



# Confluence Aquatic Habitat Area Aquatic Groundwater Dependent Ecosystem Monitoring Workplan

Upper Ventura River Groundwater Basin

*prepared for*

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# 1 Introduction

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The Upper Ventura River Groundwater Agency (UVRGA) Groundwater Sustainability Plan (GSP) identified the Confluence Aquatic Habitat Area as an aquatic groundwater dependent ecosystem (GDE)<sup>1</sup>. This GDE occurs at the confluence of the Ventura River and San Antonio Creek (Figure 1), which is an important spawning tributary for southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*)<sup>2</sup> (Normandeau Associates, Inc. 2015). The Confluence Aquatic Habitat Area also includes federally designated critical habitat for both the southern California DPS of steelhead and the California red-legged frog (CRLF, *Rana draytonii*) (NOAA 2022, USFWS 2022). This important aquatic habitat area is characterized by cool upwelling groundwater, as well as inflow from San Antonio Creek. Appendix A presents aerial photographs of the northern and southern portions of the GDE.

The GSP concluded that there are limited biological data available to assess whether interconnected surface water (ISW) depletion effects in the Confluence Aquatic Habitat Area are significant and unreasonable. While it is understood that aquatic species in this intermittent or ephemeral streamflow environment have adapted to periodic dry or low-flow conditions to survive, it is not known whether ISW depletion causes stranding in isolated habitat areas or mortality that would not otherwise occur and, if so, whether such effects are significant and unreasonable. The GSP concluded that the need for sustainable management criteria (SMC) in the Confluence Aquatic Habitat Area could not be evaluated until these data gaps are addressed. The biological monitoring program proposed in this workplan will address these biological data gaps. In addition to the biological data gaps, there are currently no groundwater level or surface water flow monitoring sites in the Confluence Aquatic Habitat Area. The GSP recommended the installation of at least one groundwater level monitoring site and one stream gage (or periodic streamflow measurements) in the Confluence Aquatic Habitat Area to monitor hydrologic conditions, which can then be correlated with the biological monitoring data and to address other needs identified in the GSP. The proposed groundwater level and surface water flow monitoring sites (Figure 1 and 2) are being pursued by UVRGA in parallel with workplan development and implementation of the biological monitoring program.

Following guidance provided in Sections 4.9.1 and 5.8 of the GSP, this workplan outlines a three-year monitoring program to address existing data gaps. As described above, the overall goal of the monitoring program is to determine if ISW depletion is causing significant and unreasonable effects on the Confluence Aquatic Habitat Area GDE. This program will seek to answer questions regarding potential impacts to the GDE that may be caused or exacerbated by groundwater pumping, specifically with respect to the depletion of ISW within the Confluence Aquatic Habitat Area. This workplan provides protocols and field methods for each of the monitoring components that will be implemented; establishes a monitoring schedule for each of these components; and describes methodologies that will be used to interpret and analyze monitoring data.

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<sup>1</sup> Aquatic GDEs were assessed and identified separately from riparian GDEs within the Basin. Riparian GDEs are comprised of riparian vegetation communities with rooting depths that reach directly to groundwater, while aquatic GDEs are comprised of instream habitat that is dependent on interconnected surface water. This monitoring workplan pertains to instream aquatic habitat, while existing efforts are in place to monitor vegetation communities identified within the South Santa Ana GDE Unit (which includes the Confluence Area). More details regarding riparian GDE monitoring are provided in Table 2.

<sup>2</sup> Steelhead are the anadromous (ocean-going) form of *O. mykiss*, while rainbow trout are the resident (solely freshwater) form of the species. All *O. mykiss* in waterbodies with connectivity to the ocean have the potential to become anadromous and are therefore treated as steelhead from a regulatory standpoint.

The monitoring program is designed to provide data that can inform whether SMC for the *Depletion of Interconnected Surface Water* sustainability indicator are warranted for the Confluence Aquatic Habitat Area. To address data gaps identified in the GSP, the monitoring program will seek to answer the following questions:

- What is the current distribution of aquatic mesohabitats<sup>3</sup> in the Confluence Aquatic Habitat Area Aquatic GDE?
- What are the current aquatic habitat suitability conditions within this GDE?
- How do aquatic habitat suitability conditions within this GDE change in response to seasonal variation?
- How and when does IISW depletion affect habitat suitability conditions within this GDE?
- How might groundwater pumping in the Basin affect habitat suitability conditions within this GDE?

Answering these questions will provide the necessary information to evaluate the potential impacts of ISW depletion within the Confluence Aquatic Habitat Area Aquatic GDE, to assess whether SMC are needed in this area, and to establish a long-term monitoring plan for the GDE (if UVRGA determines that SMC are needed in this area).

## 1.1 Existing Monitoring Efforts and Previous Studies within the Basin

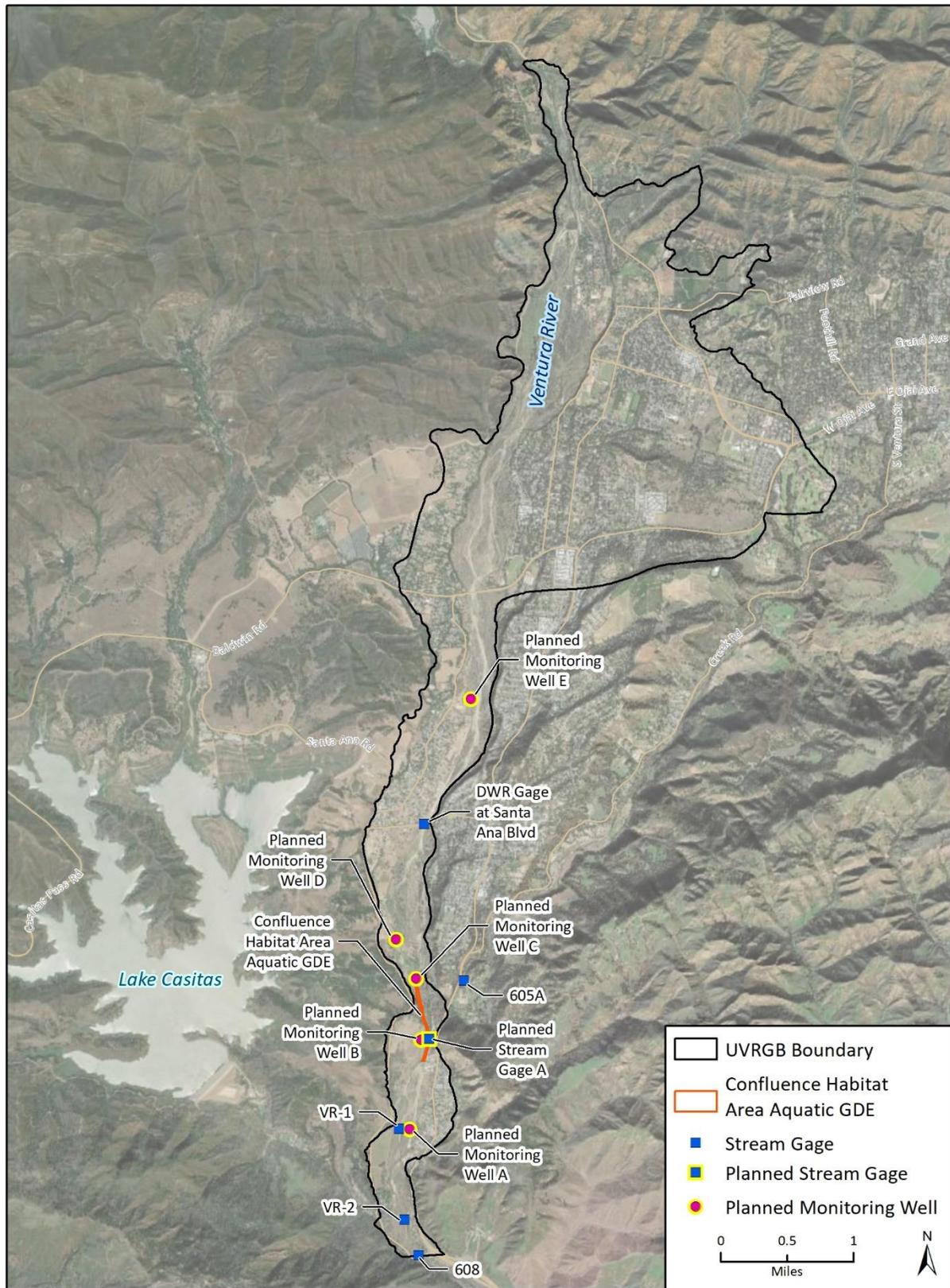
UVRGA is committed to working with various stakeholders within the Upper Ventura River Groundwater Basin (Basin) and will seek input from other entities in the Basin during the process of finalizing and implementing this workplan. The monitoring program will consider current and ongoing monitoring efforts being undertaken by other stakeholders in the Basin and will include information on the collaborative and data-sharing approach UVRGA will take with its monitoring efforts. This collaboration will aid in establishing a comprehensive monitoring program that can prevent duplication of efforts and provide a broader data set, which will ultimately increase confidence in the results and conclusions drawn from monitoring data.

Table 1 provides a summary of relevant existing monitoring programs and previous studies conducted in the Basin. These existing monitoring efforts and previous studies were referenced during the development of the monitoring program methods, and data from these efforts conducted by other stakeholders will be incorporated into this program's data analysis and evaluation, as appropriate and feasible.

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<sup>3</sup> Aquatic mesohabitats are visually and functionally distinct areas of instream habitat (e.g., pools, riffles, and runs).

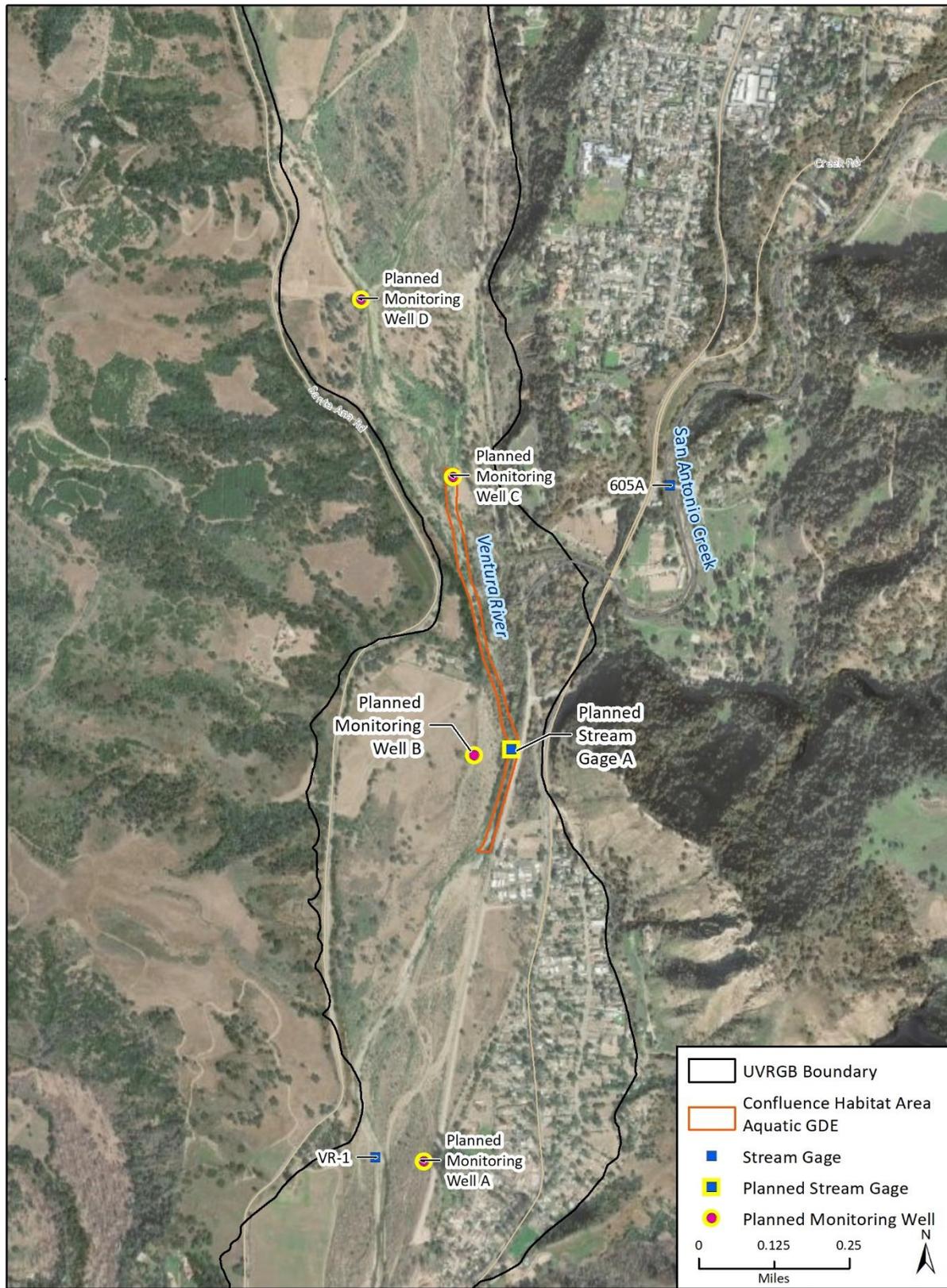
Figure 1 Confluence Aquatic Habitat Area Location



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Fig 1 Confluence Habitat Area Location

Figure 2 Confluence Habitat Area Aquatic GDE



**Table 1 Relevant Existing Monitoring Programs and Previous Studies within the UVRGB**

<b>Program Name</b>	<b>Responsible Party</b>	<b>Description of Data Collection/ Study</b>	<b>Recurrence Interval/Study Date</b>	<b>Availability/ Applicability Notes</b>
<b>Matilija Dam Removal</b>	County <sup>1</sup>	Habitat mapping and sediment/hydrologic modeling completed by Stillwater and AECOM. Habitat suitability and <i>O. mykiss</i> population studies completed by Normandeau Associates throughout the Basin, including within the Confluence Aquatic Habitat Area.	Annually/Completed (Normandeau Associates, Inc. 2015)	Data are publicly available or provided upon request. May offer watershed-scale context to changing habitat conditions over time.
<b>County-wide Bioassessment Monitoring</b>	County	Long-term benthic macroinvertebrate and physical habitat monitoring.	Annually	Data are publicly available or provided upon request. On-going studies provide long-term data for instream aquatic habitat conditions. The latest five-year study began in 2021. Previous studies were conducted from 2009-2014 and 2015-2020. This program may reveal trends related to macroinvertebrate abundance, composition, and diversity, as well as physical conditions including substrate, sinuosity, flow, and habitat type (e.g., pool, riffle, glide).
<b>Ventura River Streamflow Monitoring</b>	County DWR <sup>2</sup> USGS <sup>3</sup>	Continuous water level and streamflow data collection.	Continuous	Data are publicly available in online databases. Provides real time and historic instream flow data upstream and downstream of the Confluence Aquatic Habitat Area.
<b>Stream Team Water Quality Monitoring</b>	Santa Barbara Channel Keeper	Water quality and instantaneous streamflow monitoring.	Monthly	Data are publicly available or provided upon request. Community-based monitoring with a consistent monitoring schedule within the vicinity of the Confluence Aquatic Habitat Area. Data are currently available online from 2007 to 2018.
<b>Robles Diversion Fish Passage Monitoring</b>	CMWD <sup>4</sup>	Long term monitoring program consisting of streamflow, fish passage, fish spawning, fish presence and distribution, and aquatic habitat assessment.	Annually	Data are publicly available on CMWD's website, but not regularly updated. The most recent annual report is from 2018. Monitoring efforts include the Confluence Aquatic Habitat Area. These data provide information pertaining to habitat suitability trends, fish population dynamics, and hydrologic conditions throughout the river system. Data are not available until published by CMWD, which may not occur on a schedule that would inform this effort.
<b>Ventura River Algae TMDL Monitoring</b>	County	Long term monitoring consisting of monthly instantaneous water quality and streamflow, quarterly	Monthly	Data are publicly available or provided upon request. Monitoring occurs upstream and downstream of the Confluence Aquatic Habitat Area. This program provides a long-term dataset for specific habitat suitability parameters.

**Confluence Aquatic Habitat Area Aquatic Groundwater Dependent Ecosystem Monitoring Workplan**

Program Name	Responsible Party	Description of Data Collection/ Study	Recurrence Interval/Study Date	Availability/ Applicability Notes
		continuous pH and dissolved oxygen (DO), and summertime algal biomass.		
<b>CDFW<sup>4</sup> Instream Flow Studies</b>	CDFW <sup>5</sup>	Habitat suitability and habitat mapping, fish habitat use, critical riffle analysis, streamflow measurements	2017 to present	Publicly available. Data are collected at multiple sites throughout the watershed. Also includes data from previous studies. Draft instream flow recommendations for Reach 4 (which extends to the Confluence Aquatic Habitat Area) were released in 2021. These recommendations are still preliminary, and while they can inform the UVRGA in their development and evaluation of SMC, they were not developed with the intent of meeting SGMA requirements and are not proscriptive for establishing minimum thresholds in the GSP.
<b>California Coastal Salmonid Monitoring Plan (CMP)</b>	CDFW NMFS <sup>6</sup>	Steelhead abundance, spawning behavior and habitat availability. Conducted biological surveys and use of Dual-Frequency Identification Sonar (DIDSON) and Adaptive Resolution Imaging Sonar (ARIS) cameras.	2006-2011	Publicly available (Adams et al. 2011). Data were collected at multiple sites throughout the watershed. Also includes data from previous studies. The CMP describes the overall strategy, design and methods used in monitoring salmonid populations. While the scope of this program is beyond that of this monitoring work plan, these data and monitoring protocol may be referenced to inform the use of the aquatic GDE habitat for different life stages.
<b>Integration of Coastal Salmonid Monitoring Plan</b>	CDFW NMFS	An updated and expanded monitoring program of the original version CMP (Adam et al. 2011) and focuses on a more detailed strategy, design and methodology for the Southern California Area.	2013-2022	Publicly available (Boughton et al. 2022). Data was collected at multiple sites throughout the watershed. Also includes data from previous studies. This updated and expanded CMP provides important information pertaining to steelhead recovery. While the scope of this program is beyond that of this monitoring work plan, these data and monitoring protocol may be referenced to inform the use of the aquatic GDE habitat for different life stages.

1. County of Ventura
2. Department of Water Resources
3. United States Geological Survey

4. Casitas Municipal Water District
5. California Department of Fish and Wildlife
6. National Marine Fisheries Service

### 1.1.1 Existing and Planned UVRGA Monitoring Efforts

In addition to the programs and studies listed in Table 1, the UVRGA currently implements a suite of monitoring efforts and the GSP identifies additional future monitoring efforts to satisfy SGMA requirements. Table 2 provides a summary of these existing and planned monitoring efforts.

**Table 2 Existing and Planned UVRGA Monitoring Efforts**

<b>Program Name</b>	<b>Description of Data Collection/ Study</b>	<b>Schedule</b>	<b>Notes</b>
<b>Groundwater Level Monitoring</b>	Continuous groundwater level data logging currently in 5 wells and compilation of data collected by others in 3 additional wells	Continuous data collection, data are downloaded and archived on a semi-annual basis in May/June and September/October	The GSP proposes five additional wells into the network. Three of these wells will provide data directly upstream, downstream, and within the Confluence Aquatic Habitat Area. These additional wells will help to address data gaps identified in the GSP.
<b>Streamflow Monitoring</b>	Continuous streamflow monitoring at two proposed locations within the Basin.	Continuous data collection, data will be downloaded periodically. Gages will be maintained seasonally during baseflow recession period and dry season.	The GSP proposes two UVRGA-maintained baseflow gages, at the Camino Cielo Road crossing and within the Confluence Aquatic Habitat Area (Planned Stream Gage A, Figure 1).
<b>Visual Stream Monitoring</b>	Monitor the extent of surface water flows, map wet and dry reaches	Monthly for winter months and increased during late spring-to-Fall period	Informs analysis of how seasonal conditions influence streamflow and when various reaches within the Basin (and the Confluence Area) are typically dry.
<b>Riparian GDE Monitoring</b>	Desktop assessment of NDVI/NDMI values for riparian vegetation within GDEs, and assessment of relationship between these indices and groundwater levels	Annual desktop assessment	Assessment follows protocols outlined by The Nature Conservancy for evaluating riparian vegetative health within GDEs (The Nature Conservancy 2018).

## 2 Monitoring Program Components

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The Confluence Aquatic Habitat Area monitoring program includes a suite of monitoring components to address data gaps identified in the GSP. The program will seek to answer the specific questions presented in the introduction, which can inform whether SMC for this aquatic GDE are necessary. The monitoring program will follow established survey protocols and methods when appropriate, which may be slightly modified as necessary, to assess site conditions most accurately. These established protocols include the following:

- The California Department of Fish and Wildlife (CDFW) California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010)
- The U.S. Fish and Wildlife Service (USFWS) Habitat Suitability Information (HSI) Model for Rainbow Trout (Raleigh et al. 1984)
- The Southern Steelhead Habitat Suitability Index (SS HSI) Model (Normandeau Associates, Inc. 2015)
- The USFWS Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog (USFWS 2005)
- UVRGA Monitoring and Data Collection Protocols (UVRGA 2018)
- The National Marine Fisheries Service (NMFS) and CDFW Integration of Steelhead Viability Monitoring, Recovery Plans and Fisheries Management in the Southern Coastal Area (Boughton et al. 2022)

Biological monitoring methods will be primarily focused on steelhead habitat suitability, because all of the mainstem of the Ventura River and most of the major tributaries (including Coyote Creek, Santa Antonio Creek, Matilija Creek and North Fork Matilija Creek) are designated as critical habitat for the federally endangered southern California DPS of steelhead. The Confluence Aquatic Habitat Area specifically includes habitat components (e.g., cool upwelling water and pools) that provide important over summering and rearing habitat for fry, juvenile, and adult *O. mykiss* (Normandeau Associates, Inc. 2015). Furthermore, instream areas that provide suitable habitat for steelhead can also provide important habitat for other special-status aquatic and amphibious species, including CRLF, two-striped gartersnake (*Thamnophis hammondi*), Pacific lamprey (*Entosphenus tridentatus*), and southwestern pond turtle (*Actinemys pallida*). Steelhead habitat preferences are well studied and defined, and typically represent the most extensive and demanding habitat requirements of any aquatic species in southern California instream habitats. Therefore, steelhead habitat suitability requirements can be viewed as the limiting conditions when analyzing instream habitat. Habitat conditions for other aquatic species, including CRLF, will also be evaluated through this program.

An initial habitat mapping survey of the entire GDE will be conducted at the onset of this monitoring program. During this initial habitat mapping effort, specific monitoring locations throughout the GDE will be established for subsequent routine surveys. Electronic data tablets with ArcGIS Collector software and high accuracy GPS units will be used to collect field data, which will then be synced with an online server. Descriptions of each of the monitoring program components are provided below. Table 3 provides an overview of each of these components, including the anticipated schedule, data to be collected, and protocols that will be implemented.

It is not anticipated that any permits will be required for implementation of the monitoring program components. Public access points will be used for entry into the Confluence Aquatic Habitat Area

and monitoring activities will avoid modifying the active channel. Should access to any privately-owned areas be required, monitoring personnel will coordinate with the Ojai Valley Land Conservancy, or other landowners. Finally, while not anticipated, an encroachment permit to access County rights-of-way would be required to access stream gaging locations that fall within County jurisdiction.

**Table 3 Monitoring Program Overview**

<b>Monitoring Component</b>	<b>Data Collected</b>	<b>Purpose</b>	<b>Schedule</b>	<b>Locations</b>	<b>References/Protocols</b>
<b>Initial Habitat Mapping</b>	Map aquatic mesohabitats in the Confluence Aquatic Habitat Area Aquatic GDE	Will provide in-depth information on existing habitats within the GDE and allow for identification of specific mesohabitats to monitor	Once at beginning of the program (likely during Fall 2022)	Entire Confluence Aquatic Habitat Area Aquatic GDE (approximately 3,450 feet in length)	California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010)
<b>Fish Stranding and Mortality Surveys</b>	Document any observed fish stranding and/or mortality that might occur as streamflow recedes. The extent of wetted and dry portions of the river will also be documented.	Will provide important information on steelhead migration habitat within the GDE, as well as fine scale data on when and how streamflow recedes within this area following varying climatic conditions and modeled ISW depletion estimates.	Monthly to weekly during dry season, as streamflow recedes	Designated monitoring locations at important riffles within the Confluence Aquatic Habitat Area Aquatic GDE	Pedestrian Bank Surveys
<b>Routine Habitat Suitability and Snorkel Surveys</b>	Survey HSI parameters, including sediment type, riparian vegetation/cover, water depth, and various in-stream structure, as well as all species observed, within predetermined pools, riffles, and glides. Steelhead presence/ absence will be documented during snorkel surveys. Fish stranding/mortality will also be documented.	Will provide in-depth information on existing conditions and allow for assessment of habitat suitability for steelhead, CRLF, and other aquatic organisms. Conditions can be quantified and compared with streamflow, as well as climatic data and modeled ISW depletion.	At least four times per year (once during winter and at least three times during summer/fall)	Designated monitoring locations (e.g., pools, riffles, glides) within the Confluence Aquatic Habitat Area Aquatic GDE	SS HSI (Normandeau Associates, Inc. 2015, Padre Associates, Inc. 2013) California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010) Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog (USFWS 2005) NWFS and CDFW Integration of Steelhead Viability Monitoring, Recovery Plans and Fisheries Management in the Southern Coastal Area (Boughton et al. 2022)

Monitoring Component	Data Collected	Purpose	Schedule	Locations	References/Protocols
<b>Water Quality and Flow Monitoring</b>	Water level, DO, pH, temperature	Will provide continuous flow and water quality data that can then be correlated with streamflow, as well as climatic data and modeled ISW depletion.	Continuous data collection, data downloaded during each field visit	One designated location within the Confluence Aquatic Habitat Area Aquatic GDE	LARWQCB <sup>1</sup> Basin Plan (2014), USGS <sup>2</sup> standards for stream gauge installation, UVRGA Monitoring and Data Collection Protocols (2018)
<b>Aerial Photography</b>	Aerial images	Will provide a visual time series of overall conditions within the GDE and allow for comparison of conditions over time and during different hydrologic and climatic conditions	At least four times per year, concurrent with habitat suitability surveys	Aerial photographs will be taken of the upper, middle, and lower portions of the Habitat Area Aquatic GDE	General photography and FAA rules
<b>Repeat Ground Photography</b>	Photographs of instream and riparian habitat from fixed locations	Will provide a visual time series for each monitoring location that will allow for comparison of habitat conditions over time and during different hydrologic and climatic conditions	At least four times per year, concurrent with habitat suitability surveys	Photographs will be taken from fixed locations at each mesohabitat that is monitored during the habitat suitability surveys	General photography

<sup>1</sup> Los Angeles Regional Water Quality Control Board

<sup>2</sup> U.S. Geological Survey

## **Initial Habitat Mapping**

The Confluence Aquatic Habitat Area Aquatic GDE will be mapped using CDFW methods (Flosi et al. 2010), most likely to the Level II or Level III<sup>4</sup> habitat types. This survey will occur once at the beginning of the monitoring program, likely in the Fall of 2022. Surveyors will document all mesohabitats within the GDE, including pools, riffles, and glides.

### *Purpose of monitoring component*

This initial survey effort will provide data on the aquatic habitat present within the GDE, as well as a map of all aquatic mesohabitats in the GDE. These mesohabitats can then be randomly or systematically chosen as monitoring locations for the subsequent fish stranding and mortality surveys and routine habitat suitability surveys.

Note that habitat conditions are likely to change during and following large storm events, and the monitoring locations will inherently require adjustment if mesohabitat characteristics are substantially changed. This assessment would be made through the subsequent biological surveys, and if a large storm event occurred that substantially "reset" the channel morphology, an additional mapping event may be needed to account for the new habitat structure.

## **Fish Stranding and Mortality Surveys**

During periods of receding streamflow (likely between April and November), pedestrian surveys (with chest waders, if necessary) will be conducted within previously identified portions of the Confluence Aquatic Habitat Area (e.g., critical riffles) to document any observed fish stranding and/or mortality that might occur if species are present as flow is diminished. The extent of wetted and dry portions of the river will also be documented within survey areas. These surveys will likely be conducted on a monthly basis during the dry season and may be increased to weekly during times low flow periods when the extent of aquatic habitat is constricted.

### *Purpose of monitoring component*

Conducting fish stranding and mortality surveys will provide important information on hydrologic conditions as flows recede naturally, as well as fine scale data on when and how streamflow recedes within this GDE following varying climatic conditions and modeled ISW depletion. This information will help to fill data gaps identified in the GSP for the Confluence Aquatic Habitat Area.

## **Routine Habitat Suitability and Snorkel Surveys**

Routine habitat suitability surveys will be conducted once during the rainy season (between December and April) and at least three times during the dry season (between July and October) and will focus on a subset of mesohabitats (e.g., pools, riffles, glides) either randomly or systematically selected following the initial habitat mapping effort. These surveys will provide data on habitat suitability for special-status species, including steelhead and CRLF, as well as other aquatic organisms.

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<sup>4</sup> There are four levels of classification used to describe physical fish habitat. Each higher level in the sequence includes more descriptive categories of habitat types. Level I categorizes habitat into riffles or pools. Level II categorizes riffles into riffle or flatwater habitat types, for a total of three types (riffle, pool, and flatwater). Level III further differentiates riffle types on the basis of water surface gradient (riffle or cascade), and pool types according to their location in the stream channel (main channel, lateral scour, or backwater).

Surveyors will collect data for a suite of variables within these predetermined mesohabitats, including, but not limited to, substrate size, canopy cover, instream cover, gradient, elevation, and thalweg depth. Water quality data, including water temperature, DO, and pH, will also be collected at each monitoring location using a handheld probe. Macroalgae presence/absence will be documented, and photos will be collected to show areal extent. Habitat suitability surveys will follow protocols outlined by Flosi et al. (2010), Normandeau Associates, Inc (2015), Padre Associates, Inc. (2013), and the USFWS (2005).

When sufficient water is present, underwater snorkel surveys will also be performed as part of these routine surveys to document the presence of steelhead, CRLF tadpoles, and other aquatic species. Performing underwater surveys is a cost-effective and non-invasive method to determine fish distribution and aquatic species composition. Snorkel surveys will follow the appropriate protocols outlined by Flosi et al. (2010) and Boughton et al. (2022). Any observed fish stranding and/or mortality will also be documented during each survey.

In addition, nighttime surveys will be conducted at designated locations throughout the Confluence Aquatic Habitat Area to provide more accurate documentation of the presence or absence of CRLF, invasive amphibian species (such as bullfrogs), and other nocturnal aquatic species. Night surveys will follow protocols outlined by the USFWS (2005).

#### *Purpose of monitoring component*

Conducting routine habitat suitability surveys will allow for the quantification of habitat suitability and species abundance within the Confluence Aquatic Habitat Area Aquatic GDE and will allow for a better understanding of if and when fish stranding and mortality occurs within critical riffles. These data will build on the findings of previous studies conducted in the Upper Ventura River (e.g., Normandeau Associates, Inc. 2015, Padre 2013) to provide an understanding of existing habitat conditions within the GDE and allow for a comparison of SS HSI scores and water quality parameters under varying flow conditions. These monitoring data combined with modeling estimates of ISW depletions can inform whether SMCs for the Confluence Aquatic Habitat Area are warranted.

### **Continuous Surface Water Quality and Flow Monitoring**

One or two continuous surface water quality and flow monitoring stations will be installed at designated locations within the Confluence Aquatic Habitat Area. One of these water quality stations may be collocated with Planned Stream Gage A (Figure 1) to reduce field data collection efforts. The need and location of a second surface water monitoring station would be determined based on field reconnaissance. Continuous data will be collected with a water level transducer and multi-parameter water quality sondes. Continuous instream monitoring will provide data on important habitat suitability parameters, including water level, water temperature, dissolved oxygen (DO), and pH. Water level will be converted to streamflow using a stage-discharge rating curve for each monitoring station location. This curve will be developed and maintained through hydrographic surveys and instantaneous flow measurements collected during the initial and routine surveys. Data from the surface water monitoring station will be downloaded during each routine habitat suitability survey. Additional downloads may occur if the water quality sonde requires more frequent maintenance. Methods will align with those outlined in the UVRGA Monitoring and Data Collection Protocols (UVRGA 2018).

*Purpose of monitoring component*

Continuous surface water quality and water level monitoring will provide data to evaluate how water quality may correspond with streamflow conditions within the GDE. The water quality parameters measured (e.g., DO, pH, and temperature) are important habitat suitability components for special-status aquatic species and continuous measurements will provide a dataset to assess habitat suitability over time and under varying flow conditions. Continuous data also allows for comparison of diurnal variation, as temperature and DO in particular can fluctuate greatly between daytime and nighttime.

This component will provide information to assess the changing habitat suitability conditions over varying hydrologic conditions and seasonal variations. This variation may provide important insight into the natural climatic drivers of habitat suitability and allow the UVRGA to evaluate how the natural baseflow recession may be exacerbated by groundwater extraction. Together, these data are intended to inform SMC evaluation and development.

**Aerial Photography**

Aerial photography of the Confluence Aquatic Habitat Area will be conducted with an unmanned aerial vehicle (UAV) by a licensed UAV pilot. Aerial photographs will be taken of the upper, lower, and middle portions of the GDE at predetermined sites, most likely from a height of 50 to 100 feet, with both upstream and downstream views captured, at a minimum. Aerial photography will be conducted at least four times annually, simultaneous with routine habitat suitability surveys.

*Purpose of monitoring component*

Conducting aerial photography provides a visual time series of the overall conditions within the GDE and allows for comparison of the aquatic habitat during and following different hydrologic and climatic conditions.

**Repeat Ground Photography**

Repeat ground photography will be conducted during each monitoring effort, at the designated monitoring locations established by the initial habitat mapping event for the routine habitat suitability surveys. Photographs will be taken at the same locations and from the same vantage points with the same orientation (upstream and downstream) at least four times annually, during each routine habitat suitability survey. Photographs will be taken in ArcGIS Collector using an electronic data tablet.

*Purpose of monitoring component*

Conducting repeat photography will provide a visual time series for each monitoring location of both instream and riparian habitat. These photographs will allow for comparison of habitat conditions over time and during differing hydrologic and climatic conditions.

### 3 Data Interpretation and Evaluation Methodology

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Monitoring data will be collected in the field using ArcGIS Collector software (as described in Section 2), synced with an online server, and compiled into a digital database for organization, interpretation, and evaluation.

#### **Habitat Suitability Conditions and Relationship to ISW Depletion**

It is known that steelhead occur throughout the Ventura River, and the entire river (up to the Ordinary High Water Mark) within the Basin is designated as critical habitat for steelhead. Established methodologies will be used to evaluate habitat suitability for steelhead within the Confluence Aquatic Habitat Area, which will also provide data on the overall existing ecological conditions within the aquatic GDE. Understanding existing ecological conditions within the aquatic GDE and tracking how conditions change in comparison with modeled ISW depletion will inform how ISW depletions may be affecting this aquatic GDE, whether these effects are significant and unreasonable, and whether SMC for ISW depletion are necessary for the Confluence Aquatic Habitat Area.

The SS HSI model developed by Normandeau Associates, Inc. (2015) will be used to analyze data collected during the habitat suitability surveys, as well as continuously collected water level and water quality data. The SS HSI model will be used to calculate HSI scores at each monitoring location within the Confluence Aquatic Habitat Area. These SS HSI scores can then be compared with species presence/absence data, streamflow data, and numerical modeling of ISW depletion to gain a better understanding of whether potential significant and unreasonable effects might occur as a result of ISW depletion.

Steelhead presence/absence and overall species abundance data will also be considered when assessing if and when significant and unreasonable effects are occurring. Additionally, aerial and repeat photography will allow for visual comparisons of conditions within the GDE, as well as at specific mesohabitats within the GDE. Qualitative assessments of vegetative health, presence or absence of water, and water quality may be made using these time series images.

The results of the monitoring program will be evaluated to assess undesirable results for depletions of ISW. Specifically, the SS HSI scores, species presence/absence and overall species abundance data, will be evaluated together with the model derived estimates of ISW depletion to draw conclusions about the effects of the depletion on the aquatic GDE. This evaluation will occur in the 5-year GSP assessment and update.

#### **Consideration of Other Monitoring Programs**

In addition to the data collected through this monitoring program, data collected by other regional stakeholders (as described in Section 1.1) will be incorporated into the analysis. Data collected in other areas of the Basin could also serve as a basis of comparison for the GDE and may help in understanding how habitat conditions change within the river both seasonally and/or due to groundwater pumping.

### 3.1 Annual Progress Reports

Following completion of each full year of monitoring, a written memo will be provided to the UVRGA with a summary of the monitoring efforts completed, the data collected, and a preliminary analysis of the findings for that year. Links to the online server with the data and Collector maps will also be provided. Annual progress reports will be submitted in December 2023 and December 2024 covering the preceding water year.

### 3.2 Final Assessment Report

The monitoring program data will be compiled and analyzed in a final assessment report that will be submitted to the UVRGA following completion of the third year of monitoring. This report will include the following components:

- Detailed maps and figures of all monitoring locations and habitat mapped within the GDE;
- Detailed accounts of species presence and abundance within the GDE, as well as a summary of any fish stranding and/or mortality observations;
- Quantitative and qualitative descriptions of overall habitat conditions within the GDE, habitat suitability conditions at various flows and groundwater conditions, and modeled depletion of ISW;
- Calculated HSI scores for each monitoring location within the GDE during each site visit;
- Statistical analyses of the relationship between streamflow, groundwater levels, modeled ISW depletion, and habitat conditions within the GDE;
- Evaluation of whether significant and unreasonable effects on the aquatic GDE may occur as a result of ISW depletion; and
- Recommendations for SMC and future monitoring efforts (if potential significant and unreasonable effects due ISW depletion are indicated)

## 4 Monitoring Program Schedule and Budget

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### 4.1 Monitoring Program Schedule

Table 4 provides an overview of the approximate schedule for implementation of this workplan.

**Table 4 Three-year Monitoring Program Schedule Overview**

Monitoring Program Milestones	Timeline
Submittal of Draft Workplan	May 2022
Public Comment Period	June 2022
Approval of Final Workplan and Contracting	August 2022
Implementation of the Monitoring Program	October 2022 – October 2025
1. Initial Habitat Mapping	1. Fall 2022
2. Routine Habitat Suitability Surveys	2. At least four times annually (once during winter, at least three times during dry season)
3. Aerial Photography	3. At least four times annually, during each field visit
4. Repeat Ground Photography	4. At least four times annually, during each field visit
5. Water Quality and Water Level Monitoring	5. Continuous monitoring, data downloads during each field visit
Installation of Water Quality and Water Level Monitoring Stations	Fall 2022
Annual Progress Reports	December 2023 and 2024
Final Three-Year Findings Report	December 2025

### 4.2 Budget

Rincon anticipates that implementation of the monitoring program over three years (2022 through 2025), as described in this workplan, will not exceed the Confluence Area monitoring budget estimated in the GSP. Specifically, this amount is expected to be sufficient to cover monitoring efforts, as well as data management, analysis, and reporting. The budget included in the GSP was as follows:

- Fiscal Year 2022/2023: \$46,082
- Fiscal Year 2023/2024: \$41,532
- Fiscal Year 2024/2025: \$36,666

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# Appendix A

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Confluence Aquatic Habitat Area Aquatic GDE Photographs



**Photograph 1.** Northern portion of Confluence Aquatic Habitat Area (facing north).



**Photograph 2.** Southern portion of Confluence Aquatic Habitat Area (facing north).

Photographs by S. Howard, April 19, 2021