entrainment. The PMFL has a hydraulic capacity of 9.8 mgd[2]. The existing Kannah Creek WTP draws water from the Juniata Reservoir to serve customers on the Kannah Creek basin. The Kannah Creek WTP has an approximate capacity of 200 gallons per minute (0.3 mgd) and does not send water to the City's WTP.

   b. **Kannah Creek –** The KCFL draws raw water from Kannah Creek at the City Intake, approximately 4-miles upstream from the Juniata Reservoir. The KCFL provides additional raw water to the City during the peak summer season and acts as a backup pipeline to the PMFL. During winter, the KCFL is only used to transfer water from the Kannah Creek watershed into the Juniata Reservoir. The City has 7.81 cubic feet per second (cfs) (5 mgd) of paramount water rights from Kannah

[1] DiNatale Water Consultants, November 2020, Evaluation of Firm Yield with Refined Reliability Criteria and Climate Change
[2] Black & Veatch, Project 197600, February 2018, Draft Purdy Mesa Flow Line Hydraulic Evaluation

Creek. The City may access an additional 3.91 cfs (2.5 mgd) of winter water rights when available. The KCFL is approximately 20-miles of 18-inch cast iron and 20-inch steel gravity transmission main. City operations limit the flow to less than 2 mgd to minimize stress on the pipeline. The upper portion of the pipeline, between the Kannah Creek diversion and the "Juniata Drop" can handle up to 7.5 mgd when the City is delivering irrigation water. This memo assumes that the KCFL replacement and the new interconnection at the Juniata Reservoir are complete, allowing water from either Juniata Reservoir or Kannah Creek to flow down either the PMFL or the KCFL.

2. **Gunnison River –** The City has 120 cfs of water rights to the Gunnison River that are not being utilized (18.6 cfs absolute and 101.4 cfs conditional). The Gunnison River is a river source of variable quality, subject to swings in turbidity and has high levels of total dissolved solids (TDS). The existing WTP is not capable of treating the Gunnison River without modifications to their treatment process. The City used the Gunnison River source in the past to augment peak summer demands by blending with the Kannah Creek Basin source in the existing raw water Reservoirs 3 and 4 at the WTP. Recent peak day demands have been met by the PMFL, making it unnecessary to use the Gunnison River source. The existing Gunnison River Pump Station (GRPS) is in poor condition with only one pump operational and is located in the flood plain. The GRPS is now only exercised periodically, with raw water blended in Reservoirs 3 and 4. The GRPS pumping capacity is approximately 6 mgd.

3. **Colorado River** – The City owns 80 cfs of water rights to the Colorado River that are not being utilized. This right was originally 120 cfs, but subsequent diligence proceedings have reduced the City's right to 80 cfs, with 20 cfs going to the Clifton and 20 cfs to the Water Development Group. The City does not have any active infrastructure to access their Colorado River source.

4. **Clifton Water District –** The City has an agreement with Clifton for seasonal water exchange. The 1998 amendment allows Clifton to supply the City with up to 250 million gallons between April and September each year (1.4 mgd average). The amendment states that the City will supply Clifton with up to 250 million gallons between October and March. The agreement has informally expanded over the years to allow the City to take up to 4.5 mgd of treated water from Clifton in emergency situations. Clifton treats a mix of Grand Mesa and Colorado River sources at its 12 mgd capacity WTP. The interconnection with Clifton is located on 29 Road, north of D Road. Water main breaks in 2019 required the City to use the Clifton interconnection. Maximum day flows up to 5.5 mgd were sustainable through the existing interconnection.

5. **Ute Water Conservancy District** – The Ute water distribution system surrounds the City's distribution system to the west, north and east, with eight points of interconnection. Ute supplies water to some customers in the municipal boundary of the City. There is no formal agreement between the City and Ute for water supply. However, there is a verbal agreement for supply in emergency conditions. The raw water source for Ute is Plateau Creek, which is considered a high quality mountain source. Ute has a 50 cfs (30 mgd) water right for Plateau Creek, which is used to fill Ute's reservoirs with a total capacity of 8,736 AF. As an alternate source, Ute holds a contract for Colorado River water in the Reudi Reservoir of 12,000 AF (firm yield of 10,800 AF). This equates to an average of 9.6 mgd over the year. The Ute WTP has a capacity of 25.9 mgd, limited by the current filtration capacity. The peak hour operating capacity of the Ute WTP without filter restriction is 34 mgd. Ute uses chloramines for disinfection, which are not

compatible with the City's use of free chlorine. Blending of the two waters would require additional treatment.

4.0 DEMAND FORECAST

4.1 Current and Future Conditions

Future water demands were studied separately[3]. The future water demands of the City of Grand Junction were summarized in the Options Assessment Study as follows:

Table 4-1 Current and Future Water Demands, Grand Junction

Parameter	Current Value	Future Value
Year	2019	2069
Population	29,500	49,000
Residential demand (gpcd)	88	88
Average day demand (mgd)	4.7	6.5
Annual average demand (AF)	5,265	7,281
Peaking factor	2.07	2.00
Peak day demand (mgd)	9.8	13.3

A 30% increase in peak demand over the next 50 years was assumed to estimate the potential water available from Clifton and Ute. Peak demand was used for Clifton and Ute to make a conservative estimate of the spare capacity of each system for potential use by the City. Clifton and Ute would have significantly more water available for the City's potential use if utilized during the winter. Additionally, the enforcement of water restrictions would increase the available water for both parties.

Table 4-2 Current and Future Water Demands, Clifton and Ute

Parameter	Current Value	Future Value
Year	2019	2069
Clifton peak day demand (mgd)	6.3	8.2
Ute peak day demand (mgd)	16.5	21.5

4.2 Existing Water Sources

The City can currently utilize water rights from several sources – Juniata Reservoir, Kannah Creek, Gunnison River, Colorado River, and the existing agreement with Clifton. Juniata Reservoir and Kannah Creek are assumed to be one combined source, the Kannah Creek Basin, for the purposes of this memo because Kannah Creek is used to fill Juniata Reservoir. The Options Assessment Study found that use of the Colorado River by Grand Junction as a raw water source was highly unlikely given the need for a new intake and treatment process. The Options Assessment Study also identified that Grand Junction could transfer its Colorado River allocation to Clifton or Ute for

[3] Source – DiNatale Water Consultants, July 9, 2019, Memorandum, Water Supply Analysis in support of a finding of diligence for the Gunnison River Pipeline Water Right

treatment and transmission back to Grand Junction. Therefore, this analysis categorizes access to the Colorado River water rights under the Clifton and Ute options.

Figure 4-1 compares the predicted average daily demands (solid orange block) with the forecasted water available from the City's existing sources (Kannah Creek Basin, Gunnison River, and the existing Clifton interconnect). The firm yield for WTP production from the Kannah Creek Basin is assumed as 6,056 AF when non-potable and Kannah Creek WTP are accounted for. The graph shows that if demand growth is linear, the City will exceed the firm yield of Kannah Creek Basin around 2039, meaning that if average day demands are met, the City will not meet their storage objectives in Juniata Reservoir and other storage facilities it owns on the Grand Mesa. This date could be pushed further if growth is not linear, or by utilizing Gunnison River for raw water as well as utilizing the Clifton interconnect. The ultimate annual demand is predicted to be 7,278 AF by 2069, resulting in an ultimate deficit of approximately 1,122 AF.

The City's existing interconnect with Clifton has a hydraulic capacity of 5.5 MGD and should be sufficient as a backup or replacement source to the Kannah Creek Basin for indoor uses until approximately 2032. The Clifton interconnect cannot supply current or future summertime demands. If these two sources are combined, the City should have enough water supply for average day demand through at least 2069, but will need to consider seasonal demand patterns in taking delivery from Clifton. However, if an event takes out all or part the Kannah Creek Basin or the agreement with Clifton cannot be renegotiated, the City will need to develop access to an additional water supply.

Furthermore, the City has absolute rights to the Gunnison River, which could satisfy average day and peak day demands through 2069 and beyond, but new infrastructure will be required to use the Gunnison River source (intake, pump station and treatment).

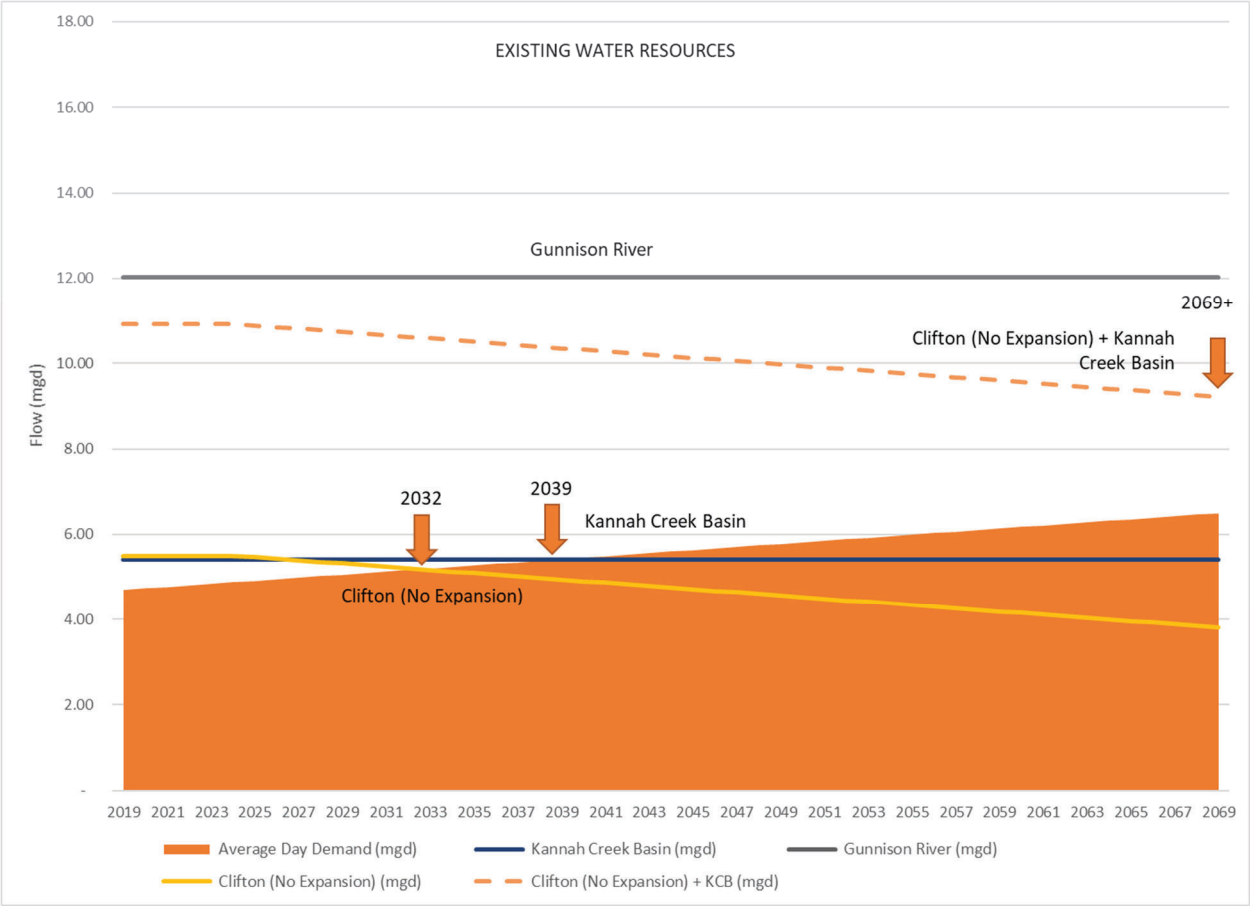

Figure 4-1 Existing Water Resources

Table 4-3 summarizes the existing water resources. Note, the AF of water available from Clifton is based on 2019. As Clifton grows, less water will be available to the City.

Table 4-3 Existing Water Resources

Resource	Demand / Water Right (AF)	Year Exceeded	Description
Average Daily Demand (2019)	5,265	-	4.7 mgd over 12 months
Kannah Creek Basin	6,056	2039	Limited by water rights
Clifton Interconnect (2019)	6,161	2032	Hydraulic capacity 5.5 mgd
Kannah Creek Basin + Clifton Interconnect	11,672	>2069	
Gunnison River	13,460	>2069	18.6 cfs over 12 months

The City may also consider making use of excess Clifton WTP capacity in the winter when the City's demands are low and less than the hydraulic capacity of the interconnect piping (5.5 MGD). This takes advantage of the City's priority water right in winter and could be used for meeting future demands. Short term emergency use of the Clifton interconnect during the summer must consider Clifton's excess capacity. Also, the City's water right is generally out of priority at the upper diversion points during the summer.

5.0 RISK SCENARIOS

Several risk scenarios (Table 5-1) were identified to map the City's resiliency with respect to short and long term interruptions with their existing infrastructure and water sources. These scenarios include infrastructure breaks, malevolent acts, droughts, climate change, and water quality events (toxic algae blooms or wildfires).

Table 5-1 Risk Scenarios Considered

	Infrastructure Breaks	Malevolent Act	Drought	Toxic Algae Bloom	Wildfire
Infrastructure					
PMFL	X	X			
KCFL	X	X			
Juniata Interconnect	X	X			
Clifton	X	X			
Grand Junction WTP	X	X			
Water Source					
Juniata Reservoir		X		X	X
Kannah Creek		X			X
Kannah Creek Basin			X		X

5.1 Infrastructure Breaks

Infrastructure breaks includes blockages, leaks, breaks, outages or failures on existing water systems or structures. It is assumed that City staff will repair breaks or failures within 5 days of the event. It also assumed that only one break occurs at a time (e.g., a break on the PMFL would not impact the KCFL). The City would rely upon the existing 23 mg of raw water storage in Reservoirs 3 and 4 at the WTP to meet average daily demands. The 23 mg of raw water storage can provide an average day demand of 4.6 mgd over 5 days.

5.1.1 PMFL

If the PMFL experiences a break, the replaced KCFL and the planned Juniata Interconnection would allow the City to still access both Juniata Reservoir and Kannah Creek to deliver raw water to the WTP.

If the break occurs before the KCFL is replaced or the Juniata Interconnection is installed, then the City must rely on the Clifton interconnect to meet average day demands. However, the Clifton interconnect is hydraulically limited to 5.5 mgd without infrastructure upgrades. Therefore, water restrictions would be implemented if the break occurred during the peak demand season. Accounting for both the Clifton interconnect and the City's raw water storage, the City can meet average day demands through at least 2069. Less stringent water restrictions could be implemented if both resources are available.

Figure 5-1 compares potential options to meet average demands if the PMFL is offline for less than 5 days.

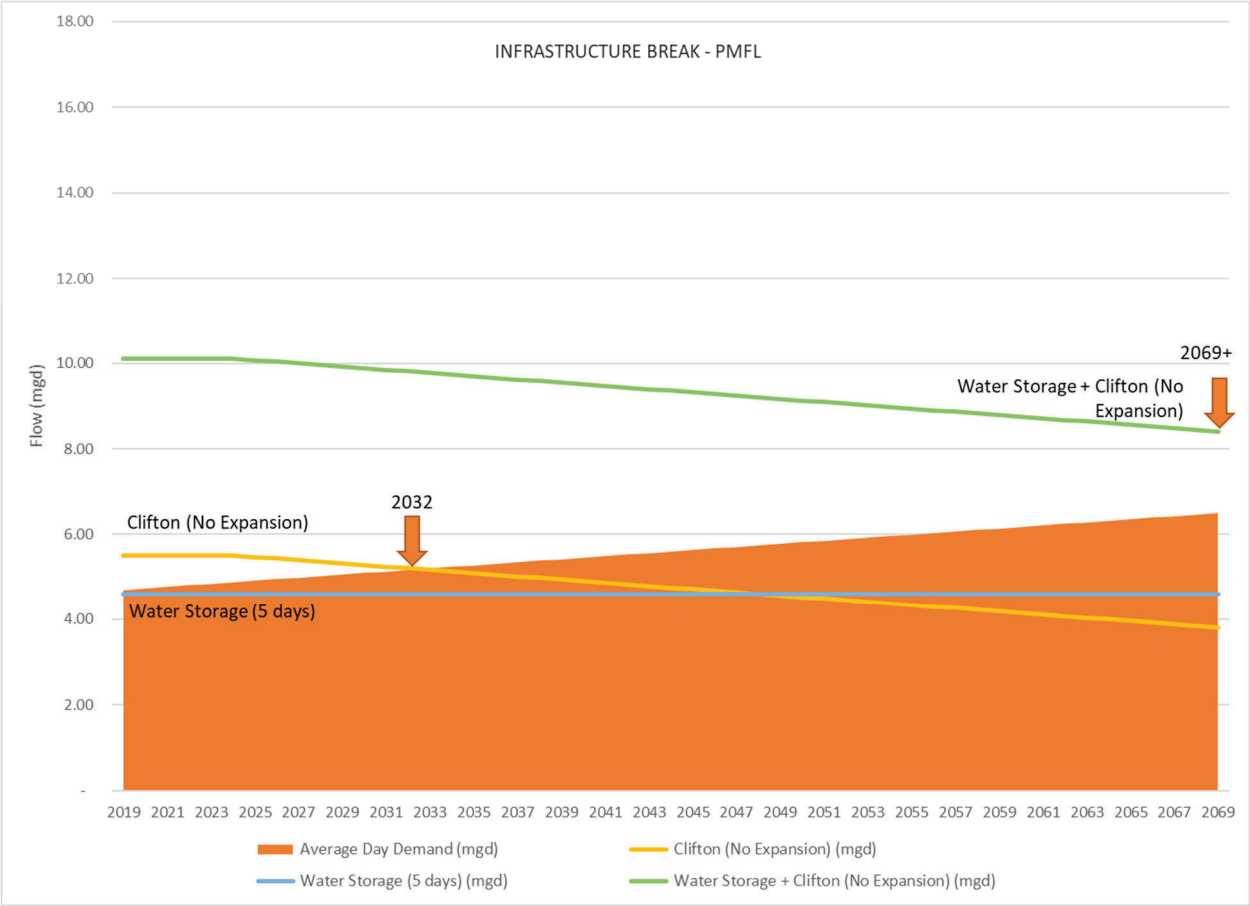

Figure 5-1 Infrastructure Break – PMFL

5.1.2 KCFL

If the KCFL experiences a break, the City would remain mostly unaffected. If the break occurred in the upper portion of the KCFL that is used to fill Juniata Reservoir, the reservoir's water level would lower at a more rapid rate, but the City would still be able to use PMFL to deliver raw water to the WTP. The City would need to consider this outage when planning for storage through the following winter. If the break occurred in the lower portion of the KCFL, Juniata Reservoir would not be affected, and the City would still be able to use PMFL.

5.1.3 Juniata Interconnect

If the planned Juniata Interconnect between the PMFL and KCFL experienced a break, the City would lose some operational flexibility, but raw water delivery would largely be unaffected.

5.1.4 Clifton

If the Clifton interconnect or Clifton WTP experienced a break or interruption, then the City could rely on the 23 mg of raw water storage to supplement flows from the Kannah Creek Basin through at least 2069. Figure 5-2 compares potential options to meet average demands if the City cannot source water from Clifton for less than 5 days.

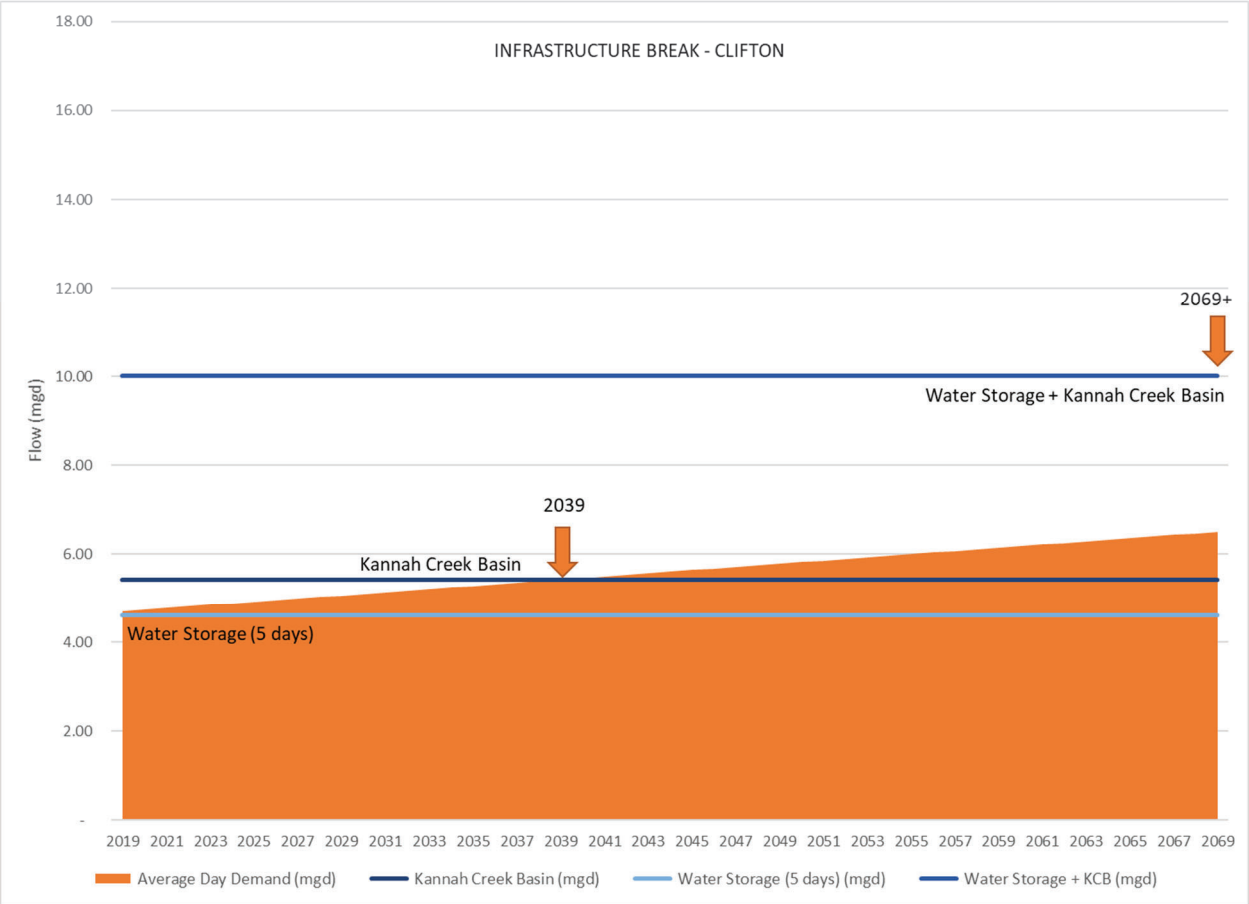

Figure 5-2 Infrastructure Break - Clifton

5.1.5 Grand Junction WTP

The City would not be able to provide treated water from the Kannah Creek Basin if there was an infrastructure break, fault, or outage at the Grand Junction WTP. Therefore, the City would need to rely on either Clifton or Ute to provide treated water to its customers. The existing Clifton interconnect could provide average day flows through 2032. Two options exist after 2032. The City could work with Clifton to expand Clifton's WTP to a capacity of 16 mgd, which would supply the Clifton and the City's average day flows through at least 2069. Alternatively, the City could work with Ute to establish a separate water supply agreement. The existing Ute WTP could likely provide average day flows to both Ute and the City through approximately 2054 without a Ute WTP expansion. The combination of the existing Clifton interconnect and a new Ute interconnection agreement allows the City to meet their average day demands through at least 2069. Water restrictions would be required if this scenario occurred during peak demand season. Figure 5-3 compares options to meet average demands if the Grand Junction WTP is offline.

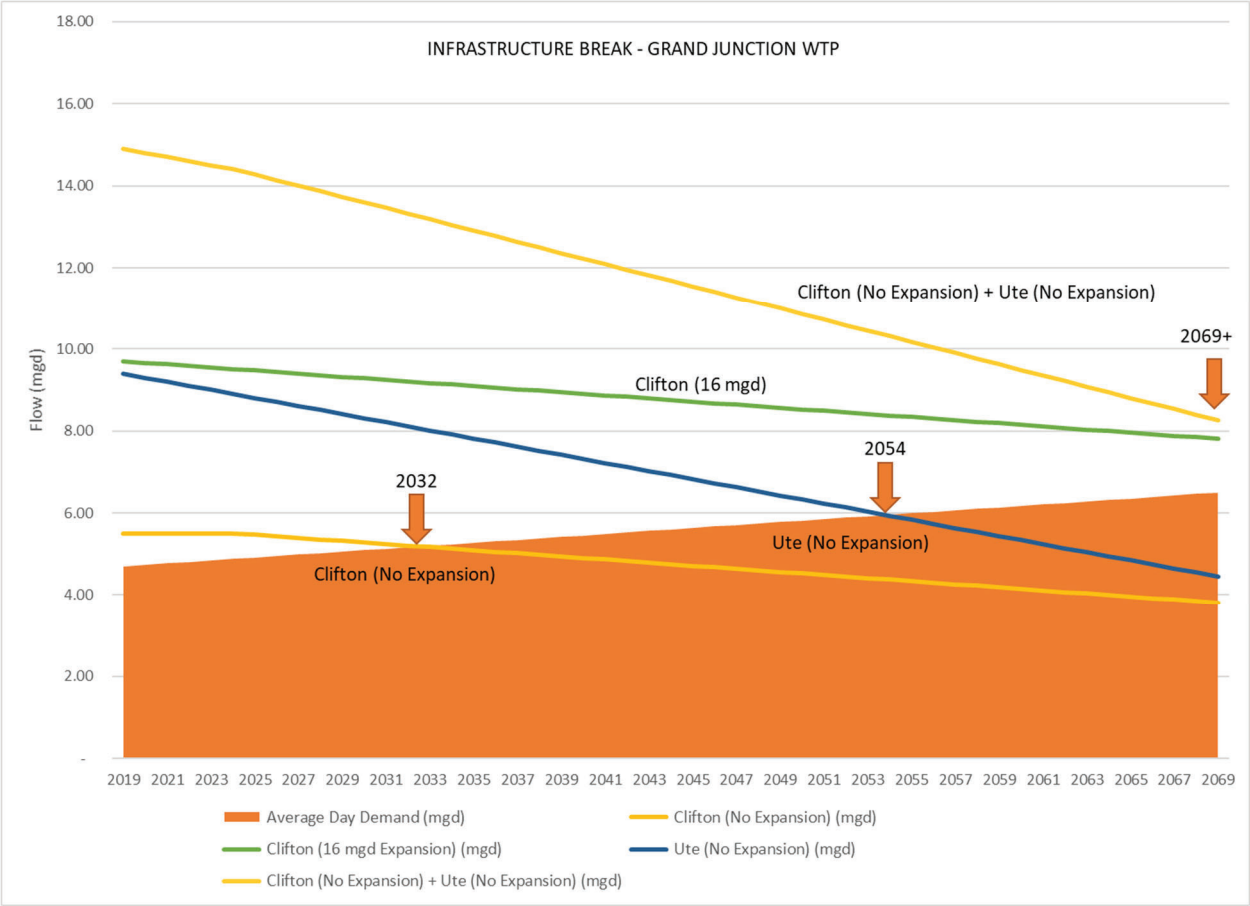

Figure 5-3 Infrastructure Break – Grand Junction WTP

5.2 Malevolent Acts

Malevolent acts are defined as actions by malicious actors or events that substantially disruption the ability of the system to provide treated water safely and reliably. Malevolent acts consist of assault, theft, diversion, sabotage, contamination, or cyber-attacks. Malevolent acts toward the City's water sources or infrastructure would likely be managed similar to the infrastructure breaks previously described. The impacts of a malevolent act on a water source are likely to last longer than 5 days.

5.2.1 Juniata Reservoir

If Juniata Reservoir was the target of a malevolent act, such as contamination, the City would stop using Kannah Creek to fill the reservoir and direct flows to the KCFL and the WTP. This event reinforces the need to upgrade the KCFL. The flow-based, seasonal water rights of Kannah Creek are slightly less than the firm yield for the Kannah Creek Basin. Kannah Creek can provide approximately 4.7 mgd of finished water after accounting for the Kannah Creek WTP and non-potable uses. This is approximately the current average day demand. However, if used in combination with the Clifton interconnect, then average day demands can be met through at least 2069. Figure 5-4 compares options to meet average day demand if Juniata Reservoir is not available due to a malevolent act.

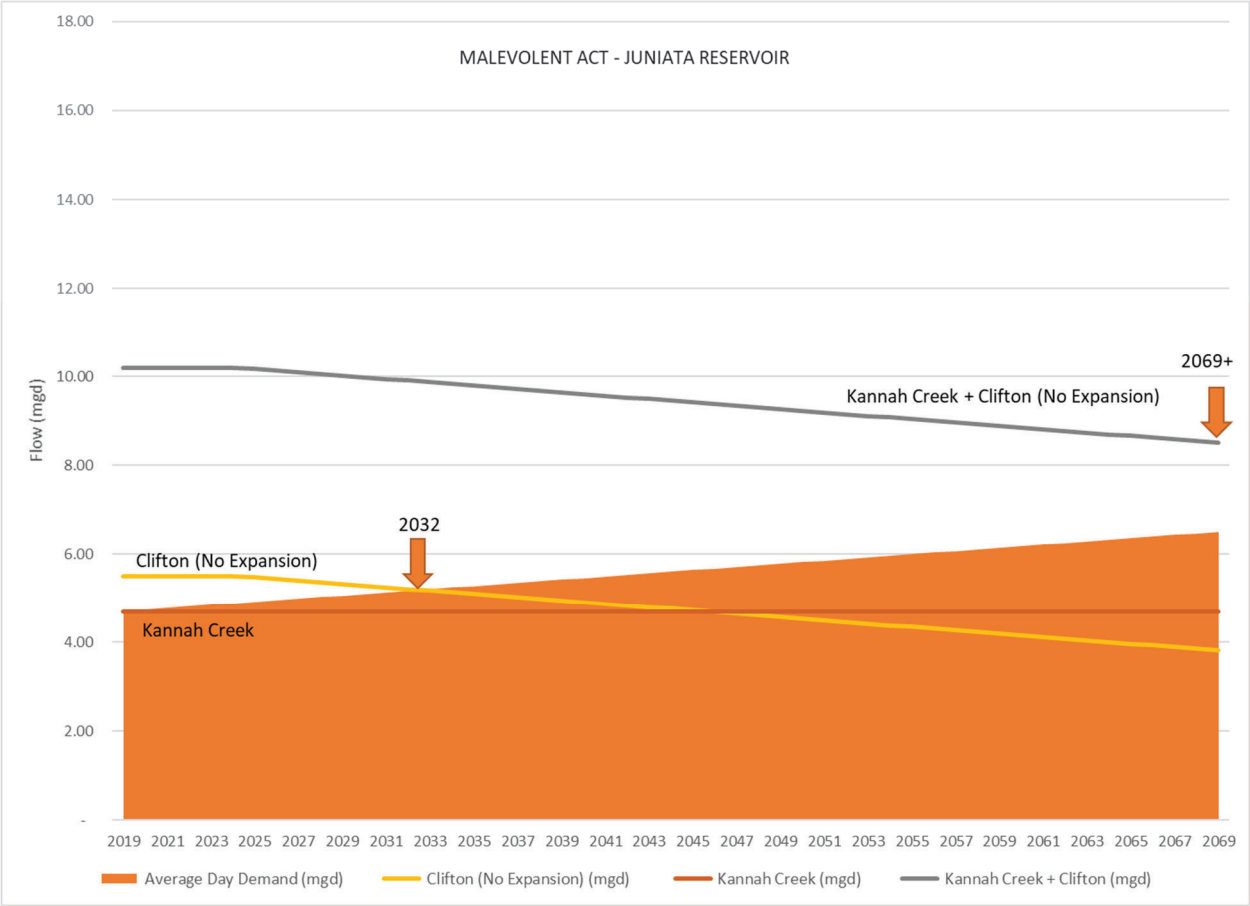

Figure 5-4 Malevolent Act - Juniata Reservoir

5.2.2 Kannah Creek

If Kannah Creek was the target of a malevolent act, such as contamination, the City would not be able to fill Juniata Reservoir. The volume stored in Juniata Reservoir would remain available for use for up to one year if the Juniata Reservoir was filled to the City's annual operating goals. Juniata Reservoir would be at critically low levels after a year if not filled by Kannah Creek and the City would need another source.

Options in this scenario are similar to the infrastructure break at the Grand Junction WTP, with the added option of treating the Gunnison River. Treating of the Gunnison River source provides average day demands through at least 2069. This is similar to the options of expanding the Clifton WTP to 16 mgd or combining the existing Clifton interconnect with a Ute interconnect. The Gunnison River has the added benefit of being able to meet peak day demands. Figure 5-5 compares options to meet average day demands in the case that Kannah Creek is not able to fill Juniata Reservoir for over a year.

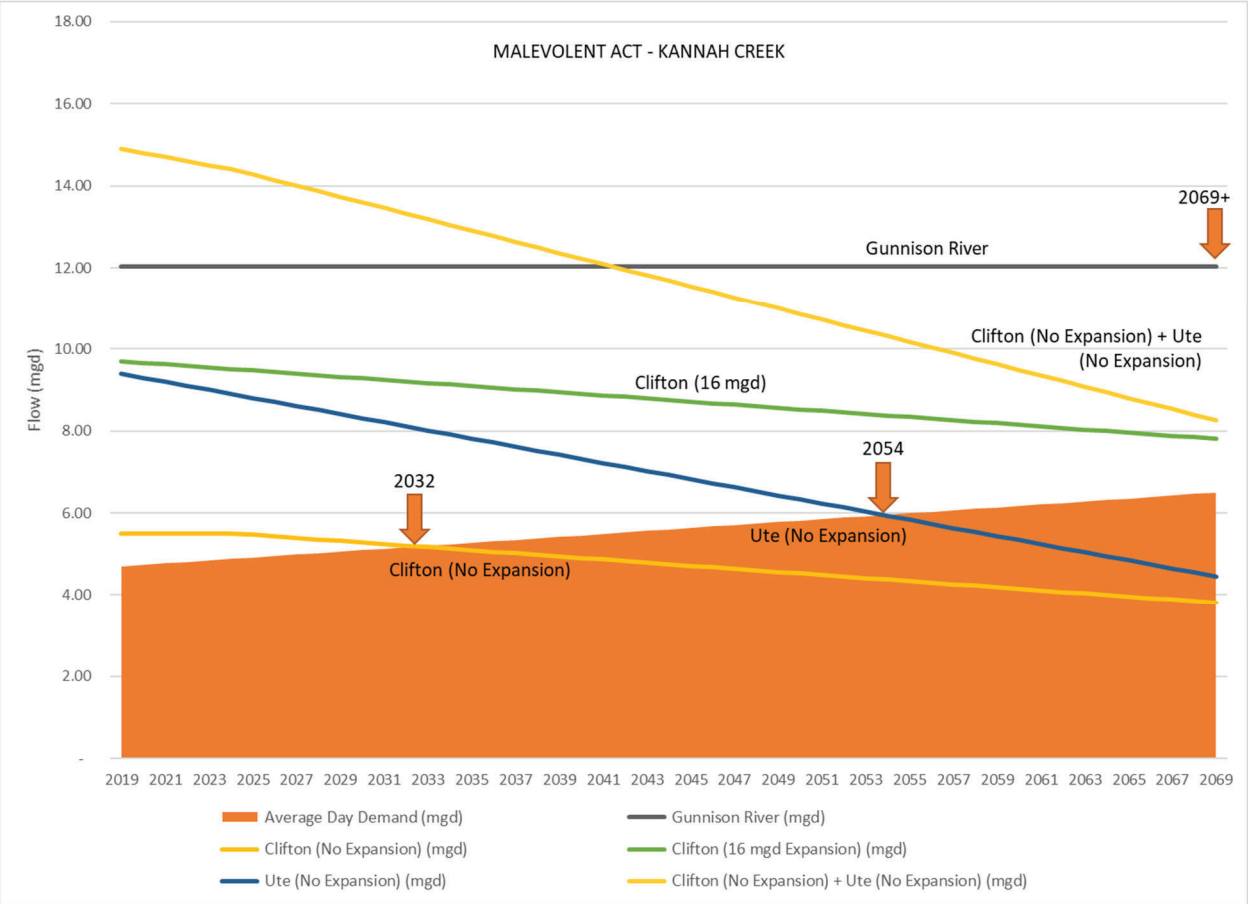

Figure 5-5 Malevolent Act - Kannah Creek

5.3 Drought

5.3.1 Kannah Creek Basin

DiNatale[4] estimated drought impacts on the firm yield of the Kannah Creek Basin. The high evaporation scenario resulted in a firm yield of 6,125 AF/yr, while multiple years of drought further reduces the firm yield to 6,000 AF/yr. This results in a range of 5,656 to 5,781 AF available for WTP production from the Kannah Creek Basin when non-potable and Kannah Creek WTP losses are accounted for. Therefore, the City can deliver an average daily demand of 5.05 to 5.16 mgd during drought conditions. This is sufficient to meet average day demands until 2029 to 2032. However, the Kannah Creek Basin source in drought condition in combination with the existing Clifton interconnection can meet average flows through at least 2069. This assumes Clifton is not as impacted by the drought, because its primary source is the Colorado River. The Colorado River flows are not significantly impacted by drought because of its larger watershed and downstream flow commitments. The same factors apply to the Gunnison River, which is not shown in this scenario for clarity. Figure 5-6 illustrates this scenario.

[4] DiNatale Water Consultants, November 2020, Evaluation of Firm Yield with Refined Reliability Criteria and Climate Change

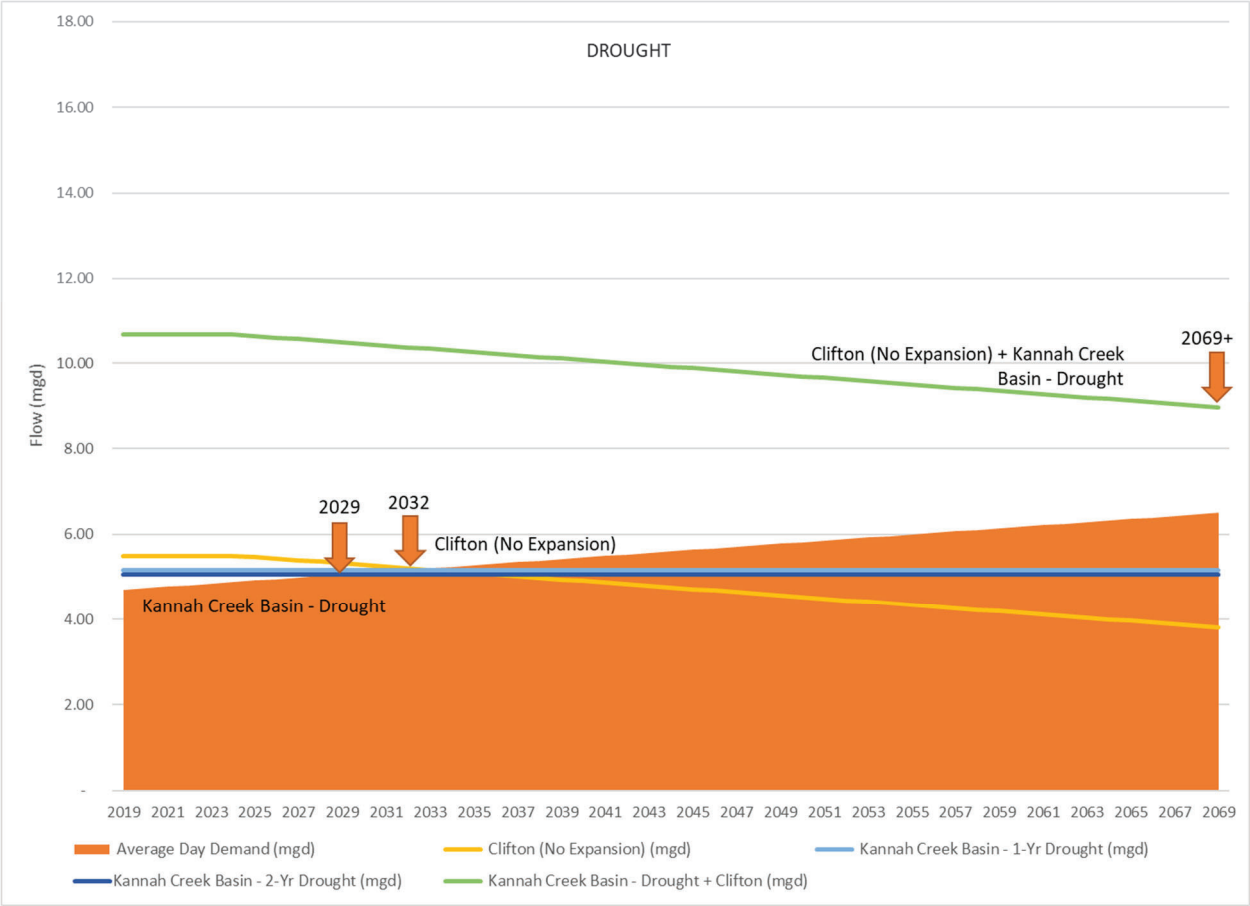

Figure 5-6 Kannah Creek Basin - Drought

5.4 Toxic Algae Bloom

5.4.1 Juniata Reservoir

A toxic algae bloom is likely only to affect larger, static bodies of water, such as the Juniata Reservoir. The City would rely on flows from Kannah Creek if Juniata Reservoir was affected by a toxic algae bloom. This scenario results in a situation similar to a malevolent act on the Juniata Reservoir (Figure 5-4). The available sources are Kannah Creek and the existing Clifton interconnect. The Kannah Creek flows are less than the current average day demands but can be used in combination with the Clifton interconnect.

5.5 Wildfire

The size and location of a wildfire will determine the impact on the City's primary water source, which may impact Juniata Reservoir, Kannah Creek, or the entire Kannah Creek Basin. The likelihood of the same wildfire event impacting the Gunnison River, the Colorado River or Ute's water source is low because of their geographic locations and physical separation.

5.5.1 Kannah Creek

Kannah Creek is the most likely source to be affected by wildfire because of its geographic location – spanning a larger area at a higher altitude. Wildfire may impact a water source due to ash, solids run-off with reduced vegetation or contamination from fire retardant. Undesirable water quality events related to solids run-off or contamination from fire retardant have potential to last several years.

This scenario results in a situation similar to a malevolent act on the Kannah Creek (Figure 5-5). The City would be able to use the storage in Juniata Reservoir for up to a year to meet average demands, after which the City would be in a critical position and require another source.

5.5.2 Juniata Reservoir

It is unlikely that wildfire would impact only Juniata Reservoir and not affect Kannah Creek. However, a wildfire at the Juniata Reservoir results in a situation similar to a malevolent act on the Juniata Reservoir (Figure 5-4). The available sources are Kannah Creek and the existing Clifton interconnect.

5.5.3 Kannah Creek Basin

If both Juniata Reservoir and Kannah Creek were impacted by wildfire, the upper reservoirs in the Kannah Creek Basin would not be sufficient to meet average day demands. The City would need an alternative source in this scenario because there would be no supply to the Grand Junction WTP. This scenario results in a situation similar to the Grand Junction WTP being offline (Figure 5-3). Alternative sources include treating the Gunnison River, expanding the Clifton WTP to 16 mgd or combining the existing Clifton interconnection with a new Ute interconnection.

6.0 DISCUSSION

6.1 Risk and Resiliency

The City can manage most risk scenarios through their existing Kannah Creek Basin sources, existing raw water storage and the existing Clifton interconnect. However, the existing interconnection agreement between the City and Clifton does not reflect the current use of up to 5.5 mgd in emergency situations or its potential use as a more consistent, year-round back-up. The City/Clifton interconnection agreement should be updated if Clifton is selected as the City's redundant water source.

The risk scenarios also highlight the importance of upgrading the KCFL and adding the Juniata Interconnection.

However, specific scenarios such as an outage at the Grand Junction WTP or a wildfire in the Kannah Creek Basin identify the need for a redundant water supply. The options for a redundant water supply include treating the Gunnison River, expanding the Clifton WTP, or establishing an interconnection or water rights exchange with Ute. The Clifton and Ute options provide a higher level of redundancy than Gunnison River because the Grand Junction WTP becomes a single point of failure in the Gunnison River option.

Table 6-1 highlights the critical scenarios where existing infrastructure or water sources are not sufficient to meet average daily demands in the event of an outage. The table also case of an outage as well as options for

redundancy in those scenarios. Existing infrastructure includes the PMFL, the replaced KCFL, the Juniata Interconnect and the existing Clifton interconnect.

Table 6-1 Available Sources by Risk Scenario

Facility / Source	Event	Existing Infrastructure Adequate?	Available Sources	Year Available Source Insufficient	Potential Water Sources to Meet Average Day Demands		
					Gunnison River	Expanded Clifton	Ute
Purdy Mesa Flow Line	Infrastructure Break	✓	Kannah Creek Basin	2039	Not Required		
	Malevolent Act		Clifton	2032			
Kannah Creek Flow Line	Infrastructure Break	✓	Kannah Creek Basin	2039	Not Required		
	Malevolent Act		Clifton	2032			
Juniata Interconnect	Infrastructure Break	✓	Kannah Creek Basin	2039	Not Required		
	Malevolent Act		Clifton	2032			
Clifton Interconnection	Infrastructure Break	✓	Kannah Creek Basin	2039	Not Required		
	Malevolent Act		Raw Water Storage	**2020**[1]			
Grand Junction WTP	Infrastructure Break	✗	Clifton	2032	✗[2]	✓	✓
	Malevolent Act						
Juniata Reservoir	Malevolent Act	✓	Kannah Creek	**2020**[3]	✓	✓	✓
	Wildfire		Clifton	2032			
	Toxic Algae Bloom						
Kannah Creek	Malevolent Act	✓	Juniata Reservoir	**2021**[4]	✓	✓	✓
	Wildfire		Clifton	2032			
Kannah Creek Basin	Drought	✓	Kannah Creek Basin	2029-2032[5]	✓	✓	✓
	Wildfire		Clifton	2032			

1. The existing raw water storage of 23 mg in Reservoirs 3 and 4 at the Grand Junction WTP will provide 4.6 mgd over 5 days. This is less than the current average daily demand of 4.7 mgd.
2. Gunnison River water would not be able to be treated at the Grand Junction WTP if the WTP is offline.
3. Kannah Creek seasonal water rights of 5 mgd summer, 7.5 mgd winter would not meet current average daily demands, once Kannah Creek WTP and non-potable uses are accounted for.
4. Juniata Reservoir would sustain up to one year without re-filling from Kannah Creek before reaching critically low levels.
5. Kannah Creek Basin was modeled for multiple drought scenarios. This range encompasses one to two years of drought conditions.

6.2 Costs by Option

The estimated capital and operational costs for each infrastructure upgrade option is discussed in Table 6-2. The option number corresponds to the upgrade/expansion option presented in the Options Assessment Study.

Table 6-2 Cost Summary by Infrastructure Upgrade Project

Option No.	Description	Major Scope Items	Capital Cost	Monthly O&M Cost including Bulk Purchase
1	Gunnison River – Lime Softening	GR Pump Station, Softening Clarifiers, Dewatering System, Corrosion Control, Chemical Systems, Two PS Buildings	$41,900,000	$233,000
11	Clifton Partial Expansion	Raw water pumps, pretreatment expansion, UF expansion, RO expansion, Chemical Systems, Evaporation Ponds, High service PS, Pipeline	$25,300,000	$72,000
13	Ute (no WTP expansion)	Vault modifications, Pipeline, Sodium hypochlorite system expansion	$2,900,000	$584,000

6.3 Project Implementation Duration

The City has three infrastructure project options that would allow them to meet average day demands through at least 2069: treatment of the Gunnison River, expansion of the Clifton WTP and interconnect agreement, or establishment of an interconnect agreement with Ute. Each of these projects involves a slightly different project implementation timeline, see Figure 6-1, varying from 4 to 5 years in estimated duration.

The Gunnison River treatment option requires no negotiations but permitting is expected to be lengthy due to modifications required for the river intake. The Gunnison River option also requires the longest construction phase.

The Clifton expansion option requires some negotiation, but this phase is shorter than the Ute negotiation due to the existing agreement. Permitting is estimated to be comparable to the Gunnison River option, as a new transmission main through the City will require considered permitting. While the Clifton option does require expansion of treatment processes, construction is expected to be shorter than the Gunnison River option as no new buildings are expected to be required.

The Ute option timeline is heavily dependent on negotiations. While minimal permitting and construction will be required, there is no existing agreement in place to begin negotiations with.

ACTIVITY		Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Option 1 - Gunnison River	Duration (months)																				
Negotiation	0																				
Permitting	18																				
Design	15																				
Construction	30																				
Total Duration	**57**																				
Option 2 - Clifton WTP Expansion																					
Negotiation with Clifton	12																				
Permitting Transmission Main Route	18																				
Design	12																				
Construction	18																				
Total	**54**																				
Option 3 - Purchase from Ute																					
Negotiation with Ute	30																				
Permitting	9																				
Design	9																				
Construction	9																				
Total	**48**																				

Figure 6-1 Project Timelines

6.4 Linear Demand Forecast

The risk evaluation identified three scenarios where the City will have insufficient water to meet the average water demands of their customers:

A. Demand higher than Kannah Creek Basin firm yield,
B. Demand higher than the Kannah Creek Basin firm yield in drought conditions, and
C. Demand higher than the existing Clifton interconnect capacity, resulting in no backup source to KCB.

Table 6-3 summarizes the earliest project start dates based on the risk scenario used for planning, infrastructure project chosen, and a linear demand growth. The 2-year consecutive drought scenario results in the earliest start date of 2027 depending upon the infrastructure upgrade chosen.

Table 6-3 Earliest Project Start Dates

			Earliest Project Start Date		
Scenario		**Earliest Year of Occurrence**	**Gunnison Option**	**Clifton Option**	**Ute Option**
A	Demand > KCB Firm Yield	2039	Q1 2034	Q2 2034	Q1 2035
B1	Demand > KCB Firm Yield, High Evaporation Scenario	2032	Q1 2027	Q2 2027	Q1 2028
B2	Demand > KCB Firm Yield, 2-yr Drought	2029	Q1 2024	Q2 2024	Q1 2025
C	Demand > Clifton Interconnect Capacity	2032	Q1 2027	Q2 2027	Q1 2028

6.5 Demand Forecast by Actual Tap Sales

The future water demand of Grand Junction can either be assumed to be a linear or non-linear growth trend. A non-linear trend is more likely because growth is predicted to increase rapidly at the end of the 50-year planning horizon. This is because infill development is generally more expensive than development of new lands. Meaning in the short-term, development is more likely outside of the city's service boundary. As new development pushes farther from the city center, the attractiveness and rate of infill development within the city's boundary is likely to increase.

A non-linear growth trend is evidenced by analyzing the City's tap sales (Figure 6-2). Assuming a single-family equivalent tap is typically allocated 0.5 AF, the City would expect to add approximately 4,000 single-family equivalent taps over the next 50 years, or approximately 80 taps per year if the trend is assumed to be linear. The highest year of tap sales in the last decade was 2018, with 47 taps. The last two years, 2019 and 2020, were even lower, with 34 and 33 taps, respectively. This indicates that the City is not following a linear trend. However, for the purposes of this memo, a linear trend is assumed because it is the worst case scenario for water demand. Alternative trigger levels such as one based on tap sales will be discussed in the implementation timeline to account for the likelihood of non-linear growth.

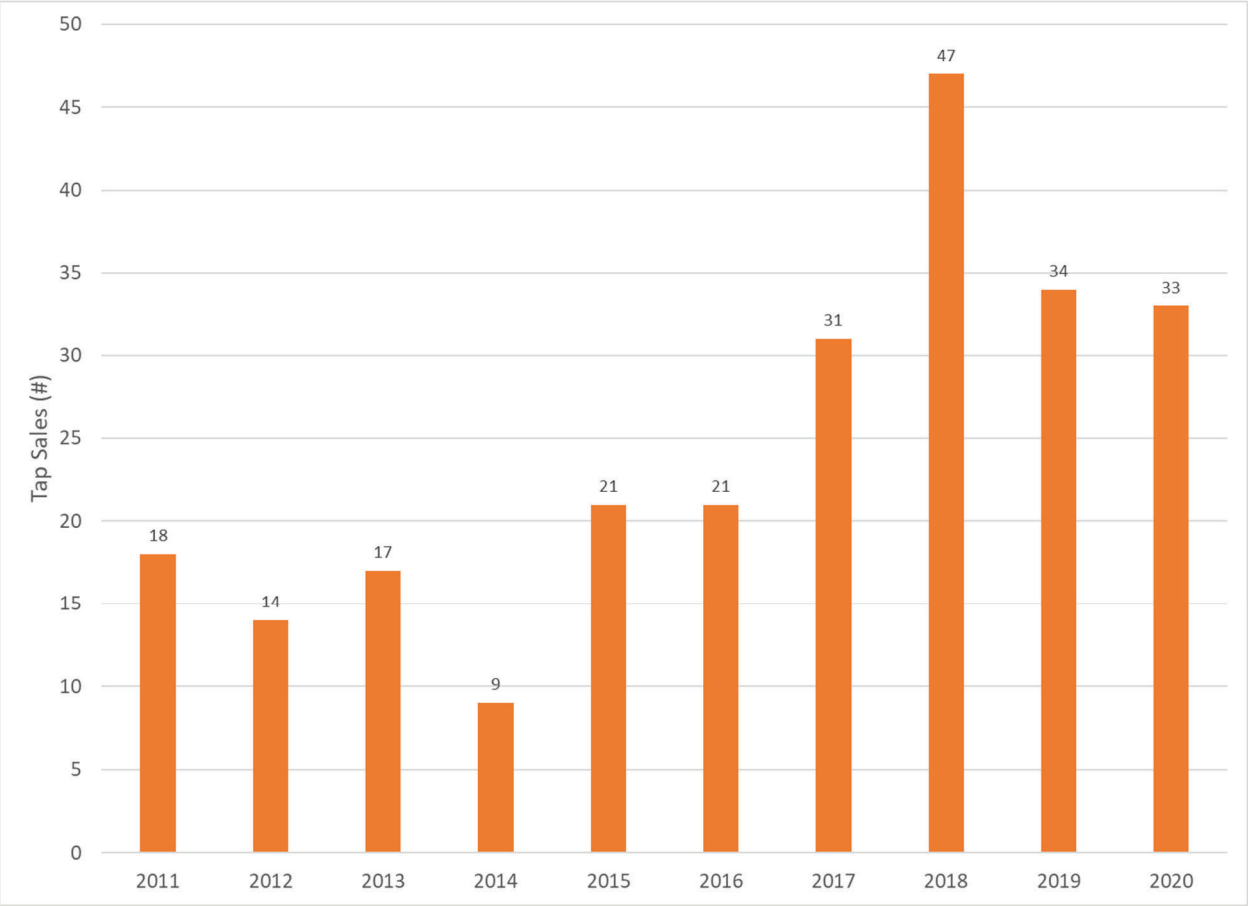

Figure 6-2 Historic Tap Sales

The growth trend is likely to be somewhat exponential, starting relatively close to current growth and increasing rapidly at the end of the 50 year planning horizon. Figure 6-3 illustrates an example trend that is in between current growth and linear growth.

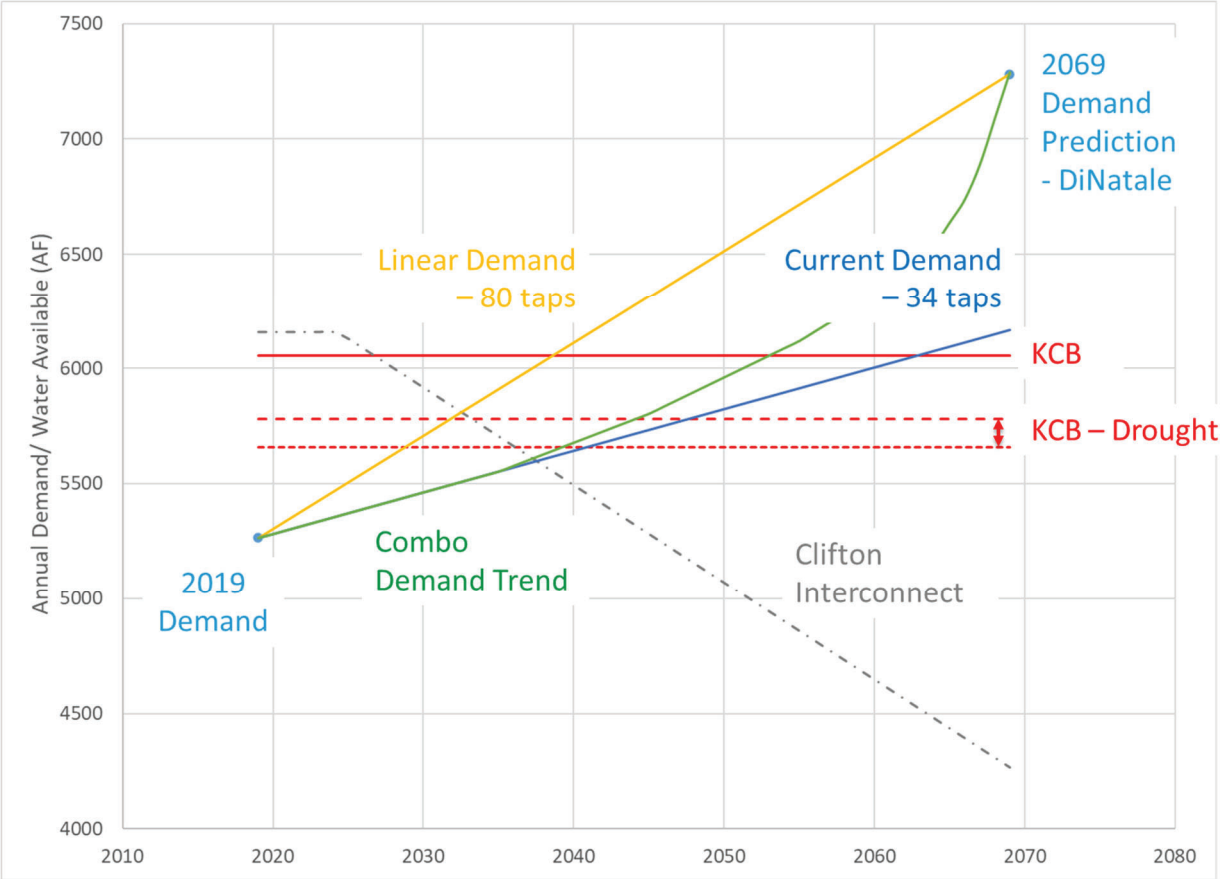

Figure 6-3 Demand Forecasting

Figure 6-3 illustrates the challenges with accurately forecasting demand in parallel with planning infrastructure upgrades. The two blue dots indicate where demand was in 2019 during the DiNatale study and where demand is predicted to be in 2069 based on that study. The trend between those two points could be any number of paths. The yellow line represents the linear trend used for the purposes of this memo. The blue line represents the current demand trend based on new recent annual tap sales. This trend would not reach future demand by 2069. The actual demand trend is more likely to follow the green line, somewhere between the linear trend and the recent tap sales.

6.5.1 Tap Sales Forecasting Tool

While the worst case scenarios based on linear growth are important to consider, the City could also consider a more flexible approach to infrastructure planning, such as one based on moving average demand and average tap sales. The following section presents a tool for the City monitor the demand trend to predict when water demand exceeds the capacity of the risk scenarios in Table 6-3.

Assuming an increased demand of 0.5 AF per single-family equivalent tap, the City could use a formula similar to the following to evaluate the need for new infrastructure on a yearly basis.

$$Risk\ Scenario - Current\ Average\ Annual\ Demand > \#\ of\ New\ Taps * 0.5\frac{AF}{Tap} * Project\ Timeline$$

Where:
Risk Scenario = Water available, AF (either KCB firm yield, KBC firm yield – drought, or Clifton capacity)
Current Average Annual Demand = Demand in year of evaluation, AF

# of New Taps = Average number of new taps in previous 5 years, unitless
Project Timeline = Project timeline of chosen options, years (either Gunnison, Ute, or Clifton option)

The City may be able to delay infrastructure implementation past the worst case scenarios previously presented, depending upon actual water demand growth. For example, the City could theoretically reach the year 2026 and be considering starting a Gunnison River project to ensure water availability in case of a drought. The City could analyze water demand for the year and average number of taps sold to determine if this is necessary.

Scenario A:
Risk scenario: Assume drought condition – 5,781 AF available
Current Average Annual Demand in 2026: 5,500 AF
# of New Taps: Average number of 50 taps/year over previous 5 years
Project Timeline: Assume Gunnison River option, 4.75 years

$$5{,}781\ AFY - 5{,}500\ AFY > 50\ taps/year * 0.5\frac{AF}{tap} * 4.75\ years$$
$$281 > 118.75$$

The water available is greater than the short-term predicted growth, so the City could consider delaying the start of the project.

Scenario B:
Risk scenario: Assume drought condition – 5,781 AF available
Current Average Annual Demand in 2026: 5,600 AF
# of New Taps: Average number of 95 taps/year over previous 5 years
Project Timeline: Assume Gunnison River option, 4.75 years

$$5{,}781\ AFY - 5{,}600\ AFY > 95\ taps/year * 0.5\frac{AF}{tap} * 4.75\ years$$
$$181 >/ 225.625$$

The water available is less than the short-term predicted growth, so the City should move forward with starting the infrastructure project.

7.0 CONCLUSIONS

Linear demand forecasting based on the DiNatale study prediction for future demand indicates a more dire picture than linear demand forecasting based on current tap sales. Increase in demand growth is much more likely to be a non-linear trend in between the two predictions.

Depending on the City's tolerance for risk, infrastructure upgrade projects should be considered as early as 2024 but could be potentially delayed until well past 2050. It is recommended the City monitors demand growth on a yearly basis to evaluate the potential needs of the City.

Options Assessment for the City of Grand Junction Water Supply

City of Grand Junction, CO

April 22, 2021

Project No. 117086

Final

Options Assessment for the City of Grand Junction Water Supply

Prepared for

City of Grand Junction

Grand Junction, CO

Project No. 117086

Final

4/22/2021

Prepared by

Burns & McDonnell Engineering Company, Inc.

Centennial, Colorado

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ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AACE	Association of Advancement of Cost Engineering
AF	Acre Feet
BMcD	Burns & McDonnell Engineering Company, Inc.
CDPHE	Colorado Department of Public Health and Environment
cfs	Cubic Feet Per Second
CCS	Corrosion Control Study
CCT	Corrosion Control Treatment
City	City of Grand Junction
Clifton	Clifton Water District
EOPCC	Engineer's Opinion of Probable Construction Cost
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
GRPS	Gunnison River Pump Station
HGL	Hydraulic Grade Line
IFC	International Fire Code
KCFL	Kannah Creek Flow Line
kWh	Kilowatt Hour
MCL	Maximum Contaminant Level
MF	Microfiltration, Membrane Filtration
mgd	Million Gallons Per Day
mg/L	Milligrams Per Liter
NF	Nanofiltration
NTU	Nephelometric Turbidity Unit
PS3	Reservoir 3 Pump Station
PMFL	Purdy Mesa Flow Line
PRV	Pressure Reducing Valve
RO	Reverse Osmosis
TDS	Total Dissolved Solids
Ute	Ute Water Conservancy District
WTP	Water Treatment Plant
ZOP	Zinc Orthophosphate

1 EXECUTIVE SUMMARY

The City of Grand Junction (City) provides potable water to its customers from its existing water treatment facility (WTP) at 244 26 1/4 Road, Grand Junction, Colorado. The primary source of raw water for the WTP is the Juniata Reservoir on the Grand Mesa through the Purdy Mesa flow line (PMFL). The Kannah Creek flow line (KCFL) runs parallel to the PMFL as a secondary supply from the Kannah Creek, also on the Grand Mesa. The KCFL experienced a series of several breaks in 2019 and is not capable of providing peak day demands.

The City contracted with Burns & McDonnell Engineering Company, Inc. (BMcD) to investigate the feasibility of alternative water supplies in the event that the PMFL is not available. The PMFL and KCFL both draw from mountain sources on the Grand Mesa. The City also has water rights to the Colorado and Gunnison Rivers, as well as an interconnection agreement with Clifton Water District. The Ute Water Conservancy District (Ute) distribution system surrounds the City with several interconnections, but there is no formal agreement.

Fifteen options were identified by the Project Team:

1. Treat Gunnison River by Lime Softening
2. Treat Gunnison River by Reverse Osmosis
3. Settle Gunnison River in the Existing Raw Water Reservoirs and Blend with Clifton
4. Settle Gunnison River in the Existing Raw Water Reservoirs and Use for Raw Water
5. Replace KCFL (24 inch)
6. Replace KCFL (20 inch)
7. Replace KCFL (24 inch) and Add Turbine
8. New WTP in Kannah Creek Watershed and Replace KCFL
9. Clifton Water Emergency Interconnect
10. Transfer Colorado River Rights to Clifton for Treatment (Full Expansion, 24 inch pipeline)
11. Transfer Colorado River Rights to Clifton for Treatment (Partial Expansion, 20 inch pipeline)
12. Route Gunnison to Clifton WTP from Current Intake
13. Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)
14. Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)
15. Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)

Conceptual designs were developed for each of the options to create planning-level engineer's opinion of probable construction cost (EOPCC). Estimates of operating costs were compared to purchase costs for each of the identified Options.

The analysis identified that an interconnection between the PMFL and KCFL at the Juniata Reservoir would improve redundancy by directing flow from the Juniata Reservoir and the Kannah Creek watersheds into either flowline.

The Project Team developed and evaluated the Options through a series of meetings, culminating in a Selection Workshop in January 2020. Three additional Options were added in April 2020 following a meeting with key stakeholders from the City. The Options were then re-ranked. Qualitative, non-monetary selection criteria were used to score each option, weight the criteria, rank and calculate the cost/benefit of each Option.

The Options receiving the highest weighted scores were:

1. Option 5 – Replace KCFL (24-inch)
2. Option 15 – Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)
3. Option 6 – Replace KCFL (20-inch) (Tied)
4. Option 14 – Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination) (Tied)

The scoring indicates two types of projects will provide benefit to the City, but the nature of their benefit varies. The KCFL options provide multiple ways to access the full water rights from the Purdy Mesa. This prioritizes operational redundancy. However, the KCFL options do not provide long term resiliency for the City as a source interruption would leave the City with a limited water supply. In this case, the City has the option to pursue either interconnects with Clifton or Ute. The two Ute options scored higher than the Clifton interconnects because of their perception as a higher quality mountain source with minimal capital improvements required.

2 BACKGROUND

2.1 Project Objective

The City provides potable water to its customers from its existing WTP at 244 26 1/4 Road, Grand Junction, Colorado. The primary source of raw water for the WTP is the Juniata Reservoir on Purdy Mesa through the PMFL. The KCFL runs parallel to the PMFL as a secondary supply. The KCFL experienced a series of several breaks in 2019 and is not capable of providing peak day demands.

The City contracted with BMcD to investigate the feasibility of alternative water supplies in the event that the PMFL is not available. The PMFL and KCFL both draw from the same mountain sources on the Grand Mesa. The City also has water rights to the Colorado and Gunnison Rivers, as well as an interconnection agreement with Clifton. The Ute Water Conservancy District surrounds the City and is an additional source, however, the City does not have an interconnection with Ute.

This study identifies the available water sources for the City and evaluates the associated infrastructure required to supply future peak day demands as an alternate supply to the PMFL. This study considers both redundancy (ability to provide peak day flow) and resiliency (ability to draw from alternative source waters). Monetary and non-monetary factors were used to score and rank the identified Options.

The conceptual design of the preferred option is not included in this study.

2.2 Water Sources

The following water sources are available to the City:

1. **Purdy Mesa –** The PMFL draws raw water from the Juniata Reservoir on the Grand Mesa. This high quality mountain source is the primary raw water supply for the City. The PMFL consists of approximately 18.2 miles of 18-inch steel, 20-inch steel and PVC and 24-inch PVC diameter gravity transmission main. Upgrades are proposed to replace sections that were at the end of their useful life as well as upsizing segments to 20-inch diameter to reduce air entrainment. Juniata Reservoir has a storage right of 7,459 acre-feet (AF) of water, which translates to a firm yield of 5,800 to 6,225 AF. The 20-inch gravity transmission main has a hydraulic capacity of 9.8 mgd [1]. The existing Kannah Creek WTP draws water from both the Juniata and Hallenbeck Reservoirs to serve customers on the Kannah Creek basin. The Kannah Creek WTP has an approximate capacity of 200 gallons per minute (0.3 million gallons per day, mgd) and does not send water to the City's WTP.

2. **Kannah Creek –** The KCFL draws raw water from Kannah Creek at the City Intake, approximately 4-miles upstream from the Juniata Reservoir. The KCFL provides additional raw water to the City during the peak summer season and acts as a backup pipeline to the PMFL. During winter, the KCFL is only used to transfer water from the Kannah Creek watershed into the Juniata Reservoir. The City has 7.81 cubic feet per second (cfs) (5 mgd) of paramount water rights from Kannah Creek. The City may access an additional 3.91 cfs (2.5 mgd) of winter water rights when available. The Kannah Creek watershed can deliver up to 6,400 AF[2]. The KCFL is approximately 20-miles of 18-inch cast iron and 20-inch steel gravity transmission main. City operations limit the flow to less than 2 mgd to minimize stress on the pipeline. The upper portion of the pipeline, between the Kannah Creek diversion and the "Juniata Drop" can handle up to 7

[1] Black & Veatch, Project 197600, February 2018, Draft Purdy Mesa Flow Line Hydraulic Evaluation
[2] DiNatale Water Consultants, November 2020, Evaluation of Firm Yield with Refined Reliability Criteria and Climate Change

mgd when the City is delivering irrigation water. Extensive repairs are required on the KCFL to provide critical redundancy.

3. **Gunnison River –** The City has 120 cfs of water rights to the Gunnison River that are not being utilized (18.6 cfs absolute and 101.4 cfs conditional). The Gunnison River is a river source of variable quality, subject to swings in turbidity and has high levels of total dissolved solids (TDS). The existing water treatment plant (WTP) is not capable of treating the Gunnison River without modifications to their treatment process. The City used the Gunnison River source in the past to augment peak summer demands by blending with the Grand Mesa sources in the existing Reservoirs 3 and 4. Recent peak day demands have been met by the PMFL, making it unnecessary to use the Gunnison River source. The existing Gunnison River Pump Station (GRPS) is in poor condition with only one pump operational and is located in the flood plain. The GRPS is now only exercised periodically, with raw water blended in Reservoirs 3 and 4. The GRPS pumping capacity is approximately 6 mgd.

4. **Colorado River** – The City owns 80 cfs of water rights to the Colorado River that are not being utilized. This right was originally 120 cfs, but subsequent diligence proceedings have reduced the City's right to 80 cfs, with 20 cfs going to the Clifton and 20 cfs to the Water Development Group. The City does not have any active infrastructure to use the Colorado River source.

5. **Clifton Water District –** The City has an agreement with Clifton for seasonal water exchange. The 1998 amendment allows Clifton to supply the City with up to 250 million gallons between April and September each year (1.4 mgd average). The amendment states that the City will supply Clifton with up to 250 million gallons per day between October and March. The agreement has informally expanded over the years to allow the City to take up to 4.5 mgd of treated water from Clifton in emergency situations. Clifton treats a mix of Grand Mesa and Colorado River at its 12 mgd capacity WTP. The interconnection with Clifton is located on 29 Road, north of D Road. Water main breaks in 2019 required the City to use the Clifton interconnection. Maximum day flows up to 5.5 mgd were sustainable through the existing interconnection.

6. **Ute Water Conservancy District** – The Ute water distribution system surrounds the City's distribution system to the west, north and east, with eight points of interconnection. Ute supplies water to some customers in the municipal boundary of the City. There is no formal agreement between the City and Ute for water supply. However, there is a verbal agreement for supply in emergency conditions. The raw water source for Ute is the Plateau Creek, which is considered a high quality mountain source. Ute has a 50 cfs (30 mgd) water right for Plateau Creek, which is used to fill Ute's reservoirs with a total capacity of 8,736 AF. As an alternate source, Ute holds a contract for Colorado River water in the Reudi Reservoir of 12,000 AF (firm yield of 10,800 AF). This equates to an average of 9.6 mgd over the year. The Ute WTP has a capacity of 25.9 mgd, limited by the current filtration capacity. The peak hour operating capacity of the plant, without filter restriction is 34 mgd. Ute uses chloramines for disinfection, which are not compatible with the City's use of free chlorine. Blending of the two waters would require additional treatment.

The locations of the water sources are illustrated in Figure 1.

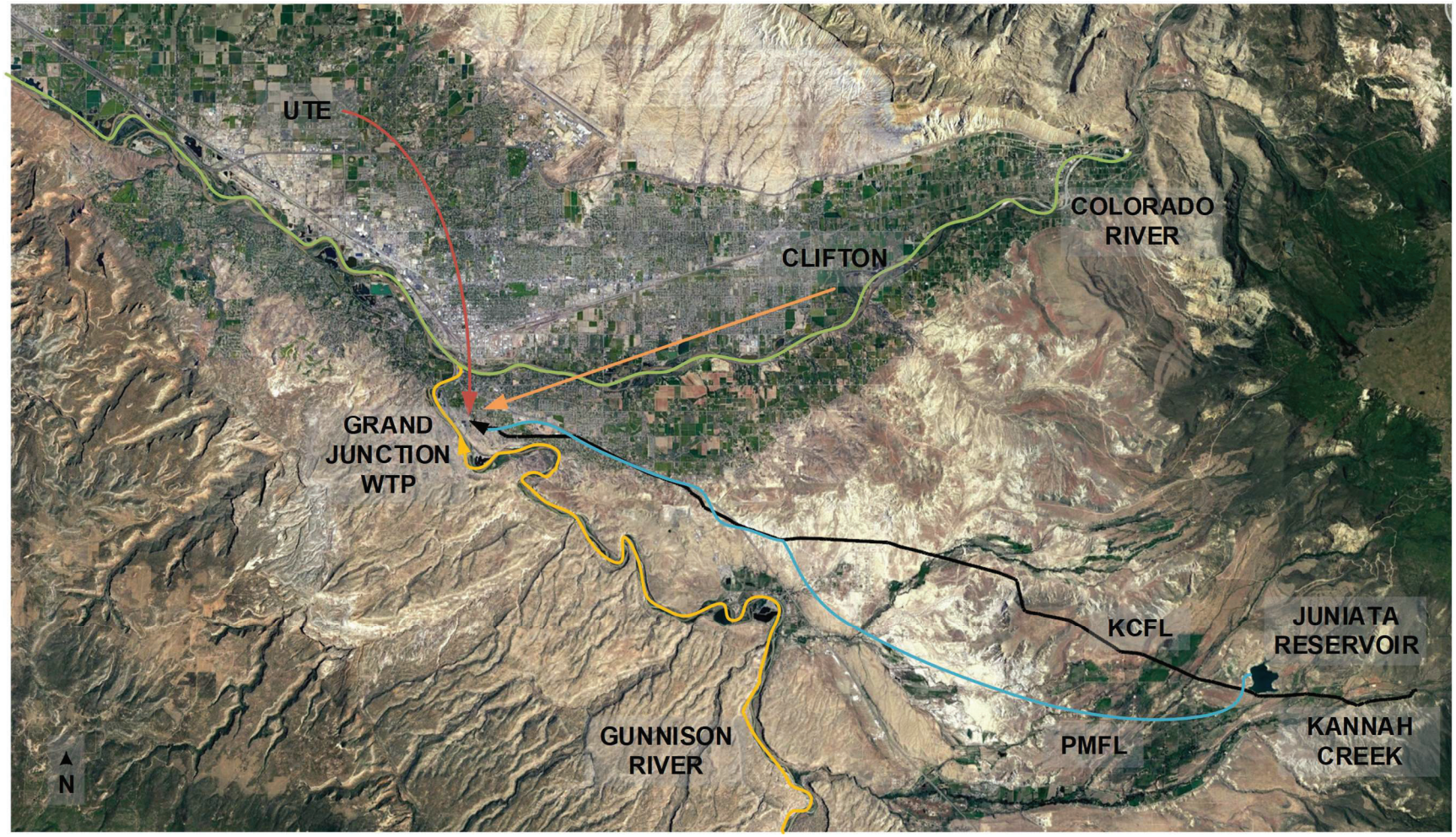

Figure 1: Map of Potential Sources for All Options

The City's available water sources are summarized in Table 1.

Table 1: Raw Water Source Summary

Source	Type	Water Rights	Current Capacity
Juniata Reservoir	Raw	7,459 AF (5,800 to 6,225 AF firm yield)	9.8 mgd (PMFL at 20-inch)
Kannah Creek	Raw	7.81 cfs (5 mgd) summer 11.72 cfs (7.5 mgd) winter	2 mgd[1]
Gunnison River	Raw	18.6 cfs[2] (12 MGD)	6 mgd[3]
Colorado River	Raw	80 cfs[4]	N/A
Clifton Water District[5]	Treated	4.5 mgd	5.5 mgd
Ute Water Conservancy District[6]	Treated	---	---

[1] KCFL capacity restricted by City's operations staff due to history of recent breaks, air entrainment. Upper portion sees up to 7 mgd.
[2] 18.6 cfs absolute and 101.4 cfs conditional on availability (120 cfs total)
[3] Gunnison River capacity is limited by the condition and size of the existing pumps and electrical systems at the Gunnison River Pump Station
[4] Originally 120 cfs, transferred 20 cfs to Clifton and 20 cfs to Rifle
[5] The City and Clifton have an emergency interconnection agreement allowing 250 million gallons between April and September at no cost to City. Water rights are based on current agreement. Current capacity is based on the max peak daily flow through the interconnect in the summer of 2019.
[6] The City has eight emergency interconnects with the Ute but no formal interconnection agreement.

Table 2 compares the water quality of the raw water sources considered in this study.

Table 2: Raw Water Quality Comparison for Average and Maximum

Parameter	Juniata Reservoir[7] (Avg./Max.)	Kannah Creek[8] (Avg./Max.)	Gunnison River[9] (Avg./Max.)	Colorado River (Avg./Max.)
pH	7.9/8.0	8.2/8.6	8.4/8.8	8.01/8.53
Alkalinity (mg/L as $CaCO_3$)	81/83	64/91	137/188	143/260
Hardness (mg/L as $CaCO_3$)	92/95	66/90	339/492	218/316
TDS (mg/L)	86/119	62/122	530/778	517/865
Turbidity (NTU)	2.5/2.7	3.8/11.6	66/560	Unavailable
TOC (mg/L)	Unavailable	2.0/2.3	3.4/5.1	2.86/10
Fluoride (mg/L)	0.13/0.14	0.11/0.18	0.4/0.5	0.25/0.42
Chloride (mg/L)	1.0/1.1	0.42/0.75	6.5/10.6	170/408
Calcium (mg/L)	Unavailable	Unavailable	90.6/135	161/246
Sulfate (mg/L)	18.8/20.0	3.0/6.6	256/401	125/243
Selenium (mg/L)	Unavailable	Unavailable	3.4/6.5	Unavailable

[7] Source - City (based on 2016-2018 averages, unknown number of data points)
[8] Source - City (10-15 data points)
[9] Source - USGS 09152500 Gunnison River near Grand Junction, CO (38-44 data points)

2.3 Existing Water Treatment Plant

The City provides up to 9.8 mgd (peak day demand) of treated water to its and customers from its existing WTP. The rated capacity of the WTP is 16 mgd.

The WTP uses a conventional direct filtration process as shown in Figure 2. Raw water from the PMFL and KCFL enters at the Raw Water Control Vault, where it can be sent to either the contact basin or Reservoir 4. PMFL and KCFL raw water is sent to Reservoir 4 and/or Reservoir 3 during periods of poor water quality for pre-sedimentation. Water from Reservoirs 3 and 4 is recycled back to the Raw Water Control Vault from the existing Reservoir 3 Pump Station (PS3).

Raw water flows through the baffled contact basin before the gravity media filters. Filtered water flows by gravity to two 4 million gallon ground storage tanks and onto the distriubtion system. On-site sodium hypochlorite generation is used for disinfection. Backwash waste is sent to Reservoir 4 for settling before being recycled back to the Raw Water Control Vault. Residuals are disposed in a monofill on site.

Raw water from the Gunnison River is pumped from an existing intake and pump station to the 8 mg Reservoir 4. Reservoir 4 supplies raw water to the Spy Glass subdivision for irrigation from a dedicated pump station. Reservoir 4 overflows into the 15 mg Reservoir 3 and is pumped back to the Raw Water Control vault from an existing PS3. Reservoir 3 is also used to direct raw water to the nearby cemetery and Las Colonias development for irrigation purposes.

The average finished water quality can be found in Table 3.

Table 3: WTP Finished Water Quality

Parameter	Average Value
pH	8
Alkalinity	80 mg/L (as $CaCO_3$)
Hardness	88 mg/L (as $CaCO_3$)
Turbidity	0.07 NTU
Total Dissolved Solids	110 mg/L
Fluoride	0.58 mg/L
Chloride	5.8 mg/L

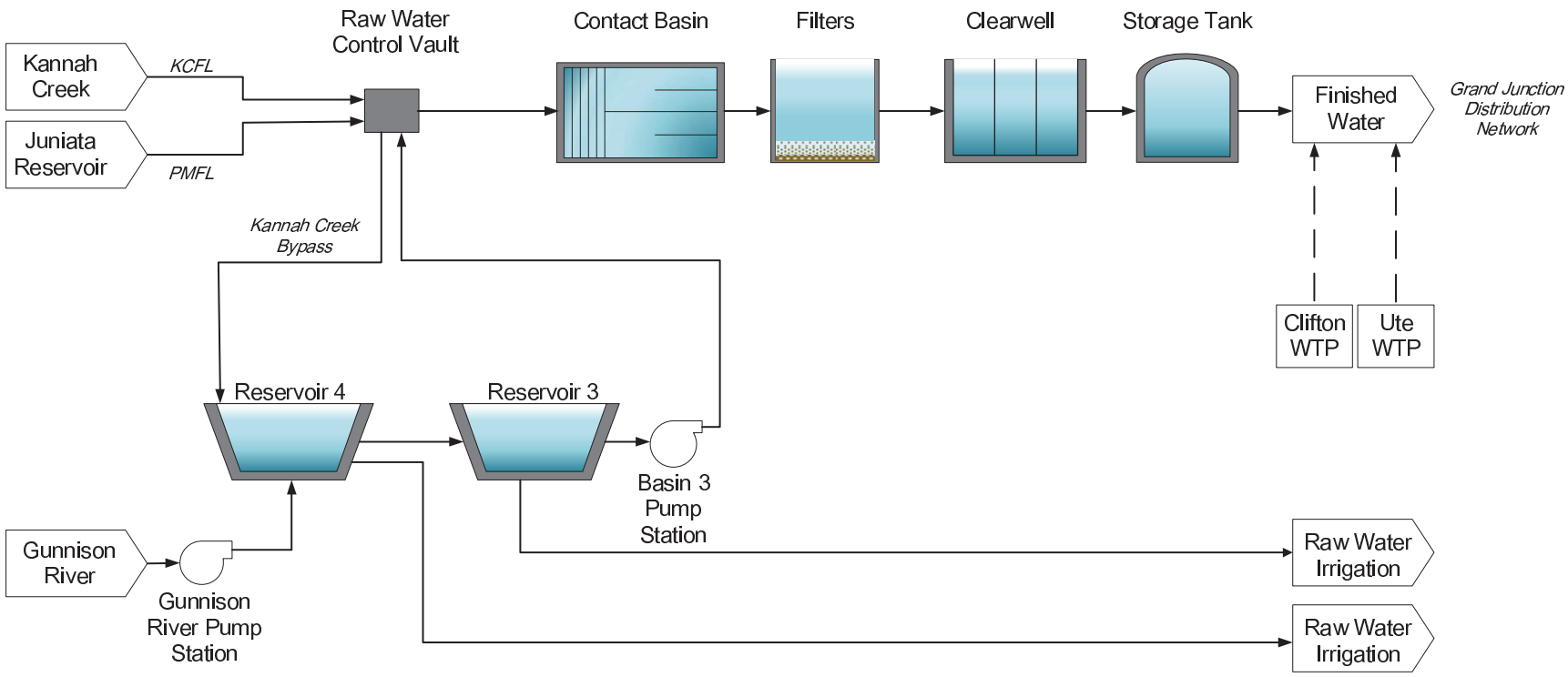

Figure 2: Existing WTP Process Flow Diagram

The City's raw water customers include the Spy Glass subdivision, the adjacent cemetery, and the City's Public Works Department for irrigation. The City has an agreement to supply the proposed and Las Colonias business park with raw water for its customers for irrigation, including a recreational amenity lake. Allocations for raw water customers are summarized in Table 4.

Table 4: Raw Water Irrigation Customer Summary

Customer	Average Flow (mgd)
Spy Glass Subdivision	0.4
Irrigation	1.0
Las Colonias	0.6
TOTAL	**2.0**

2.4 Future Water Demand

Future water demands were studied separately[3]. The future capacity of infrastructure for the purposes of this study is calculated as follows:

- Current conditions (2019):
  - Population of 29,500.
  - WTP annual production of 5,300 AF.
  - Average day demand 4.7 mgd.
  - Peak day demand 9.8 mgd.
  - Peaking factor of 2.07 (ratio of peak day to average day demand).
  - Residential demand of 88 gallons per capita per day (gpcd).

- Future conditions (2069):
  - Population of 49,000.
    - This City's Planning Department estimates an annual growth rate of 1.4%. However, the growth in the City's water service area is expected to be infill by nature, which is anticipated to result in a lower overall increase in population.
  - Population change of 19,400 .
  - Additional average day demand of 1.8 mgd (88 gpcd for new population of 19,400)
  - Future average day demand of 6.5 mgd (4.7 mgd current average day plus 1.8 mgd future average day)
  - Future peaking factor of 2.0.
    - The ratio of future peak to average day demand will be lower due to the infill nature, with less outdoor irrigation, fewer new parks, commercial or industrial users.
  - Peak day demand of 13.0 mgd.

Options considered in this study will be sized for a peak day demand of 13.0 mgd.

[3] Source – DiNatale Water Consultants, July 9, 2019, Memorandum, Water Supply Analysis in support of a finding of diligence for the Gunnison River Pipeline Water Right

2.5 Planning Goals

The options presented in the study are evaluated with their respect to their ability to provide operational redundancy, long term resiliency or both. For the purposes of discussion, the terms are defined as follows:

- **Operational Redundancy** – The ability to provide redundancy to the hydraulic capacity of the Purdy Mesa Flow Line, up to future peak day demands of 13 mgd.

- **Long Term Resiliency** – The ability to supply raw water from an alternative source in the event of a long term interruption to the City's primary source (Kannah Creek watershed and the Juniata Reservoir).

2.5.1 Operational Redundancy

This study considers which available water source has the ability to provide operational redundancy to the PMFL. The options are sized for 13 mgd future peak day demands if the PMFL is offline. PMFL outages are defined as short term events due to line breaks or periodic maintenance. Short term outages are expected to be corrected within five days.

It is anticipated that the City staff is able to repair line breaks on the PMFL within five days. The existing raw water Reservoirs 3 and 4 have up to 23 mg of storage that is available to the WTP from PS3 during short term outages (approximately 5 days of storage at current average day demands). The raw water stored in Reservoirs 3 and 4 is also available to augment flows to the WTP for Options that do not provide the future peak day demand of 13 mgd.

The KCFL provides redundancy to the PMFL from the upper Kannah Creek watershed. However, the existing KCFL is limited to only 2 mgd to limit stress on the pipeline and air entrainment. An Option considering the replacement of the KCFL will need to be sized for 13 mgd if a truly redundant pipeline is desired. However, this will require a new connection from Juniata Reservoir to the KCFL to augment KCFL flows due to the seasonal water rights from Kannah Creek (5 mgd summer and up to 7.5 mgd in the winter, when available). The redundancy provided by a replaced KCFL is only available if the Juniata Reservoir and the Kannah Creek watershed are not impacted by the same event preventing the use of the PMFL.

The City may use their existing Clifton interconnection (5.5 mgd capacity) to augment any treated water flows that the WTP is not able to produce. The use of Clifton treated water also allows the City to reserve its Grand Mesa water allocation (Juniata Reservoir and Kannah Creek), while utilizing their Colorado River rights through a water rights transfer. This is discussed in more detail in Option 10.

2.5.2 Long Term Resiliency

Long term resiliency is necessary for outages that impact the source availability of the Juniata Reservoir and the Kannah Creek watershed. A redundant pipeline to the Grand Mesa will not resolve water supply issues if the Juniata Reservoir and Kannah Creek watershed are impacted as a whole.

Events that may impact the availability of the KC watershed include runoff from wildfire, algae blooms, or drought. These events are expected to be longer term in nature and could last for a period of a few

weeks to several months. Resiliency options including those drawing from alternate sources than the Grand Mesa – Gunnison River, Colorado River, or the Plateau Creek watershed (Ute).

2.6 Corrosion Control Study

Corrosion control studies (CCS) are required by both the Colorado Department of Public Health and Environment (CDPHE) and the Environmental Protection Agency's Lead and Copper Rule to evaluate and determine the optimal corrosion control treatment (CCT) for a water system. Usually a CCS is required to obtain an "optimized" designation for either an action level exceedance of lead or copper or treatment changes expected to affect corrosivity.

The City has had no action level exceedances that would normally trigger a CCS. However, a CCS is required if there is a change of the raw water source. A CCS would review the current treatment process and review other potential CCT's to comply with CDPHE and EPA requirements.

Lead and Copper Rule requirements state that a single CCT must be used at all treatment sites. Therefore, the optimal CCT for the City's entire water system must be identified from a holistic view of the City's distribution system, The optimal CCT is not for individual treatment sites and must include other finished water entry points (e.g. Clifton or Ute interconnections, if used).

Potential CCT for the City may include zinc orthophosphate (ZOP) addition, alkalinity adjustment, pH adjustment or calcium hardness adjustment. The effectiveness of CCT options must be studied over a range of conditions and water quality parameters.

This study assumes the implementation of a ZOP as the optimal CCT, which requires the City to add the corrosion control chemical at the WTP or other finished water entry points. Implementing ZOP would require the addition of chemical feed and storage equipment in a new building. Additionally, the City must consider the potential impacts ZOP will have on the Persigo Wastewater Treatment Plant, which will be subject to low phosphorous limits in the future. The implementation of ZOP could result in a significant rise in treatment costs for the Wastewater Treatment Plant.

A CCS is not part of this study but is recommended if there is a change to the City's raw water source.

3 OPTION DESCRIPTIONS

The Project Team identified the following options for providing redundancy to the PMFL, as well as resiliency to the Purdy raw water source. Table 5 lists the options that were developed as part of this study.

Table 5: Summary of Options

#	Option
1	Treat Gunnison River by Lime Softening
2	Treat Gunnison River by Reverse Osmosis
3	Settle Gunnison River in Existing Reservoirs and Blend with Clifton
4	Settle Gunnison River in Existing Reservoirs and Use for Raw Water
5	Replace Kannah Creek Flow Line (24 inch)
6	Replace Kannah Creek Flow Line (20 inch)
7	Replace Kannah Creek Flow Line (24 inch) and Add Turbine
8	New WTP in Kannah Creek Watershed
9	Clifton Water Emergency Interconnect
10	Transfer Colorado River Rights to Clifton for Treatment (Full Expansion, 24 inch pipeline)
11	Transfer Colorado River Rights to Clifton for Treatment (Partial Expansion, 20 inch pipeline)
12	Route Gunnison to Clifton WTP from Current Intake
13	Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)
14	Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)
15	Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)

The following sections provide a narrative of each option, list the assumptions made and present a process flow diagram.

Appendix A includes the detailed scope used to develop the EOPCC for each option.

Appendix B presents the EOPCC.

3.1 Option 1: Treat Gunnison River by Lime Softening

The City owns water rights to the Gunnison River that are not currently being utilized. The existing intake and Gunnison River Pump Station (GRPS) are only exercised periodically when raw water is sent to the WTP to blend with water in Reservoirs 3 and 4. Total dissolved solids (TDS) levels in the Gunnison River are above the secondary maximum contaminant level (MCL) of 500 mg/L. High TDS make the Gunnison River an undesirable water source, which necessitates additional treatment if used as a raw water source.

The existing intake will remain in service at its current location. The GRPS will be upgraded with new pumps, electrical and superstructure. Raw water from the Gunnison River will be pumped to Reservoir 4 to settle by gravity before it is sent to new lime softening clarifiers.

Lime softening by lime and/or soda ash addition will remove hardness by precipitation. Lime softening is assumed to the effective at reducing TDS because the Gunnison River TDS is dominated by calcium sulfate. A softened TDS goal of 200 mg/L was selected to produce water quality similar to that of Purdy Mesa. Lime silos and feed equipment, soda ash feed equipment, carbon dioxide feed equipment, solids handling and dewater systems will be included within the main building. Lime clarifiers and the chemical facilities will be located on City land to the north of Reservoir 3.

The existing Reservoir 3 Pump Station will be replaced with a new Filter Feed Pump Station to pump softened water to the existing WTP for filtration. All irrigation flows will also be routed from this pump station.

The softened Gunnison River source is significantly different in character from the current Purdy Mesa source. Therefore, a ZOP storage and dosing facility will be required on the finished at the WTP for corrosion control.

The following assumptions were used for this Option:

- Raw water source: Gunnison River via GRPS
- 13 mgd peak day demand
- KCFL will remain at current capacity as a partial backup for PMFL
- Reuse the existing intake and wet well for GRPS
- Reuse the existing pipeline from GRPS to Reservoir 3
- Lime softening process is able to reduce TDS to 200 mg/L, based on water dominated by calcium sulfate
- Lime softening effective at removing selenium present in Gunnison River
- Locate lime softening on City land north of Reservoir 3
- Treated water target to match that of Purdy Mesa (100 to 200 mg/L TDS)
- Turbidity: < 2 NTU

Figure 3 illustrates a conceptual process flow diagram for Option 1.

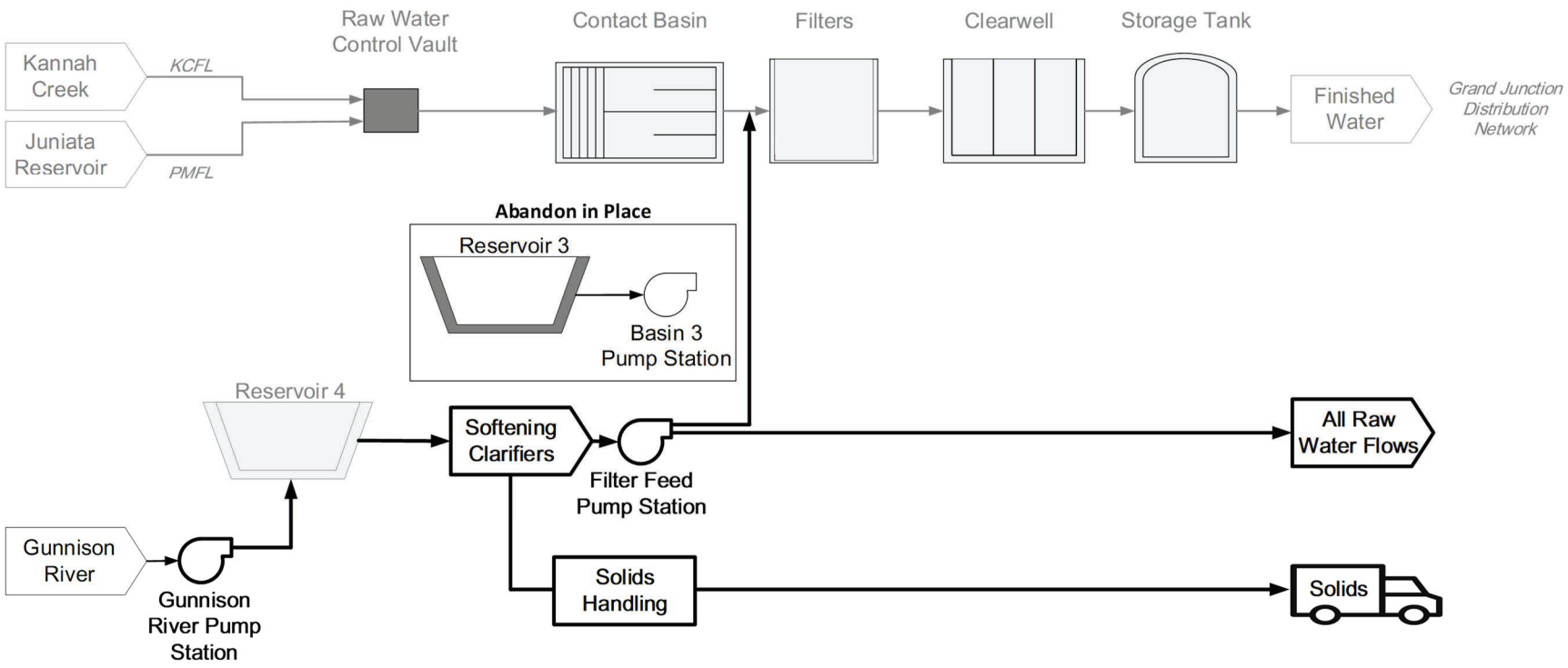

Figure 3: Process Flow Diagram for Option 1

3.2 Option 2: Treat Gunnison River by Reverse Osmosis

The high TDS of the Gunnison River may also be treated using nanofiltration (NF) or reverse osmosis (RO). A treatment goal of 100 to 200 mg/L TDS was selected to match the existing water quality supplied by the City from Purdy Mesa. This NF/RO process is similar to that used by Clifton on their Colorado River source.

The proposed treatment train consists of high pressure feed pumps, cartridge filters, RO skids, cleaning system, and chemical systems.

The existing intake will remain in service at its current location. The GRPS will be upgraded with new pumps, electrical and superstructure. Raw water from the Gunnison River will be pumped to Reservoir 4 to settle by gravity before it is sent to Reservoir 3. Reservoir 3 Pump Station pumps and electrical system will be upgraded. The settled Gunnison River water will be blended with the PMFL at the WTP contact basins and sent to filtration. A side stream flow of approximately 50% will be sent to NF/RO to remove TDS. NF/RO filtrate will be blended into the WTP filtered water to meet the TDS treatment goal.

The treated Gunnison River source is significantly different in character from the current Purdy Mesa source. Therefore, a ZOP storage and dosing facility will be required on the finished at the WTP for corrosion control.

Brine disposal is a challenge for RO facilities and will require negotiation with the CDPHE Water Quality Control Division. Disposal options include evaporation ponds, deep well injection, discharge to a wastewater treatment plant or discharge to surface water. Disposal by evaporation ponds will require a significant footprint larger than the City's existing WTP property. Therefore, deep well injection was assumed for this study because of the proximity of abandoned oil and gas wells and likelihood of CDPHE approval.

The following assumptions were used for this Option:

- Raw water source: Gunnison River via GRPS
- 13 mgd peak day demand
- KCFL will remain at current capacity as a potential backup for PMFL
- Reuse the existing intake and wet well for GRPS and PS3
- Reuse the existing pipeline from GRPS to Reservoir 3
- Locate the proposed RO system on open land to the south of the existing WTP
- Pretreatment turbidity goal: < 10 NTU
- Treated water target: < 100 mg/L TDS (to match existing source).
- Brine disposal using a high-pressure pump station and injected to four deep injection wells (10,000 to 15,000 feet).
- Suitable nearby candidates to locate and permit RO brine disposal by deep well injection

Figure 4 illustrates a conceptual process flow diagram for Option 2.

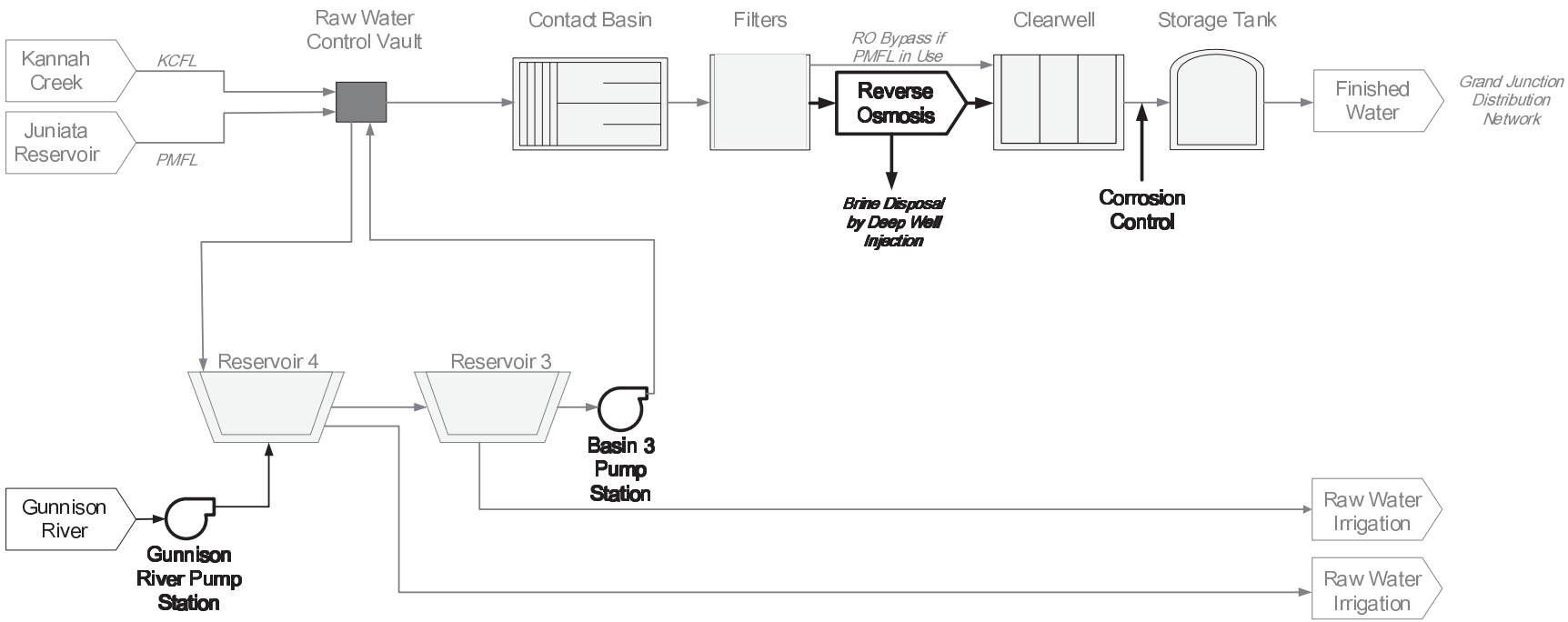

Figure 4: Process Flow Diagram for Option 2

3.3 Option 3: Settle Gunnison River in Existing Reservoirs and Blend with Clifton

This Option utilizes Gunnison River water rights by pumping to Reservoir 4 where major turbidity will be settled to less than 10 NTU. Settling in Reservoir 4 will be achieved by gravity with no mechanical modifications. Settled Gunnison River water will be pumped to the Raw Water Control Vault by a new PS3 and treated through the existing WTP.

This treatment will not impact the salinity or TDS of the water which is above the secondary maximum contaminant level (MCL) of 500 mg/L. Thus, settled water from Gunnison River will be blended with treated water from Clifton at the Raw Water Control Vault to meet the City's existing distribution system TDS. The blending of Clifton water to the Gunnison River is assumed at a 4:1 ratio to meet the finished water TDS goal.

The existing interconnection with Clifton is located on 29 Road, north of D Road. Maximum daily flows of up to 5.5 mgd were sustainable through the existing interconnection during emergency conditions in 2019. Clifton flows of 10.4 mgd are required to achieve peak day flows of 13 mgd at a 4:1 ratio with Gunnison River (2.6 mgd). The required Clifton flows of 10.4 mgd exceed the capacity of the existing interconnection. Therefore, a new pipeline will be required to bring from the Clifton WTP to the City's WTP.

The existing intake will remain in service at its current location. The GRPS will be upgraded with new pumps, electrical and superstructure . Raw water from the Gunnison River will be pumped to Reservoir 4 to settle by gravity before it is sent to the WTP from a new PS3. PS3 will be replaced due to its current condition, age, and lack of redundancy.

The treated Gunnison River source is significantly different in character from the current Purdy Mesa source. Therefore, a ZOP storage and dosing facility will be required on the finished at the WTP for corrosion control.

The following assumptions were used for this Option:

- Raw water source: Gunnison River via GRPS
- Blend with treated water from Clifton
- 13 mgd day demand
    - 2.6 mgd from Gunnison River
    - 10.4 mgd from Clifton
- KCFL will remain at current capacity as a potential backup for PMFL
- New 20-inch pipeline from Clifton to WTP (10.3 miles)
- Reuse intake and wet well for GRPS
- Reuse pipeline from GRPS to Reservoir 3
- Route GR flow to Reservoir 4 to settle by gravity
- Upgraded PS3
- Blend water 4:1
- Blending must occur before filters due to compliance point
- Turbidity: <10 NTU
- Total Dissolved Solids: 150-200 mg/L

Figure 5 below illustrates a conceptual process flow diagram for Option 3. Figure 6 shows a preliminary alignment of the pipeline from the Clifton WTP to the City's WTP.

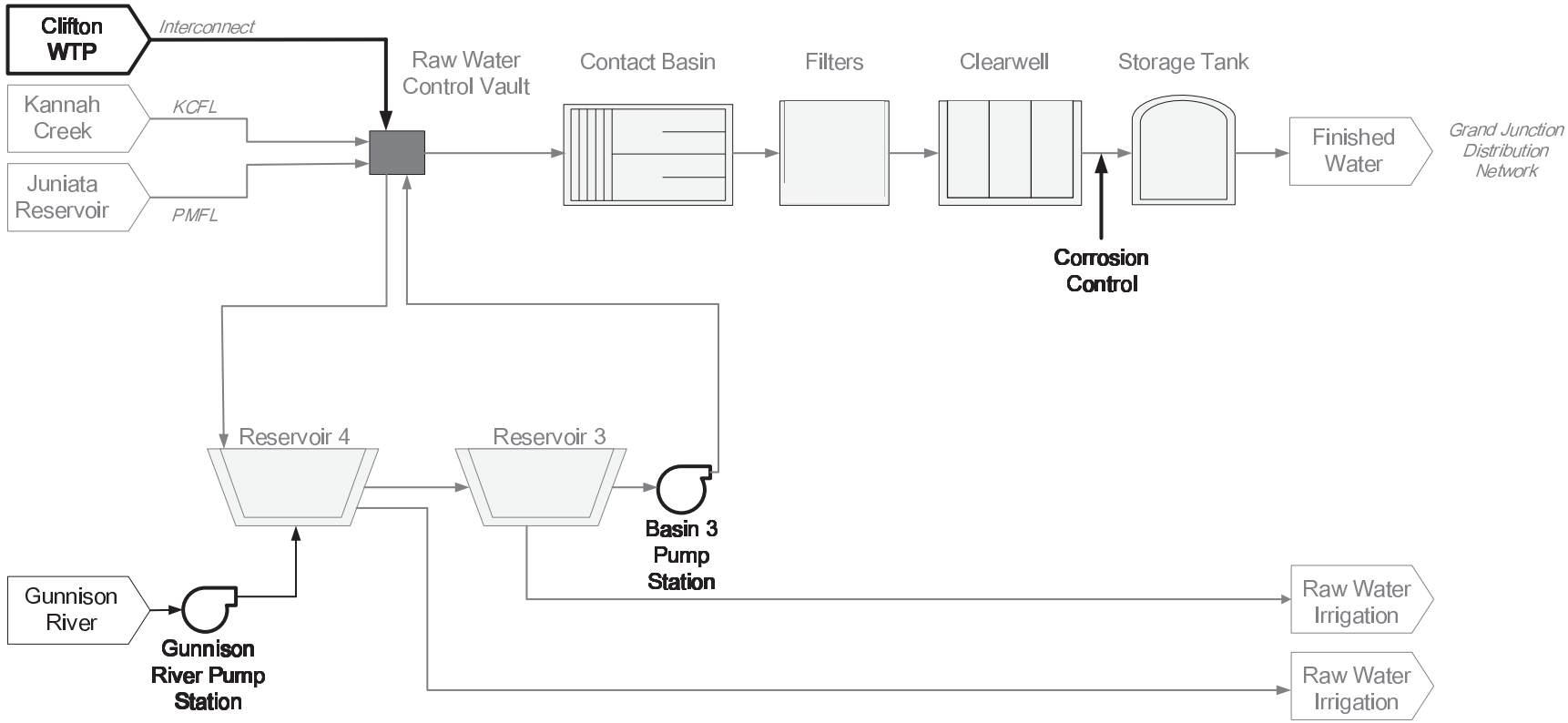

Figure 5: Process Flow Diagram for Option 3

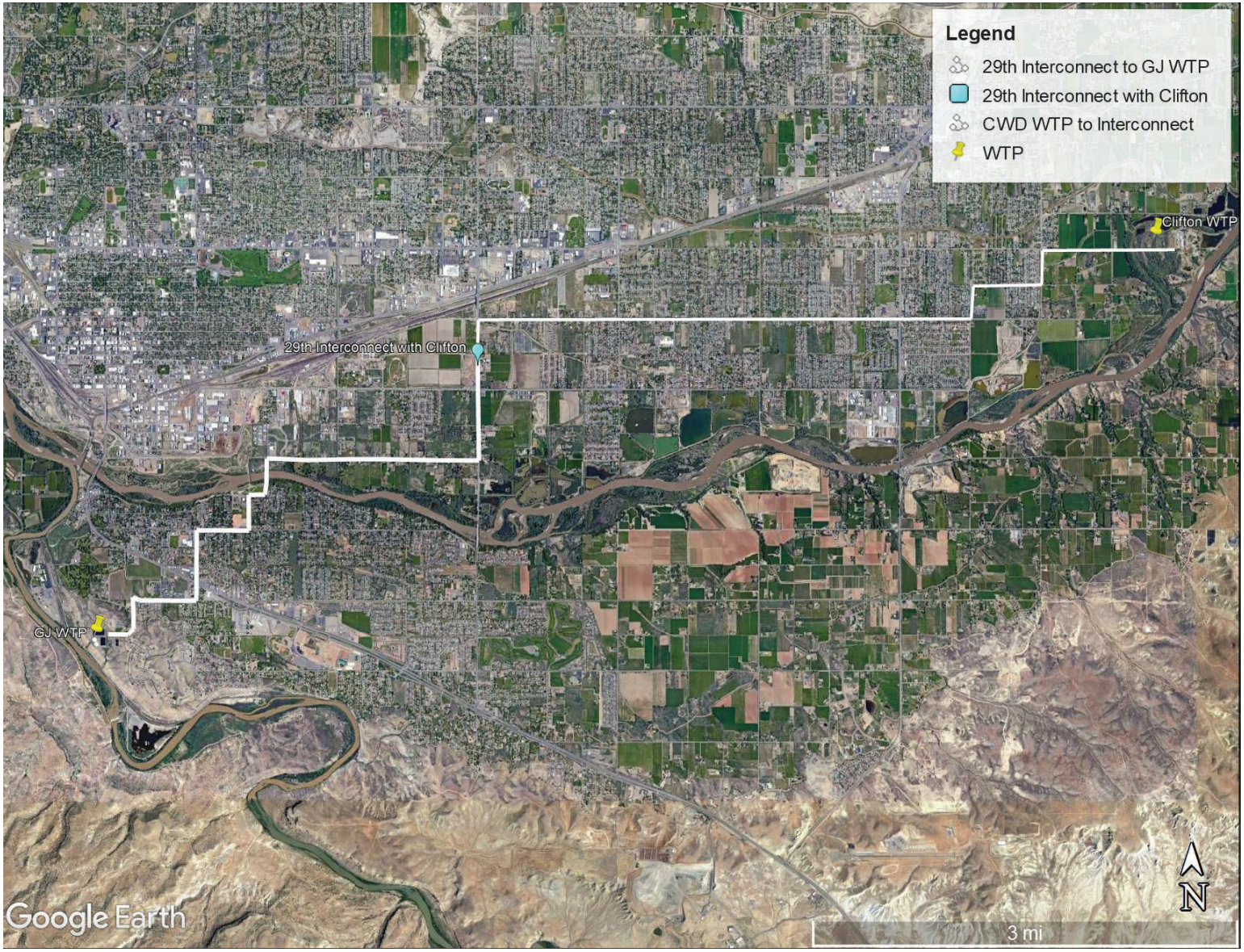

Figure 6: Preliminary Alignment for Pipeline from Clifton WTP to the City WTP

3.4 Option 4: Settle Gunnison River in Existing Reservoirs and Use for Raw Water Irrigation

This Option uses Gunnison River water rights by pumping to Reservoir 4 where major turbidity will be settled to less than 10 NTU. The Gunnison River will be used for all irrigation customers (Spy Glass Development, Las Colonias Industrial Park, and the cemetery). This reduces the total demand from the Grand Mesa source in the KCFL by dedicating all of the Kannah Creek flows for treatment at the WTP. The KCFL will be replaced but at a smaller diameter due to the 2 mgd of irrigation flows being supplied from the Gunnison River. KCFL replacement options are discussed in more detail in Option 6.

The existing intake will remain in service at its current location. The GRPS will be upgraded with new pumps, electrical and superstructure . Raw water from the Gunnison River will be pumped to Reservoir 4 to settle by gravity before it is sent to the irrigation customers. Reservoir 3 will remain as storage and settling reservoir for high turbidity events in both Grand Mesa sources.

Based on discussions with the City, this Option is not likely because the quality of settled Gunnison River water will not meet the water quality standards for the existing irrigation customers (high TDS).

The following assumptions were used for this Option:

- Raw water sources:
  - Gunnison River via GRPS
  - Kannah Creek via KCFL
- 11.7 mgd peak day flow
  - Gunnison River raw water at 2.0 mgd
  - Kannah Creek raw water of 9.7 mgd (20-inch KCFL replacement per Option 6)
- Reuse the existing intake and wet well for GRPS
- Reuse the existing pipeline from GRPS to Reservoir 3
- Route Gunnison River through Reservoir 4, settle by gravity to < 10 NTU
- Gunnison River only through Reservoirs 3 and 4 to raw water customers
- Customers do not require a higher level of treatment beyond removal of major turbidity

Figure 7 below illustrates a conceptual process flow diagram for Option 4. Figure 8 shows a preliminary alignment of the KCFL replacement.

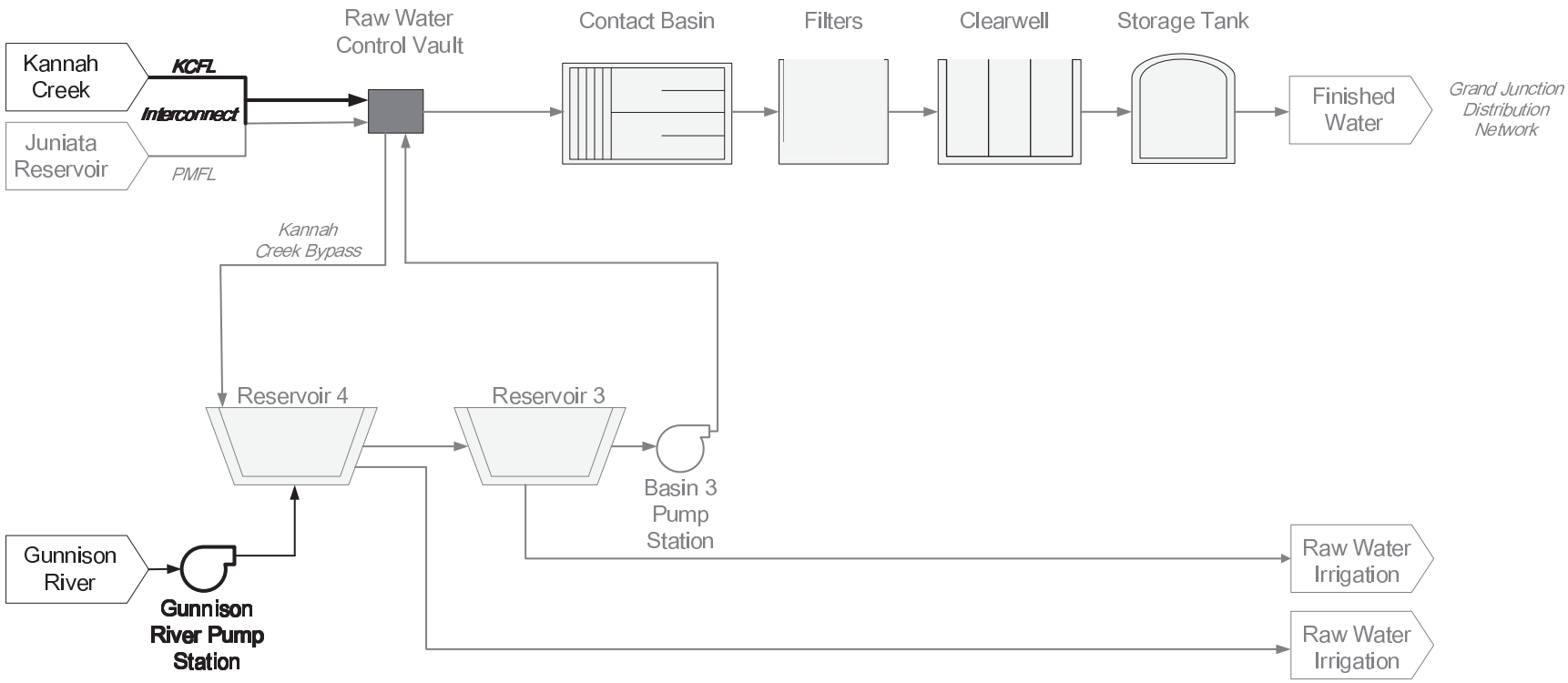

Figure 7: Process Flow Diagram for Option 4

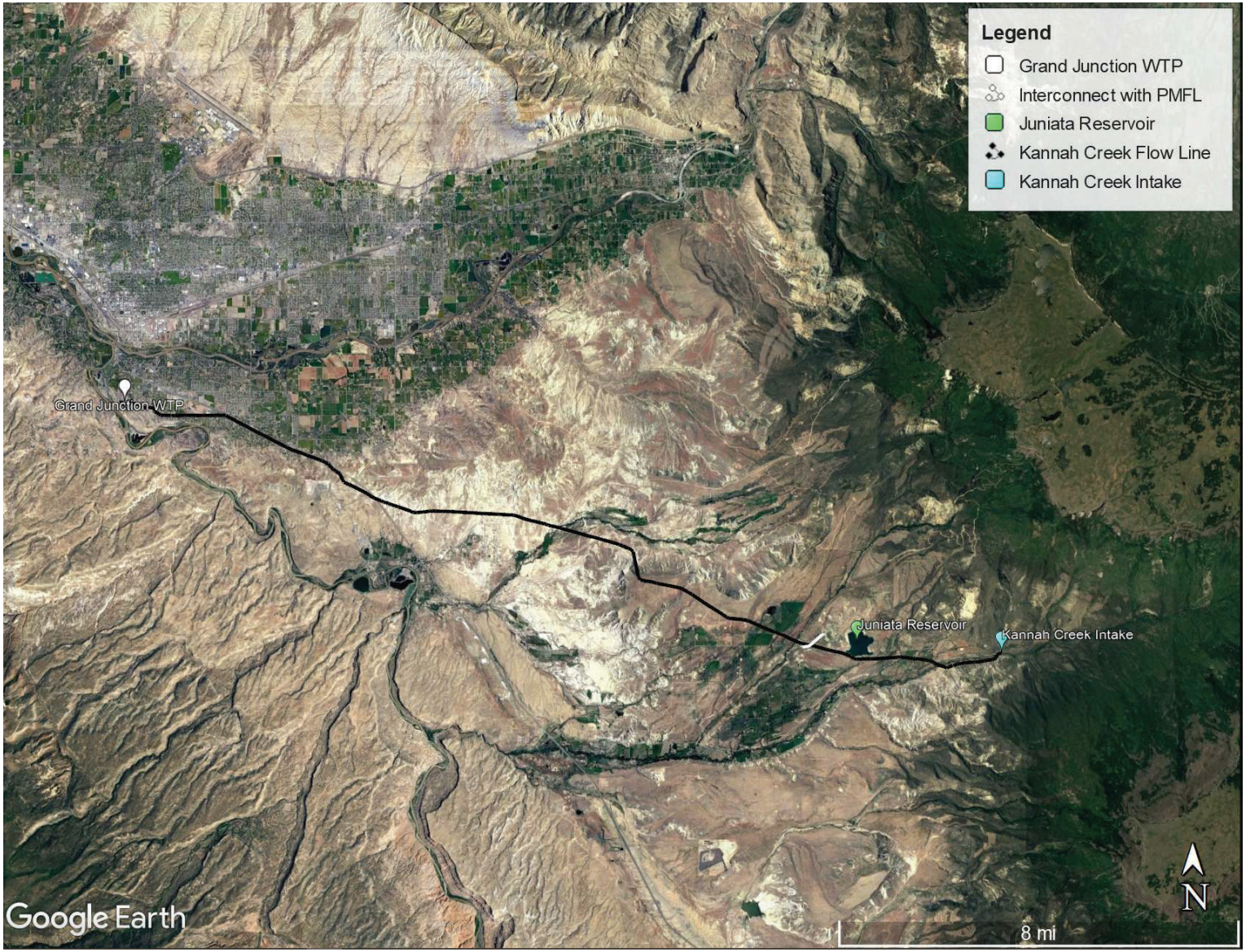

Figure 8: Preliminary Alignment for KCFL Replacement

3.5 Option 5: Replace Kannah Creek Flow Line (24 inch)

The KCFL draws raw water from Kannah Creek at the City intake, approximately 4-miles upstream from the Juniata Reservoir. The KCFL provides additional raw water to the City during the peak summer season and acts as a backup pipeline to the PMFL. During winter, the KCFL is only used to transfer water from the Kannah Creek watershed into the Juniata Reservoir.

The KCFL is approximately 20-miles of 18-inch cast iron and 20-inch steel gravity transmission main. Current City operations limit the flow to less than 2 mgd to minimize stress on the pipeline. Extensive repairs to the KCFL or a full replacement are required to provide critical redundancy.

The City has 7.81 cfs (5 mgd) of paramount water rights from Kannah Creek. The City may access an additional 3.91 cfs (2.5 mgd) of winter water rights when available. Modelling results indicate that the Kannah Creek watershed can deliver up to 5,800 to 6,225 AF annually, with approximately 350 AF dedicated to the Kannah Creek WTP and other non-potable uses.

An interconnect to the Juniata Reservoir is required to achieve fully redundant peak day flows to the KCFL. Juniata Reservoir water rights will augment the flow from Kannah Creek to provide peak day flow. The interconnection will allow flow from both Kannah Creek and Juniata Reservoir into either the PMFL or KCFL. The scope of the interconnection is discussed below (Section 3.5.1).

The City is planning on replacing the 4-miles of pipeline between Kannah Creek and Juniata Reservoir. Therefore, the scope of all KCFL options in this study is limited to the approximately 16-miles between Juniata Reservoir and the WTP.

Figure 9 shows the approximate pipeline elevation (blue), hydraulic grade line (red), static pressure (purple) and pipe pressure class (green). The hydraulic grade line must remain below the green line, representing the pipe pressure rating. The vertical drop in the red and purple lines represents the pressure drop at the proposed pressure reducing valve (PRV) chamber. The pipe pressure class, PRV setting, PRV location and diameter are optimized to prevent operating and static pressures from exceeding the pipe pressure class. Further optimization of pipe pressure class will occur during the concept design.

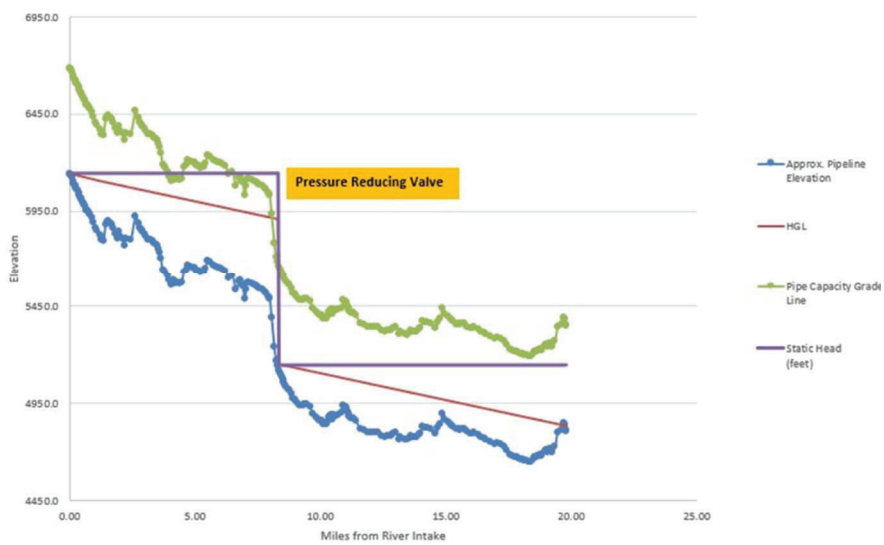

Figure 9: Hydraulic Profile of 24 inch KCFL Replacement (Option 5)

Option 5 at 24-inch diameter will convey up to 12.5 mgd. One pressure control valve is required (Figure 9). A new PRV chamber at the mesa will reduce pressures to less than the pipeline rating (235 psi). KCFL flow control will be relocated to the WTP with modulating a valve and flowmeter. KCFL flow control at Kannah Creek will be abandoned.

This Option does not change the WTP treatment processes. Kannah Creek will remain as the secondary raw water source to Purdy Mesa flow line. The Gunnison River will not be used.

The following assumptions were used for this Option:

- Raw water source:
  - Kannah Creek via KCFL
  - Augmented by Juniata Reservoir interconnection
- Capacity:
  - 12.5 mgd hydraulic capacity
    - Summer: 5 mgd paramount water rights from Kannah Creek plus 7.5 mgd from Juniata Reservoir
    - Winter: 7.5 mgd from Kannah Creek (5 mgd paramount rights plus an additional 2.5 mgd of winter water rights when available) plus 5 mgd from Juniata Reservoir
- Add one pressure control chamber along KCFL
- Uppermost 4 miles of KCFL replacement outside scope of this project

This Option does not provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage. The interconnection with Clifton may also be used to meet peak daily flows greater than 12.5 mgd.

This Option does not provide access to an alternate water source than the PMFL.

Figure 10 below illustrates a conceptual process flow diagram for this Option. Figure 11 shows a preliminary alignment of the KCFL replacement.

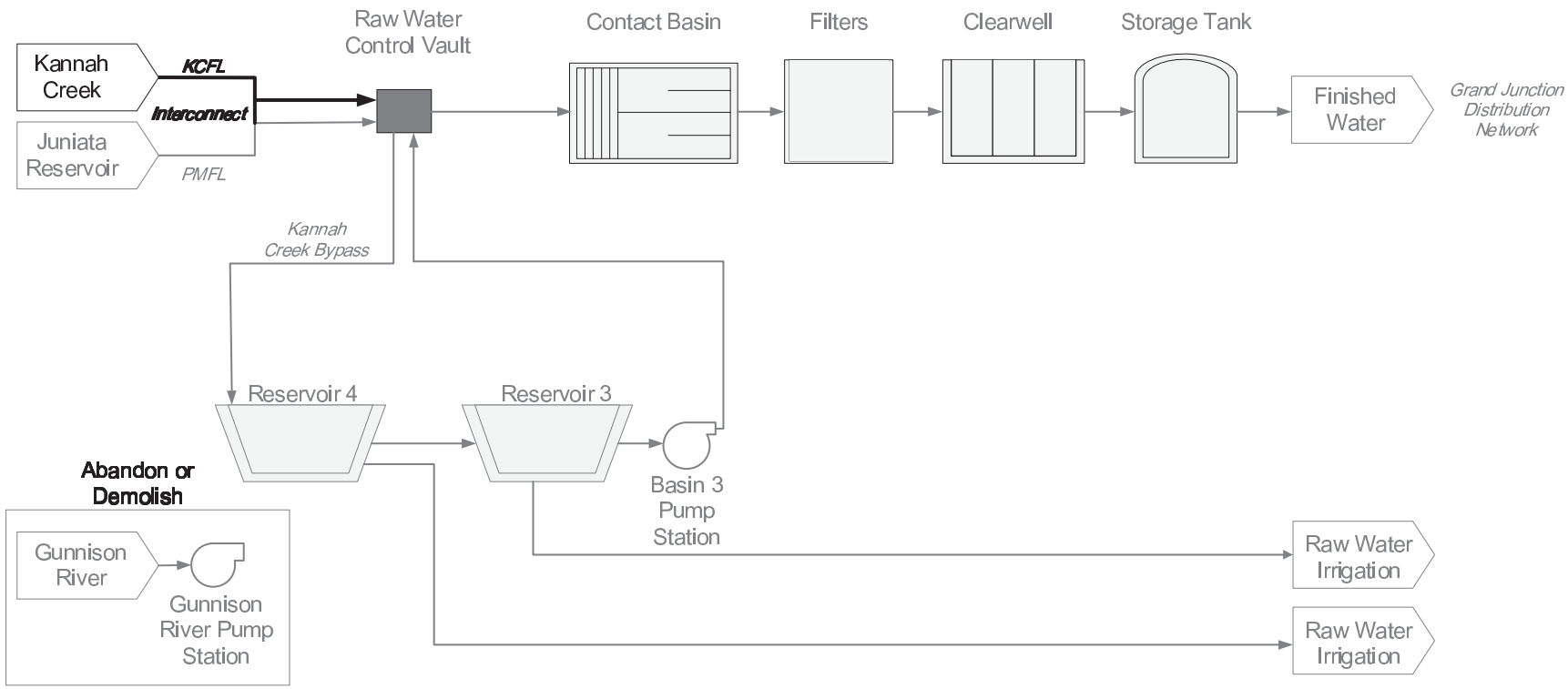

Figure 10: Process Flow Diagram for Option 5

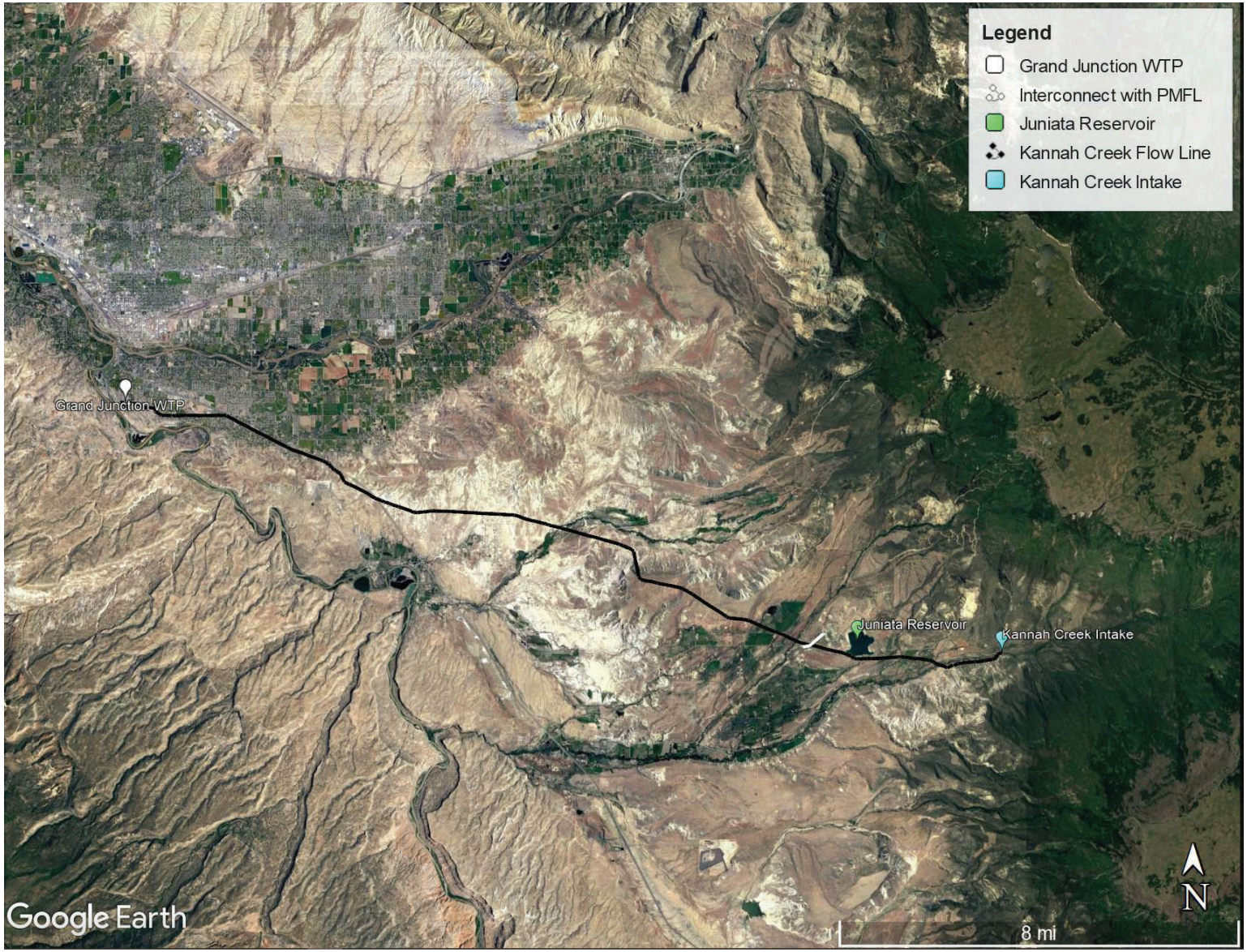

Figure 11: Preliminary Alignment for KCFL Replacement

3.5.1 Juniata Reservoir Interconnection

An interconnect to the Juniata Reservoir will be required to achieve fully redundant peak day flows to the KCFL. Juniata Reservoir water rights will augment the flow-limited, seasonal water rights from Kannah Creek to provide peak day flow. The interconnection will allow flows from both Kannah Creek and Juniata Reservoir into either the PMFL or KCFL. This improves the overall water system resiliency by allowing access to either the Juniata Reservoir or Kannah Creek watershed in either pipeline during periods of poor water quality, wildfire or algae blooms.

Control valves on the KCFL will direct flow from Kannah Creek water into the Juniata Reservoir. The existing outlet piping from Juniata Reservoir will then be sent to either the PMFL or the PMFL. Kannah Creek is at a higher elevation (approximately 6,130 feet) than Juniata Reservoir (approximately 5,760 feet). Therefore, flow control valves will isolate the portion of the KCFL upstream of the Juniata Reservoir. The interconnection will be sized to deliver the difference between the maximum hydraulic capacity of the KCFL and the seasonal water flows from Kannah Creek. The KCFL has a hydraulic capacity of 12.5 mgd at 24-inch diameter, resulting in an interconnection capacity of 7.5 mgd (5,200 gpm).

The proposed location of the Junita Reservoir Interconnection is shown in Figure 12.

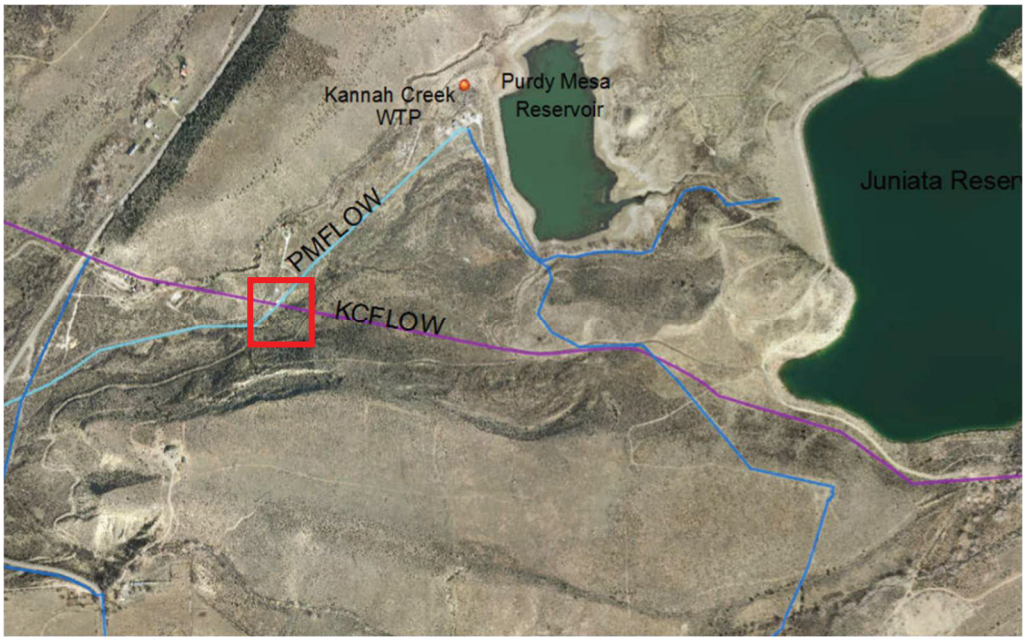

Figure 12: Proposed Location of Juniata Reservoir Interconnection

Figure 13 shows a preliminary process flow diagram for the interconnection facility. The interconnection improvement is recommended regardless of which Option is selected. The interconnection will allow flows from both the Juniata Reservoir and Kannah Creek water sources through either pipeline.

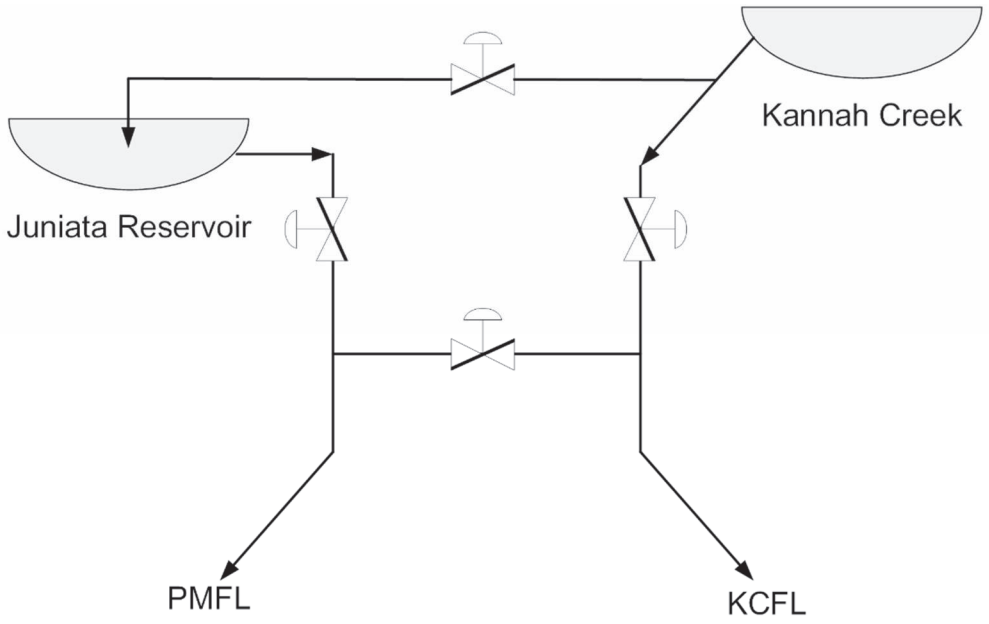

Figure 13: Process Flow Diagram for Juniata Reservoir Interconnection

3.6 Option 6: Replace Kannah Creek Flow Line (20 inch)

This Option includes the replacement of the KCFL at 20-inch diameter. Raw water is sourced from Kannah Creek, as described in Option 5. The Juniata Reservoir Interconnection (Section 3.5.1) will be required to achieve fully redundant raw water flows in either pipeline to the WTP from the Grand Mesa.

Reducing to 20-inch diameter will reduce the hydraulic capacity to 9.7 mgd. Two pressure control stations will be required. The operating pressure in the KCFL will be higher at 20-inch diameter, resulting in a higher pressure class pipe. The Option cost will be reduced at the smaller diameter KCFL.

Figure 14 shows the approximate pipeline elevation (blue), hydraulic grade line (red), static pressure (purple) and pipe pressure class (green) for both pipeline options. The hydraulic grade line must remain below the green line, representing the pipe pressure rating. The vertical drop in the red and purple lines represents the pressure drop at the proposed PRV. The pipe pressure class, PRV setting, PRV location and diameter are optimized to prevent operating and static pressures from exceeding the pipe pressure class. Further optimization of pipe pressure class will occur during the concept design.

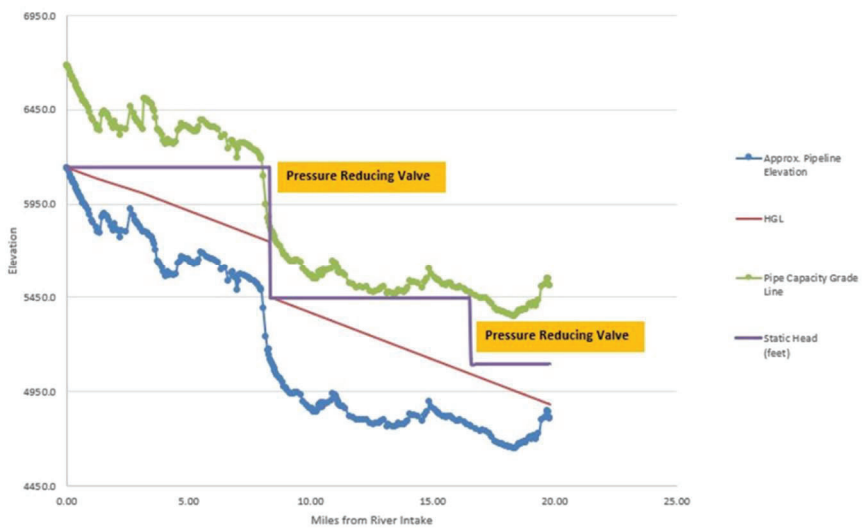

Figure 14: Hydraulic Profile of 20 inch KCFL Replacement (Option 6)

Two new PRV chambers will manage the operating pressures to the pipe rating. PVC pipe pressure class will vary along KCFL, limited either to 235 psi or 300 psi. KCFL flow control will be relocated to the WTP with modulating a valve and flowmeter. KCFL flow control at Kannah Creek will be abandoned. This option does not change the WTP treatment processes. Kannah Creek will remain as the secondary raw water source to Purdy Mesa. The Gunnison River will not be used.

The following assumptions were used for this Option:

- Raw water source:
  - Kannah Creek via KCFL
  - Augmented by Juniata Reservoir interconnection
- Capacity:
  - 9.7 mgd hydraulic capacity
    - Summer: 5 mgd paramount water rights from Kannah Creek plus 7.5 mgd from Juniata Reservoir

    - Winter: 7.5 mgd from Kannah Creek (5 mgd paramount rights plus an additional 2.5 mgd of winter water rights when available) plus 5 mgd from Juniata Reservoir
- Two PRV chambers along KCFL
- Uppermost 4 miles of KCFL replacement outside scope of this project

This Option does not provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage. The interconnection with Clifton may also be used to meet peak daily flows greater than 9.7 mgd.

This Option does not provide access to an alternate water source than the PMFL.

Figure 15 below illustrates a conceptual process flow diagram for this Option. Preliminary alignment is identical to Option 5 above.

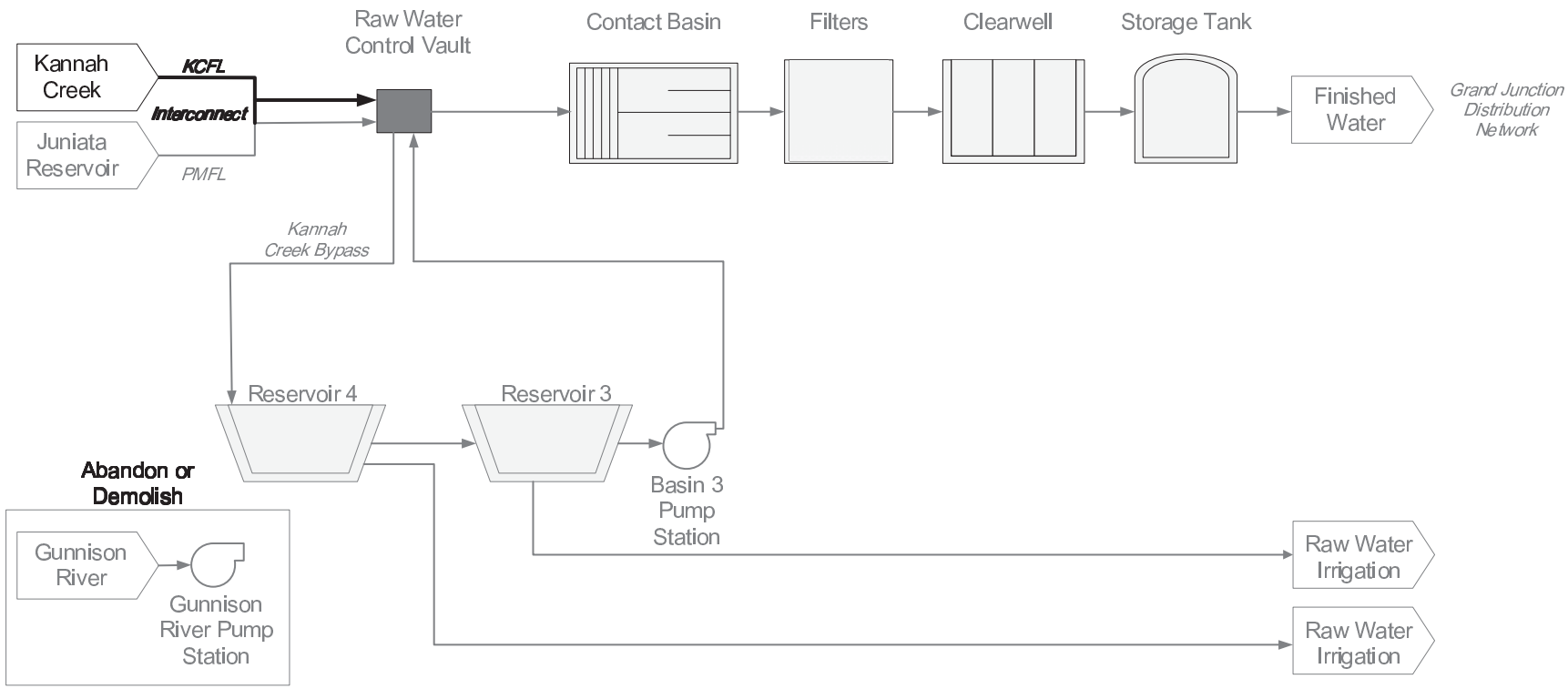

Figure 15: Process Flow Diagram for Option 6

3.7 Option 7: Replace Kannah Creek Flow Line (24 inch) and Add Turbine

This Option includes the replacement of the KCFL at 24-inch diameter. Raw water is sourced from Kannah Creek, as described in Option 5. The Juniata Reservoir Interconnection (Section 3.5.1) will be required to achieve fully redundant raw water flow to the WTP.

A new PRV chamber at the mesa will limit the pipeline pressures to less than 235 psi. A hydroelectric turbine will be installed in parallel with PRV to capture the potential energy of the high-pressure raw water. Electricity generated at the hydroelectric turbine will be transmitted overhead approximately 6 miles to the Grand Valley Power substation. Conceptual calculations indicate the potential to generate up to 3,000,000 kilowatt hours (kWh) per year (700 kW turbine), based on assumed monthly flows and available pressure.

KCFL flow control will be relocated to the WTP with modulating a valve and flowmeter. KCFL flow control at Kannah Creek will be abandoned. This Option does not change the WTP treatment processes. Kannah Creek will remain as the secondary raw water source to Purdy Mesa. The Gunnison River will not be used.

The following assumptions were used for this Option:

- Raw water source:
  - Kannah Creek via KCFL
  - Augmented by Juniata Reservoir interconnection
- Capacity:
  - 12.5 mgd hydraulic capacity
    - Summer: 5 mgd paramount water rights from Kannah Creek plus 7.5 mgd from Juniata Reservoir
    - Winter: 7.5 mgd from Kannah Creek (5 mgd paramount rights plus an additional 2.5 mgd of winter water rights when available) plus 5 mgd from Juniata Reservoir
- Add one pressure control chamber along KCFL
- Uppermost 4 miles of KCFL replacement outside scope of this project
- Elevation change requires control valves to reduce pressure
- Transmit generated electricity to Grand Valley Power's Substation near Highway 50 and 32 Road. The capacity of this substation to receive the generated electricity must be confirmed.

This Option does not provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage. The interconnection with Clifton may also be used to meet peak daily flows greater than 12.5 mgd.

This Option does not provide access to an alternate water source than the PMFL.

Figure 16 below illustrates a conceptual process flow diagram for this Option. Figure 17 shows a preliminary alignment for the KCFL as well as preliminary turbine placement.

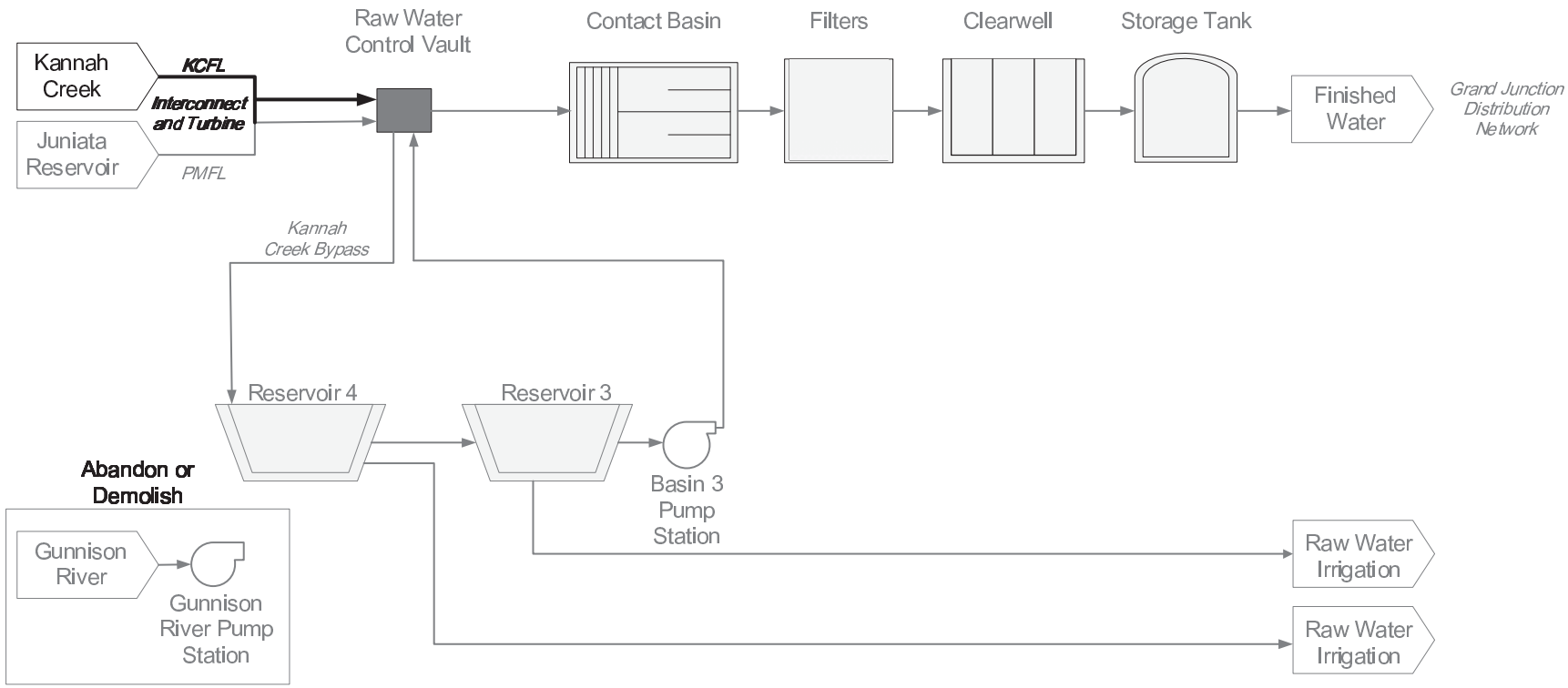

Figure 16: Process Flow Diagram for Option 7

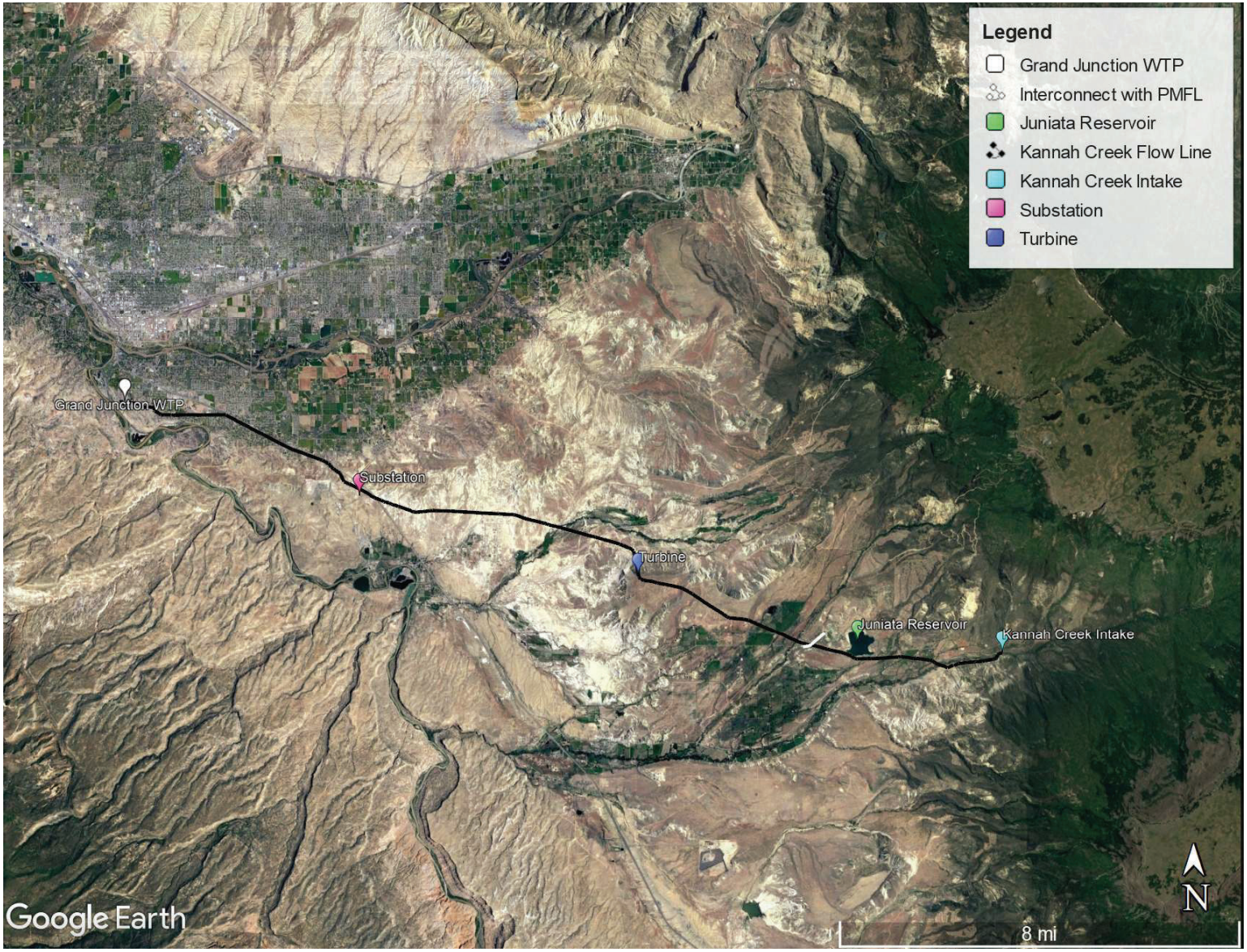

Figure 17: Preliminary Alignment for KCFL Replacement and Preliminary Turbine Placement

3.8 Option 8: New WTP in Kannah Creek Watershed

This Option includes a new WTP sized for peak day flows constructed in the Kannah Creek watershed. This new Kannah Creek WTP will utilize both Kannah Creek and Juniata Reservoir water rights. The Juniata Reservoir Interconnection (Section 3.5.1) will be required to achieve fully redundant raw water flow to the new Kannah Creek WTP.

A new Low Lift Pump Station will be constructed deliver water from either Kannah Creek or Juniata Reservoir to the new WTP. The new WTP will include conventional pretreatment, filtration, and chemical systems. Treated water will be conveyed to the distribution system via gravity through either PMFL or KCFL. The KCFL will be completely replaced with a new 24 inch pipeline (Option 5).

The new 13 mgd Kannah Creek WTP will provide treated water to the local Kannah Creek area customers and make the existing 0.3 mgd WTP redundant.

The Gunnison River will not be used but may remain operational to supply irrigation customers.

The following assumptions were used for this Option:

- Raw water source:
  - Kannah Creek via KCFL
  - Augmented by Juniata Reservoir interconnection
- Capacity:
  - 12.5 mgd (limited to hydraulic capacity of KCFL at 24-inch)
    - Summer: 5 mgd paramount water rights from Kannah Creek plus 7.5 mgd from Juniata Reservoir
    - Winter: 7.5 mgd from Kannah Creek (5 mgd paramount rights plus an additional 2.5 mgd of winter water rights when available) plus 5 mgd from Juniata Reservoir
- Kannah Creek via interconnection and low lift pump station will be treated at new WTP
- Juniata Reservoir via low lift pump station will be treated at new WTP
- Residual pressure from the new WTP will be used to supply water directly to distribution system
- KCFL or PMFL available to convey either raw or treated water to the existing WTP for treatment or distribution
- Abandon existing 0.3 mgd WTP in place
- Add one pressure control chamber along KCFL
- Uppermost 4 miles of KCFL replacement outside scope of this project

This Option does not provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage. The interconnection with Clifton may also be used to meet peak daily flows greater than 12.5 mgd.

This Option does not provide access to an alternate water source than the PMFL.

Figure 18 below illustrates a conceptual process flow diagram for this Option. Figure 19 shows a preliminary alignment for the KCFL as well as preliminary Kannah Creek WTP location.

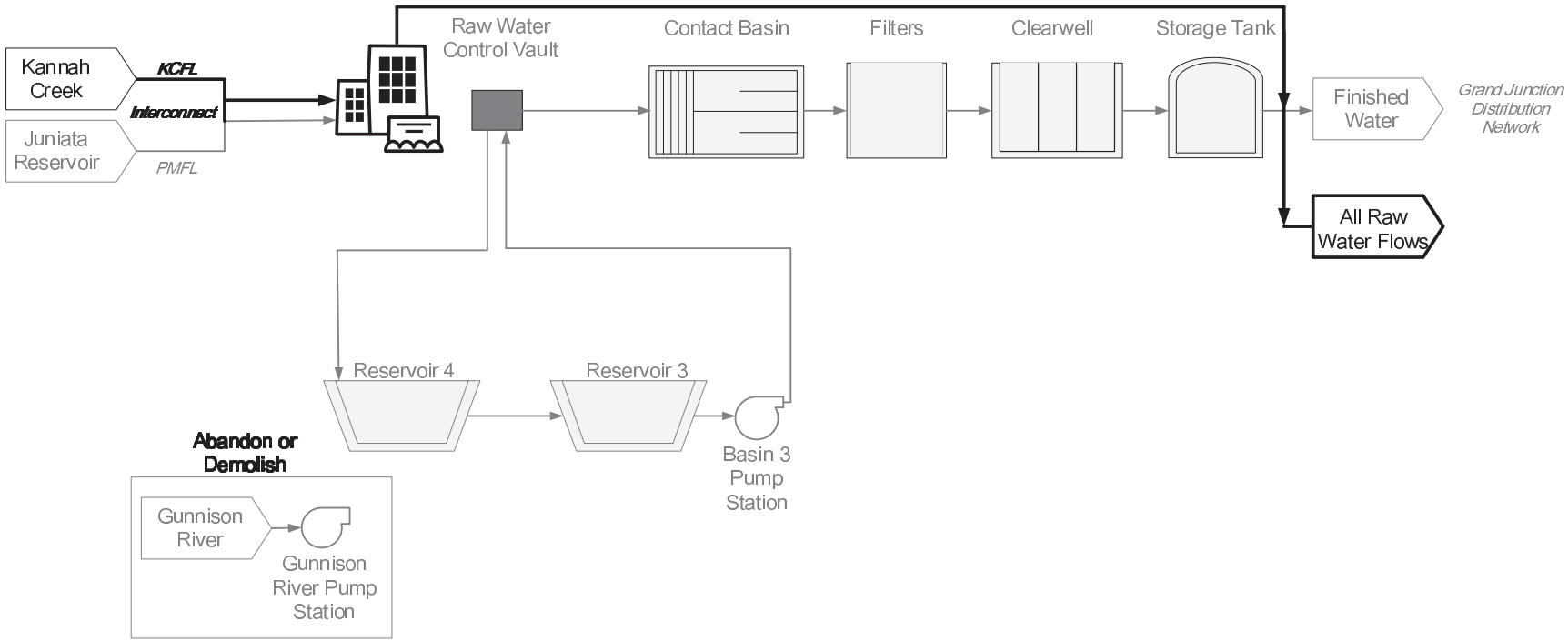

Figure 18: Process Flow Diagram for Option 8

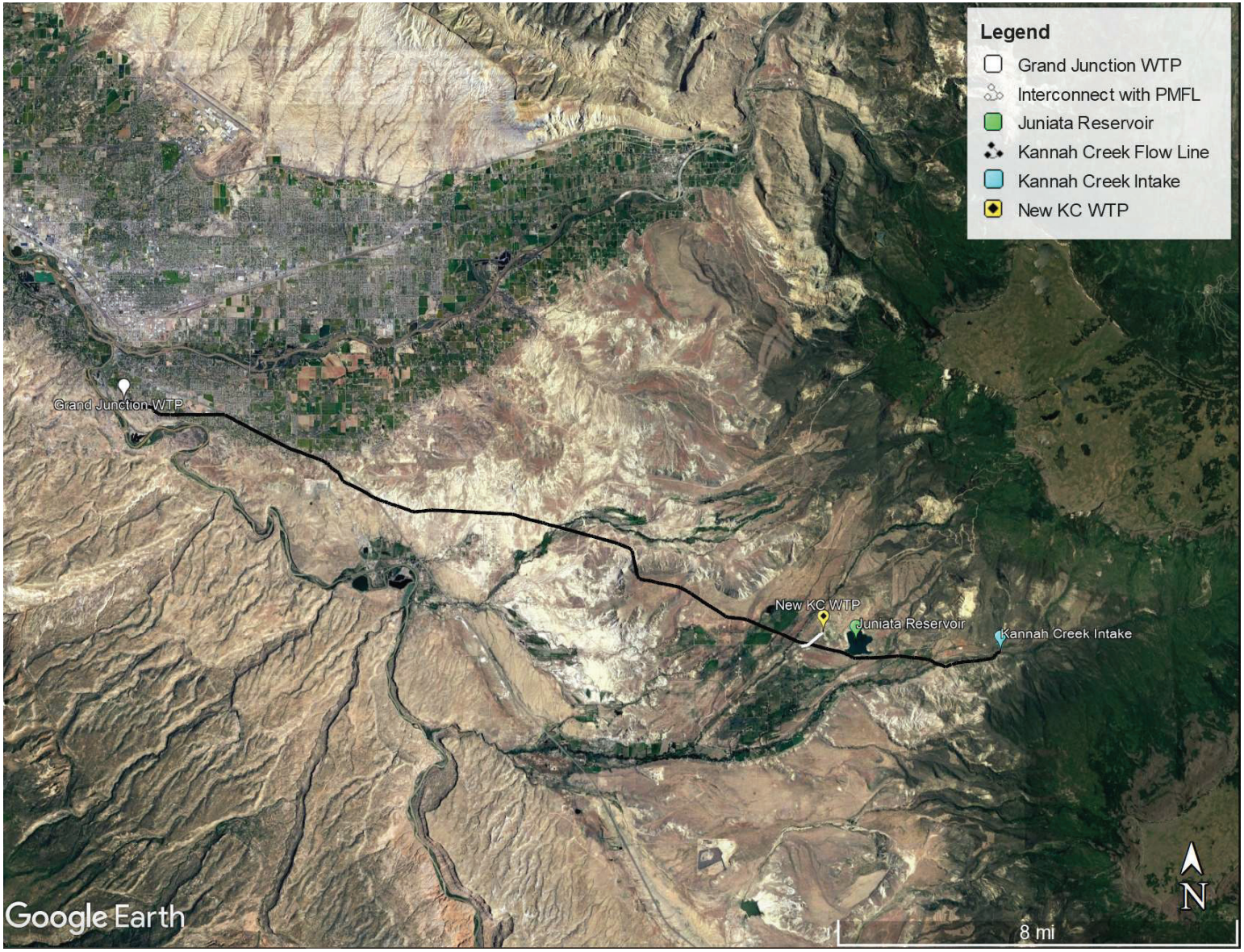

Figure 19: Preliminary Alignment for KCFL Replacement and Preliminary KC WTP Placement

3.9 Option 9: Clifton Water Emergency Interconnect

This Option is based on using the existing interconnection agreement with Clifton. The 1998 amendment allows Clifton to supply the City with up to 250 million gallons between April and September each year (1.4 mgd average). The amendment states that the City will supply Clifton with up to 250 million gallons per day between October and March. The agreement has informally expanded over the years to allow the City to take up to 4.5 mgd of treated water from Clifton in emergency situations. The Clifton interconnection on 29 Road is able to sustain flows up to 5.5 mgd.

The City will use the interconnection with Clifton in the event of a failure of the PMFL. This water would supplement the KCFL at its current capacity until complete failure of the KCFL.

The following assumptions were used for this Option:

- Raw water source: Kannah Creek via KCFL
- Treated water source: Grand Mesa and Colorado River via Clifton
- Capacity: 7.5 mgd
    - 5.5 mgd raw water from Clifton
    - 2 mgd raw water from KCFL in current condition
- KCFL will be utilized at current capacity until complete pipe failure
- Negotiate an updated agreement with Clifton
- Finished water from Clifton will be sent to the City through the existing interconnect
- Reservoirs 3 and 4 will be used to supply existing raw water irrigation customers while the PMFL is offline for repairs lasting a maximum of one week

This Option does not provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage.

The City may also consider using the Clifton interconnection agreement to preserve its water allocation on the Purdy Mesa. Clifton water may be used in non-emergency situations under the existing agreement. This approach may trigger a renegotiation of the agreement if used as a permanent, non-emergency source. Investigation of transfer, exchange, or credit of water rights to either Gunnison River or Colorado River should be explored by City but is not included in this study.

Figure 20 below illustrates a conceptual process flow diagram for this Option. This Option does not involve any capital costs, so it has been purposefully excluded from Appendices A and B.

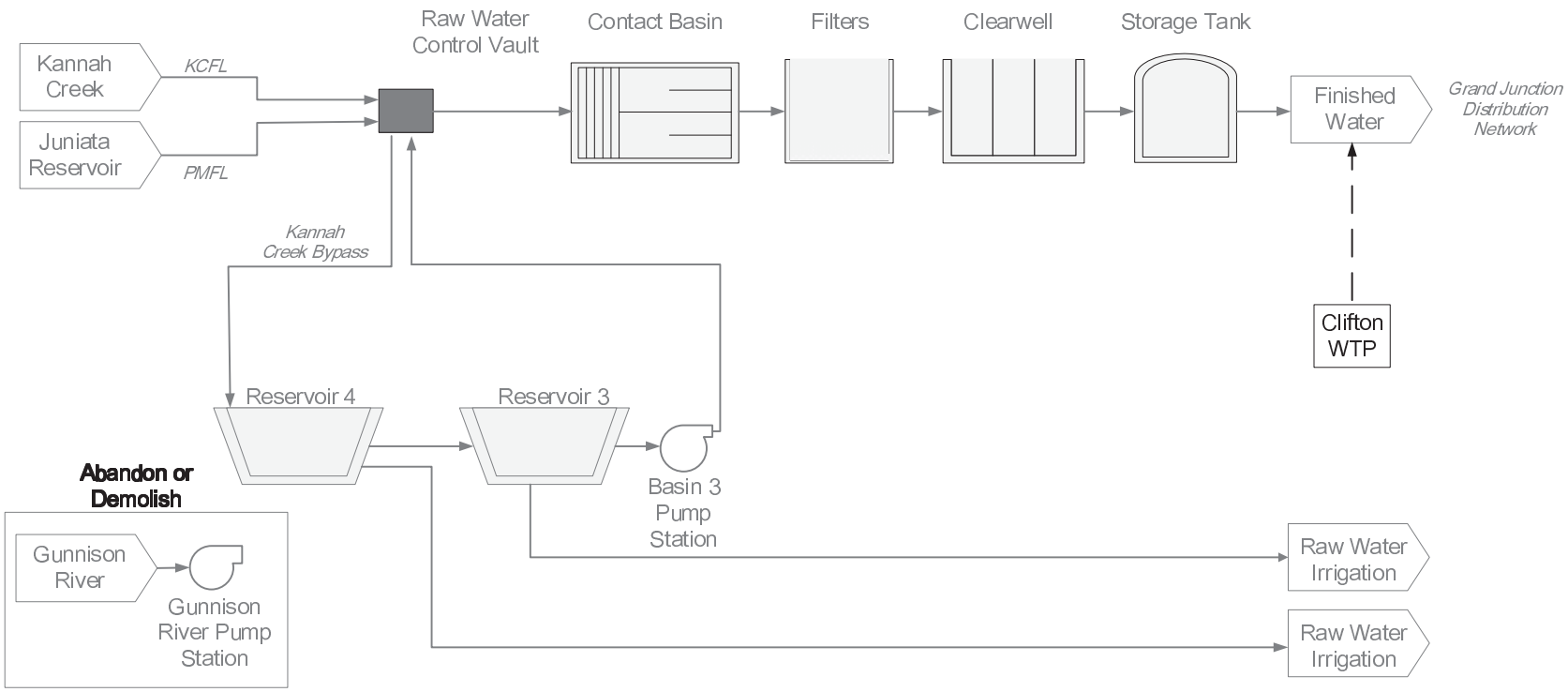

Figure 20: Process Flow Diagram for Option 9

3.10 Option 10: Transfer Colorado River Rights to Clifton for Treatment (Full Expansion, 24 inch pipeline)

The City owns 80 cfs of additional water rights to the Colorado River that are not being utilized. There is no active infrastructure that will allow the City to access its Colorado River source. This Option includes the transfer of Colorado water rights to Clifton for treatment and distribution back to the City. The Clifton WTP will be expanded to provide a fully redundant supply of 13 mgd to the City. It is anticipated that the City will contribute to the construction, operation, and maintenance of the expanded Clifton WTP.

The Clifton WTP combines membrane filtration with reverse osmosis. The treatment train is pre-sedimentation, flocculation, sedimentation and MF/UF. A portion of flow is treated by NF/RO to address high TDS in the Colorado River. The NF/RO bypass stream is blended back into the MF/UF stream.

The existing Clifton WTP has a capacity of 12 mgd, with a peak day flow of 6.3 mgd. The Clifton WTP has available space on the MF/UF and NF/RO racks for additional modules, as well as floor space in the existing buildings for additional membrane trains.

This Option is based on the expansion of the Clifton WTP to 21 mgd accommodate future peak day demands in Clifton and the City. This assumes future Clifton peak day demand of 8 mgd (30% increase), plus 13 mgd peak day demand from Grand Junction.

A new water transmission main will route treated water from the Clifton WTP to 30th Rd where existing pipe will be utilized to connect to the City's distribution network (24-inch diameter for 4 miles). This new treated water pipeline will provide flows above the 5.5 mgd capacity of the existing Clifton interconnection.

The following assumptions were used for this Option:

- Raw water source: Colorado River via Clifton WTP
- 13 mgd peak day flow
- KCFL will be abandoned in place
- Clifton will provide treatment
- Expand Clifton WTP from 12 to 21 mgd
    - 8 mgd for Clifton
    - 13 mgd for Grand Junction
- Adequate space available for Clifton WTP expansion
- CDPHE permits the expansion of the existing Clifton brine disposal ponds
- New 24-inch pipeline from Clifton to the City's distribution (4 miles)
- Reservoirs 3 and 4 will be used to supply existing raw water customers while PMFL is offline for up to one week

This Option uses the City's existing Colorado River water rights and provides access to an alternate water source than the Purdy Mesa.

Figure 21 below illustrates a conceptual process flow diagram for this Option. Figure 22 shows a preliminary alignment for the finished water pipeline from the Clifton WTP to the City's distribution system.

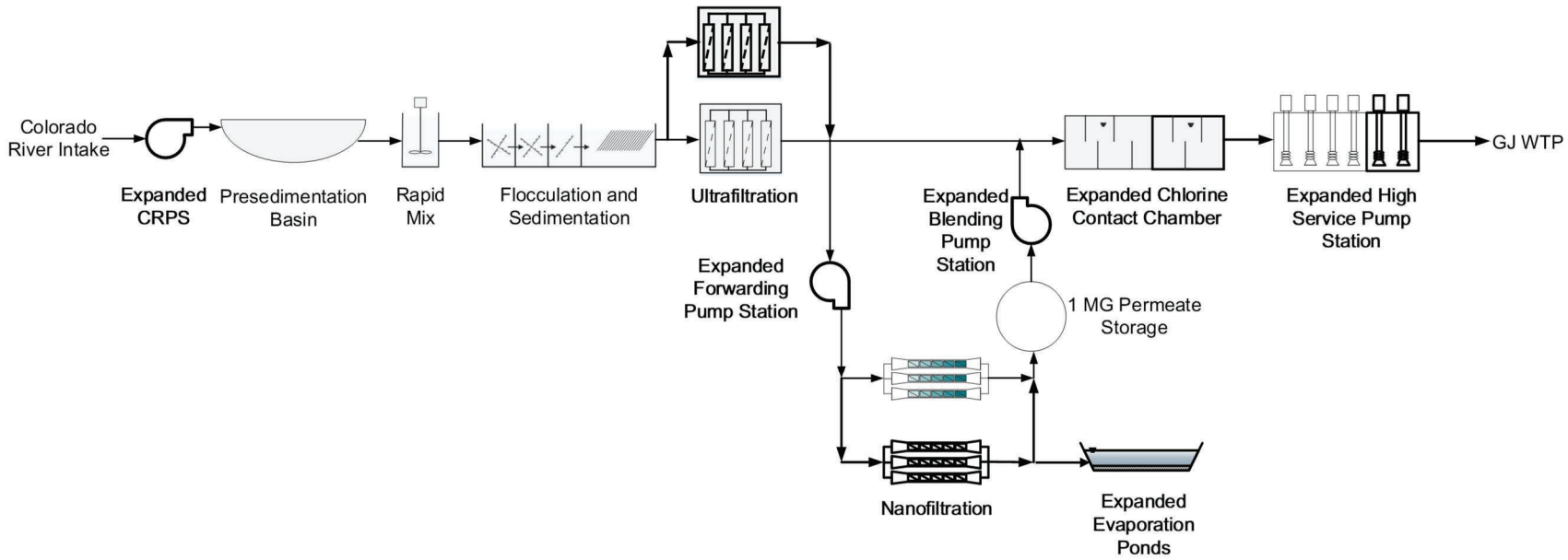

Figure 21: Process Flow Diagram for Option 10

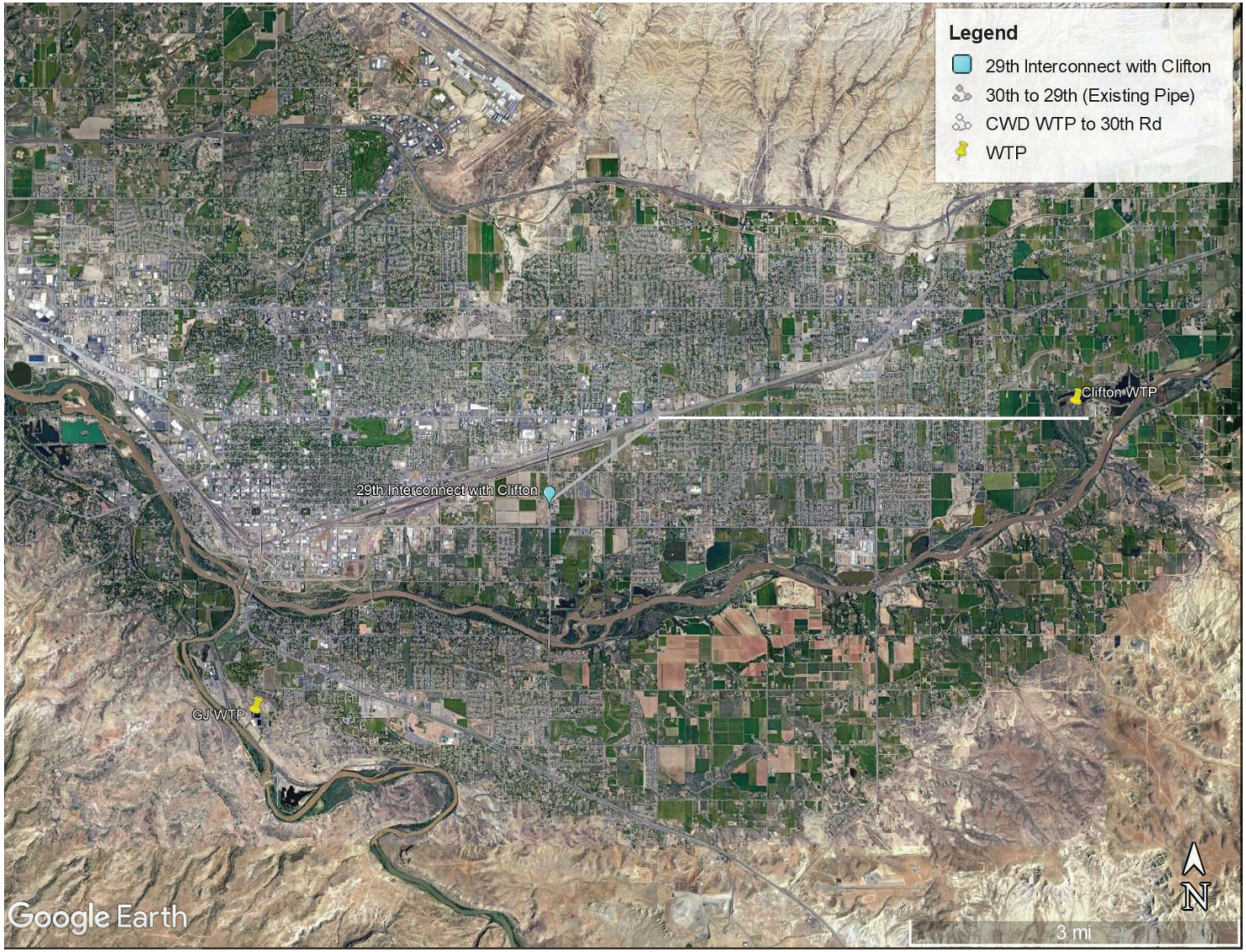

Figure 22: Preliminary Alignment for FW Transmission from CWD WTP to Grand Junction Distribution System

3.11 Option 11: Transfer Colorado River Rights to Clifton for Treatment (Partial Expansion, 20 inch pipeline)

This Option is based on an expansion of the Clifton WTP, similar to Option 10, but to a capacity of 16 mgd. This does not provide full future redundancy to the City but is a less complex and expensive expansion than the Clifton WTP expansion to 21 mgd. Clifton's pretreatment is already sized for 16 mgd, reducing the number of processes that need to be expanded. The MF/UF system will be expanded through a combination of populating existing skids with additional membrane modules, as well as adding a new MF/UF skid in the existing building space.

This Option assumes a future peak day demand of 8 mgd in Clifton (30% increase), leaving 8 mgd available for the City.

A new water transmission main will route treated water from the Clifton WTP to 30th Rd where existing pipe will be utilized to connect to the City's distribution network (20-inch diameter for 4 miles). This new treated water pipeline will provide flows above the 5.5 mgd capacity of the existing Clifton interconnection.

The following assumptions were used for this Option:

- Raw water source: Colorado River via Clifton WTP
- KCFL will be abandoned in place
- Clifton will provide treatment
- Expand Clifton WTP from 12 to 16 mgd
    - 8 mgd for Clifton
    - 8 mgd for Grand Junction
- Adequate space available for Clifton WTP expansion
- CDPHE permits the expansion of the existing Clifton brine disposal ponds
- New 20-inch pipeline from Clifton to the City's distribution (4 miles)
- Reservoirs 3 and 4 will be used to supply existing raw water customers while PMFL is offline for up to one week

This Option uses the City's existing Colorado River water rights and provides access to an alternate water source than the Purdy Mesa.

Refer to Figure 21 and Figure 22 under Option 10 for a conceptual process flow diagram and a preliminary alignment for the finished water pipeline from the Clifton WTP to the City's distribution system.

3.12 Option 12: Route Gunnison River to Clifton WTP

The City owns 120 cfs of additional water rights to the Gunnison River that are not being utilized. These rights could be transferred to Clifton for treatment at their WTP. This will require upgrades to the GRPS and a new raw water pipeline from the existing Gunnison River Intake to the Clifton WTP.

There are no significant water allocations between Clifton's Colorado River intake and the confluence of the Gunnison River. Therefore, the City could transfer part of its Colorado River rights to Clifton for treatment and replace those flows with its Gunnison River rights downstream. This avoids significant upgrades at the existing or a new Gunnison River intake, modifications to the GRPS and a raw water pipeline to the Clifton WTP.

The required upgrades after the transfer of water rights become the same as those proposed in Option 10. Options 10 and 12 result in the same scope of work (Clifton WTP expansion and finished water piping from Clifton to the City).

3.13 Blending of Free Chlorine and Chloraminated Sources

Options 13, 14, and 15 are based utilizing the existing interconnections between the City and Ute. Ute uses chloramines for disinfection, which are not compatible with the City's use of free chlorine. Blending of the two waters would require additional treatment.

Blending of chlorinated and chloraminated water is generally not recommended due to the potential to lose chlorine residual. The ratio of chlorine to ammonia (Cl_2:NH_4-N) changes in an uncontrolled manner when free chlorine sources are blended with chloraminated sources. This can lead to a lowering of the disinfectant residuals to unsafe levels and create aesthetically unpleasing water.

Options for blending free chlorine and chloraminated sources include:

- Breakpoint Chlorination. Convert chloraminated water to free chlorine by adding sodium hypochlorite.
- Ammoniate the Chlorinated Water. Convert all water to chloramines by adding ammonia after free chlorine injection.
- Isolate Disinfectants. Separate or partition portions or zones of the distribution system to accommodate Ute's chloraminated water while some zones continue with the City's treated water from the KCFL source.
- Controlled Blending. Blend sources directly at each interconnect with the injection of chorine to convert to free chlorine residual. This option must include extensive controls to verify that free and total chlorine residuals will remain at acceptable levels. This may cause taste and odor issues if dichloramines form in the system. This option assumes use of some treated water from the City is available in the distribution system.
- Emergency Utilization. Utilize interconnects to blend Ute water as-is only in the event of emergency. This option is not recommended due to the inherent water quality risks.

Breakpoint chlorination (Options 13 and 14) and ammoniating of chlorinated water (Option 15) are discussed in the following sections.

3.14 Option 13: Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)

The City has eight emergency interconnects in their water distribution network with Ute. Currently, the interconnects are not used due to the differing disinfection regimes (free chlorine at the City, chloramines at Ute).

The existing Ute WTP has a capacity of 25.9 mgd, with a peak day flow of 16.5 mgd. The plant capacity is limited by current filtration capacity. The peak hour operating capacity of the plant, without filter restriction, is 34 mgd.

The Linden Vault at Highway 50 and Linden Avenue is the closest Ute interconnect to the WTP at less than one mile away. Ute water enters the Linden Vault in an 18-inch pipe at approximately 200 psi. This is assumed to be adequate pressure to deliver treated Ute water to the WTP in a new 18-inch pipeline from the Linden Vault.

A breakpoint chlorination station will be installed at the WTP to receive Ute treated water and convert chloramines to free chlorine. The City's existing sodium hypochlorite system will be expanded to accommodate the Ute flows and the higher free chlorine dose needed to destroy the chloramines. Sodium hypochlorite will be dosed in-line via a mixer past breakpoint concentrations to match the free chlorine residual required by the City.

Breakpoint chlorination (Figure 23) will remove the chloramines from the Ute treated water and convert to a free chlorine residual that matches the treated water in the City's distribution system. Breakpoint adjusted Ute water will be blended with the City's treated water in the existing storage tanks.

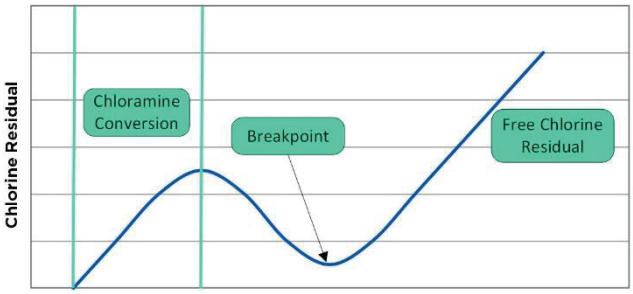

Figure 23: Breakpoint Chlorination Curve

Extensive pilot testing on the two source waters will be required to determine feasibility of blending Ute treated water with the City's water. A corrosion control/blending study is also recommended to determine the outcomes of the proposed break point chlorination design parameters across the City's distribution system.

A monitoring program must be implemented during episodes of blending Ute water. A monitoring program must monitor total chlorine, monochloramine, free ammonia, and free chlorine in the blended water to prevent issues with maintaining the chlorine residual and avoiding nitrification in the distribution network. This monitoring program will help the City verify that the water has reached and exceeded breakpoint chlorination, and that the ammonia has been removed. Nitrification action plans are also required for systems blending free and chloraminated water.

Note that the City's distribution system may encounter elevated concentrations of disinfection byproducts (DBPs) due to the additional chlorine required for breakpoint chlorination.

This Option is based on no expansion of the Ute WTP. This option assumes future Ute peak day demand of 21.5 mgd (30% increase for year 2069). This Option does not provide the future peak day flows of 13

mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage.

Pilot testing, blending studies, monitoring programs and nitrification action plans are not included in the scope of this study.

The following assumptions were used for this Option:

- Raw water source: Plateau Creek via Ute
- Capacity: 6.4 mgd
    - 4.4 mgd water from Ute
    - 2 mgd raw water from KCFL in current condition
- Single interconnection with Ute at Linden Vault
- Adequate pressure (200 psi) at Linden Vault to avoid re-pumping to the City's WTP
- Expand City's on-site sodium hypochlorite system for breakpoint chlorine doses
- Sufficient space for sodium hypochlorite tanks and pumps in existing chemical rooms (no building expansion)
- Must conduct CCS to understand the impact of using Ute water in the City's distribution system

This Option provides access to an alternate water source than the Purdy Mesa.

Figure 24 below illustrates a conceptual process flow diagram for this Option. Figure 25 shows a preliminary alignment for the raw water pipeline from the Linden Vault to the WTP.

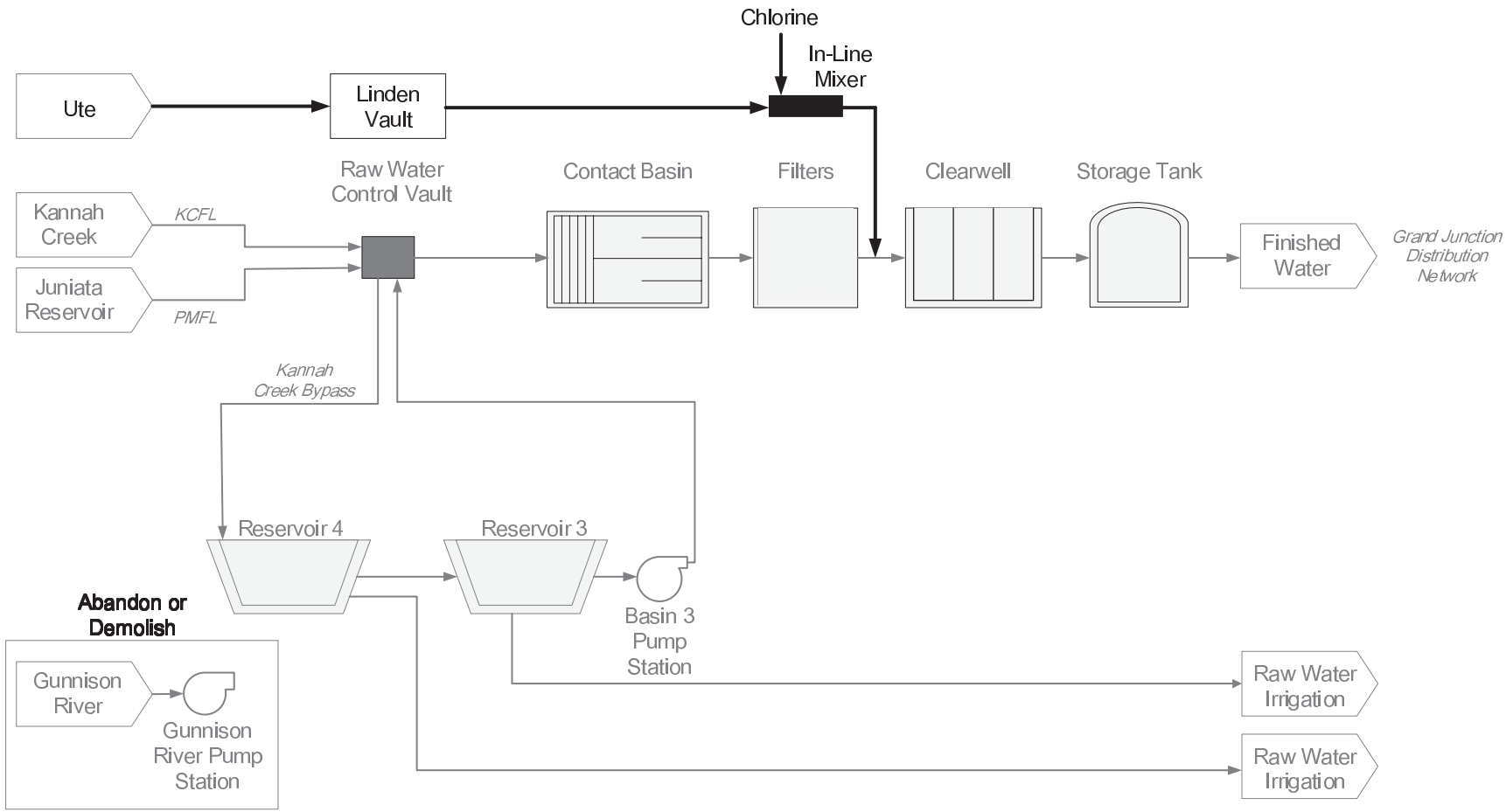

Figure 24: Process Flow Diagram for Option 13

Figure 25: Preliminary Alignment of Pipeline from Linden Vault to GJ WT

3.15 Option 14: Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)

This option is similar to Option 13 in that it involves breakpoint chlorination of water supplied through the Ute interconnect. However, this option involves a partial expansion of the Ute WTP in order to provide a supply of greater future capacity to the City (12.5 mgd). It is anticipated that the City will contribute to the construction, operation, and maintenance of the expanded Ute WTP.

The Ute WTP operates a conventional water treatment facility with chemical flocculation, sedimentation, dual-media filtration, corrosion control, fluoridation, and disinfection.

The existing Ute WTP has a capacity of 25.9 mgd, with a peak day flow of 16.5 mgd. The plant capacity is limited by current filtration capacity. The peak hour operating capacity of the plant, without filter restriction, is 34 mgd. This Option is based on the expansion of the Ute WTP to remove the restriction. The expansion will include 2 additional dual-media filters including filter media. It is assumed that the building will need to be expanded for the new filters, but that existing backwash supply and waste system has enough capacity for the expansion.

The rest of the scope is the same as Option 13, with the exception of the diameter of the pipe from the Linden Vault to the City's WTP. This option requires a 24-inch pipeline.

This option assumes future Ute peak day demand of 21.5 mgd (30% increase). This assumes approximately 12.5 mgd is available for the City. This Option does not quite provide the future peak day flows of 13 mgd. Therefore, WTP flows must be augmented on peak demand days by raw water storage in Reservoirs 3 or 4 or existing distribution system storage.

Pilot testing, blending studies, monitoring programs and nitrification action plans are not included in the scope of this study.

The following assumptions were used for this Option:

- Raw water source: Plateau Creek via Ute
- Adequate water rights and capacity in Ute raw water source to supply both Ute and the City's future needs
- Expand Ute WTP Filtration System from 25.9 to 34 mgd
    - 21.5 mgd for Ute
    - 12.5 mgd for Grand Junction
- Single interconnection with Ute at Linden Vault
- Adequate pressure (200 psi) at Linden Vault to avoid re-pumping to the City's WTP
- Expand City's on-site sodium hypochlorite system for breakpoint chlorine doses
- Sufficient space for sodium hypochlorite tanks and pumps in existing chemical rooms (no building expansion)
- Must conduct CCS to understand the impact of using Ute water in the City's distribution system

This Option provides access to an alternate water source than the Purdy Mesa.

Refer to Figure 24 in Option 13 for a conceptual process flow diagram for this Option. Figure 25 in Option 13 also shows a preliminary alignment for the raw water pipeline from the Linden Vault to the WTP.

3.16 Option 15: Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)

This Option involves the same expansion of the Ute WTP as Option 14, but this Option includes the conversion of City water to chloramines instead of free chlorine. This allows the City to directly utilize any of the eight interconnects with Ute without needing to pump the water to the plant for breakpoint chlorination. It is assumed that the City will utilize the Linden and Riverside Vaults with modifications for flow control. Unlike breakpoint chlorination, this would be a permanent change to WTP operations, not just necessary when utilizing Ute water.

A liquid ammonia sulfate dosing system will be added to the WTP to convert free chlorine into chloramines. This will require a building expansion.

The use of chloramines will result with lower free chlorine levels in the distribution system, which will contribute to lower levels of DBP.

The following assumptions were used for this Option:

- Raw water source: Plateau Creek via Ute
- Adequate water rights and capacity in Ute raw water source to supply both Ute and the City's future needs
- Expand Ute WTP Filtration System from 25.9 to 34 mgd
    - 21.5 mgd for Ute
    - 12.5 mgd for Grand Junction
- Two interconnects with Ute at the Linden and Riverside Vaults
- New 700 square foot liquid ammonia sulfate building at WTP
- Adequate pressure to avoid re-pumping to the City's distribution network
- Must conduct CCS to understand the impact of using Ute water in the City's distribution system

This Option provides access to an alternate water source than the Purdy Mesa.

Converting the City to chloramines will make the disinfection regime incompatible with Clifton, who use free chlorine. This may require renegotiation with Clifton on the interconnection agreement that is based on seasonal flow swapping between the City and Clifton.

Figure 26 shows a map of the top six interconnects the City has with Ute.

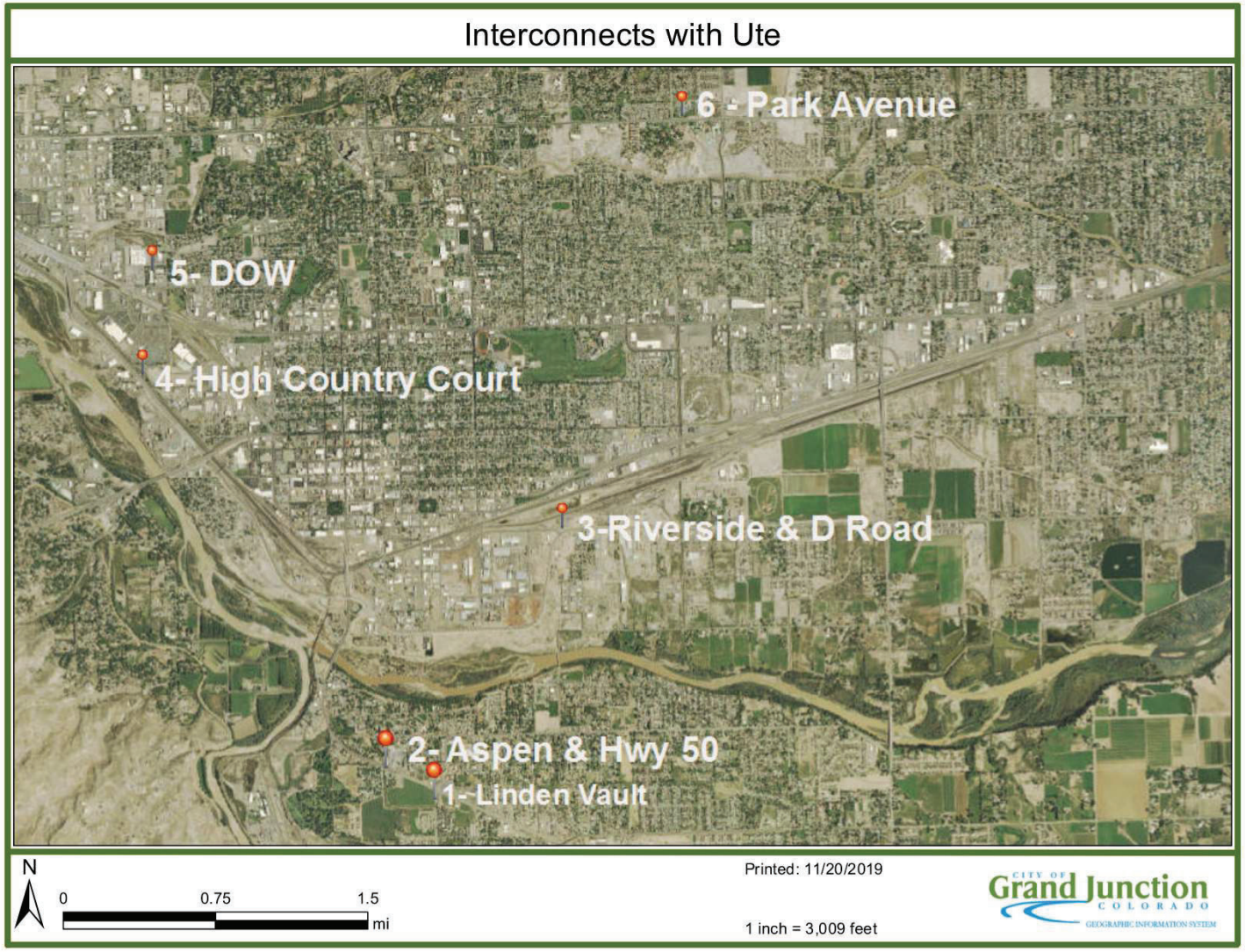

Figure 26: Map of Top Six Interconnects with Ute

4 OPTIONS SUMMARY

4.1 Hydraulic Capacity

Not all Options considered provide a fully redundant supply of 13 mgd flow. Therefore, combinations of sources were used within specific Options to achieve the 13 mgd future peak day flows. Option 9 (Clifton Emergency Interconnect) does not provide full redundancy but is included as an emergency option only. Table 6 summarizes the source, conveyance, and maximum flow of each option.

Table 6: Option Flow Composition

	Option	Source	Conveyance	Flow (mgd)
1	Treat Gunnison by Lime Softening	Gunnison River	GRPS	13.0
2	Treat Gunnison by Reverse Osmosis	Gunnison River	GRPS	13.0
3	Settle Gunnison in Existing Reservoirs and Blend with Clifton	Gunnison River Colorado River	GRPS Clifton	13.0
4	Settle Gunnison in Existing Reservoirs and Use for Raw Water	Gunnison River Kannah Creek	GRPS KCFL	11.7
5	Replace KCFL (24 inch)	Kannah Creek	KCFL	12.5
6	Replace KCFL (20 inch)	Kannah Creek	KCFL	9.7
7	Replace KCFL (24 inch) and Add Turbine	Kannah Creek	KCFL	12.5
8	New WTP in Kannah Creek Watershed	Kannah Creek	KCFL	12.5
9	Clifton Water Emergency Interconnect	Colorado River Kannah Creek	Clifton KCFL	7.5
10	Transfer Colorado Water Rights to Clifton for Treatment (Full Exp., 24 inch)	Colorado River	Clifton	13.0
11	Transfer Colorado Water Rights to Clifton for Treatment (Part. Exp., 20 inch)	Colorado River	Clifton	8.0
12	Route Gunnison to Clifton WTP	Colorado River (Same as Option 10)	Clifton	13.0
13	Purchase Treated Water from Ute (No Ute Exp., Breakpoint Chlorination)	Grand Mesa	Ute	6.4
14	Purchase Treated Water from Ute (Ute Exp., Breakpoint Chlorination)	Grand Mesa	Ute	12.5
15	Purchase Treated Water from Ute (Ute Exp., Chloramine Conversion)	Grand Mesa	Ute	12.5

Figure 27 illustrates the combination of sources for each Option and their respective hydraulic capacities. Flows must be augmented on peak demand days by either raw water storage in Reservoirs 3 or 4 or the City's existing treated water storage reservoirs. The 5.5 mgd capacity interconnection with Clifton may also be used to augment Options (except Option 15) which do not provide 13 mgd.

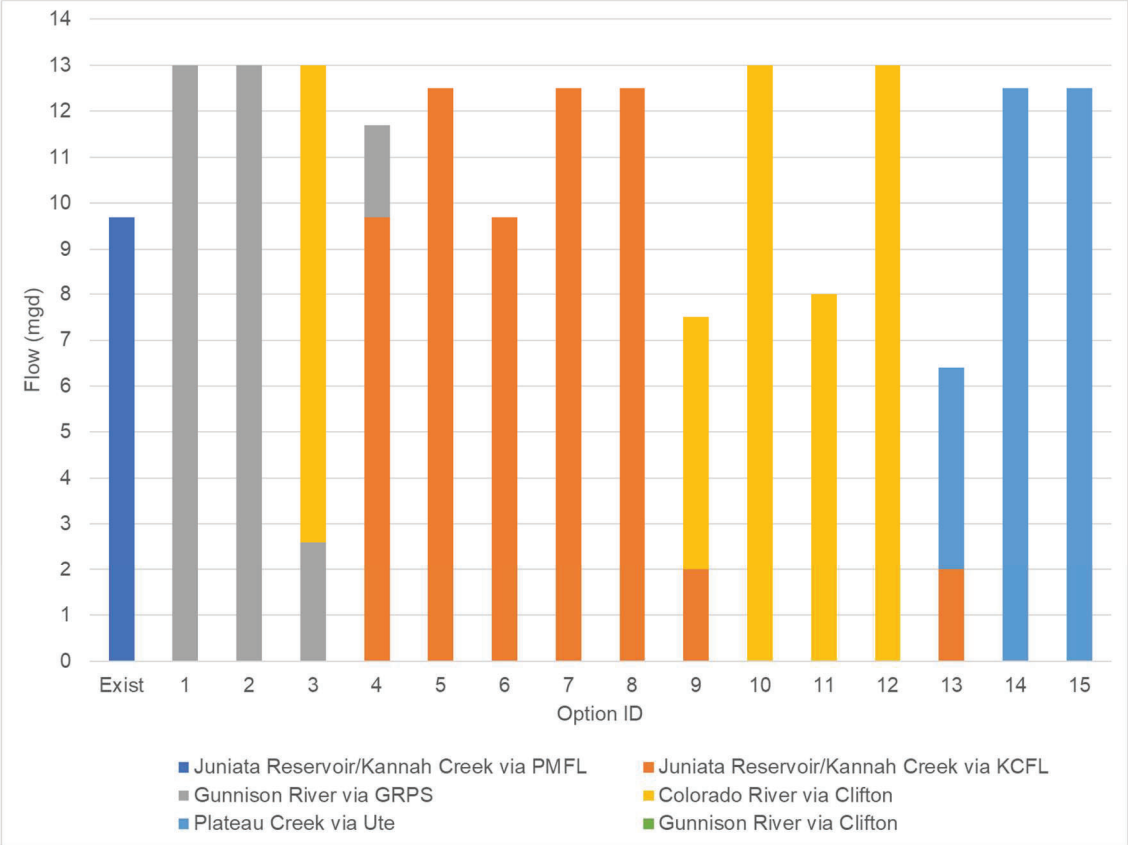

Figure 27: Hydraulic Capacity by Option

4.1.1 Treated Water Storage

The City has two 4 mg ground storage tanks at the WTP site (8 mg total). There is no treated water storage in the distribution system. Treated water storage capacity is determined through engineering studies to assess domestic demands and fire flows. Generally, water storage tanks provide:

- Peak balancing storage for instantaneous demands greater than the WTP production rate,
- Fire flows, and
- Emergency storage.

Current and future peak day demands are discussed in Section 2.4.

Fire flows in Grand Junction are based on the 2000 edition of the International Fire Code (IFC). Fire flow rates are determined by the size of the building, its use, and type of construction. Fire flows range from a minimum of 1,500 gpm for single family dwellings to 8,000 gpm for large buildings per Table B105.1 of the IFC. An assumed fire flow of 6,000 gpm is used in this study, which represents a Type 1A building of over 300,000 square feet. A duration of 4 hours required for fire flows of 6,000 gpm.

Emergency storage is available to serve customers in the event of a watermain break or service interruption at the WTP. Emergency storage may be reduced if there is sufficient capacity in the source water supply and the WTP with standby power to meet peak demands. Excess capacity may lead to water quality deterioration.

Table 7: Grand Junction Treated Water Storage

Component	Design Criteria	Flow / Volume	Volume
Peak balancing	25% of maximum day demand	13 mgd	3.3 mg
Fire flow	Table B105.1 IFC, 2000	6,000 gpm for 4 hours	1.4 mg
Emergency storage	15% of average day flow	6.5 mgd	1.0 mg
		Recommended treated water storage (future)	5.7 mg
		Actual treated water storage	8.0 mg
		Spare treated water storage (future)	2.3 mg

Table 7 indicates the City has spare storage available in the existing treated water storage tanks. This volume is available for short term operational issues, such as line breaks in the PMFL or KCFL or periodic maintenance at the WTP. The contributes to the City's goal of operational redundancy. This equates to approximately 30 hours of treated water supply at the current average day demand of 4.7 mgd, while maintaining the recommended fire flow and emergency storage volumes in the tanks. The available treated water storage is augmented by the up to 23 mg of raw water storage in Reservoirs 3 and 4 (approximately 5 days of storage at current average day demands).

Further engineering analysis and modeling is recommended to assess the benefit of additional treated water storage in the distribution system, its potential volume and location. Potential sites may require land acquisition and may modify the operating pressures due to the tank elevation. Additional water storage may impact water quality due to a longer water age.

4.2 Cost Comparison

4.2.1 Engineer's Opinion of Probable Construction Costs

EOPCC were completed in accordance with the Association for the Advancement of Cost Engineering (AACE) Class 4 definition. Class 4 EOPCC are prepared to evaluate and compare the options presented in Section 2. Class 4 EOPCC are generally developed with limited information and subsequently vary in their accuracy. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval.

Class 4 EOPCC are typically based on 1% to 15% complete design development, comprising at a minimum of:

- Plant capacity,
- Block schematics,
- Process flow diagrams (PFDs) for main process systems,
- Preliminary equipment lists, and
- Pipeline diameter and initial routing.

The expected accuracy range is -15% to -30% below and +20% to +50% above. Vendor quotes were sought and gross unit costs/ratios from past projects were used to develop the estimates in this study.

Contingency values range from 10 to 30% based on the level of detail known for each option. Major scope items and EOPCC for each option are presented in Appendices A and B, respectively. A summary of each option including EOPCC and construction cost per gallon of capacity can be found in Table 8.

The estimates, analyses, and recommendations contained in this analysis are based on professional experience, qualifications, and judgment. BMcD has no control over weather; cost and availability of labor, material, and equipment; labor productivity; energy or commodity pricing; demand or usage; population demographics; market conditions; changes in technology; and other economic or political factors affecting such estimates, analyses, and recommendations. Therefore, BMcD makes no guarantee or warranty (actual, expressed, or implied) that actual results will not vary, perhaps significantly, from the estimates, analyses, and recommendations contained herein.

4.2.2 Escalation

The EOPCC presented in this study are based on 2020 dollars at the time of issue. The use of the costs presented in this study should be escalated if used for future purposes to reflect changes in labor, material, and equipment. Local cost data or published cost indices should be consulted to determine an appropriate cost escalation factor.

Table 8: Summary of EOPCC

	Option	EOPCC	Capital Cost/Gal	Notes
1	Treat Gunnison by Lime Softening	$41,900,000	$3.22/gal	$15,300,000 Lime Softening $10,600,000 Solids Handling
2	Treat Gunnison by Reverse Osmosis	$70,900,000	$5.45/gal	$28,800,000 RO Treatment $42,100,000 Brine Disposal
3	Settle Gunnison in Existing Reservoirs and Blend with Clifton	$18,100,000	$1.39/gal	
4	Settle Gunnison in Existing Reservoirs and Use for Raw Water	$23,300,000	$1.99/gal	11.7 mgd
5	Replace KCFL (24 inch)	$27,900,000	$2.23/gal	12.5 mgd
6	Replace KCFL (20 inch)	$23,000,000	$2.32/gal	9.7 mgd
7	Replace KCFL (24 inch) and Add Turbine	$39,200,000	$3.14/gal	$28,000,000 Pipeline $1,500,000 Turbine plus $7,300,000 Electrical Transmission
8	New WTP in Kannah Creek Watershed	$59,400,000	$4.75/gal	$20,300,000 WTP $28,200,000 Pipeline
9	Clifton Water Emergency Interconnect	N/A	N/A	7.5 mgd
10	Transfer Colorado Water Rights to Clifton for Treatment (Full Exp., 24 inch)	$44,600,000	$3.43/gal	$37,300,000 Clifton WTP expansion with evap. ponds $7,300,000 Pipeline
11	Transfer Colorado Water Rights to Clifton for Treatment (Part. Exp., 20 inch)	$25,300,000	$3.16/gal	$19,400,000 Clifton WTP expansion with evap. ponds $5,900,000 Pipeline
12	Route Gunnison to Clifton WTP	$44,600,000	$4.31/gal	Same as Option 10
13	Purchase Treated Water from Ute (No Ute Exp., Breakpoint Chlorination)	$2,900,000	$0.66/gal	Excluding CCS, blending study, monitoring costs 4.4 MGD
14	Purchase Treated Water from Ute (Ute Exp., Breakpoint Chlorination)	$12,800,000	$1.02/gal	Excluding CCS, blending study, monitoring costs 12.5 MGD
15	Purchase Treated Water from Ute (Ute Exp., Chloramine Conversion)	$17,000,000	$1.36/gal	Excluding CCS, blending study, monitoring costs 12.5 MGD

4.2.3 Operating Costs

Operations and maintenance (O&M) costs were developed under the following assumptions:

- Operating costs are based on one month use of the alternate source at current peak day flow (9.8 mgd). This value was chosen to compare to current baseline O&M costs. If option provides less than 9.8 mgd, cost is based on the lower value.
- O&M costs include chemical and electricity usage
- O&M costs exclude consumables and labor
- Treatment costs based on typical cost per 1,000 gallon (kgal) from white paper research:
    - $0.50/kgal for lime softening
    - $1.00/kgal for reverse osmosis
- Gunnison River Options
    - $35,000 pumping cost for 9.8 mgd
    - $5,000 pumping cost for 2 mgd (Option 4)
- O&M cost equivalent for KCFL is equivalent to the existing PMFL ($88,000/month)
- O&M cost for new Kannah Creek WTP (Option 8) equivalent to existing WTP
- Hydro-turbine operating costs
    - Power generation estimated 370 psi available head at average flow of 5.3 mgd
    - Turbine efficiency 73%
    - Energy cost savings of $0.034/kWh
    - Electrical demand charge savings vary seasonally between $18 and $23 per kW
- Clifton Interconnect Options
    - Purchase cost of treated water includes O&M cost (e.g. pump costs from CWD)
    - Current agreement of $0.30/kgal treated water between the City and CWD may need to be renegotiated
- Ute Interconnect Options
    - Purchase cost of treated includes O&M cost (e.g. pump costs from Ute)
    - No current agreement for treated water.
    - City and Ute to negotiate bulk purchase agreement.
        - Ute water rates as published on the City's website
        - Assumed Ute's cost to supply water is their Tier 2 rate of $3.70/kgal
        - Assumed that the negotiated interconnection rate between the City and Ute will be higher than their cost to supply water (Tier 2). Applied Ute's Tier 3 rate of $4.20/kgal for purposes of this study
        - Note that the purchase cost of water from Ute may be as high as $7.22/kgal

A comparison of the O&M costs versus the bulk water purchase costs is shown in Table 9.

Table 9: Summary of Purchase and Operating Costs by Month

	Option	Purchase Cost	O&M Cost	Total Cost
1	Treat Gunnison by Lime Softening	NA	$233,000	$233,000
2	Treat Gunnison by Reverse Osmosis	NA	$379,000	$379,000
3	Settle Gunnison in Existing Reservoirs and Blend with Clifton	$70,000	$93,000	$163,000
4	Settle Gunnison in Existing Reservoirs and Use for Raw Water	NA	$93,000	$93,000
5	Replace KCFL (24 inch)	NA	$88,000	$88,000
6	Replace KCFL (20 inch)	NA	$88,000	$88,000
7	Replace KCFL (24 inch) and Add Turbine	NA	$71,000	$71,000
8	New WTP in Kannah Creek Watershed	NA	$88,000	$88,000
9	Clifton Water Emergency Interconnect	$50,000	$18,000	$68,000
10	Transfer Colorado Water Rights to Clifton for Treatment (Full Expansion, 24 inch)	$88,000	NA	$88,000
11	Transfer Colorado Water Rights to Clifton for Treatment (Partial Expansion, 20 inch)	$72,000	NA	$72,000
12	Route Gunnison to Clifton WTP	$88,000	NA	$88,000
13	Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)	$554,000	$30,000	$584,000
14	Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)	$1,222,000	$30,000	$1,252,000
15	Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)	$1,222,000	$30,000	$1,252,000

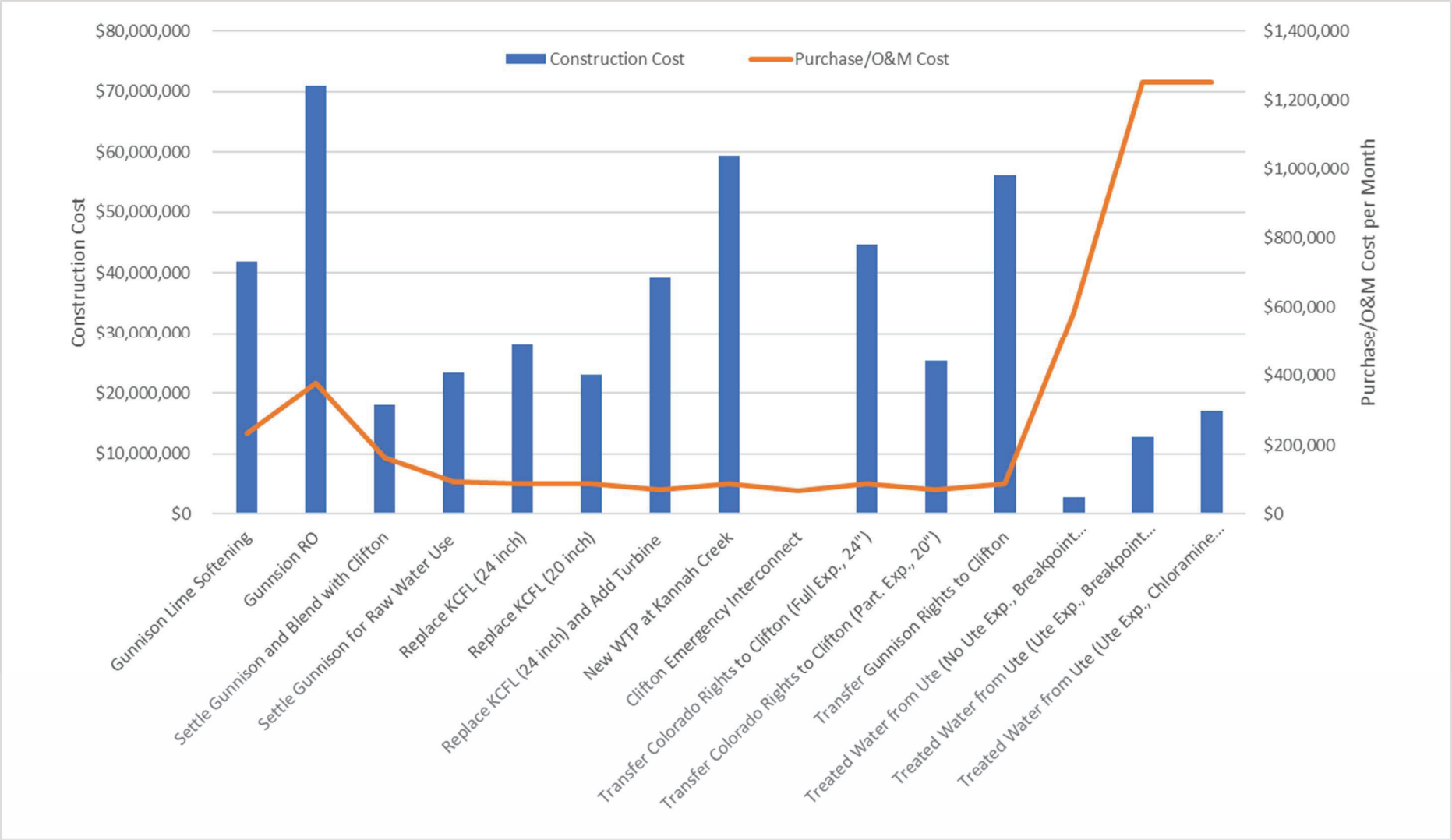

Figure 28: Comparison of Construction and O&M Costs

5 EVALUATION

The Project Team held a series of meetings in order to develop the Options for alternative water supplies. A Selection Workshop was held in January 2020 to evaluate the identified Options and select the preferred Option for conceptual design. The Project Team included the Utilities Director, Water Services Manager, Water Operations, Water Distribution, Asset Management and BMcD. The results of this initial Selection Workshop are document in Appendix C.

Three additional Options were added in April 2020 following a meeting with key stakeholders from the City. The Options were then re-ranked using a qualitative, non-monetary selection criteria. The results of the second evaluation are presented in the following sections.

5.1 Initial Screening

The following options are recommended for disqualification from the evaluation for the reasons presented in Table 9.

Table 10: Disqualified Options

	Option	Reason
2	Treat Gunnison by Reverse Osmosis	High capital cost to treat Gunnison River Option 1 (lime softening) provides lower cost of treatment
4	Settle Gunnison in Existing Reservoirs and Use for Raw Water	Does not provide acceptable water quality for raw water irrigation
7	Replace KCFL (24 inch) and Add Turbine	Feasibility not confirmed with Grand Valley Power. Potential energy production of turbine does not pay for extensive electrical upgrades
8	New WTP in Kannah Creek Watershed	High capital cost for new facility New WTP is redundant to the existing WTP KCFL update required to deliver water to City
9	Clifton Water Emergency Interconnect	Does not provide a fully redundant alternative Capacity well less than future peak day demand of 13 mgd
12	Route Gunnison to Clifton WTP	High infrastructure cost to send Gunnison River to Clifton replaced by water transfer Transfer City's Colorado River rights to Clifton and replace with City's Gunnison River allocation at confluence Becomes same as Option 10

Table 11: Options Evaluated by Project Team

#	Option
1	Treat Gunnison River by Lime Softening
3	Settle Gunnison River in Existing Reservoirs and Blend with Clifton
5	Replace Kannah Creek Flow Line (24 inch)
6	Replace Kannah Creek Flow Line (20 inch)
10	Transfer Colorado River Rights to Clifton for Treatment (Full Expansion, 24 inch)
11	Transfer Colorado River Rights to Clifton for Treatment (Partial Expansion, 20 inch)
13	Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)
14	Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)
15	Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)

5.2 Scoring of Options

A multi-step process was used to evaluate the technical, qualitative, and monetary criteria of each option. The first step involved developing the non-monetary criteria and then ranking the criteria in a Workshop with the Project Team. The selected criteria are shown in Table 12.

Table 12: Selection Criteria

Criteria Category	Description
Operational Redundancy	Ability to provide full redundancy of up to 13 mgd to the Purdy Mesa flowline. Options scoring high in this category can provide full redundancy to Purdy Mesa flowline without concern over water rights. Low scoring options do not provide the full capacity of 13 mgd.
Raw Water Quality	Measure of the raw water quality of the source water(s) included within the option. Options scoring high in this category mean the sources have water quality similar to Purdy Mesa. Low scoring options have poor source water quality.
Finished Water Quality	Measure of the anticipated finished water quality as a result of the treatment associated with the option. Options scoring high in this category mean the treatment is expected to produce finished water similar or better than the current WTP. This criteria also considers the satisfaction of raw water customers.
Long Term Resiliency	Ability to supply raw water from an alternative source in the event of a long term interruption to the City's primary source (Juniata Reservoir and Kannah Creek watershed).
Complexity of Sources	Evaluates the number of sources required to provide a fully-redundant capacity and the complexity to operate multiple sources. Options scoring high in this category only require one source to create redundancy.
Ease of Operations	Evaluates the complexity of operations and maintenance, number of treatment process steps and units and chemical dosing systems associated with the option. Options scoring high in this category apply operating procedures similar or less complex than the current WTP.
Public Perception	Evaluates the public perception to the alternate water source. Public opinion prefers elevated sources, considered pristine mountain source. Less favorable view of using river sources.

The second step ranked the non-monetary criteria used a paired comparison to identify the weighting for each criterion (Table 13). Each criteria were paired against the other criteria, with the criteria of higher importance being preferred. The alphanumeric identification of the preferred criteria is recorded in Table 13 (e.g. B). Then the degree to which the criteria was preferred were scored on their relative importance on a scale of 1 to 3, with 3 as a high importance. The numeric score of the preferred criteria is recorded in Table 13 (e.g. 2), resulting in a paired score (e.g. B2).

Table 13: Weighted Criteria

DEVELOP CRITERIA & WEIGHTED MATRIX										
ITEM	CRITERIA	RELATIVE IMPORTANCE							SCORE	NORMALIZED
A	Operational Redundancy	A	A 3	A 3	A 1	A 1	A 2	A 1	11	2.9
B	Raw Water Quality		B	C 3	D 2	B 2	B 1	G 3	3	0.8
C	Finished Water Quality			C	D 2	C 1	C 2	C 1	7	1.8
D	Long Term Resiliency				D	D 1	F 1	G 2	5	1.3
E	Complexity of Sources					E	E 3	G 2	3	0.8
F	Ease of Operations						F	G 1	1	0.3
G	Public Perception							G	8	2.1
Directions: For each pair, select the more important criteria. Then choose a relative importance between 1-3 (3 as high importance).									38	10

Next, the Project Team scored each Option against the criteria on a scale of 1 to 5, with 5 being high (Table 14).

Table 14: Scored Options

SCORE OPTIONS								
Option	Operational Redundancy	Raw Water Quality	Finished Water Quality	Long Term Resiliency	Complexity of Sources	Ease of Operations	Public Perception	Total
Option 1: Treat GR by Lime Softening	5	1	2	5	1	1	1	16
Option 3: Blend GR with Clifton	5	2	1	5	1	2	2	18
Option 5: 24-in KCFL	5	5	5	2	5	5	5	32
Option 6: 20-in KCFL	4	5	5	2	5	4	5	30
Option 10: Transfer Add. CR to Clifton, Full Ex., 24-in	5	1	3	5	2	3	3	22
Option 11: Transfer Add. CR to Clifton, Part. Ex., 20-in	3	1	3	5	2	3	3	20
Option 13: No Ute Expansion, Breakpoint Chlor.	2	4	4	4	3	3	4	24
Option 14: Ute Expansion, Breakpoint Chlor.	5	4	4	4	4	4	4	29
Option 15: Ute Expansion, Chloramine Conversion	5	4	5	3	4	3	4	28
Directions: Score each option for each criteria between 1-5 (5 is high).								

The weighting criteria was then applied to the scores to establish a weighted score (Table 15).

Table 15: Weighted Scored Options

WEIGHT SCORED OPTIONS								
Option	Operational Redundancy	Raw Water Quality	Finished Water Quality	Long Term Resiliency	Complexity of Sources	Ease of Operations	Public Perception	Total
Option 1: Treat GR by Lime Softening	55	3	14	25	3	1	8	109
Option 3: Blend GR with Clifton	55	6	7	25	3	2	16	114
Option 5: 24-in KCFL	55	15	35	10	15	5	40	175
Option 6: 20-in KCFL	44	15	35	10	15	4	40	163
Option 10: Transfer Add. CR to Clifton, Full Ex., 24-in	55	3	21	25	6	3	24	137
Option 11: Transfer Add. CR to Clifton, Part. Ex., 20-in	33	3	21	25	6	3	24	115
Option 13: No Ute Expansion, Breakpoint Chlor.	22	12	28	20	9	3	32	126
Option 14: Ute Expansion, Breakpoint Chlor.	55	12	28	20	12	4	32	163
Option 15: Ute Expansion, Chloramine Conversion	55	12	35	15	12	3	32	164
Directions: Table autopopulates based on weight of criteria and scored options.								

High Score	Option 5: 24-in KCFL

The Options were then ranked by their weighted score and compared against the EOPCC (Table 16). The cost/benefit for each Option was calculated by dividing the EOPCC by the weighted score. A low cost/benefit indicates a favorable Option, with more benefit achieved at a lower cost investment.

Table 16: Comparison of EOPCC and Weighted Score

Comparison of EOPCC and Weighted Score					
Option		EOPCC	Weighted Score		Cost/Benefit
Option 5: 24-in KCFL	$	27,900,000	175	$	159,000
Option 15: Ute Expansion, Chloramine Conversion	$	17,000,000	164	$	104,000
Option 6: 20-in KCFL	$	22,200,000	163	$	136,000
Option 14: Ute Expansion, Breakpoint Chlor.	$	12,800,000	163	$	79,000
Option 10: Transfer Add. CR to Clifton, Full Ex., 24-in	$	44,600,000	137	$	326,000
Option 13: No Ute Expansion, Breakpoint Chlor.	$	2,900,000	126	$	23,000
Option 11: Transfer Add. CR to Clifton, Part. Ex., 20-in	$	25,300,000	115	$	220,000
Option 3: Blend GR with Clifton	$	18,100,000	114	$	159,000
Option 1: Treat GR by Lime Softening	$	41,900,000	109	$	384,000

Figure 29 presents the relative benefit of the evaluated Options against their EOPCC.

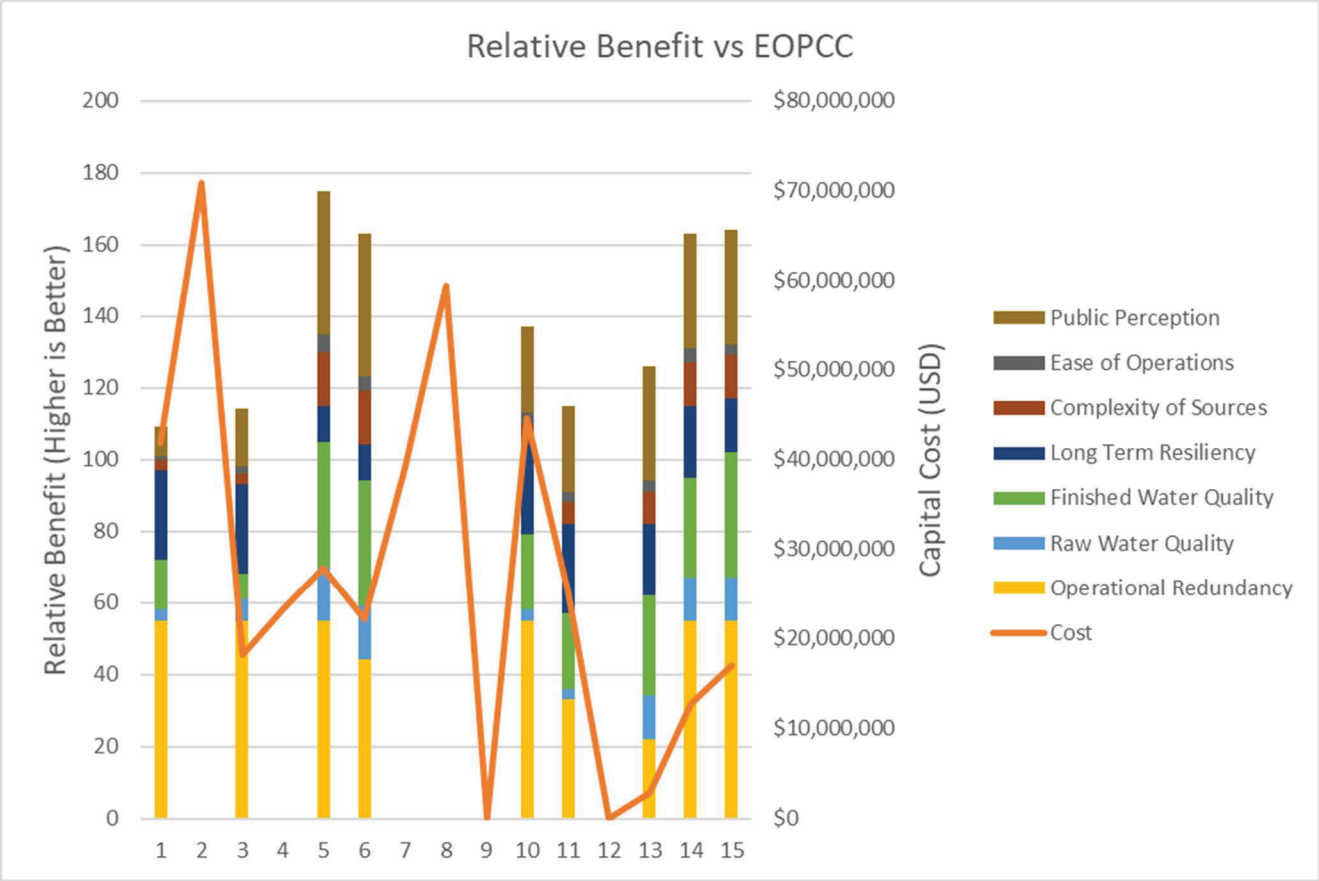

Figure 29: Relative Benefit of Each Option

Figure 30 presents the relative cost/benefit for each Option.

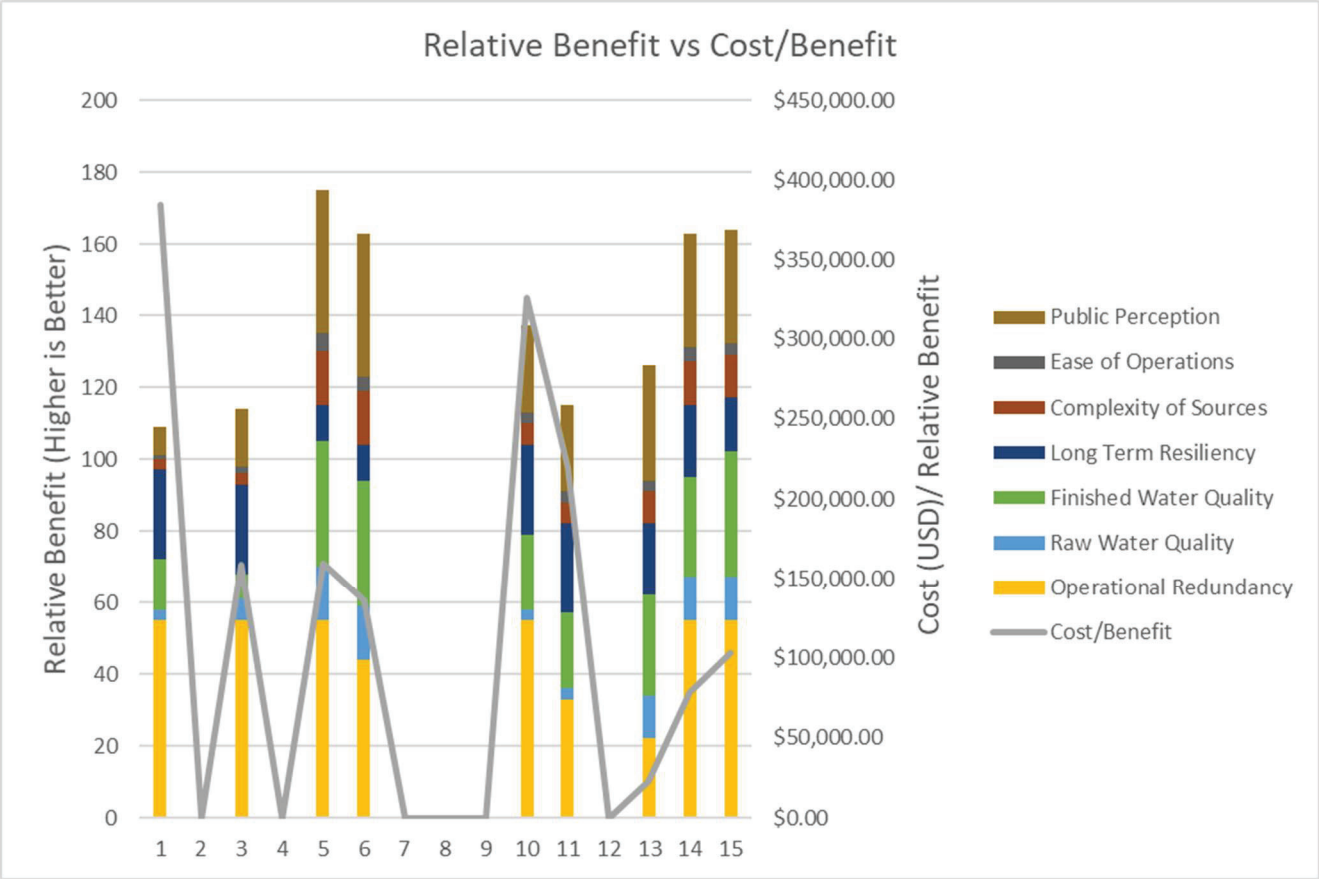

Figure 30: Relative Cost/Benefit of Each Option

The Options were also compared against the operating costs (Table 17). The cost/benefit for each Option was calculated by dividing the EOPCC by the weighted score. A low cost/benefit indicates a favorable Option, with more benefit achieved at a lower cost investment.

Table 17: Comparison of Operating Cost and Weighted Score

Comparison of Monthly Operating Cost and Weighted Score				
Option	Monthly Op. Cost		Weighted Score	Op. Cost/Benefit	
Option 5: 24-in KCFL	$	88,000	175	$	500
Option 15: Ute Expansion, Chloramine Conversion	$	1,252,000	164	$	7,630
Option 6: 20-in KCFL	$	88,000	163	$	540
Option 14: Ute Expansion, Breakpoint Chlor.	$	1,252,000	163	$	7,680
Option 10: Transfer Add. CR to Clifton, Full Ex., 24-in	$	88,000	137	$	640
Option 13: No Ute Expansion, Breakpoint Chlor.	$	584,000	126	$	4,630
Option 11: Transfer Add. CR to Clifton, Part. Ex., 20-in	$	72,000	115	$	630
Option 3: Blend GR with Clifton	$	163,000	114	$	1,430

Figure 31 presents the relative benefit of the evaluated Options against their monthly operating cost.

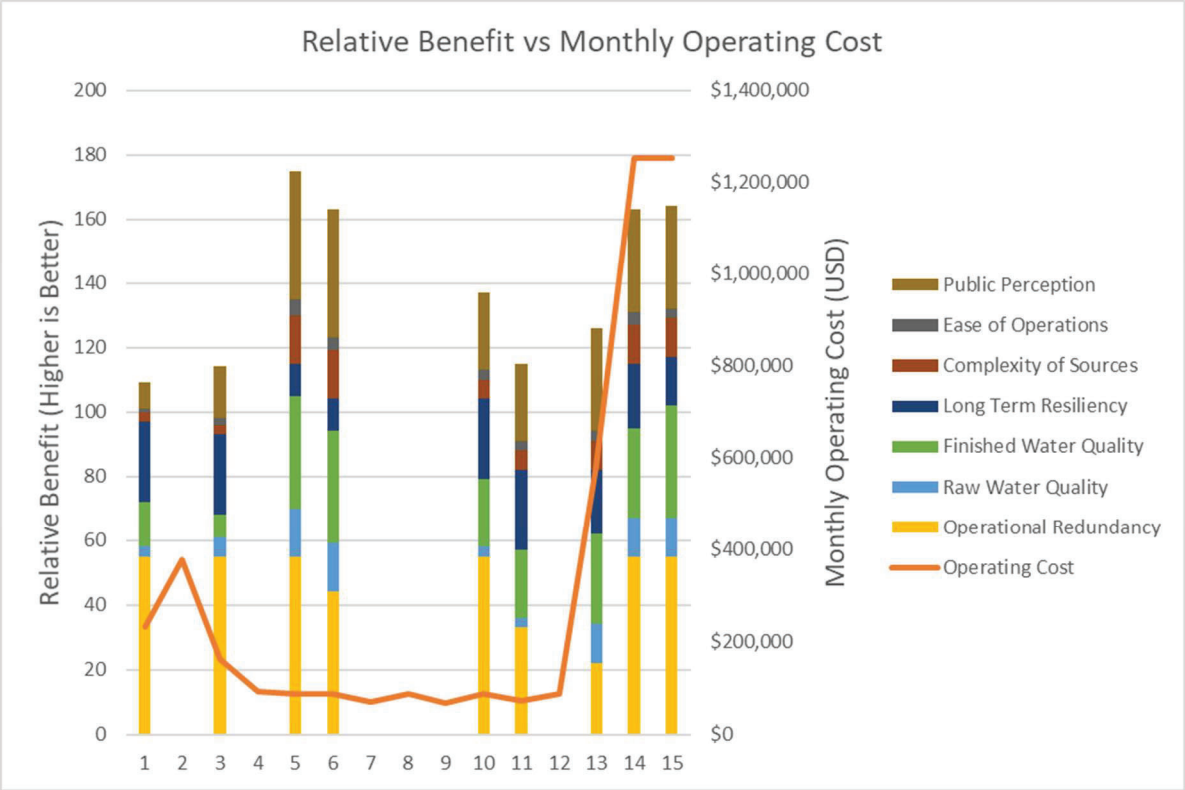

Figure 31: Relative Benefit of Each Option vs Monthly Operating Cost

Figure 32 presents the relative cost/benefit for each Option.

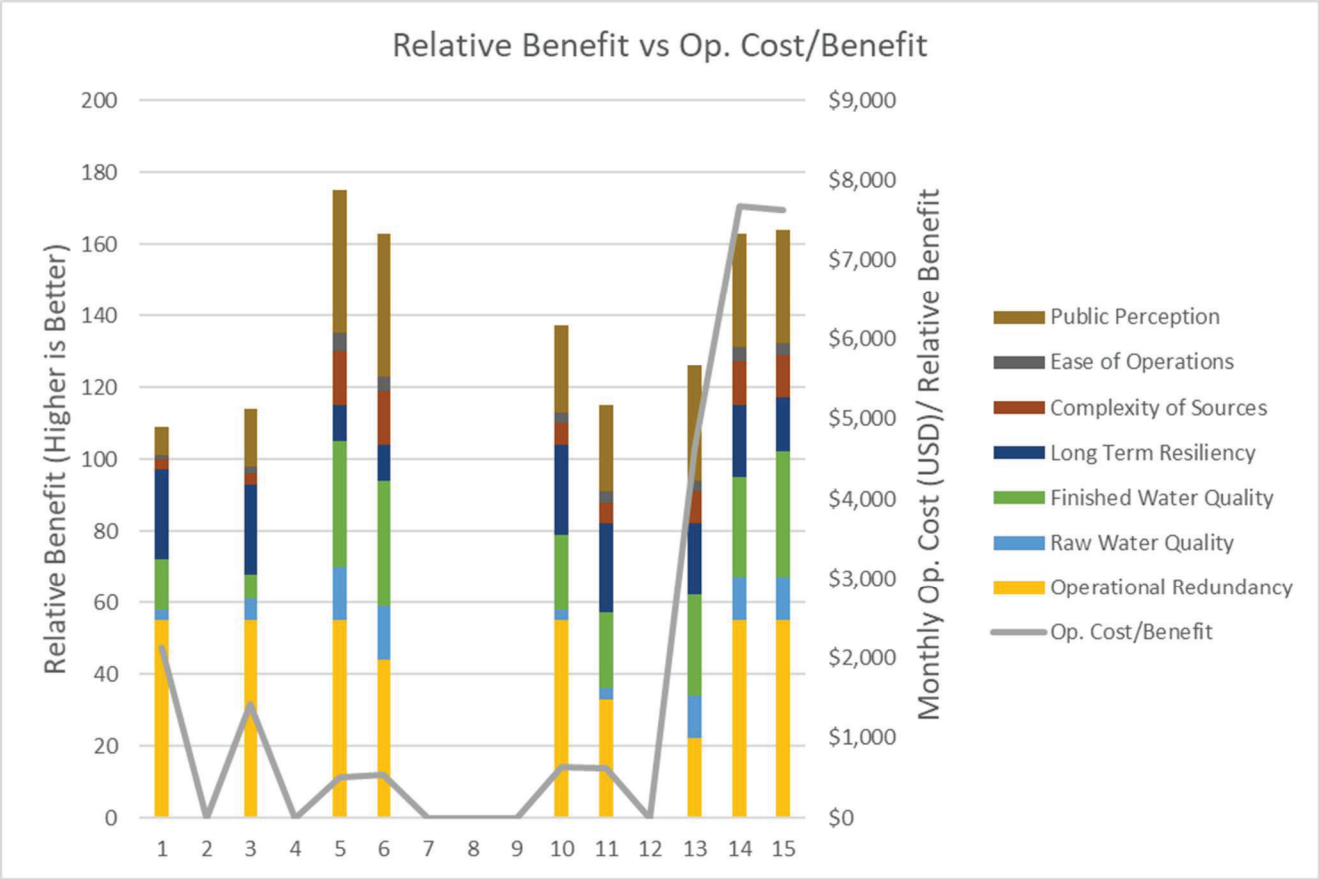

Figure 32: Relative Operating Cost/Benefit of Each Option

Options receiving high weighted scores include the both KCFL replacement Options (Option 5 and 6) and two Ute Options (Option 14 and 15). Of these, Option 14 has the lowest cost/benefit ratio for construction cost, while Option 5 has the lowest cost/benefit ratio for operating costs.

6 CONCLUSIONS

6.1 Scoring Results

Table 18 summarizes the Options that received the highest weighted scores.

Table 18: Highest Weighted Scores

#	Option	Weighted Score	Primary Criteria
5	Replace Kannah Creek Flow Line (24 inch)	175	Operational Redundancy
15	Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)	164	Long Term Resiliency
6	Replace Kannah Creek Flow Line (20 inch)	163	Operation Redundancy
14	Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)	163	Long Term Resiliency

The scoring indicates two types of projects will provide benefit to the City, but the nature of their benefit differs. The KCFL options provide multiple ways to access the full water rights from the Purdy Mesa. This prioritizes operational redundancy. However, the KCFL options do not provide long term resiliency for the City as a source interruption would leave the City without a water supply. In this case, the City has the option to pursue either interconnects with Clifton or Ute. The two Ute options scored higher as a mountain source with minimal capital improvements required.

6.1.1 Operational Redundancy – KCFL Replacement

The two KCFL Options scored very similarly, with high scores across all criteria. A new KCFL will provide operational redundancy to the PMFL but does not provide long term resiliency. Raw and Finished Water Quality from a replaced KCFL will be similar to the current conditions because it will draw from the same Juniata Reservoir and Kannah Creek sources. This fact contributed to the high score for Complexity of Sources by remaining consistent with current operational practices. Public Perception is expected to remain favorable for continuing with the higher quality mountain sources accessed from the KCFL. Some regulatory challenges are anticipated related to right of way and easement access along the KCFL pipeline route. The 24-inch Option scored higher in Ease of Operation due to only one PRV chamber when compared with two PRV chambers on the 20-inch Option.

The two KCFL Options received high weighted scores, with the 24-inch Option (175 points) scoring higher than the 20-inch Option (163 points) because of the higher complexity of operating two PRV chambers on the 20-inch pipeline as well as the lower capacity. The hydraulic capacity of the 20-inch Option (9.5 mgd) does not supply the future peak day demand of 13 mgd. The 24-inch Option received the highest weighted score and provides a greater hydraulic capacity than the 20-inch Option. The City retains their independence and control of its water supply with both KCFL Options. The cost/benefit of the 24-inch Option was $159,000 per weighted score point for construction cost, while the op. cost/benefit was $500 per weighted score point.

6.1.2 Long Term Resiliency – Ute Interconnection

The two Ute Options involving Ute expansion also scored high across all criteria, however, operational challenges associated with the blending of the two sources affected the Complexity of Sources and Ease of Operations scores. Further study and a CCS are recommended before the blending of Ute waters into the City's distribution system. This will involve review and approvals by CDPHE before implementation. Public Perception is expected to be favorable with Ute's mountain source in comparison to Clifton's river source. The Ute Options will be implemented at a much lower construction cost when compared with other Options, resulting in a significantly lower cost/benefit ratio.

An interconnection agreement with Ute must be negotiated to confirm bulk water purchase costs before the financial impact of this Option are fully understood. The Ute Option will increase the City's reliance on another government entity for its back-up supply, but it also provides both operational redundancy and long term resiliency where the KCFL options do not. However, Option 15 would result in a loss in the ability to trade water with Clifton easily.

The Ute Options warrant further investigation if the City is interested in pursuing a lower cost Option ($12,800,000/$17,00,000) with a relatively high weighted score (163/164 points) to increase long term resiliency. These Options resulted in a lower cost/benefit score ($79,000/$104,000 per weighted score point) due to low estimated construction costs. However, these Options also resulted in a significantly higher op. cost/benefit score ($7,630/$7,680 per weighted score point). The Ute Options will require dependence on another government agency and the City will not be providing their own water. The bulk water purchase cost, future Ute water demands, and water quality studies (corrosion control and disinfection by-products) require additional investigation.

Although Option 15 received a minimally higher score than Option 14, the City should consider that Option 15 limits the ability to exchange water with Clifton. If the City decides to pursue one of the Ute options and wants to split the project into two phases (e.g. chemical system modifications at the WTP in one phase, Ute expansion in second phase), Option 14 allows greater flexibility to source water from both Clifton and Ute in the intermediate phase when full capacity is not available from Ute.

6.1.3 Other Options

Treatment Options using the Gunnison River at the City's WTP or the Colorado River at Clifton's WTP did not score well in Finished Water Quality, Complexity of Sources, and Public Perception. Additionally, these Options had comparatively high cost/benefit ratios due to their high construction and operating costs.

6.2 Recommendations

It is recommended to implement the following:

1. Implement either KCFL Option for operational redundancy from the Purdy Mesa source. Consider the benefit of 20 or 24-inch diameter pipeline against the overall project cost.

2. Investigate the feasibility of a Ute interconnection for long term resiliency. Start preliminary discussions with Ute on the terms and bulk purchase cost in a formal interconnection agreement.

3. Determine the City's preference for break-point chlorination of Ute treated water at the WTP or conversion of the City to chloramines to facilitate multiple Ute interconnection in the distribution system.

4. Start the design and construction of the Juniata Reservoir Interconnect to create access to both the Juniata Reservoir and the Kannah Creek watersheds from either the PMFL or KCFL, regardless of which Option is selected.

APPENDIX A – DETAILED SCOPE BY OPTION

Option 1: Treat Gunnison River by Lime Softening	
Gunnison River Pump Station Improvements	Five vertical turbine pumps (4 duty, 1 standby) • Rated for 2,246 gpm @ 250 foot TDH • Maximum speed of 1800 RPM • 200 HP Motor, VFD • Oil lubricated enclosed line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station Building • Demolish existing above grade building • Raise floor above floodplain • 20 foot by 20 foot masonry building with steel roof • Replace electrical systems
Lime Softening Clarifiers, Dewatering Systems, and Building	Three softening clarifiers (2 duty, 1 standby) • 3470 gpm/clarifier • 0.75 to 1 gpm/sf • 76 foot diameter • Coated Steel Basins • Lime slurry feed silo • Carbon dioxide feed • Soda ash feed Dewatering Systems • Belt filter presses • Solids feed pumps and conveyors Chemical Feed and Solids Handling Building • 75 foot by 75 foot masonry building with steel roof
Filter Feed Pump Station	Filter Feed Pumps: • Five vertical turbine pumps (4 duty, 1 standby) • Rated for 2,246 gpm @ 30 foot TDH • Maximum speed of 1200 RPM • 30 HP Motor, VFD • Oil lubricated enclosed line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal Pump Station • New concrete wet well • 30 foot by 30 foot masonry building near PS3
Disclaimer: Equipment selections are based on representative projects in Colorado and engineers' experience. The information presented is intended to provide sizing in order to estimate costs.	

Option 2: Treat Gunnison River by Reverse Osmosis	
Gunnison River Pump Station Improvements	Five vertical turbine pumps (4 duty, 1 standby) • Rated for 2,246 gpm @ 250 foot TDH • Maximum speed of 1800 RPM • 200 HP Motor, VFD • Include an oil lubricated enclosed line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station Building • Demolish existing building • Raise floor above floodplain • 20 foot by 20 foot masonry building with steel roof
Reservoir 3 Pumps	Reservoir 3 Pumps: Five vertical turbine pumps (4 duty, 1 standby) • Rated for 2,778 gpm @ 30 foot TDH • Maximum speed of 1200 RPM • 30 HP Motor, VFD • Include an oil lubricated enclosed line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station • New concrete wet well • 30 foot by 30 foot masonry building near PS3
Reverse Osmosis System, Brine Disposal System, and Building	13 MGD, Six Train Reverse Osmosis System • 1800 gpm (each train) permeate flow • 85% system design recovery • Includes cartridge filters, RO high pressure pumps, RO skids, interstage booster pumps, system instruments, CIP system, feed tank Brine Disposal System • Four duty, one redundant deep injection wells • Estimated injection rate is 300 to500 gpm, assumed 300 gpm • Pipeline from brine pump station to wells, estimated 14 miles based on minimum distance to reach outside of town limits and minimum of 1 mile between wells Building • Concrete masonry with steel roof • Assumed 75 foot by 100 foot

Option 3: Settle Gunnison River in Existing Reservoirs and Blend with Clifton	
Gunnison River Pump Station Improvements	Three vertical turbine pumps (2 duty, 1 standby) • Rated for 1,042 gpm @ 250 foot TDH • Maximum speed of 1200 RPM • 100 HP Motor, VFD • Include an oil lubricated encased line shaft, bowl assembly, inlet strainer • Up to 10' setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station Building • Demolish existing above grade building • Raise floor above floodplain • 20'x20' masonry building with steel roof • Replace electrical systems
Reservoir 3 Pumps	Reservoir 3 Pumps: Five vertical turbine pumps (4 duty, 1 standby) • Rated for 2,778 gpm @ 30 foot TDH • Maximum speed of 1200 RPM • 30 HP Motor, VFD • Include an oil lubricated enclosed line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station • New concrete wet well • 30 foot by 30 foot masonry building near PS3
Pipeline	• Alignment from Clifton WTP to City's WTP • 10.25 mile, 20 inch diameter pipeline • Open-Cut Installation • Utilize existing pedestrian bridge on Colorado River

Option 4: Settle Gunnison River in Existing Reservoirs and Use for Raw Water Irrigation	
Gunnison River Pump Station Improvements	Three vertical turbine pumps (2 duty, 1 standby) • Rated for 1,042 gpm @ 250 foot TDH • Maximum speed of 1200 RPM • 100 HP Motor, VFD • Include an oil lubricated encased line shaft, bowl assembly, inlet strainer • Up to 20 foot setting depth • Fabricated steel discharge head with single mechanical seal • Fitted into existing wet well Pump Station Building • Demolish existing above grade building • Raise floor above floodplain • 20 foot by 20 foot masonry building with steel roof • Replace electrical systems
Pipeline	• KCFL replacement • 16 mile, 24 inch diameter pipeline • Open-Cut Installation • New interconnect with PMFL near Juniata Reservoir

Option 5: Replace Kannah Creek Flow Line (24 inch)	
Pipeline	• KCFL replacement • 16 mile, 24 inch diameter pipeline • DR18 PRV, 235 psi rated • Open-Cut Installation • New Juniata Reservoir Interconnection with PMFL • New PRV chamber near toe of mesa to maintain pressures over Whitewater Hill

Option 6: Replace Kannah Creek Flow Line (20 inch)	
Pipeline	• KCFL replacement • 16 mile, 20 inch diameter pipeline • DR18 PVC, 235 psi rated upstream • DR14 PVC, 300 psi rated upstream • Open-Cut Installation • New Juniata Reservoir Interconnection with PMFL • Two new PRV chamber to control pressures to the pipe pressure rating along the KCFL

Option 7: Replace Kannah Creek Flow Line (24 inch) and Add Turbine	
Turbine	• 700 kW running year round • Locate at 1,000 foot hydraulic grade drop at PRV station • Sell generated electricity back to grid (Grand Valley Power) • Must confirm capacity of substation to receive the generated electricity • Route to nearest substation approximately 6 miles through overhead wire
Pipeline	• KCFL replacement • 16 mile, 24 inch diameter pipeline • DR18 PRV, 235 psi rated • Open-Cut Installation • New Juniata Reservoir Interconnection with PMFL • New PRV chamber near toe of mesa to maintain pressures over Whitewater Hill

Option 8: New WTP in Kannah Creek Watershed	
Water Treatment Plant	• Raw Water Intake • Low Lift Pump Station • Flocculation and Sedimentation • Media Filters • Chemical Systems
Pipeline	• KCFL replacement • 16 mile, 24 inch diameter pipeline • Open-Cut Installation • New interconnect with Purdy Mesa near Juniata Reservoir

Option 9: Purchase Clifton Water (Intentionally Omitted, No Construction Scope)

Option 10: Transfer Colorado River Rights to Clifton for Treatment (Full Expansion, 24 inch)	
Clifton WTP Plant Modifications	• No modifications to the existing Clifton intake on the Colorado River • Two new raw water pumps at 4,250 gpm • No modifications to existing raw water settling pond • One new pretreatment train sized for 8 mgd o New rapid mix o Four stage flocculation o Inclined plate settlers o Solids collection system • Microfiltration system expansion from 12 to 21 mgd o Three new MF feed pumps at 2,380 gpm o One new MF feed strainer o Three new MF racks o Populate spare 15% in existing 8 MF racks o No changes to existing clean in place, blower or air compressor o Fit inside existing building (space available) • Nanofiltration system expansion from 2.4 to 4.2 mgd o Two new NF feed pumps o Five new dual media filters o Four new cartridge filters o Three new NF racks • Expand chlorine contact tank from 68,000 to 120,000 gallons • Two new high service pumps • Expand evaporation ponds by 50 acres
Pipeline from Clifton to 30th Rd	• 4 mile, 24 inch diameter pipeline • Open-Cut Installation • See map of estimated alignment in Figure 22

Option 11: Transfer Colorado River Rights to Clifton for Treatment (Partial Expansion, 20 inch)	
Clifton WTP Plant Modifications	• No modifications to the existing Clifton intake on the Colorado River • One new raw water pumps at 4,250 gpm • No modifications to existing raw water settling pond • No new pretreatment train sized for 8 mgd • Microfiltration system expansion from 12 to 16 mgd o Two new MF feed pumps at 2,380 gpm o One new MF feed strainer o One new MF racks o Populate spare 15% in existing 8 MF racks o No changes to existing clean in place, blower or air compressor o Fit inside existing building (space available) • Nanofiltration system expansion from 2.4 to 3.6 mgd o One new NF feed pumps o Three new dual media filters o Two new cartridge filters o Two new NF racks • Expand chlorine contact tank • One new high service pumps • Expand evaporation ponds by 35 acres

Pipeline from Clifton to 30th Rd	• 4 mile, 20 inch diameter pipeline • Open-Cut Installation • See map of estimated alignment in Figure 22

Option 12: Route Gunnison to Clifton WTP from Current Intake (Same as Option 10)

Option 13: Purchase Treated Water from Ute (No Ute Expansion, Breakpoint Chlorination)	
Pipeline from Linden Vault to WTP	• 1 mile, 18 inch diameter pipeline • Open-Cut Installation
Breakpoint Chlorination Station	• In-line mixer • Injection quill • Chemical feed pumps • FRP storage tanks • Expand existing on-site sodium hypochlorite generation system • Chemical feed and misc. internal piping. • No building expansion

Option 14: Purchase Treated Water from Ute (Ute Expansion, Breakpoint Chlorination)	
Pipeline from Linden Vault to WTP	• 1 mile, 24 inch diameter pipeline • Open-Cut Installation
Breakpoint Chlorination Station	• In-line mixer • Injection quill • Chemical feed pumps • FRP storage tanks • Expand existing on-site sodium hypochlorite generation system • Chemical feed and misc. internal piping. • No building expansion
Ute WTP Expansion	• No modifications on any processes except filtration • Adequate capacity for backwash supply and waste • Two new filters (465 sq. ft/filter, 6.3 gpm/sq. ft) • Filter media including anthracite, sand, and gravel • 2790 sq. ft building expansion

Option 15: Purchase Treated Water from Ute (Chloramine Conversion)	
Vault Modifications	• Modifications for flow control
Chloramine Conversion	• In-line mixer • Injection quill • Chemical feed pumps • FRP storage tanks • LAS system • Chemical feed and misc. internal piping. • 700 sq. ft building expansion
Ute WTP Expansion	• No modifications on any processes except filtration • Adequate capacity for backwash supply and waste • Two new filters (465 sq. ft/filter, 6.3 gpm/sq. ft) • Filter media including anthracite, sand, and gravel • 2790 sq. ft building expansion

APPENDIX B – EOPCC WORKSHEETS

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 1: Treat Gunnison River by Lime Softening

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment and Materials							
Gunnison River Pumps	5	3.3	MGD	$125,000	$625,000	1.3	$812,500
Softening Clarifiers, Dewatering Systems[2]	3	5	MGD	$1/gal	$13,000,000	1.3	$16,900,000
Post-Clarifier Pumps	5	3.3	MGD	$50,000	$250,000	1.3	$325,000
Corrosion Control System	1			$100,000	$100,000	1.3	$130,000
Chemical Systems	3			$100,000	$300,000	1.3	$390,000
TOTAL EQUIPMENT					$14,275,000	IE=	$18,557,500
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
GR Pump Station Building	1	400	sq ft	$ 750	$300,000	1	$300,000
Floor Demolition					$50,000	1	$50,000
New Raised Floor					$100,000	1	$100,000
Filter Feed PS Building	1	900	sq ft	$ 750	$675,000	1	$675,000
							$0
Misc. Civil & Structural (Including Yard Piping)					% of IE	5%	$927,875
Electrical					% of IE	12%	$2,226,900
Instrumentation					% of IE	4%	$742,300
TOTAL UNMARKED UP COST							$23,579,575
GENERAL REQUIREMENTS					% of Above	8%	$1,886,400
CONTRACTOR O&P					% of Above	10%	$2,546,600
TOTAL CONSTRUCTION COST							$28,012,575
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$4,201,900
CONTINGENCY[3]					% of Above	30%	$9,664,300
TOTAL WITH CONTINGENCY							$41,900,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2- Estimate for softening clarifiers and dewatering systems includes price of Dewatering and Chemical Feed Building. One clarifier is redundant, and unit cost is based on gallons of treated water.
3 - Contingency of 30% based on limited design development.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 2: Treat Gunnison River by Reverse Osmosis

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment and Materials							
Gunnison River Pumps	5	3.3	MGD	$125,000	$625,000	1.3	$812,500
Reservoir 3 Pumps	5	3.3	MGD	$50,000	$250,000	1.3	$325,000
Reverse Osmosis	1	13	MGD	$6,000,000	$6,000,000	1.3	$7,800,000
Chemical Systems	5			$100,000	$500,000	1.3	$650,000
Sulfuric Acid							
Anti-Scalant							
High pH Cleaner							
Low pH Cleaner							
Corrosion Control							
RO Feed Tank	1			$200,000	$200,000	1.3	$260,000
TOTAL EQUIPMENT					$7,575,000	IE=	$9,847,500
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
RO Building	1	6,750	sq ft	$ 500	$3,375,000	1	$3,375,000
GR Pump Station Building	1	400	sq ft	$ 750	$300,000	1	$300,000
Floor Demolition					$50,000	1	$50,000
New Raised Floor					$100,000	1	$100,000
Basin 3 Pump Station Building	1	900	sq ft	$ 750	$675,000	1	$675,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	1%	$98,475
Electrical					% of IE	12%	$1,181,700
Instrumentation					% of IE	6%	$590,850
TOTAL UNMARKED UP COST							$16,218,525
GENERAL REQUIREMENTS					% of Above	8%	$1,297,500
CONTRACTOR O&P					% of Above	10%	$1,751,600
TOTAL CONSTRUCTION COST							$19,267,625
ENGINEERING					% of Above	15%	$2,890,100
CONTINGENCY[2]					% of Above	30%	$6,647,300
TOTAL WITH CONTINGENCY							$28,805,025
BRINE DISPOSAL	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Pipeline to Injection Sites[3]	1	73,920	LF	$100	$7,392,000	1.3	$9,609,600
Deep Injection Wells[4]	5			$5,000,000	$25,000,000	1.3	$32,500,000
BRINE DISPOSAL COST							$42,109,600
TOTAL COST							$70,900,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - Contigency of 30% based on limited design development.
3 - Pipeline estimate of 14 miles based on minimum distance to reach outside of town limits and minimum of 1 mile between wells. Actual length could be significantly greater depending on distance of wells from town.
4 - Estimate of five wells based on minimum pumping rate of 300 gpm/well and need for one redundant well.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 3: Settle Gunnison River and Blend with Clifton

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment and Materials							
Gunnison River Pumps	3			$50,000	$150,000	1.3	$195,000
Chemical Systems for Corrosion	1			$100,000	$100,000	1.3	$130,000
Post-Clarifier Pumps	5	3.3	MGD	$50,000	$250,000	1.3	$325,000
Pipeline from CWD WTP to GJ WTP	54,120	20	in	$200.00	$10,824,000	1	$10,824,000
						IE[2]=	$650,000.00
TOTAL EQUIPMENT					$11,324,000		$11,474,000
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
GR Pump Station Building	1	400	sq ft	$750/sq ft	$300,000	1	$300,000
Floor Demolition					$50,000	1	$50,000
New Raised Floor					$100,000	1	$100,000
PS 3 Building	1	900	sq ft	$ 750	$675,000	1	$675,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	4%	$26,000
Electrical					% of IE	12%	$78,000
Instrumentation					% of IE	4%	$26,000
TOTAL UNMARKED UP COST							$12,729,000
GENERAL REQUIREMENTS					% of Above[3]	8%	$152,400
CONTRACTOR O&P					% of Above[3]	10%	$205,700
TOTAL CONSTRUCTION COST							$13,087,100
ENGINEERING					% of Above	15%	$1,963,100
CONTINGENCY[4]					% of Above	20%	$3,010,000
TOTAL WITH CONTINGENCY							$18,100,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 20% based on uncertainty involved with routing pipeline through city.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by -KK
AACE Class 4 Estimate[1]

Option 4: Settle Gunnison River and Use for Raw Water Supply

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Gunnison River Pumps	3	1.5	MGD	$50,000	$150,000	1.3	$195,000
Control Valve and Valve House	1			$325,000	$325,000	1	$325,000
Interconnect between PMFL and KCFL	1			$250,000	$250,000	1	$250,000
KCFL Replacement	84,480	20	in	$200	$16,896,000	1	$16,896,000
						IE[2]=	$520,000
TOTAL EQUIPMENT					$17,621,000		$17,666,000
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
GR Pump Station Building	1	400	sq ft	$750/sq ft	$300,000	1	$300,000
Floor Demolition					$50,000	1	$50,000
New Raised Floor					$100,000	1	$100,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	4%	$20,800
Electrical					% of IE	12%	$62,400
Instrumentation					% of IE	4%	$20,800
TOTAL UNMARKED UP COST							$18,220,000
GENERAL REQUIREMENTS					% of Above[3]	8%	$85,900
CONTRACTOR O&P					% of Above[3]	10%	$116,000
TOTAL CONSTRUCTION COST							$18,421,900
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$2,763,300
CONTINGENCY[4]					% of Above	10%	$2,118,500
TOTAL WITH CONTINGENCY							$23,300,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 10% based on higher level of detail in pipeline estimates.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 5: Replace Kannah Creek Pipeline (24 in) and Install New Interconnect

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Control Valve and Valve House	1			$350,000	$350,000	1	$350,000
Interconnect between PMFL and KCFL	1			$500,000	$500,000	1	$500,000
KCFL Replacement	84,480	24	in	$250	$21,120,000	1	$21,120,000
						IE[2]=	$350,000
TOTAL EQUIPMENT					$21,970,000		$21,970,000
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Misc. Civil & Structural (Including Yard Piping)					% of IE	0%	
Electrical					% of IE	0%	
Instrumentation					% of IE	0%	
TOTAL UNMARKED UP COST							$21,970,000
GENERAL REQUIREMENTS					% of Above[3]	8%	$28,000
CONTRACTOR O&P					% of Above[3]	10%	$37,800
TOTAL CONSTRUCTION COST							$22,035,800
DESIGN AND CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$3,305,400
CONTINGENCY[4]					% of Above	10%	$2,534,100
TOTAL WITH CONTINGENCY							$27,900,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 10% based on higher level of detail in pipeline estimates.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 6: Replace Kannah Creek Pipeline (20 in) and Install New Interconnect

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Control Valve and Valve House	2			$325,000	$650,000	1	$650,000
Interconnect between PMFL and KCFL	1			$500,000	$500,000	1	$500,000
KCFL Replacement	84,480	20	in	$200	$16,896,000	1	$16,896,000
						IE[2]=	$650,000
TOTAL EQUIPMENT					$18,046,000		$18,046,000
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Misc. Civil & Structural (Including Yard Piping)					% of IE	0%	
Electrical					% of IE	0%	
Instrumentation					% of IE	0%	
TOTAL UNMARKED UP COST							$18,046,000
GENERAL REQUIREMENTS					% of Above[3]	8%	$52,000
CONTRACTOR O&P					% of Above[3]	10%	$70,200
TOTAL CONSTRUCTION COST							$18,168,200
DESIGN AND CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$2,725,200
CONTINGENCY[4]					% of Above	10%	$2,089,300
TOTAL WITH CONTINGENCY							$23,000,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 10% based on higher level of detail in pipeline estimates.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 7: Replace Kannah Creek Pipeline, Install New Interconnect and Add Turbine

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Hydro Turbine Equipment	1			$600,000	$600,000	1	$600,000
Electrical Distribution Line[2]	1	34320	ft	$160/LF	$5,500,000	1	$5,500,000
Control Valve and Valve House	1			$350,000	$350,000	1	$350,000
Interconnect between PMFL and KCFL	1			$500,000	$500,000	1	$500,000
KCFL Replacement	84,480	24	in	$250	$21,120,000	1	$21,120,000
						IE[3]=	$6,450,000
TOTAL EQUIPMENT					$28,070,000		$28,070,000
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Turbine Building	1	1000	sq ft	$500	$500,000	1	$500,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	4%	$258,000
Electrical					% of IE	6%	$387,000
Instrumentation					% of IE	4%	$258,000
TOTAL UNMARKED UP COST							$29,473,000
GENERAL REQUIREMENTS					% of Above[4]	8%	$628,200
CONTRACTOR O&P					% of Above[4]	10%	$848,100
TOTAL CONSTRUCTION COST							$30,949,300
DESIGN AND CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$4,642,400
CONTINGENCY[5]					% of Above	10%	$3,559,200
TOTAL WITH CONTINGENCY							$39,200,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - Electrical distribution line cost estimate does not include environmental, permitting, or right of way acquisition costs.
3 - IE only includes major equipment and does not include other materials such as pipeline.
4 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
5 - Contigency of 10% based on higher level of detail in pipeline estimates.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 03/16/2020
Made by - MAL
Checked by - KK
AACE Class 4 Estimate[1]

Option 8: New Water Treatment Plant in Kannah Creek Watershed

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Raw water intake					$500,000	1.3	$650,000
Raw water pumps	4	3.3	MGD	$100,000	$400,000	1.3	$520,000
Floc/Sed	1			$1,235,000	$1,235,000	1.3	$1,605,500
Media Filters	1			$1,300,000	$1,300,000	1.3	$1,690,000
Chemical Systems	5			$100,000	$500,000	1.3	$650,000
Control Valve and Valve House	1			$350,000	$350,000	1	$350,000
Interconnect between PMFL and KCFL	1			$500,000	$500,000	1	$500,000
KCFL Replacement	84,480	24	in	$250	$21,120,000	1	$21,120,000
Misc. Internal Piping					% of IE	15%	$819,800
						IE[2]=	$5,465,500
TOTAL EQUIPMENT					$25,905,000		$27,905,300
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
WTP Building	1	13,000	sq ft	$750	$9,750,000	1	$9,750,000
Abandon ex WTP in place					$100,000	1	$100,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	15%	$819,800
Electrical					% of IE	12%	$655,900
Instrumentation					% of IE	5%	$273,300
TOTAL UNMARKED UP COST							$39,504,300
GENERAL REQUIREMENTS					% of Above[3]	8%	$3,160,300
CONTRACTOR O&P					% of Above[3]	10%	$4,266,500
TOTAL CONSTRUCTION COST							$46,931,100
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$7,039,700
CONTINGENCY[4]					% of Above	10%	$5,397,100
TOTAL WITH CONTINGENCY							$59,400,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 10% based on higher level of detail in pipeline estimates.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 06/09/2020
Made by - MAL
Checked by - BDP
AACE Class 4 Estimate[1]

Option 10: Exchange Colorado River Rights with Clifton for Emergency Supply (Full Expansion, 24 inch)

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Colorado River Intake Modifications					$0.00	1	$0.00
Raw water pumps	2	6.1	MGD	$100,000	$200,000	1.3	$260,000
Rapid Mix	1			$50,000	$50,000	1.3	$65,000
4 stage floc, inclined plates, solids collect	1			$500,000	$500,000	1.3	$650,000
MF Feed Pumps	3	3.4	MGD	$60,000	$180,000	1.3	$234,000
MF Feed Strainers	1	8.2	MGD	$30,000	$30,000	1.3	$39,000
Microfiltration/Ultrafiltration Racks	3	2	MGD	$600,000	$1,800,000	1.3	$2,340,000
Nanofiltration Racks	3	0.6	MGD	$800,000	$2,400,000	1.3	$3,120,000
RO Feed Pumps	2	1.7	MGD	$40,000	$80,000	1.3	$104,000
RO Dual Media Filters	5	0.4	MGD	$25,000	$125,000	1.3	$162,500
RO Cartridge Filters	4	0.8	MGD	$25,000	$100,000	1.3	$130,000
Chemical Systems	7			$50,000	$350,000	1.3	$455,000
Evaporation Ponds - Class A Impoundment	50	1	acre	$129,000	$6,450,000	1.3	$8,385,000
High Service Pumps	2			$150,000	$300,000	1.3	$390,000
Pipeline from CWD WTP to 30th Rd	21,120	24	inch	$250	$5,280,000	1	$5,280,000
Misc. Internal Piping					% of IE	15%	$1,192,400
						IE[2]=	$7,949,500
TOTAL EQUIPMENT					$17,845,000		$22,806,900
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Pretreatment Building	1	3,031	sq ft	$500	$1,515,520	1.3	$1,970,176
Main Process Building			sq ft		$0	1.3	$0
NF/RO Building			sq ft		$0	1.3	$0
CCC Expansion	1700	1	sq ft	$500	$850,000	1.3	$1,105,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	10%	$795,000
Electrical					% of IE	12%	$953,900
Instrumentation					% of IE	5%	$397,500
TOTAL UNMARKED UP COST							$28,028,476
GENERAL REQUIREMENTS					% of Above[3]	8%	$1,819,900
CONTRACTOR O&P					% of Above[3]	10%	$2,456,800
TOTAL CONSTRUCTION COST							$32,305,176
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$4,845,800
CONTINGENCY[4]					% of Above	20%	$7,430,200
TOTAL WITH CONTINGENCY							$44,600,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline or evaporation ponds.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 20% based on uncertainty of Clifton expansion.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 06/18/2020
Made by - MAL
Checked by - BDP
AACE Class 4 Estimate[1]

Option 11: Exchange Colorado River Rights with Clifton for Emergency Supply (Partial Expansion, 20 inch)

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Colorado River Intake Modifications					$0.00	1	$0.00
Raw water pumps	1	6.1	MGD	$100,000	$100,000	1.3	$130,000
Rapid Mix					$0	1	$0
4 stage floc, inclined plates, solids collect					$0	1	$0
MF Feed Pumps	2	3.4	MGD	$60,000	$120,000	1.3	$156,000
MF Feed Strainers	1	4.1	MGD	$30,000	$30,000	1.3	$39,000
Microfiltration/Ultrafiltration Racks	1	2	MGD	$600,000	$600,000	1.3	$780,000
Nanofiltration Racks	2	0.6	MGD	$800,000	$1,600,000	1.3	$2,080,000
RO Feed Pumps	1	1.7	MGD	$40,000	$40,000	1.3	$52,000
RO Dual Media Filters	3	0.4	MGD	$25,000	$75,000	1.3	$97,500
RO Cartridge Filters	2	0.8	MGD	$25,000	$50,000	1.3	$65,000
Chemical Systems	7			$30,000	$210,000	1.3	$273,000
Evaporation Ponds - Class A Impoundment	35	1	acre	$129,000	$4,515,000	1.3	$5,869,500
High Service Pumps	1			$150,000	$150,000	1.3	$195,000
Pipeline from CWD WTP to 30th Rd	21,120	20	inch	$200	$4,224,000	1	$4,224,000
gall					% of IE	15%	$580,100
						IE[2]=	$3,867,500
TOTAL EQUIPMENT					$11,714,000		$14,541,100
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Pretreatment Building			sq ft		$0	1.3	$0
Main Process Building			sq ft		$0	1.3	$0
NF/RO Building			sq ft		$0	1.3	$0
CCC Expansion	755	1	sq ft	$500	$377,500	1.3	$490,750
Misc. Civil & Structural (Including Yard Piping)					% of IE	10%	$386,800
Electrical					% of IE	12%	$464,100
Instrumentation					% of IE	5%	$193,400
TOTAL UNMARKED UP COST							$16,076,150
GENERAL REQUIREMENTS					% of Above[3]	8%	$948,200
CONTRACTOR O&P					% of Above[3]	10%	$1,280,000
TOTAL CONSTRUCTION COST							$18,304,350
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$2,745,700
CONTINGENCY[4]					% of Above	20%	$4,210,000
TOTAL WITH CONTINGENCY							$25,300,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline or evaporation ponds.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 20% based on uncertainty of Clifton expansion.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 08/05/2020
Made by - MAL
Checked by - BDP
AACE Class 4 Estimate[1]

Option 13: Purchase Treated Water from Ute (No Ute Expansion, Break Point Chlorinate)

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Linden Vault Modifications	1			$400,000	$400,000	1.3	$520,000
Pipeline to GJ WTP	4,066	18	inch	$180	$731,808	1	$731,808
Mixer	1			$9,000	$9,000	1.3	$11,700
Injection Quill	1			$5,000	$5,000	1.3	$6,500
Chemical Feed Pumps	2			$11,000	$22,000	1.3	$28,600
FRP Storage Tanks	2	5000	gal	$56,000	$112,000	1.3	$145,600
Chemical Feed Piping	1			$8,000	$8,000	1.3	$10,400
Sodium Hypochlorite System Expansion	1			$130,000	$130,000	1.3	$169,000
Misc. Internal Piping	1				% of IE	40%	$81,120
						IE[2]=	$202,800
TOTAL EQUIPMENT					$1,417,808		$1,704,728
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Misc. Civil & Structural (Including Yard Piping)					% of IE	3%	$6,084
Electrical					% of IE	17%	$34,476
Instrumentation					% of IE	5%	$10,140
TOTAL UNMARKED UP COST							$1,755,428
GENERAL REQUIREMENTS					% of Above[3]	8%	$81,900
CONTRACTOR O&P					% of Above[3]	10%	$110,600
TOTAL CONSTRUCTION COST							$1,947,928
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$292,200
CONTINGENCY[4]					% of Above	30%	$672,000
TOTAL WITH CONTINGENCY							$2,900,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 30% based on uncertainty of routing through plant.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 08/05/2020
Made by - MAL
Checked by - BDP
AACE Class 4 Estimate[1]

Option 14: Purchase Treated Water from Ute (Ute Expansion, Break Point Chlorinate)

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Filters	2	465	sq ft	$750,000.00	$1,500,000.00	1.3	$1,950,000
Filter Media (Combined)	1			$1,000,000.00	$1,000,000.00	1.3	$1,300,000
Filter Media - Anthracite	1	18,600	cubic ft				
Filter Media - Sand	1	9,300	cubic ft				
Filter Media - Gravel	1	16,740	cubic ft				
Linden Vault Modifications	1			$400,000	$400,000	1.3	$520,000
Pipeline to GJ WTP	4,066	24	inch	$250	$1,016,400	1	$1,016,400
Mixer	1			$9,000	$9,000	1.3	$11,700
Injection Quill	1			$5,000	$5,000	1.3	$6,500
Chemical Feed Pumps	2			$11,000	$22,000	1.3	$28,600
FRP Storage Tanks	2	5000	gal	$56,000	$112,000	1.3	$145,600
Chemical Feed Piping	1			$8,000	$8,000	1.3	$10,400
Sodium Hypochlorite System Expansion	1			$130,000	$130,000	1.3	$169,000
Misc. Internal Piping	1				% of IE	40%	$1,448,720
						IE[2]=	$3,621,800
TOTAL EQUIPMENT					$4,202,400		$4,656,920
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Filter Building	1	2790	sq ft	$500	$1,395,000	1.3	$1,813,500
Misc. Civil & Structural (Including Yard Piping)					% of IE	3%	$108,654
Electrical					% of IE	17%	$615,706
Instrumentation					% of IE	5%	$181,090
TOTAL UNMARKED UP COST							$7,375,870
GENERAL REQUIREMENTS					% of Above[3]	8%	$508,800
CONTRACTOR O&P					% of Above[3]	10%	$686,800
TOTAL CONSTRUCTION COST							$8,571,470
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$1,285,700
CONTINGENCY[4]					% of Above	30%	$2,957,200
TOTAL WITH CONTINGENCY							$12,800,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 -General Requirements and Contractor O&P included in pipeline estimate, so pipeline cost has been excluded from % of Above to prevent double counting.
4 - Contigency of 30% based on uncertainty of routing through plant.

Client - City of Grand Junction
Project Number - 117086
Description - Construction Cost Option Breakdown

Date - 08/05/2020
Made by - MAL
Checked by - BDP
AACE Class 4 Estimate[1]

Option 15: Purchase Treated Water from Ute (Ute Expansion, Chloramine Conversion)

Line Item Description	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor	Installed Cost
Major Equipment							
Filters	2	465	sq ft	$750,000.00	$1,500,000.00	1.3	$1,950,000
Filter Media (Combined)	1			###########	$1,000,000.00	1.3	$1,300,000
Filter Media - Anthracite	1	18,600	cubic ft				
Filter Media - Sand	1	9,300	cubic ft				
Filter Media - Gravel	1	16,740	cubic ft				
Linden and Riverside Vault Modifications	2			$400,000	$800,000	1.3	$1,040,000
Mixer	1			$9,000	$9,000	1.3	$11,700
Injection Quill	1			$5,000	$5,000	1.3	$6,500
Chemical Feed Pumps	2			$11,000	$22,000	1.3	$28,600
FRP Storage Tanks	2	5000	gal	$56,000	$112,000	1.3	$145,600
Chemical Feed Piping	1			$8,000	$8,000	1.3	$10,400
LAS System	1			$100,000	$100,000	1.3	$130,000
Misc. Internal Piping	1				% of IE	40%	$1,433,120
						IE[2]=	$3,582,800
TOTAL EQUIPMENT					$3,556,000		$6,055,920
MISC. SUB-CONTRACTORS	No.	Size ea.	Units	Unit Purchased Cost	Purchased Cost	Installation Factor or Complexity	Installed Cost
Filter Building	1	2790	sq ft	$500	$1,395,000	1.3	$1,813,500
Building Expansion	1	700	sq ft	$500	$350,000	2.3	$805,000
Misc. Civil & Structural (Including Yard Piping)					% of IE	3%	$107,484
Electrical					% of IE	17%	$609,076
Instrumentation					% of IE	5%	$179,140
TOTAL UNMARKED UP COST							$9,570,120
GENERAL REQUIREMENTS					% of Above	8%	$765,600
CONTRACTOR O&P					% of Above	10%	$1,033,600
TOTAL CONSTRUCTION COST							$11,369,320
DESIGN & CONSTRUCTION PHASE ENG. SERVICES					% of Above	15%	$1,705,400
CONTINGENCY[3]					% of Above	30%	$3,922,400
TOTAL WITH CONTINGENCY							$17,000,000

Notes:
1- AACE Class 4 Estimates are used for feasibility studies. The expected accuracy range is -15% to -30% on the low end, and +20% to +50% on the high end.
2 - IE only includes major equipment and does not include other materials such as pipeline.
3 - Contigency of 30% based on uncertainty of routing through plant.

APPENDIX C – INITIAL WORKSHOP SCORING

Initial Screening

The following options are recommended for disqualification from the evaluation for the reasons presented in Table 1.

Table1: Disqualified Options

	Option	Reason
2	Treat Gunnison by Reverse Osmosis	High capital cost to treat Gunnison River Option 1 (lime softening) provides lower cost of treatment
4	Settle Gunnison in Existing Reservoirs and Use for Raw Water	Does not provide acceptable water quality for raw water irrigation
7	Replace KCFL (24 inch) and Add Turbine	Feasibility not confirmed with Grand Valley Power. Potential energy production of turbine does not pay for extensive electrical upgrades
8	New WTP in Kannah Creek Watershed	High capital cost for new facility New WTP is redundant to the existing WTP KCFL update required to deliver water to City
9	Clifton Water Emergency Interconnect	Does not provide a fully redundant alternative Capacity well less than future peak day demand of 13 mgd
11	Route Gunnison to Clifton WTP	High infrastructure cost to send Gunnison River to Clifton replaced by water transfer Transfer City's Colorado River rights to Clifton and replace with City's Gunnison River allocation at confluence Becomes same as Option 10

Table 2: Options Evaluated by Project Team

#	Option
1	Treat Gunnison River by Lime Softening
3	Settle Gunnison River in Existing Reservoirs and Blend with Clifton
5	Replace Kannah Creek Flow Line (24 inch)
6	Replace Kannah Creek Flow Line (20 inch)
10	Transfer Colorado River Rights to Clifton for Treatment
12	Purchase Treated Water from Ute

Selection Workshop

A multi-step process was used to evaluate the technical, qualitative and monetary criteria of each option. The first step involved developing the non-monetary criteria and then ranking the criteria in a Workshop with the Project Team. The selected criteria are shown in Table 3.

Table 3: Selection Criteria

Criteria Category	Description
Redundancy	Ability to provide full redundancy to the Purdy Mesa flowline. Options scoring high in this category can provide full redundancy to Purdy Mesa flowline without concern over water rights. Low scoring options do not provide the full capacity of 13 mgd.
Raw Water Quality	Measure of the raw water quality of the source water(s) included within the option. Options scoring high in this category mean the sources have water quality similar to Purdy Mesa. Low scoring options have poor source water quality.
Finished Water Quality	Measure of the anticipated finished water quality as a result of the treatment associated with the option. Options scoring high in this category mean the treatment is expected to produce finished water similar or better than the current WTP. This criteria also considers the satisfaction of raw water customers.
Regulatory Challenges	Evaluates the likelihood of permitting-related challenges associated with the option, including but not limited to, CDPHE permits and land easements. Options scoring high in this category require little to no permitting.
Complexity of Sources	Evaluates the number of sources required to provide a fully-redundant capacity and the complexity to operate multiple sources. Options scoring high in this category only require one source to create redundancy.
Ease of Operations	Evaluates the complexity of operations and maintenance, number of treatment process steps and units and chemical dosing systems associated with the option. Options scoring high in this category apply operating procedures similar or less complex than the current WTP.
Public Perception	Evaluates the public perception to the alternate water source. Public opinion prefers elevated sources, considered pristine mountain source. Less favorable view of using river sources

The second step ranked the non-monetary criteria used a paired comparison to identify the weighting for each criterion (Table 4). Each criteria were paired against the other criteria, with the criteria of higher importance being preferred. The alphanumeric identification of the preferred criteria is recorded in Table 4(e.g. B). Then the degree to which the criteria was preferred were scored on their relative importance on a scale of 1 to 3, with 3 as a high importance. The numeric score of the preferred criteria is recorded in Table 4(e.g. 2), resulting in a paired score (e.g. B2).

Table 4: Weighted Criteria

DEVELOP CRITERIA & WEIGHTED MATRIX										
ITEM	CRITERIA	RELATIVE IMPORTANCE							SCORE	NORMALIZED
A	Redundancy	A	A 3	A 3	A 2	A 1	A 2	A 1	12	3
B	Raw Water Quality		B	C 3	B 1	B 2	B 1	G 3	4	1
C	Finished Water Quality			C	C 3	C 1	C 2	C 1	10	2
D	Regulatory Challenges				D	E 3	F 3	G 3	0	0
E	Complexity of Sources					E	E 3	G 2	6	1
F	Ease of Operations						F	G 1	3	1
G	Public Perception							G	9	2
Directions: For each pair, select the more important criteria. Then choose a relative importance between 1-3 (3 as high importance).									44	10

Next, the Project Team scored each Option against the criteria on a scale of 1 to 5, with 5 being high (Table 5).

Table 5: Scored Options

SCORED OPTIONS								
Option	Redundancy	Raw Water Quality	Finished Water Quality	Regulatory Challenges	Complexity of Sources	Ease of Operations	Public Perception	Total
Option 1: Treat GR by Lime Softening	5	1	2	3	1	1	1	14
Option 3: Blend GR with Clifton	5	2	1	3	1	2	2	16
Option 5: 24" KCFL	5	5	5	4	5	5	5	34
Option 6: 20" KCFL	5	5	5	4	5	4	5	28
Option 10: Transfer Add. CR to Clifton	5	1	3	4	2	3	3	21
Option 12: Purchase Treated Ute Water	5	4	4	4	4	4	4	29
Directions: Score each option for each criteria between 1-5 (5 is high).								

The weighting criteria was then applied to the scores to establish a weighted score (Table 6).

Table 6: Weighted Scored Options

WEIGHTED SCORES								
Option	Redundancy	Raw Water Quality	Finished Water Quality	Regulatory Challenges	Complexity of Sources	Ease of Operations	Public Perception	Total
Option 1: Treat GR by Lime Softening	60	4	20	0	6	3	9	102
Option 3: Blend GR with Clifton	60	8	10	0	6	6	18	108
Option 5: 24" KCFL	60	20	50	0	30	15	45	220
Option 6: 20" KCFL	60	20	50	0	30	12	45	217
Option 10: Transfer Add. CR to Clifton	60	4	30	0	12	9	27	142
Option 12: Purchase Treated Ute Water	60	16	40	0	24	12	36	188
Directions: Table autopopulates based on weight of criteria and scored options.								

High Score	Option 5: 24" KCFL

The Options were then ranked by their weighted score and compared against the EOPCC (Table 7). The cost/benefit for each Option was calculated by dividing the EOPCC by the weighted score. A low cost/benefit indicates a favorable Option, with more benefit achieved at a lower cost investment.

Table 7: Comparison of EOPCC and Weighted Score

Comparison of EOPCC and Weighted Score					
Option		EOPCC	Weighted Score		Cost/Benefit
Option 5: 24" KCFL	$	27,900,000	220	$	127,000
Option 6: 20" KCFL	$	23,000,000	217	$	106,000
Option 12: Purchase Treated Ute Water	$	3,300,000	188	$	18,000
Option 10: Transfer Add. CR to Clifton	$	56,000,000	142	$	394,000
Option 3: Blend GR with Clifton	$	18,100,000	108	$	168,000
Option 1: Treat GR by Lime Softening	$	41,900,000	102	$	411,000

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Grand Junction City Council

Workshop Session

Item #1.c.

Meeting Date: November 29, 2021

Presented By: Greg Caton, City Manager

Department: City Manager's Office

Submitted By: Greg LeBlanc, Sr. Asst. to the City Manager

Information

SUBJECT:

ARPA Committee Member Discussion

EXECUTIVE SUMMARY:

This item is intended for members of City Council to review and discuss nominations for the American Rescue Plan Advisory Committee (ARPAC) and potentially finalize a list of selections for final approval at a future City Council meeting.

BACKGROUND OR DETAILED INFORMATION:

Council members have each reviewed the 35 applications received for the ARPAC and selected 5 nominations. These nominations are based on experience, expertise, or interests in the community that pertains to the use of the American Rescue Plan State and Local Fiscal Recovery Funds. The intent of the ARPAC is to advise City Council by providing a menu of options and recommended actions for the use of ARPA funds.

Of the 35 applications, the City Council nominated a total of 21 applicants (several applicants were nominated by more than one Councilmember but only one received support from four members of Council). Because there was not strong support for a slate of twelve (see attached tabulation of votes) among the nominations, the Agenda Committee has proposed that each Councilmember reconsider the applications and propose an additional seven committee members (for a total of 12 names from each Councilmember). The intent of the additional names is to provide clearer expression of Council's support among the nominations by having more names from each member.

FISCAL IMPACT:

N/A

SUGGESTED ACTION:

This item is for Council discussion and direction.

Attachments

1. ARPAC Nomination Memo with Attachment
2. Tabulation of Recommendations for Each Person Nominated

CITY OF Grand Junction COLORADO

CITY MANAGER'S OFFICE

Memorandum

TO: Members of City Council

FROM: Greg Caton, City Manager

DATE: November 15, 2021

SUBJECT: Council ARPA Committee (ARPAC) Nominations

After reviewing the 35 applications submitted by community members for the American Rescue Plan Advisory Committee (ARPAC), the members of City Council each reviewed and selected five nominations for the ARPAC. These selections are based on experience, expertise or interests in the community that pertain to the authorized use of American Rescue Plan State and Local Fiscal Recovery Funds.

Of the 35 Council selections, 21 individual applicants were nominated, as several applicants were nominated by more than one Councilmember. Each nomination was recorded on the attached spreadsheet, along with a brief description of the expertise or interests relevant to the ARPAC.

Attachments: Council Nominations, ARPA Committee

C: Department Directors

Council Nominations: ARPA Committee		
Dennis Simpson	**Nominations**	**Areas of Interest**
	Fid Braffett	Tax Principal; Boards and Commissions Rep
	Scott Bielfuss	Aging Populations; Healthcare, Environmental Sustainability
	Vara Kusal	ED, Horizon Drive Business Improvement District
	Bill Wade	New Realties Consulting; Mesa County Non-Profit Community
	Diane Schwenke	CEO, GJ Chamber of Commerce
Abe Herman	**Nominations**	**Areas of Interest**
	Becky Winegard	Special Education; Low-Income Families; vulnerable populations
	Estrella Ruiz	Business Owner; Non-Profit Board Rep; Latino Community
	Laurel Cole	ED, Habitat For Humanity; Affordable Housing
	Linda V. Taylor	ED, Center for Independence; Individuals with Disabilities
	Raul De Villegas-Decker	Clinical Psychologist; Public Health, Non-Profit Sector, Underserved communities
Randall Reitz	**Nominations**	**Areas of Interest**
	Mary Cornforth	Mesa County Public Health
	William Findley	Pediatrician, Western Colorado Pediatrics Associates; President, Colorado West Land Trust; Riverfront Foundation, VP
	Robin Brown	CMU
	Estrella Ruiz	Business Owner; Non-Profit Board Rep; Latino Community
	Raul De Villegas-Decker	Clinical Psychologist; Public Health, Non-Profit Sector, Underserved communities
Chuck McDaniel	**Nominations**	**Areas of Interest**
	Cindy Enos-Martinez	Riverside Neighborhood Representative; underserved communities
	Kay Ramachandran	CEO, Marillac Health
	Linda Taylor	ED,Center for Independence; Individuals with Disabilities
	Vara Kusel	ED, Horizon Drive Business Improvement District
	William Wade	New Realties Consulting; Mesa County Non-Profit Community
Anna Stout	**Nominations**	**Areas of Interest**
	Ben Herman	land use, housing, economic development, transportation; non-profit sector; affordable housing
	Catherine Ventling	co-chair, Colorado Riverfront Commission; transportation, land management, education and healthcare
	Pamela Anderson	Licensed Clinical Social Worker; prior clinical director, HopeWest
	Raul De Villegas-Decker	Clinical Psychologist; Public Health, Non-Profit Sector, Underserved communities
	William Wade	New Realties Consulting; Mesa County Non-Profit Community
Phillip Pe'a	**Nominations**	**Areas of Interest**
	Cindy Enos-Martinez	Riverside Neighborhood Representative; underserved communities
	Diane Schwenke	CEO, GJ Chamber of Commerce
	Gary Schroen	Parks and Rec Advisory Board; Financial Analyst/Accountant

	Jennifer Crowe	Psychiatric Mental Health Nurse Practitioner; Grand Valley Primary Care
	William Findley	Pediatrician, Western Colorado Pediatrics Associates; President, Colorado West Land Trust; Riverfront Foundation, VP
Rick Taggart	**Nominations**	**Areas of Interest**
	Estrella Ruiz	Business Owner; Non-Profit Board Rep; Latino Community
	Kay Ramachandran	CEO, Marillac Health
	Laurel Cole	ED, Habitat For Humanity; Affordable Housing
	Stacey Mendell	Social Worker, Non-Profit Community
	William Wade	New Realties Consulting; Mesa County Non-Profit Community

City Council Workshop – November 29, 2021

ARPAC Tabulation of Recommendations for Each Person Nominated

Applicant Name	# of Votes
1. William Wade	4
2. Estrella Ruiz	3
3. Raul De Villegas- Decker	3
4. Vara Kusal	2
5. Diane Schwenke	2
6. Laurel Cole	2
7. Linda V. Taylor	2
8. William Findley	2
9. Cindy Enos-Martinez	2
10. Kay Ramachandran	2
11. Fid Braffett	1
12. Scott Bielfuss	1
13. Becky Winegard	1
14. Mary Cornforth	1
15. Robin Brown	1
16. Ben Herman	1
17. Catherine Ventling	1
18. Pamela Anderson	1
19. Gary Schroen	1
20. Jennifer Crowe	1
21. Stacey Mendell	1