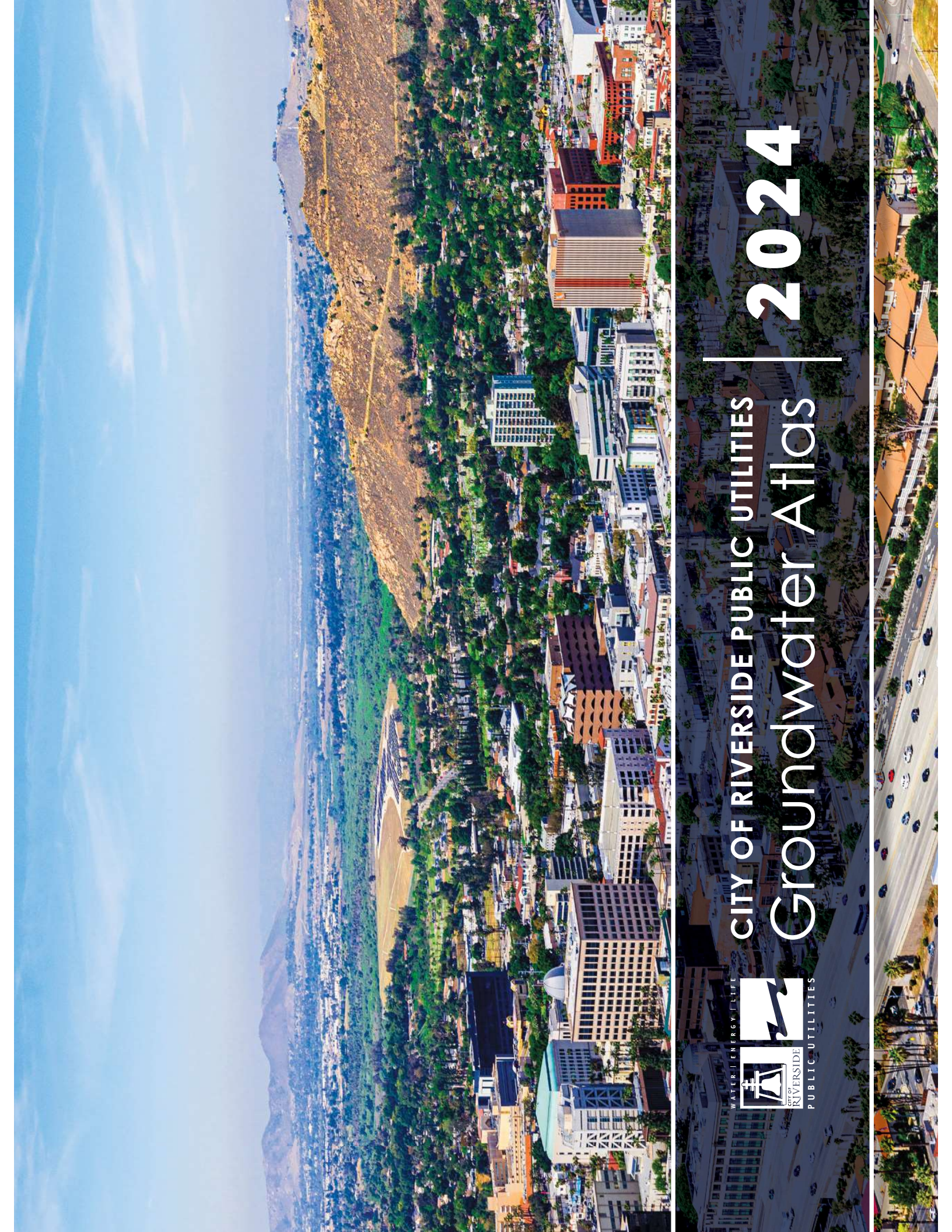




WATER | ENERGY | LIFE



CITY OF RIVERSIDE PUBLIC UTILITIES Groundwater Atlas

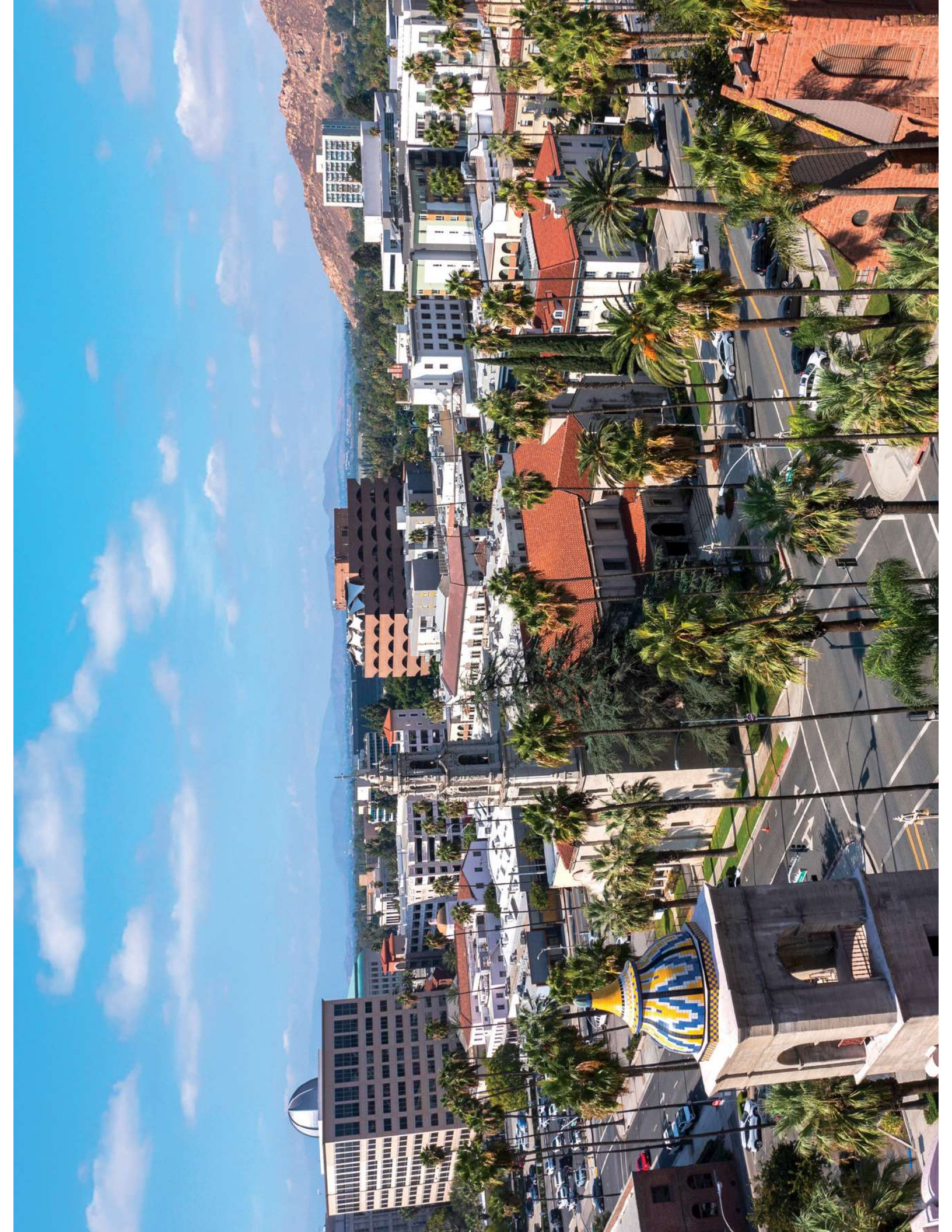
2024





CITY OF RIVERSIDE PUBLIC UTILITIES
Groundwater Atlas

2024





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INTRODUCTION

The Groundwater Atlas aims to provide a comprehensive report on the water quality and quantity conditions of the groundwater basins that provide potable and non-potable water supplies to Riverside Public Utilities' (RPU) customers. This Atlas will support RPU's groundwater management strategies and activities related to managing water supplies in a sustainable and resilient manner.

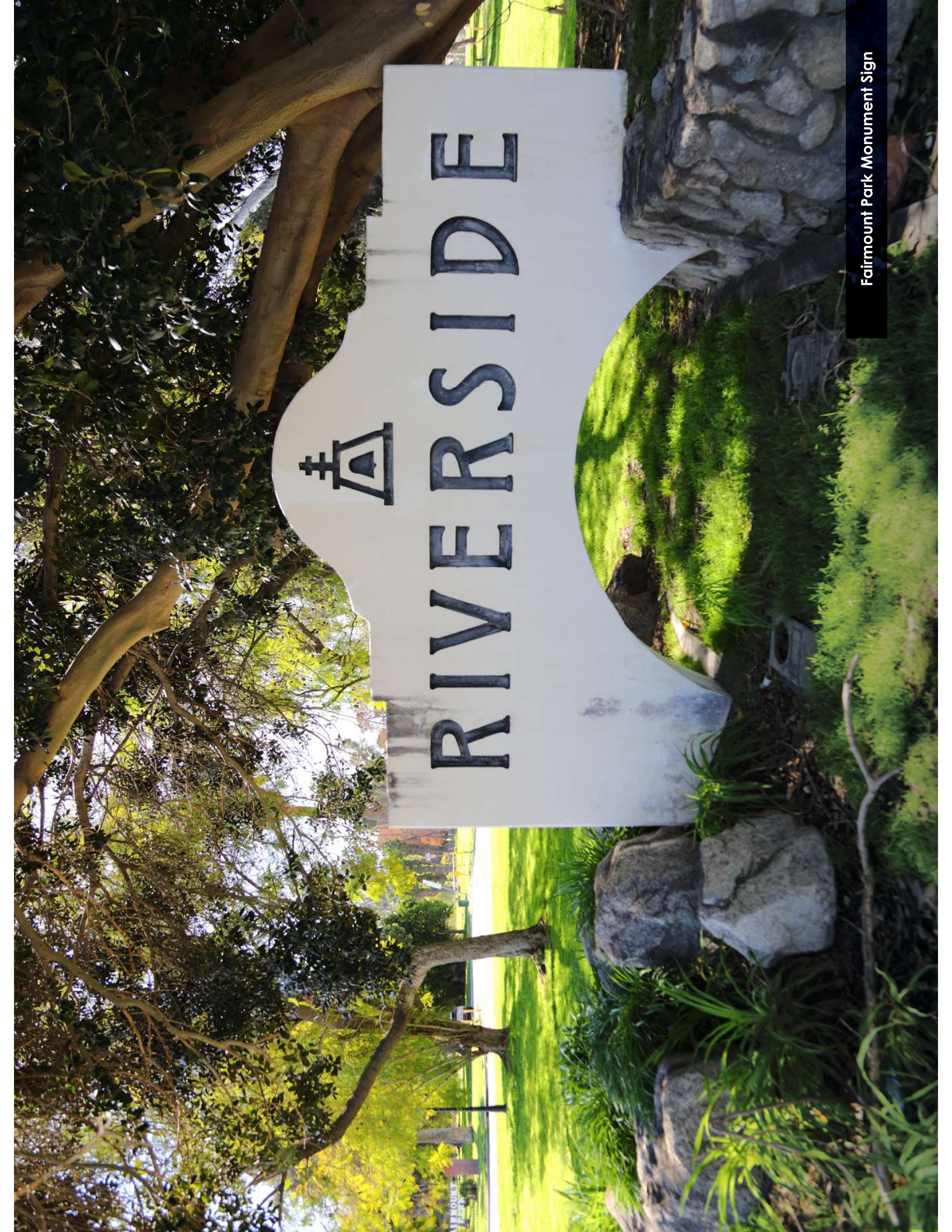
RPU provides potable, non-potable, and recycled water to the City of Riverside (City). Serving a population of approximately 299,800 residents through 69,340 service connections, the RPU service area spans 75 square miles. In addition, RPU provides surplus potable and non-potable water to Western Municipal Water District (Western Water), which serves City residents outside of the RPU service area. A small amount of potable water is also supplied to the City of Norco via a wholesale agreement. Since 2009, all of the City's potable water demand has been supplied solely from local groundwater rights as established by the court's Western-San Bernardino 1969 Judgment.

The condition of the groundwater basins is dynamic and influenced by various factors beyond RPU's control, including groundwater contamination from historical agricultural, industrial, and defense practices, natural variations in weather patterns, actions by other agencies,

and evolving State and Federal regulations. These basins are shared with other water providers and their associated water infrastructure, such as well fields, groundwater recharge facilities, and wastewater treatment plants. The operation of these facilities combined with regional hydrologic variance adds to the complexity of managing these resources. To ensure a reliable and sustainable water supply for both current and future generations, RPU closely tracks annual groundwater basin conditions. This 2024 edition of the Groundwater Atlas presents data collected from January 1, 2024, to December 31, 2024, and provides insights into groundwater hydrology, production, recharge, levels, and quality.

The purpose of this Groundwater Atlas is to:

- Characterize groundwater basin conditions and how they change over time.
- Provide readable and reliable data to customers, elected officials, executive management, and staff.
- Provide information and analysis to RPU staff for use in managing the City's water supply.
- Protect RPU's strong water supply position and financial stability.

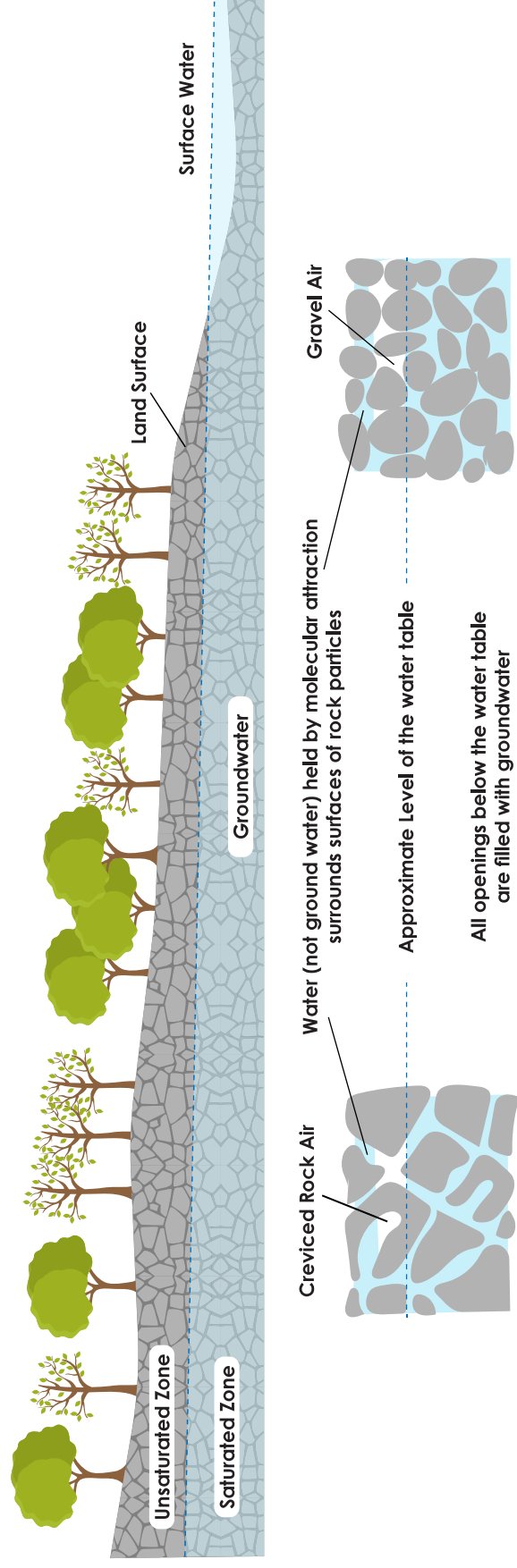


Fairmount Park Monument Sign

ABOUT OUR GROUNDWATER BASINS

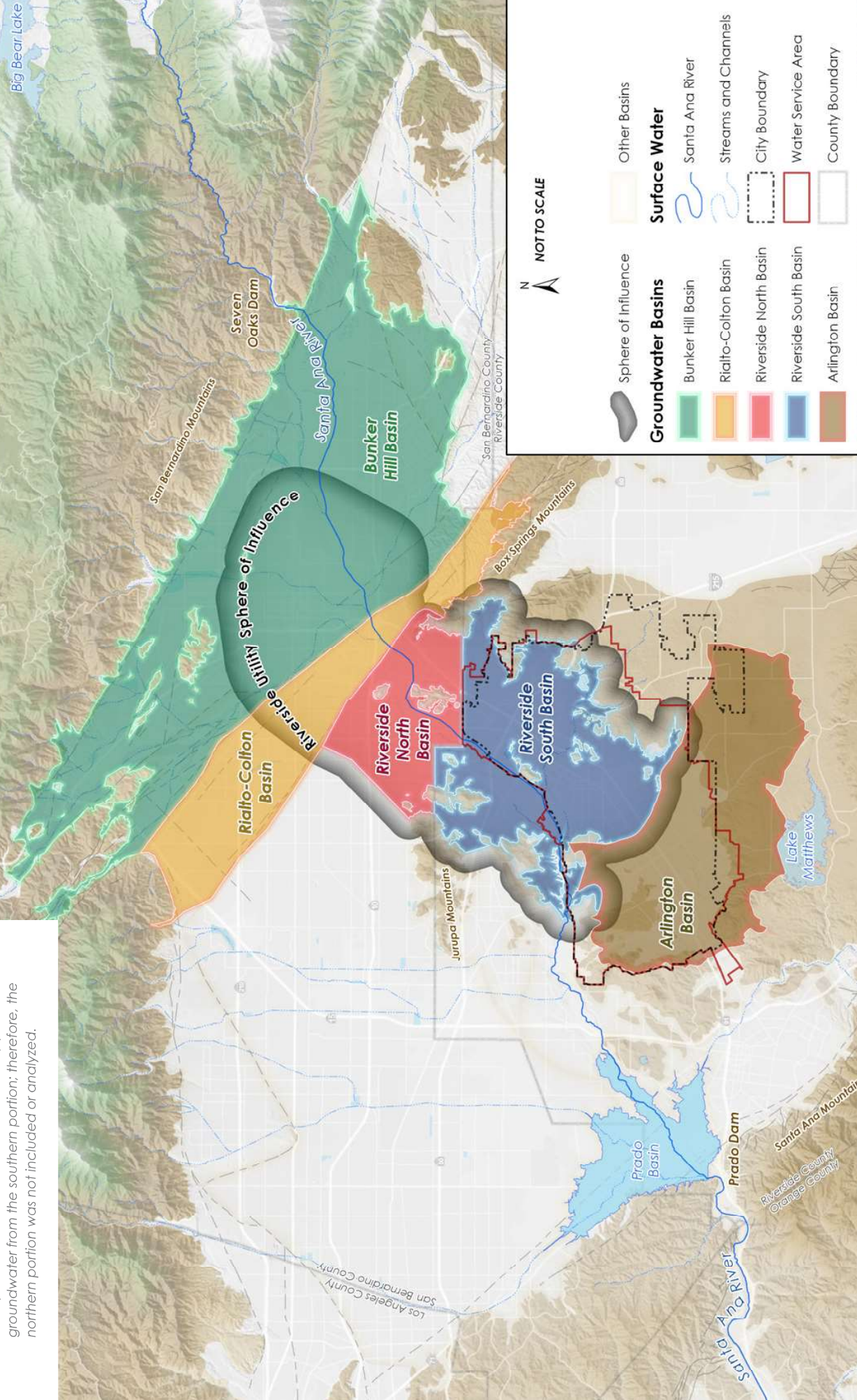
The City of Riverside was developed around the once prolific water supply of the Santa Ana River. Our groundwater basins are significantly influenced by the tectonic forces of the San Andreas and San Jacinto faults. The San Jacinto fault limits the movement of groundwater and forces shallow groundwater to the surface. The San Jacinto Fault, in conjunction with semi-confining clay zone's helped to pressurize portions of the groundwater beneath the City of San Bernardino. As the surface water flows from the Santa Ana River diminished from weather patterns and regional development in the late 1800s, RPU took advantage of the seismically-influenced groundwater basins to drill and construct artesian wells. The artesian wells acted as a conduit, allowing pressurized water to escape freely from the ground. As these pressures and high groundwater levels decreased in the early 1900s, RPU began equipping these groundwater wells with pumps. Today, groundwater levels and pressures have subsided to some of the lowest levels in recent times. However, the aquifer remains a prolific and productive source for local groundwater.

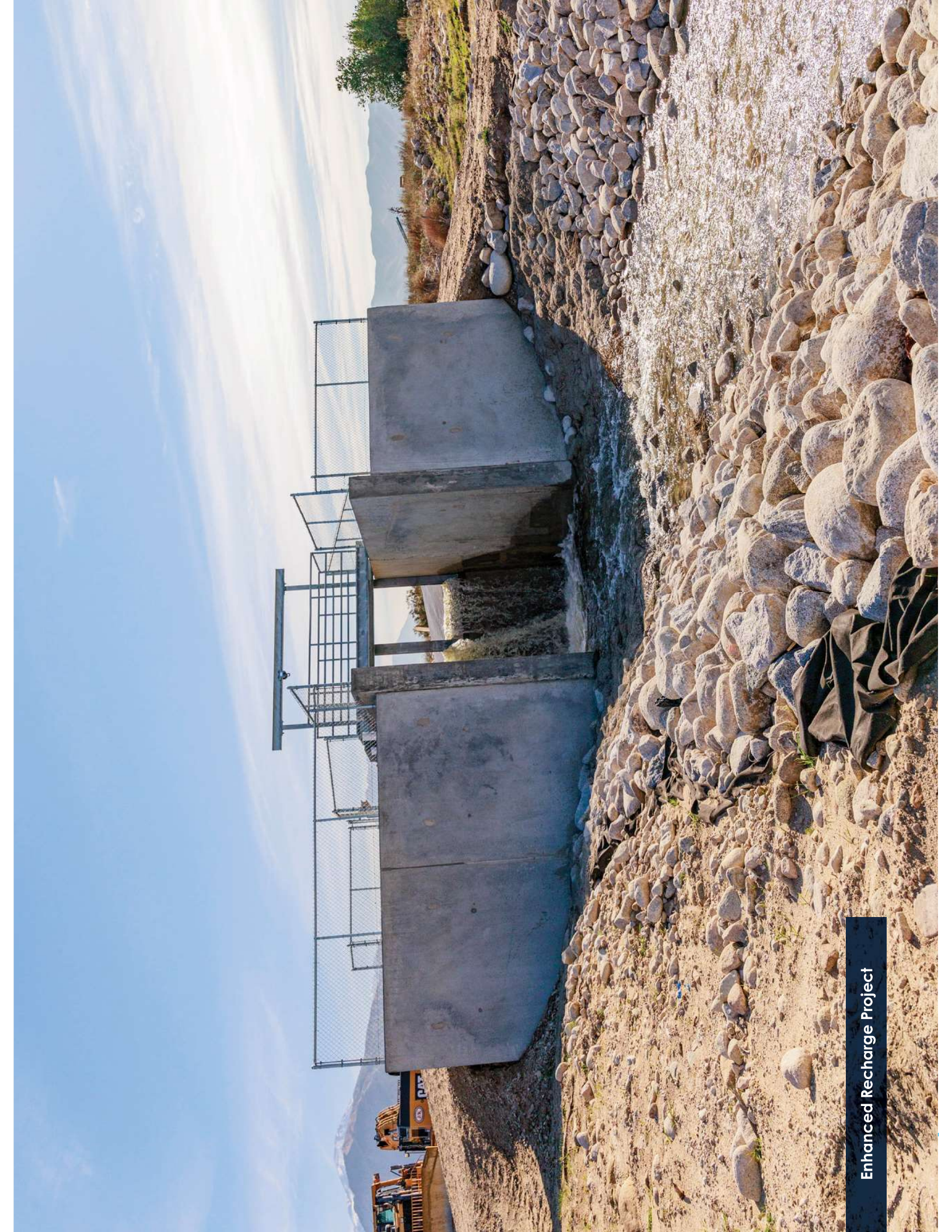
RPU's water supplies come from groundwater basins consisting of underground geologic formations called aquifers that are fed by rain and snow melting in the San Bernardino Mountains and local foothills and is illustrated in the graphic below. RPU produces water from four groundwater basins adjacent to the Santa Ana River including the Bunker Hill, Rialto-Colton, Riverside North and Riverside South Basins as shown in the figure on the adjacent page. Over the years, RPU has constructed infrastructure that enables efficient groundwater management, achieving complete independence from imported water supplies since 2009.



RPU's Water Sphere of Influence on Groundwater Basins

Note: The RPU Sphere of Influence is the approximate area where the RPU wells are located. It is also the area used for contouring analysis throughout this atlas. For example, in the Rialto-Colton Basin, RPU only produces groundwater from the southern portion; therefore, the northern portion was not included or analyzed.





Enhanced Recharge Project

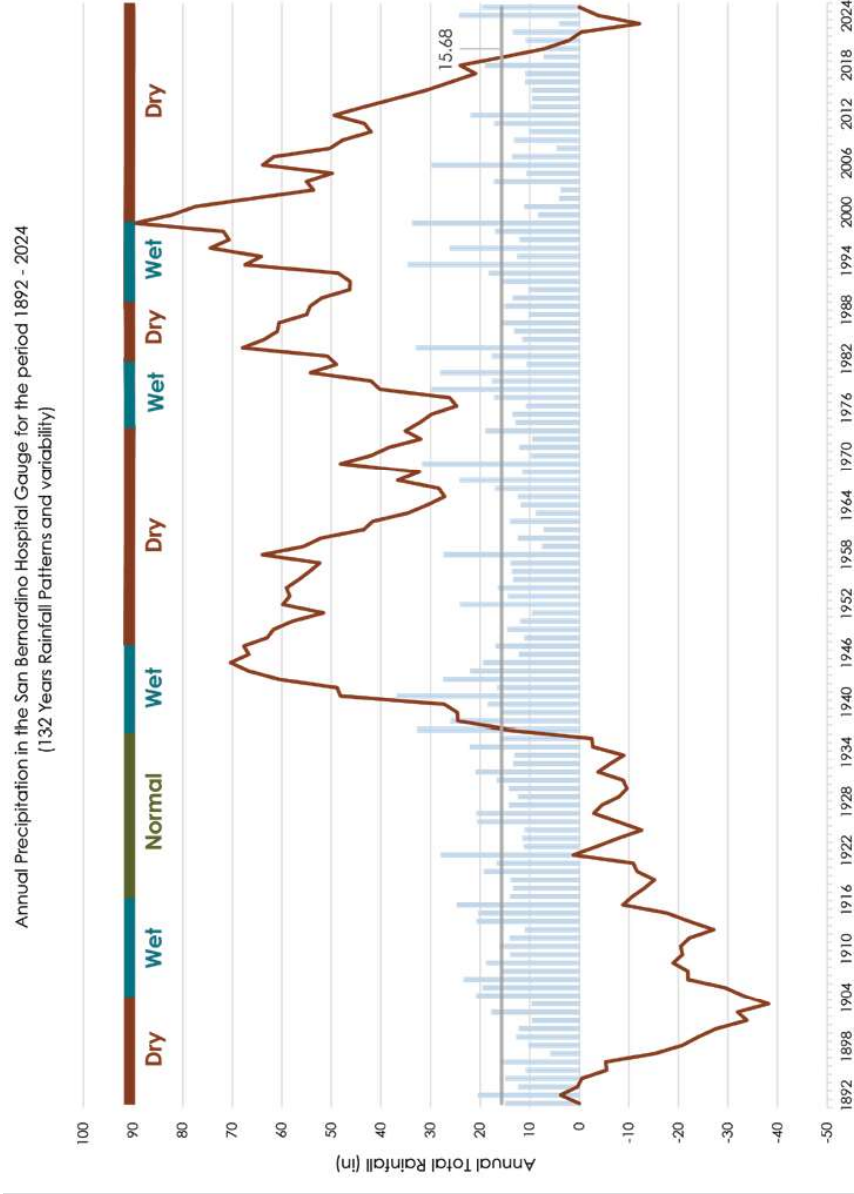
01 HYDROLOGIC CONDITIONS



HYDROLOGIC CONDITIONS

Both regional and local hydrologic conditions fluctuate year to year. Understanding the relationships between meteorological, surface water, groundwater, and biological factors that influence the flow, quality, and recharge of water in a groundwater basin is important and can have significant impacts on local water supplies.

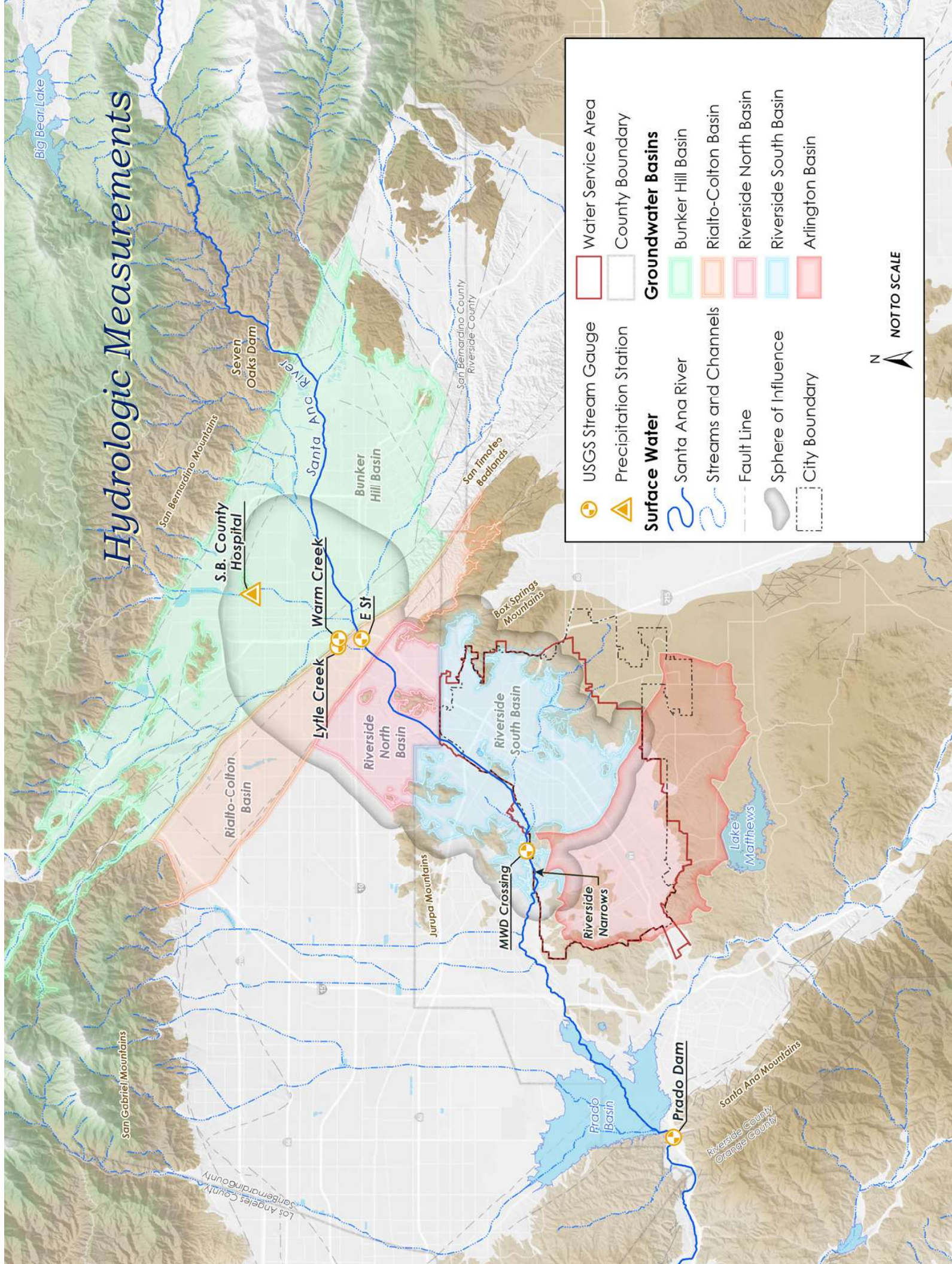
RPU participates in monitoring the hydrologic conditions of the region through measurements of precipitation and flow in the Santa Ana River and its tributaries. The primary source of recharge to the groundwater basins is precipitation. The region uses a precipitation gage of San Bernardino County to characterize long-term meteorological conditions. The average annual rainfall over historical record was about 15.68 inches and 10.6 inches in the last 10 years (2014 -2024) during an extended dry period. The following chart shows the cumulative departure from mean (CDFM) precipitation. The CDFM plot characterize the occurrence and magnitude of wet upward trend), dry (downward trend), and normal periods (flat trend). These trends are labeled at the top of the chart. The period from 1999 until 2024 shows a 26-year dry period with eight wet years during this period.



Historical Annual Precipitation (San Bernardino County Hospital Gage)

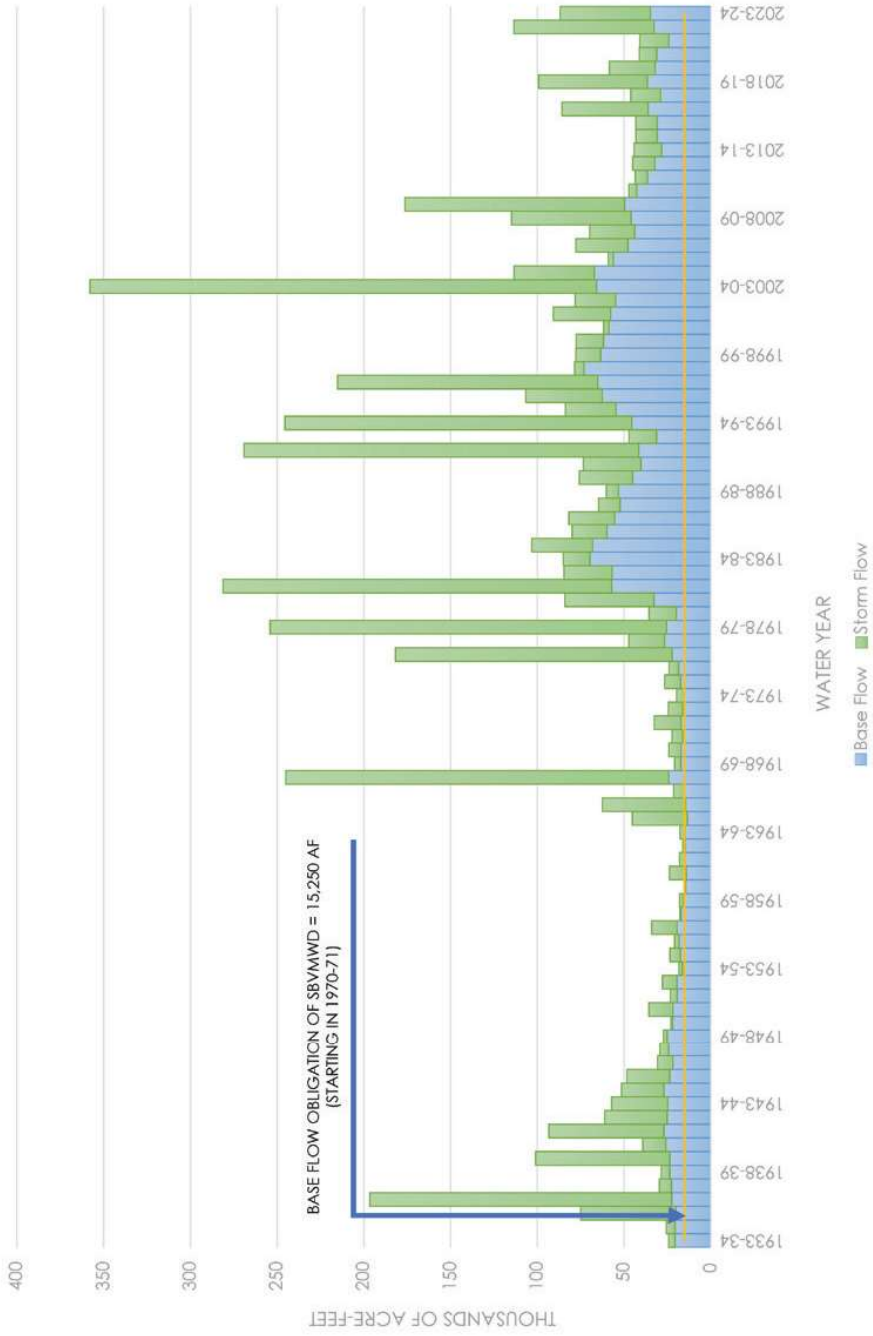
San Bernardino's average annual precipitation over the last 132 years is 15.68 inches.

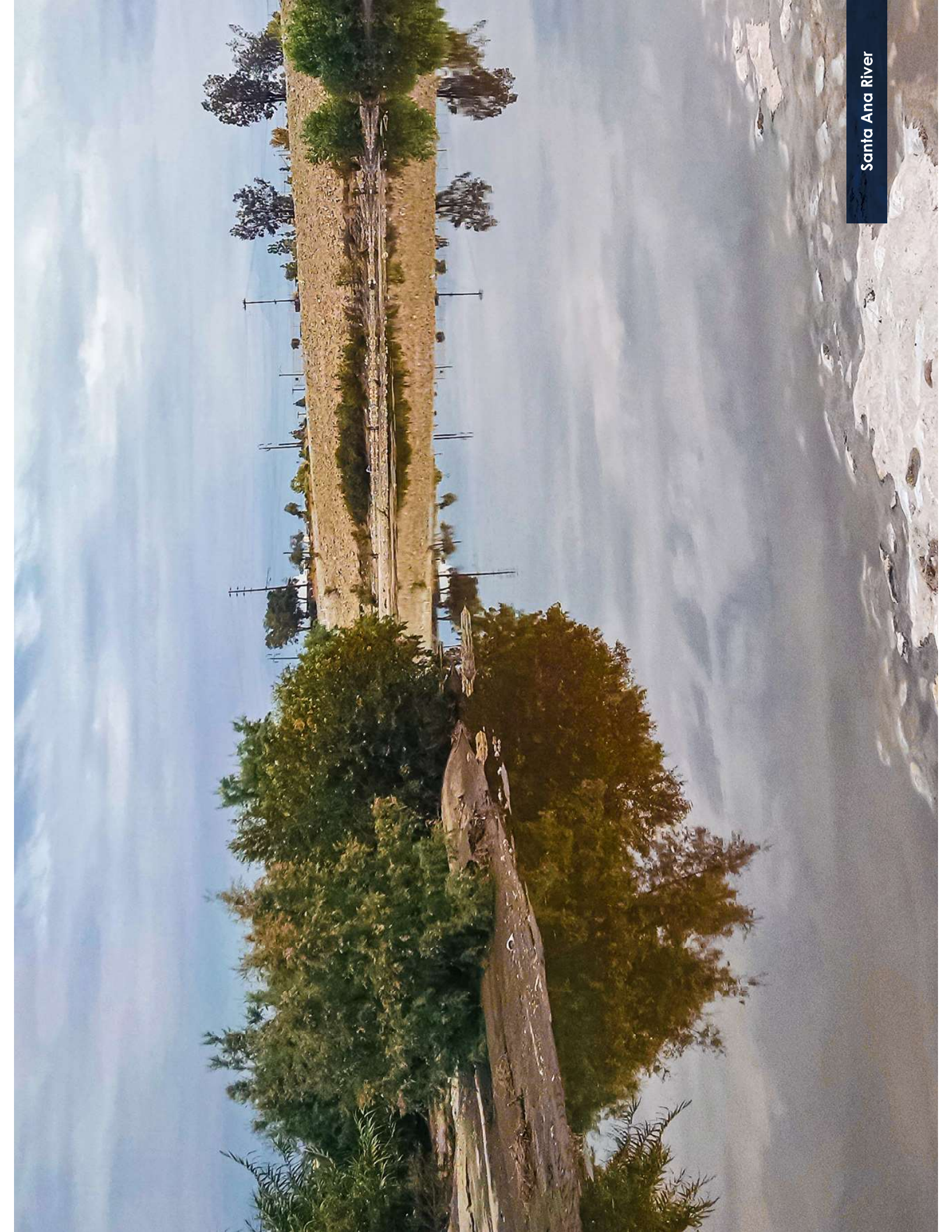
Hydrologic Measurements



The Santa Ana River Watermasters characterize the hydrology in the region by quantifying the flow in the Santa Ana River at Riverside Narrows, and RPU monitors the data. The flow is measured by the United States Geological Survey (USGS) at a gaging station named Santa Ana River at MWD Crossing (USGS-11066460) near the Riverside narrows. The chart below illustrates the annual time series of the baseflow and stormwater flow at the MWD Crossing station. Baseflow is the portion of streamflow that is sustained between precipitation events and primarily consists of effluent from municipal wastewater treatment plants located along the river as well as groundwater rising to the surface due to shallow bedrock. Minimum baseflow discharges were identified by water managers in the 1960s to ensure that everyone along the Santa Ana River had enough water supplies for beneficial uses. The data is utilized to measure compliance with water rights, ensuring that the Orange County agencies have the quantity and quality that was agreed to in the 1969 Judgment.

Discharge of Santa Ana River at Riverside Narrows starting with 1934-35





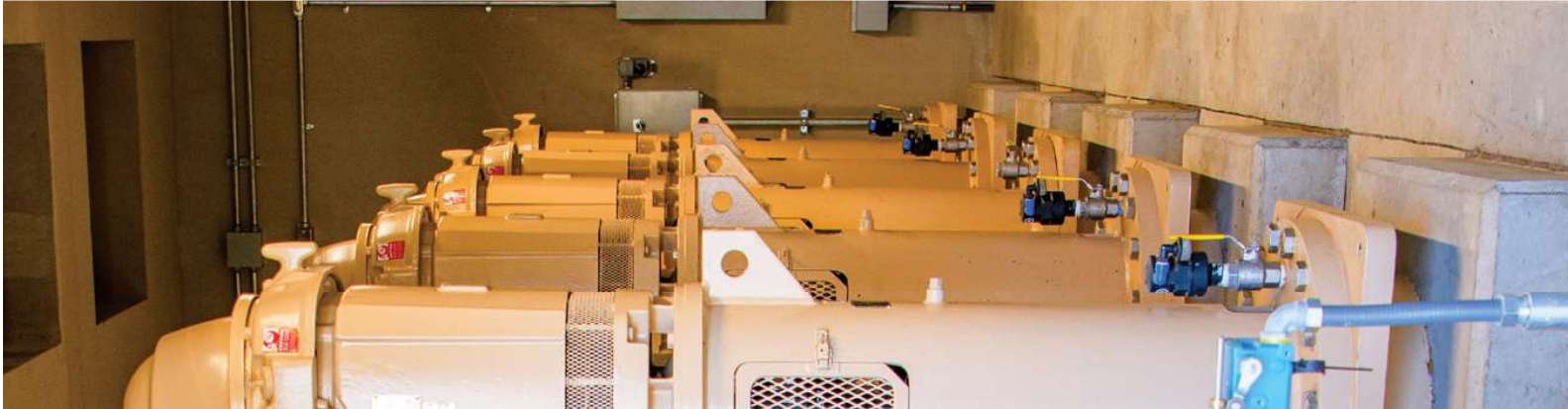
Santa Ana River



Canyon Crest Booster Station

02

GROUNDWATER RESOURCES MANAGEMENT

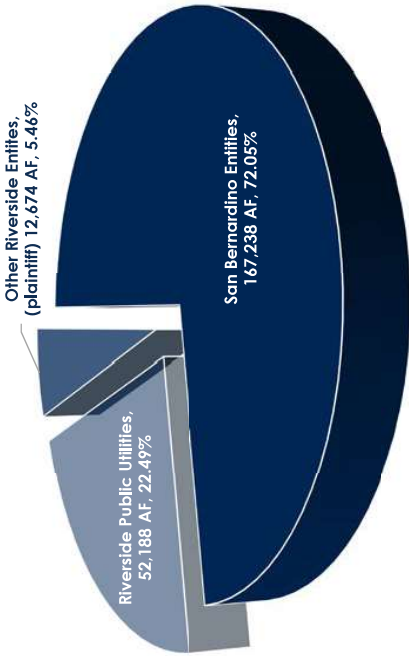
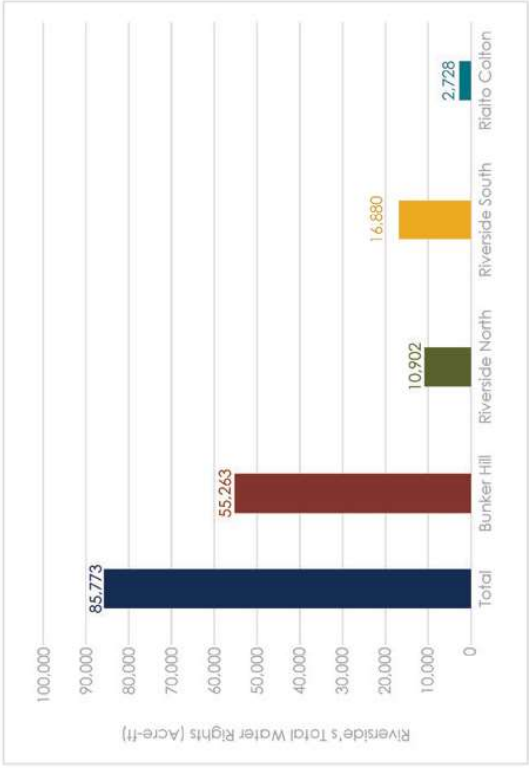


GROUNDWATER RESOURCES MANAGEMENT

The City started developing water supplies from the region in the 1870s. Since this time, RPU and its customers/owners have continually improved its water conveyance system and have strategically and cost-effectively developed the City's water supply from key locations within the groundwater basins.

RPU keeps its customers and decision-makers informed with the best available data and management practices. In turn, this has preserved the City's strong regional water rights and superior water quality by holding responsible parties accountable. The City actively defends its water rights, which were clearly defined "through the adjudication process of" the 1969 Judgment. RPU management maintains a close dialogue with the Western-San Bernardino Watermaster to ensure groundwater compliance with the Judgment is maintained. As groundwater conditions evolve and new challenges arise, RPU remains committed to continuously assessing these changes and keeping customers and public representatives informed. Through proactive communication and the promotion of best management practices, RPU aims to ensure a reliable and sustainable water supply portfolio rooted in local resources. As a plaintiff party to the Western-San Bernardino Judgment, the City's total water right and base period production is 85,773 AF.

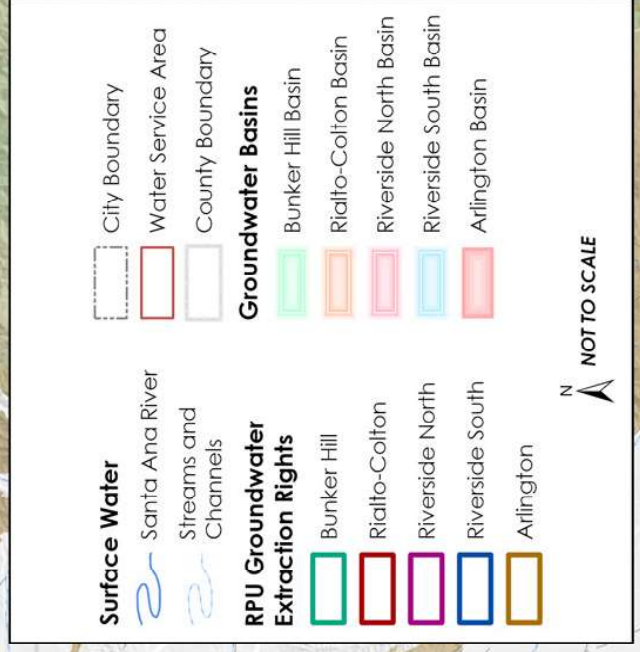
The City of Riverside Total Water Right and Base Period Production (in acre-feet) by Basin

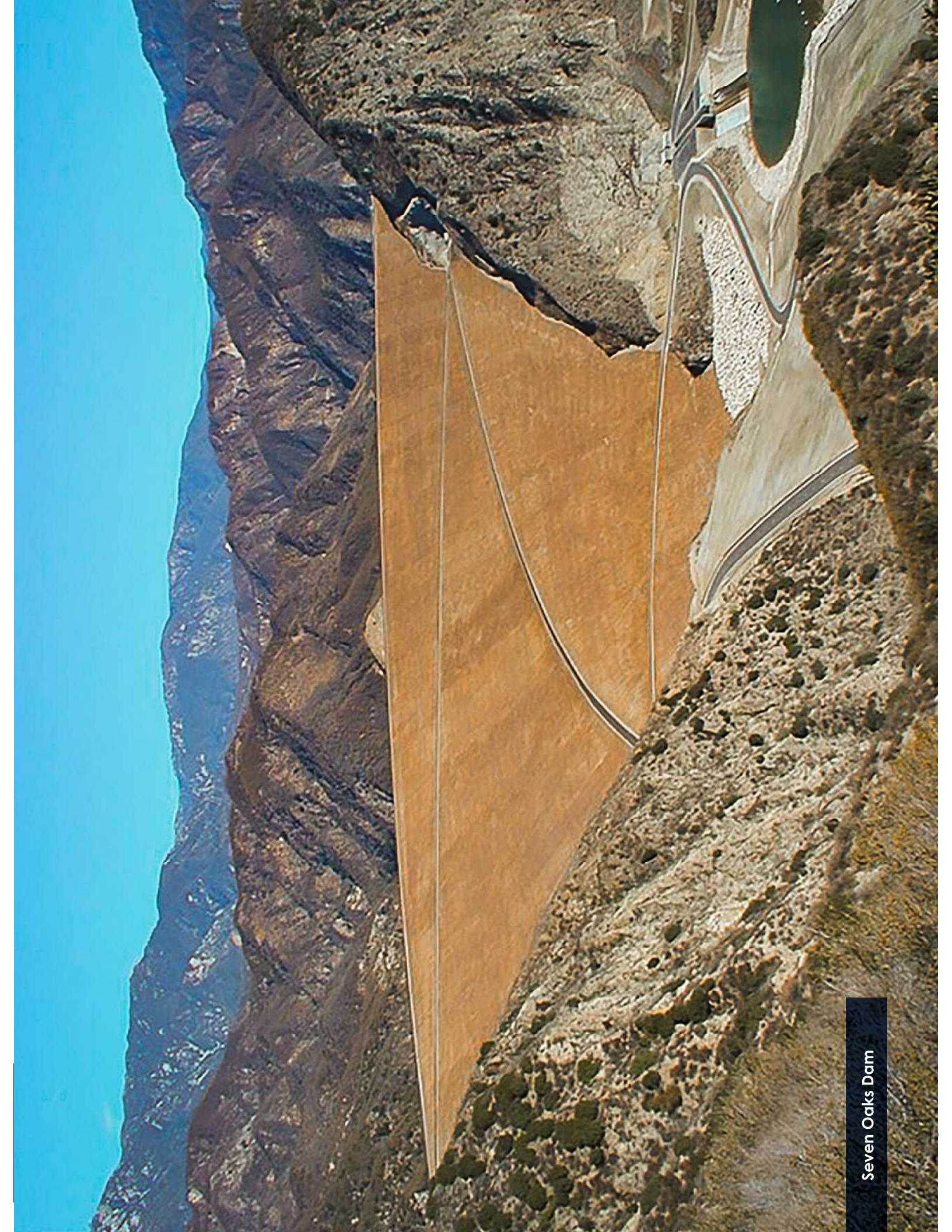


The original division of water resources in the San Bernardino Basin Area.
Source: Physical Solution Western-San Bernardino Watermaster

RPU Groundwater Extraction or Export Rights

Groundwater Basin	Extraction or Export Rights
Bunker Hill	55,263 AFY
Rialto-Colton	2,728 AFY
Riverside North	16,880 AFY
Riverside South	10,902 AFY
TOTAL	85,773 AFY





Seven Oaks Dam

03 GROUNDWATER PRODUCTION



GROUNDWATER PRODUCTION

RPU has over 52 active wells located in five well fields that produce groundwater from the Bunker Hill, Rialto-Colton Basin, Riverside North, and Riverside South groundwater basins. The majority of groundwater is produced from the Waterman and Gage well field located in the Bunker Hill Basin.

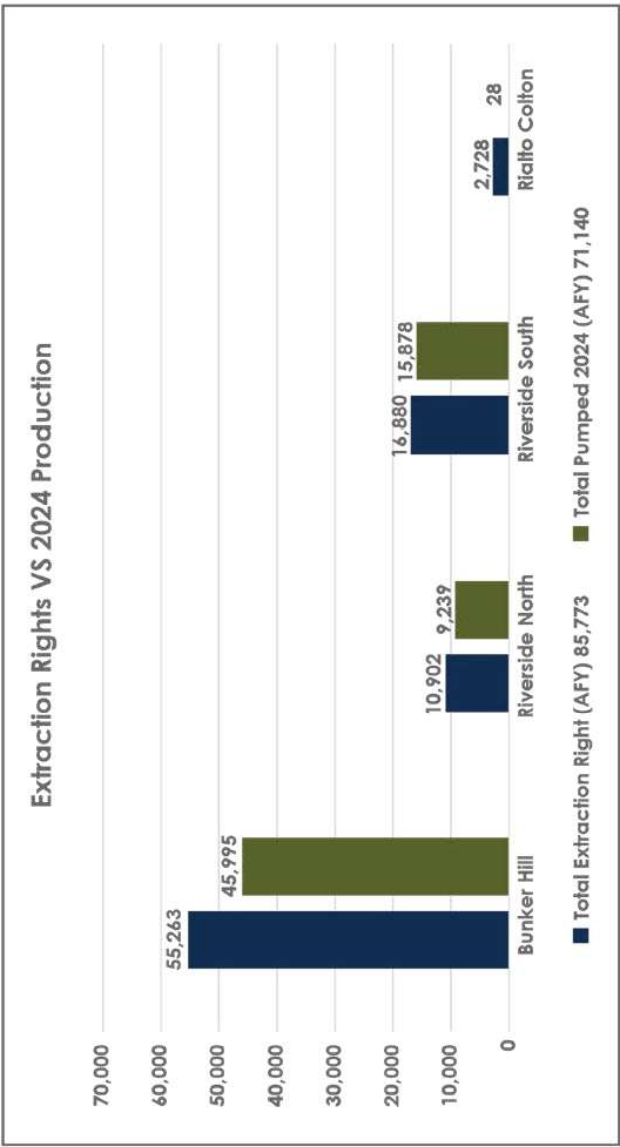
Groundwater extracted from the groundwater basins is conveyed via pipeline to RPU's potable or non-potable distribution system based on the well location and demand. Raw groundwater from all of RPU's wells receives some form of treatment prior to entering the potable distribution system. In 2024, RPU operated 45 active potable water wells and 7 active non-potable water wells, for a total of 52 active wells. In addition, a portion of the treated potable water produced along the Gage pipeline is used for irrigation purposes by Gage Canal Company (GCC) customers located within Riverside's "Greenbelt".

Since 2009, 100% of RPU's water supplies have originated from the groundwater basins, Flume, Gage, North Orange, Rialto-Colton, and Waterman well fields. RPU's wells are generally located in the section of the basin, with the greatest thickness of water-bearing layers, in which 71,140 AF were pumped in 2024 under the City's water right and the rest 4,727 AF were wheeled to Western Water under their water right. Approximately 75,868 acre-feet, which equal to 24.65 billion gallons, of water were extracted from aquifers in 2024 to supply water to the

RPU service area and wheeled water to Western Water. The Western-San Bernardino Watermaster prepares an annual report presenting groundwater production data, while the Santa Ana River Watermaster prepares an annual report on the surface water flows along the Santa Ana River. These annual Watermaster reports are issued and submitted to the court annually to comply with the 1969 Judgment, which set surface water and groundwater rights for the region.

Groundwater Production by Basin in 2024

Total amounts may vary slightly due to rounding



Production by Basin

Rialto-Colton Basin
1 Well: 28 AFY

Riverside North Basin
7 Wells: 9,239 AFY

Bunker Hill Basin
31 Wells: 50,722 AFY

Riverside South Basin
13 Wells: 15,878 AFY

San Bernardino County
Riverside County

Jurupa Mountains

Linden-Evans Reservoir

N
NOT TO SCALE



Groundwater Production

Well Field

- Gage
- Waterman
- North Orange
- Flume
- Non-potable

Production (AFY)

- 1,100
- 2,200
- 3,300
- 4,400

Canal

- Gage Canal
- Riverside Canal

Linden-Evans Reservoir

Water Conveyance

Sphere of Influence

Surface Water

- Santa Ana River
- Streams and Channels
- City Boundary
- Water Service Area
- County Boundary

Groundwater Basins

- Bunker Hill Basin
- Rialto-Colton Basin
- Riverside North Basin
- Riverside South Basin
- Arlington Basin

Santa Ana River

San Bernardino Mountains

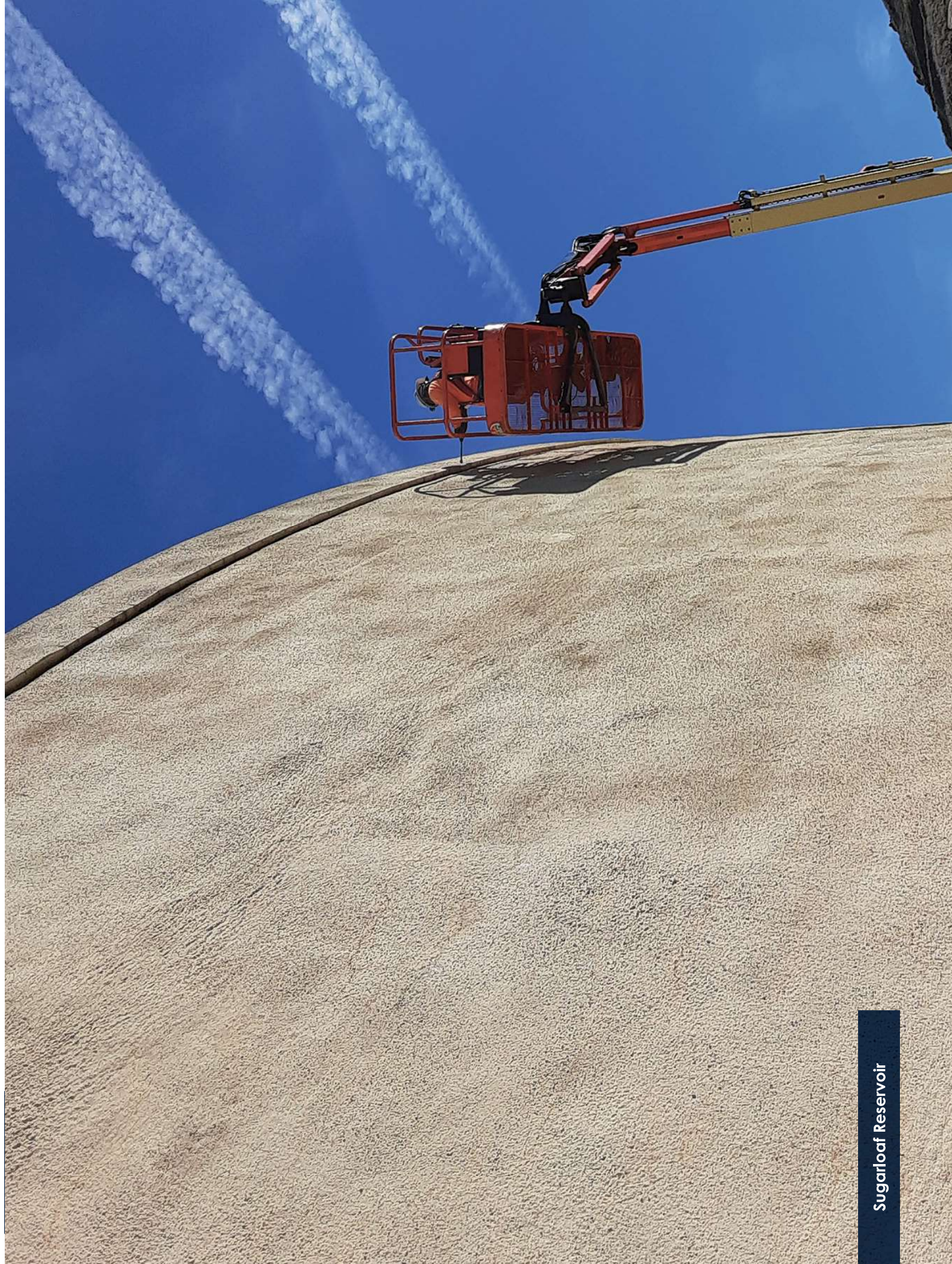
Seven Oaks Dam

91

210

60

215



Sugarloaf Reservoir

04 GROUNDWATER FACILITIES



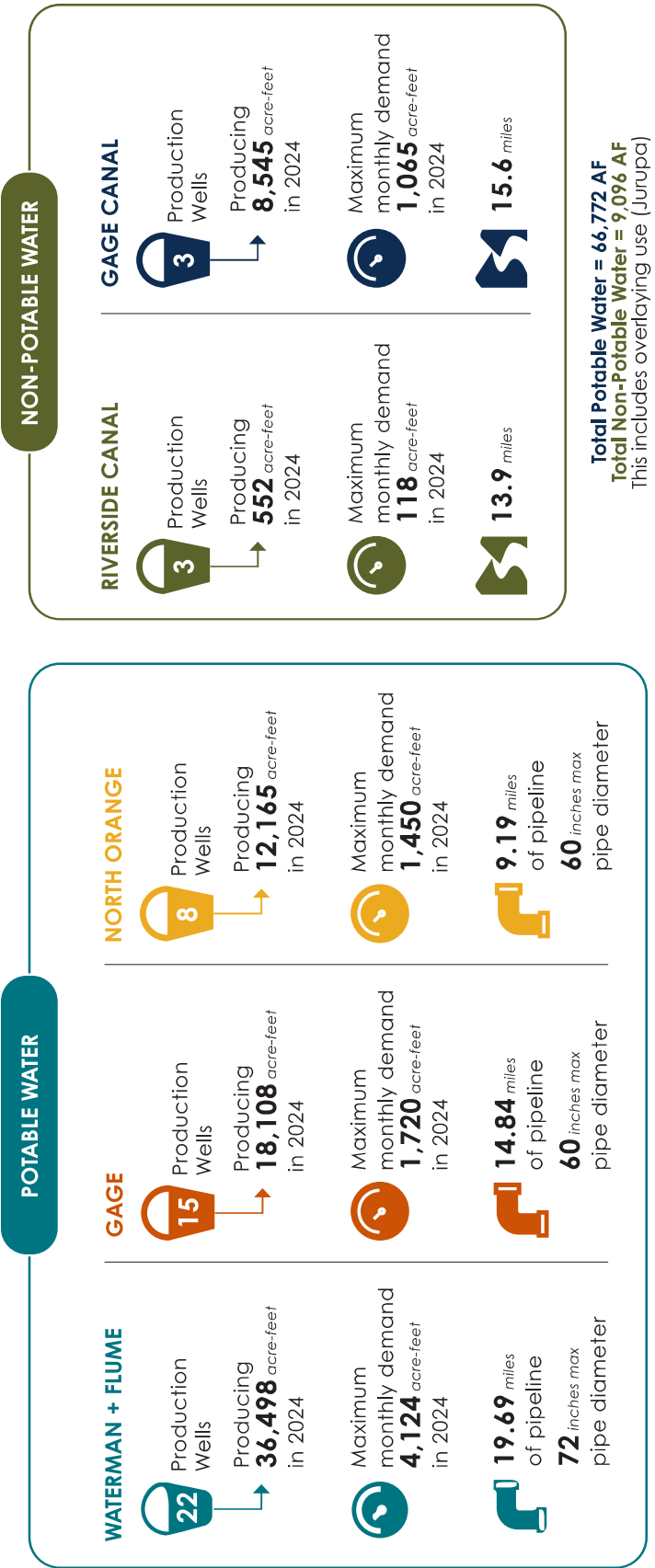
GROUNDWATER FACILITIES

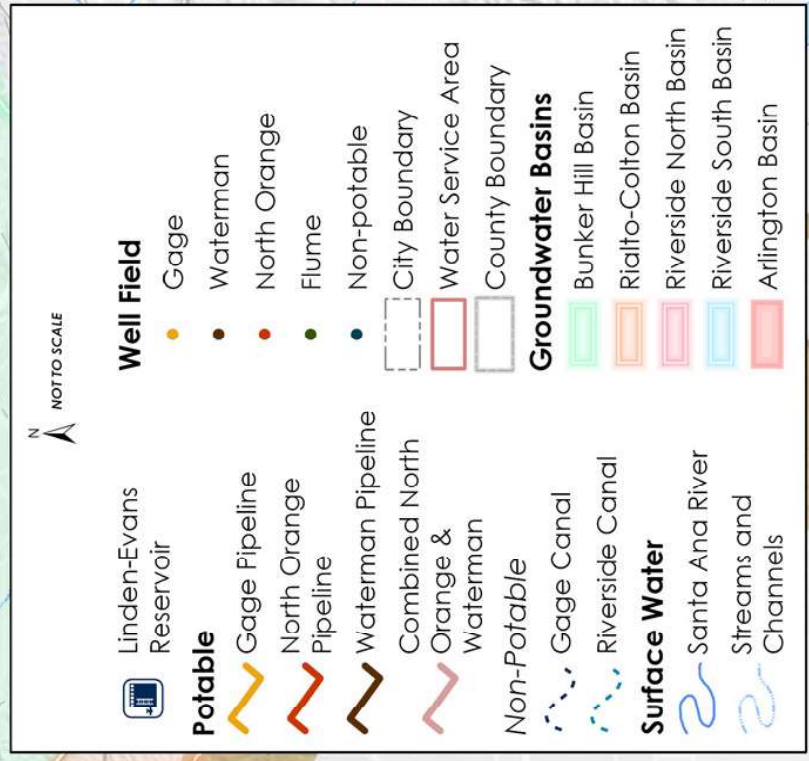
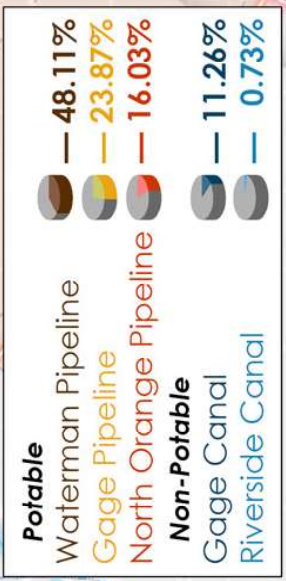
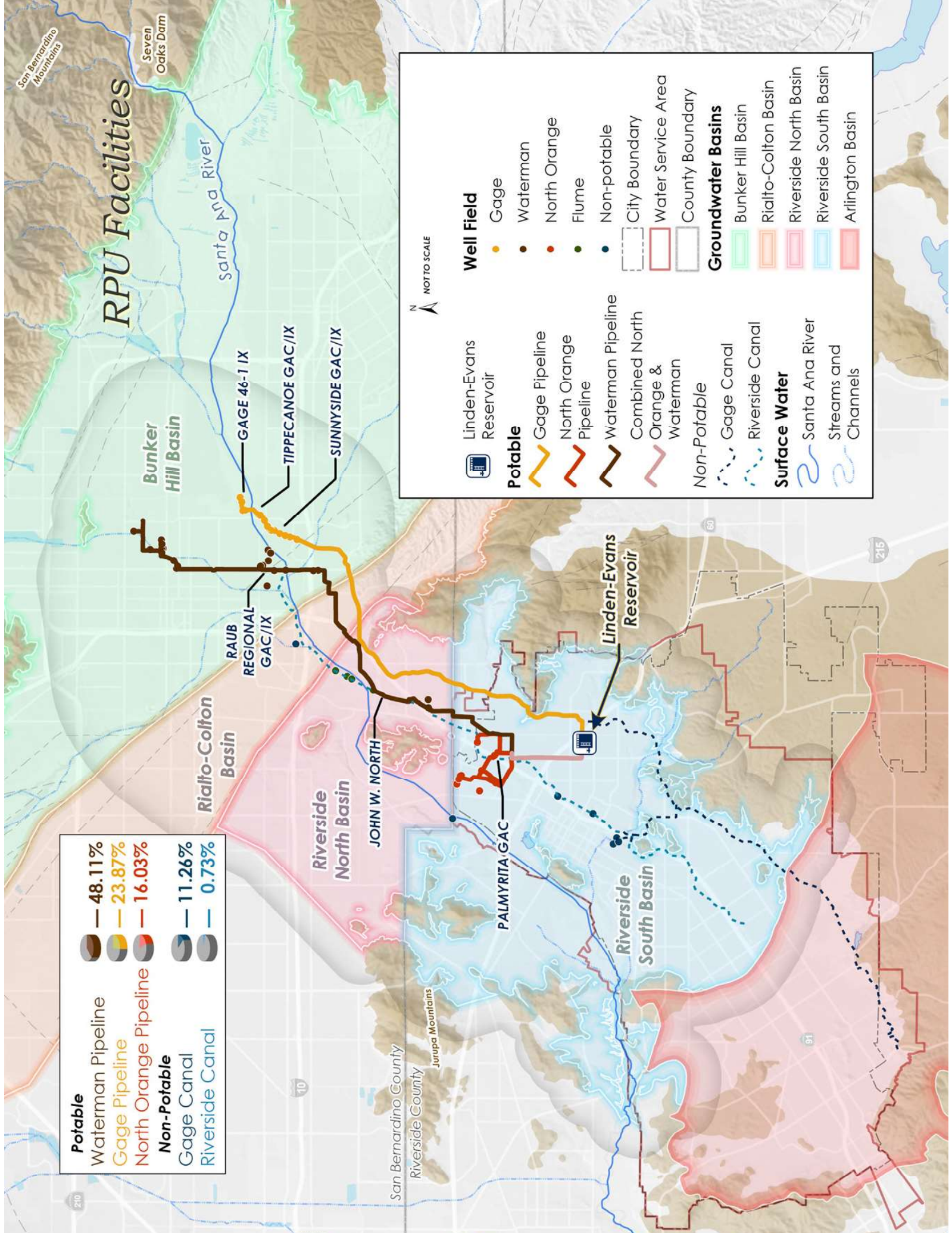
RPU has a vast network of conveyance facilities to deliver the groundwater produced from the basins to its customers through wells, treatment facilities, pipelines, reservoirs, and canals. RPU relies on these facilities and maintains them to ensure a reliable water supply throughout every season of the year.

Since 2009, all the City's water demand has been supplied from local groundwater sources in the Bunker Hill, Rialto-Colton, and Riverside basins.

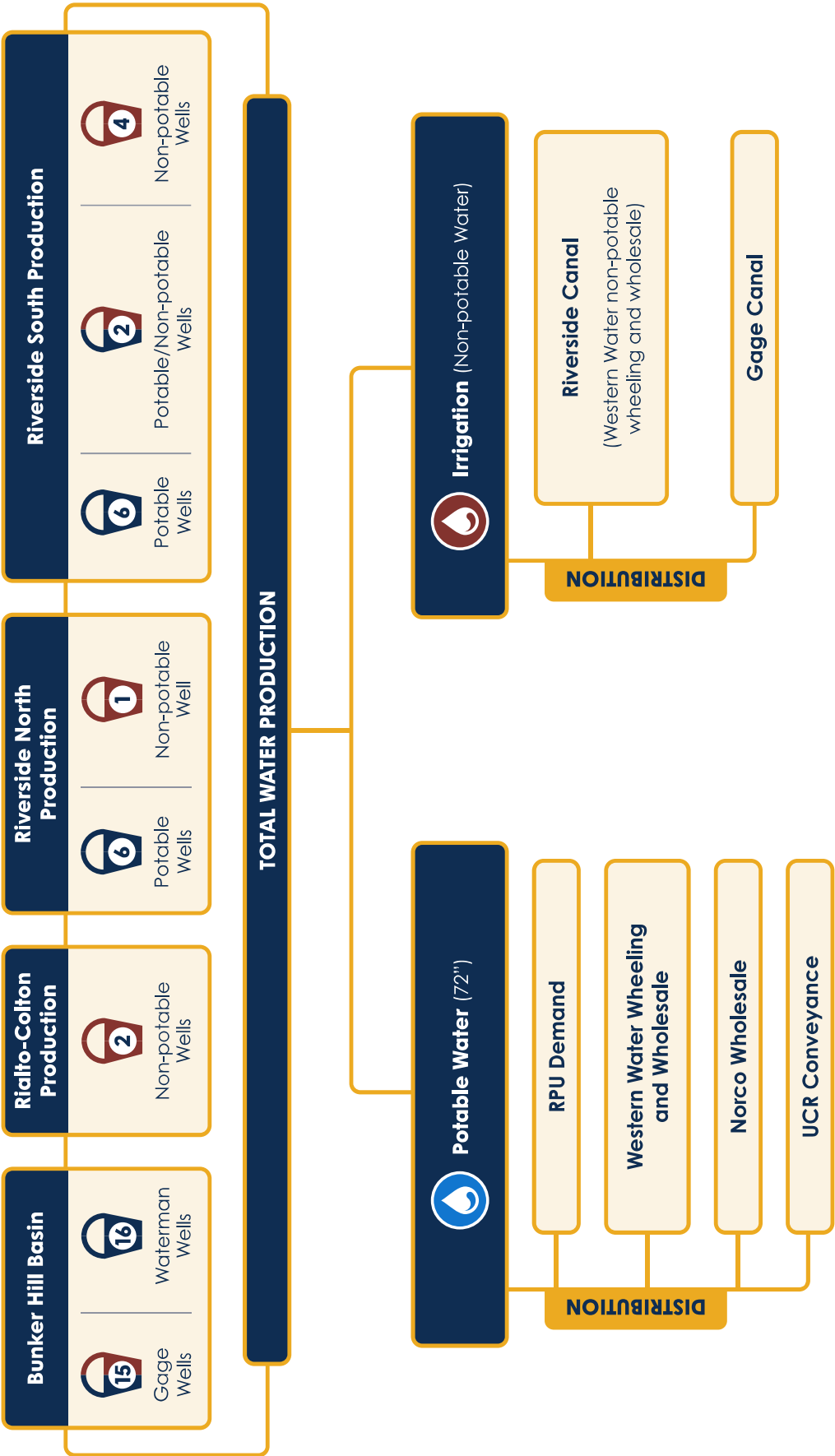
RPU's potable water is conveyed via the Waterman, Gage, and North Orange distribution main pipelines to RPU Rialto-Colton customers. RPU's non-potable water is delivered by the Riverside and the Gage Canal to the Western Water and GCC respectively. Reports are prepared annually presenting groundwater production data and water quality.

Groundwater Well Production and Pipes

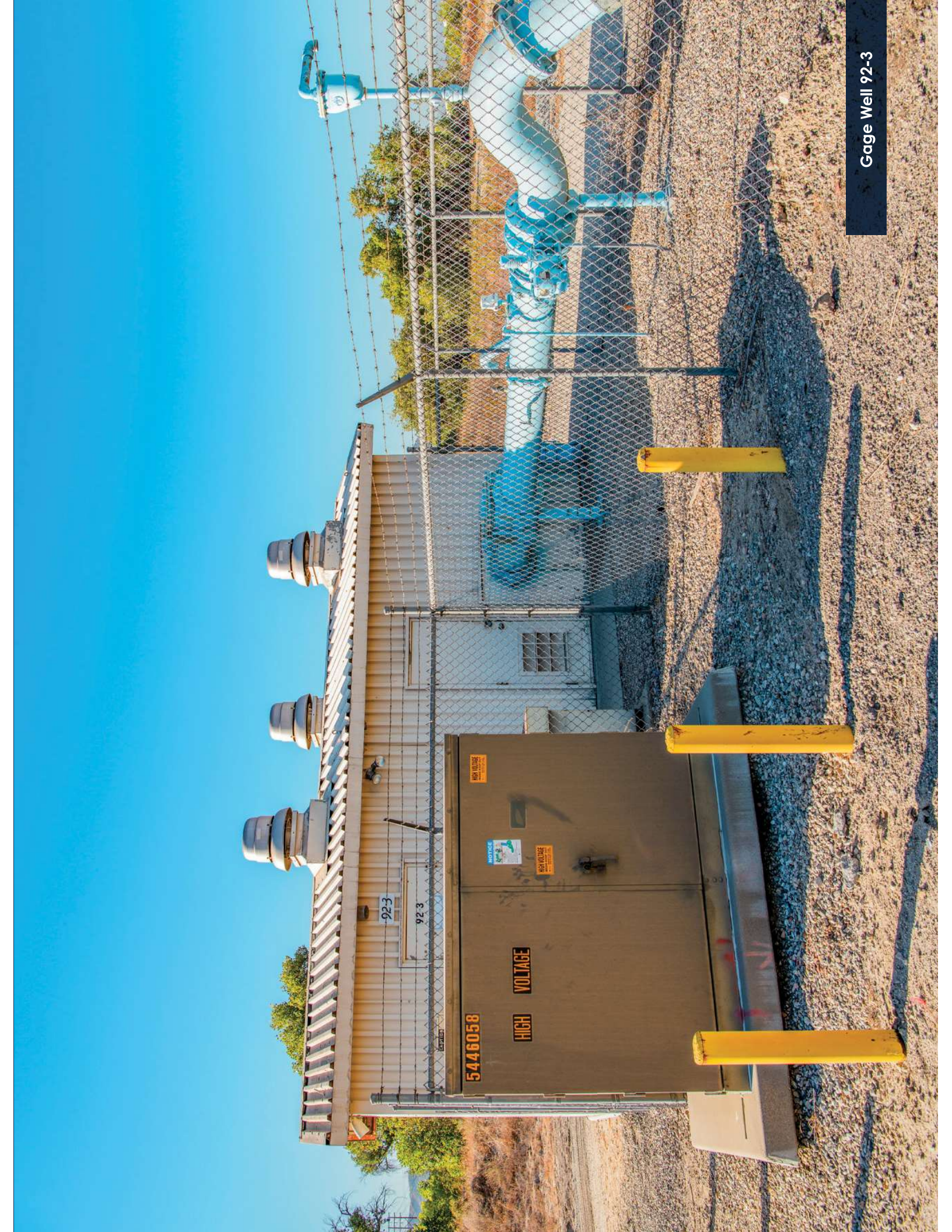




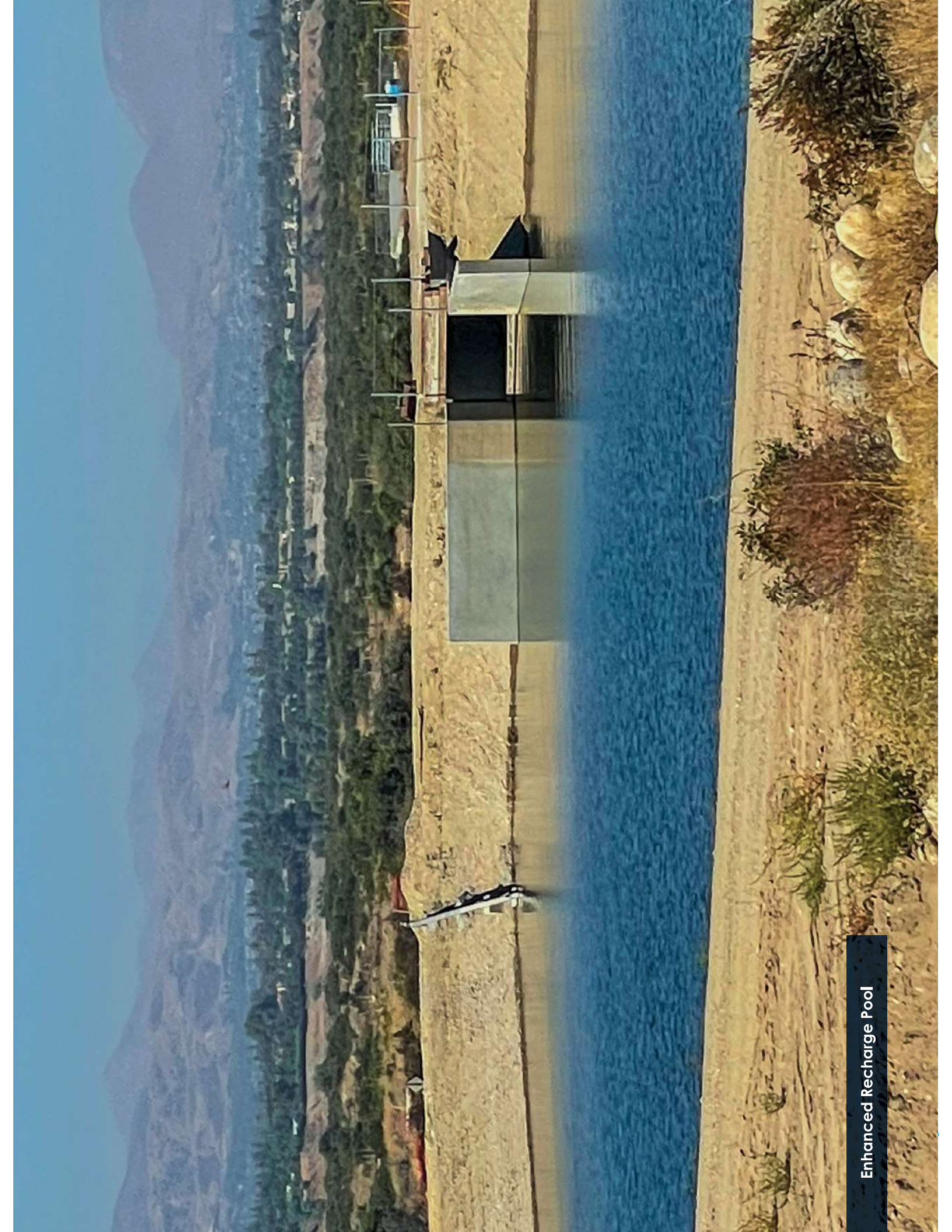
RPU Water Production



	Potable		Potable/Non-potable		Non-potable		Potable Water (72")		Irrigation (Non-potable Water)
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Gage Well 92-3



Enhanced Recharge Pool

05 GROUNDWATER LEVELS



GROUNDWATER LEVELS

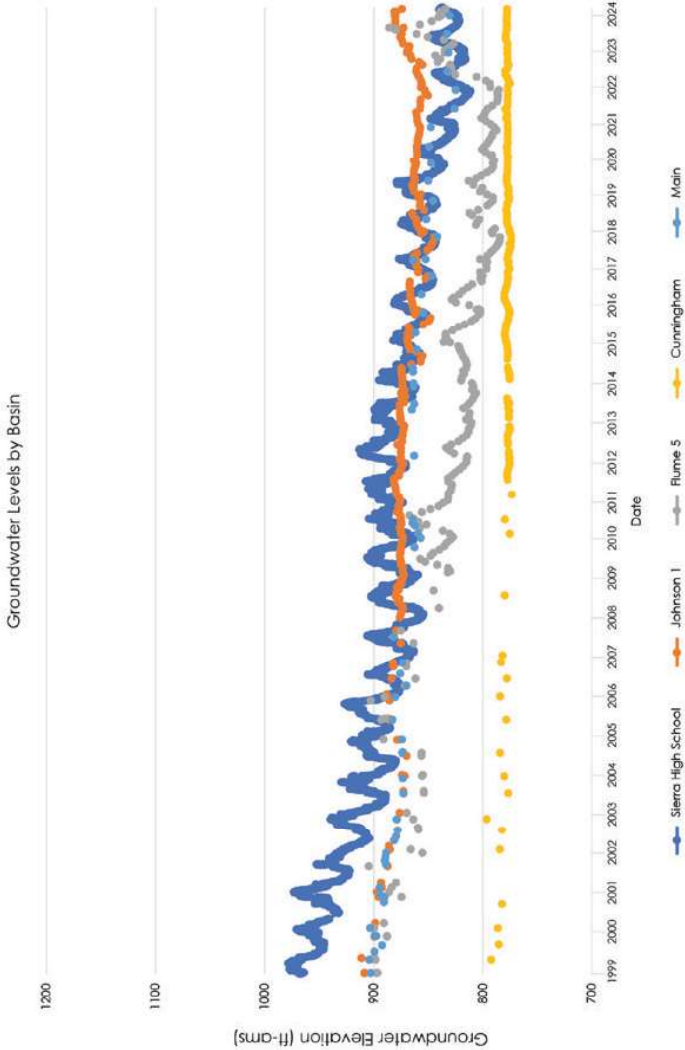
Overall groundwater conditions—specifically water levels—are unique to each basin. Tracking water levels throughout a basin can be used to understand how water levels respond to varying conditions (i.e., drought, groundwater pumping, recharge). RPU routinely measures water levels from their wells and uses this data to evaluate both short- and long-term trends. By collecting and evaluating this data, and understanding the factors driving changing conditions, RPU can act as environmental stewards, collaborate effectively with other local water agencies, and strategically plan future investments to ensure a reliable groundwater supply.

In 2024, RPU obtained over 100 water level measurements to determine the depth-to-water, flow direction, and gradient of groundwater in each basin. Groundwater elevations are calculated by subtracting the water level measurement from the surface elevation at each well. This information is then compared to historical data to identify trends in recharge and groundwater usage. Groundwater elevations are also contoured to identify pumping depressions, flow directions, areas of higher gradient, or areas that may be lower at depths to groundwater than anticipated. Over the last 20 years, average groundwater elevations have dropped over 100 feet in the Bunker Hill Basin with some areas having 200 feet in groundwater elevation change.

This section displays a series of maps showing the groundwater levels in 2023 and 2024 and the change in groundwater levels from 2023 to 2024. To illustrate the change in groundwater levels over the last 10 years, corresponding to the most recent drought, groundwater elevation contours were generated for 2014 and 2024 and the change in water levels.

Rate of Groundwater Level Decline from 1999 to 2024 within RPU's Sphere of Influence

Groundwater Levels by Basin

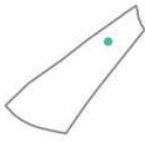


The figure above shows a time series of groundwater levels from representative wells located in Riverside's sphere of influence, overlying the groundwater basins from 1999 to the end of 2024. Each dot represents a groundwater level measurement and is plotted over time to identify trends. The chart shows how groundwater basins respond to hydrologic conditions and groundwater pumping. The groundwater levels in the respective basins represent a long-term decline in groundwater levels. Sierra High School, located in the Bunker Hill Basin, shows groundwater level declines of about 4.7 ft/yr. Johnson 1, located in the Rialto-Colton Basin, shows groundwater level declines of about 1.0 ft/yr. Flume 5, located in the Riverside North Basin, shows groundwater level declines of about 2.1 ft/yr. Cunningham, located in the Riverside South Basin, have been relatively stable with groundwater level declines of about 0.3 ft/yr over a 25-year time period.



BUNKER HILL

Decline of about 4.7 ft/yr



RIALTO-COLTON

Decline of about 1.0 ft/yr



RIVERSIDE NORTH

Decline of about 2.1 ft/yr

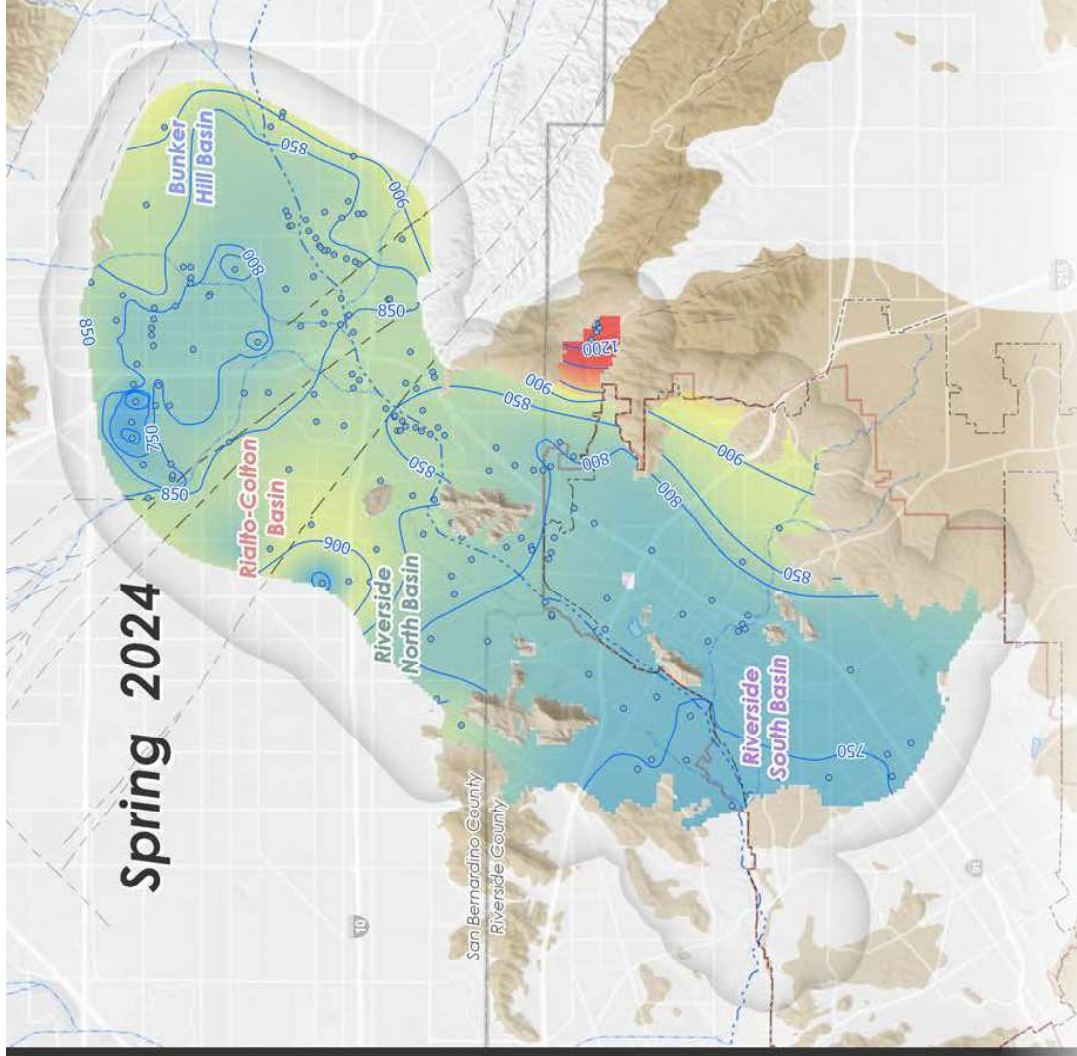
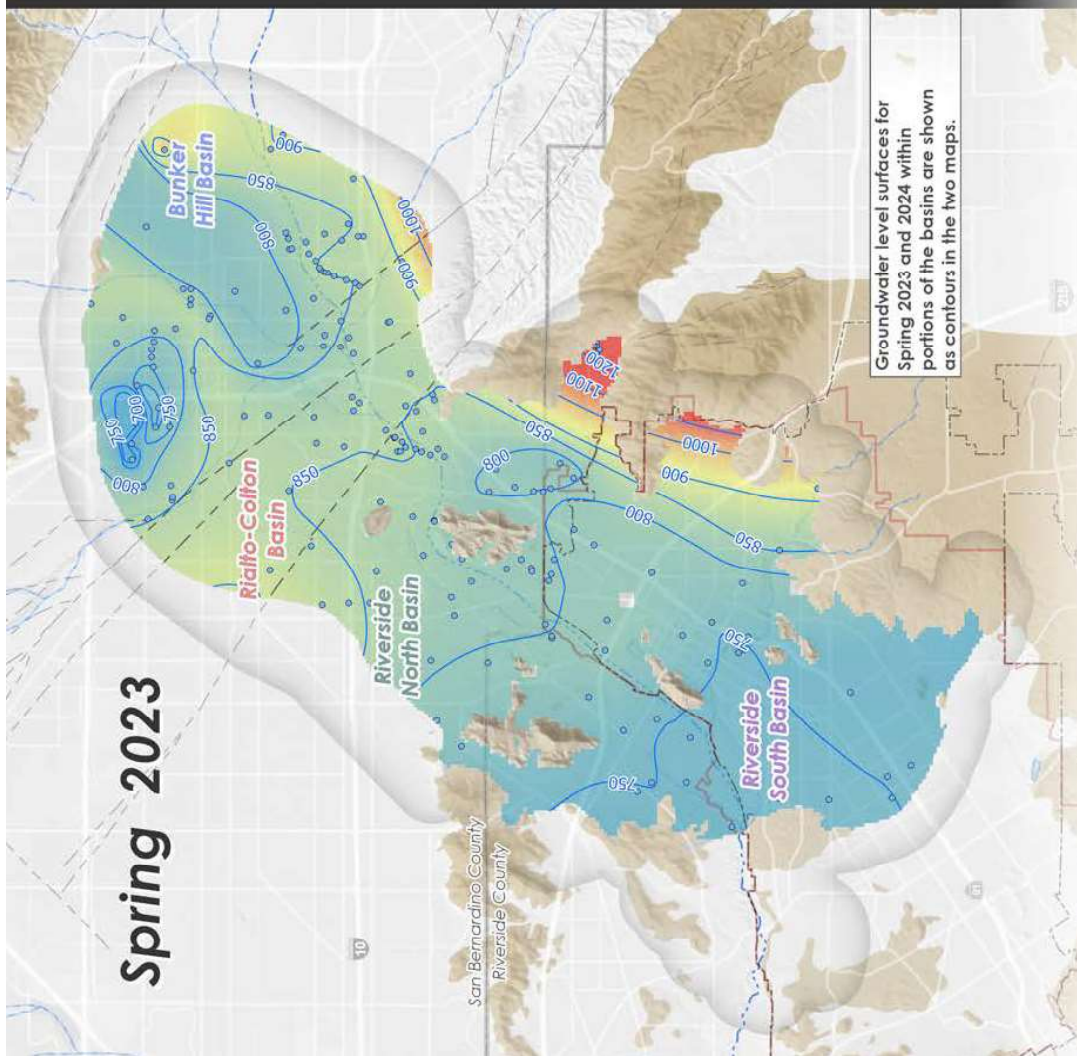


RIVERSIDE SOUTH

Decline of about 0.3 ft/yr

Spring 2023

Spring 2024



1-Year Change (Water Level)

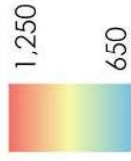
Surface Water

Santa Ana River

Streams and Channels

Groundwater Elevation (ft-amsl)

(feet above mean sea level)



Groundwater Levels

Groundwater Elevation Point (Regional Wells)

Groundwater Elevation Contour (50 ft-amsl)

Fault Line

Sphere of Influence

City of Riverside

City Boundary

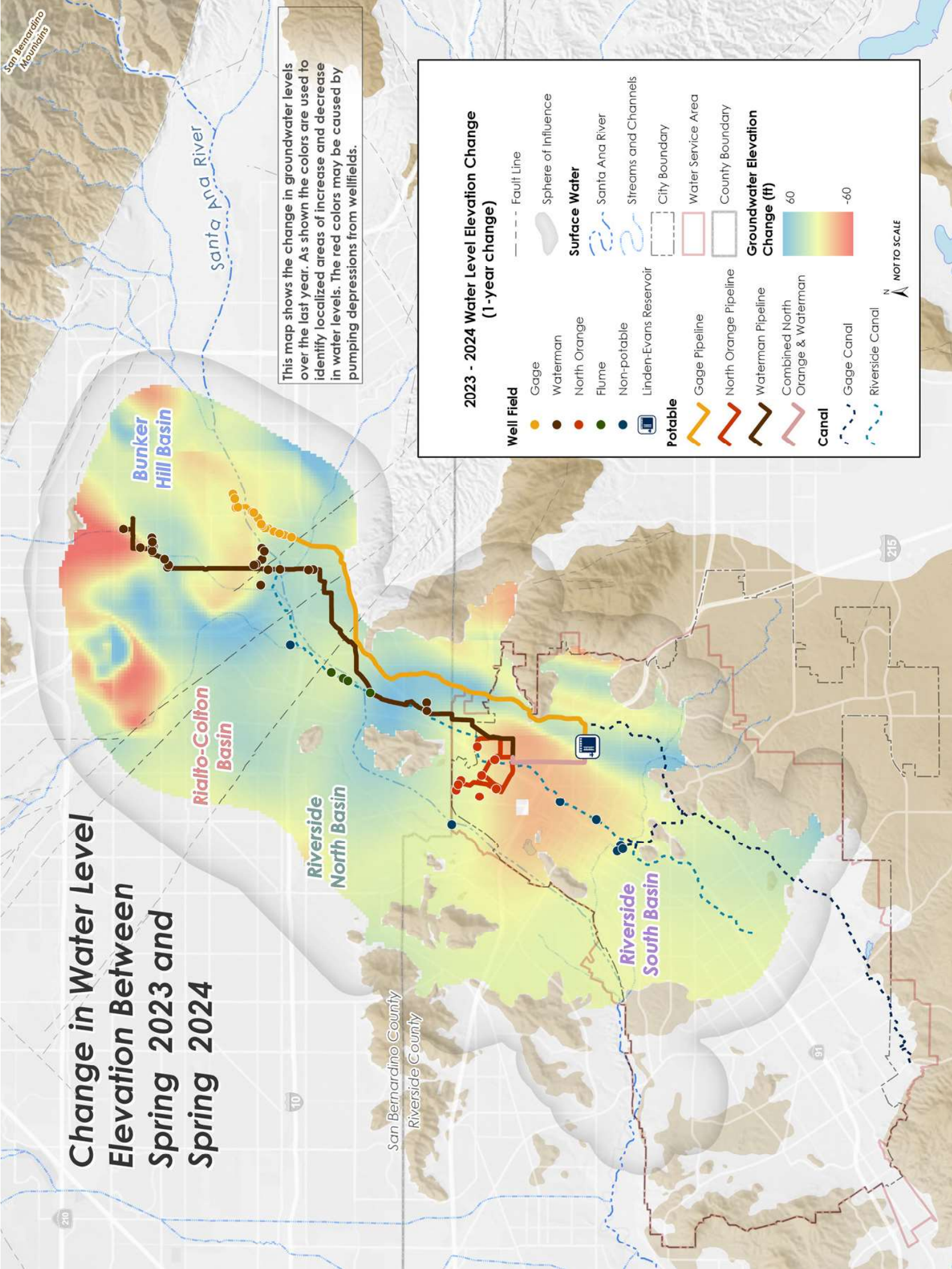
Water Service Area

County Boundary



NOT TO SCALE

Change in Water Level Elevation Between Spring 2023 and Spring 2024



Fall 2014

Fall 2024

RPU staff takes long term trends into account to proactively manage their groundwater facilities.

Groundwater level surfaces for Fall of 2014 and 2024 within portions of the basins are shown as contours of these two maps. This 10-year period represents the most recent drought.

10-Year Change (Water Level)

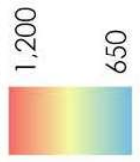
Surface Water

Santa Ana River

Streams and Channels

Groundwater Elevation (ft-amsl)

(feet above mean sea level)



Groundwater Levels

Groundwater Elevation Point (Regional Wells)

Groundwater Elevation Contour (50 ft-amsl)

Fault Line

Sphere of Influence

City of Riverside

City Boundary

Water Service Area

County Boundary



Change in Water Level Elevation Between Fall 2014 and Fall 2024

Bunker
Hill Basin

Rialto-Colton
Basin

Riverside
North Basin

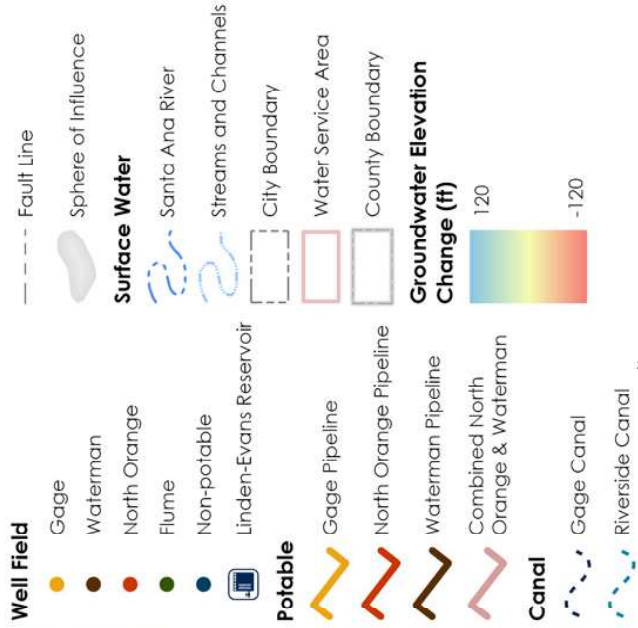
Riverside
South Basin

Santa Ana River

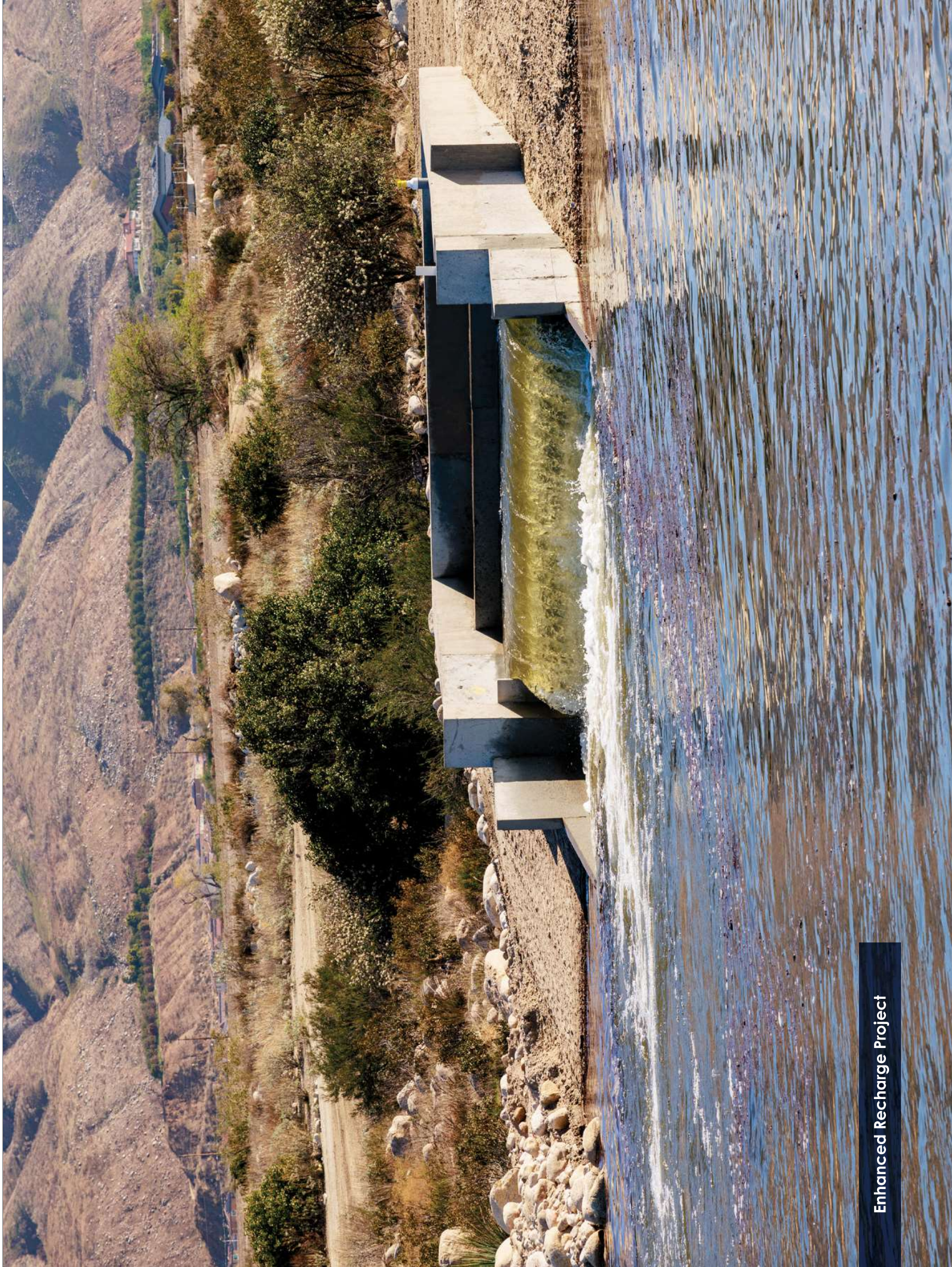
San Bernardino County
Riverside County

The this map shows the change in groundwater levels over the drought from 2014 to 2024. The red areas reflect the areas most impacted by the drought. During drought conditions water purveyors rely more on groundwater than during normal years.

2014 - 2024 Water Level Elevation Change (10-year change)



Enhanced Recharge Project



06 GROUNDWATER IN STORAGE

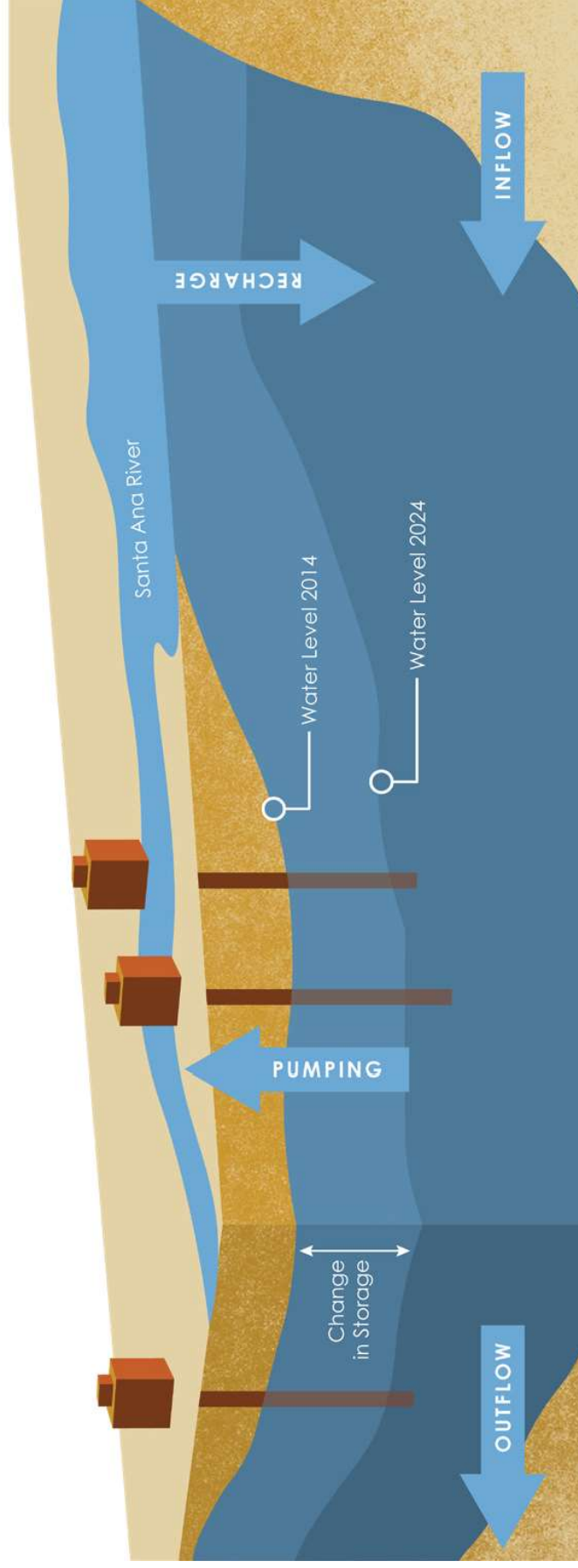


GROUNDWATER IN STORAGE

RPU tracks the quantity of groundwater in storage in each basin area as another tool to monitor groundwater conditions. Changes in storage can be used to better understand groundwater production and demands from each of RPU's wellfields distributed across the groundwater basins, and to make future decisions on where to replace and locate groundwater wells.

The change in storage over a time period is calculated by multiplying the change in groundwater level, by the specific yield of the aquifer materials over which the water-level change occurred, and by the area where the change occurred. The graphic below is a 3D representation of what a groundwater basin such as the Bunker Hill Basin may look like when comparing the change in storage that occurred over the 10-year period corresponding to drought conditions. Water levels decreased possibly due to a combination of items such as urbanization, cultural conditions, changes in pumping patterns from other agencies, lower amounts of recharge, and less rainfall in general.

The volume of groundwater for each basin is summarized in the graphic below. The preceding pages show the spatial distribution of the volume of groundwater in each basin.



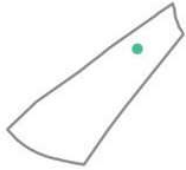
Summary of Groundwater in Storage by Basin within RPU's Sphere of Influence (Acre-Feet)

BUNKER HILL



Fall 2014 Total Volume: 1,988,000
Spring 2023 Total Volume: 1,937,000
Spring 2024 Total Volume: 1,942,000
Fall 2024 Total Volume: 1,942,000
Spring 2023-2024 Volume Change: 5,000
Fall 2014 to 2024 Volume Change: -46,000

RIALTO-COLTON



Fall 2014 Total Volume: 465,000
Spring 2023 Total Volume: 468,000
Spring 2024 Total Volume: 478,000
Fall 2024 Total Volume: 468,000
Spring 2023-2024 Volume Change: 10,000
Fall 2014 to 2024 Volume Change: 3,000

RIVERSIDE NORTH



Fall 2014 Total Volume: 439,000
Spring 2023 Total Volume: 445,000
Spring 2024 Total Volume: 437,000
Fall 2024 Total Volume: 437,000
Spring 2023-2024 Volume Change: -8,000
Fall 2014 to 2024 Volume Change: -2,000

RIVERSIDE SOUTH



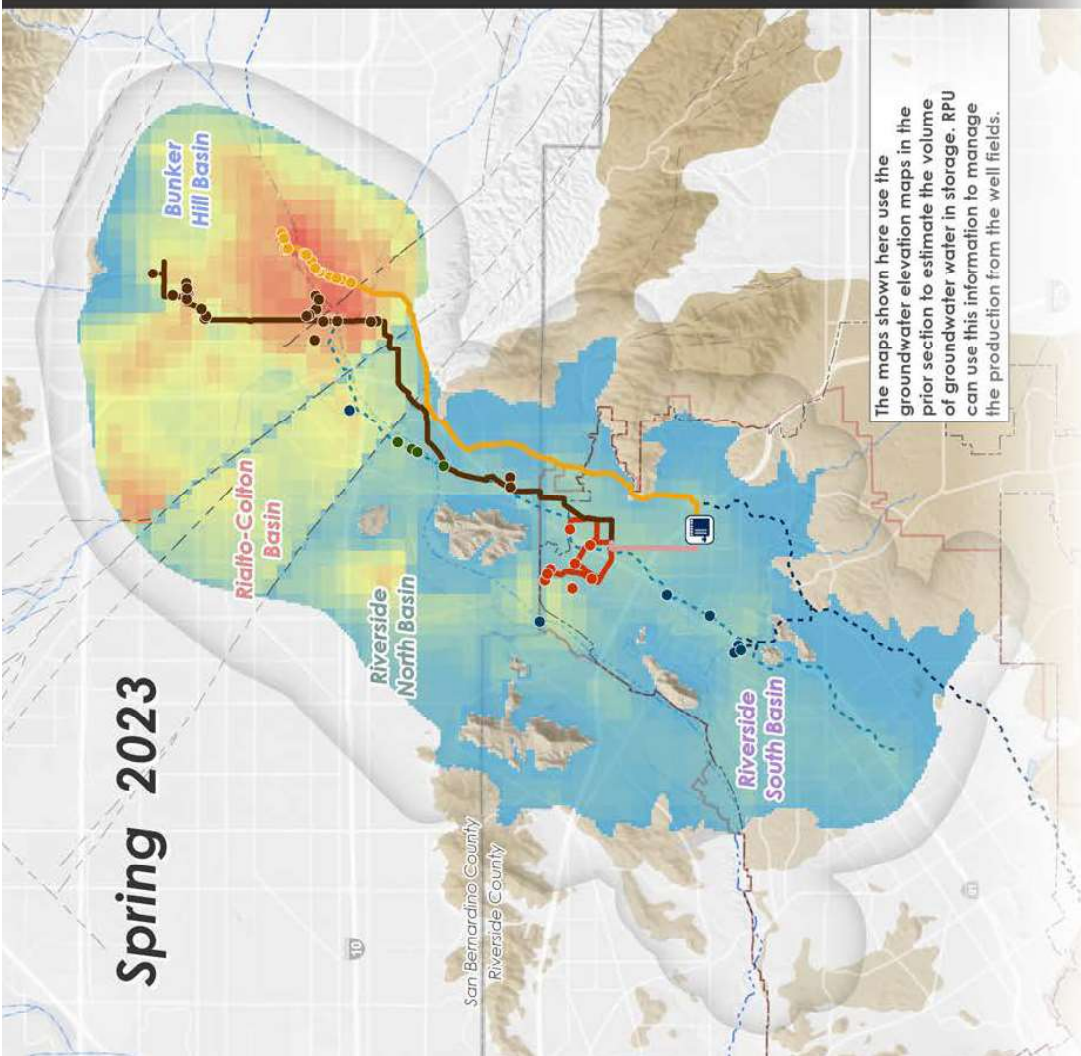
Fall 2014 Total Volume: 351,000
Spring 2023 Total Volume: 351,000
Spring 2024 Total Volume: 368,000
Fall 2024 Total Volume: 367,000
Spring 2023-2024 Volume Change: 17,000
Fall 2014 to 2024 Volume Change: 16,000

TOTAL VOLUME

Fall 2014 Total Volume: 3,243,000
Spring 2023 Total Volume: 3,201,000
Spring 2024 Total Volume: 3,225,000
Fall 2024 Total Volume: 3,214,000
Spring 2023-2024 Volume Change: 24,000
Fall 2014 to 2024 Volume Change: -29,000



Note: The groundwater basin boundaries used in the storage calculations represent only a portion of each basin in the vicinity of RPU's well fields.



Spring 2023

Bunker Hill Basin

Rialto-Colton Basin

Riverside North Basin

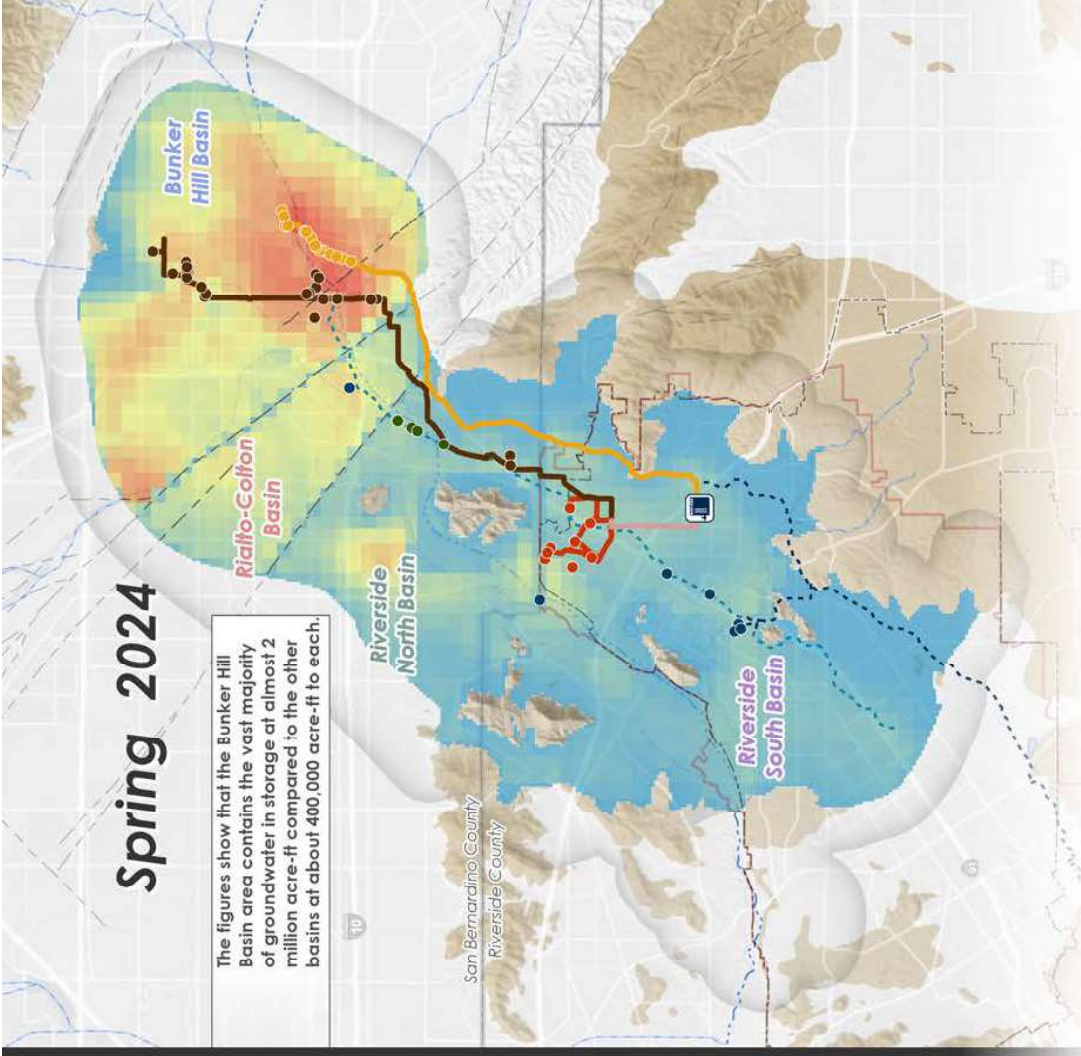
Riverside South Basin

San Bernardino County

Riverside County

0 10

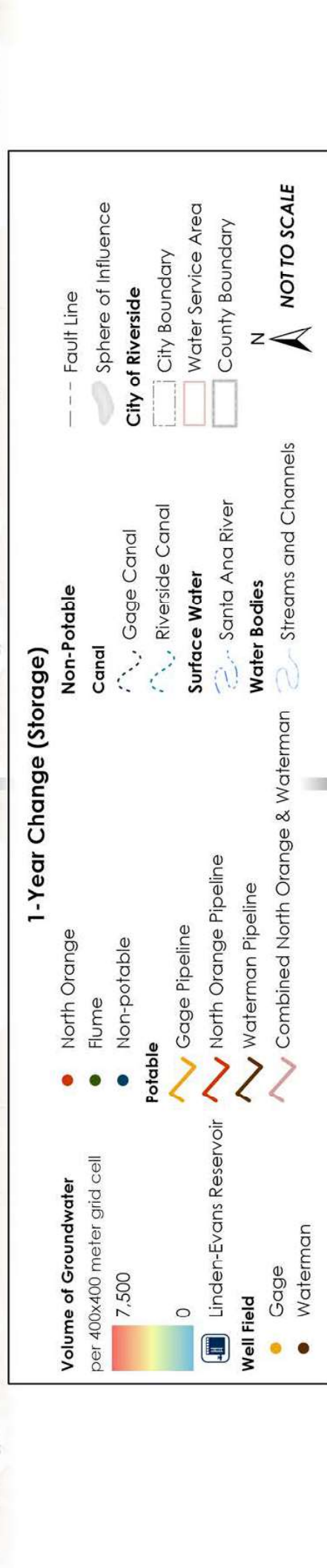
The maps shown here use the groundwater elevation maps in the prior section to estimate the volume of groundwater water in storage. RPU can use this information to manage the production from the well fields.



Spring 2024

The figures show that the Bunker Hill Basin area contains the vast majority of groundwater in storage at almost 2 million acre-ft compared to the other basins at about 400,000 acre-ft to each.

San Bernardino County
Riverside County



Change in Groundwater Storage Between Spring 2023 and Spring 2024

Bunker Hill Basin

Rialto-Colton Basin

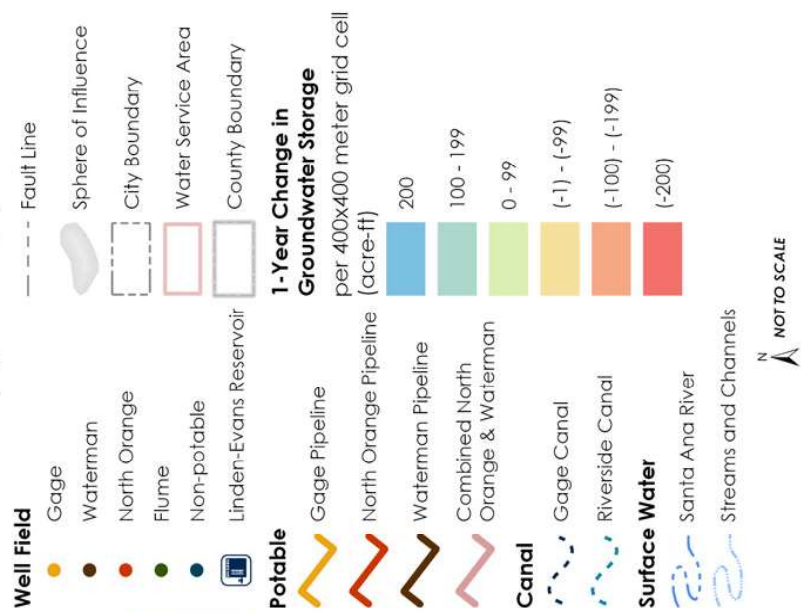
Riverside North Basin

Riverside South Basin

Santa Ana River

This map shows the change in groundwater storage from Spring 2023 to Spring 2024. A positive change in storage means that the volume of water in storage increased. For example, in the Eastern Gage well field groundwater, the volume of groundwater in storage increased.

2023 - 2024 Storage Change (1-year change)

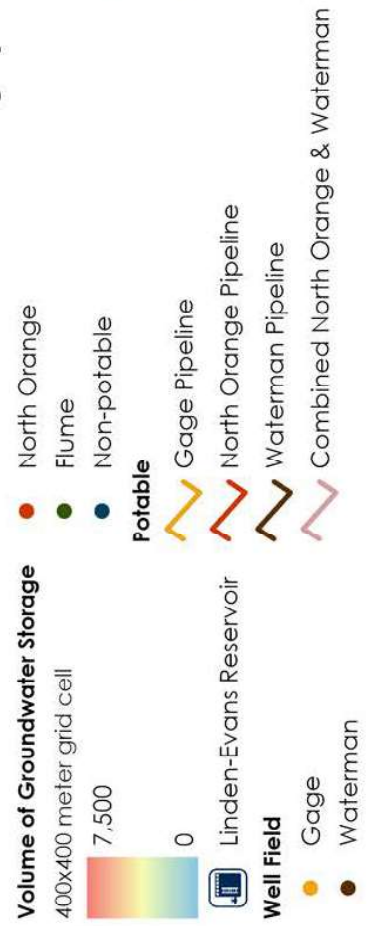


Fall 2014

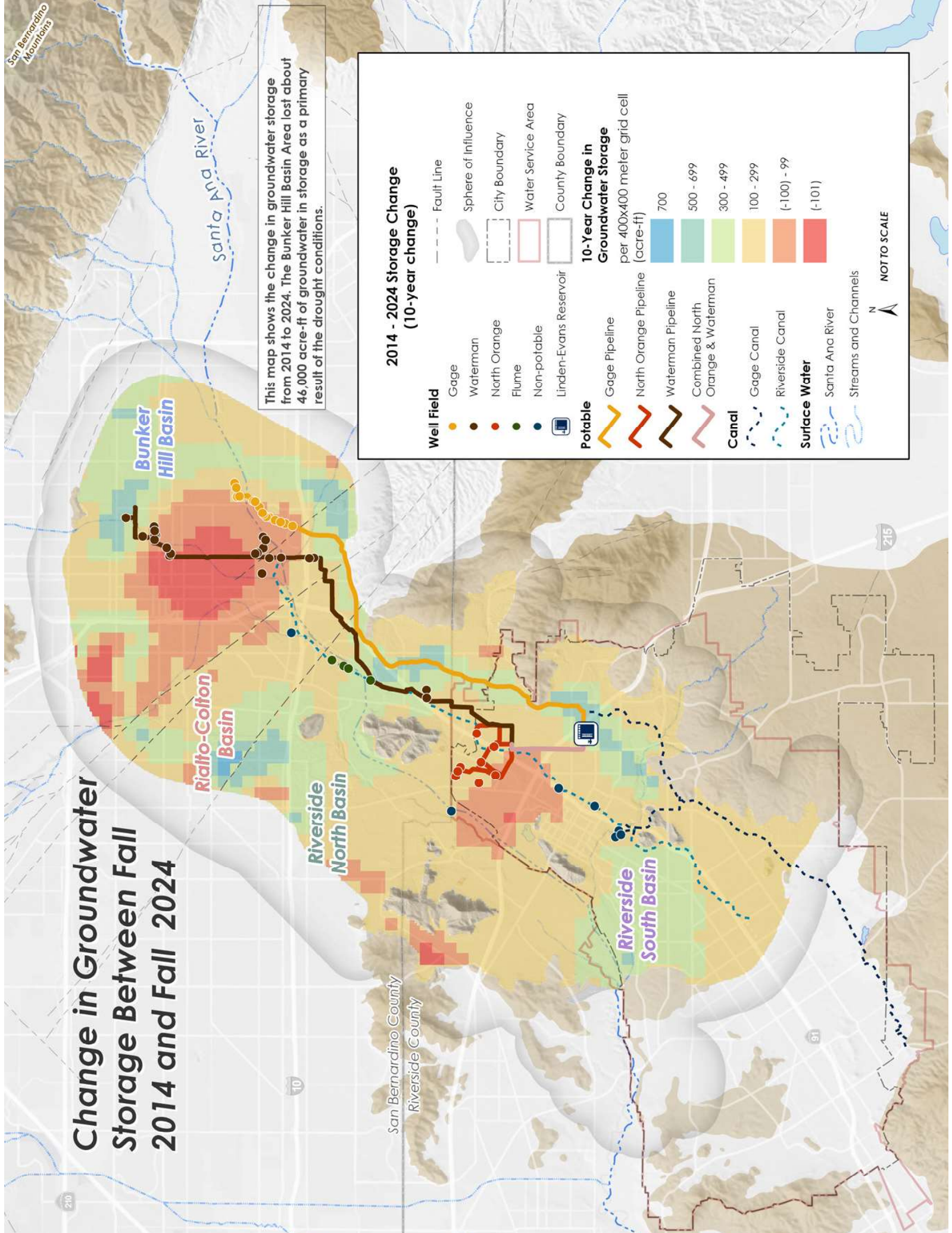
Fall 2024

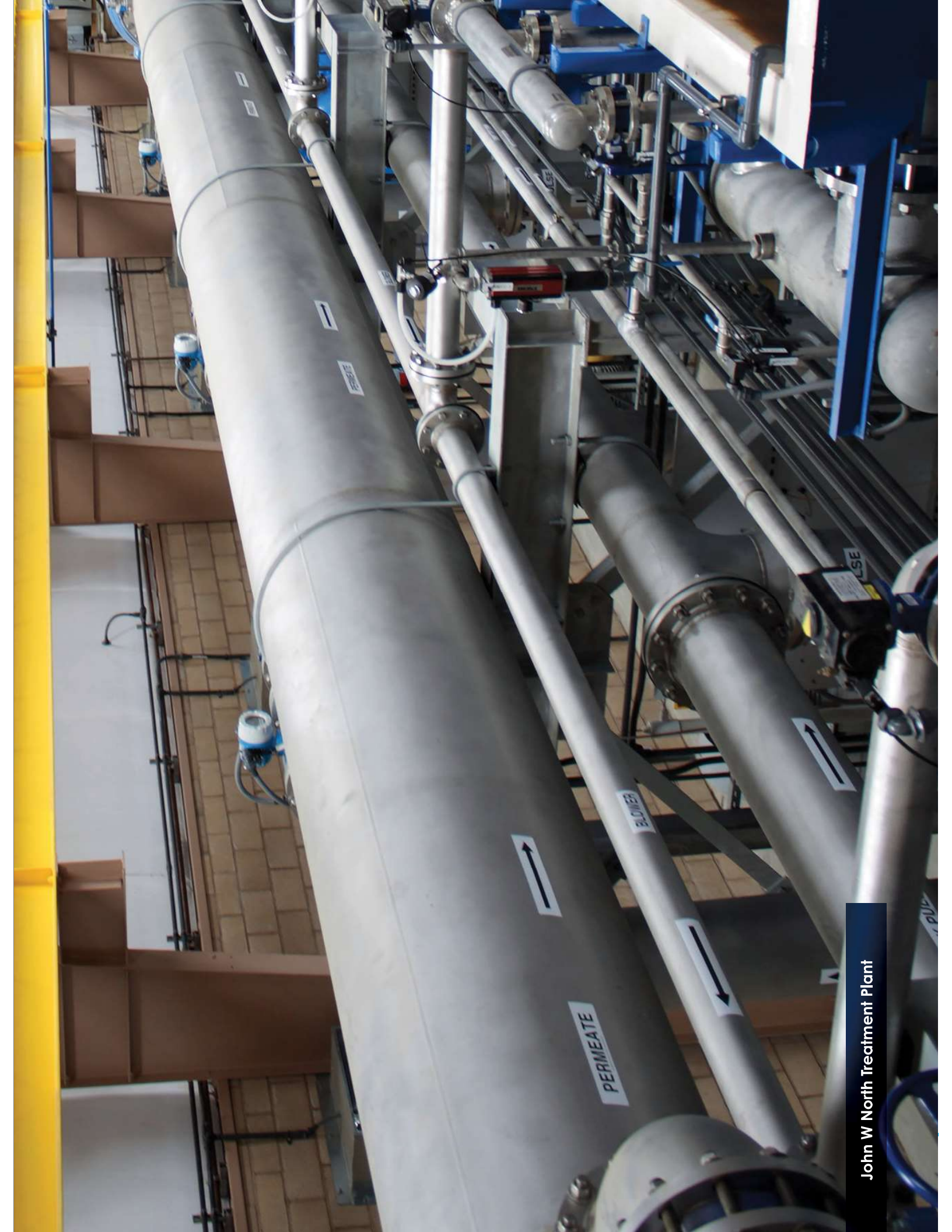
The maps shown here are used to show the effects of the drought from 2014 to 2024.

10-Year Change (Storage)



Change in Groundwater Storage Between Fall 2014 and Fall 2024





John W North Treatment Plant

07 GROUNDWATER QUALITY



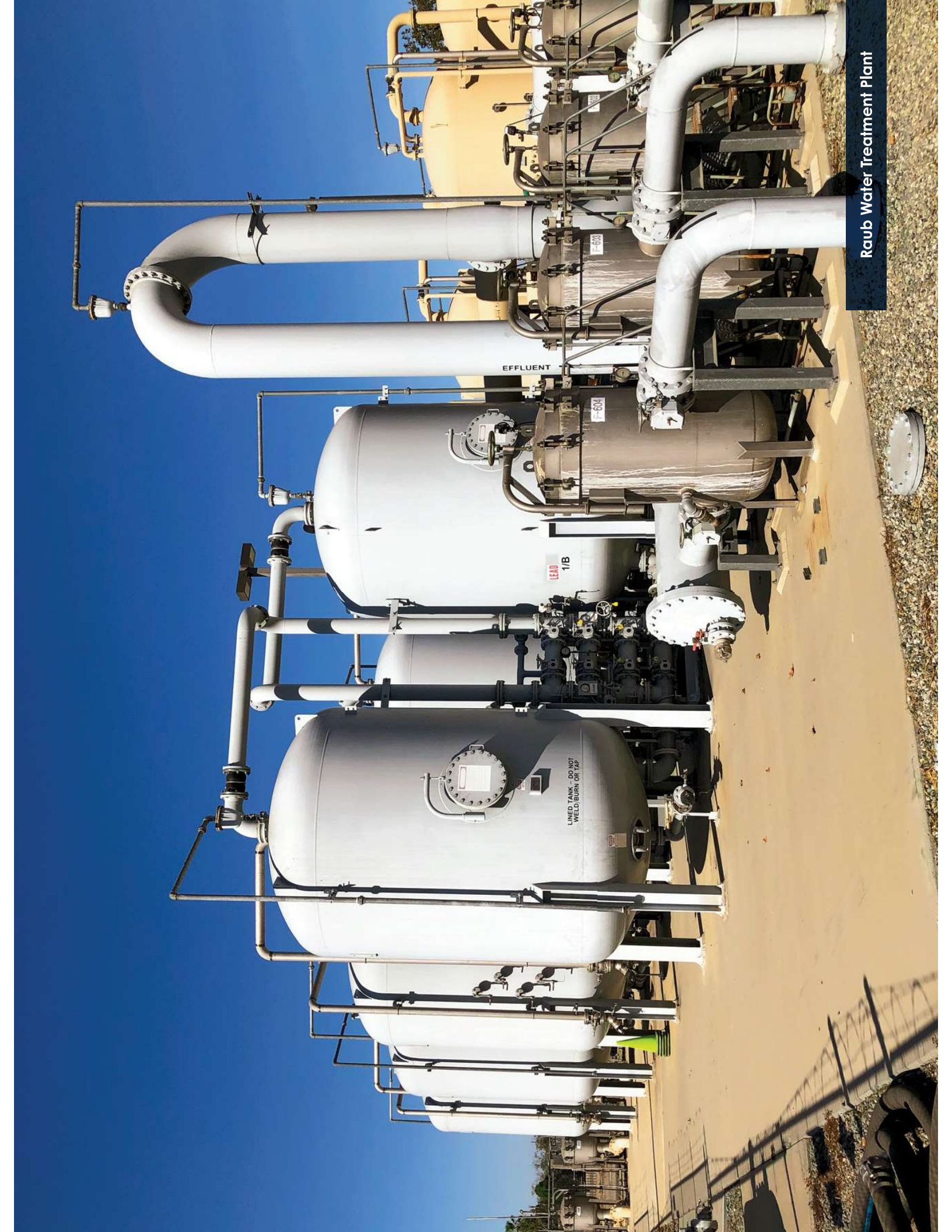
GROUNDWATER QUALITY

Most groundwater produced throughout the southern California region requires treatment. RPU continuously monitors the water quality of its drinking water wells to ensure the water it serves meets both federal and state drinking water standards. This proactive approach allows RPU to quickly identify changes in groundwater quality conditions so we may pursue additional investigations, communicate with stakeholders, and take remedial action if necessary.

The Safe Drinking Water Act was originally passed by Congress in 1974 to protect public health by regulating public drinking water supplies. Since then, additional amendments and measures have been implemented by Federal and State Officials to ensure public water supply systems deliver safe and reliable drinking water for public consumption. Historical waste disposal practices and chemical application of now-banned chemicals that were once legally and regularly used, have created localized contaminant plumes that have impacted the region's groundwater basins and at times, the City's supply. The City of Riverside has actively litigated against known entities that have impacted Riverside's groundwater supplies and has successfully obtained funding for construction and maintenance of facilities used to remove the constituents of concern from its groundwater supply. RPU has developed mutually beneficial relationships with some of the known entities to work collaboratively to intentionally capture a plume with select wells to limit the spread of the plume and protect downstream wells, and to provide treatment at the capture wells to remove the constituents of concern. Extensive monitoring occurs in areas of known plumes to ensure plume containment is always maintained. In addition, RPU strategically locates and constructs new wells to extract water from deeper, cleaner zones within the groundwater basin. The following figures depict some of the constituents RPU closely tracks.

2024 RPU Groundwater Sampling





Raub Water Treatment Plant

Nitrate (as Nitrogen)

Common Sources: Solid rocket propellant, aerospace operations, fireworks, explosives, flares, matches, and agriculture activity

Common Sources: Fertilizers, septic tank sewage, erosion of natural deposits.

Nitrate

(parts per million)

California DLR = 0.4 ppm
(Detection Level Report)

California MCL = 10 ppm
(Maximum Contaminant Level)

RPU Wells Above MCL = 3

Highest

Detection = 13 ppm

Perchlorate

(parts per billion)

California DLR = 1 ppb
(Detection Level Report)

California MCL = 6 ppb
(Maximum Contaminant Level)

RPU Wells Above MCL = 11

Highest

Detection = 33 ppb

Legend

Well Contaminant Level

- < Detection Level Reporting
- > Detection Level Reporting & <= Maximum Contaminant Level
- > Maximum Contaminant Level
- Linden-Evans Reservoir

Water Conveyance

- Waterman Pipeline
- Gage Pipeline
- North Orange Pipeline
- Combined North Orange & Waterman Pipeline
- Flume Pipeline
- Non-potable

Canal

- Gage Canal
- Riverside Canal
- Surface Water
- Santa Ana River
- Streams and Channels
- Fault Line

Groundwater Basins

- Bunker Hill Basin
- Rialto-Colton Basin
- Riverside North Basin
- Riverside South Basin

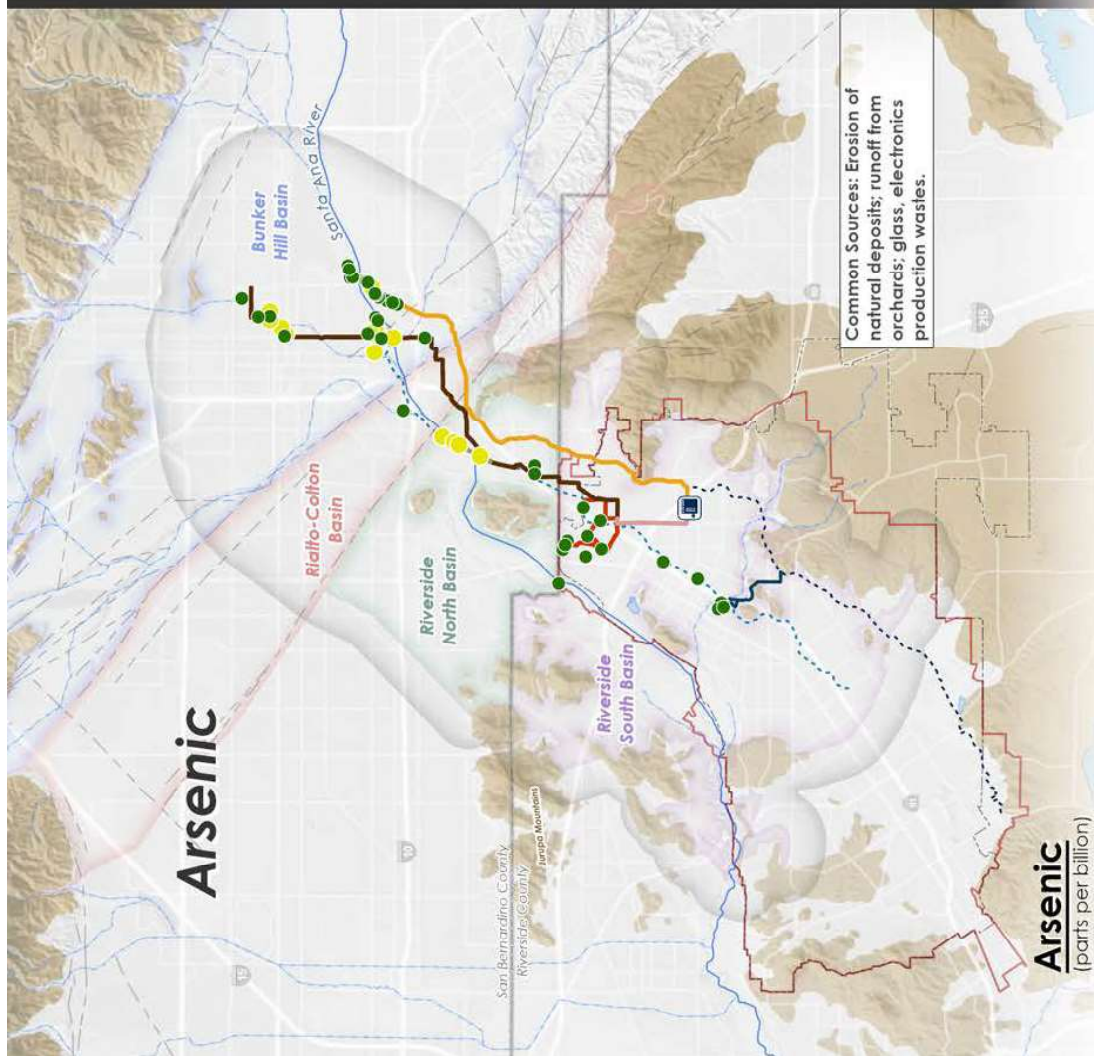
City of Riverside

- City Boundary
- Water Service Area

N
NOT TO SCALE

Data shown in the figures above shows raw groundwater prior to treatment and delivery to RPU customers.

Arsenic



Arsenic

(parts per billion)

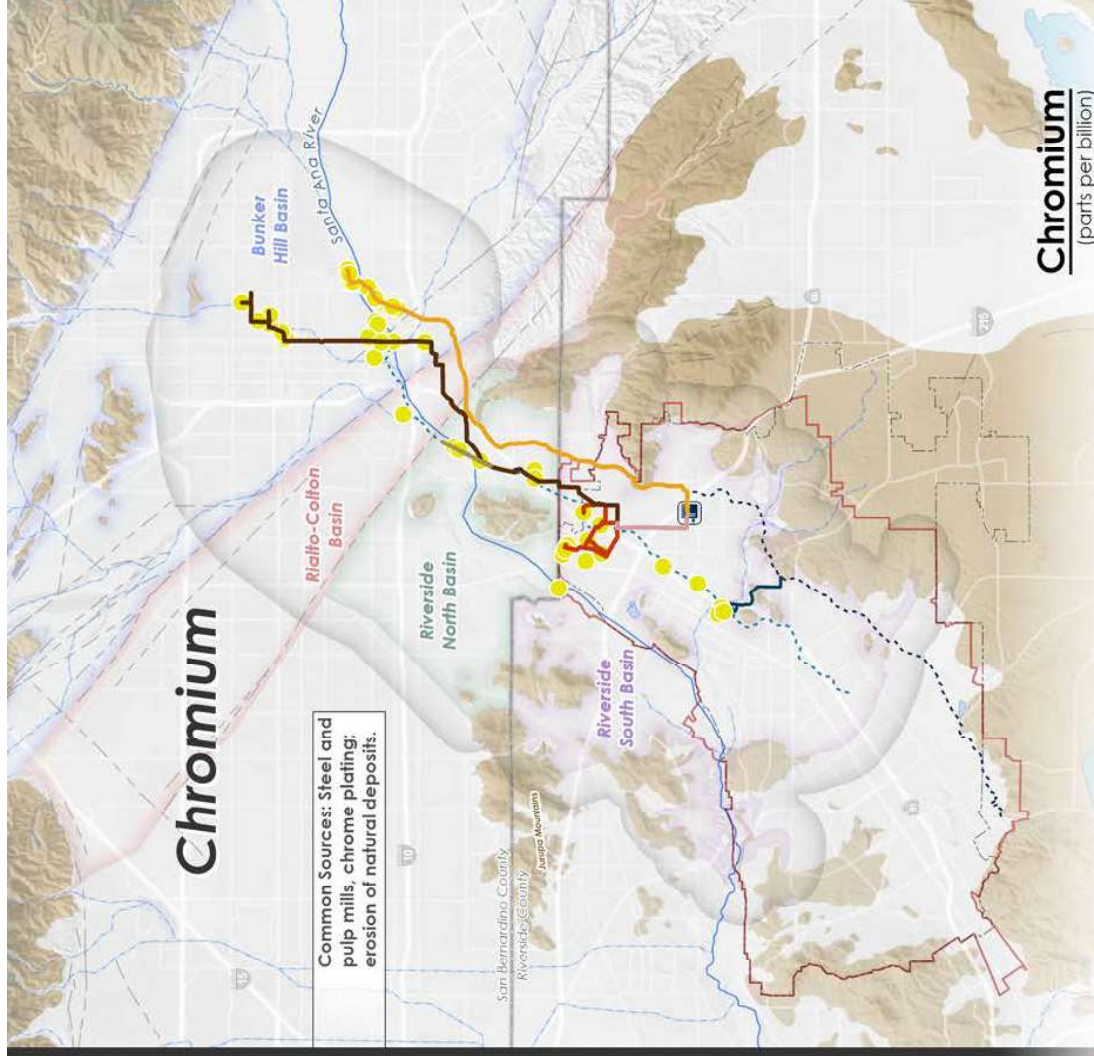
California DLR = 2 ppb
(Detection Level Report)

California
MCL = 10 ppb
(Maximum Contaminant Level)

RPU Wells
Above MCL = 0

Highest
Detection = 6.9 ppb

Chromium



Chromium

(parts per billion)

California DLR = 10 ppb
(Detection Level Report)

California
MCL = 50 ppb
(Maximum Contaminant Level)

RPU Wells
Above MCL = 0

Highest
Detection = 6.7 ppb

Legend

Well Contaminate Level	Water Conveyance	Canal	Groundwater Basins
● < Detection Level Reporting	↗ Waterman Pipeline	--- Gage Canal	■ Bunker Hill Basin
● > Detection Level Reporting & ≤ Maximum Contaminant Level	↗ Gage Pipeline	--- Riverside Canal	■ Rialto-Colton Basin
● > Maximum Contaminant Level	↗ North Orange Pipeline	Surface Water	■ Riverside North Basin
Linden-Evans Reservoir	↗ Combined North Orange & Waterman Pipeline	~ Santa Ana River	■ Riverside South Basin
	↗ Flume Pipeline	~ Streams and Channels	City of Riverside
	↗ Non-potable	--- Fault Line	 City Boundary

NOT TO SCALE

N

Data shown in the figures above shows raw groundwater prior to treatment and delivery to RPU customers.

Trichloroethylene (TCE)



Common Sources: Discharges from industrial and chemical factories; biodegradation byproducts, discharges from metal degreasing sites.

Trichloroethylene (TCE)

(parts per billion)

California DLR = 0.5 ppb
(Detection Level Report)

California MCL = 5 ppb
(Maximum Contaminant Level)

RPU Wells Above MCL = 2

Highest

Detection = 8.9 ppb

1,2,3-Trichloropropane (1,2,3-TCP)



Common Sources: Industrial and agricultural chemicals, leach wastes, cleaning solvents, paints, varnish remover, and pesticides.

1,2,3-Trichloropropane (1,2,3-TCP)

(parts per trillion)

California DLR = 5 ppt
(Detection Level Report)

California MCL = 5 ppt
(Maximum Contaminant Level)

RPU Wells Above MCL = 6

Highest

Detection = 41 ppt

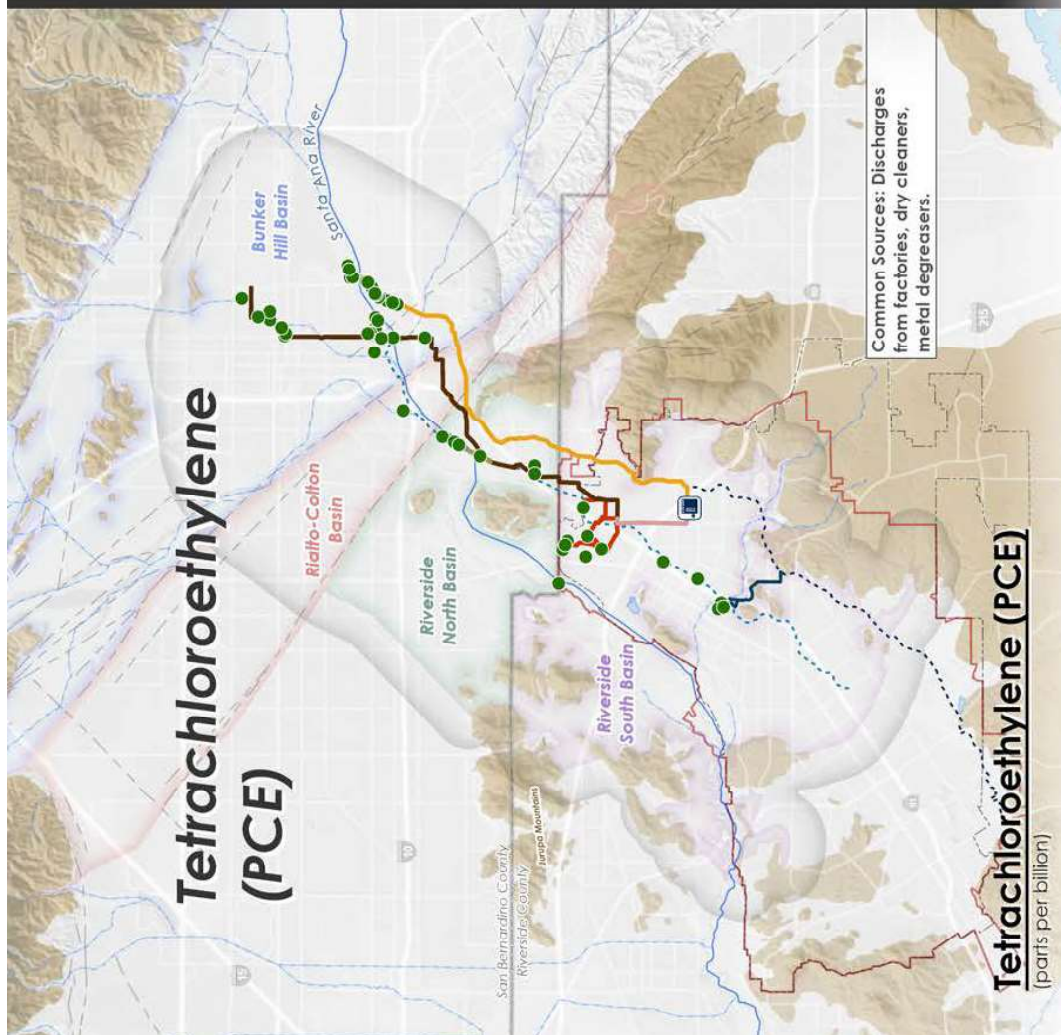
Legend

Well Contaminate Level	Water Conveyance	Canal	Groundwater Basins
● < Detection Level Reporting	— Waterman Pipeline	— Gage Canal	■ Bunker Hill Basin
● > Detection Level Reporting & <= Maximum Contaminant Level	— Gage Pipeline	— Riverside Canal	■ Rialto-Colton Basin
● > Maximum Contaminant Level	— North Orange Pipeline	— Surface Water	■ Riverside North Basin
■ Linden-Evans Reservoir	— Combined North Orange & Waterman Pipeline	— Santa Ana River	■ Riverside South Basin
	— Flume Pipeline	— Streams and Channels	— City Boundary
	— Non-potable	— Fault Line	— Water Service Area

Data shown in the figures above shows raw groundwater prior to treatment and delivery to RPU customers.

N
NOT TO SCALE

Tetrachloroethylene (PCE)



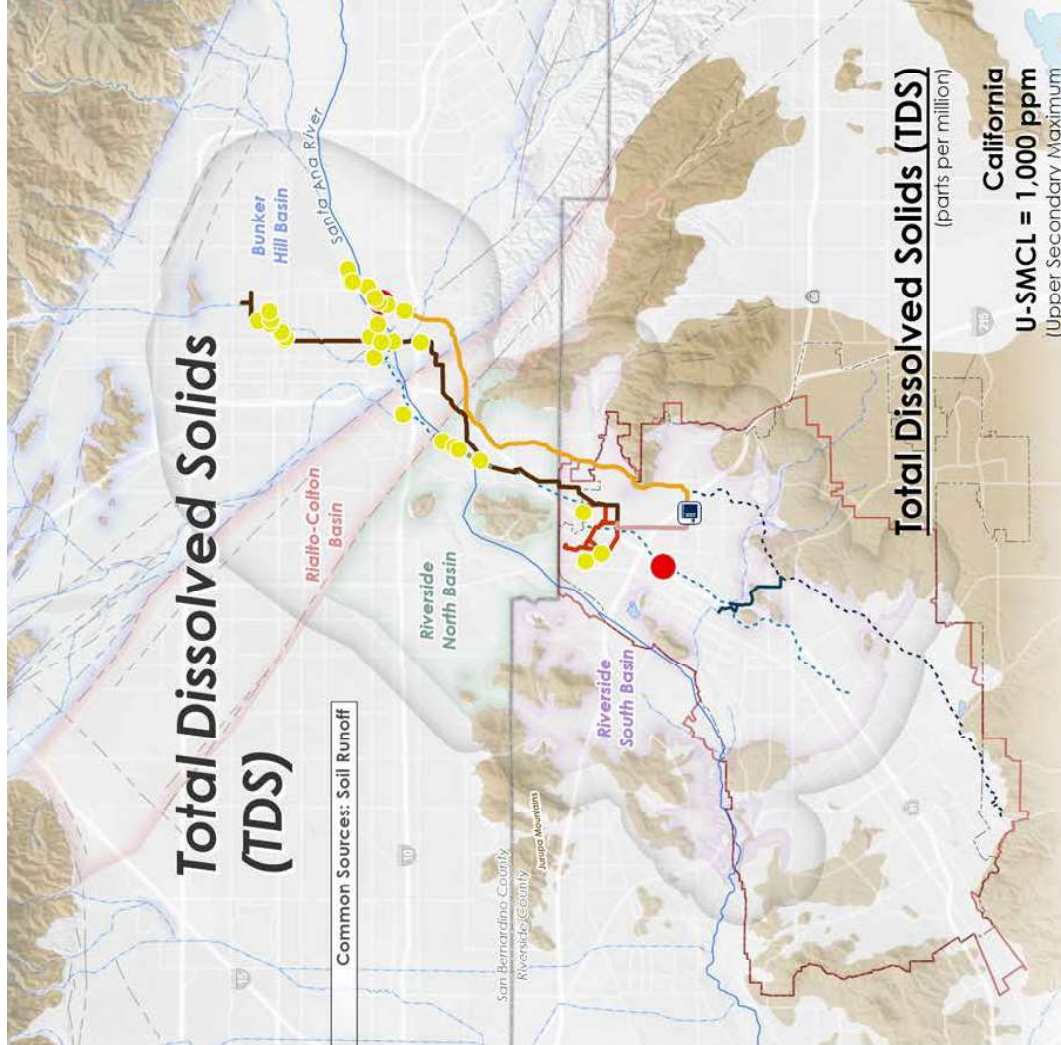
Common Sources: Discharges from factories, dry cleaners, metal degreasers.

Tetrachloroethylene (PCE)

(parts per billion)

- California**
DLR = 0.5 ppb
(Detection Level Report)
- California**
MCL = 5 ppb
(Maximum Contaminant Level)
- RPU Wells**
Above MCL = 0
- Highest**
Detection < 0.5 ppb

Total Dissolved Solids (TDS)



Common Sources: Soil Runoff

Total Dissolved Solids (TDS)

(parts per million)

- California**
U-SMCL = 1,000 ppm
(Upper Secondary Maximum Contaminant Level)
- California**
SMCL = 500 ppm
(Recommended Secondary Maximum Contaminant Level)
- RPU Wells**
Above U-SMCL = 0
- RPU Wells**
Above SMCL = 2
- Highest**
Detection = 550 ppm

Well Contaminate Level

- < Detection Level Reporting
- > Detection Level Reporting & <= Maximum Contaminant Level
- > Maximum Contaminant Level

Water Conveyance

- Waterman Pipeline
- Gage Pipeline
- North Orange Pipeline
- Combined North Orange & Waterman Pipeline
- Flume Pipeline
- Non-potable

Groundwater Basins

- Bunker Hill Basin
- Rialto-Colton Basin
- Riverside North Basin
- Riverside South Basin

Canal

- Gage Canal
- Riverside Canal

Surface Water

- Santa Ana River
- Streams and Channels
- Fault Line

City of Riverside

- City Boundary
- Water Service Area

NOT TO SCALE

N

Data shown in the figures above shows raw groundwater prior to treatment and delivery to RPU customers.

Perfluorooctane Sulfonic Acid (PFOS)

PFOS
(parts per trillion)

California NL = 6.5 ppt
(Notification Level)

USA Federal MCL = 4 ppt
(Maximum Contaminant Level)

RPU Wells Above MCL = 32

Highest Detection = 26 ppt

Perfluorooctanoic Acid (PFOA)

PFOA
(parts per trillion)

California NL = 5.1 ppt
(Notification Level)

USA Federal MCL = 4 ppt
(Maximum Contaminant Level)

RPU Wells Above MCL = 27

Highest Detection = 23 ppt

Common Sources: Used worldwide as an industrial surfactant in non-stick and stain-resistant consumer products, food packaging, fire-fighting foam, and industrial processes in addition to also being used as a material used in feedstock.

Common Sources: Airports, Firefighting Foams, Stain-Resistant Carpets, Water-Resistant Clothing, Upholstery, Cleaning Products, Cosmetics, Paints, Varnishes, Sealants, etc.

Well Contaminate Level

< Notification Level

> Notification Level

Linden-Evans Reservoir

PFOS and PFOA Data shown in the figures above are for raw well data prior to treatment and delivery. The State and Federal regulations are met at the compliance point below Linden-Evans Reservoir. EPA compliance required by 2029.

Water Conveyance

Waterman Pipeline

Gage Pipeline

North Orange Pipeline

Combined North Orange & Waterman Pipeline

Flume Pipeline

Non-potable

Canal

Gage Canal

Riverside Canal

Surface Water

Santa Ana River

Streams and Channels

Fault Line

Groundwater Basins

Bunker Hill Basin

Rialto-Colton Basin

Riverside North Basin

Riverside South Basin

City of Riverside

City Boundary

Water Service Area

Technical Fact Sheet - PFOS - US EPA

Technical Fact Sheet - PFOA - US EPA

Perfluorohexane Sulfonic Acid (PFHxS)

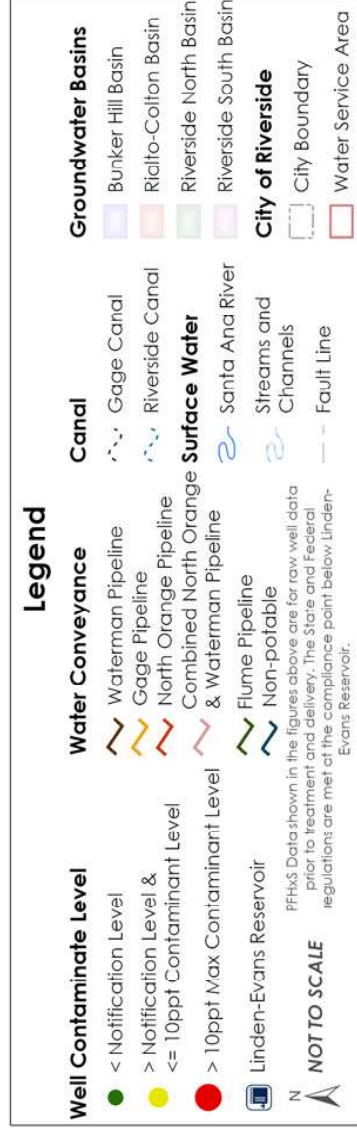
PFHxS
(parts per trillion)

California NL = 3 ppt
(Notification Level)

USA Federal MCL = 10 ppt
(Maximum Contaminant Level)

RPU Wells Above MCL = 9

Highest Detection = 83 ppt



Common Sources: Water and Stain Protective Coatings used for carpets, textiles, paper, packaging, electronics, etc. In addition, used in cleaning and polishing products, water-proofing agents, aqueous film-forming foam (AFFF), etc.



Palmyrita Treatment Plant

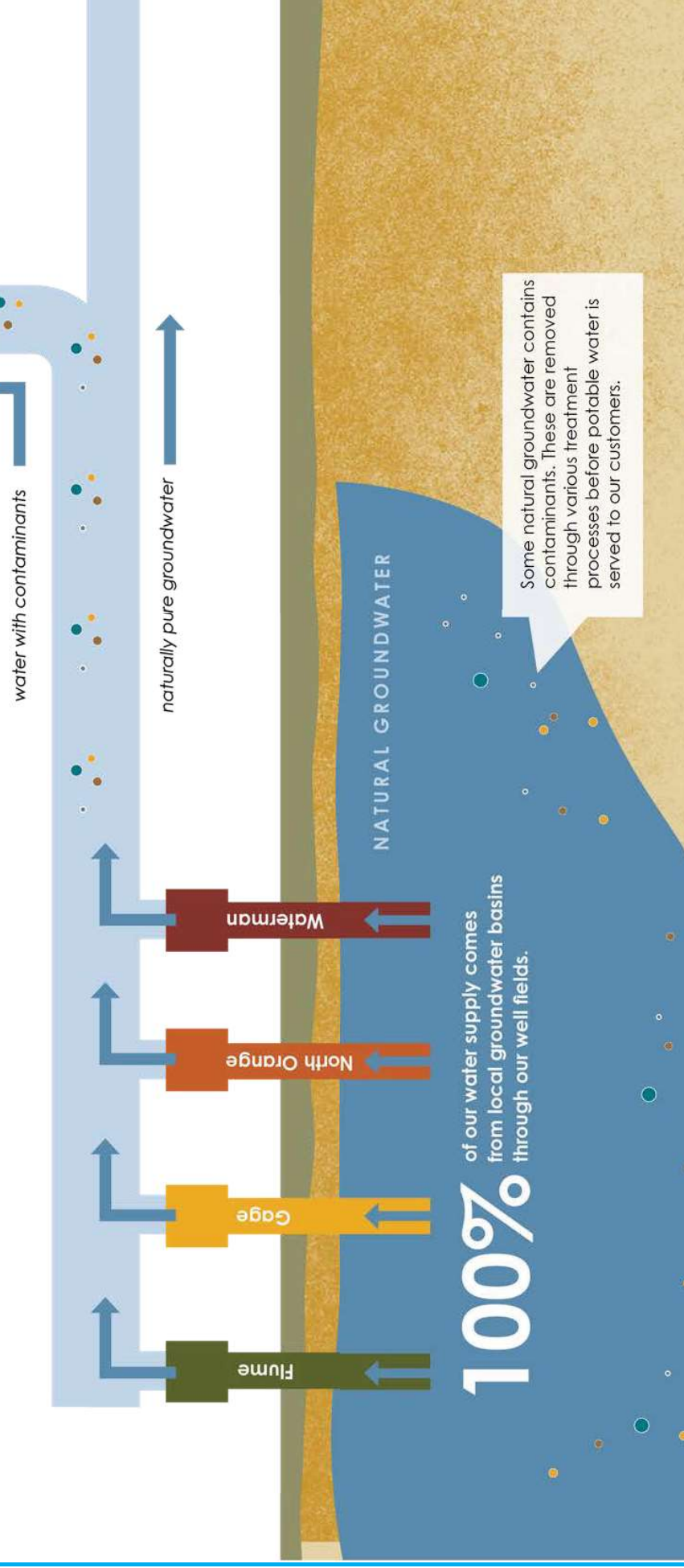
08 GROUNDWATER TREATMENT



GROUNDWATER TREATMENT

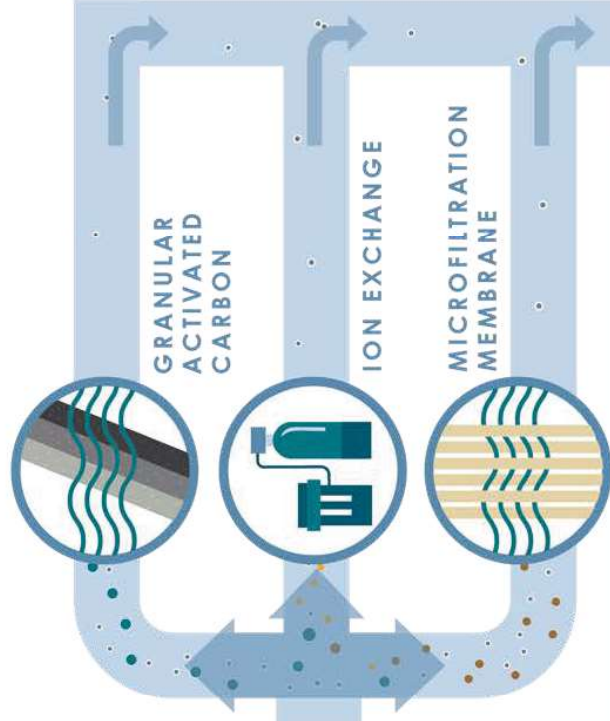
To ensure the City's drinking water is of highest quality, RPU operates 6 treatment facilities and 7 Disinfection facilities to produce safe, clean water. RPU's treatment plants use a combination of Ion Exchange, Granular Activated Carbon, Microfiltration Membranes and Chlorine Disinfection to purify groundwater for public use.

All of the water leaving the groundwater treatment plants is treated prior to entering RPU's potable water distribution system. RPU's treatment regimes are regulated by the California's Division of Drinking Water.



100% of our water supply comes from local groundwater basins through our well fields.

RPU routinely monitors each groundwater well for contaminants and provides targeted treatment.



Some wells don't need to be treated. Water from these wells is blended with the treated water and disinfected.

CHLORINE DISINFECTION



All treated water is stored at the Linden Evans Reservoir where it receives final testing. Then, it is sent to 14 other reservoirs for distribution to the community. Linden/Evans and the other reservoirs help maintain pressure and are tested daily to ensure reliable water service.



Linden Evans Reservoir

All of the potable water served to RPU's customers meets stringent state and federal water quality regulations. Water is tested at all of the stages of extraction, treatment, and distribution.

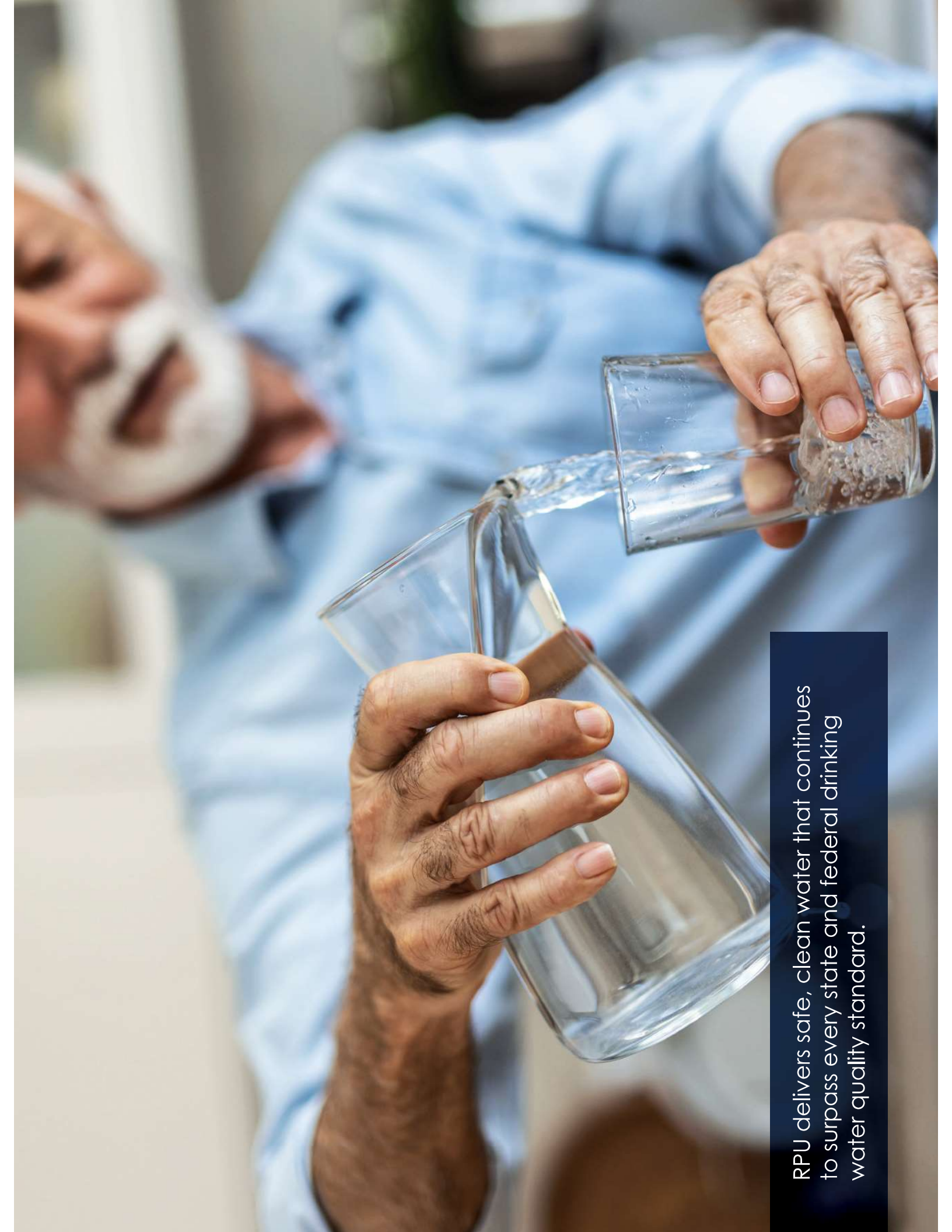
GROUNDWATER TREATMENT

Granular Activated Carbon filters are made of layers of activated carbon, which contains millions of small pores that help remove small particles through a process called adsorption. Effective in removing organic contaminants such as TCE, 1,2,3-TCP, DBCP, and has shown effectiveness in removing emerging contaminants such as PFAS.

Ion Exchange reactors are filled with tiny resin beads that remove charged compounds. RPU's ion exchange reactors are designed for removal of perchlorate through an ionic exchange. This treatment is effective in removing Perchlorate (ClO_4^-), and can be effective in removing PFAS.

Microfiltration Membrane filters use pressurized membranes with very small pores to remove particles and bacteria from the water. The pores are 0.1 to 10 microns or 1/300th the diameter of a human hair. This treatment is effective in removing microorganisms.

Chlorine Disinfection uses a small amount of chlorine to kill or inactivate bacteria, viruses, or other waterborne pathogens that may be remaining in the water. A small chlorine residual of less than one ppm is usually maintained throughout the entire system to protect the public from downstream contamination. This treatment deactivates/kills any remaining pathogens or viruses.

A close-up photograph of a man's hands pouring water from a small glass into a larger glass. The man has a white beard and is wearing a light blue button-down shirt. The background is blurred, showing an outdoor setting with a fence and some greenery. The lighting is bright, suggesting daylight. The focus is on the water being poured and the hands holding the glasses.

RPU delivers safe, clean water that continues to surpass every state and federal drinking water quality standard.

ACKNOWLEDGMENTS

Riverside Public Utilities Board of Directors:

Rebecca A. Goldware (Board Chair), Ward 2
Brian D. Siana (Board Vice-Chair), City Wide/Ward 2
Warren Avery, Ward 3
Gary Montgomery, Ward 4
Tom Evans, Ward 5
Mikael Becker, Ward 7
Peter Wohlgemuth, Citywide/Ward 1

Riverside Public Utilities Executives:

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Daniel Honeyfield, Assistant General Manager
Energy Delivery
Robin Glenney, Assistant General Manager Water
Dr. Scott Lesch, Assistant General Manager
Power Resources
Brian Seinturier, Assistant General Manager
Finance and Administration
Tracy Sato, Assistant General Manager
Strategic Initiatives and Customer Engagement



The 2024 City of Riverside Public Utilities Groundwater Atlas was prepared by the RPU team

Farid Boushaki, P.E., PhD.

Jolie Matta, E.I.T.

Jonathan Buckley

Drew Faherty

Amy Navas-Lopez

Reginald Agunwah

Noemi Martinez

With the assistance of the Water Systems Consulting, Inc.

Michael Cruikshank, P.G., C.H.G, M.S.

Irvin Matamoros, GIT

Eric Fregoso

