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Technical Memorandum

SHN Reference:	020091.150
GHD Reference:	11217388. 2.3.1
Date:	September 20, 2021
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Copy To:	Hank Seemann, Deputy Director, Humboldt County Department of Public Works-Environmental Services
From:	SHN: Mindi Curran and Jason Buck GHD: Patrick Sullivan
Subject:	**Water Quality Technical Memorandum**

1.0 Introduction

1.1 Overview

For inclusion in the Humboldt County Department of Public Works' Eel River Valley Groundwater Sustainability Plan (GSP), this technical memorandum provides a summary of available water quality data for the Eel River Valley Basin (ERVB) (Appendix 1, Figure 1), the results and analysis of water quality sampling conducted in 2021, and an evaluation of groundwater quality areas of concern in the context of Sustainable Groundwater Management Act (SGMA) regulations.

Data collection efforts involved:

1. A comprehensive historical data review to identify areas and constituents of concern, a process which encompasses data collection from the Groundwater Ambient Monitoring and Assessment (GAMA) program database, the North Coast Regional Water Quality Control Board (RWQCB), the State of California's GeoTracker database, and data reported by municipal drinking water suppliers.
2. Coordination with the project team and County for identification of candidate wells for sampling, finalization of the relevant analyte list, and the preparation of a Water Quality Sampling and Analysis Plan.
3. Sample collection at 15 well locations and submittal to a laboratory for analysis.

The purpose of this work is to support the description of general water quality in the hydrogeologic conceptual model (HCM), the characterization of the water quality sustainability indicator, and the development of sustainable management criteria.

1.2 Previous Work Done by Others

The U.S. Geological Survey (USGS) and California Department of Water Resources (DWR) conducted reconnaissance investigations of groundwater within Humboldt County, concluding that the quality of water is generally good, with iron being a common constituent found in high concentrations (up to 28 parts per million [ppm]). Elevated chloride concentrations (500 to 1,000 ppm) within wells along

the coast and near tidal reaches were noted (Evenson 1959). The water coming from the Carlotta and Wildcat sediments is sometimes unfit for use because of the high iron-oxide and manganese-oxide content (Ogle, 1953).

Groundwater quality in the Northern Coast Ranges (NOCO) study unit was investigated as part of the Priority Basin Project (PBP) of the Groundwater Ambient Monitoring and Assessment (GAMA) Program and the USGS National Water-Quality Assessment Program. The GAMA NOCO study was designed to provide an assessment of the quality of untreated (ambient) groundwater in the primary aquifer system within the study unit. The assessment is based on water quality and ancillary data collected in 2009 by the USGS from 58 sites, as well as on water quality data from the California Department of Public Health (CDPH) database (Mathany and Belitz 2015).

1.3 Summary of Work Completed in the Alternative Plan

Water quality data made available online as part of the California State Water Resources Control Board's (SWRCB) GAMA program was compiled and presented in the 2016 Groundwater Sustainability Plan Alternative (SHN 2016). Fifteen (15) constituents were queried and analyzed in the GAMA database to evaluate water quality, including aluminum, arsenic, barium, boron, cadmium, chloride, chromium, lead, mercury, nitrate, selenium, silver, sodium, specific conductance, and total dissolved solids (TDS). Six (6) of the 15 constituents had concentration levels that were detected above method detection limits, including arsenic, chloride, nitrate-N, sodium, specific conductance, and TDS. For the six (6) constituents that were selected for further analysis, all datasets in the database were used to provide an assessment of the average concentration for each constituent for each 10-year period of record (decadal averages). None of the detected constituents were found to be above their respective water quality objectives. Analysis of the data trend for each constituent indicated that there was little to no increase in concentrations in the last 10-year period of record as compared to the entire dataset.

A summary of the decadal averages and findings were included in the groundwater sustainability plan alternative (SHN 2016). In DWR's alternative assessment staff report (DWR 2019), DWR staff expressed concern that decadal averages can make it difficult to identify specific areas or wells that have reoccurring state maximum contaminant levels (MCLs) exceedances. To address this concern, data for the 15 constituents evaluated in the 2016 alternative plan were downloaded again in April 2021 to assess specific exceedances for each constituent. The 2021 GAMA analysis is discussed below in Section 1.4.3.

1.4 State Water Board Resources Review

Historical water quality data was reviewed to screen for ERVB-wide groundwater quality concerns that would inform the selection of water quality sample locations and form an understanding of background conditions. Each of the SWRCB resources reviewed are listed below; data reviewed from each source are detailed in subsections below.

SWRCB's online data sources:

- GeoTracker
- Municipal raw water quality through the Safe Drinking Water Information System (SDWIS)
- GAMA program
- Dairy General Order
- Surface Water Ambient Monitoring Program (SWAMP)

- California Environmental Data Exchange Network (CEDEN)
- Dairy Representative Monitoring Program
- the Irrigated Lands Regulatory Program

In addition to online resources, the RWQCB recently released Staff Report for North Coast Hydrologic Region Salt and Nutrient Management Planning Groundwater Basin Evaluation and Prioritization (RWQCB 2020) was reviewed. It should be noted that the staff report includes data reported as part of the Dairy General Order and the GAMA database.

1.4.1 GeoTracker

The SWRCB's online reporting resource, GeoTracker, was used to assess the distribution of contaminated or potentially contaminated sites across the ERVB and to identify the constituents of concern that may be present (GeoTracker July 2021). GeoTracker was used to map the locations of underground storage tank (UST) sites and cleanup sites (Appendix 1, Figure 2), as well as permitted facilities comprising land disposal sites, wastewater treatment facilities, and hazardous waste sites that are regulated by the Department of Toxic Substances Control (DTSC) (Appendix 1, Figure 3).

It was found that the highest densities of regulated sites are located in the most populated areas of the ERVB, including in or near the cities of Fortuna, Ferndale, and Rio Dell. The most common type of regulated site was found to be leaking UST (LUST) sites, which could be contributors of petroleum hydrocarbons and volatile organic compounds (VOCs) to groundwater and soil. Most of the GeoTracker sites explored consist of a single property, and contamination is thought to be contained within those properties or limited to surrounding properties.

1.4.2 Municipal Raw Water Quality Data

Municipal raw water quality data was reviewed online through the SDWIS website (SDWIS July 2021). The SDWIS is a federal reporting service used by to states supervise the public water systems within their jurisdictions to ensure that each system meets state and Environmental Protection Agency (EPA) standards for safe drinking water. Through the SDWIS website, municipal drinking water systems can be searched by county and water quality data can be queried for individual water wells supplying water to each municipal system. Data available includes tabular data that can be downloaded by well or by constituent, as well as consumer confidence reports.

Municipal water suppliers in the ERVB whose data were evaluated include the City of Fortuna, City of Rio Dell, Palmer Creek Community Services District (CSD), Riverside CSD, Loleta CSD, Hydesville CSD, and Del Oro Water Company (Appendix 1, Figure 4). Water quality data available for raw water supplies were evaluated for each of the municipal water suppliers; treated water data were not evaluated. Consumer confidence reports were not reviewed in detail because they present data for treated drinking water, which are not indicative of raw water quality through the ERVB.

Each municipal water supplier reports water quality data for each of their water sources (primarily wells or springs). The water quality data reported varies between municipality and year, but generally includes data for metals, nutrients, salts, VOCs, semi-volatile organic compounds (SVOCs), and alkalinity, among others. It was found that metals (nickel, silver, aluminum, and zinc) and anions (sulfate, chloride, calcium, and magnesium) are commonly detected but do not appear to have increasing trends through time. VOC and SVOC detections appear rare. Based on discussions with RWQCB staff and the release of the RWQCB staff report on salts and nutrients, it is known that TDS

and nitrate are constituents of concern in the ERVB. The previous studies discussed in "Section 1.2: Previous Work Done by Others" also indicate that iron and manganese can be found in high concentrations in the ERVB. This is further evidenced by Del Oro Water Company, which uses a filtration system specifically to remove these two constituents. Based on the online data review and for these reasons, TDS, nitrate, iron, and manganese were selected for further analysis. Data for these four constituents were downloaded for each municipal water supplier and evaluated in Excel.

For the municipal data presented in this report, it is important to note that the SWRCB and the SDWIS use secondary MCLs, if they are available, instead of primary MCLs, which address health concerns and are considered to be the upper threshold for acceptable limits. Secondary MCLs address aesthetics such as taste and odor and are often associated with water quality objectives outlined in basin plans. However, not all constituents have been assigned a secondary MCL value. For this report, the MCLs used on the graphs are the MCLs used by the data source from which the data were accessed.

The municipal raw water data do not show any TDS exceedances (500 milligrams per liter [mg/L]) or any nitrate exceedances (10 mg/L) for the period of record. Graphs showing TDS and nitrate concentrations are presented in Appendix 2. Iron and manganese have been reported by Palmer Creek CSD, Del Oro Water Company, and Loleta CSD at levels above secondary MCLs (300 micrograms per liter [ug/L] and 50 ug/L, respectively). Concentrations of iron and manganese have been above the secondary MCLs for the entire period of record, suggesting that the occurrence of these constituents is related to background concentrations from the geologic formations of which the aquifers are comprised, as opposed to being a result of water use. Graphs presenting data for iron and manganese concentrations are also presented in Appendix 2.

1.4.3 2021 GAMA Assessment

The Groundwater Ambient Monitoring and Assessment (GAMA) program is California's comprehensive groundwater quality monitoring program that was created by the SWRCB in 2000. The GAMA program is a database effort created from interagency collaboration between the State and Regional Water Boards, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory, as well as cooperation with local water agencies and well owners. The SWRCB lists the two primary goals of GAMA as being to improve statewide comprehensive groundwater monitoring and to increase the availability of groundwater quality data to the general public. Data available through the GAMA database come from a variety of sources that are required to report data to the Water Board. Sources include municipalities and water suppliers, waste dischargers, as well as persons/entities required by the Water Board to conduct remediation groundwater monitoring. The data are collected by personnel associated with each source, and therefore are different for each source.

GAMA was used to identify areas within the ERVB that have potential groundwater quality concerns (GAMA April 2021). Three tasks were completed in GAMA to evaluate groundwater quality:

- Task one: The GAMA database was queried to identify exceedances for a chosen set of constituents that could be present in groundwater due to their use in the ERVB for industrial and commercial purposes. These queries helped to determine if there are any areas of the ERVB where industrial or commercial services may be impacting groundwater quality.

- Task two: Data were downloaded from GAMA for the same 15 constituents that were evaluated in the 2016 alternative plan but were used to identify specific exceedances for each constituent instead of using decadal averages. The purpose of this analysis was to evaluate trends through time for the 15 constituents.
- Task three: A comparison of the available dataset over the entire period of record compared to the last 10 years was made for iron, manganese, TDS, and nitrate. This comparison helped to visualize how monitoring for these constituents has changed in the ERVB over time and helped recognize data limitations within the GAMA database.

For task one, the program was queried for a specific set of constituents, for all well types, and for all years of available data. Constituents to be queried were chosen based on local industries and commercial services, as well as constituents of concern commonly associated with those types of services. Gasoline, methyl-tertiary-butyl-ether (MTBE), and naphthalene were chosen because the most common type of regulated facility in GeoTracker are USTs, which are associated with these constituents.

Tetrachloroethene (PCE) and trichloroethene (TCE) were chosen because they are commonly used solvents found at a variety of industrial and manufacturing sites. Arsenic was chosen because it is used as an additive to animal feed, wood preservatives, and pesticides, all of which could have been used in the ERVB. The GAMA evaluation showed that exceedances have occurred for all of these constituents, except for TCE. However, all of the exceedances for PCE, gasoline, MTBE, pentachlorophenol (PCP), and naphthalene have occurred in remediation monitoring wells at sites with known contamination issues. Arsenic was the only one of these constituents that had exceedances at a well that was not a remediation monitoring well. Arsenic exceedances have occurred frequently through time at the Van Ness raw water well, including one exceedance in 2020. The Van Ness raw water well also has relatively high concentrations of iron and manganese that are thought to be background concentrations.

According to the USGS, arsenic occurs naturally as a trace component in many rocks and sediment. It can also be a result of human activities such as mining and various uses in industry, including as an additive in animal feed, as a wood preservative, and as a pesticide (USGS 2021 Arsenic and Groundwater Website). Aside from gravel and aggregate recovery, mining has not been a prevalent industry in the ERVB and is not likely the source of arsenic. As shown in Appendix 3 and discussed below in Section 1.6.4, no pesticide was detected in any County groundwater monitoring well (analytical list 531.1) during the 2021 groundwater quality monitoring event. This suggests that pesticides are not likely a source of groundwater contamination. It is possible that arsenic has been used at local lumber mills as a wood preservative, but there are no lumber mills in the vicinity of Del Oro Water Company, which has the most frequent arsenic detections. For these reasons, it is possible that the arsenic concentrations may also represent background concentrations naturally occurring due to the lithology of the surrounding region.

Sediment sampling has been conducted through the Salt River corridor by the Humboldt County Resource Conservation District (HCRCD) during the Salt River Ecosystem Restoration Project (HCRCD, 2014). Soil sampling occurred in 2007 and 2008 in an effort to determine if excavated sediments were suitable for reuse on nearby agricultural lands. The results of this sampling indicate that levels for organic compounds, heavy metals, pesticides and herbicides, PCBs, and dioxin/furans are well below the human safety limits set by the EPA and the National Oceanic and Atmospheric

Administration (NOAA). The only metal that was found above the reference level was Arsenic. Results of this study support the conclusion that the concentrations of Arsenic in this area may be naturally occurring due to the lithology of the surrounding region.

Task two involved downloading tabular data for the 15 constituents that were evaluated in the 2016 alternative plan: aluminum, arsenic, barium, boron, cadmium, chloride, chromium, lead, mercury, nitrate, selenium, silver, sodium, specific conductance, and TDS. This was also described briefly in Section 1.3. All data available for each constituent for the last 10 years were downloaded and analyzed in Excel to evaluate specific exceedances during the last decade. All results fell below MCLs, except for one (1) TDS result in 2012 and an arsenic result in 2020. Graphs showing the individual detections for each of these constituents are found in Appendix 4. As mentioned above in Section 1.4.2, it is important to note that the SWRCB has not assigned secondary MCLs to all constituents, so there are both primary and secondary MCLs reported in GAMA and on the graphs in Appendix 4.

The third task completed in GAMA included comparing the available dataset over the entire period of record to the available dataset for only the last 10 years. The four primary constituents of concern known to be present across large areas of the ERVB are TDS, nitrate, iron, and manganese. These constituents of concern were queried in GAMA for all wells for the entire period of record and then again for only the last 10 years. There have been exceedances of the primary MCLs for TDS and nitrate at some points during the historical record, but not within the last 10 years. There continues to be exceedances of the secondary MCLs for iron and manganese, which is consistent with historical data from the entire period of record.

There have been fewer wells monitored for the four constituents over the last 10 years than there has been for the rest of the record. This is a notable limitation within the dataset because some of the wells that have exceedances at some point within the record have not had continued monitoring within the last decade. It is also notable that many of the wells monitored during the last 10 years are located along the margins of the ERVB, which limits the amount of available data for the central portion of the ERVB. Maps showing the wells that have available data for each of these constituents for the entire period of record, as well as for only the last 10 years, are also presented in Appendix 4.

1.4.4 Regional Salt and Nutrient Management Report

The Staff Report for North Coast Hydrologic Region Salt and Nutrient Management Planning Groundwater Basin Evaluation and Prioritization, 2020 public review draft provides ERVB-wide information on salt and nutrient concentrations (RWQCB 2020). The Eel River Valley has been identified as a high-priority basin for salts (defined as TDS in the report) and nutrients (defined as nitrate in the report).

Based on correspondence with RWQCB staff, the data sources for the staff report include GAMA, the Dairy General Order, and the California Integrated Water Quality System Project (CIWQS) (CIWQS August 2021). Data from the Dairy General Order that were included in the staff report are not available online but were given by the RWQCB upon request, including analytical results for nitrate collected in 2013 and 2014 at dairies across the ERVB. A combination of these results, data in GAMA, and locations of regulated facilities and facility types were the basis of the staff report.

In addition to the nitrate data, shapefiles of facilities regulated by the RWQCB—dairies and animal feeding facilities, cannabis sites, landfills, wastewater treatment facilities, timber harvest locations,

etc.—were accessed through the SWRCB's online geographic information system (GIS) services platform and can be viewed in ArcGIS. The general location of these facilities and their distribution across the ERVB are presented in Appendix 1, Figure 5.

RWQCB staff developed priority levels for each basin based on a review and analysis of concentrations of TDS and nitrates, the density of onsite wastewater treatment systems, types of agricultural crops, and the dairy animal count and density. The sampling results presented for nitrates spanned from 2010 to 2020 and was associated with well locations and, therefore, provided an opportunity to evaluate the spatial distribution of exceedances, which primarily occurred within the central portion of the Lower Eel River Valley. The results for TDS, however, were not reported with any spatial reference and, therefore, were not useful for identifying any specific problem areas.

The central portion of the Lower Eel River Valley is presented in the staff report as the area of most concern for nitrate exceedances. The area identified is located near Del Oro Water Company, which historically has had iron, manganese, and arsenic exceedances. Based on these data this area of the ERVB was identified as an area of interest for groundwater quality monitoring and was the basis for water quality well selection, which is described below in Section 1.6.1.

1.4.5 Additional State Water Resource Control Board Recommended Online Resources

Additional SWRCB online resources reviewed included the SWAMP, the California Environmental Data Exchange Network (CEDEN), and the Irrigated Lands Regulatory Program.

SWAMP is an online database with water quality information about water resources throughout California, comprising data on drinking water quality, watersheds, wetlands, estuaries, harmful algae blooms, and safe places to recreate (SWAMP 2021). It also includes links to other data portals, such as CEDEN, the Water Quality Goals Database, and other SWRCB databases. The information provided by SWAMP was used to gain a general understanding of water quality, but did not provide additional specific information on water quality in the ERVB that other SWRCB resources had not already provided.

CEDEN is an online database that provides information about California's surface waters, such as streams, lakes, rivers, and coastal areas (CEDEN 2021). The database can be queried by applying several layers of data filters, such as county, program, project, and location station. The database was queried by county and then through the EPA Environmental Monitoring and Assessment Program filter. Several location stations with data exist in tributaries to the Eel River, such as Allen Creek (tributary to Yager Creek), Yager Creek, Brock Creek, the Van Duzen River at Dinsmore, and Price Creek. Although many of these stations are not directly located within the ERVB, the existing data were still explored. It was found that each monitoring station has its own period of record and that the constituents and parameters reported also vary by station. Overall, the CEDEN database did not contribute additional specific information on water quality in the ERVB that other SWRCB resources had not already provided.

The Irrigated Lands Regulatory Program was not used in the water quality evaluation because it is not applicable to the North Coast region.

1.4.6 Historical Data Review Conclusions

GAMA and SDWIS databases provide the most comprehensive water quality data for the ERVB, which indicate that the groundwater in the Eel River Valley appears to be of high quality and suitable for the intended municipal and agricultural uses. Furthermore, the water quality trends in the datasets have not shown any significant increase in measured concentrations. The municipal raw water data retrieved from the SDWIS database suggest that concentrations of TDS, iron, and manganese have been reported within the same ranges since the late 1980s. The municipal data and the data retrieved through GAMA do not show increasing trends of these constituents through time, including within the last decade. The findings presented in the RWQCB's staff report on salt and nutrients indicate that elevated levels of nitrate and TDS is an existing condition within portions of the ERVB, which was an important consideration in the development of the selection of wells for the 2021 water quality sampling campaign.

1.5 2021 Water Quality Sampling

1.5.1 Well Selection

The County has 15 monitoring wells installed in Fall 2016 through DWR Proposition 1 grant funding supporting the development of the alternative plan (SHN 2016). An additional 23 wells were installed in 2021 as part of the project that is funded through a DWR Proposition 68 grant. These 38 wells form the primary network of dedicated monitoring wells for the GSP monitoring program. Unlike many other wells within the ERVB, the construction details and stratigraphy within which the County wells were constructed is known. In addition, all wells are located within the County's right-of-way, providing ease of access for sampling in the future.

As outlined in the grant scope of work, 15 wells were chosen for water quality sampling in 2021 (Appendix 1, Figure 6). The specific justification for choosing each well is outlined in the water quality sampling and analysis plan (SHN 2021). In summary, the locations were chosen to optimize spatial coverage throughout the ERVB and to represent portions of the underlying aquifers (wells screened in shallow and deep sections). Special consideration was given to areas where groundwater use is concentrated and/or has the potential to impact water quality. A substantial distribution (both horizontally and vertically) is necessary to develop a good baseline of water quality conditions for use in the HCM and groundwater conditions section of the GSP.

Eleven (11) of the 15 sample locations are within the lower Eel River Valley to help further characterize the water quality throughout this region of the ERVB, which was identified as an area of concern in the RWQCB staff report on salts and nutrients (RWQCB, 2020). The selected well locations are positioned to characterize water quality upgradient from the area of concern, within the area, and downgradient of the area of concern.

1.5.2 Fieldwork

Groundwater quality samples were collected July 7 through 13, 2021. Groundwater samples were collected in accordance with the EPA Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells guidelines (EPA 2017). Following this standard operating procedure ensures that data quality objectives are reached and that each sample is collected in the same manner, allowing for direct comparisons of repeat measurements.

Low flow sampling was completed using either a peristaltic pump or downhole bladder pump and clean tubing. Following low flow sampling procedures, water was pulled directly from the screened interval to ensure that the groundwater collected is fresh from the aquifer formation. Field measurements of temperature, pH, electrical conductance, and turbidity were collected every five (5) minutes until stabilization was achieved (a minimum of three [3] stabilized sets of parameters). Samples were then collected by decanting water directly into laboratory-supplied bottles.

Each day, prior to field sampling, all equipment was calibrated, including the pH, electrical conductance, temperature, and turbidity meters used to perform low flow monitoring for stabilization. Calibration procedures were completed according to manufacturer recommendations. All monitoring and non-dedicated sampling equipment was cleaned using a Liquinox® cleaner wash followed by a distilled water rinse. Cleaning of equipment occurred prior to being transported to the site and between sample collection at consecutive locations.

1.5.3 Laboratory Analysis

The scope of work for the grant outlines the specific constituent groups to be analyzed. The broad category analyte groups include metals, nutrients (nitrate), salts (TDS), organochlorine and organophosphorus pesticides, chlorinated herbicides, VOCs, SVOCs, polychlorinated biphenyls (PCBs), microbial contaminants, radioactive constituents, and physical parameters (pH, dissolved oxygen, redox potential, specific conductance, and temperature). Each broad category group contains many individual analytes. The broad category groups, individual analytes, and the analytical testing methods are presented on Table 1 in Appendix 3.

All groundwater quality samples were handled according to proper procedures and sent under chain-of-custody documentation to North Coast Laboratories, a California State-certified analytical laboratory located in Arcata. North Coast Laboratories subcontracted the EPA Method 8270 (SVOCs) analyses and the Gross Alpha analysis, as they do not perform those testing methods.

1.5.4 2021 Groundwater Quality Analytical Results

The groundwater quality analytical results for the July 2021 sampling event are presented in Table 2 in Appendix 3. A summary of the July 2021 sampling events is discussed below.

During the July 2021 monitoring event there were no detections for pesticides (method 531.1), chlorinated herbicides (method 615), or for glyphosate herbicide (method 547) at any wells. Endothall herbicide was detected at MW-27 and MW-28, but were below the MCL.

There was no detection of PCB (method 505) or nitrite at any wells. There were no detections of VOCs or SVOCs, except for one VOC detection at MW-15d and one SVOC detection at MW-12d. There was no detection of gasoline at any well, except for MW-28. There was one detection of E. Coli bacteria at MW-27 and there were detections of total coliform bacteria at nine (9) of the monitoring wells. Nitrate was detected in five (5) of the monitoring wells, but all detections were below the MCL. There was no detection that exceeded MCLs for fluoride, sulfate, or chloride, except for the chloride detection of 9,300 mg/L in MW-27 and 860 in MW-18. TDS was detected at every well below the Secondary MCL, except for MW-12d, MW-18, and MW-27. Every well had a detection that exceeded the MCL for alkalinity.

Metals that were not detected in any well include silver, antimony, beryllium, cadmium, thallium, mercury, and hexavalent chromium. Metals that were detected, but only at concentrations below the respective MCLs, include chromium, copper, nickel, selenium, and zinc. Metals that were detected at some wells above the respective MCLs include aluminum, iron, manganese, sodium, and arsenic. There were detections of calcium and magnesium, but there are no MCLs for these metals.

2.0 Water Quality SGMA Discussion

The evaluation of water quality in the ERVB supports the description of general water quality in the HCM, the characterization of the water quality sustainability indicators, and the development of sustainable management criteria. Specifically, it is important to identify any water quality degradation that has developed or worsened since January 1, 2015, which is required to be addressed by the GSP. The focus of this is to assess if/where significant and unreasonable impacts to groundwater quality may have been caused or exacerbated by groundwater use or groundwater management projects.

The historical data review outlined above in sections 1.2 through 1.5 used published studies, work completed in 2016 as part of the alternative plan, SWRCB and RWQCB data and online resources, data reported by municipal water suppliers, and data collected from County groundwater monitoring wells. Reviews of these resources indicate that water quality through the ERVB is generally of good quality for its intended uses.

The historical data review provides context for the condition of groundwater quality in the ERVB through time, which provides information on the background water quality, thought to have naturally moderate to high occurrences of TDS, iron, and manganese in specific areas of the ERVB. This is evidenced by the long record of municipal data, which indicate that TDS values have been below the secondary MCL of 500 mg/L, but generally above 100 mg/L at all municipal well locations since at least the mid-1980s. Iron concentrations have been an order of magnitude above the primary MCL of 300 ug/L at Palmer Creek CSD and Del Oro since at least the early 1990s. Manganese concentrations have been above the primary MCL of 50 ug/L at Palmer Creek CSD, Del Oro, and Loleta CSD since at least the late 1980s. The municipal data and the data retrieved from the online GAMA database do not suggest that trends for any of these constituents have been increasing over the last decade, which support the conclusion that these are background concentrations in the ERVB.

The results of the 2021 water quality monitoring support the conclusions of the historical data review. The 2021 monitoring results showed no detections or minor detections for many of the constituent groups, including pesticides, herbicides, PCBs, VOCs, SVOCs, gross alpha (results pending), and hydrocarbons (gasoline). Detections for nitrate were below the MCL for all wells; detections of TDS were all within expected values, except for at MW-27, which had the highest detections of all wells for endothall herbicide, alkalinity, chloride, TDS, total coliform bacteria, calcium, iron, magnesium, manganese, sodium, arsenic, barium, and nickel, and was the only well with a detection of selenium. Overall, the analyte group with the highest detections across wells is metals, and the metals detected with the highest concentrations across wells are calcium, iron, magnesium, manganese, sodium, and barium.

3.0 References

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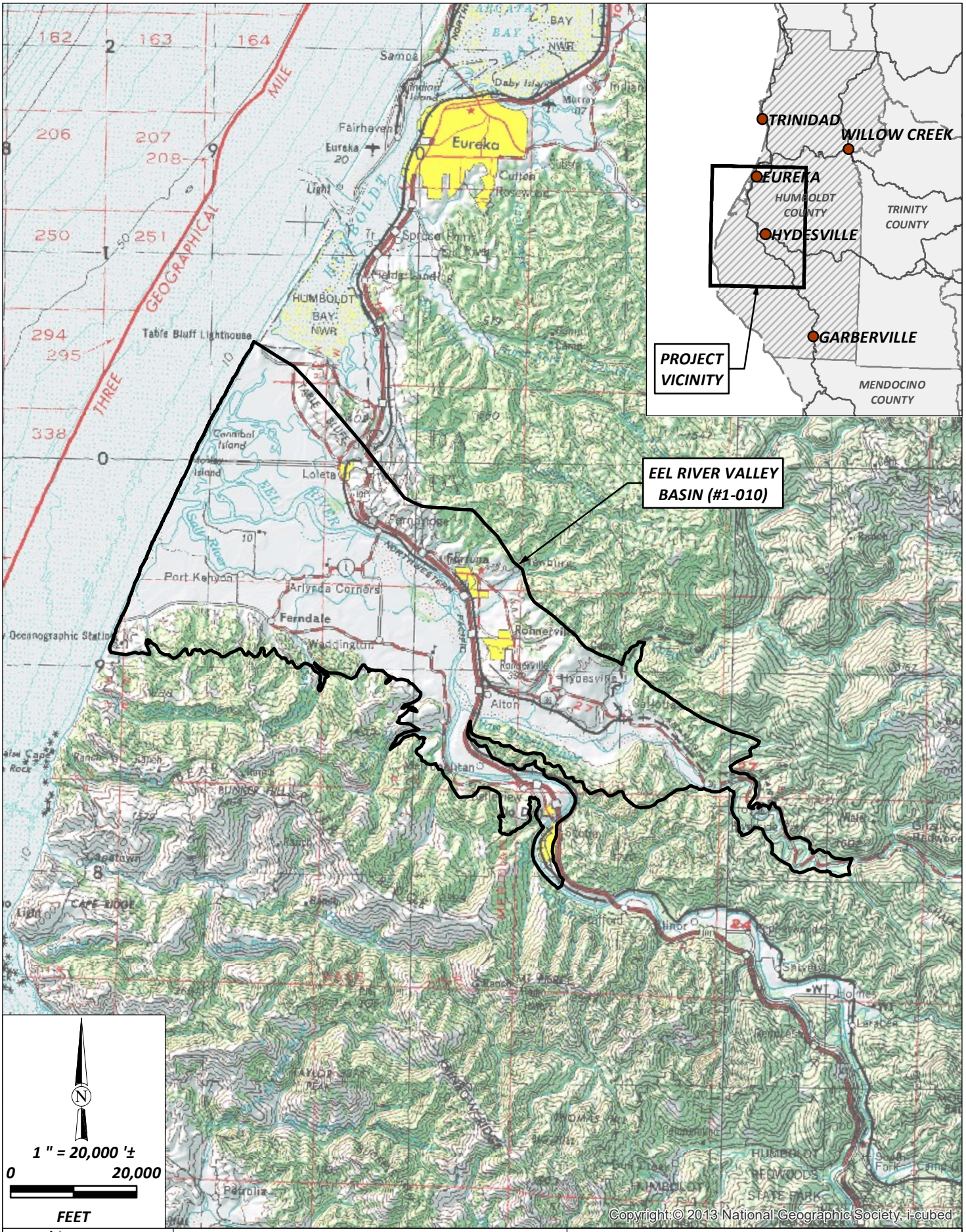
Appendices:
1. Figures
2. Municipal Raw Water Graphs
3. 2021 Groundwater Monitoring Results
4. GAMA Graphs and Images

Figures 1



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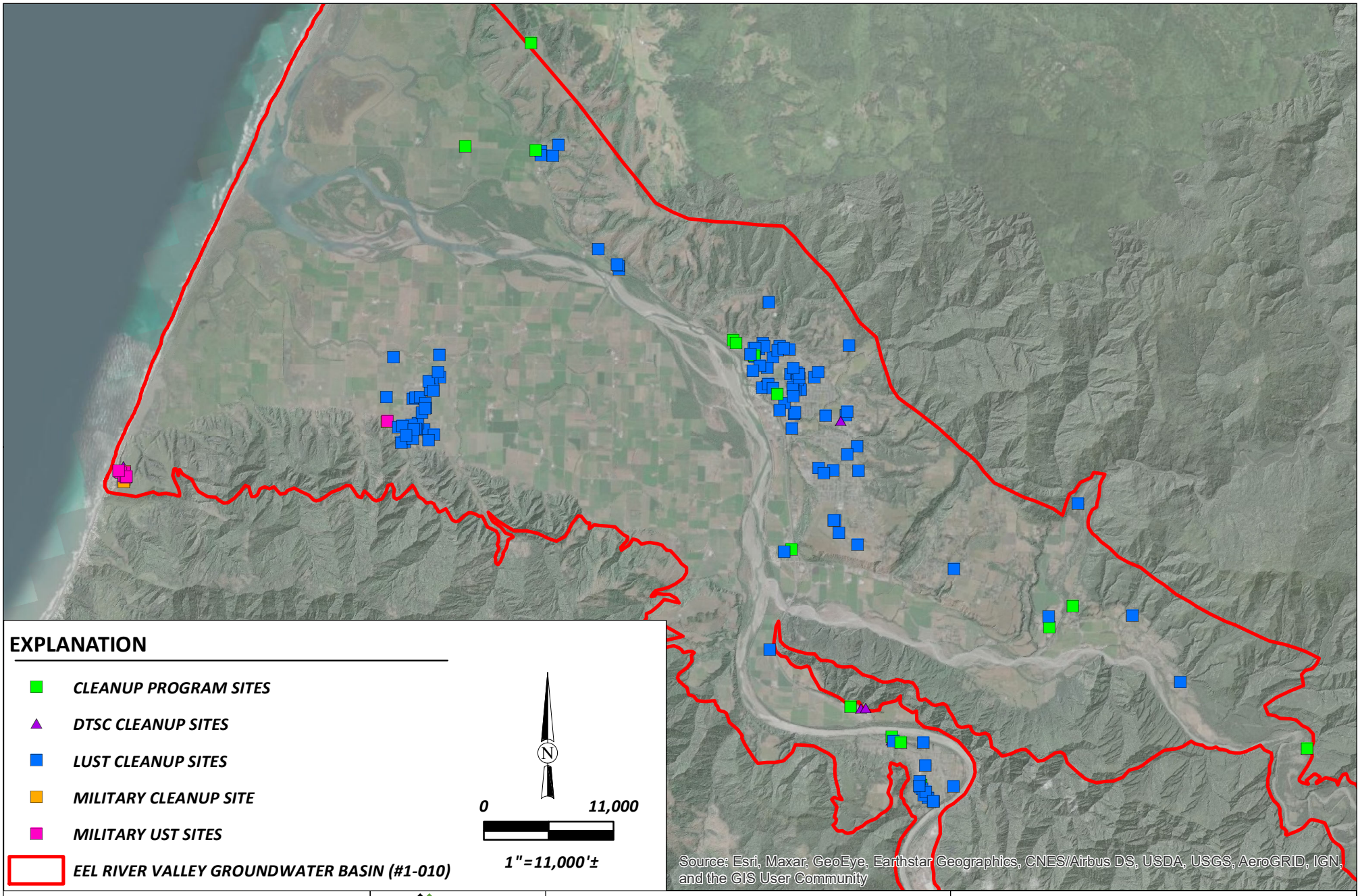
SHN	Humboldt County Public Works Eel River Groundwater Basin Humboldt County, California	Project Location SHN 020091.150
	August 2021 | Figure1_ProjectLocationMap	Figure 1

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure2_GeotrackerUSTandCleanUpSites.mxd User Name: pix4d DATE: 8/11/21, 3:05PM



NOTES: LOCATIONS DOWNLOADED FROM GEOTRACKER WEBSITE

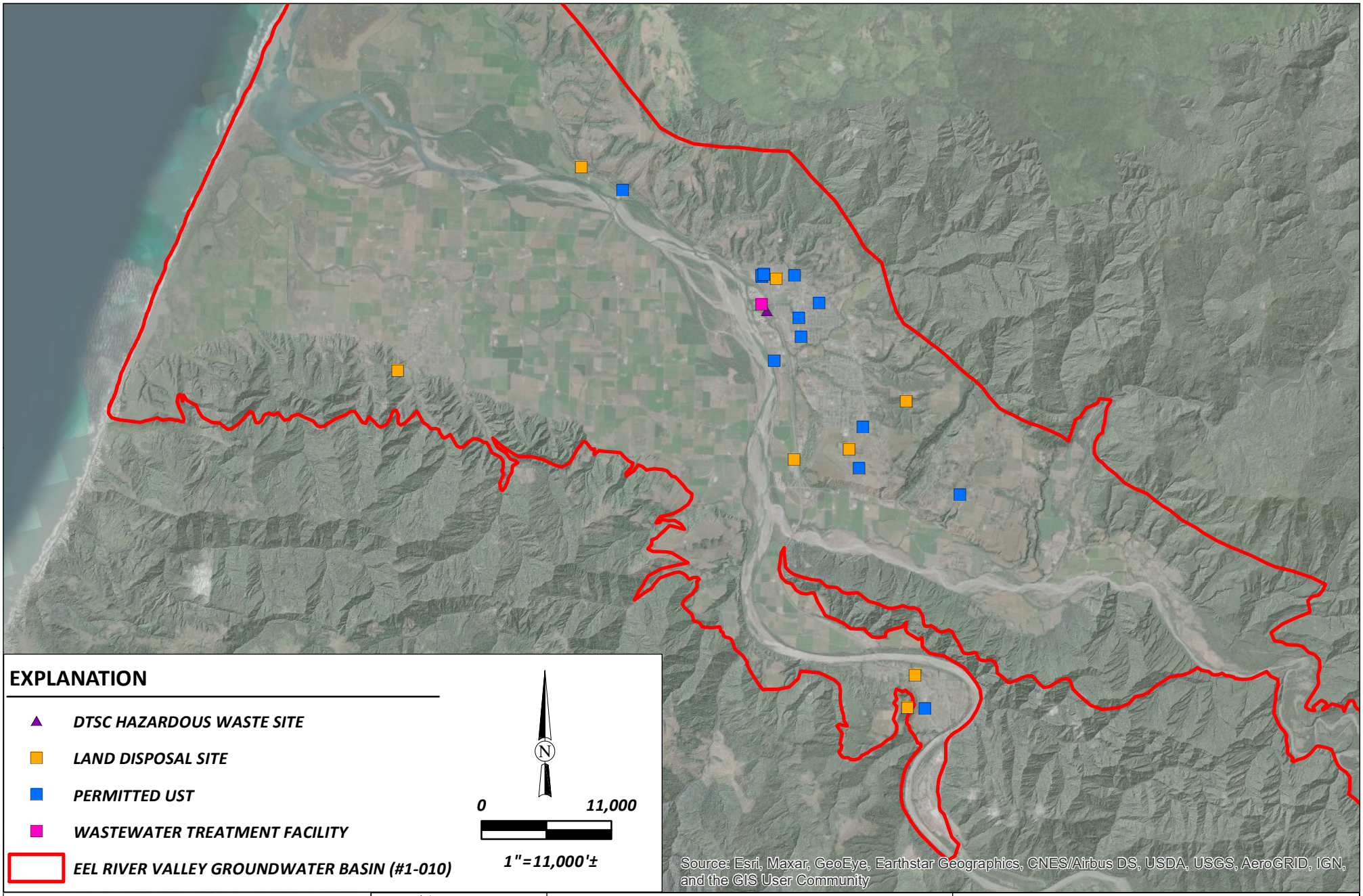
Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

GeoTracker UST and Cleanup Sites

SHN 020091.150

August 2021 | Figure2_GeotrackerUSTandCleanUpSites | Figure 2

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure3_GeotrackerPermittedFacilities.mxd User Name: pix4d DATE: 8/11/21, 4:58PM



NOTES: LOCATIONS WERE DOWNLOADED FROM THE GEOTRACKER WEBSITE; IF A LOCATION IS MISSING IT WAS NOT AVAILABLE FOR DOWNLOAD FROM THE GEOTRACKER ONLINE MAP

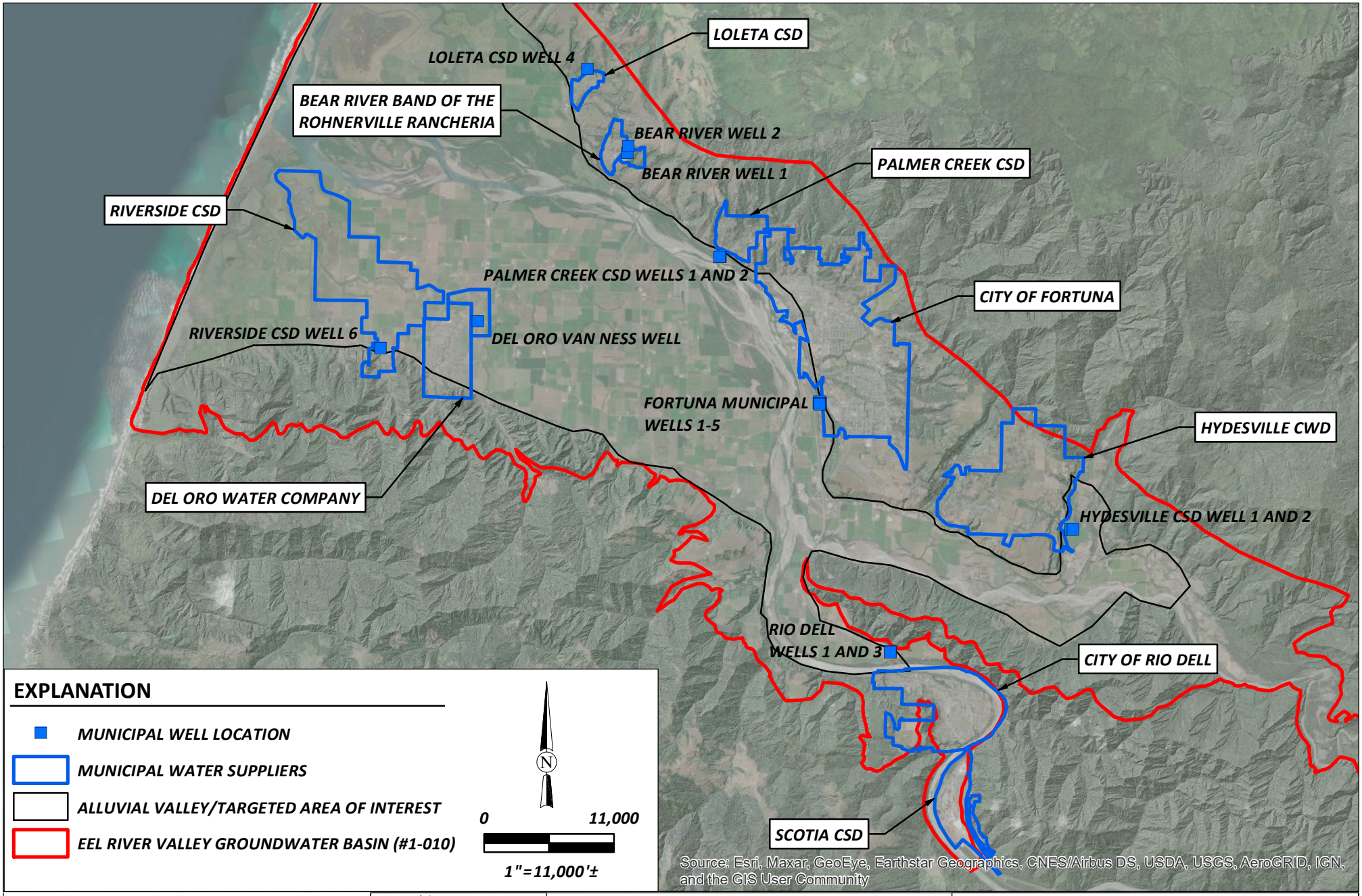
Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

GeoTracker Permitted Facilities

SHN 020019.150

August 2021 | Figure3_GeotrackerPermittedFacilities | Figure 3

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure4_MunicipalWellLocations.mxd User Name: pix4d DATE: 8/11/21, 3:04PM



Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

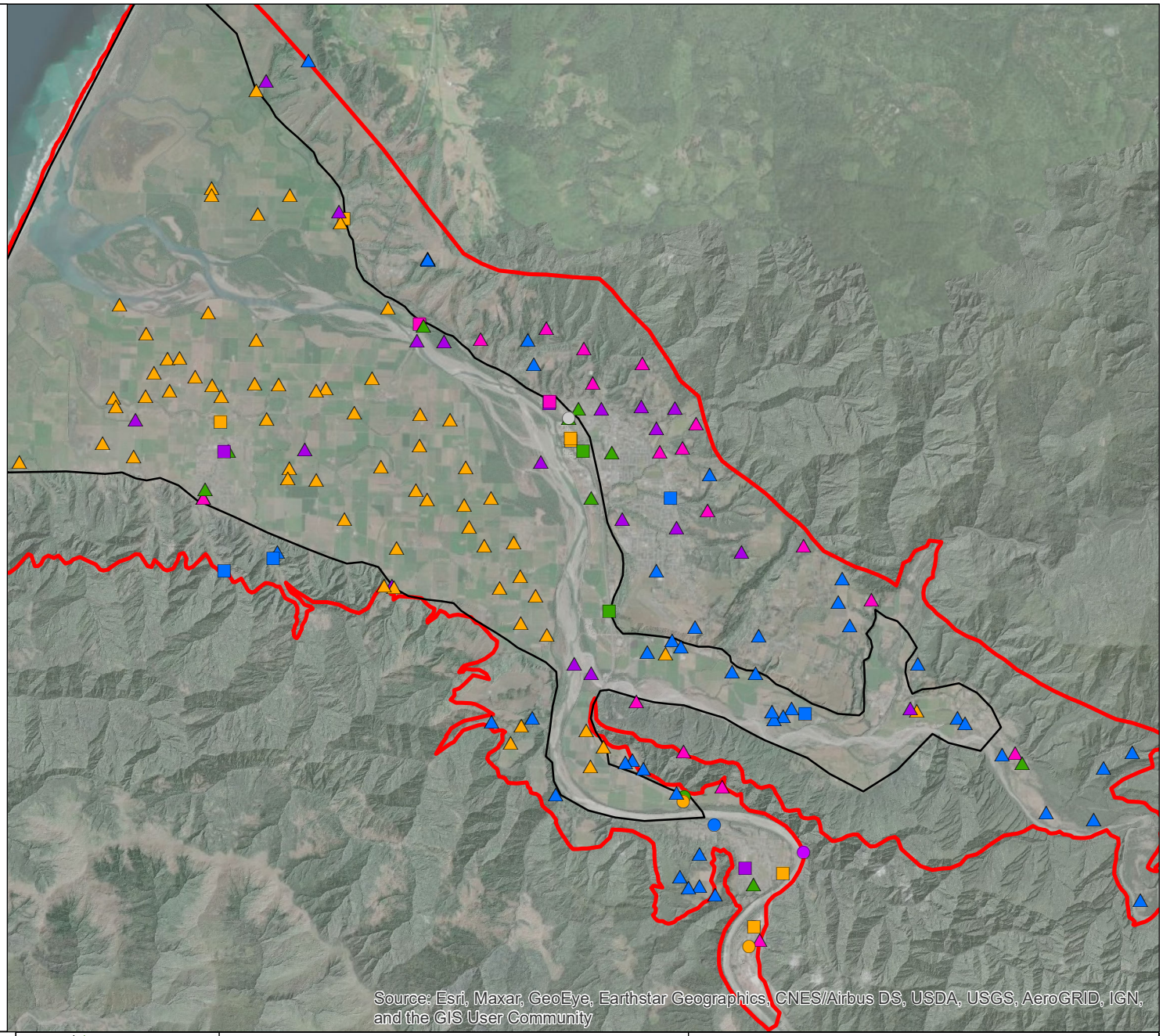
Eel River Valley Municipal
Water Suppliers and Well Locations
SHN 020091.150

August 2021 | Figure4_MunicipalWellLocations | Figure 4

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure5_RegulatedFacilities.mxd User Name: pix4d DATE: 8/11/21, 3:03PM

EXPLANATION

- ANIMAL FEEDING/DAIRY
- CANNABIS SITE
- DREDGE/FILL SITE
- TIMBER HARVESTING
- SERVICE/COMMERCIAL SITE, NEC
- WASTEWATER TREATMENT FACILITY
- HABITAT RESTORATION AREA
- GASOLINE SERVICE STATION
- FOOD PROCESSING NEC
- SAND AND GRAVEL MINING
- SAW MILL
- GROUNDWATER CLEANUP SITE
- LANDFILL
- POWER PLANT
- DOMESTIC SITE NEC
- TANK FARM
- ALLUVIAL VALLEY/ TARGETED AREA OF INTEREST
- EEL RIVER GROUNDWATER BASIN (#1-010)



N

0 12,000

1"=12,000'±

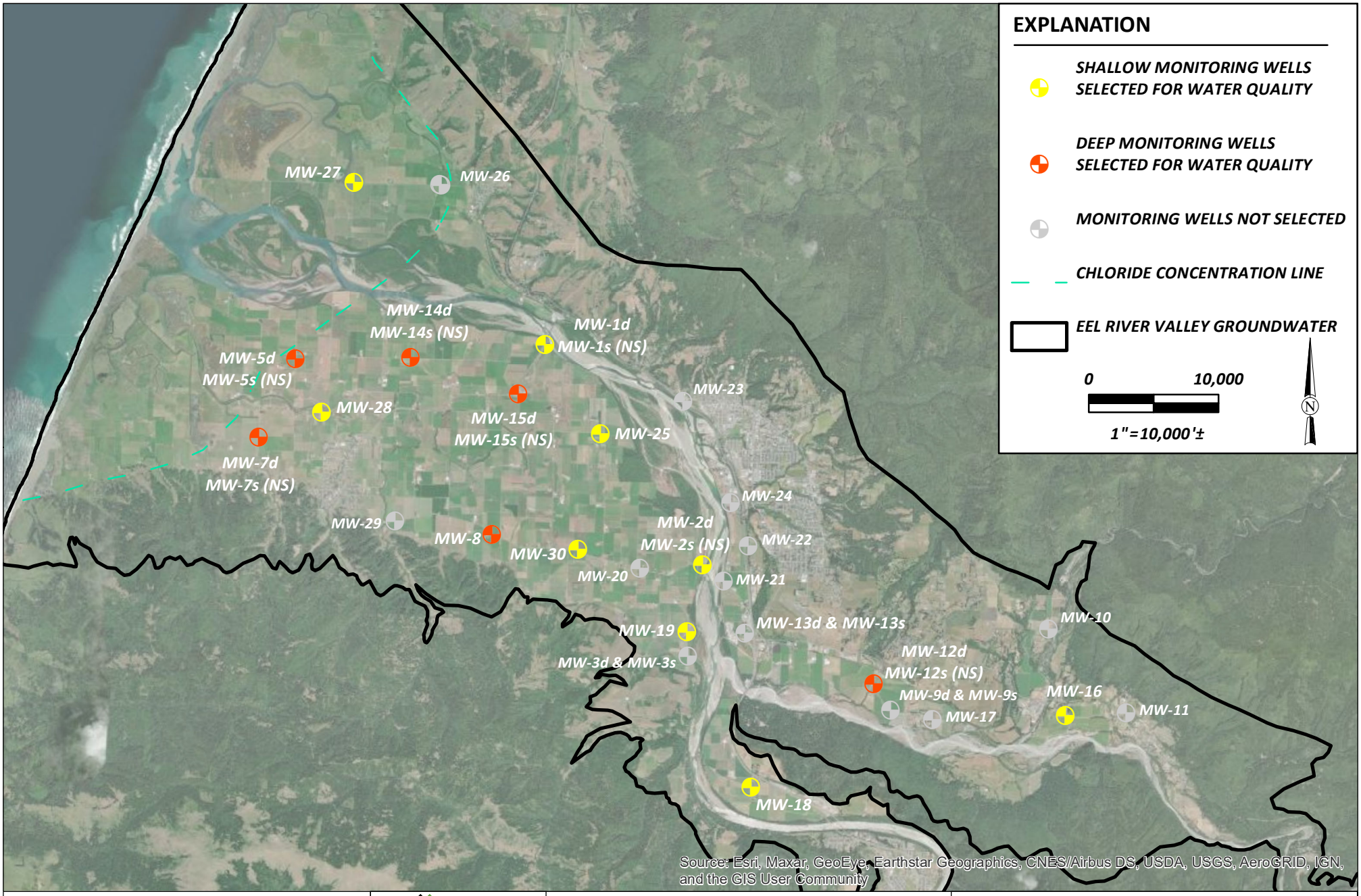
NOTES: LOCATIONS DOWNLOADED FROM CALIFORNIA STATE WATER RESOURCES CONTROL BOARD CIWQS DATABASE

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Regulated Facilities with Active Permits Listed in CIWQS
SHN 020019.150

August 2021 | Figure5_RegulatedFacilities | Figure 5

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure6_EelRiverGSP_Water_Quality_Wells.mxd User Name: pix4d DATE: 8/4/21, 11:44AM



NOTES:
(NS) - NOT SELECTED FOR WATER QUALITY MONITORING
DWR- DEPARTMENT OF WATER RESOURCES

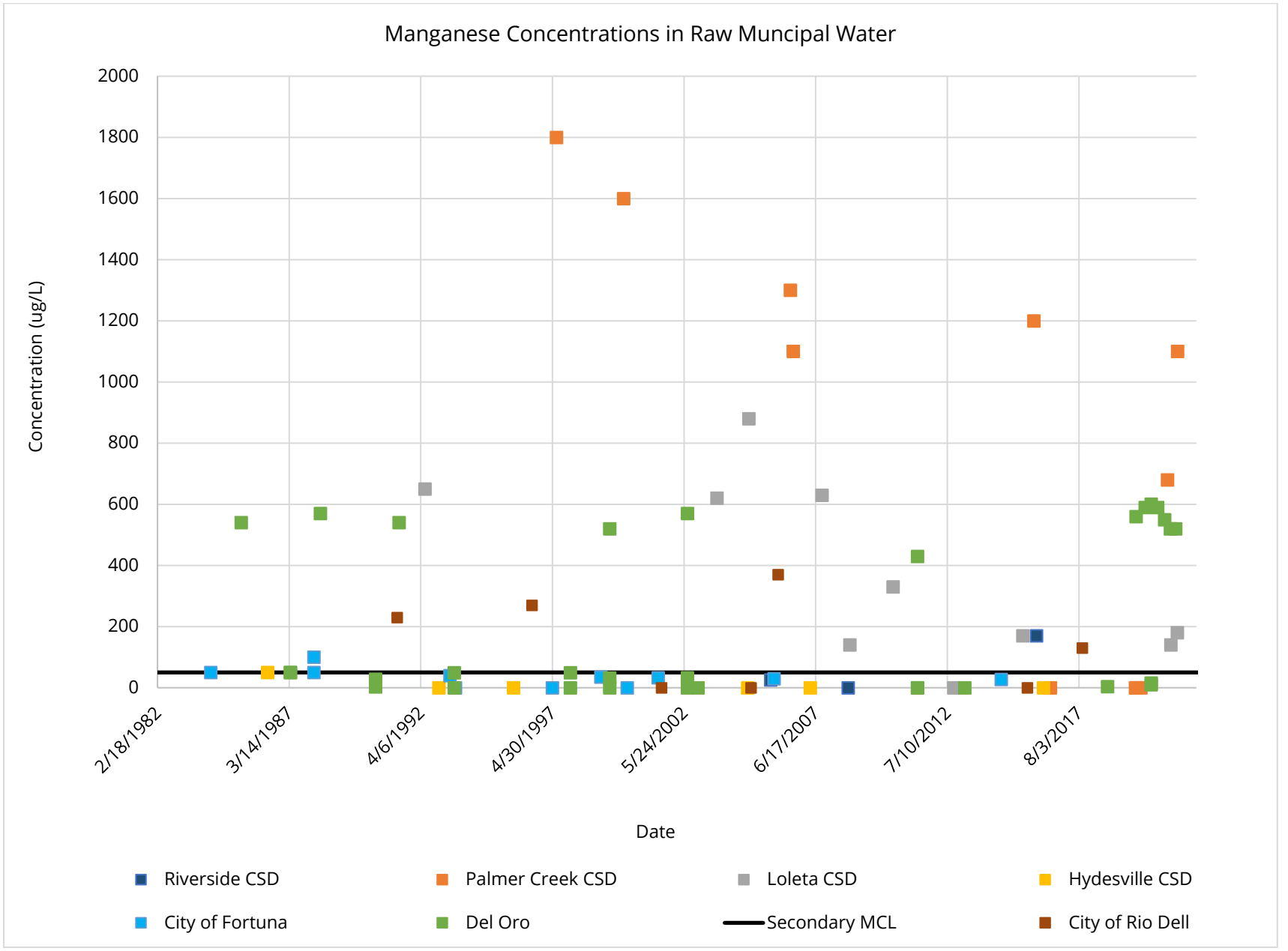
Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

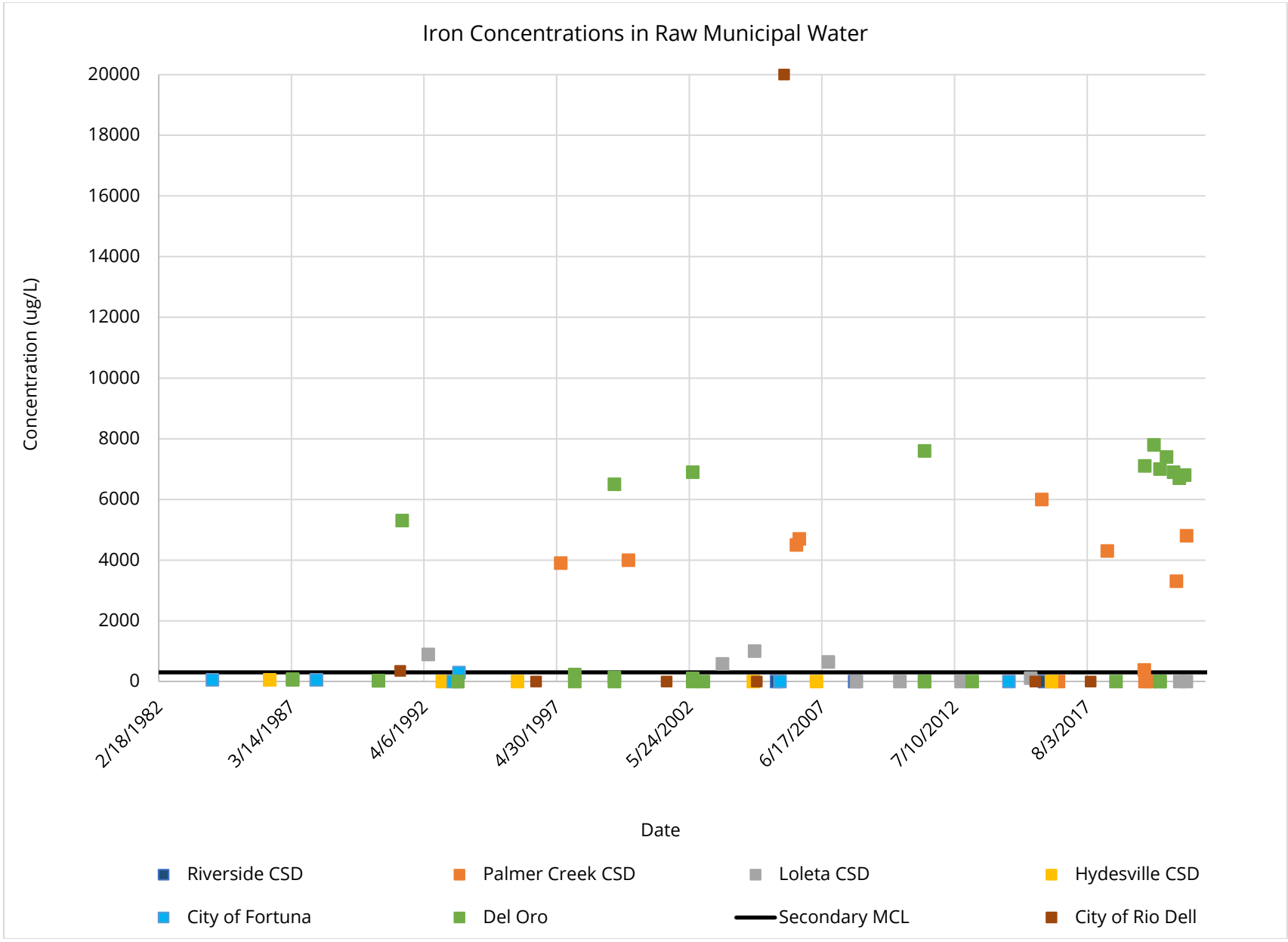
Humboldt County
Groundwater Quality Well Locations
SHN 020091.150

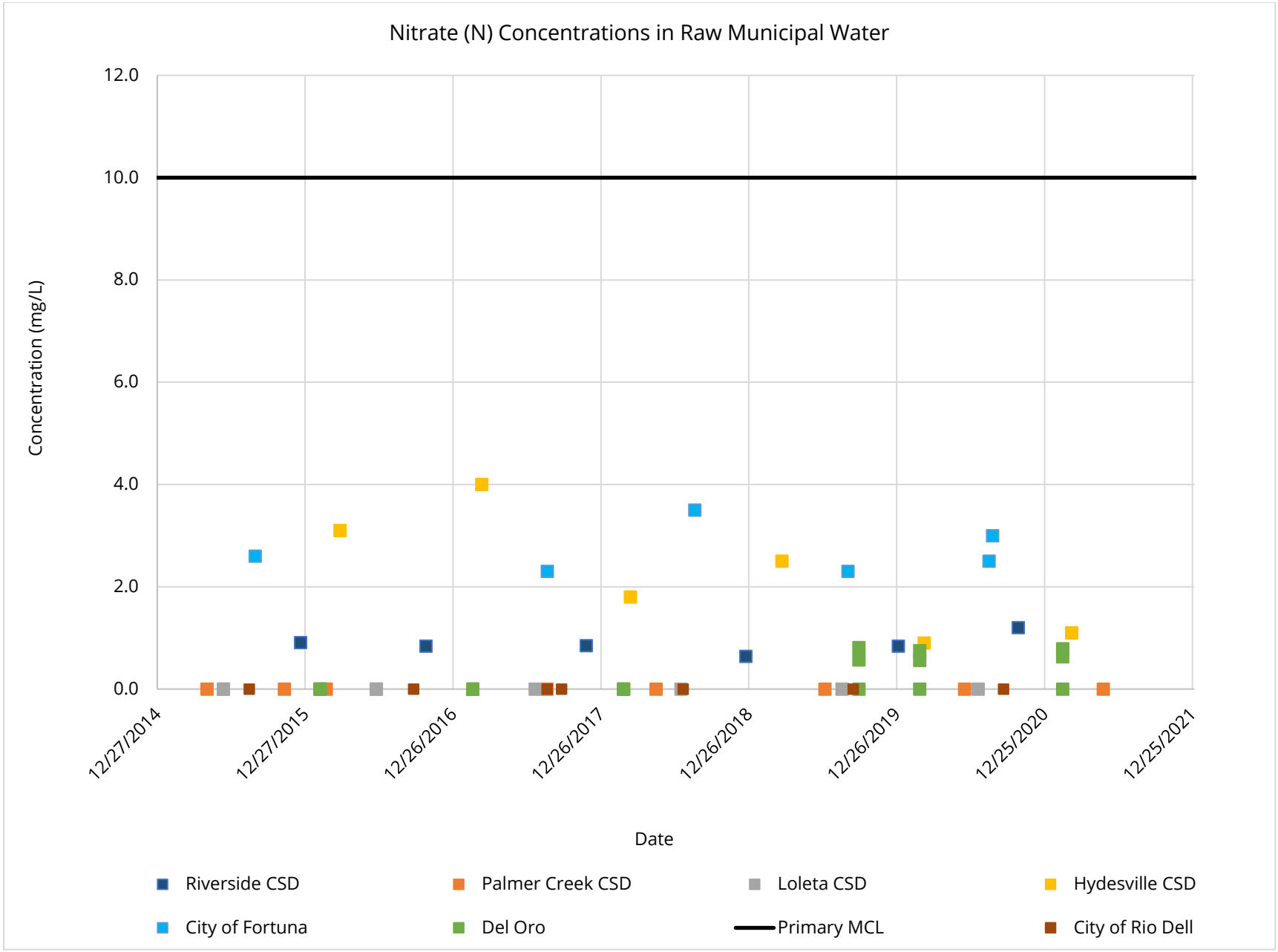
August 2021 | Figure6_EelRiverGSP_Water_Quality_Wells | Figure 6

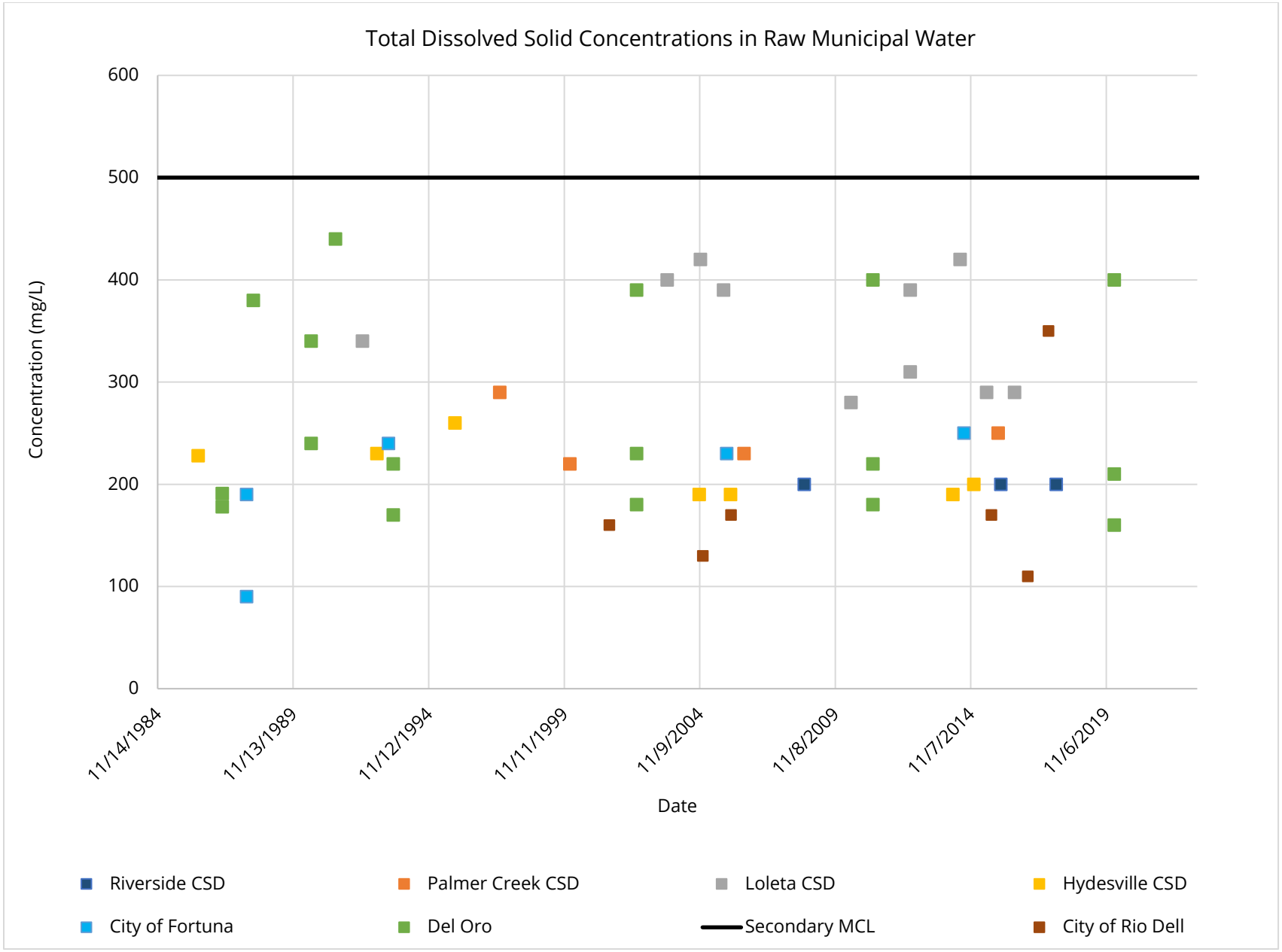
Municipal Raw Water Graphs

2


Manganese Concentrations in Raw Muncipal Water
Concentration (ug/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2/18/1982
3/14/1987
4/6/1992
4/30/1997
5/24/2002
6/17/2007
7/10/2012
8/3/2017
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell


Iron Concentrations in Raw Municipal Water
Concentration (ug/L)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
2/18/1982
3/14/1987
4/6/1992
4/30/1997
5/24/2002
6/17/2007
7/10/2012
8/3/2017
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell


Nitrate (N) Concentrations in Raw Municipal Water
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Concentration (mg/L)
12/27/2014
12/27/2015
12/26/2016
12/26/2017
12/26/2018
12/26/2019
12/25/2020
12/25/2021
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Primary MCL
City of Rio Dell


Total Dissolved Solid Concentrations in Raw Municipal Water
Concentration (mg/L)
600
500
400
300
200
100
0
11/14/1984
11/13/1989
11/12/1994
11/11/1999
11/9/2004
11/8/2009
11/7/2014
11/6/2019
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell

2021 Groundwater Monitoring Results

3

Table 1. Analytical Tests			
Grant Category	**Laboratory Test ID**	**Test**	**Example Analytes**
Metals	ACDDIG	Acid Digestion	Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium, Zinc
	CHR6CW	Hexavalent Chromium	
	ICPMSW	ICP-MS Metals	
	ICPX	ICAP Metals	
	MERCW	Mercury	
Nutrients	ICNOW	Nitrate and/or Nitrite	Nitrate/Nitrite
Salts	ICIONW	Anions by Ion Chromatography	Fluoride, sulfate, chloride (no bromide)
	TDS	Total Dissolved Solids	Total dissolved solids
Pesticides	531W	N-methyl-carbamoyloximes and Carbam	3-hydroxycarbofuran, aldicarb, aldicarb sulfone, aldicarb sulfoxide, carbaryl, carbofuran, methiocarb, methomyl, oxamyl and propoxur
Herbicides	547W	Glyphosate	Glyphosate
	548W	Endothall	Endothall
	615	Chlorinated Herbicides	2,4-D, bentazon, dicamba, picloram, triclopyr, MCPA, MCPP, Dinoseb, Dichlorprop, Dalapon, 2,4-DB, 2,4,5-TP (Silvex), 2,4,5-T
VOCs (volatile organic compounds)	8260 List 6	EPA 8260, oxygenates, scavengers, BTEX, gas	33 analytes from EPA 8260, 5 oxygenates including MTBE, lead scavengers, benzene, toluene, ethylbenzene, xylenes, gasoline, and chlorinated hydrocarbons
SVOCs (semi-volatile organic compounds)	8270W	EPA 8270 SVOCs	Extended list (70+ analytes) including naphthalene and pentachlorophenol
PCB	PCB505	PCB by microextraction	Polychlorinated biphenyls (PCBs)
Microbial	TCQUANT	Coliform Quanti-tray	Coliform and fecal (*e. coli*) bacteria
Radioactive	GROALP	Gross Alpha	Alpha particles
Physical	ALKW	Alkalinity	alkalinity
	Field	pH, Electrical Conductance, and Temperature	Parameters measured in the field at time of sampling and not quantified at the laboratory

Table 2-1
Historical Groundwater Analytical Results
Eel River Valley Basin, California
(in ug/L, unless noted otherwise)

Sample Location	Sample Date	EPA 531.1	Endothall (EPA 548.1)	Glyphosate (EPA 547)	EPA 505	EPA 615	Alkalinity (mg/L $CaCO^3$)	Fluoride (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Nitrate (as N) (mg/L)	Nitrite (as N) (mg/L)	TDS (mg/L)	VOCs (8260B)	SVOCs (8270C)	TPHG	E. Coli (MPN/100mL)	Total Coliform (MPN/100mL)	Gross Alpha (pCi/L)
MCLs		Varies	100 †	700 †	Varies	Varies	20[a]	2†	250[b]	250[b]	10†	1†	500[b]	Varies	Varies	21[c]	--	--	15†
MW-1d	04/07/21	ND	<45	<5.0	ND	ND	280	<0.10	47	25	0.73	<0.10	370	ND	ND	<50	<1.0	<1.0	1.25±1.48
MW-2d	04/07/21	ND	<45	<5.0	ND	ND	99	<0.10	15	6.0	0.14	<0.10	130	ND	ND	<50	<1.0	<1.0	0.517±1.08
MW-5d	04/07/21	ND	<45	<5.0	ND	ND	310	0.35	1.5	71	<0.10	<0.10	470	ND	ND	<50	<1.0	<1.0	0.618±1.79
MW-7d	04/06/21	ND	<45	<5.0	ND	ND	180	0.52	<1.0	120	<0.10	<0.10	390	ND	ND	<50	<1.0	<1.0	0.451±1.25
MW-8	04/06/21	ND	<45	<5.0	ND	ND	160	0.24	37	21	<0.10	<0.10	250	ND	ND	<50	<1.0	<1.0	0.502±1.20
MW-12d	07/07/21	ND	<45	<50	ND	ND	82	0.37	71	21	<0.10	<0.10	520	ND	Di-n-butyl phthalate=23	<50	<1.0	<1.0	0.925±0.655
MW-14d	07/12/21	ND	<45	<5.0	ND	ND	72	0.14	5.1	16	<0.10	<0.10	130	ND	ND	<50	<1.0	40.4	3.00±0.791
MW-15d	07/12/21	ND	<45	<5.0	ND	ND	71.0	0.2	4.4	15	<0.10	<0.10	150	Chloromethane=0.70	ND	<50	<1.0	135.4	0.888±0.666
MW-16	07/07/21	ND	<45	<5.0	ND	ND	200	0.16	19	27	0.36	<0.10	280	ND	ND	<50	<1.0	12.0	0.446±0.905
MW-18	07/09/21	ND	<45	<5.0	ND	ND	350	<0.10	1.2	860	<0.10	<0.10 B6	1,600	ND	ND	<50	<1.0	>2419.6	1.62±1.26
MW-19	07/13/21	ND	<45	<50	ND	ND	190	<0.10	43	13	0.72	<0.10	280	ND	ND	<50	<1.0	88.0	0.742±0.593
MW-25	07/08/21	ND	<45	<5.0	ND	ND	250	<0.10	24	12	3.4	<0.10	320	ND	ND	<50	<1.0	38.3	0.515±0.929
MW-27	07/08/21	ND	66	<50	ND	ND	1,000	<10 B6	<1.0	9,300	<10 B6	<10 B6	15,000	ND	ND	<50	1	>2419.6	2.24±1.53
MW-28	07/08/21	ND	57	<5.0	ND	ND	280	0.15	<1.0	94	<0.10	<1.0 B6, H2	450	ND	ND	130 G1	<1.0	>2419.6	2.55±1.26
MW-30	07/13/21	ND	75	<50	ND	ND	140	<0.10	16	18	<0.10	<0.10	210	ND	ND	<50	<1.0	196.5	0.679±0.436

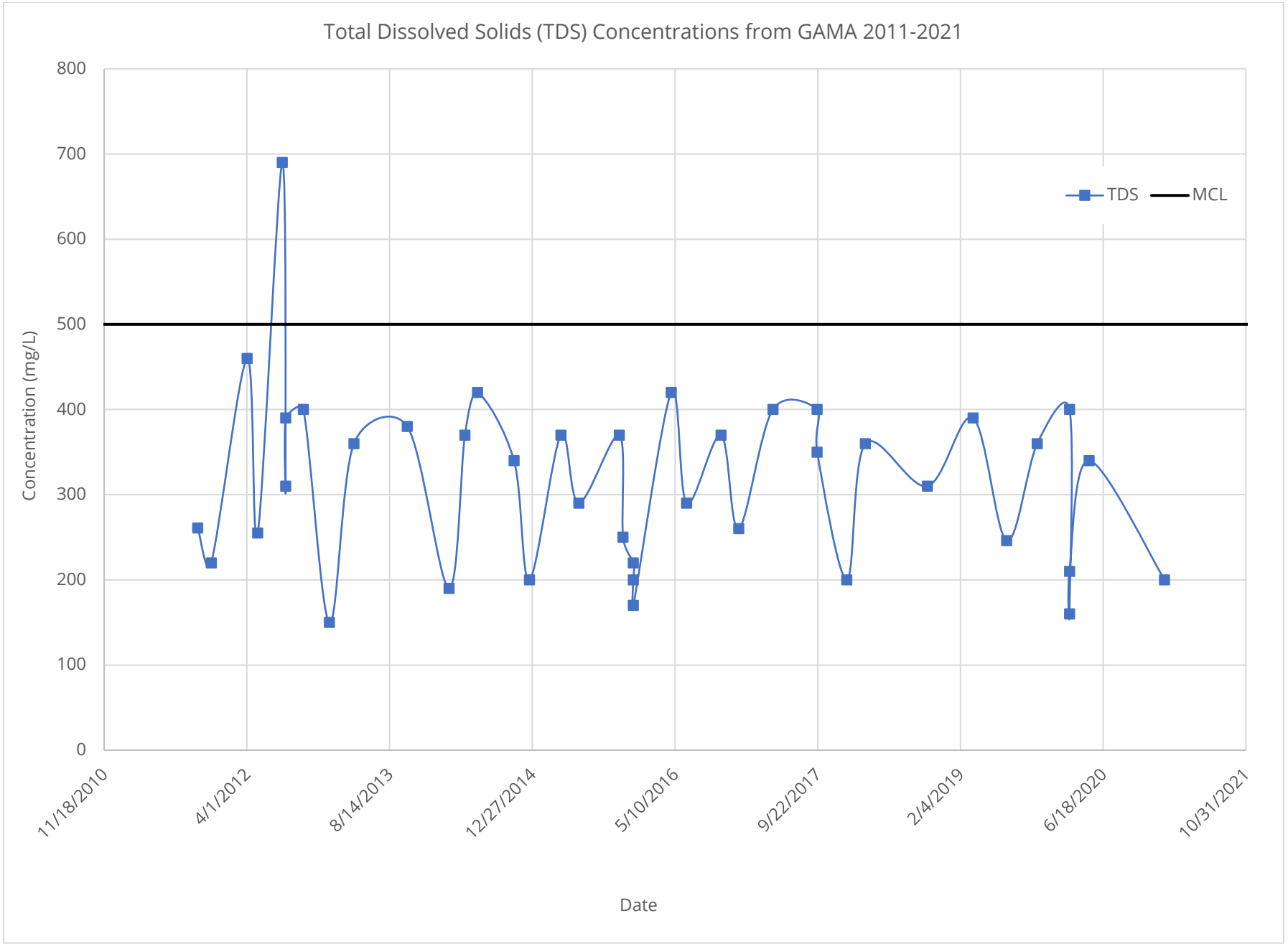
† California Division of Drinking Water Primary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
a. Minimum concentration for Freshwater Aquatic Life Protection. Continuous Concentration (4-day Average) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
b. California Division of Drinking Water Secondary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
c. EPA Superfund Provisional Cancer Slope Factor (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
--: not available/none
<: "less than" stated laboratory reporting limit
ug/L: micrograms per liter
N: nitorgen
TPHG: Total petroleum hydrocarbons as gasoline, analyzed using EPA Method No. 8260B
pCi/L: Picocuries per liter
B6: The sample was diluted due to the sample matrix.
H2: The holding time was exceeded due to a required dilution.
G1: The sample does not present a peak pattern consistent with that of gasoline. The reported result represents the amount of material in the gasoline range.

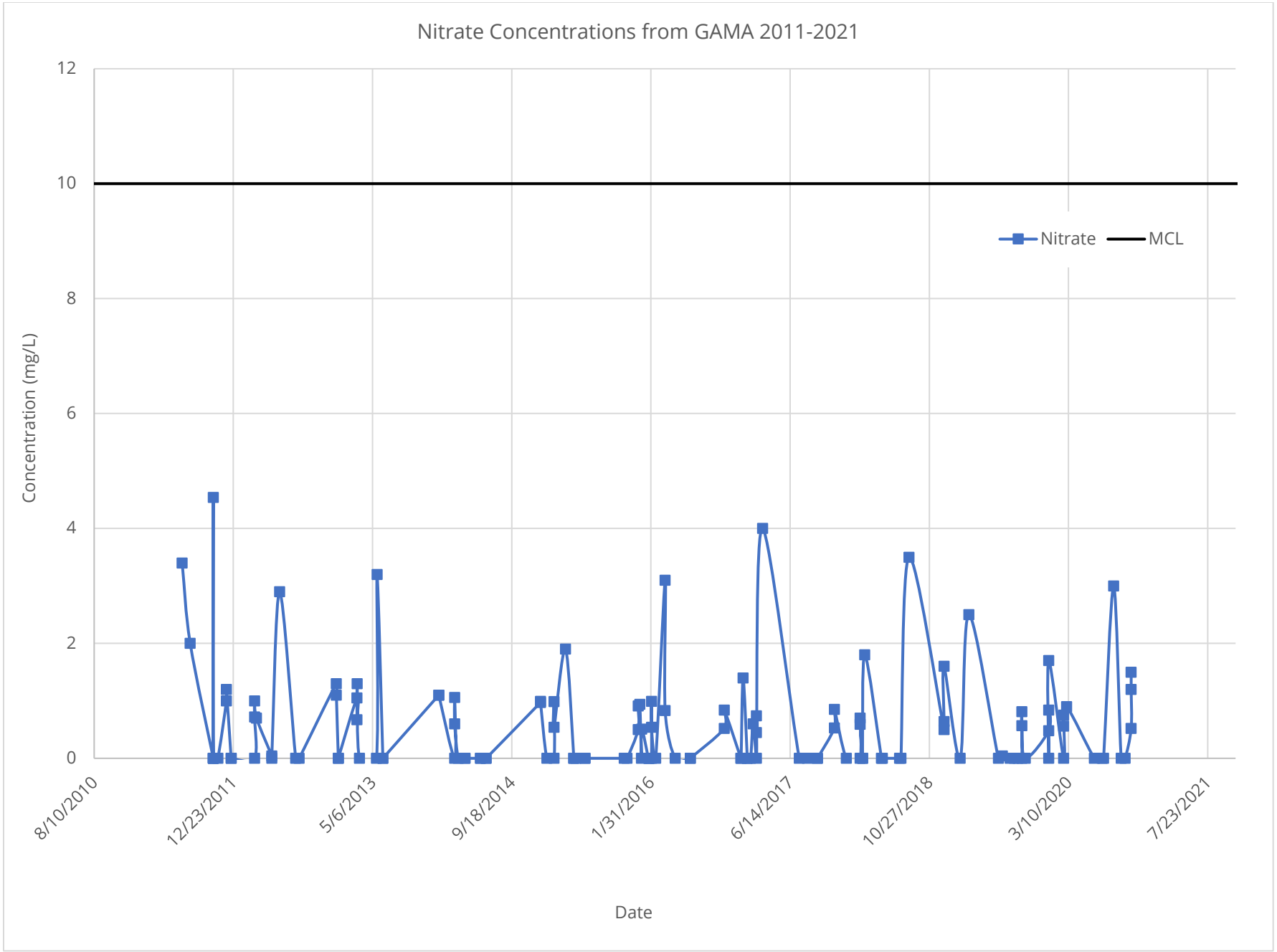
Table 2-2
Historical Groundwater Analytical Results
Eel River Valley Basin, California
(in ug/L, unless noted otherwise)

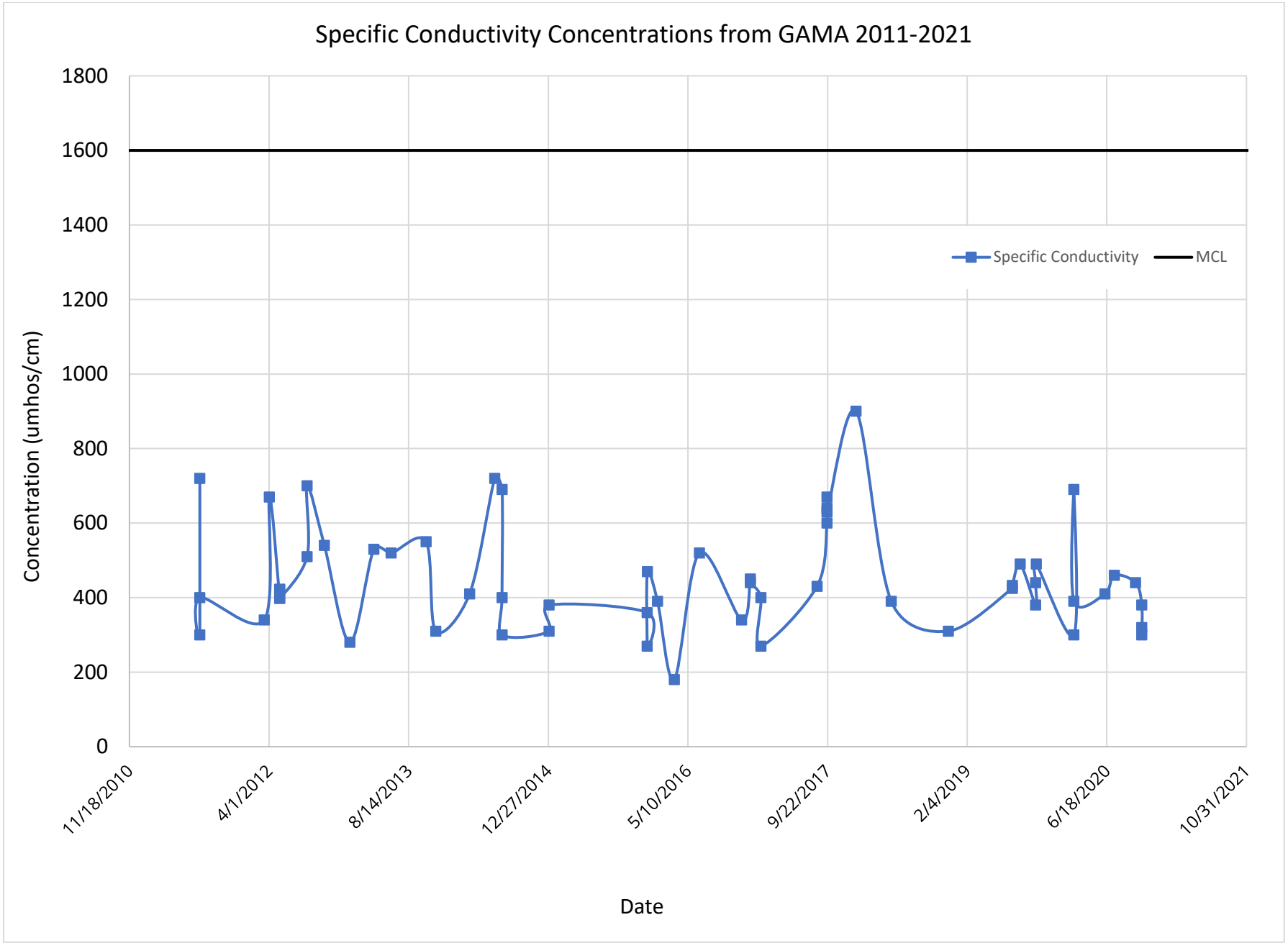
Sample Location	Sample Date	Aluminum	Calcium	Iron	Mg	Mn	Silver	Sodium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Nickel	Selenium	Thallium	Zinc	Mercury	Hexavalent Chromium
MCLs		1,000[†]	--	300[b]	--	50[b]	100[b]	20,000[d]	6[†]	10[†]	1,000[†]	4[†]	5[†]	50[†]	1,300[†]	100[†]	50[†]	2[†]	5,000[b]	0.051[e]	10[†]
MW-1d	04/07/21	<50	87,000	100	34,000	650	<10	14,000	<5.0	<5.0	340	<1.0	<5.0	6.7	9.4	<5.0	<10	<5.0	55	<1.0	<5.0
MW-2d	04/07/21	<50	32,000	<50	8,300	2.3	<10	8,800	<5.0	<5.0	97	<1.0	<5.0	6.7	9.4	<5.0	<10	<5.0	52	<1.0	<5.0
MW-5d	04/07/21	410	3,500	630	2,800	57	<10	90,000	<5.0	<5.0	52	<1.0	<5.0	6.7	9.4	<5.0	<10	<5.0	<10	<1.0	<5.0
MW-7d	04/06/21	210	35,000	7,900	36,000	2,500	<10	55,000	<5.0	12	380	<1.0	<5.0	<5.0	<5.0	5.0	<10	<5.0	<10	<1.0	<5.0
MW-8	04/06/21	<50	34,000	<50	32,000	210	<10	16,000	<5.0	<5.0	88	<1.0	<5.0	<5.0	<5.0	<5.0	<10	<5.0	<10	<1.0	<5.0
MW-12d	07/07/21	9,300	17,000	14,000	10,000	220	<10	39,000	<5.0	23	310	<1.0	<5.0	25	32	34	<10	<5.0	36	<1.0	<5.0
MW-14d	07/12/21	1,700	15,000	1,800	4,900	34	<10	13,000	<5.0	8.8	280	<1.0	<5.0	5.6	5.4	8.5	<10	<5.0	38	<1.0	<5.0
MW-15d	07/12/21	4,500	17,000	3,500	5,500	59	<10	15,000	<5.0	11	300	<1.0	<5.0	<5.0	<5.0	8.2	<10	<5.0	58	<1.0	<5.0
MW-16	07/07/21	560	50,000	760	22,000	1,500	<10	18,000	<5.0	<5.0	200	<1.0	<5.0	<5.0	<5.0	9.8	<10	<5.0	19.0	<1.0	<5.0
MW-18	07/09/21	1,900	61,000	2,400	40,000	580	<10	400,000	<5.0	12	710	<1.0	<5.0	12.0	5.3	14.0	<10	<5.0	11.0	<1.0	<5.0
MW-19	07/13/21	580	68,000	680	16,000	51	<10	12,000	<5.0	<5.0	180	<1.0	<5.0	<5.0	<5.0	5.2	<10	<5.0	<10	<1.0	<5.0
MW-25	07/08/21	540	87,000	670	22,000	40	<10	8,900	<5.0	<5.0	190	<1.0	<5.0	<5.0	<5.0	6.7	<10	<5.0	11	<1.0	<5.0
MW-27	07/08/21	860	450,000	68,000	630,000	3,000	<10	2,700,000	<5.0	26	4,700	<1.0	<5.0	11	6.0	17	23	<5.0	32.0	<1.0	<5.0
MW-28	07/08/21	900	43,000	15,000	45,000	1,200	<10	50,000	<5.0	<5.0	530	<1.0	<5.0	5.8	<5.0	11	<10	<5.0	<10	<1.0	<5.0
MW-30	07/13/21	950	31,000	3,500	20,000	380	<10	10,000	<5.0	<5.0	410	<1.0	<5.0	7.5	10.0	9.7	<10	<5.0	11.0	<1.0	<5.0

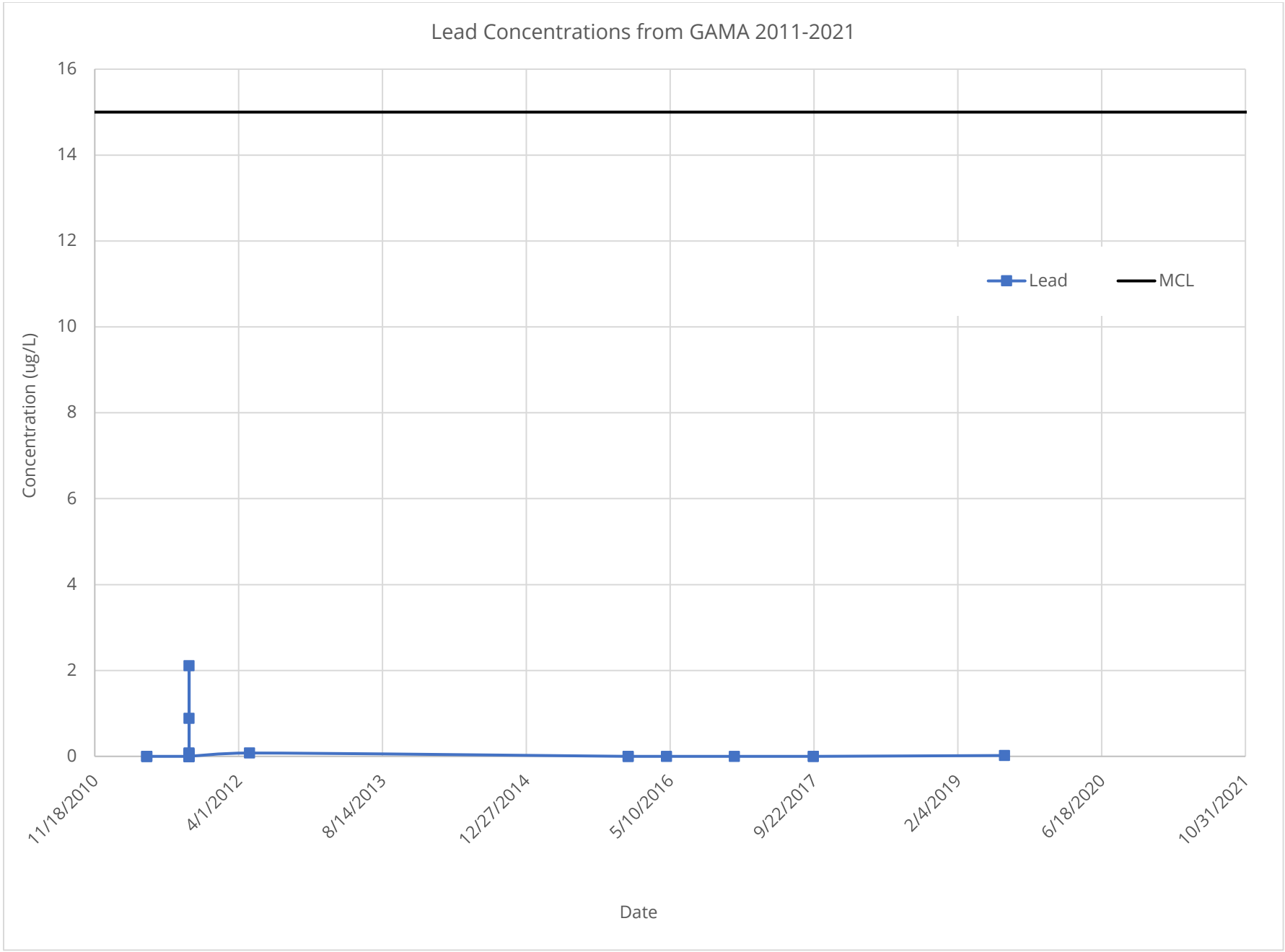
† California Division of Drinking Water Primary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
a. Minimum concentration for Freshwater Aquatic Life Protection. Continuous Concentration (4-day Average) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
b. California Division of Drinking Water Secondary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
c. EPA Superfund Provisional Cancer Slope Factor (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
d. Guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day. EPA Health Advisory (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
d. California enclosed bays & estuaries - California Toxics Rule Criteria for human health protection (USEPA) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
--: not available/none
Mg: magnesium
MN: Manganese
<: "less than" stated laboratory reporting limit
ug/L: micrograms per liter

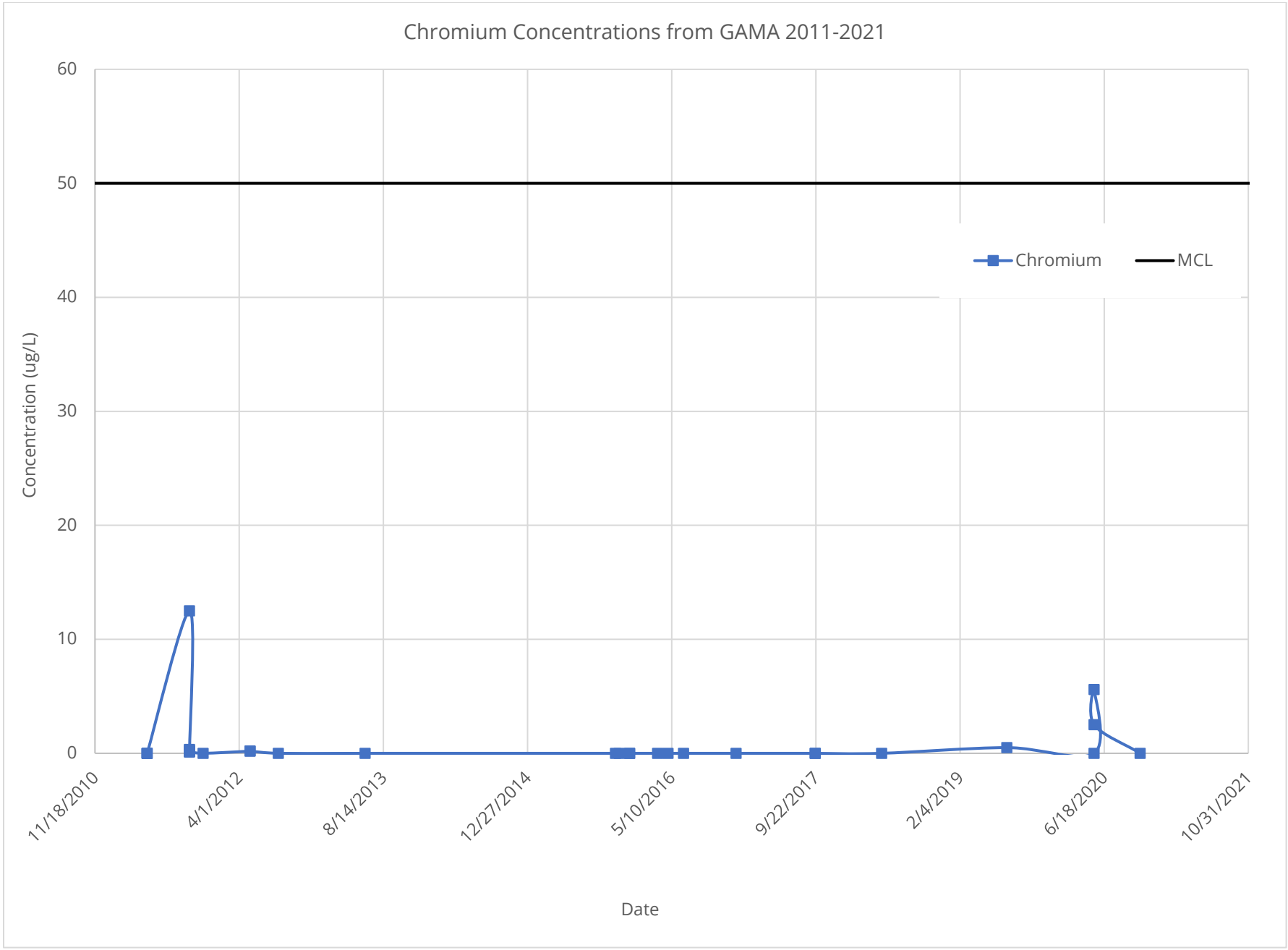
4 GAMA Graphs and Images

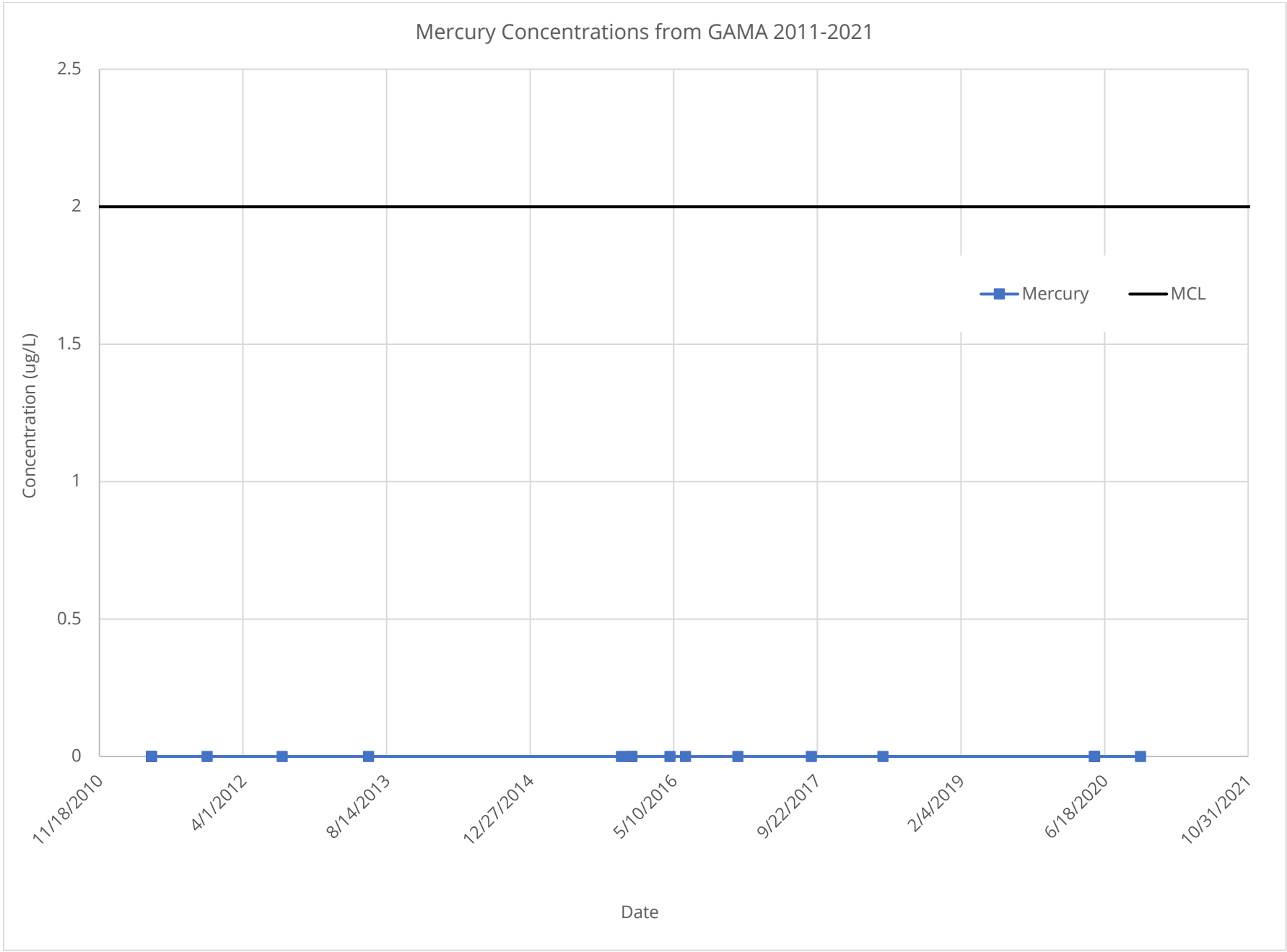

Total Dissolved Solids (TDS) Concentrations from GAMA 2011-2021
800
700
600
500
400
300
200
100
0
Concentration (mg/L)
TDS
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

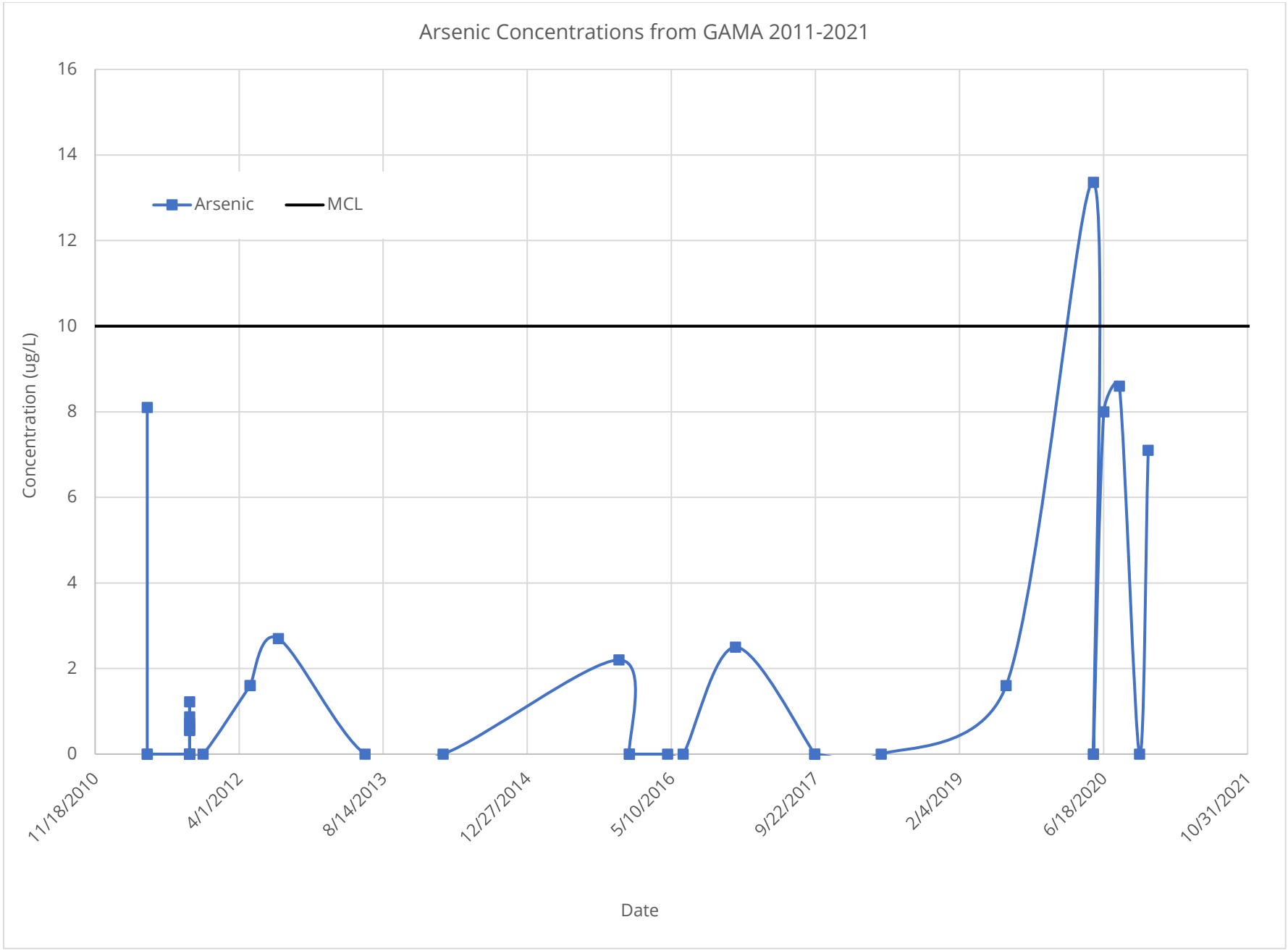

Nitrate Concentrations from GAMA 2011-2021
12
10
8
6
4
2
0
Concentration (mg/L)
Nitrate
MCL
8/10/2010
12/23/2011
5/6/2013
9/18/2014
1/31/2016
6/14/2017
10/27/2018
3/10/2020
7/23/2021
Date

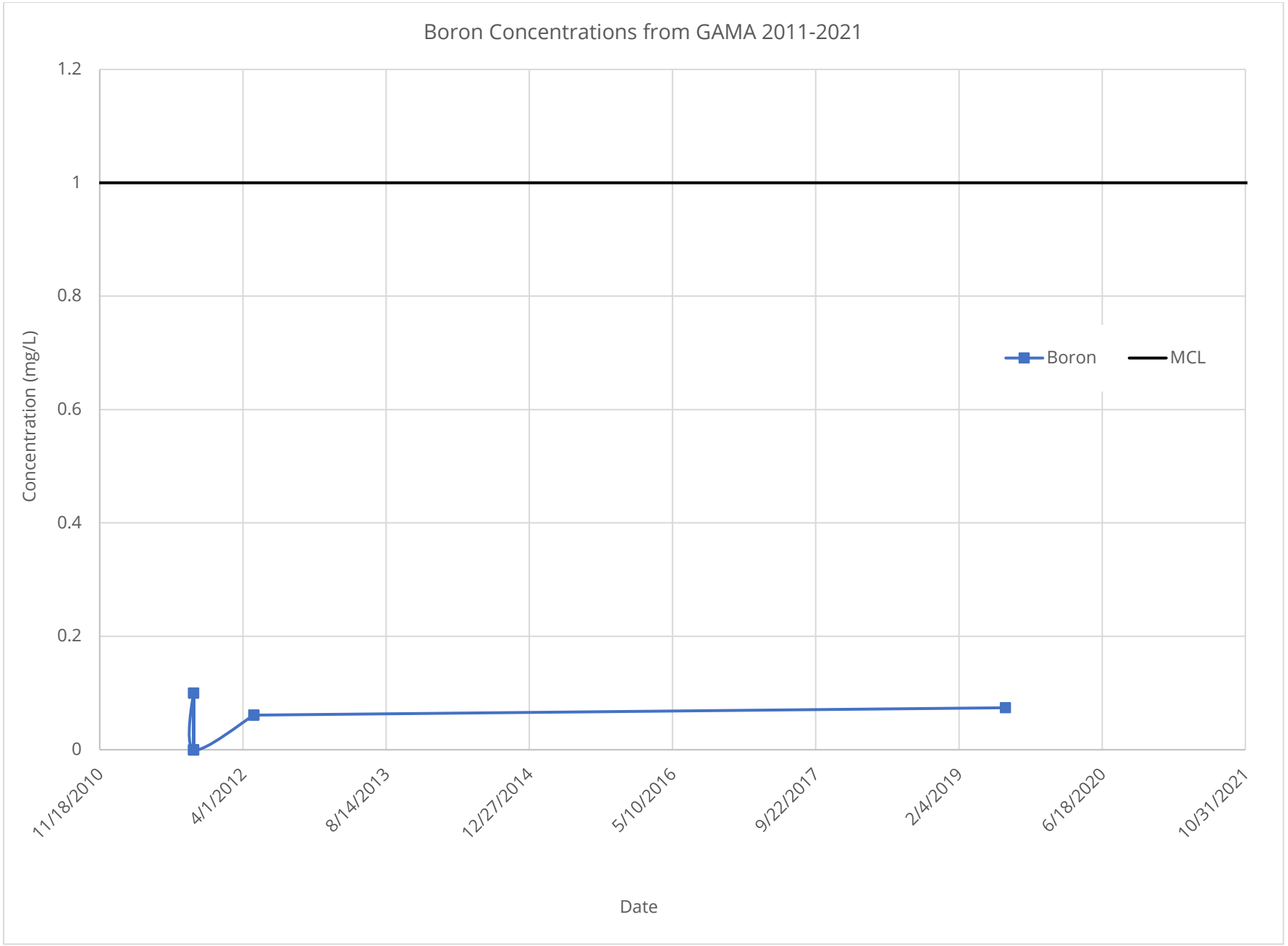

Specific Conductivity Concentrations from GAMA 2011-2021
1800
1600
1400
1200
1000
800
600
400
200
0
Concentration (umhos/cm)
Specific Conductivity
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

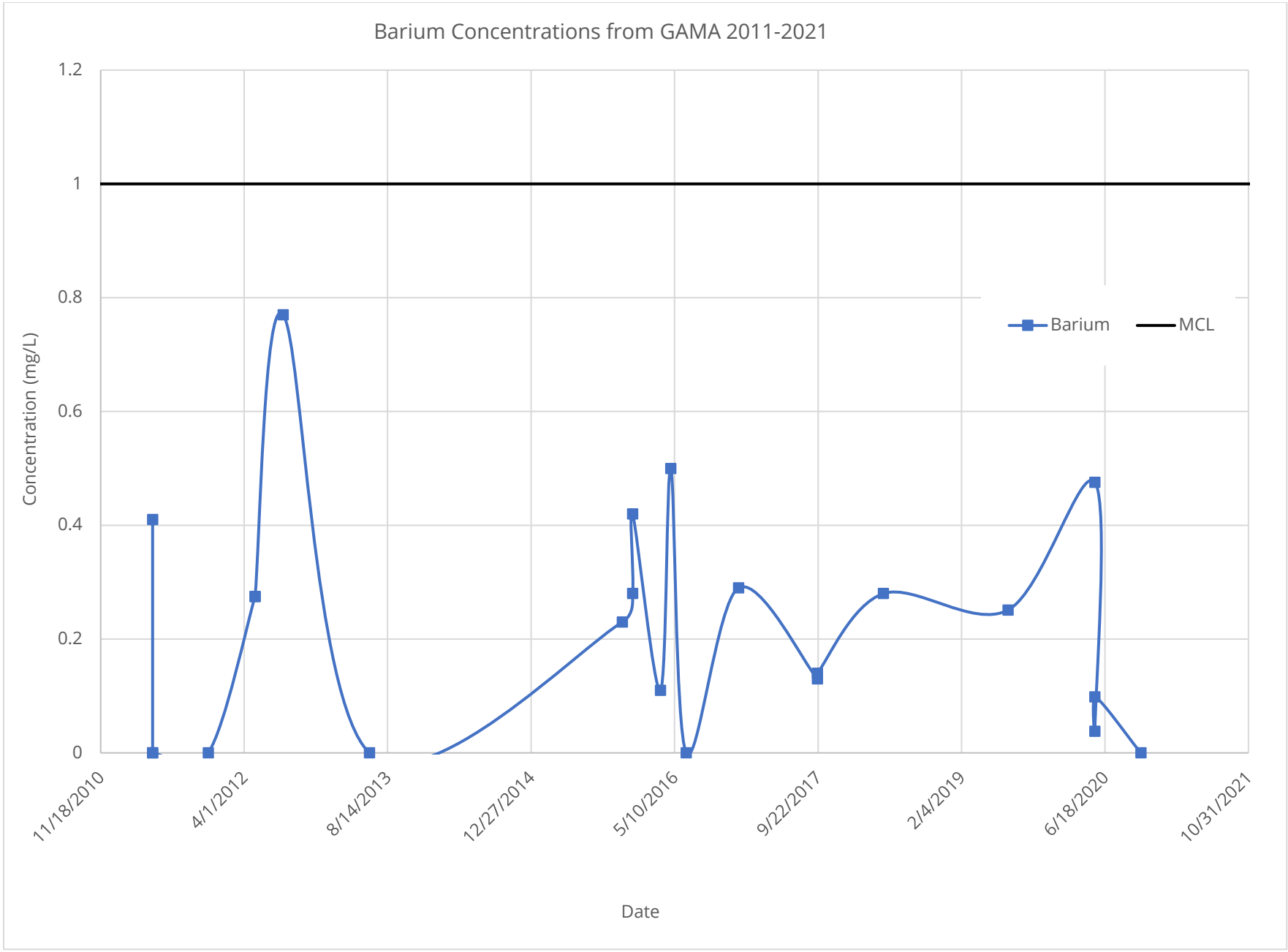

Lead Concentrations from GAMA 2011-2021
16
14
12
10
8
6
4
2
0
Concentration (ug/L)
Lead
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

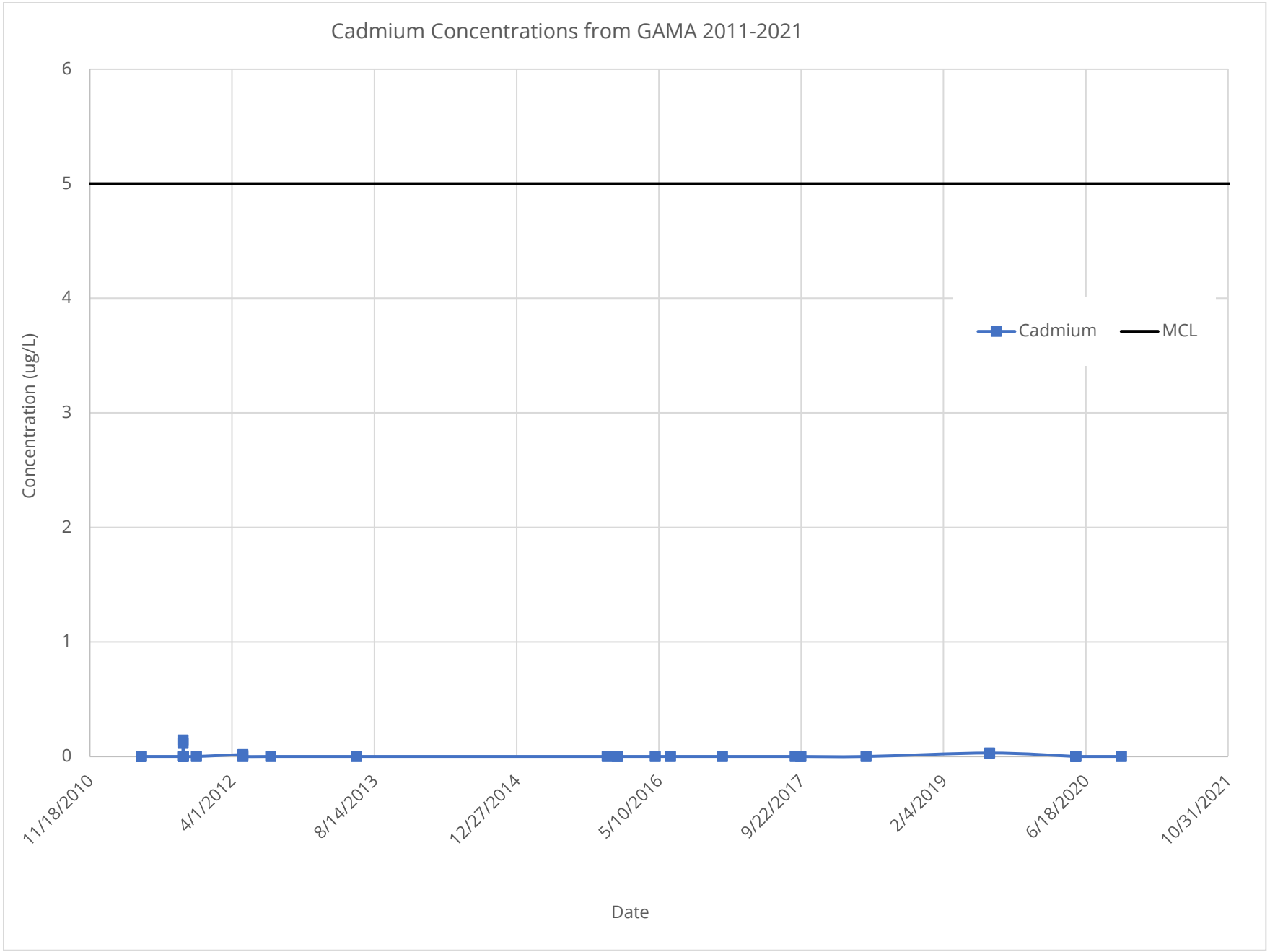

Chromium Concentrations from GAMA 2011-2021
60
50
40
30
20
10
0
Concentration (ug/L)
Chromium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

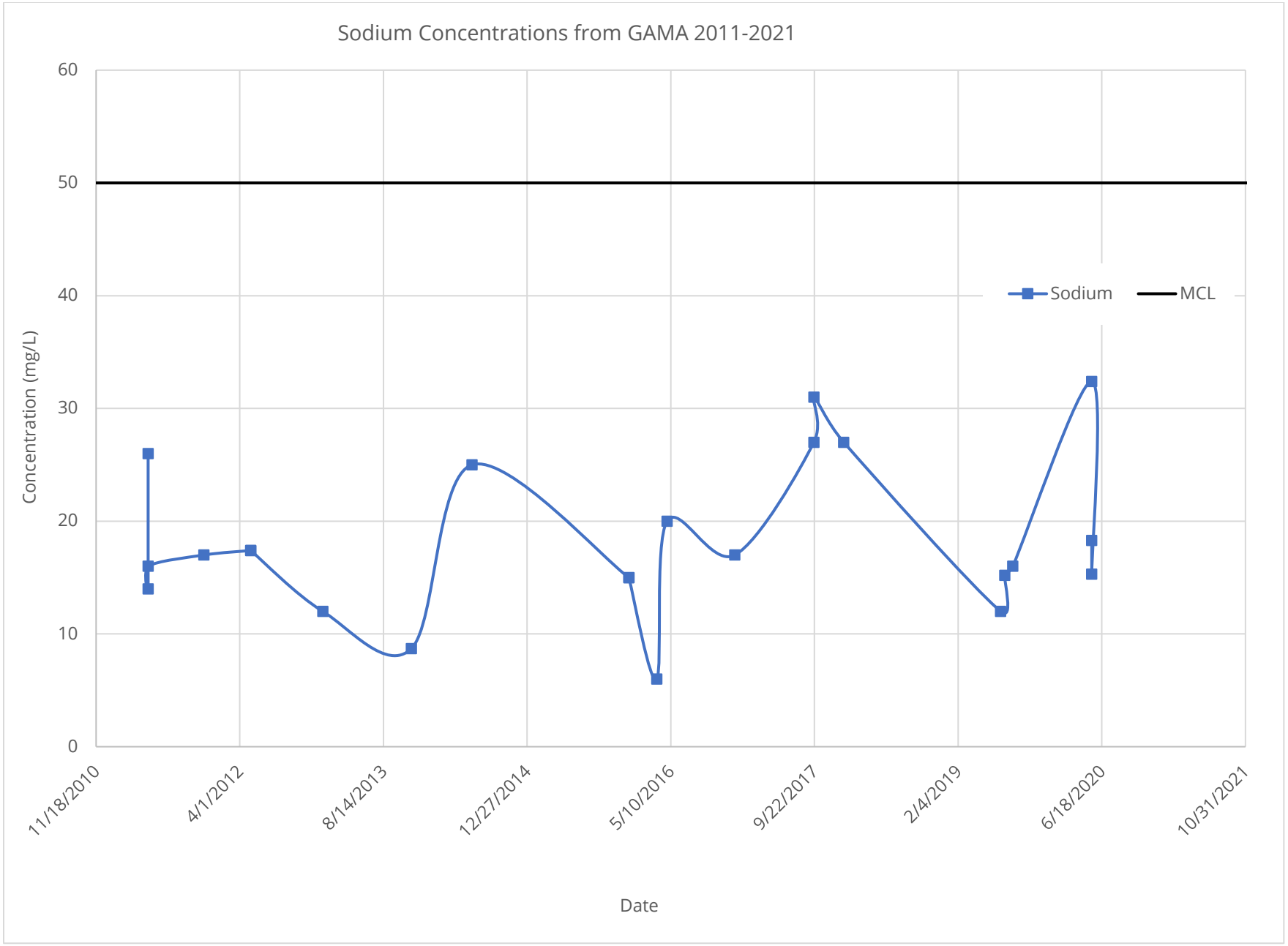

Mercury Concentrations from GAMA 2011-2021
2.5
2
1.5
1
0.5
0
Concentration (ug/L)
Mercury
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

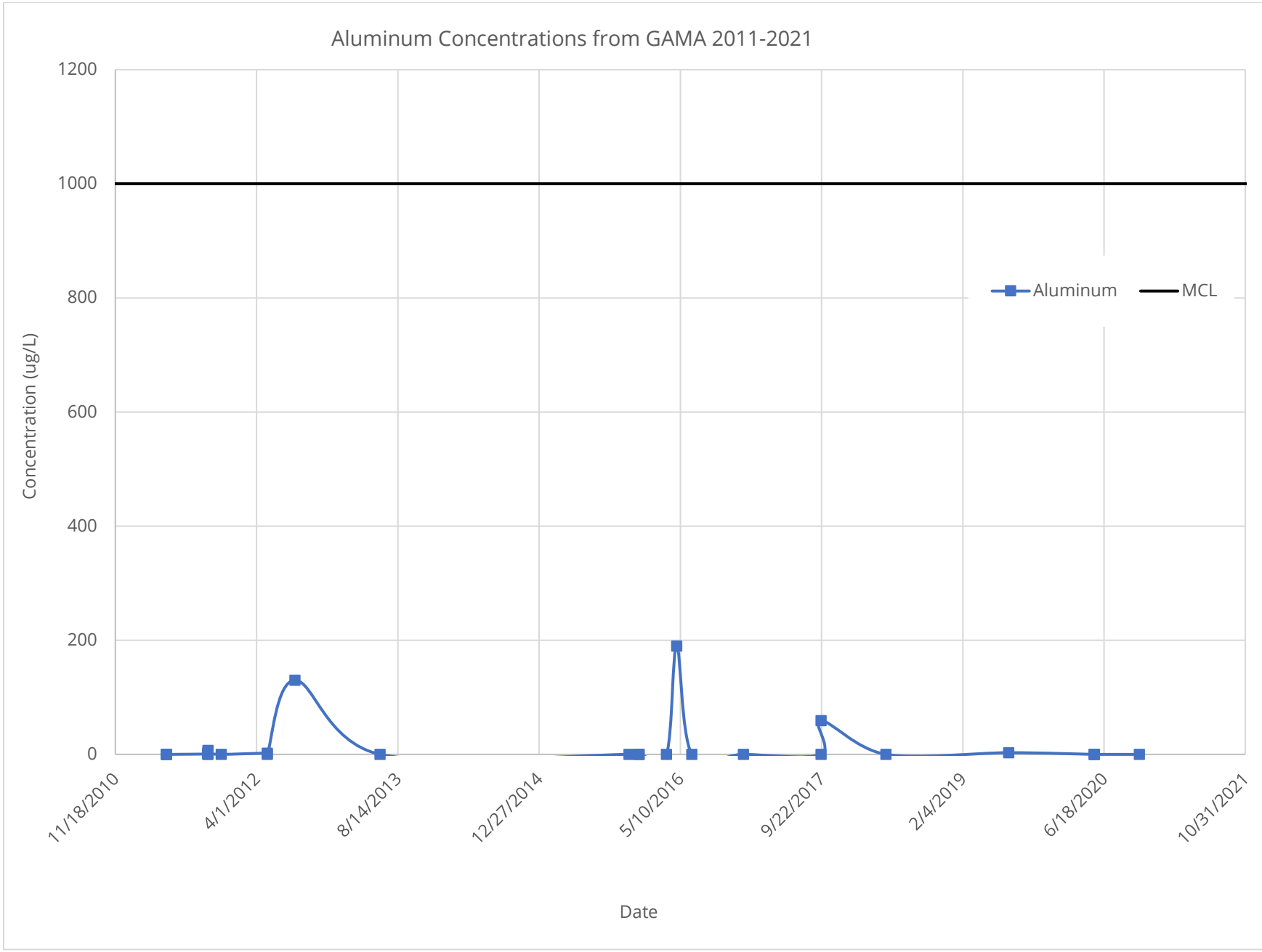

Arsenic Concentrations from GAMA 2011-2021
16
14
12
10
8
6
4
2
0
Concentration (ug/L)
Arsenic
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

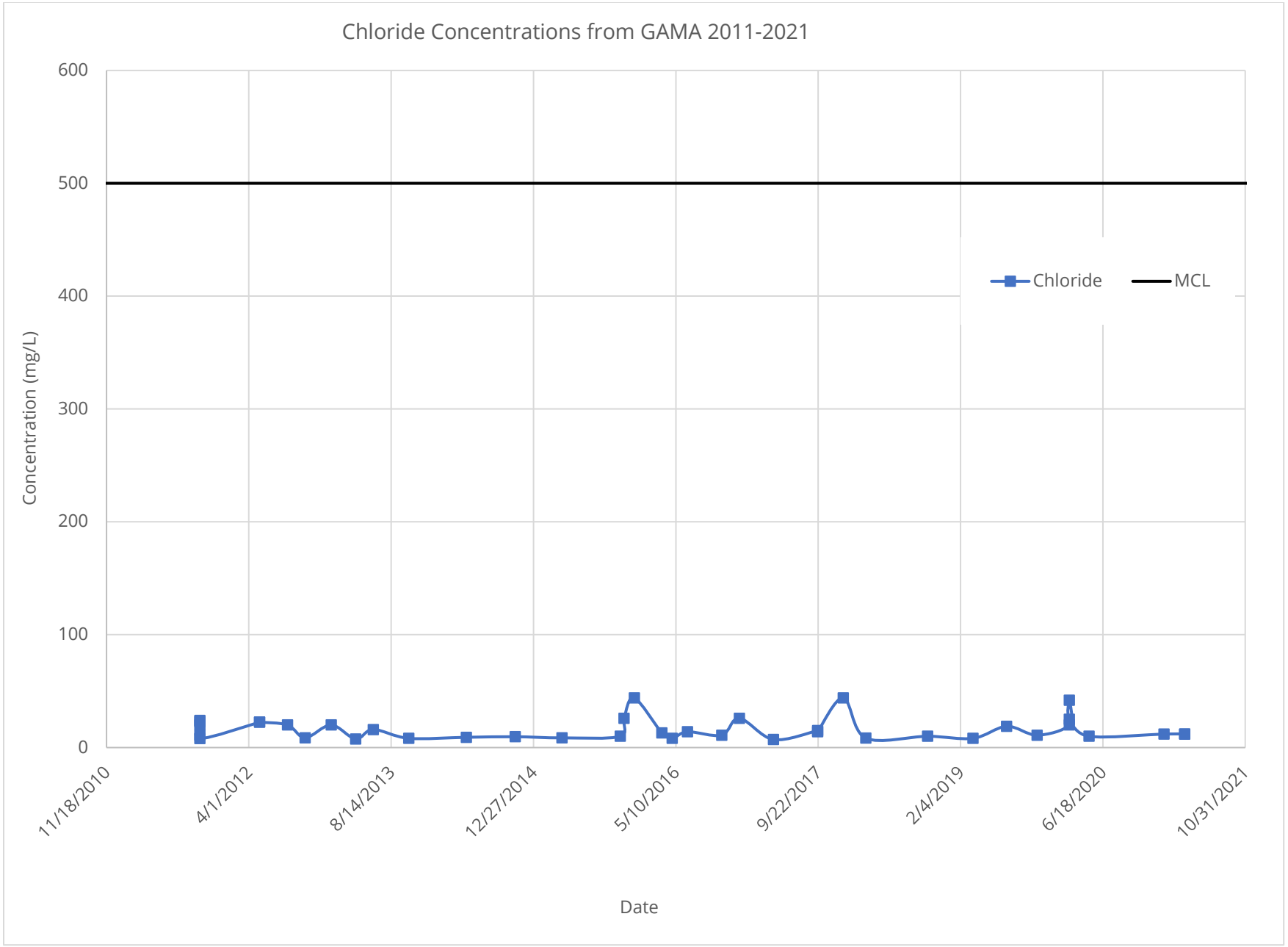

Boron Concentrations from GAMA 2011-2021
1.2
1
0.8
0.6
0.4
0.2
0
Concentration (mg/L)
Boron
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

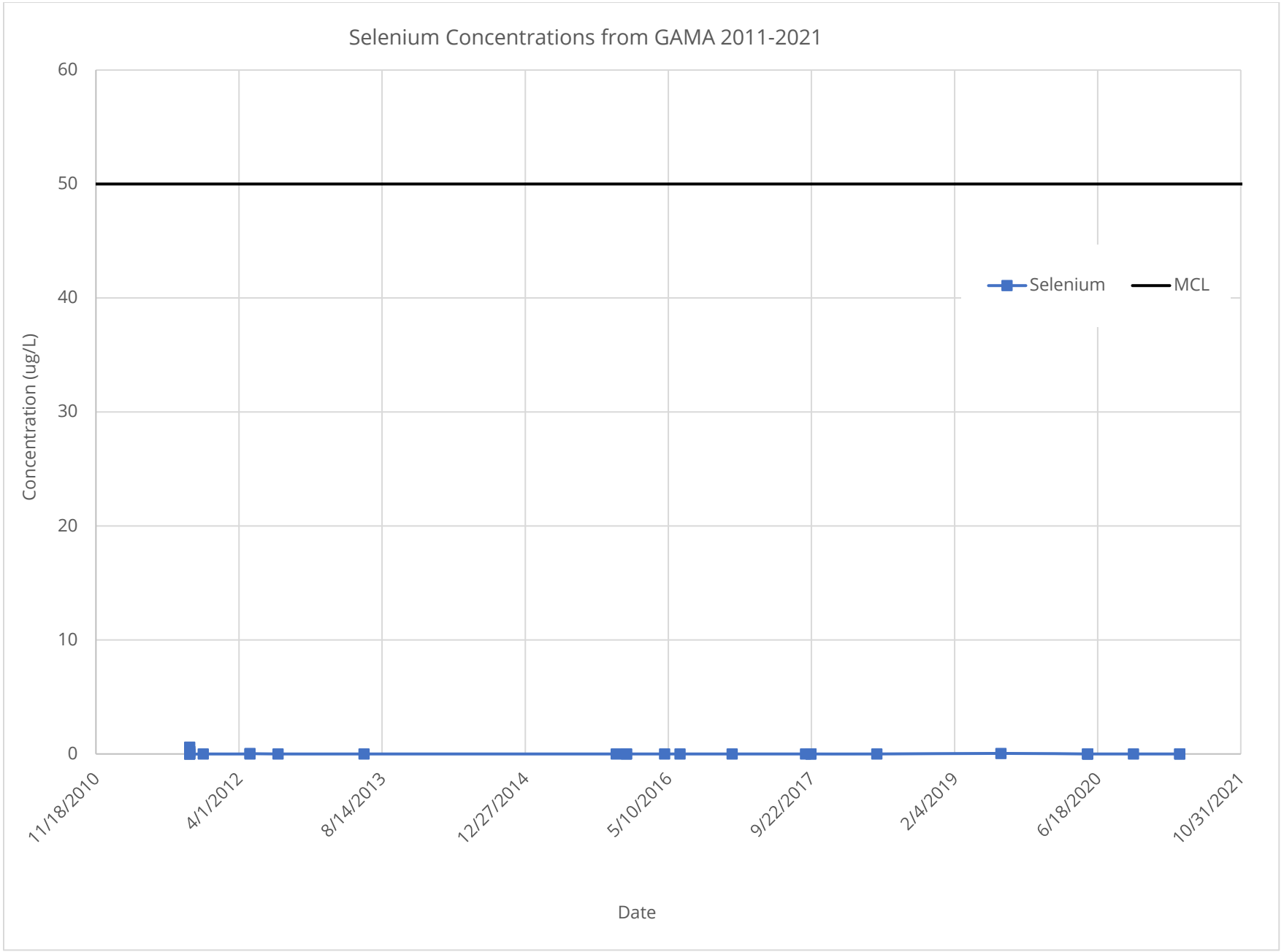

Barium Concentrations from GAMA 2011-2021
1.2
1
0.8
0.6
0.4
0.2
0
Concentration (mg/L)
Barium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

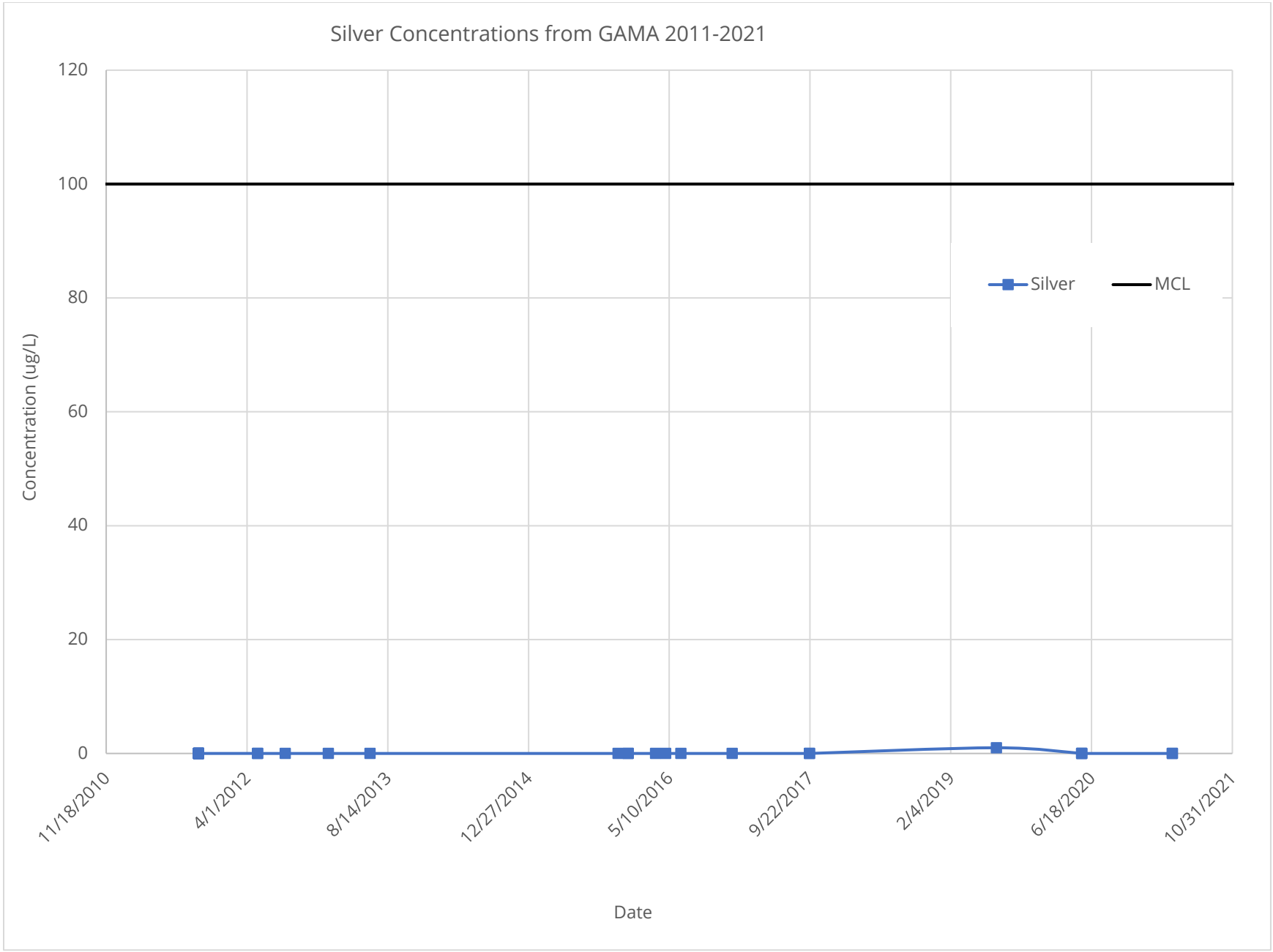

Cadmium Concentrations from GAMA 2011-2021
6
5
4
3
2
1
0
Concentration (ug/L)
Cadmium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Sodium Concentrations from GAMA 2011-2021
60
50
40
30
20
10
0
Concentration (mg/L)
Sodium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Aluminum Concentrations from GAMA 2011-2021
1200
1000
800
600
400
200
0
Concentration (ug/L)
Aluminum
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Chloride Concentrations from GAMA 2011-2021
600
500
400
300
200
100
0
Concentration (mg/L)
Chloride
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Selenium Concentrations from GAMA 2011-2021
60
50
40
30
20
10
0
Concentration (ug/L)
Selenium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Silver Concentrations from GAMA 2011-2021
120
100
80
60
40
20
0
Concentration (ug/L)
Silver
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

Total dissolved solids (TDS) concentrations across the Eel River Valley included in the GAMA database.

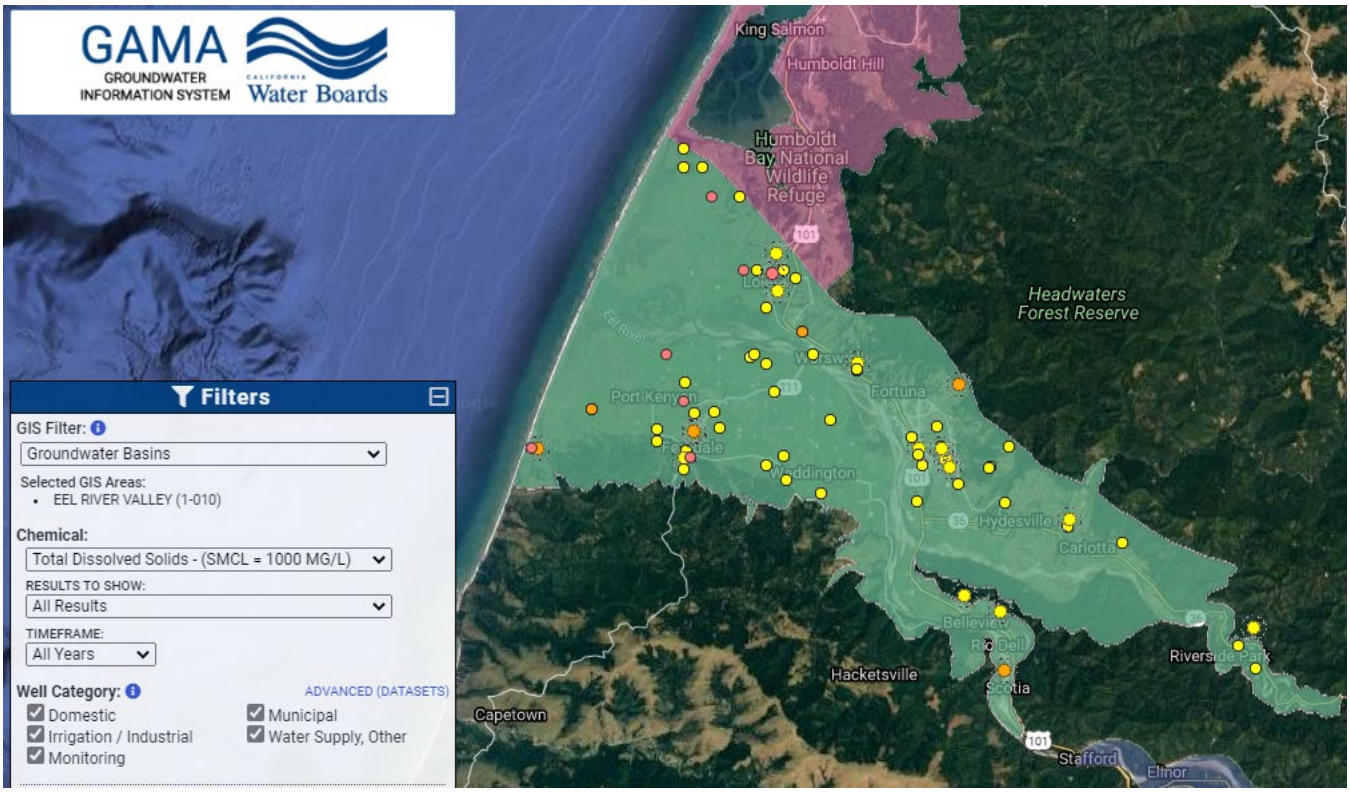


Image 1, Top: Wells with available data for TDS concentrations for all years.

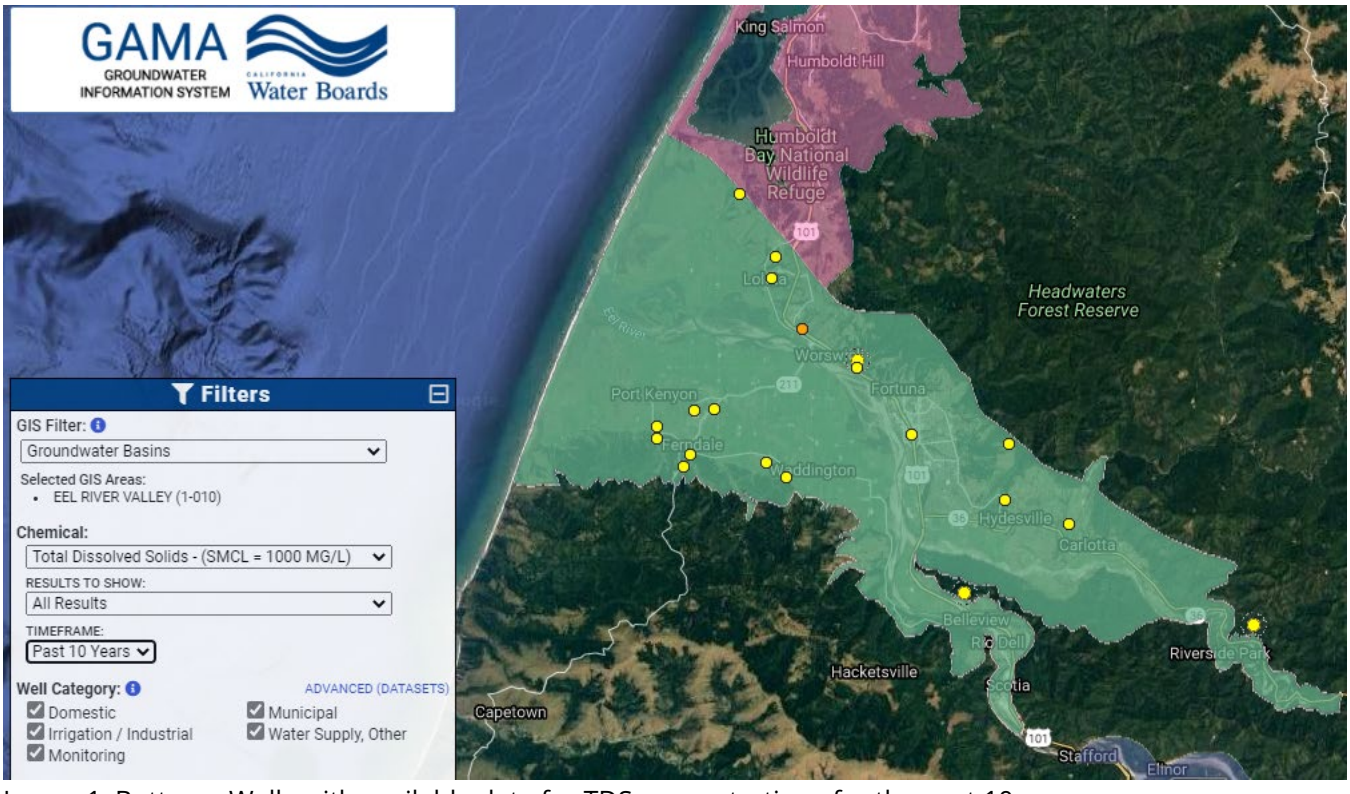


Image 1, Bottom: Wells with available data for TDS concentrations for the past 10 years.

Nitrate (N) concentrations across the Eel River Valley included in the GAMA database

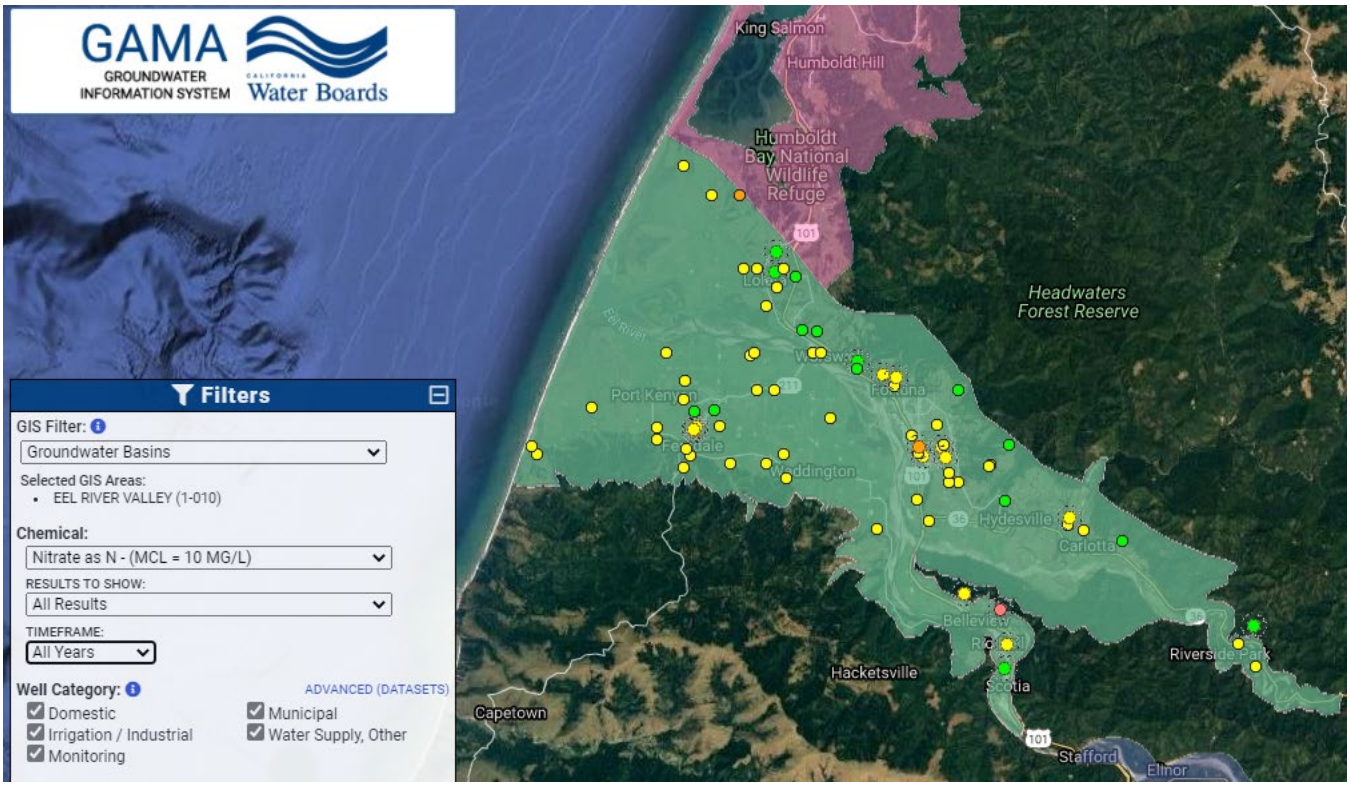


Image 2, Top: Wells with available data for nitrate concentrations for all years.

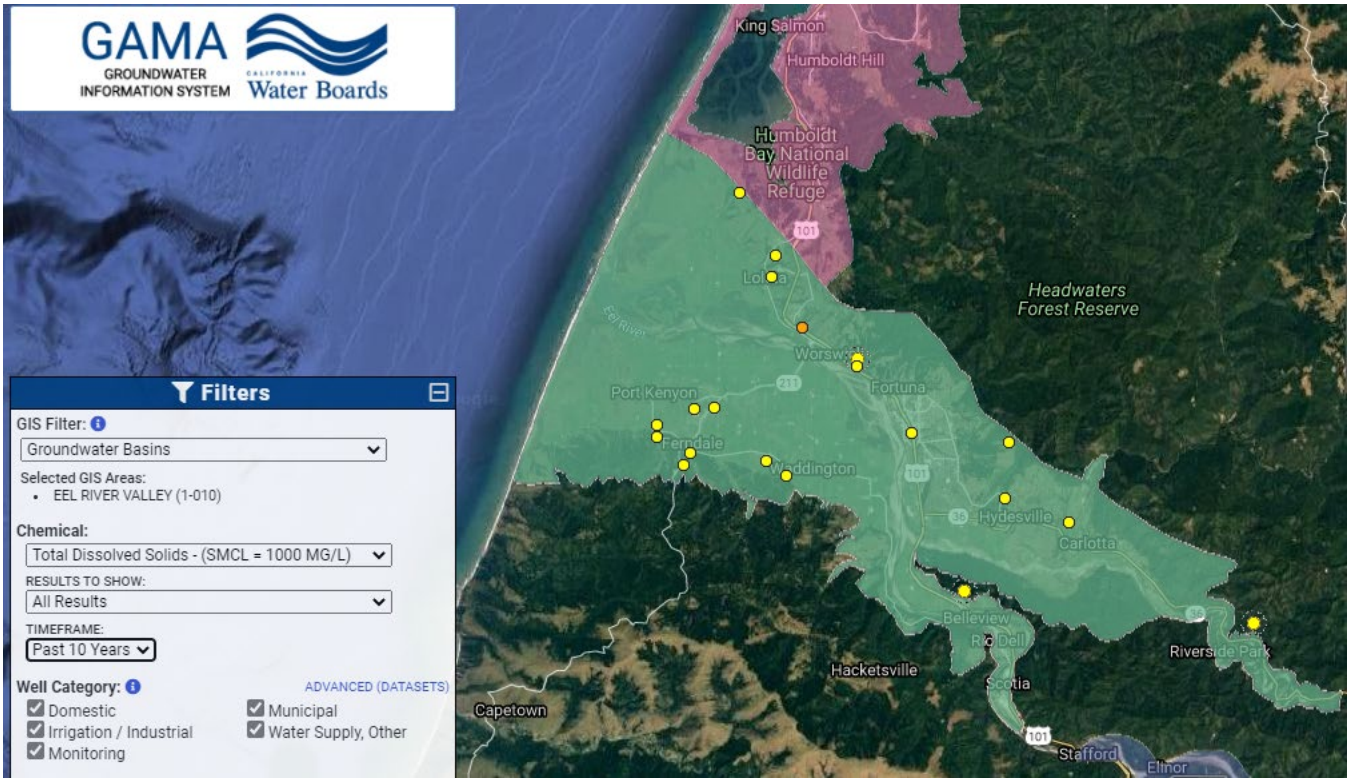


Image 2, Bottom: Wells with available data for nitrate concentrations for the past 10 years.

Iron concentrations across the Eel River Valley included in the GAMA database.

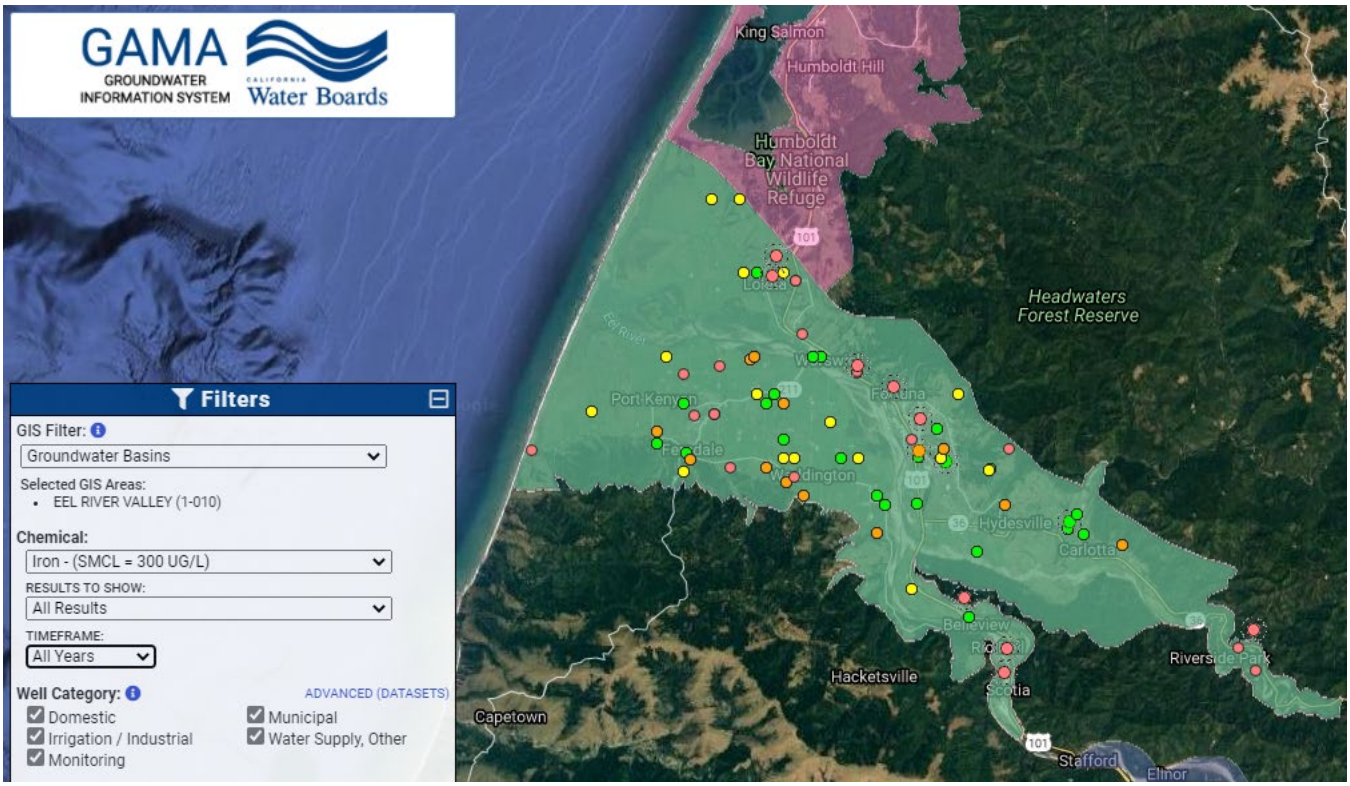


Image 3, Top: Wells with available data for iron concentrations for all years.

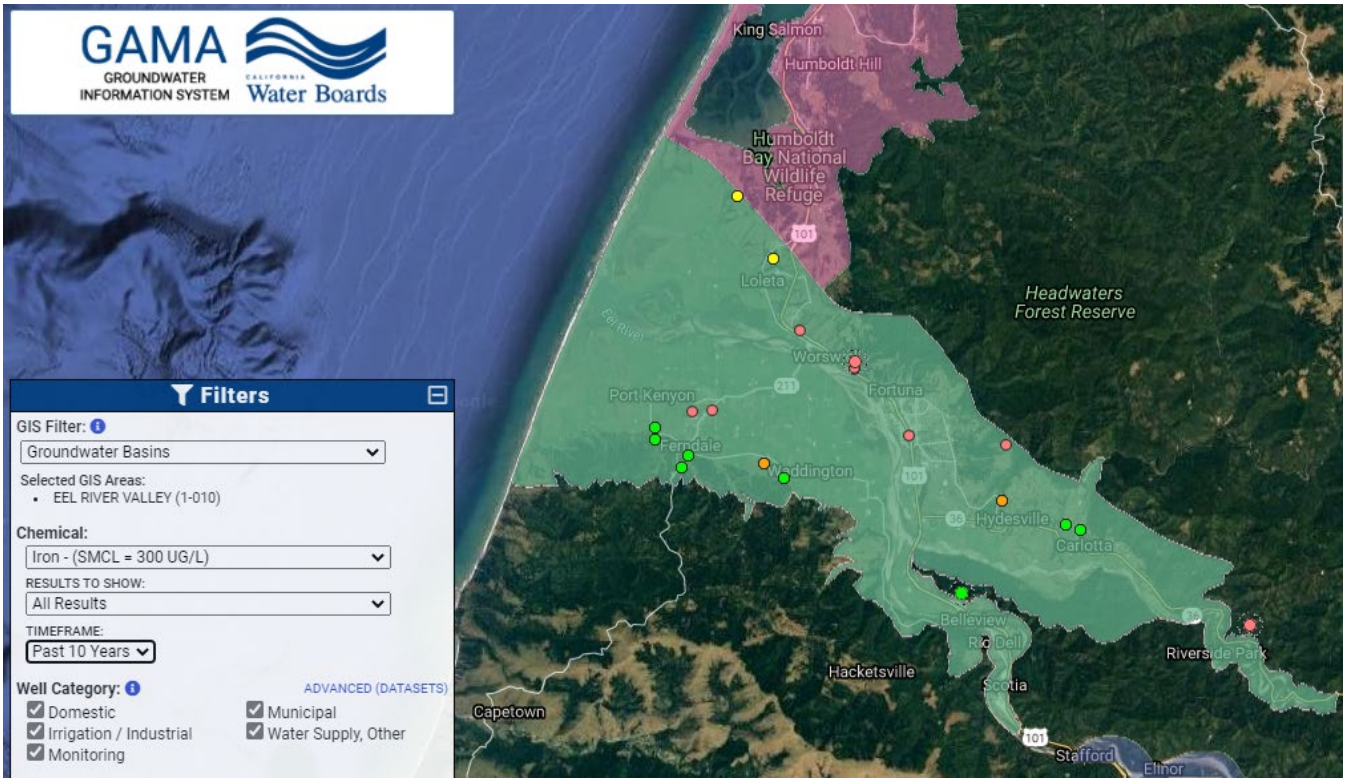


Image 3, Bottom: Wells with available data for iron concentrations for the past 10 years.

Manganese concentrations across the Eel River Valley included in the GAMA database.

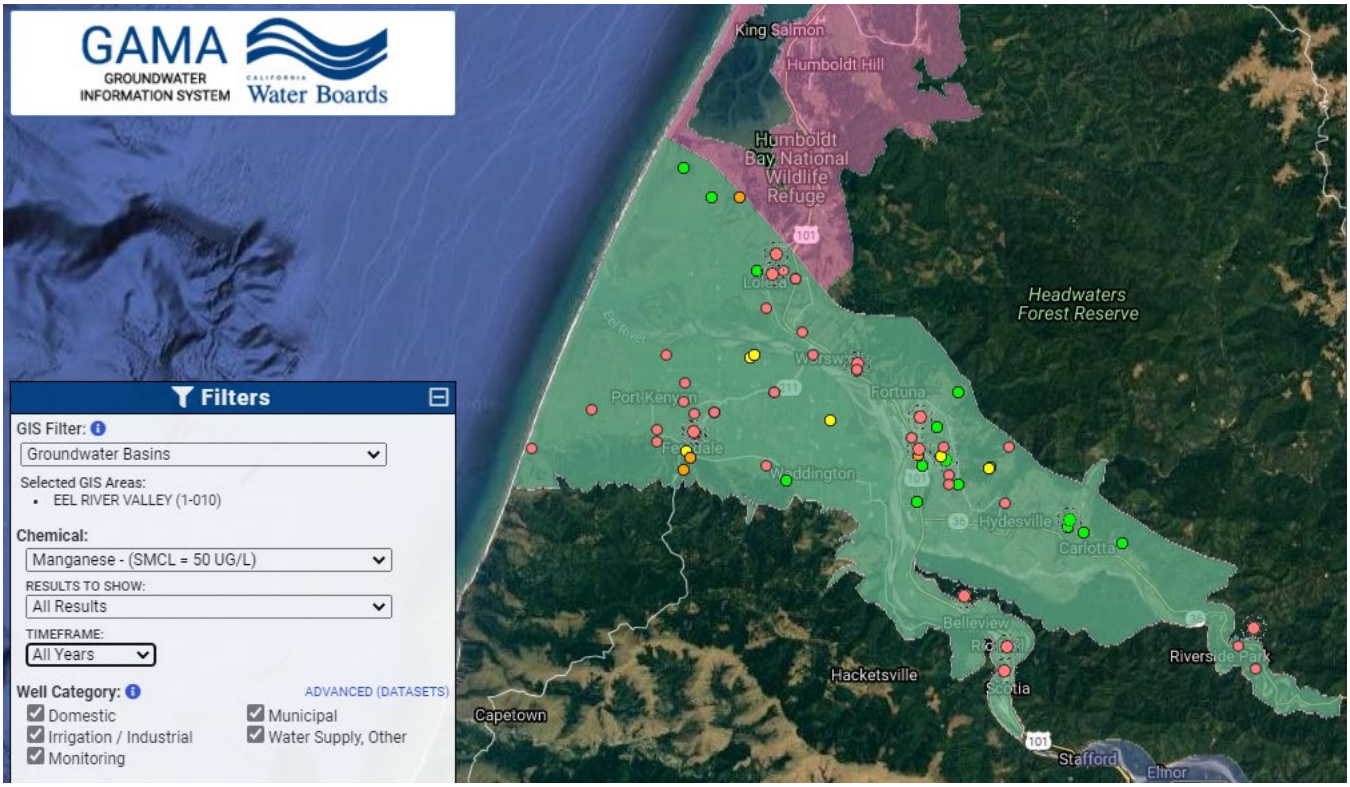


Image 4, Top: Wells with available data for manganese concentrations for all years.

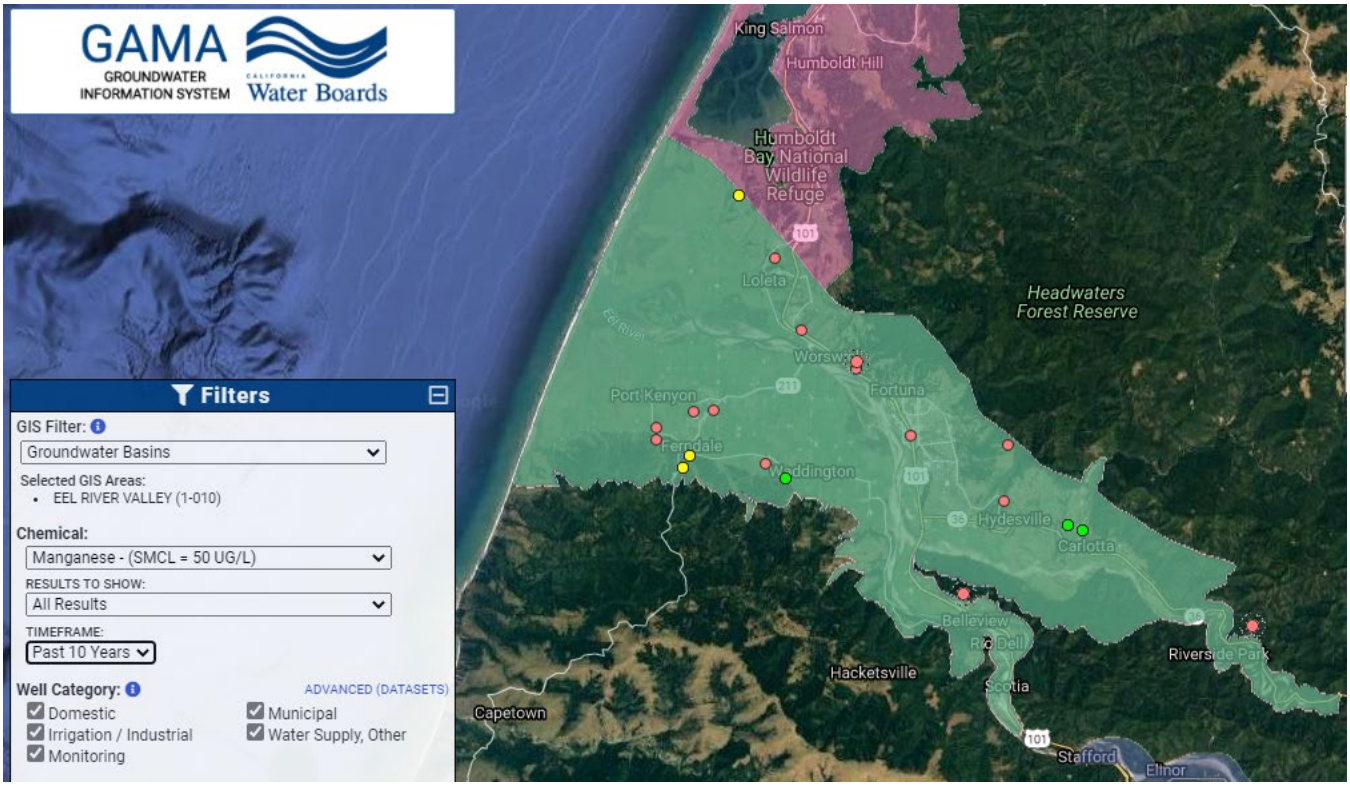


Image 4, Bottom: Wells with available data for manganese concentrations for the past 10 years.