Appendix C. Water Quality Assessment

Contents

Regulatory Background

Federal and State Regulations

The overarching federal law concerning water quality is the Clean Water Act, passed in 1972, and applicable to surface waters and wetlands. In contrast, the federal Safe Drinking Water Act (SDWA) applies to both surface and groundwater, providing protection to drinking water supplies. Under the SDWA, federal standards were established through the United States Environmental Protection Agency (USEPA), in the form of maximum concentration levels (MCLs). Secondary maximum contaminant levels (SMCLs) have also been established at the federal level; these address aesthetics of drinking water sources and are not enforceable. The state of California has its own Safe Drinking Water Act that includes MCLs and SMCLs which are, for select constituents, stricter than those set at the federal level. The California MCLs and SMCLs are codified in Title 22 of the California Code of Regulations (CCR). The standards established under the federal and state Safe Drinking Water Acts are enforced through the State Water Resource Control Board's (SWRCB's) Division of Drinking Water (DDW).

The California Porter-Cologne Water Quality Act, contained in California Water Code Division 7, applies to groundwater and surface waters, designating responsibility for water quality and safe drinking water to the SWRCB and the nine Regional Water Quality Control Boards (RWQCB) in California. The Act requires RWQCBs to develop water quality control plans for the region with defined water quality objectives. These water quality objectives, defined for specific hydrologic regions, protect the quality of surface waters, groundwaters, and associated beneficial uses. The water quality control plan must be approved by both the SWRCB and the USEPA. The Shasta Valley Basin is in the North Coast Region and is regulated under the North Coast Regional Water Quality Control Board (Regional Water Board), with water quality objectives detailed in the Water Quality Control Plan for the North Coast Region (Basin Plan).[1]

The SWRCB's Policy for Water Quality Control For Recycled Water (Recycled Water Policy),[2] most recently amended in 2018, includes additional requirements to address salt and nutrients. Under this policy, Regional Water Boards are required to assess basins or subbasins within the region where water quality is threatened by salt and nutrients, and where management is required. In basins or subbasins where salt and nutrients are identified as a threat, a salt and nutrient management plan (SNMP) or equivalent management plan is required; this plan can address other constituents in addition to salt and nutrients.

Water Quality Control Plan for the North Coast Region

The Water Quality Control Plan for the North Coast Region (Basin Plan) is a regulatory tool used by the North Coast Regional Water Quality Control Board (Regional Water Board) to protect water quality within the North Coast Region. The Basin Plan is adopted by the NCRWQCB and approved by the State Water Resources Control Board; the water quality standards are approved by the United States Environmental Protection Agency (USEPA). Within the Basin Plan, beneficial uses of water, water quality objectives, including an antidegradation policy and plans for implementing protections are included. Table 2-1 of the Basin Plan designates all groundwaters with the beneficial uses of (California North Coast Regional Water Quality Control Board 2018):

[1]{North Coast Regional Water Quality Control Board. 2018. "Water Quality Control Plan for the North Coast Region". Available: https://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/}

[2]{SWRCB Resolution No. 2018-0057 and "Amendment to the Policy for Water Quality Control For Recycled Water". Available: https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf}

- Municipal and Domestic Supply (MUN)
- Agricultural Supply (AGR)
- Industrial Service Supply (IND)
- Native American Culture (CUL)

Potential beneficial uses include:

- Industrial Process Supply (PRO)
- Aquaculture (AQUA)

The MUN beneficial use applies to all groundwater in Shasta Valley. For chemical constituents in waters with MUN beneficial uses, the Basin Plan specifies that no waters are to exceed the maximum contaminant levels (MCL) in Title 22 of the California Code of Regulations (CCR). The Basin Plan also includes numeric water quality objectives, specifically for groundwaters in the Shasta Valley hydrologic area.

A complete list of constituents, comparison concentrations and sources are listed in Table 2.

Water Quality Assessment

Data Sources

Water quality data was obtained from several databases and supplemented with data provided by local organizations and community members. The majority of the water quality data used in the assessment was sourced from the SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA), a database containing datasets from agencies including the Department of Pesticide Regulation (DPR), Department of Water Resources (DWR), the State Water Board, Lawrence Livermore National Laboratory (LLNL) and the United States Geological Survey (USGS). Additional data in the Shasta Valley Wildlife Area was directly provided by the California Department of Fish and Wildlife.

The datasets in GAMA with information in Shasta Valley Groundwater Basin are:

- **The Public Water System Wells** dataset includes wells regulated by the State Water Board's Division of Drinking Water (DDW). This dataset includes information for active and inactive drinking water sources with 15 or more connections or more than 25 people per day.
- **National Water Information System (NWIS)**, a dataset provided by USGS with samples from water supply wells and reported quarterly to the State Water Board's data management system, GeoTracker.
- **Monitoring wells** regulated by the State Water Board includes wells under different regulatory programs, with data available for download through GeoTracker. There are monitoring wells in Shasta Valley Basin for the following programs:
  - Leaking Underground Storage Tank (LUST) Cleanup sites
  - Cleanup Program Sites

  - Land Disposal Sites

- **GAMA's Priority Basin Project**, a State Water Board, USGS and LLNL initiative to assess groundwater quality statewide. Data primarily collected from public water system wells but private domestic, monitoring and irrigation wells are also sampled.
- **DWR's Water Data Library**, a dataset including groundwater quality and depth data with samples from multiple well types including irrigation, stock, domestic and public supply.
- **Department of Pesticide Regulation's Groundwater Protection program**, a compilation of information from DPR and other public agencies from domestic, public supply and irrigation wells.

Selection of Numeric Thresholds

Numeric thresholds are used with well data to evaluate groundwater quality. These numeric standards are selected to satisfy all relevant groundwater quality standards and objectives; the general selection approach used is consistent with recommendations by the State Water Board for determination of assessment thresholds for groundwater [Reference]. More than one water quality objective or standard may apply to a constituent and a prioritization process is used to select the numeric threshold value. Where available, the strictest value, of the federal and state regulated water quality standards, and water quality objectives specified in the Basin Plan, is used.

The following sources were used in establishing the numeric thresholds:

i) Basin Plan numeric water quality objectives

Specific groundwater quality objectives are defined in the Basin Plan for specific conductance, pH, hardness and boron. These limits are listed in Table 1 below.

Table 1: Basin Plan Specific Water Quality Objectives for Groundwaters in the Shasta Valley Hydrologic Area

Constituent	Limit Type	Value
Specific Conductance (mmhos) at 77 degrees F	90% Upper Limit	800
Specific Conductance (mmhos) at 77 degrees F	50% Upper Limit	500
pH	Maximum	8.5
pH	Minimum	7
Boron (mg/L)	90% Upper Limit	1
Boron (mg/L)	50% Upper Limit	0.3
Hardness (mg/L)	50% Upper Limit	180

ii) State and Federal Maximum Contaminant Levels (MCLs)

MCL-CA: State of California MCLs

MCL-US: Federal MCLs

Per the Basin Plan, groundwaters in the Shasta Valley hydrologic area have a designated beneficial use as domestic or municipal water supply (MUN) beneficial use and must not exceed the maximum contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs) defined in Title 22 of the California Code of Regulations (CCR). The strictest value of the state and federal MCLs and SMCLs is used.

The complete list of constituents and corresponding sources and values for comparison concentrations used in the water quality analysis can be found in Table 2.

Table 2: Comparison concentrations and data sources for constituents used in the water quality assessment.

Full Name	MCL	Units	Source
1,1 Dichloroethylene (1,1 DCE)	6	ug/L	Title 22 - Table 64444-A
1,1,1-Trichloroethane	200	ug/L	Title 22 - Table 64444-A
1,1,2,2 Tetrachloroethane (PCA)	1	ug/L	Title 22 - Table 64444-A
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2	mg/L	Title 22 - Table 64444-A
1,1,2-Trichloroethane	5	ug/L	Title 22 - Table 64444-A
1,1-Dichloroethane (1,1 DCA)	5	ug/L	Title 22 - Table 64444-A
1,2 Dibromoethane (EDB)	0.05	ug/L	Title 22 - Table 64444-A
1,2 Dichlorobenzene (1,2-DCB)	600	ug/L	Title 22 - Table 64444-A
1,2 Dichloroethane (1,2 DCA)	0.5	ug/L	Title 22 - Table 64444-A
1,2 Dichloropropane (1,2 DCP)	5	ug/L	Title 22 - Table 64444-A
1,2,3-Trichloropropane (1,2,3 TCP)	0.005	ug/L	Title 22 - Table 64444-A
1,2,4- Trichlorobenzene (1,2,4 TCB)	5	ug/L	Title 22 - Table 64444-A
1,2,4-Trimethylbenzene	330	ug/L	NL
1,2-Dibromo-3-chloropropane (DBCP)	0.2	ug/L	Title 22 - Table 64444-A
1,3 Dichloropropene	0.5	ug/L	Title 22 - Table 64444-A
1,3,5-Trimethylbenzene	330	ug/L	NL
1,3-Dichlorobenzene	600	ug/L	US-HAL
1,4-Dichlorobenzene (p-DCB)	5	ug/L	Title 22 - Table 64444-A
1,4-Dioxane	1	ug/L	HBSL
2 Chlorotoluene	140	ug/L	US-HAL
2,3,7,8-TCDD	0.00003	ug/L	MCL-US
2,4,5-TP (Silvex)	50	ug/L	Title 22 - Table 64444-A
2,4,6-Trinitrotoluene (TNT)	1	ug/L	US-HAL
2,4-Dichlorophenoxyacetic acid (2,4 D)	70	ug/L	Title 22 - Table 64444-A
4 Chlorotoluene	140	ug/L	HBSL
4,4’-DDD	0.1	ug/L	CA-CPF
4,4’-DDE	0.1	ug/L	CA-CPF
4,4’-DDT	0.1	ug/L	CA-CPF
Acetone	6300	ug/L	RfD
Alachlor	2	ug/L	Title 22 - Table 64444-A
Aldicarb	7	ug/L	HBSL
Aldicarb Sulfone	7	ug/L	HBSL
Aldicarb sulfoxide	7	ug/L	HBSL
Alpha-Benzene Hexachloride (Alpha-BHC)	0.15	ug/L	CA-Prop65
Aluminum	200	ug/L	Title 22 - Table 64449-A
Ammonia	30	mg/L	US-HAL
Antimony	6	ug/L	Title 22 - Table 64431-A
Arsenic	10	ug/L	Title 22 - Table 64431-A
Asbestos	7	MFL	Title 22 - Table 64431-A
Atrazine	1	ug/L	Title 22 - Table 64444-A
Azinphos Ethyl	10	ug/L	HBSL

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Table 2: Comparison concentrations and data sources for constituents used in the water quality assessment.

Full Name	MCL	Units	Source
Barium	1	mg/L	Title 22 - Table 64431-A
Bensulfuron Methyl	1000	ug/L	HBSL
Bentazon	18	ug/L	Title 22 - Table 64444-A
Benzene	1	ug/L	Title 22 - Table 64444-A
Benzo(a)pyrene	0.2	ug/L	Title 22 - Table 64444-A
Beryllium	4	ug/L	Title 22 - Table 64431-A
Beta-Benzene Hexachloride (Beta-BHC)	0.25	ug/L	CA-Prop65
Boron	0.3 (50% UL), 1.0 (90% UL)	mg/L	Basin Plan - Table 3-1
Bromacil	70	ug/L	US-HAL
Bromate	10	ug/L	MCL-US
Bromodichloromethane (THM)	80	ug/L	MCL
Bromoform (THM)	80	ug/L	MCL
Cadmium	5	ug/L	Title 22 - Table 64431-A
Carbaryl (1-naphthyl methylcarbamate)	40	ug/L	HBSL
Carbofuran	18	ug/L	Title 22 - Table 64444-A
Carbon Disulfide	160	ug/L	HBSL
Carbon Tetrachloride	0.5	ug/L	Title 22 - Table 64444-A
Chlorate	800	ug/L	NAS-HAL
Chlordane	0.1	ug/L	Title 22 - Table 64444-A
Chloride	500	mg/L	Title 22 - Table 64449-B
Chlorite	1	mg/L	MCL-US
Chlorobenzene	70	ug/L	Title 22 - Table 64444-A
Chloroform (THM)	80	ug/L	MCL
Chloropicrin	12	ug/L	NAS-HAL
Chromium	50	ug/L	Title 22 - Table 64431-A
Chromium, Hexavalent (Cr6)	20	ug/L	HBSL
cis-1,2 Dichloroethylene	6	ug/L	Title 22 - Table 64444-A
Copper	1	mg/L	Title 22 - Table 64449-A
Cyanazine	0.3	ug/L	HBSL
Cyanide (CN)	150	ug/L	Title 22 - Table 64431-A
Cypermethrin	40	ug/L	HBSL
Dacthal	70	ug/L	HBSL
Dalapon	200	ug/L	Title 22 - Table 64444-A
Deethylatrazine	50	ug/L	CA-Prop65
Di(2-ethylhexyl)adipate	0.4	mg/L	Title 22 - Table 64444-A
Di(2-ethylhexyl)phthalate (DEHP)	4	ug/L	Title 22 - Table 64444-A
Diazinon	1.2	ug/L	HBSL
Dibromochloromethane (THM)	80	ug/L	MCL
Dicamba	210	ug/L	RfD
Dichlorodifluoromethane	1	mg/L	HBSL
Dichloromethane (Methylene Chloride)	5	ug/L	Title 22 - Table 64444-A

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Table 2: Comparison concentrations and data sources for constituents used in the water quality assessment.

Full Name	MCL	Units	Source
Dichlorprop	300	ug/L	HBSL
Dichlorvos (DDVP)	0.4	ug/L	HBSL
Dieldrin	0.002	ug/L	HBSL
Diesel	100	ug/L	US-HAL
Dimethoate	2	ug/L	HBSL
Dinoseb	7	ug/L	Title 22 - Table 64444-A
Diquat	20	ug/L	Title 22 - Table 64444-A
Diuron	2	ug/L	HBSL
Endosulfan I	42	ug/L	RfD
Endosulfan II	42	ug/L	RfD
Endosulfan Sulfate	42	ug/L	RfD
Endothall	100	ug/L	Title 22 - Table 64444-A
Endrin	2	ug/L	Title 22 - Table 64444-A
EPTC	200	ug/L	HBSL
Ethylbenzene	300	ug/L	Title 22 - Table 64444-A
Ethylene glycol	14	mg/L	US-HAL
Fecal Coliform (bacteria)	0.99	Count	MCL
Fenamiphos	0.7	ug/L	HBSL
Fluoride	2	mg/L	Title 22 - Table 64431-A
Foaming Agents (MBAS)	0.5	mg/L	Title 22 - Table 64449-A
Fonofos	10	ug/L	HBSL
Formaldehyde	100	ug/L	US-HAL
Gasoline	5	ug/L	US-HAL
Glyphosate (Round-up)	700	ug/L	MCL-US
Gross Alpha radioactivity	15	pCi/L	Title 22 - Table 64442
Gross beta	50	pCi/L	MCL-US
Guthion (Azinphos Methyl)	10	ug/L	HBSL
Heptachlor	0.01	ug/L	Title 22 - Table 64444-A
Heptachlor Epoxide	0.01	ug/L	Title 22 - Table 64444-A
Hexachlorobenzene (HCB)	1	ug/L	MCL-US
Hexachlorobutadiene	0.9	ug/L	HBSL
Hexachlorocyclopentadiene	50	ug/L	Title 22 - Table 64444-A
Hexazinone	400	ug/L	HBSL
Iodide	1190	ug/L	NAS-HAL
Iprodione	0.8	ug/L	HBSL
Iron	300	ug/L	Title 22 - Table 64449-A
Isopropylbenzene (Cumene)	770	ug/L	HBSL
Kerosene	100	ug/L	US-HAL
Lead	15	ug/L	AL
Lindane (Gamma-BHC)	0.2	ug/L	Title 22 - Table 64444-A
Linuron	5	ug/L	HBSL
Malathion	500	ug/L	HBSL
Manganese	50	ug/L	Title 22 - Table 64449-A

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Table 2: Comparison concentrations and data sources for constituents used in the water quality assessment.

Full Name	MCL	Units	Source
Mercury	2	ug/L	Title 22 - Table 64431-A
Metalaxyl	500	ug/L	HBSL
Methomyl	200	ug/L	HBSL
Methoxychlor	30	ug/L	Title 22 - Table 64444-A
Methyl Bromide (Bromomethane)	10	ug/L	US-HAL
Methyl Isobutyl Ketone (MIBK)	120	ug/L	NL
Metolachlor	700	ug/L	HBSL
Metribuzin	90	ug/L	HBSL
Molinate	20	ug/L	Title 22 - Table 64444-A
Molybdenum	40	ug/L	US-HAL
MTBE (Methyl-tert-butyl ether)	5	ug/L	Title 22 - Table 64449-A
Naled	10	ug/L	HBSL
Naphthalene	17	ug/L	HBSL
Napropamide	800	ug/L	HBSL
n-Butylbenzene	260	ug/L	NL
Nickel	100	ug/L	Title 22 - Table 64431-A
Nitrate as N	10	mg/L	Title 22 - Table 64431-A
Nitrate+Nitrite	10	mg/L	Title 22 - Table 64431-A
Nitrite as N	1	mg/L	Title 22 - Table 64431-A
N-Nitrosodiethylamine (NDEA)	0.01	ug/L	CA-CPF
N-Nitrosodimethylamine (NDMA)	0.01	ug/L	CA-CPF
N-Nitrosodi-N-Propylamine (NDPA)	0.01	ug/L	CA-CPF
Norflurazon	10	ug/L	HBSL
n-Propylbenzene (Isocumene)	260	ug/L	NL
Octogen (HMX)	0.35	mg/L	US-HAL
Oxamyl	50	ug/L	Title 22 - Table 64444-A
Oxyfluorfen	20	ug/L	HBSL
Parathion	0.02	ug/L	HBSL
PCNB	21	ug/L	RfD
Pentachlorophenol (PCP)	1	ug/L	MCL-US
Perchlorate	6	ug/L	Title 22 - Table 64431-A
Perfluorooctanoic acid	5.1	ng/L	US-HAL
Perfluorooctanoic sulfonate	6.5	ng/L	NL
Permethrin	4	ug/L	HBSL
pH	7.0-8.5	-log[H+]	Basin Plan - Table 3-1
Phorate	4	ug/L	HBSL
Picloram	0.5	mg/L	Title 22 - Table 64444-A
Polychlorinated Biphenyls (PCBs)	0.5	ug/L	MCL-US
Prometon	400	ug/L	HBSL
Prometryn	300	ug/L	HBSL
Propachlor (2-Chloro-N-isopropylacetanilide)	90	ug/L	HBSL
Propanil	6	ug/L	HBSL

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Table 2: Comparison concentrations and data sources for constituents used in the water quality assessment.

Full Name	MCL	Units	Source
Propargite	1	ug/L	HBSL
Radium 226	5	pCi/L	Title 22 - Table 64442
Radium 228	5	pCi/L	Title 22 - Table 64442
Radon 222	4000	pCi/L	MCL-US
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	0.3	mg/L	US-HAL
sec-Butylbenzene	260	ug/L	NL
Selenium	50	ug/L	Title 22 - Table 64431-A
Silver	100	ug/L	Title 22 - Table 64449-A
Simazine	4	ug/L	Title 22 - Table 64444-A
Sodium	50	mg/L	AL
Specific Conductivity	500 (50% UL), 800 (90% UL)	micromhos	Basin Plan - Table 3-1
Strontium	4000	ug/L	US-HAL
Strontium 90	8	pCi/L	Title 22 - Table 64443
Styrene	100	ug/L	Title 22 - Table 64444-A
Sulfate	500	mg/L	Title 22 - Table 64449-B
tebuthiuron	1000	ug/L	HBSL
tert-Butyl alcohol (TBA)	12	ug/L	NL
tert-Butylbenzene	260	ug/L	NL
Tetrachloroethene (PCE)	5	ug/L	Title 22 - Table 64444-A
Thallium	2	ug/L	Title 22 - Table 64431-A
Thiabendazole	231	ug/L	HHBP
Thiobencarb	1	ug/L	Title 22 - Table 64449-A
Toluene	150	ug/L	Title 22 - Table 64444-A
Total Coliform Bacteria	0.99	Count	MCL
Total Dissolved Solids	1000	mg/L	Title 22 - Table 64449-B
Total Trihalomethanes	80	ug/L	MCL-US
Toxaphene	3	ug/L	Title 22 - Table 64444-A
trans-1,2, Dichloroethylene	10	ug/L	Title 22 - Table 64444-A
Trichlopyr	400	ug/L	HBSL
Trichloroethene (TCE)	5	ug/L	Title 22 - Table 64444-A
Trichlorofluoromethane (Freon 11)	150	ug/L	Title 22 - Table 64444-A
Trifluralin	20	ug/L	HBSL
Tritium	20000	pCi/L	Title 22 - Table 64443
Uranium	20	pCi/L	Title 22 - Table 64442
Vanadium	50	ug/L	RfD
Vinyl Chloride	0.5	ug/L	Title 22 - Table 64444-A
Warfarin	2	ug/L	HBSL
Xylene, Isomers m & p	1750	ug/L	Title 22 - Table 64444-A
Xylenes (total)	1750	ug/L	Title 22 - Table 64444-A
Zinc	5	mg/L	Title 22 - Table 64449-A

Calculations

Specific water quality objectives for the Shasta Valley hydrologic area groundwaters, as defined in the Basin Plan have specific limits and calculation requirements associated with specific conductance, hardness and boron. Per the Basin Plan, the 50% upper limit and 90% upper limit are defined as follows:

- 50% upper limits represent “the 50 percentile values of the monthly means for a calendar year. 50% or more of the monthly means must be less than or equal to an upper limit and greater”
- 90% upper limits represent “the 90 percentile values for a calendar year. 90% or more of the values must be equal to an upper limit and greater than or equal to a lower limit”.

Measurements of specific conductance and boron were organized to enable comparison to the 50% and 90% limits through calculation of monthly means for comparison to the 50% upper limits and organization by calendar year for comparison to the 50% and 90% upper limits.

Filtering Process

To analyze groundwater quality, several filters were applied for relevance and quality. Though groundwater quality data for the Basin is available from the 1950s, data was limited to only include information collected in the past 30 years. Restricting the timespan from which data was collected increases confidence in data collection methods and quality of the data and focuses on information that is reflective of current groundwater quality conditions.

Groundwater quality was analyzed through comparison, for each constituent, of well data to the corresponding comparison concentration. Maps were generated for each constituent showing well locations and number of samples and categorizing and displaying data into the following groups:

a) Not detected
b) Detected but below half of the comparison concentration
c) Detected and above half of the comparison concentration
d) Above the comparison concentration

Two iterations of map generation was conducted with the following scenarios:

1. Data is limited to those collected in the past 30 years only (1990-2020)
2. Data is limited to wells that have more than one data point in the past 30 years (1990-2020)

For the second scenario, where data is limited to wells that have more than one data point in the past 30 years, timeseries are generated for each constituent and well to identify changes over time in groundwater quality at a location.

The following sections contain the maps produced from these analyses.

Results

Constituents of Concern (COCs)

Constituents of Concern (COCs) were identified based on visual identification of potential groundwater quality issues using the maps generated in this assessment, identification of common constituents of concern, and through discussion with stakeholders. Resulting from this analysis and discussion with stakeholders, the full list of constituents of concern (COCs) were:

1. Arsenic
2. Boron
3. Benzene
4. Iron
5. Manganese
6. Nitrate as N
7. pH
8. Specific Conductivity

[This section should include further detail on decision making process, constituents included i.e. clean up sites under purview of another agency once the list is finalized]

A series of maps for each COC, with water quality data from the past 30 years (1990-2020), show the location of tested wells and whether the maximum concentration ever recorded in that well has exceeded the MCL. In Shasta Valley, the water quality source database categorized some wells as either municipal or monitoring. Municipal wells are a public supply well, typically related to a city or town. Monitoring wells are used for monitoring groundwater, such as for site cleanup programs or Irrigated Lands Regulatory Program. The following timeseries graphs organize wells by the highest maximum concentration to the lowest.

Figure 1 shows all wells that have been tested for Total Arsenic, even if only one monitoring event has occurred. Figure 2 filters the wells for those with two or more monitoring events. In the past 30 years, two wells near Edgewood and one near Grenada have high concentrations. Timeseries of wells in Figure 2 show that wells with high arsenic have not been sampled since 2012 (Figure 3 to Figure 7). The municipal well east of Grenada has elevated but declining arsenic. The remaining wells have low arsenic or non-detect.

The majority of boron water quality data in Shasta Valley is only the dissolved fraction while water quality regulations refer to the total fraction. Total boron can be greater or equal to dissolved boron. Therefore the following boron graphs are conservative. Figure 8 shows a number of high dissolved boron wells, though many of these wells have only one monitoring event and a trend analysis cannot be completed. Figure 9 has seventeen boron wells available for trend analysis. The three wells with high boron have not been sampled since 2011 and two have decreasing concentrations (Figure 10 to Figure 12). The remaining wells have low boron.

High benzene in Shasta Valley is associated with cleanup sites near Yreka and Carrick (Figure 13 and Figure 14). Trend analysis show that benzene concentrations have remained steady or are decreasing over time (Figure 15 to Figure 18).

High iron is detected in the east side of the valley, east of Grenada and Gazelle (Figure 19) but trend analysis can only be completed for wells in Figure 20. Trend analysis shows low iron for all wells since 1991 (Figure 21 to Figure 24).

High manganese occurs in selected wells through most of Shasta Valley (Figure 25 but trend analysis can only be completed for wells in Figure 26. Similar to iron, trend analysis shows low manganese for all wells since 1991 (Figure 27 to Figure 30).

High nitrate only occurs in a few wells in Montague and Grenada (Figure 31 and Figure 32). In wells with elevated nitrate, trend analysis show that nitrate has been generally decreasing or steady through time (Figure 33). Well 45N06W27D002M in Montague has high nitrate but was only sampled twice. Wells with low nitrate have generally maintained steady levels (Figure 34 and Figure 37).

Shasta Valley has limited pH data, with most data outside the limits set by the Basin Plan (Figure 38 and Figure 39). Trend analysis of two wells show pH that is slightly more basic then the Basin Plan limits (Figure 40).

Specific conductivity is elevated in the middle of Shasta Valley (Figure 41 but trend analysis can only be completed for wells in Figure 42). Trend analysis show that wells with high specific conductivity have not been sampled since 2011 (Figure 43 and Figure 46).

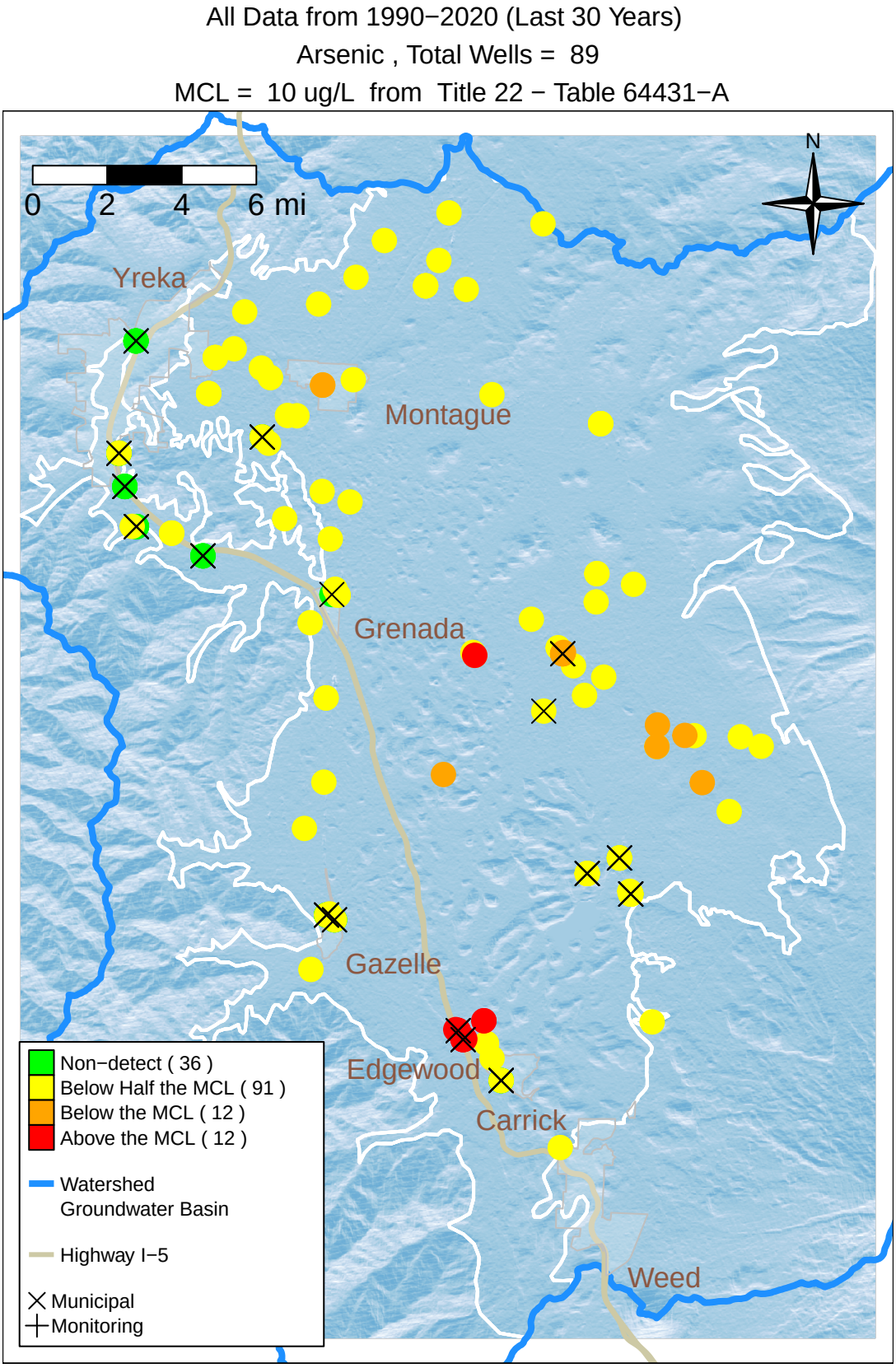

Figure 1: Groundwater Quality Observations of the Constituent Short List

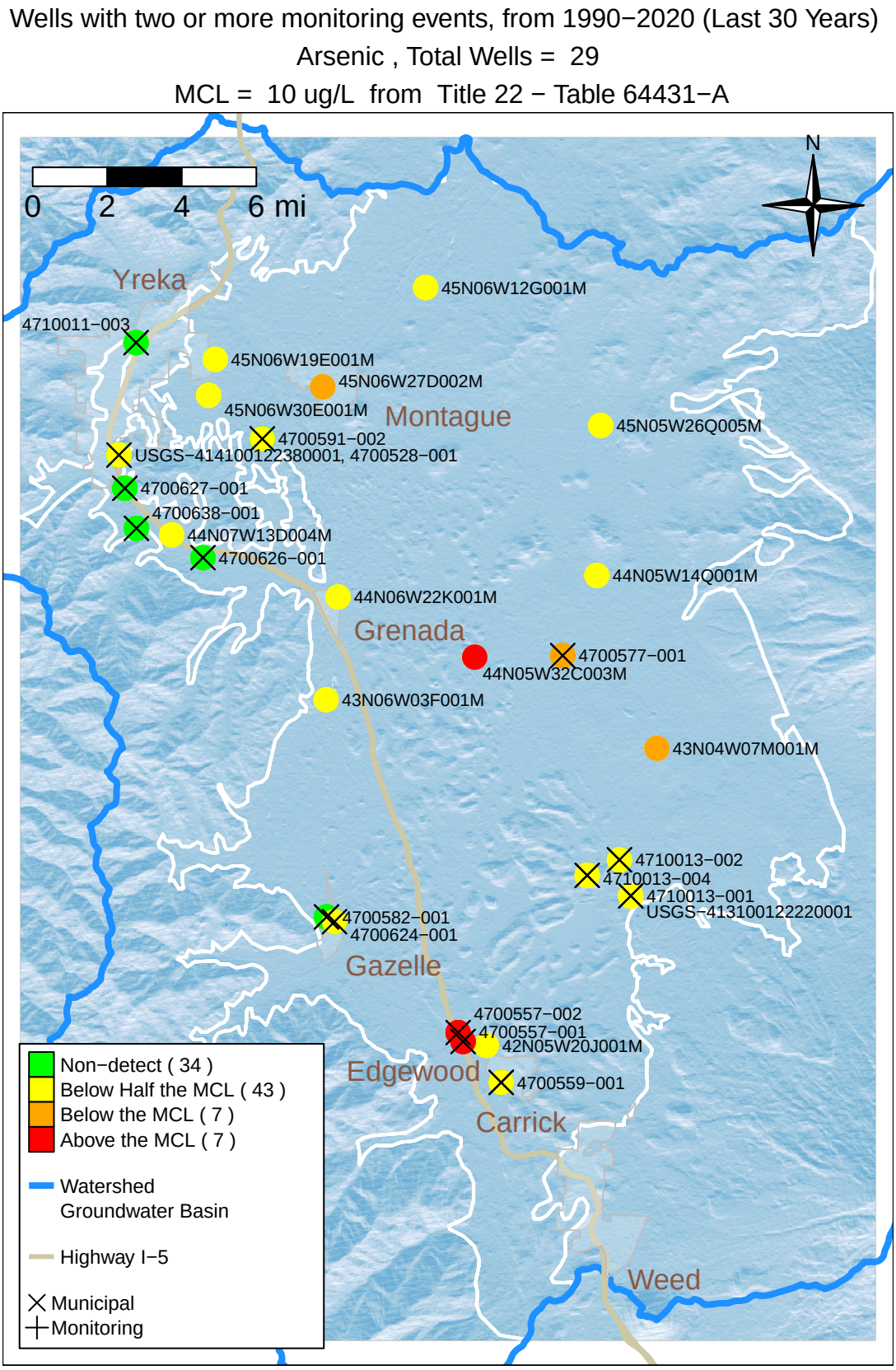

Figure 2: Filtered Groundwater Quality Observations of the Constituent Short List

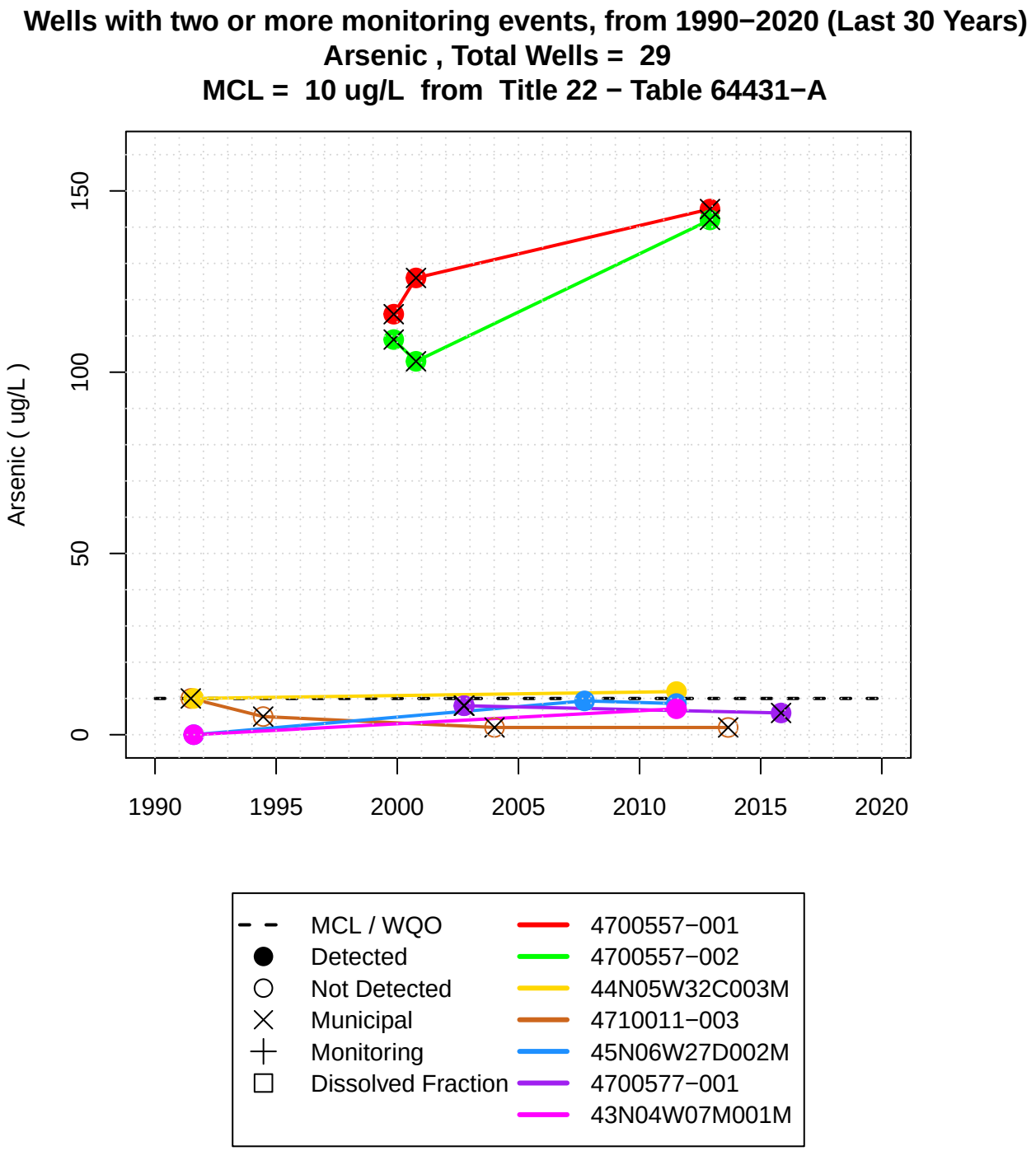

Figure 3: Filtered Groundwater Quality Observations of the Constituent Short List

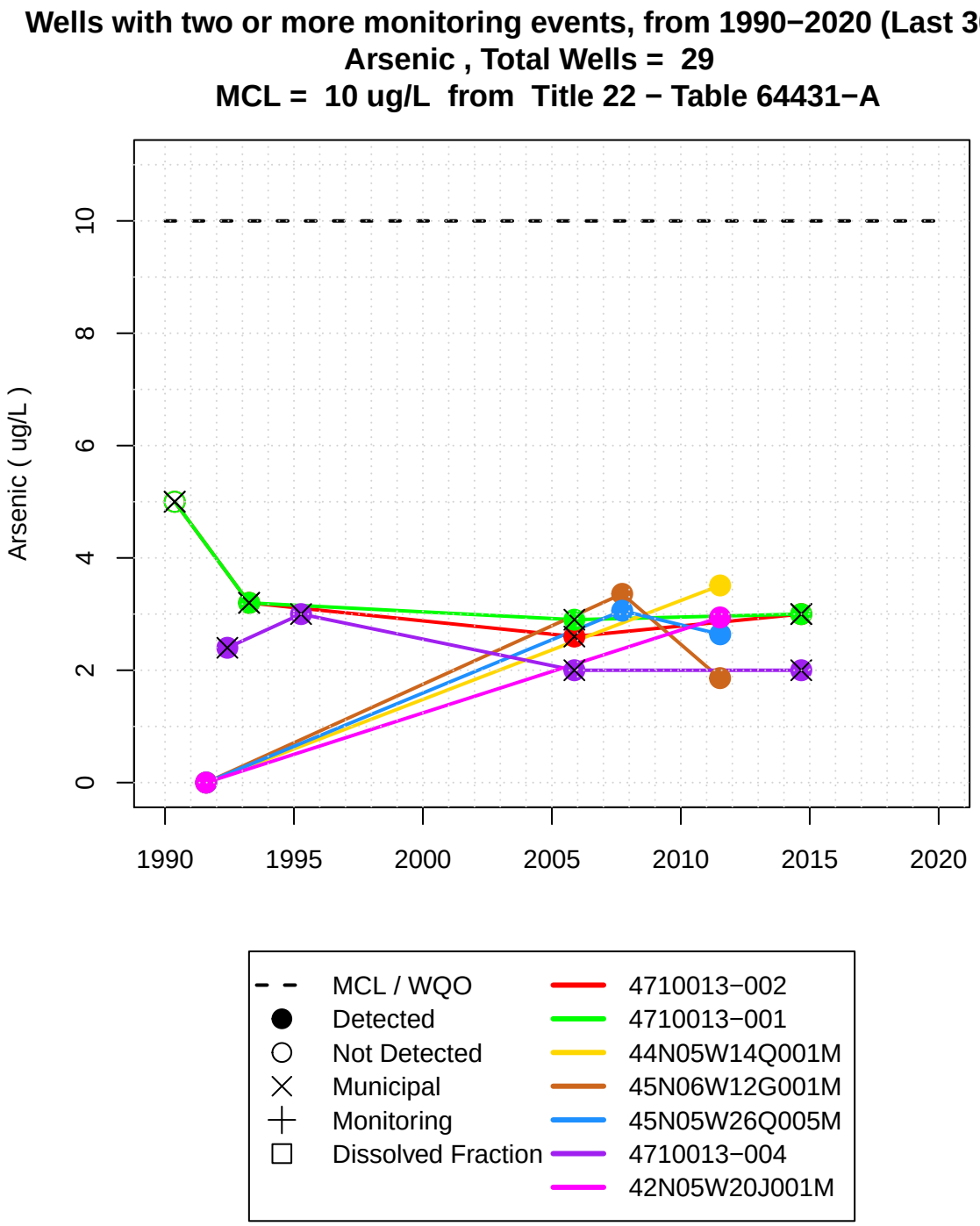

Figure 4: Filtered Groundwater Quality Observations of the Constituent Short List

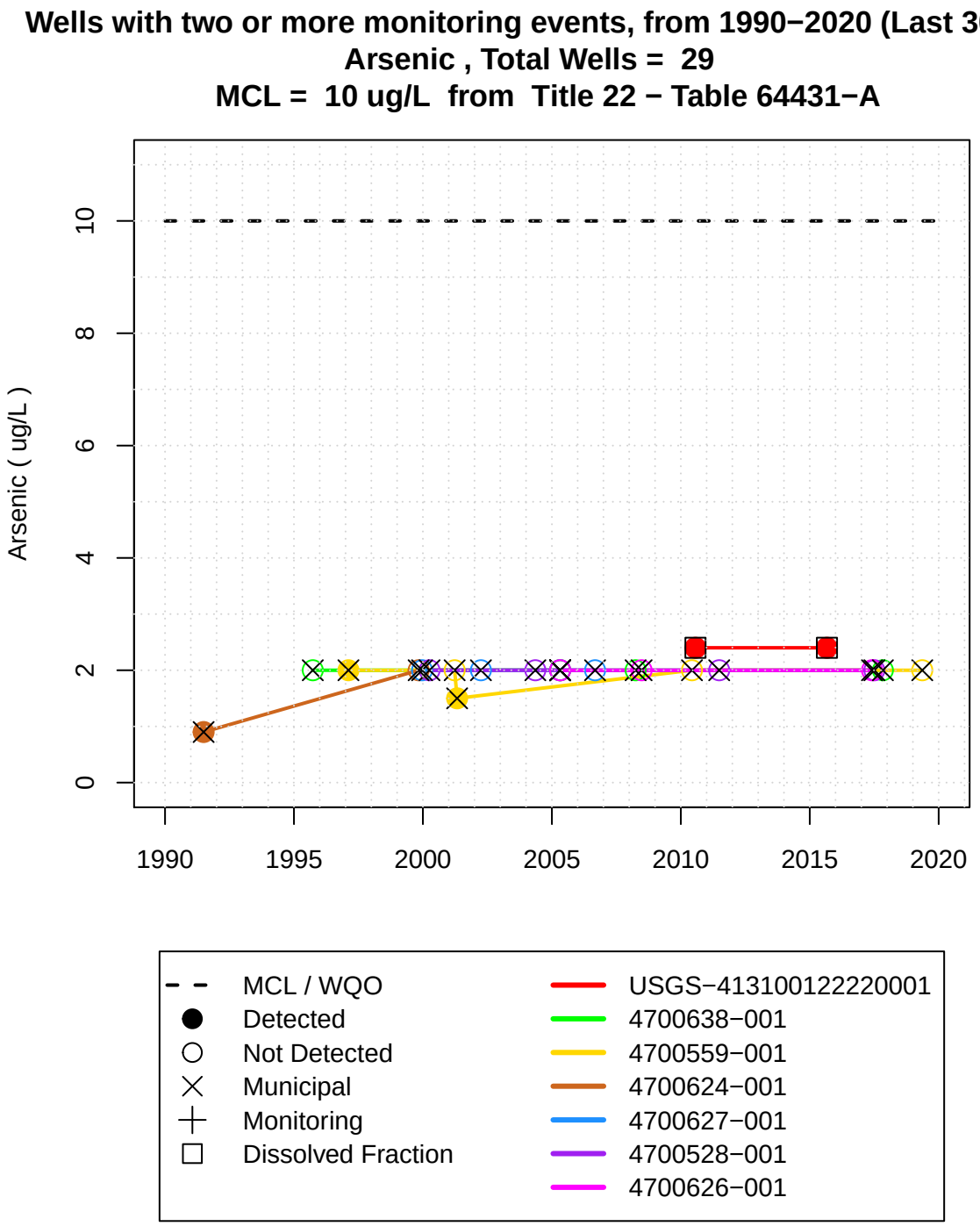

Figure 5: Filtered Groundwater Quality Observations of the Constituent Short List

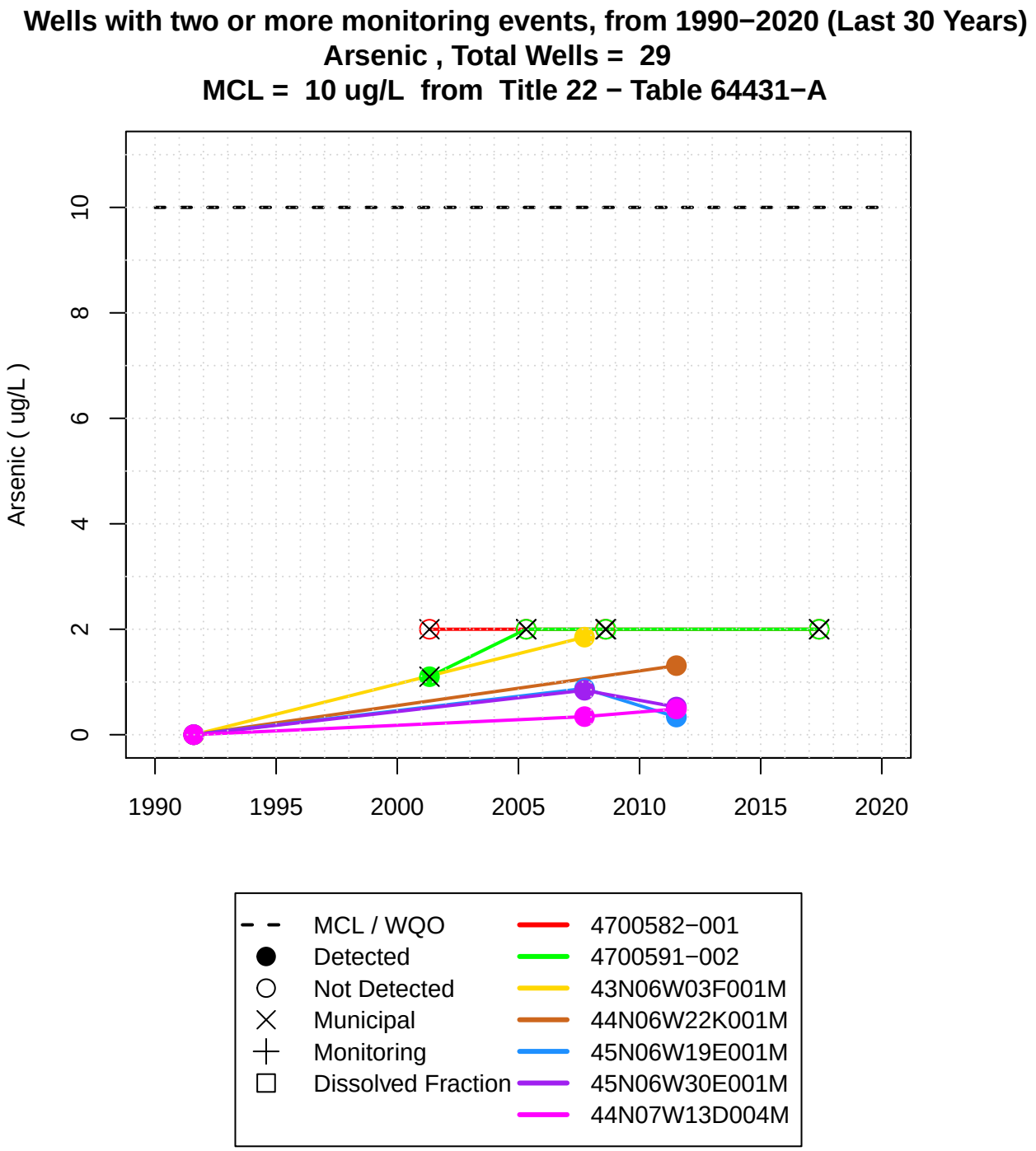

Figure 6: Filtered Groundwater Quality Observations of the Constituent Short List

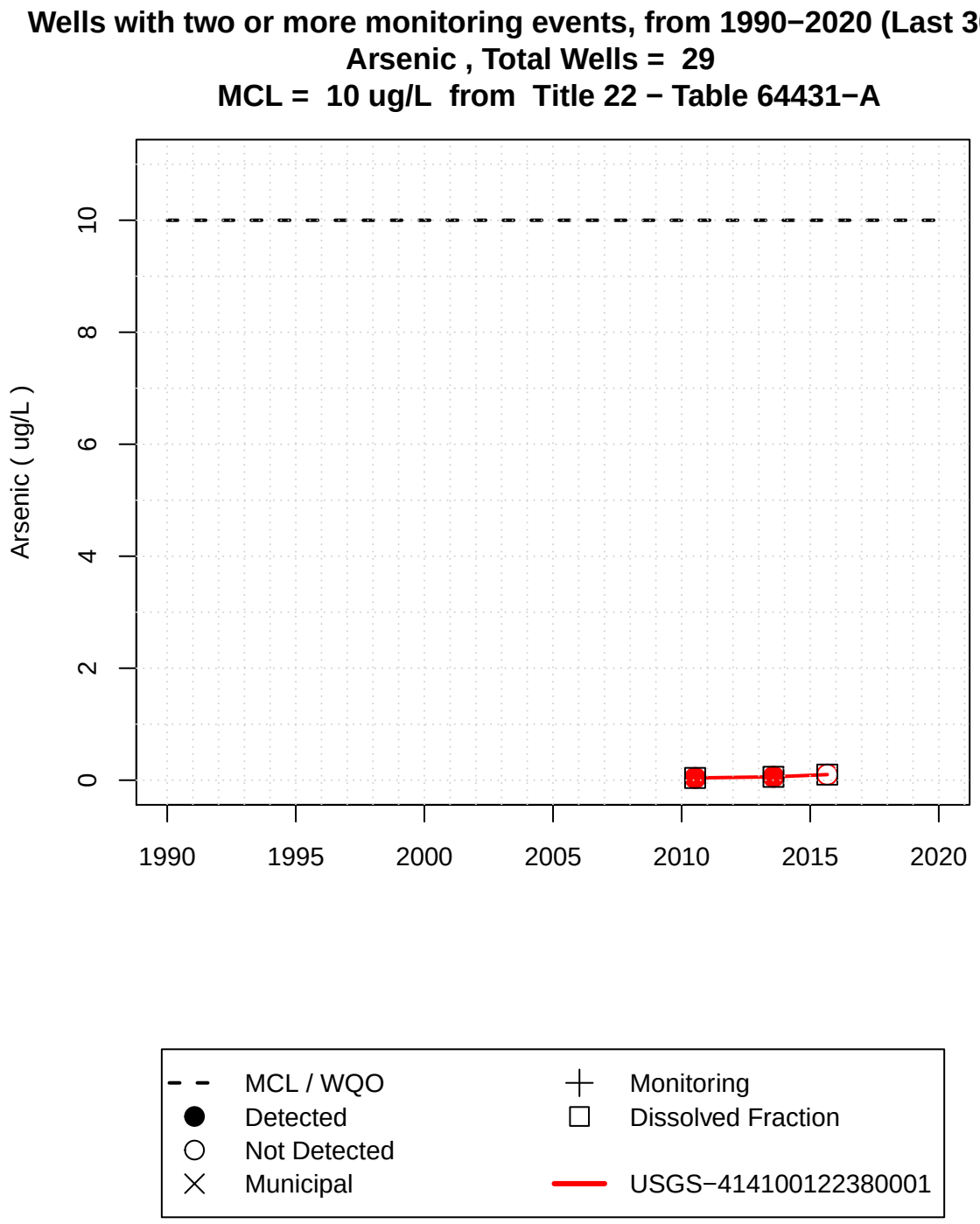

Figure 7: Filtered Groundwater Quality Observations of the Constituent Short List

All Data from 1990−2020 (Last 30 Years)
Boron , Total Wells = 77
WQO = 0.3 (50% UL), 1.0 (90% UL) mg/L from Basin Plan − Table 3−1

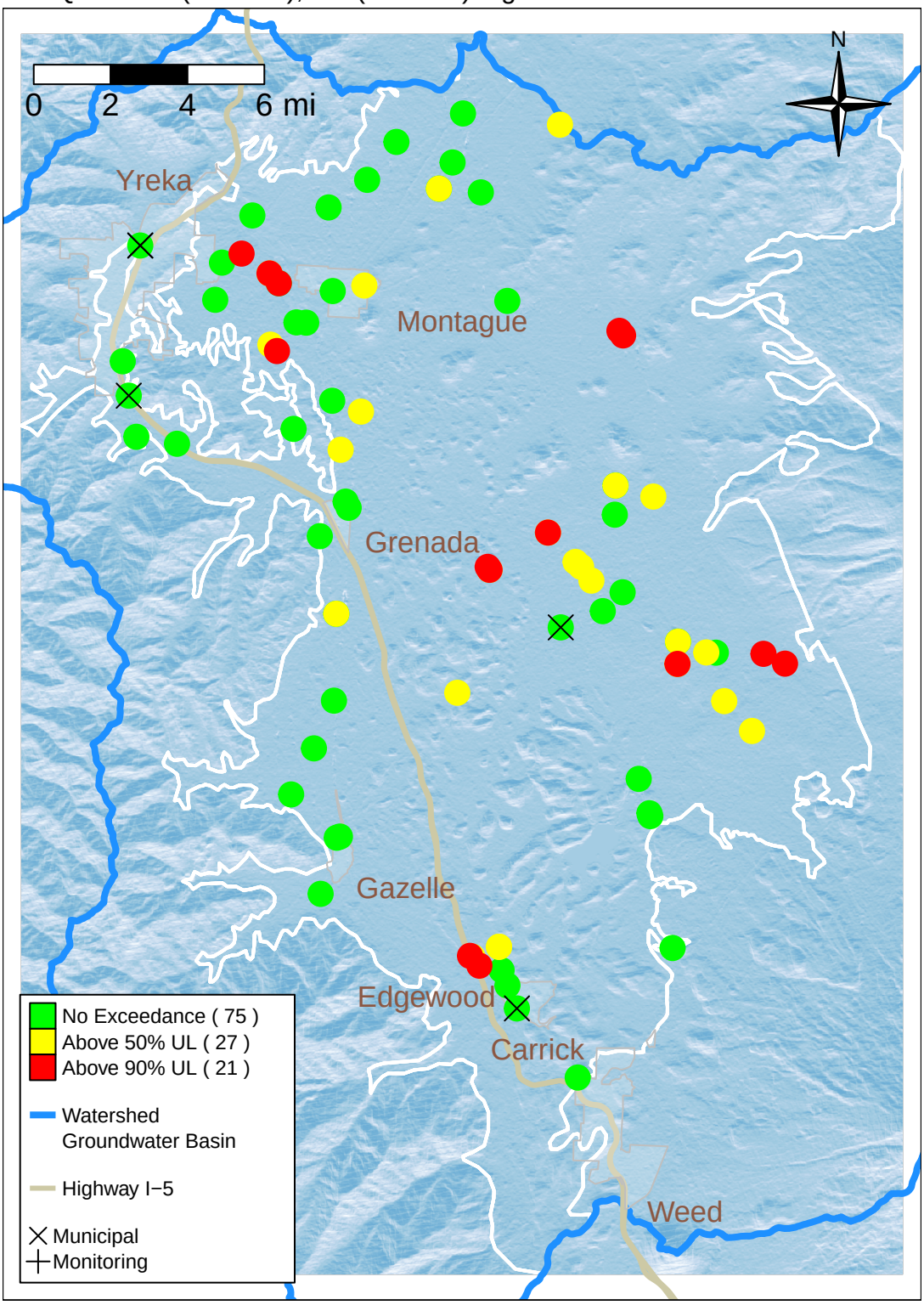

Figure 8: Groundwater Quality Observations of the Constituent Short List

Wells with two or more monitoring events, from 1990−2020 (Last 30 Years)
Boron , Total Wells = 17
WQO = 0.3 (50% UL), 1.0 (90% UL) mg/L from Basin Plan − Table 3−1

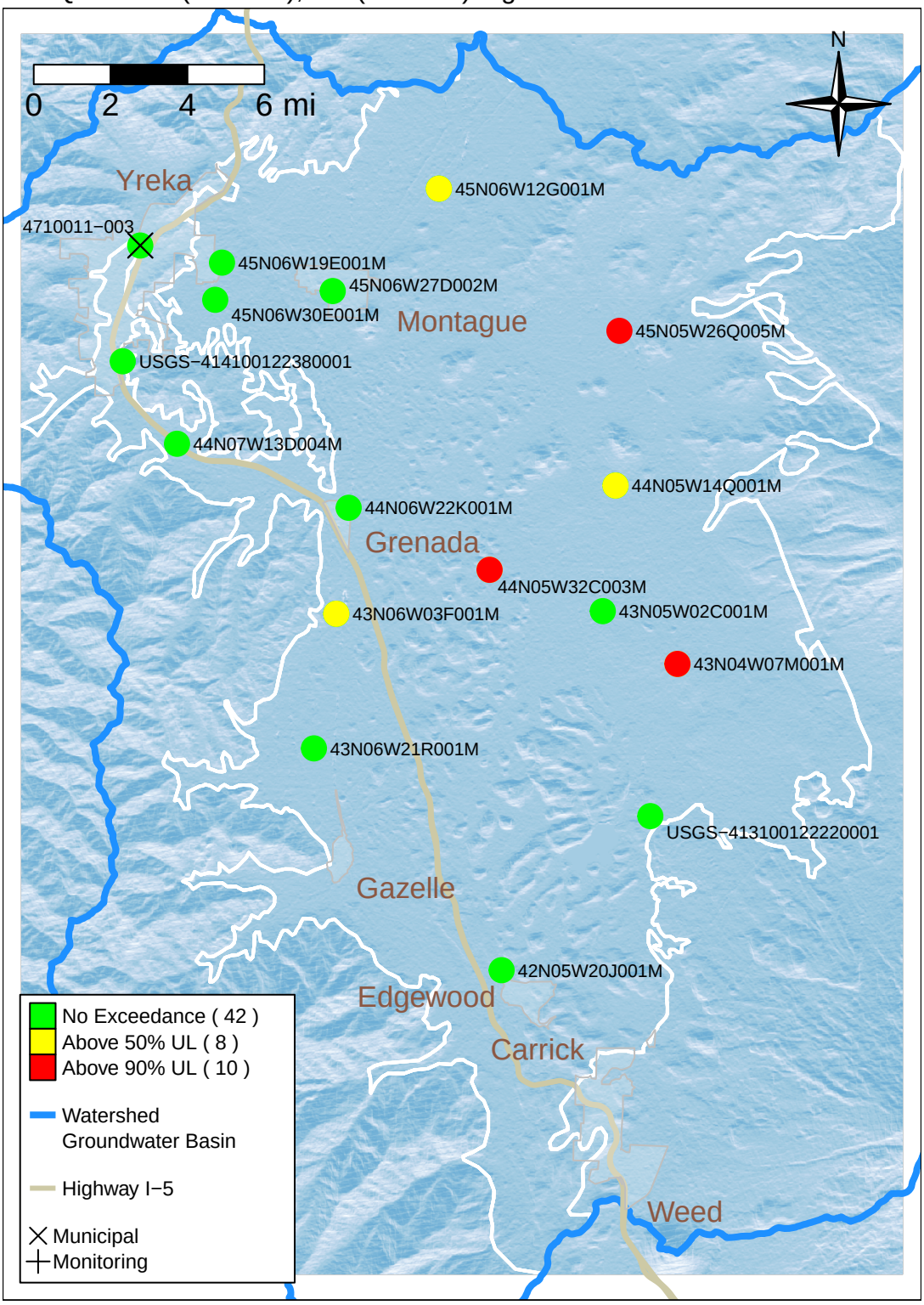

Figure 9: Filtered Groundwater Quality Observations of the Constituent Short List

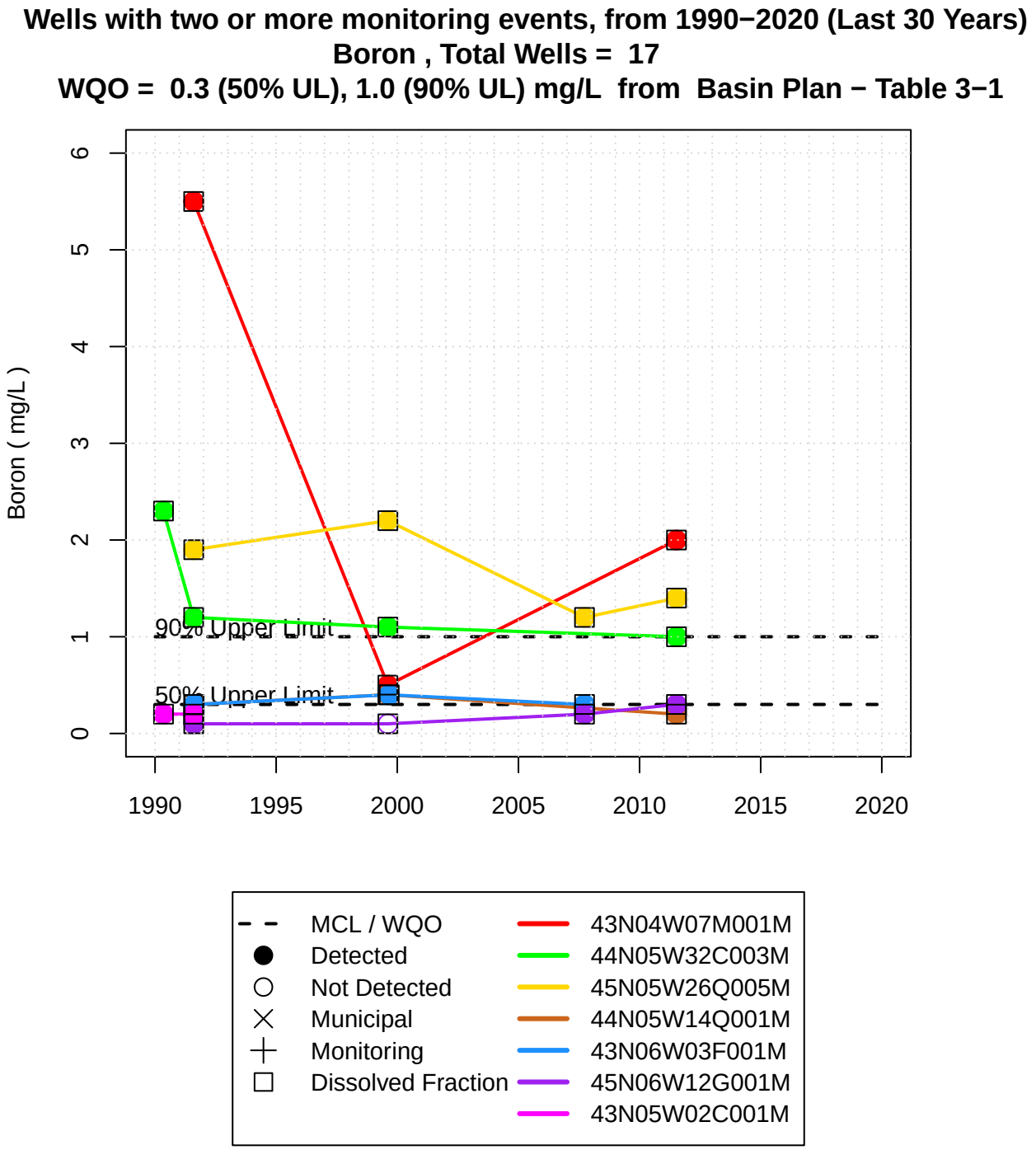

Figure 10: Filtered Groundwater Quality Observations of the Constituent Short List

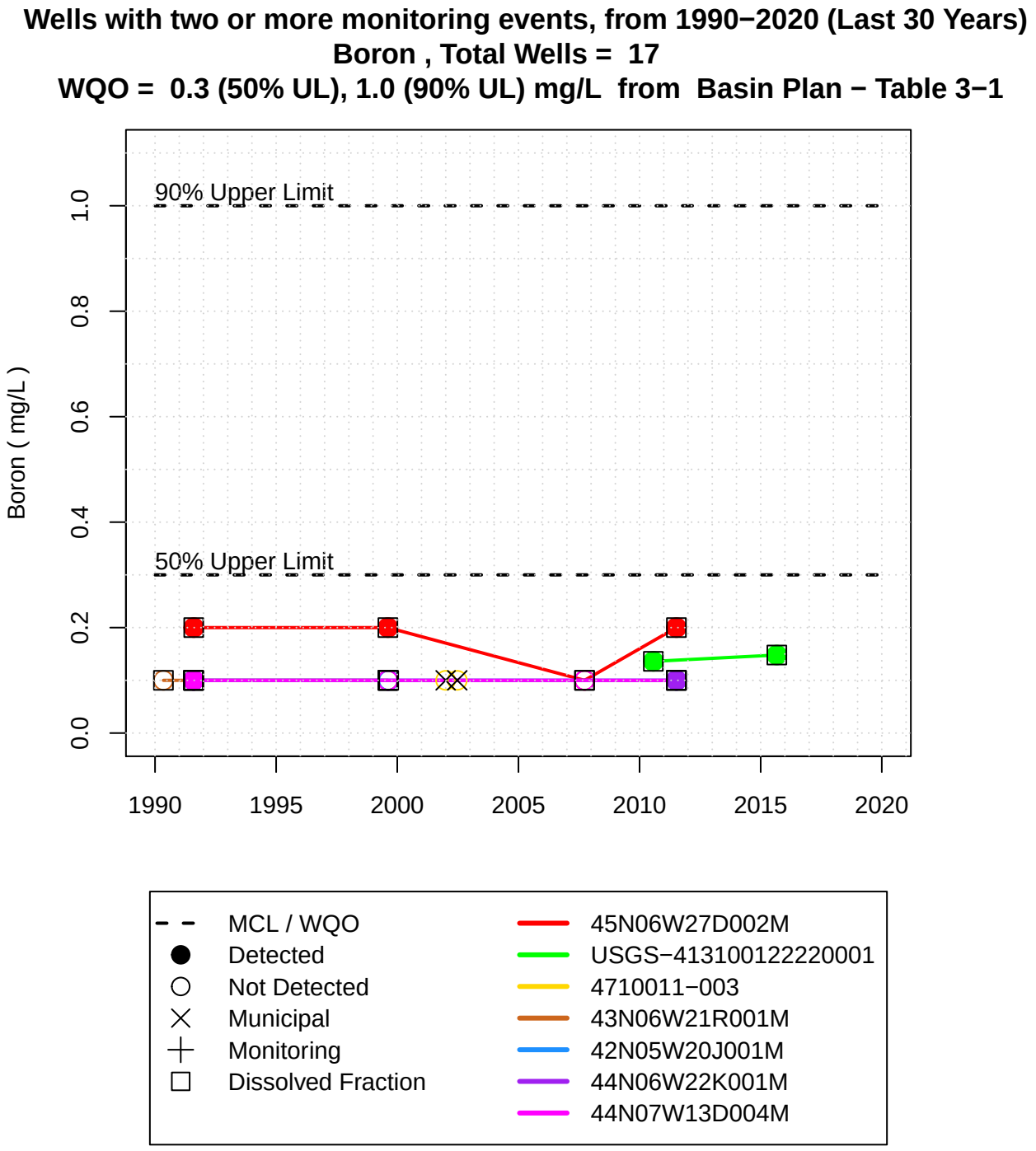

Figure 11: Filtered Groundwater Quality Observations of the Constituent Short List

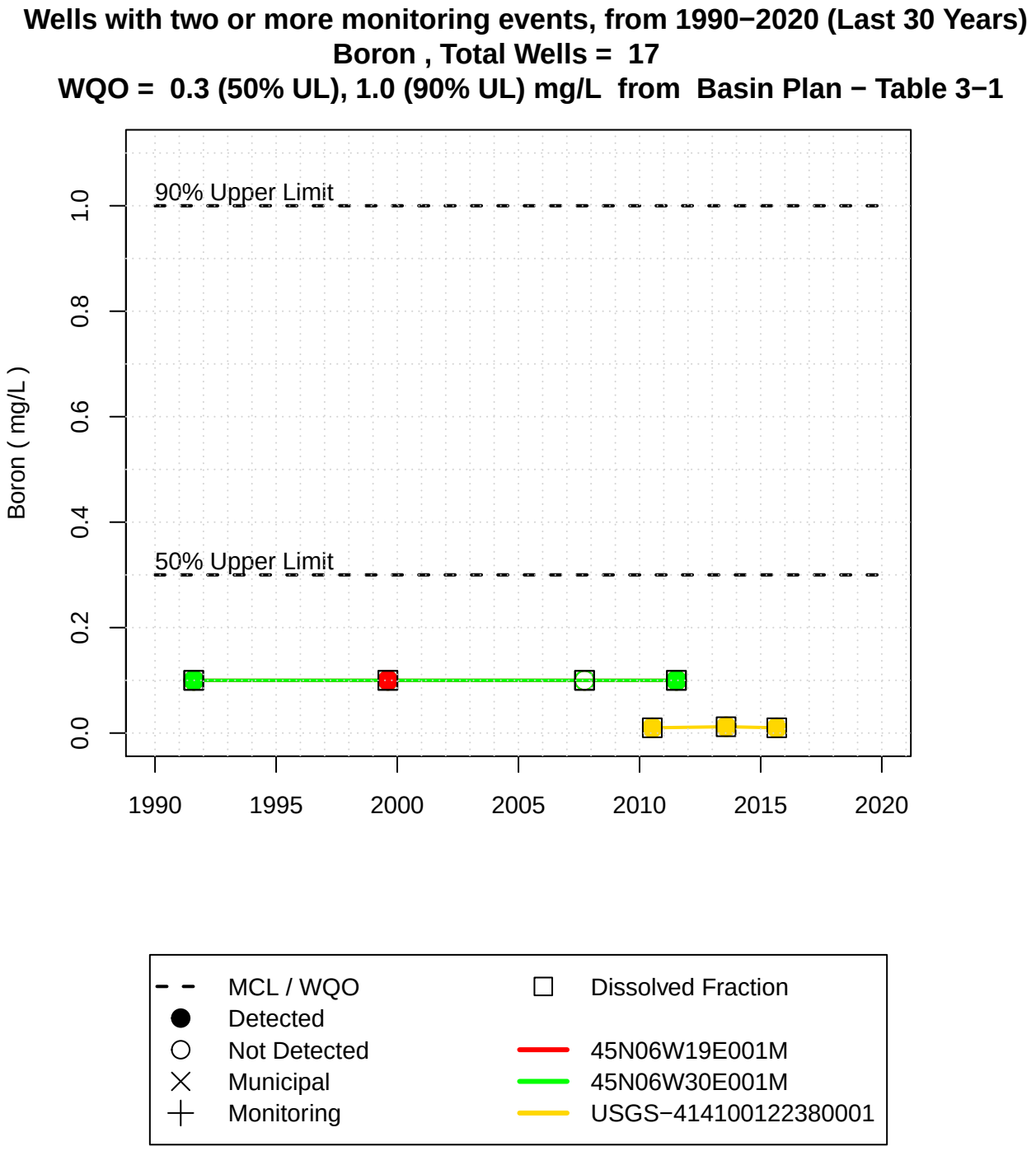

Figure 12: Filtered Groundwater Quality Observations of the Constituent Short List

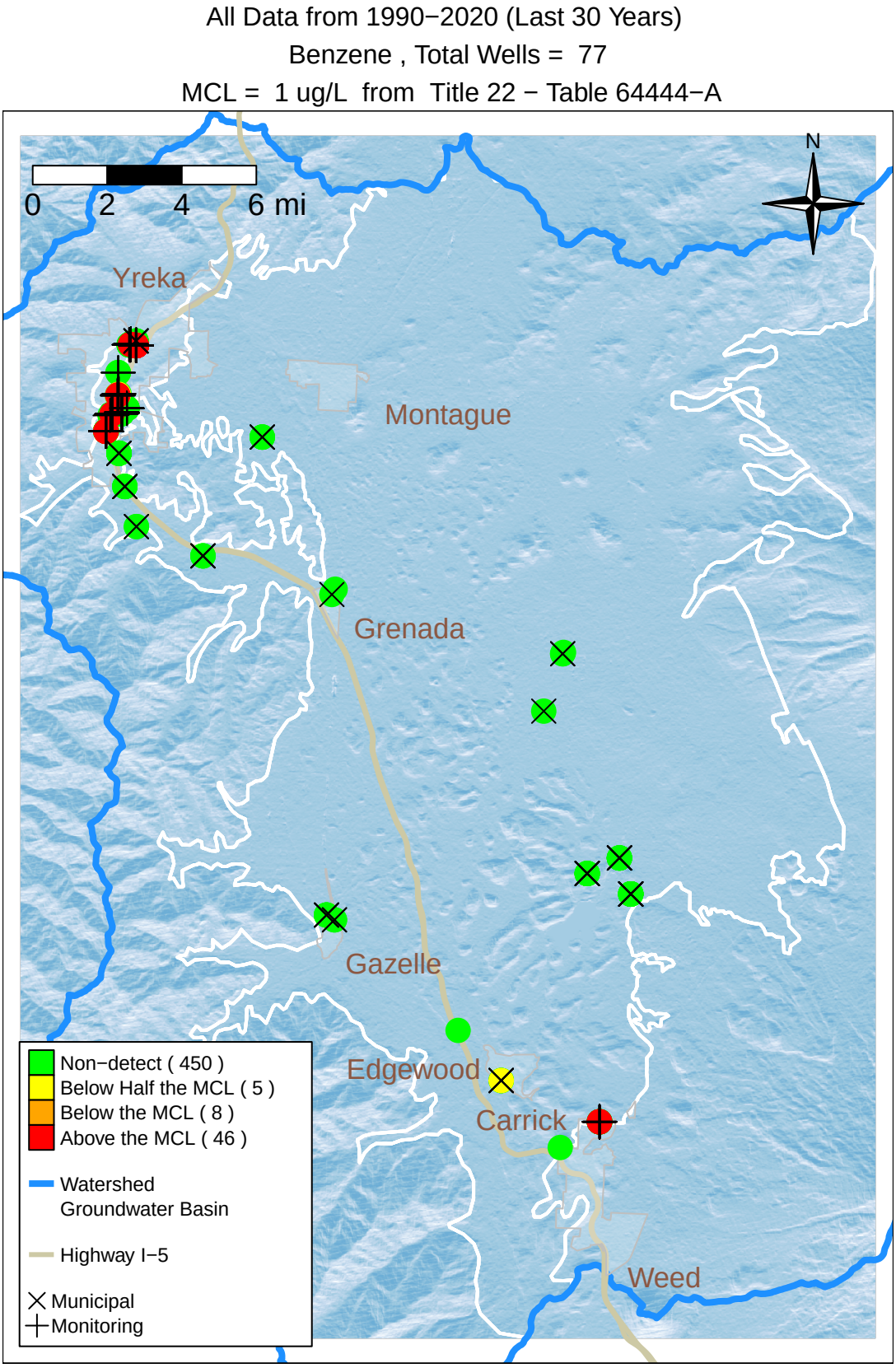

Figure 13: Groundwater Quality Observations of the Constituent Short List

Wells with two or more monitoring events, from 1990−2020 (Last 30 Years)
Benzene , Total Wells = 52
MCL = 1 ug/L from Title 22 − Table 64444−A

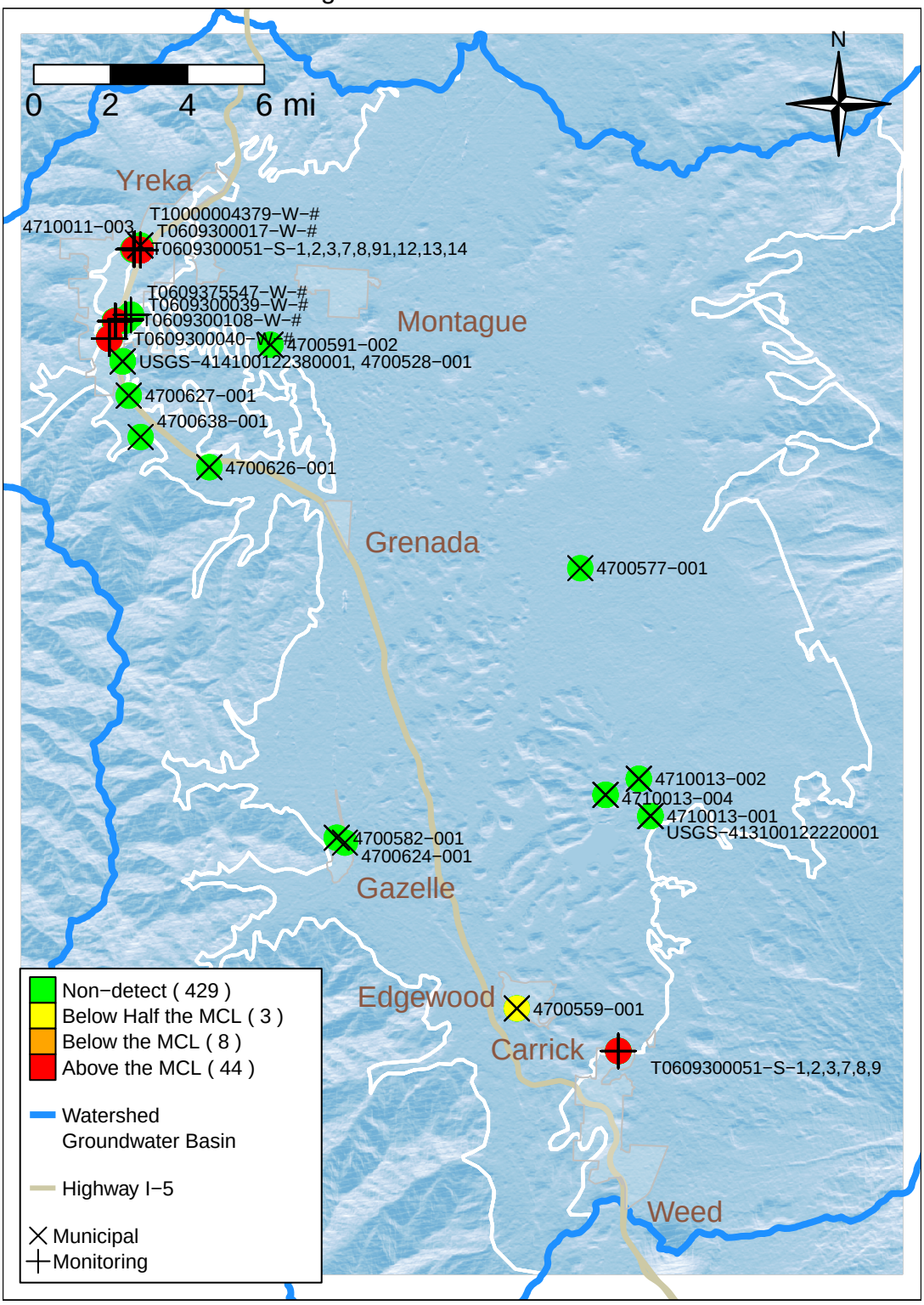

Figure 14: Filtered Groundwater Quality Observations of the Constituent Short List

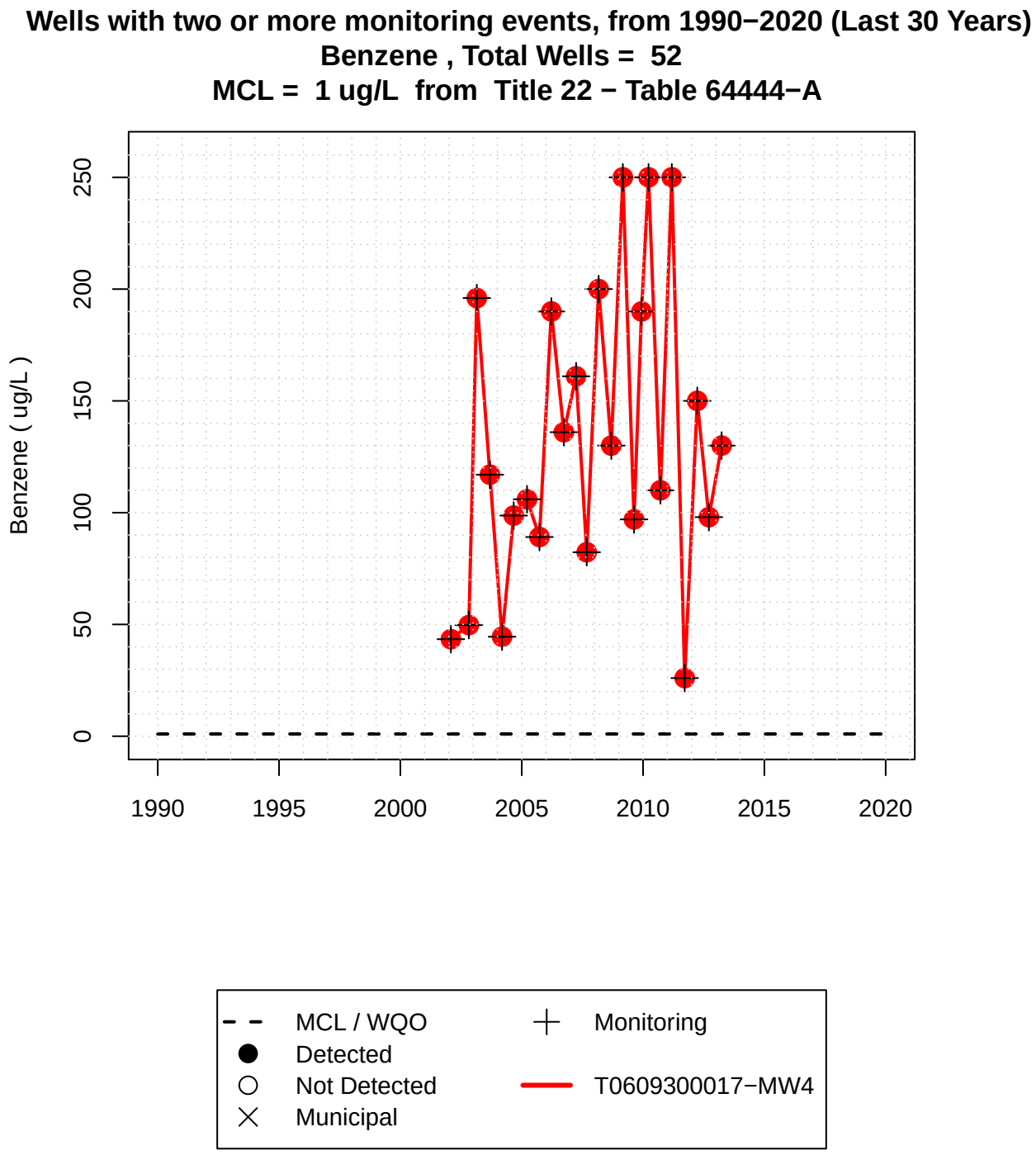

Figure 15: Filtered Groundwater Quality Observations of the Constituent Short List

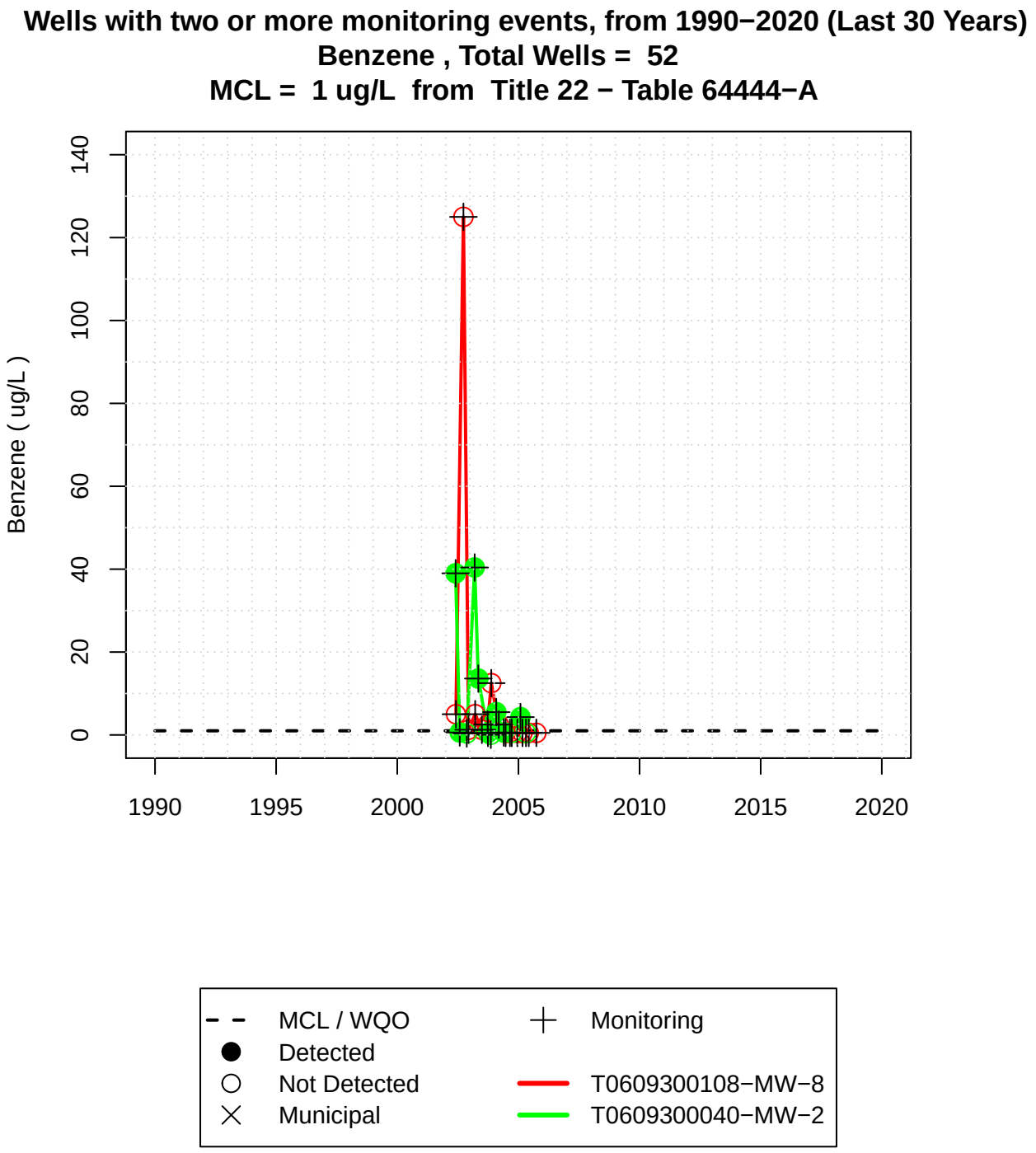

Figure 16: Filtered Groundwater Quality Observations of the Constituent Short List

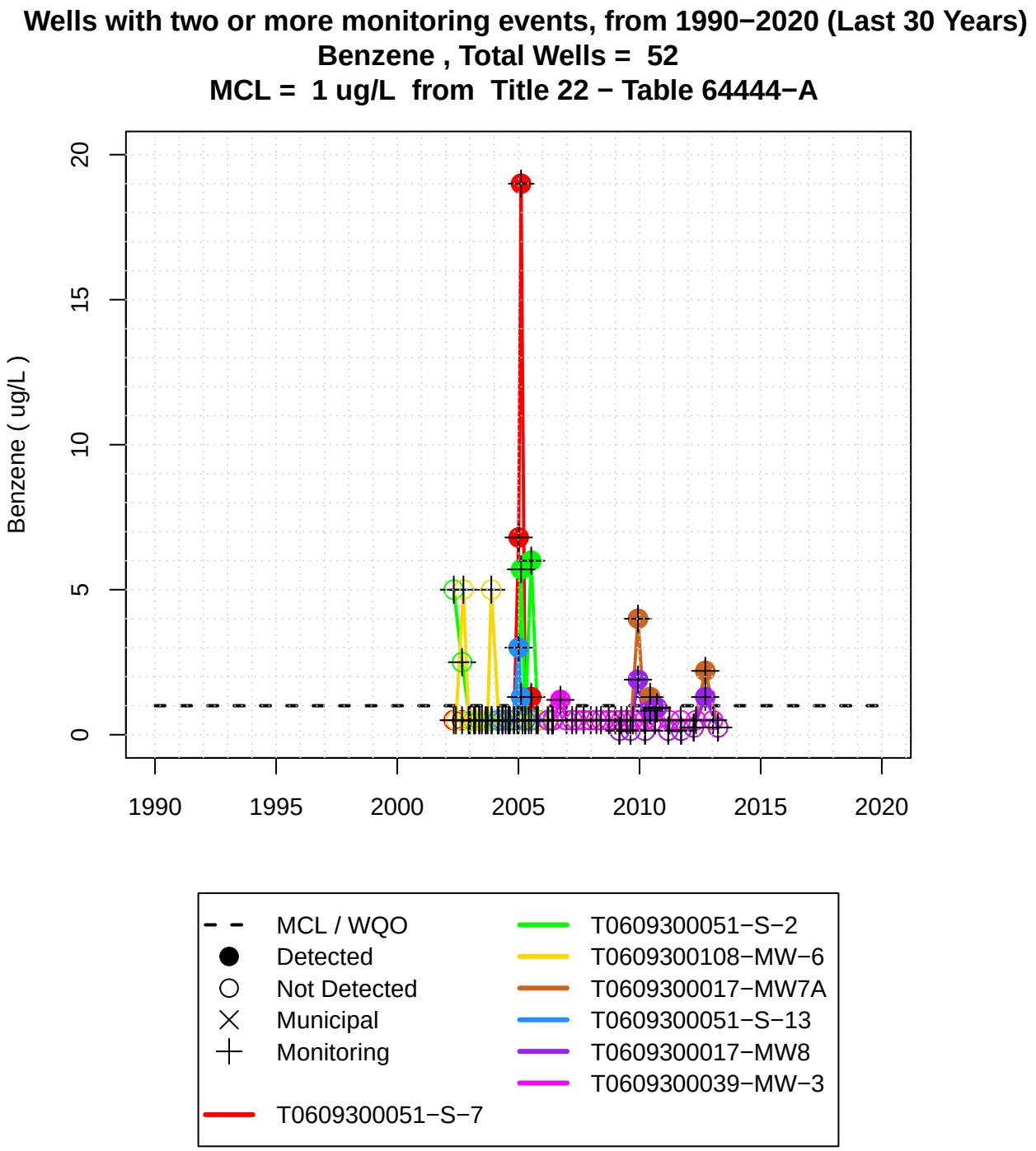

Figure 17: Filtered Groundwater Quality Observations of the Constituent Short List

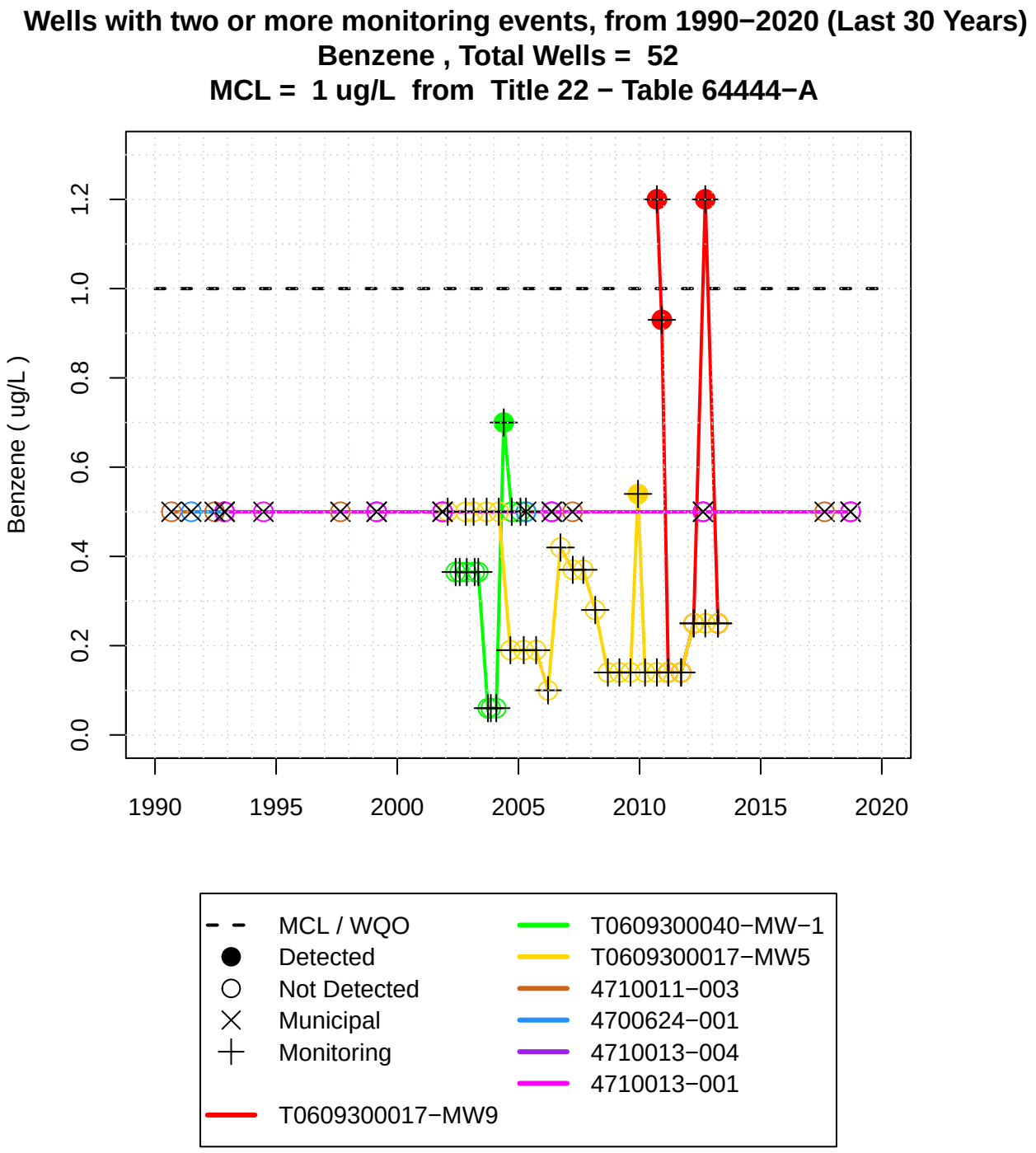

Figure 18: Filtered Groundwater Quality Observations of the Constituent Short List

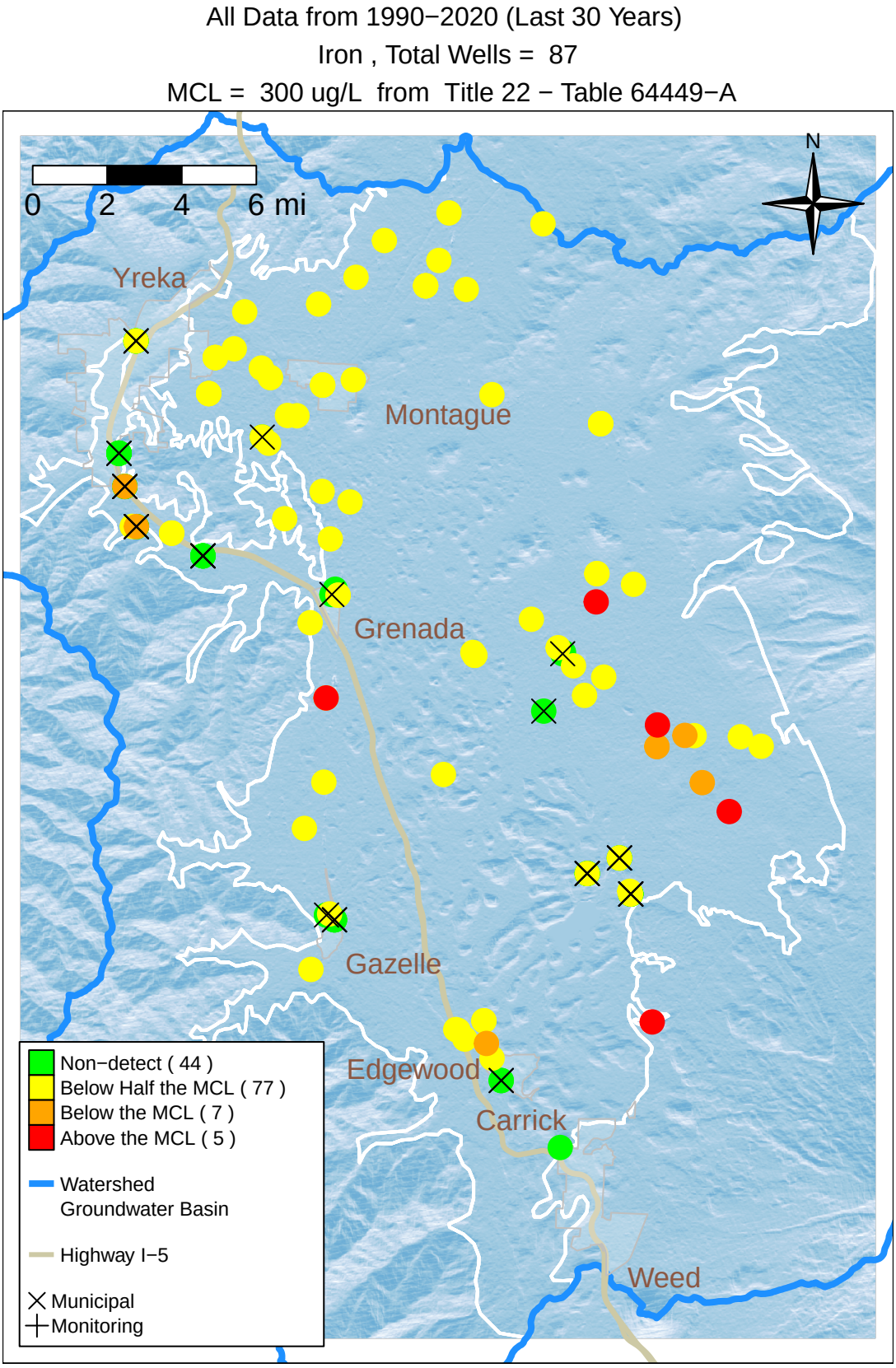

Figure 19: Groundwater Quality Observations of the Constituent Short List

Wells with two or more monitoring events, from 1990−2020 (Last 30 Years)
Iron , Total Wells = 24
MCL = 300 ug/L from Title 22 − Table 64449−A

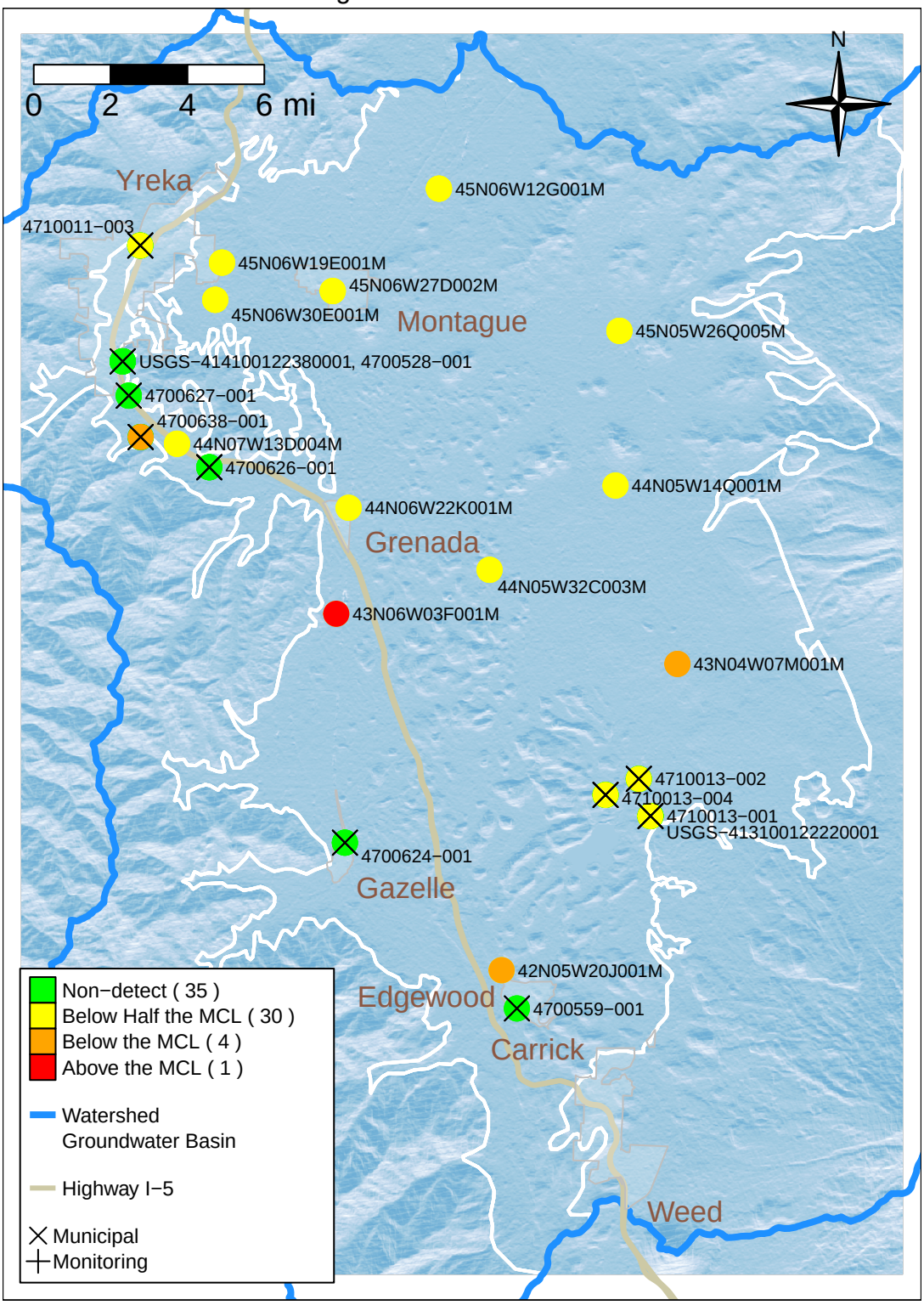

Figure 20: Filtered Groundwater Quality Observations of the Constituent Short List

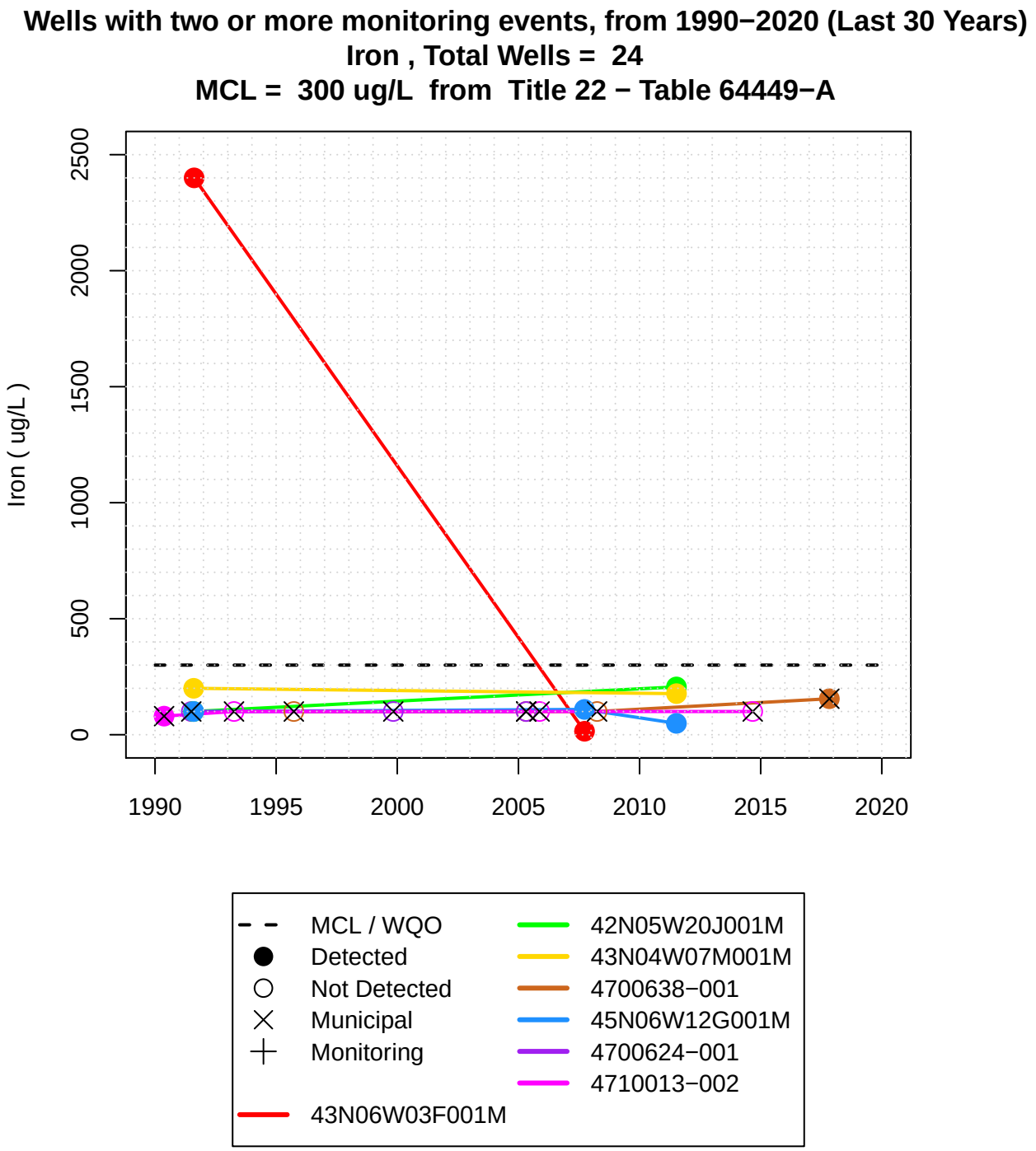

Figure 21: Filtered Groundwater Quality Observations of the Constituent Short List

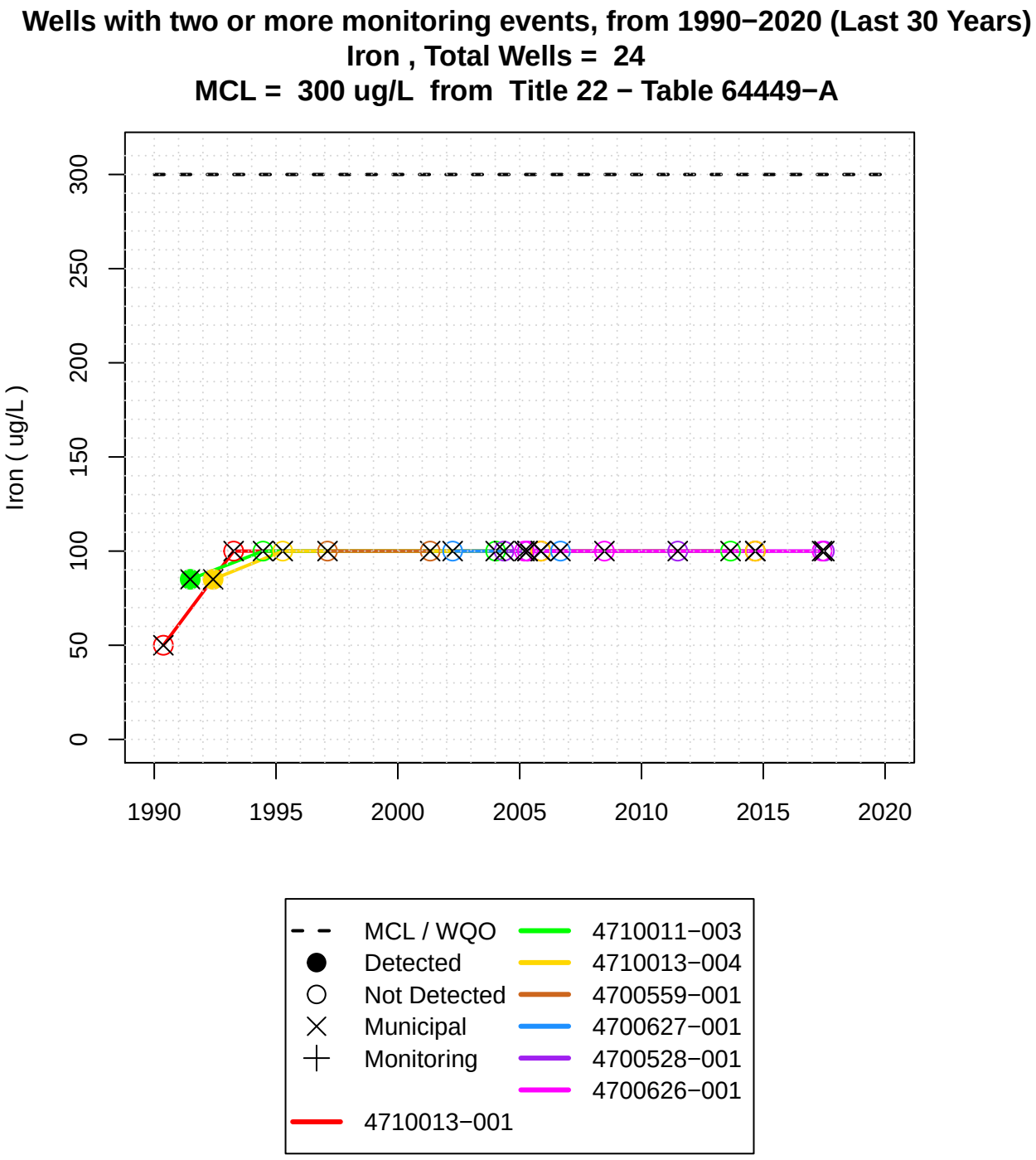

Figure 22: Filtered Groundwater Quality Observations of the Constituent Short List

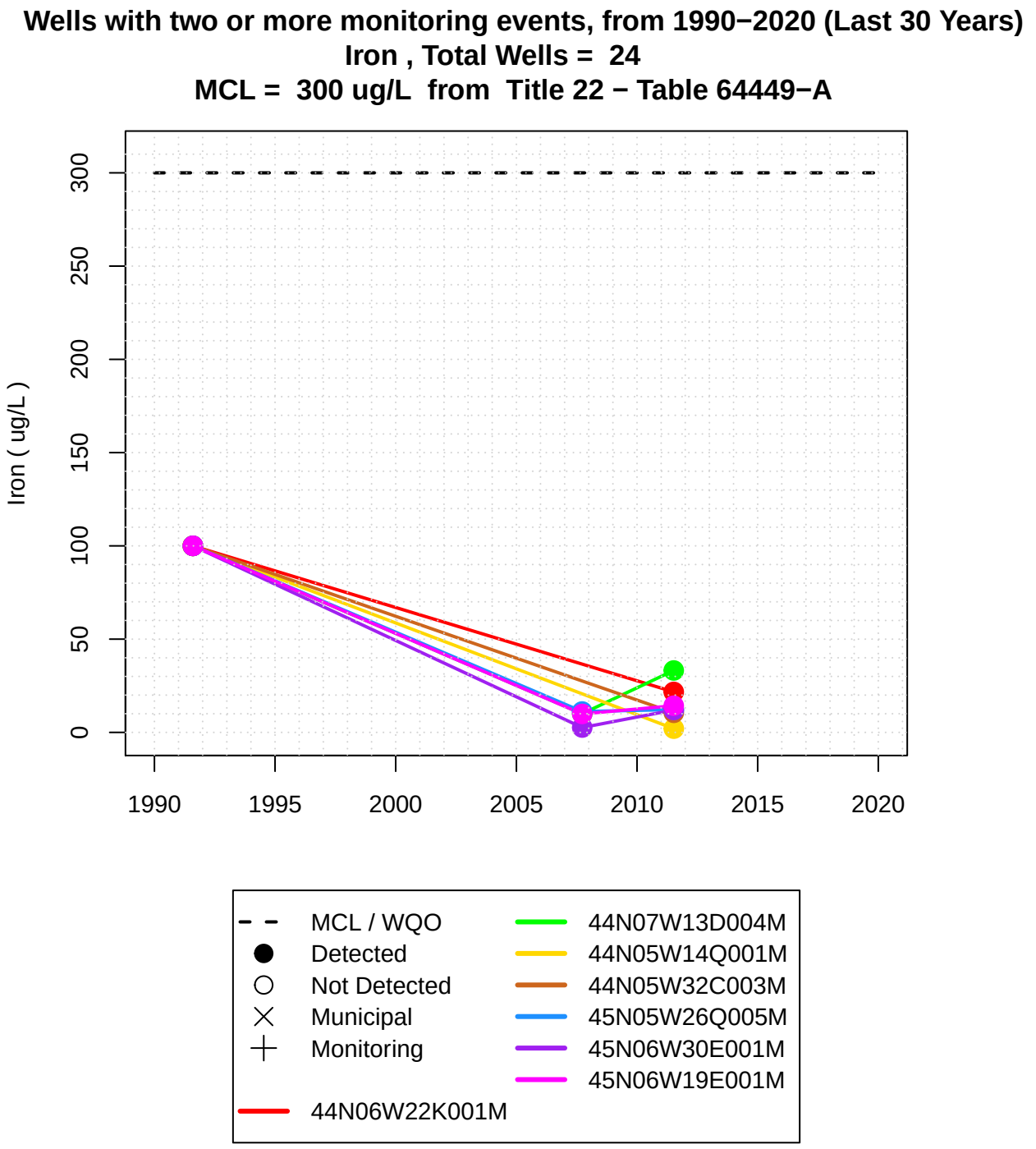

Figure 23: Filtered Groundwater Quality Observations of the Constituent Short List

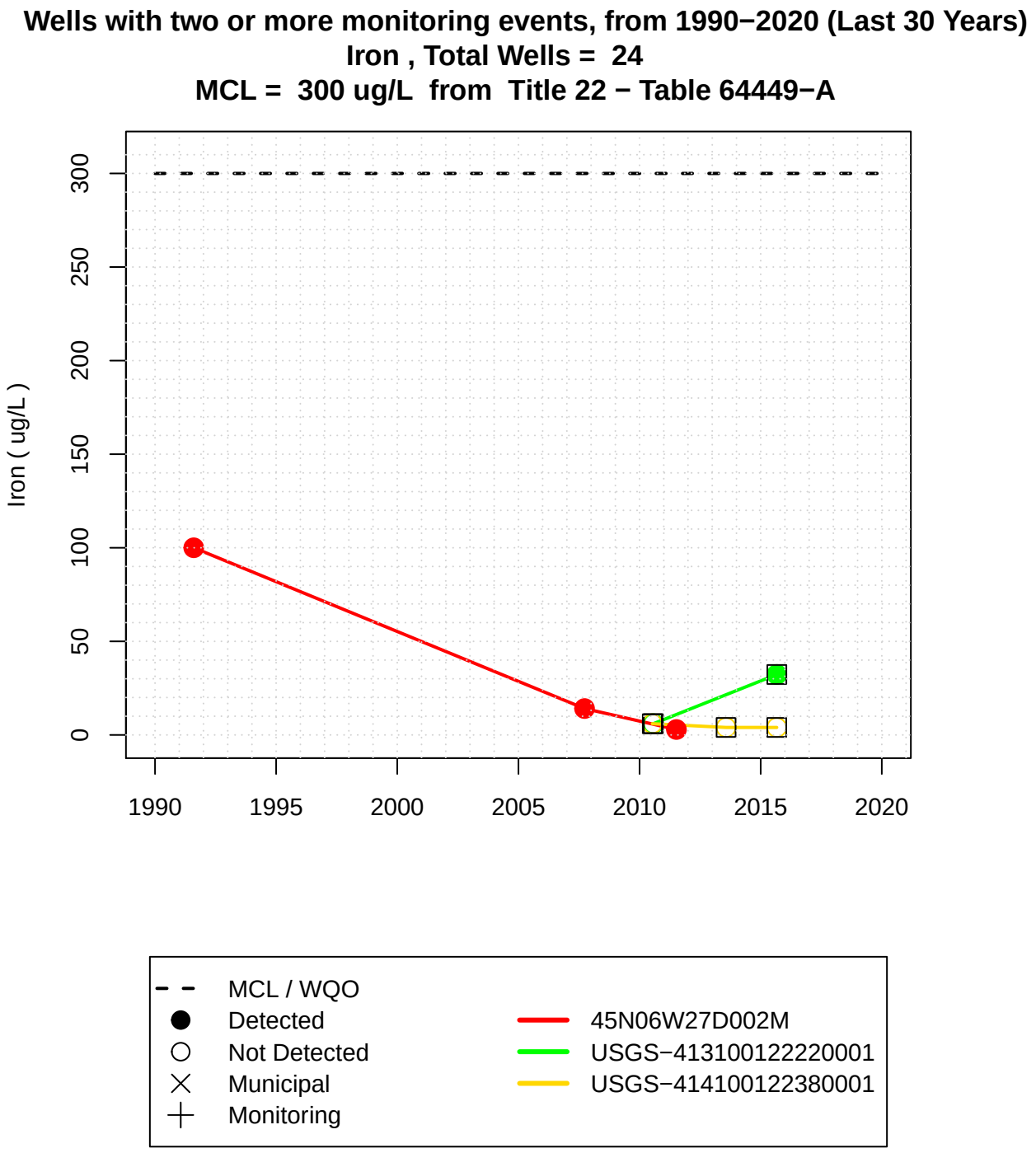

Figure 24: Filtered Groundwater Quality Observations of the Constituent Short List

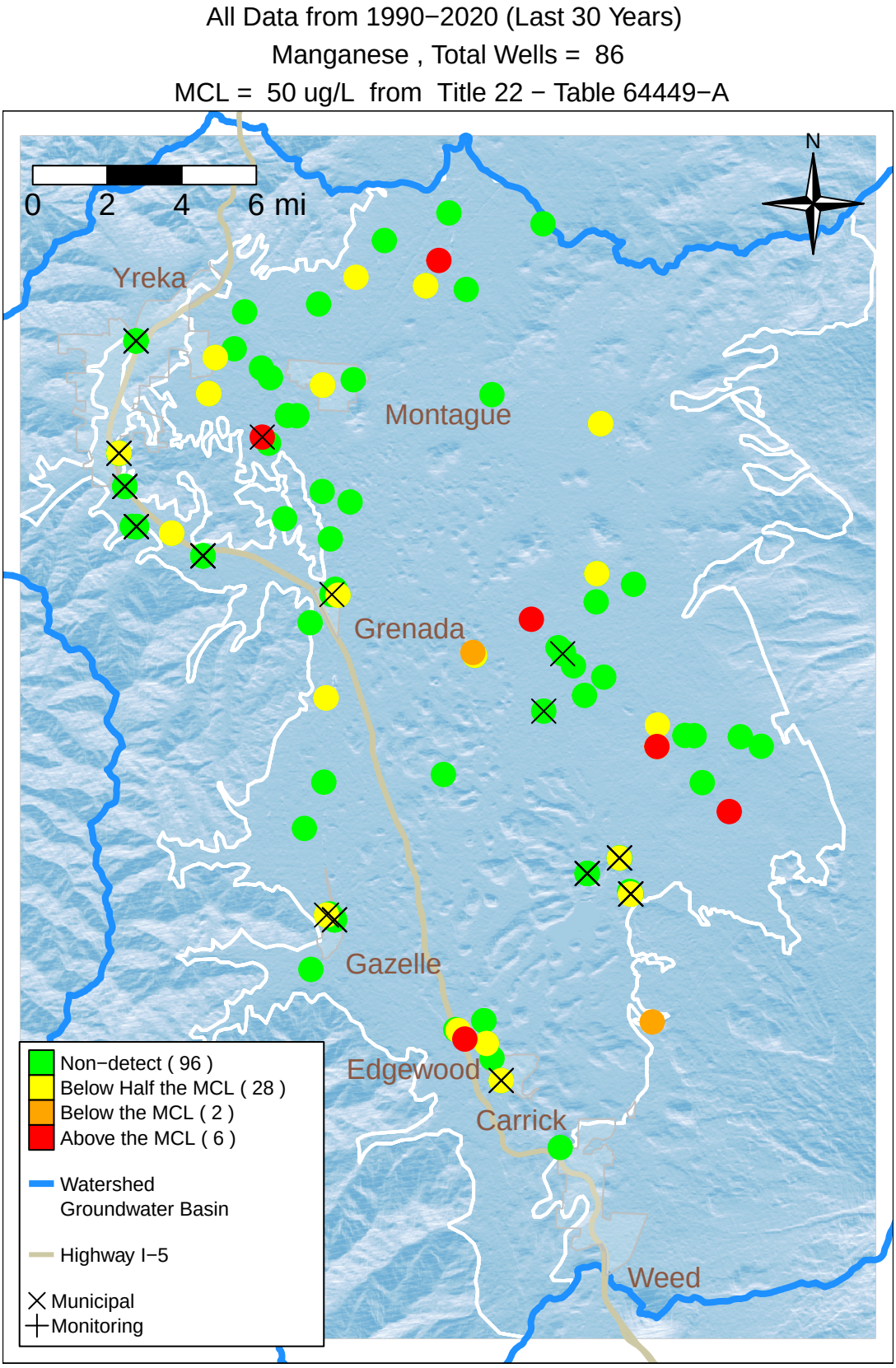

Figure 25: Groundwater Quality Observations of the Constituent Short List

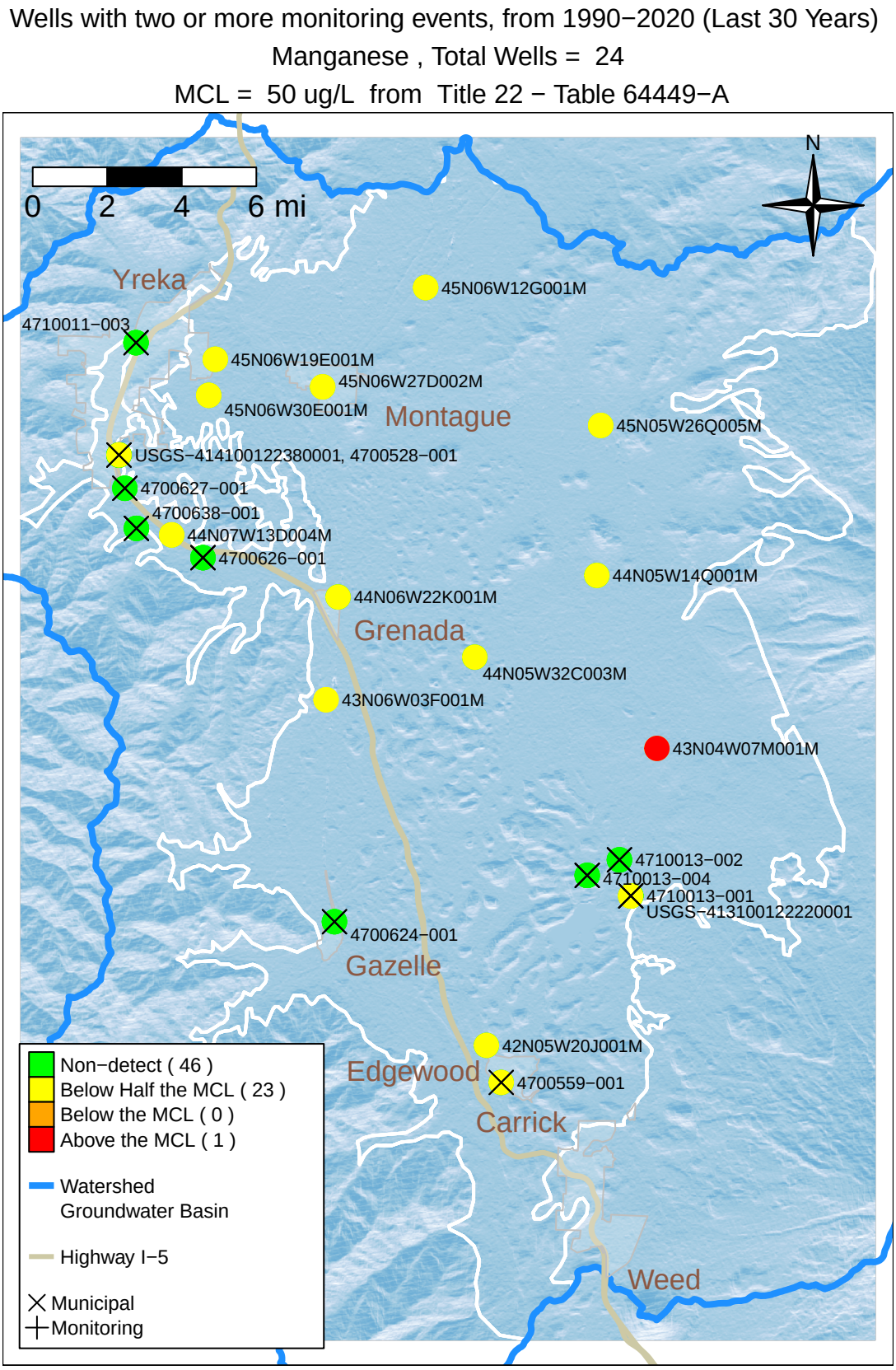

Figure 26: Filtered Groundwater Quality Observations of the Constituent Short List

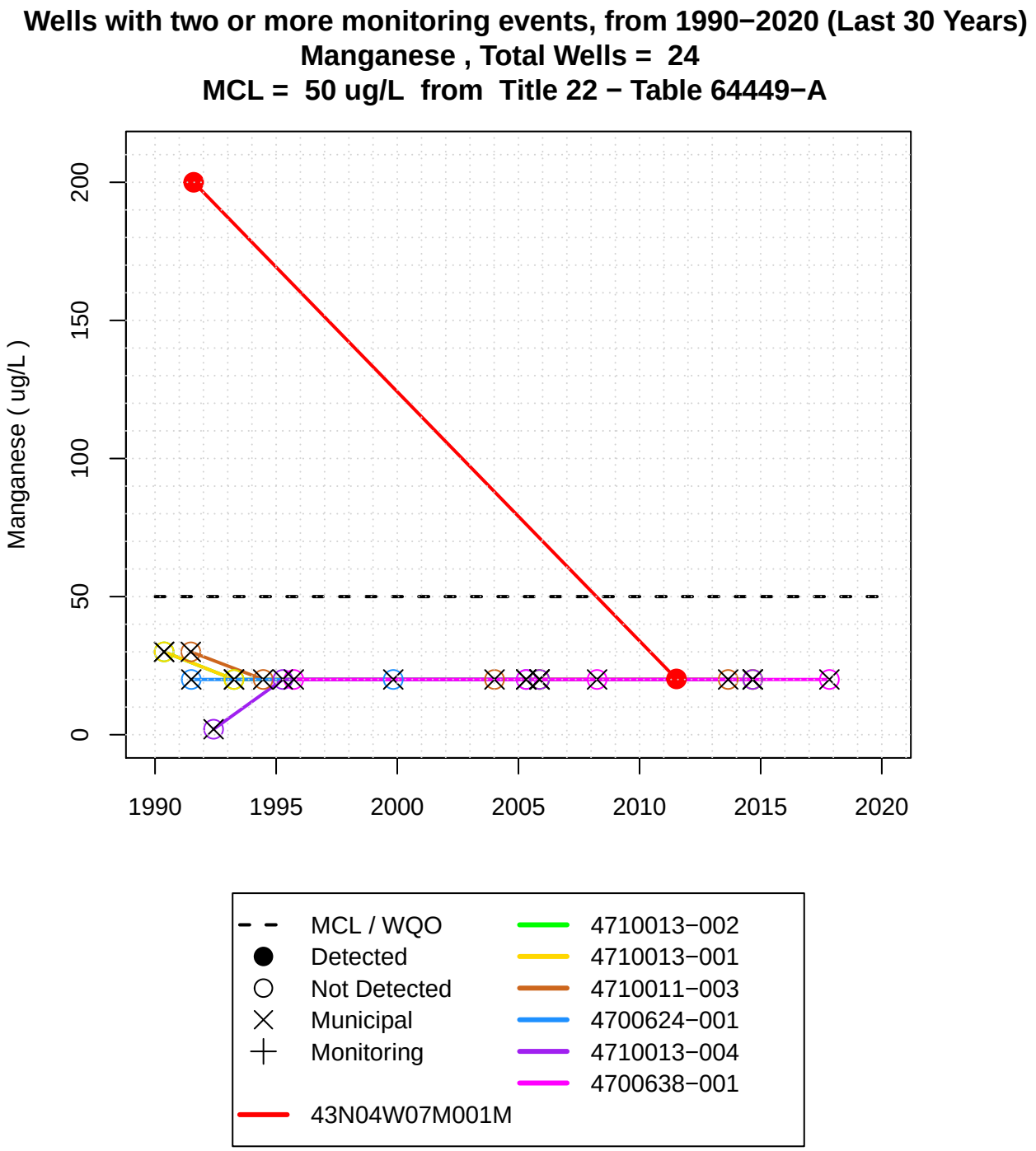

Figure 27: Filtered Groundwater Quality Observations of the Constituent Short List

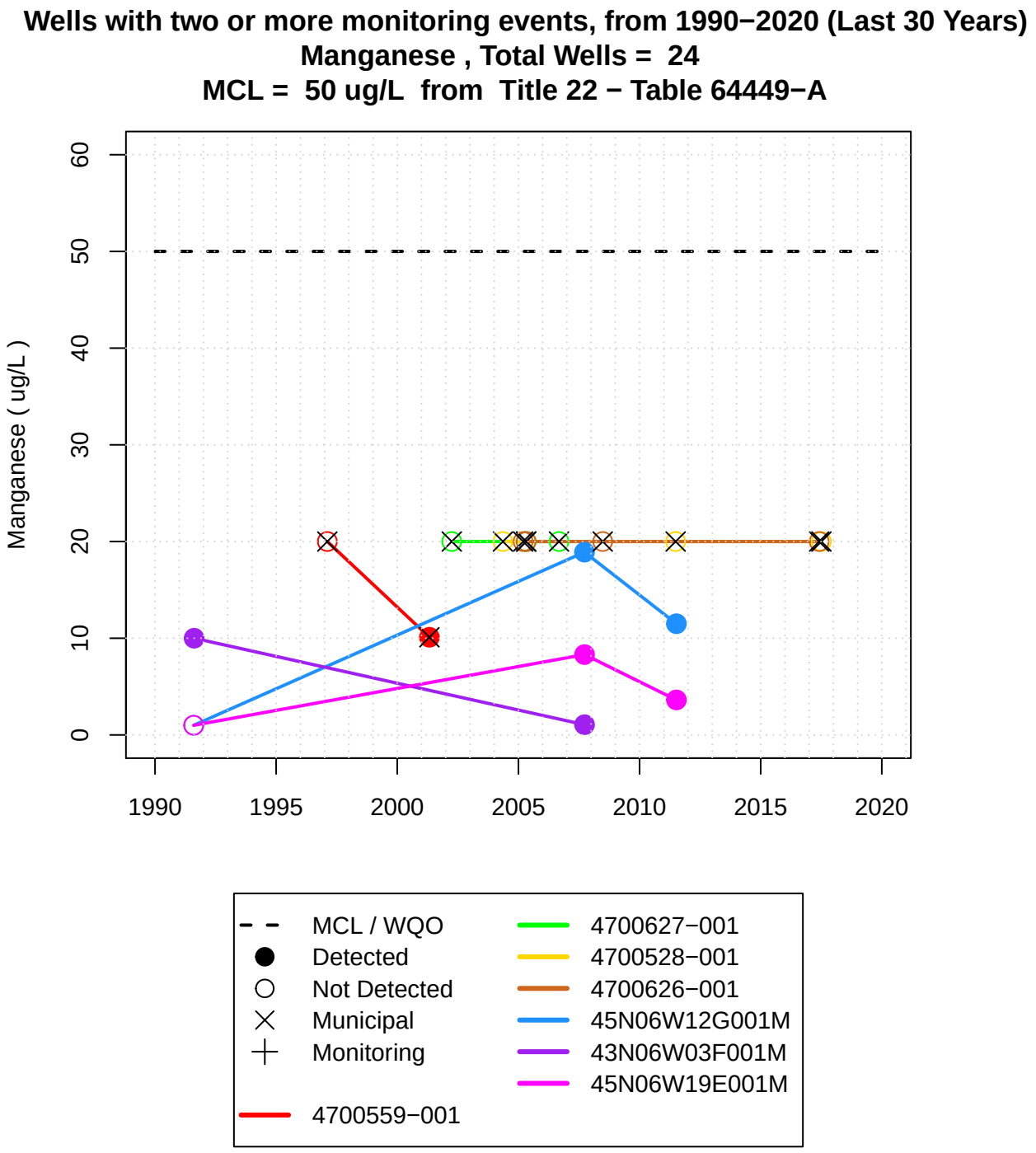

Figure 28: Filtered Groundwater Quality Observations of the Constituent Short List

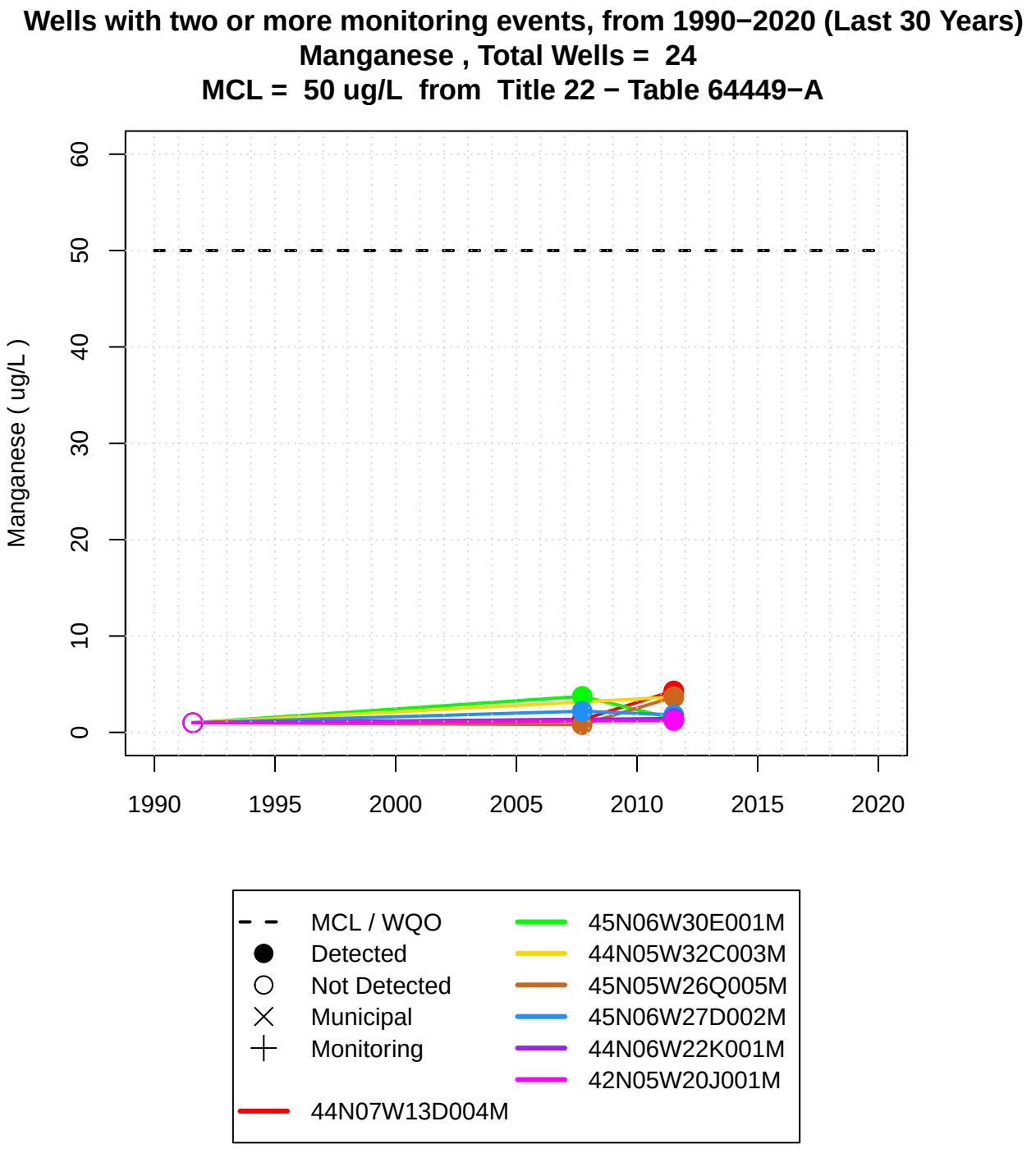

Figure 29: Filtered Groundwater Quality Observations of the Constituent Short List

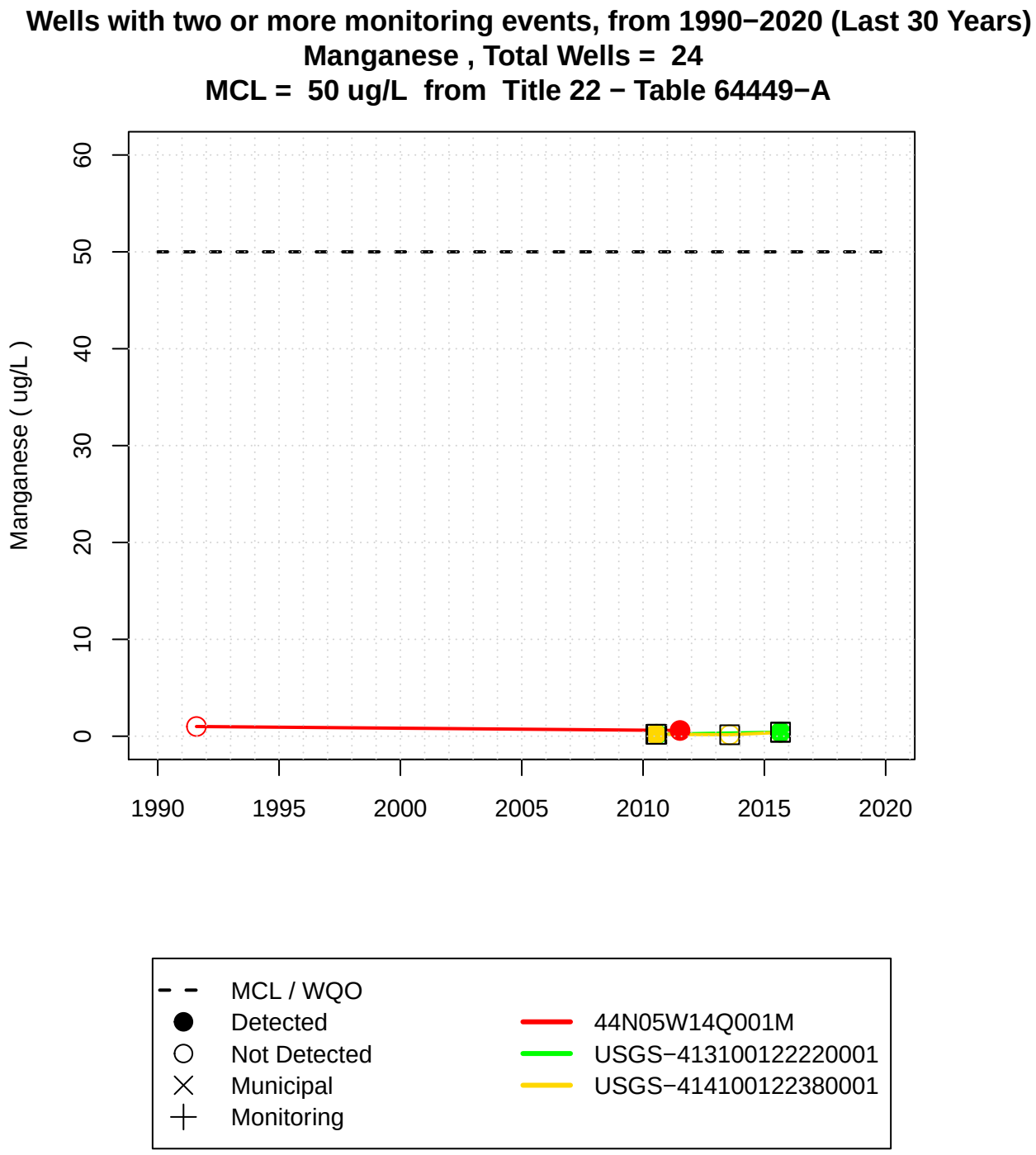

Figure 30: Filtered Groundwater Quality Observations of the Constituent Short List

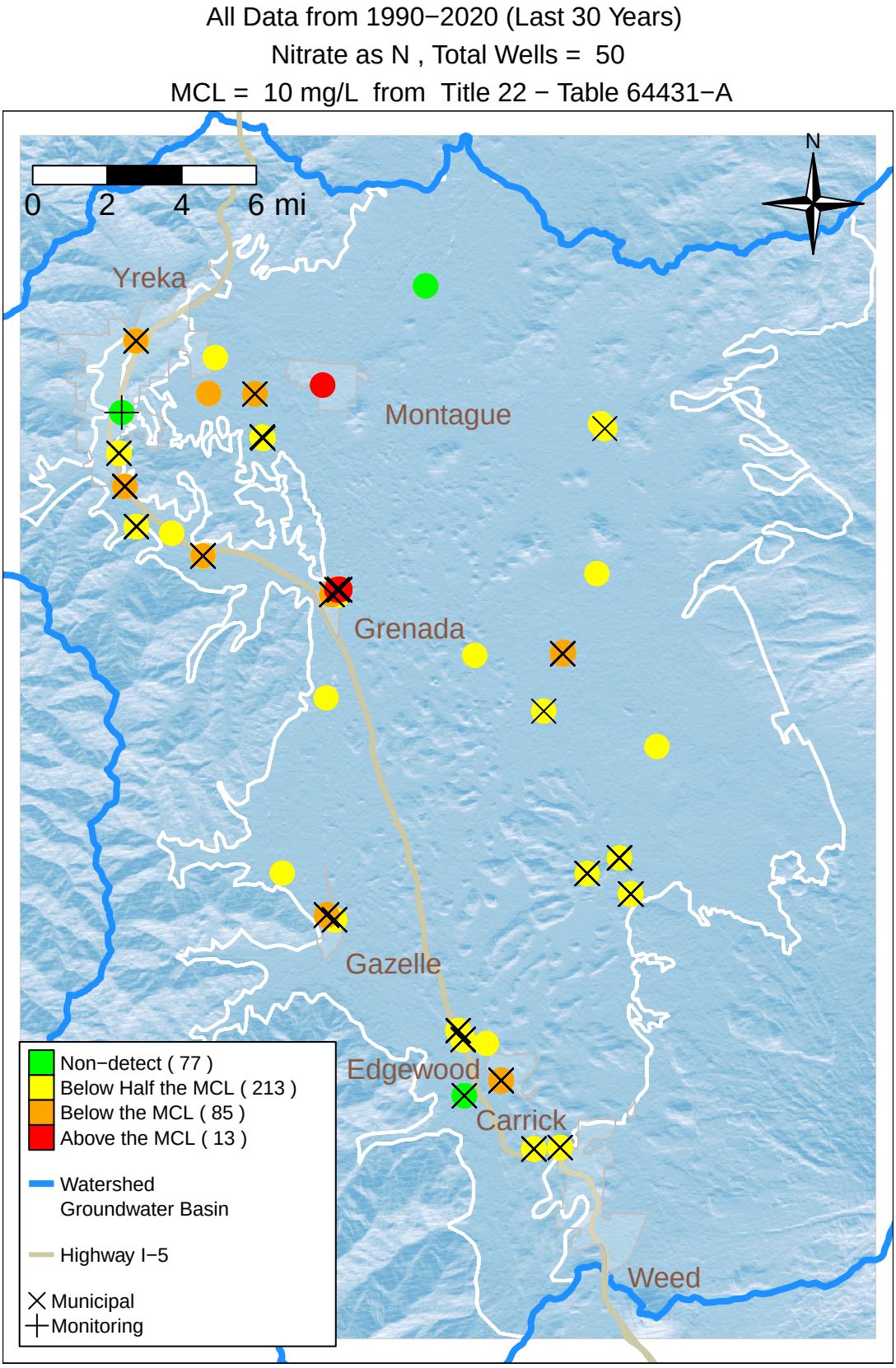

Figure 31: Groundwater Quality Observations of the Constituent Short List

Wells with two or more monitoring events, from 1990−2020 (Last 30 Years)
Nitrate as N , Total Wells = 31
MCL = 10 mg/L from Title 22 − Table 64431−A

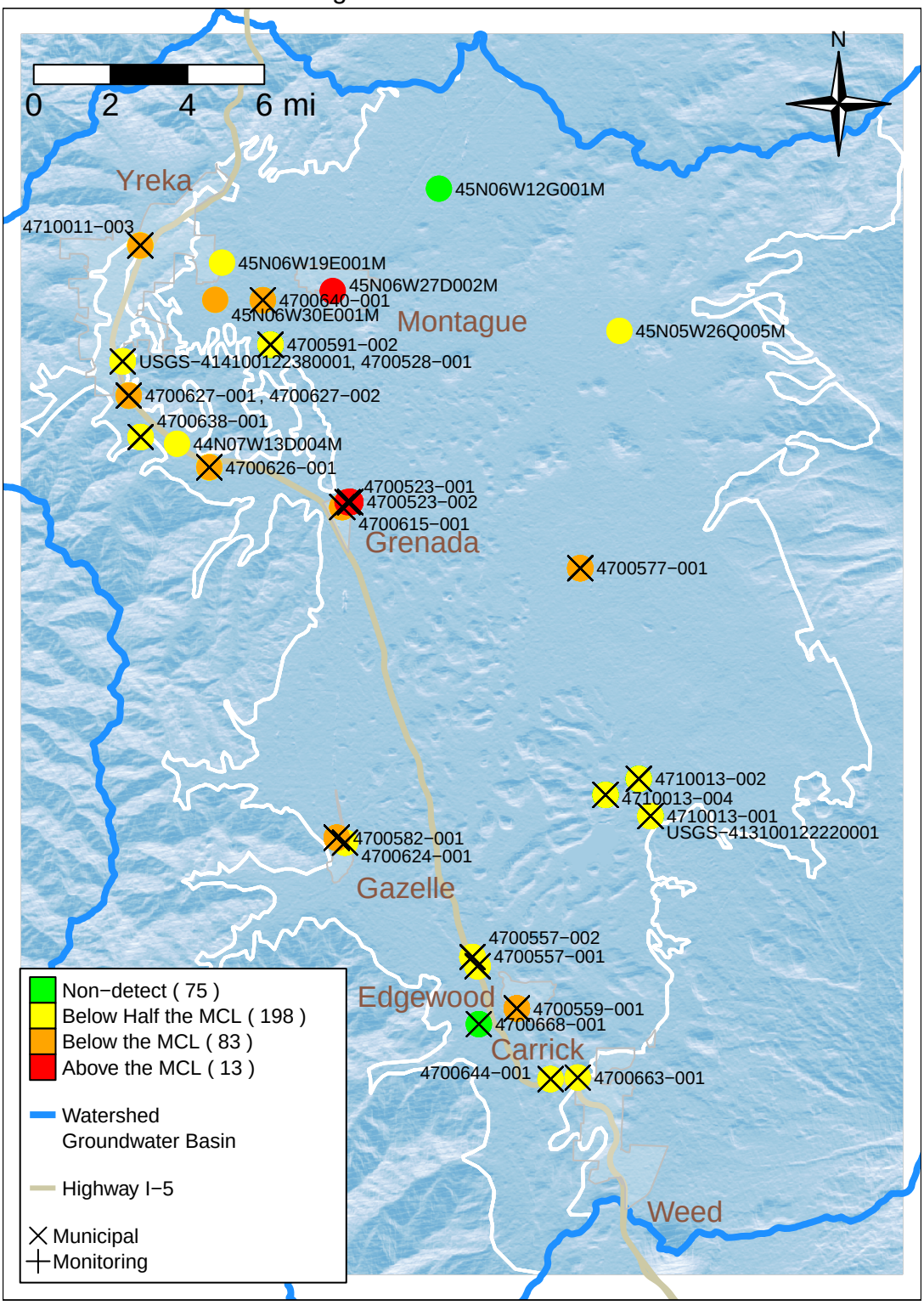

Figure 32: Filtered Groundwater Quality Observations of the Constituent Short List

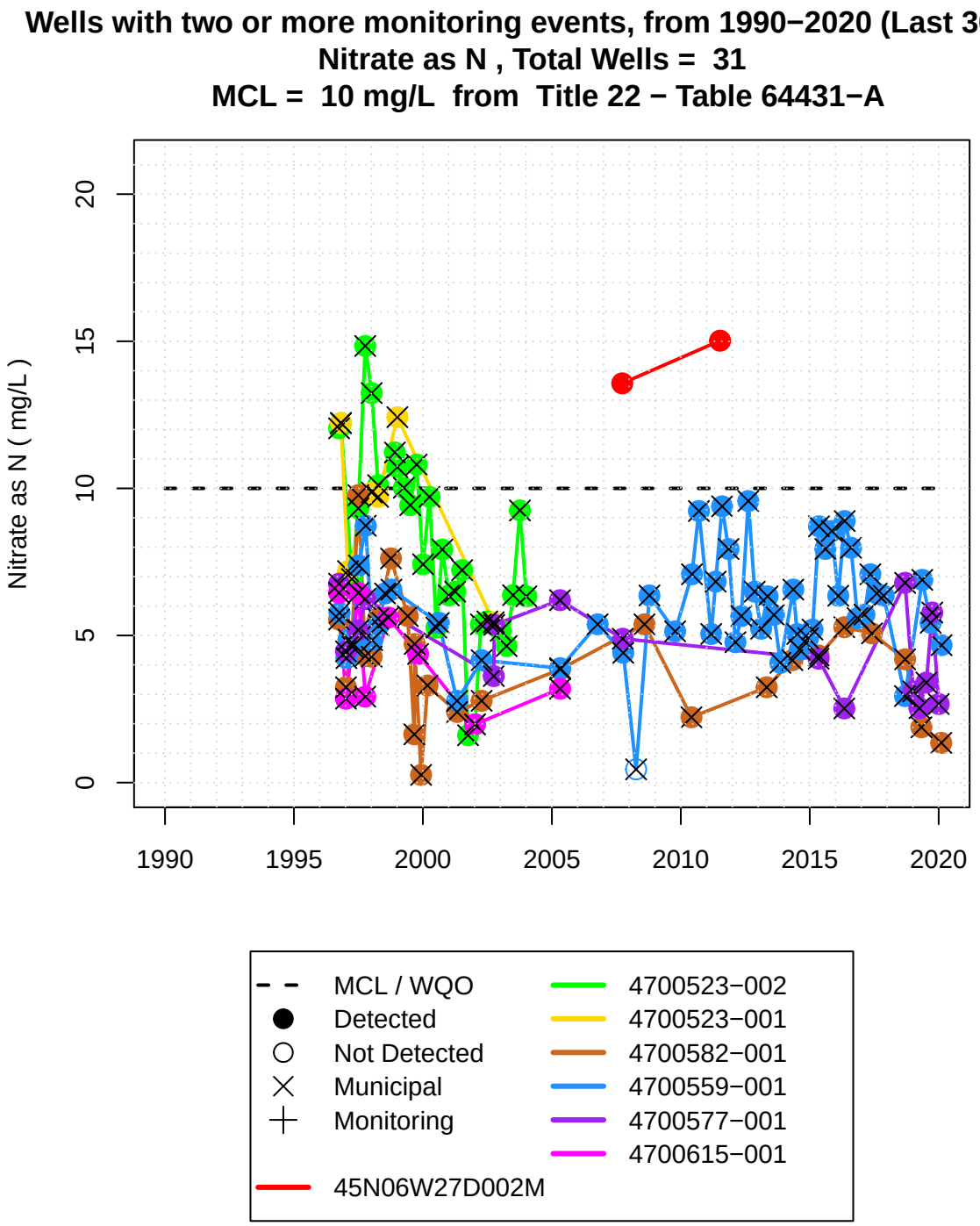

Figure 33: Filtered Groundwater Quality Observations of the Constituent Short List

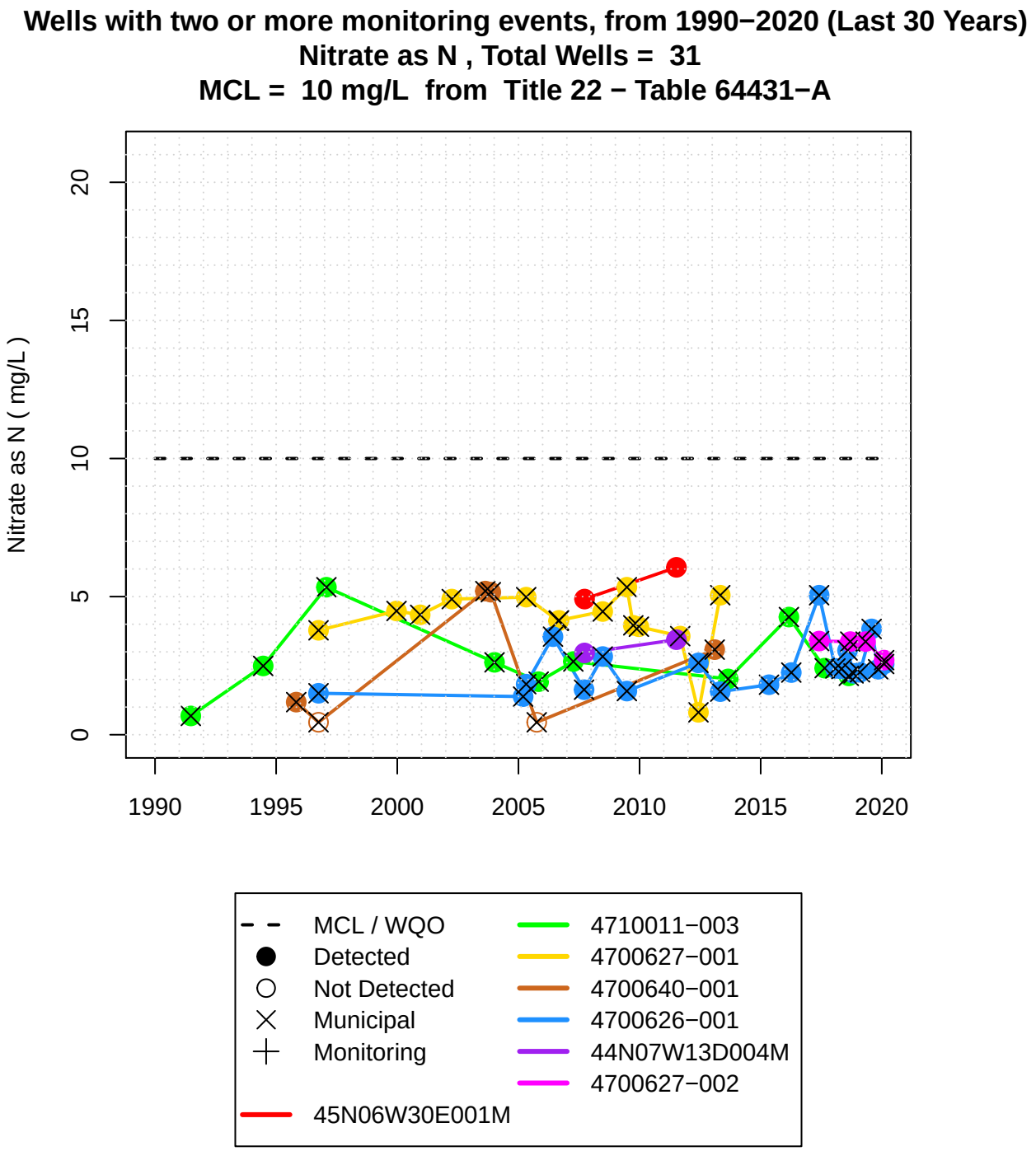

Figure 34: Filtered Groundwater Quality Observations of the Constituent Short List

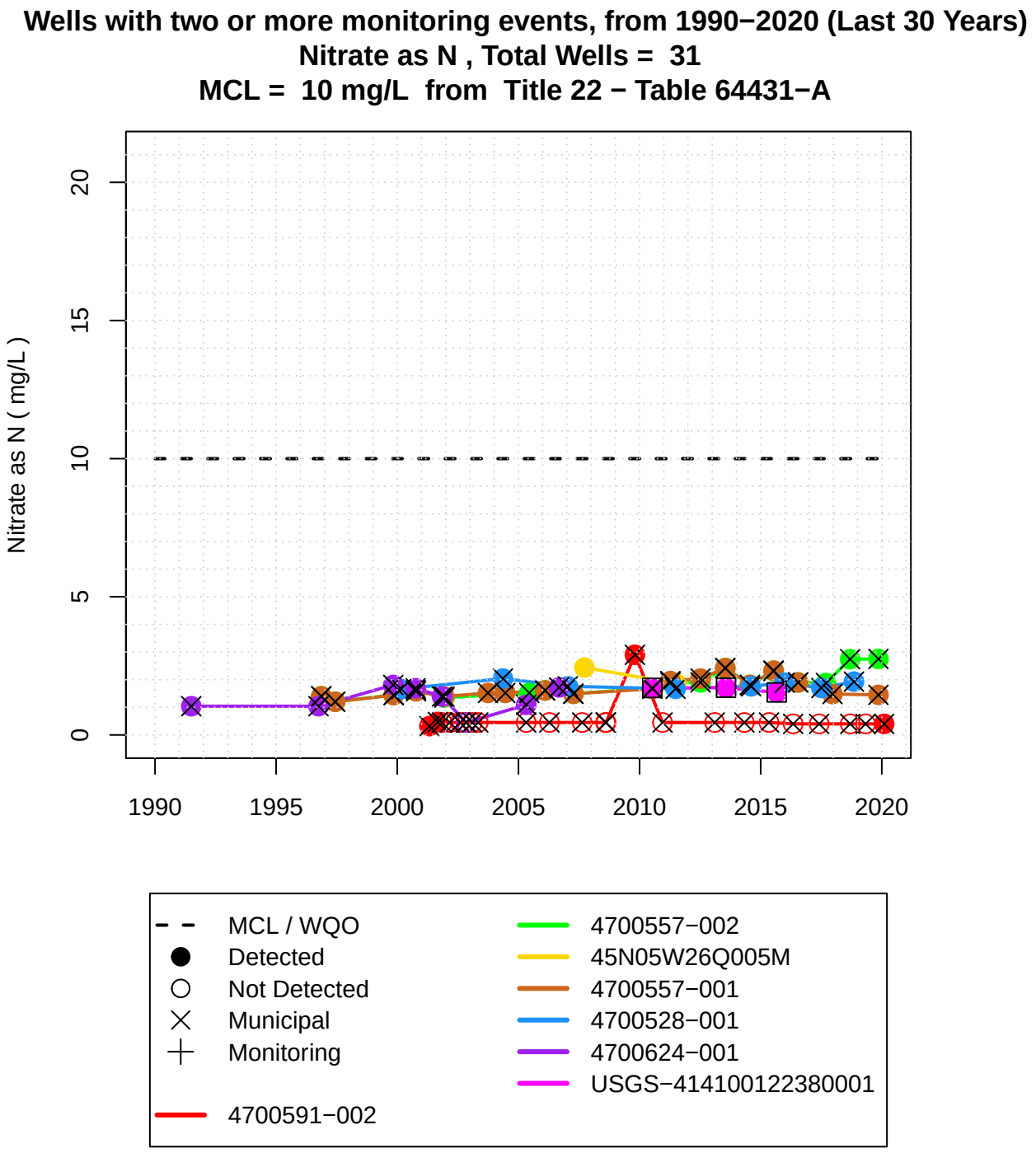

Figure 35: Filtered Groundwater Quality Observations of the Constituent Short List

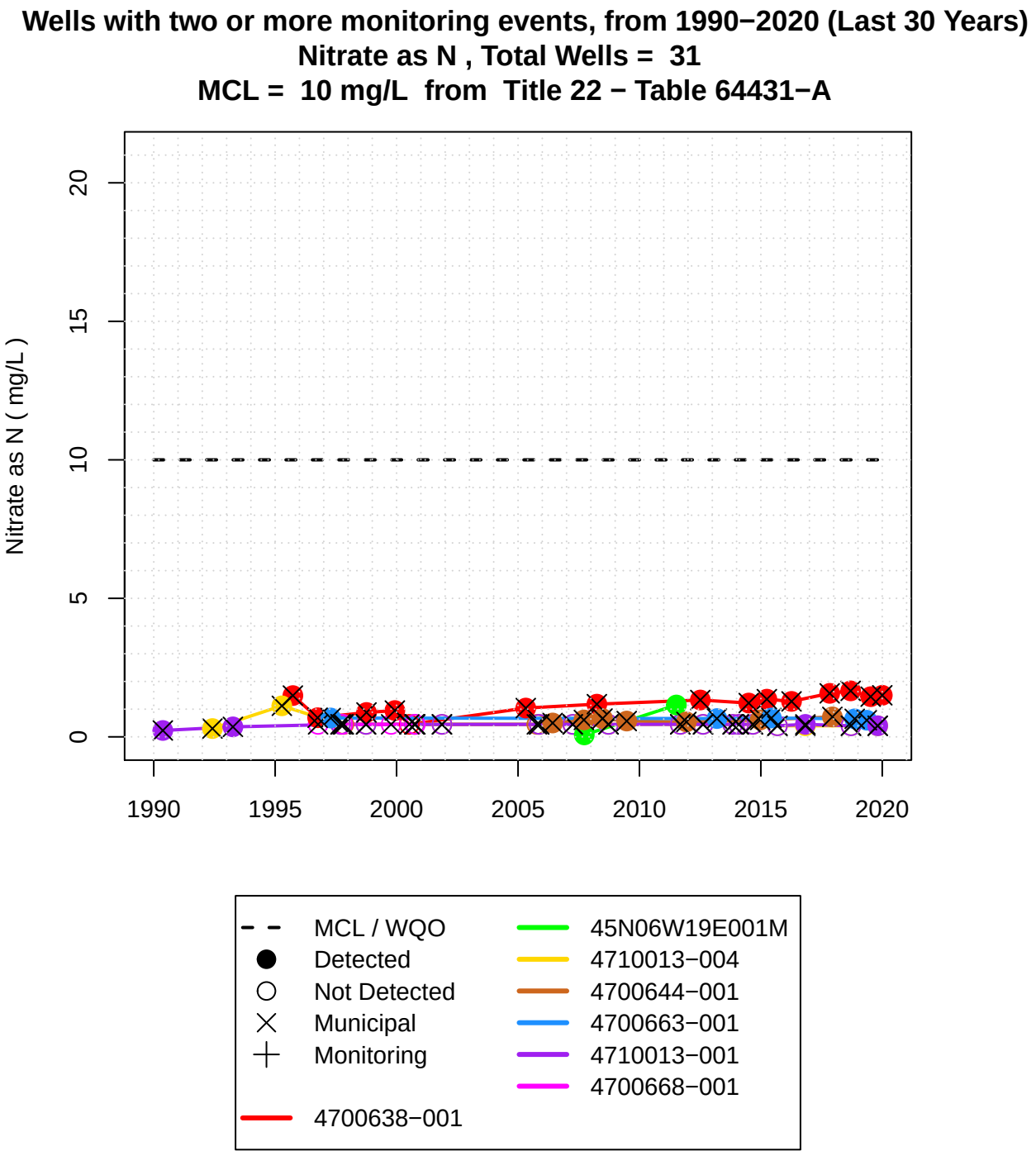

Figure 36: Filtered Groundwater Quality Observations of the Constituent Short List

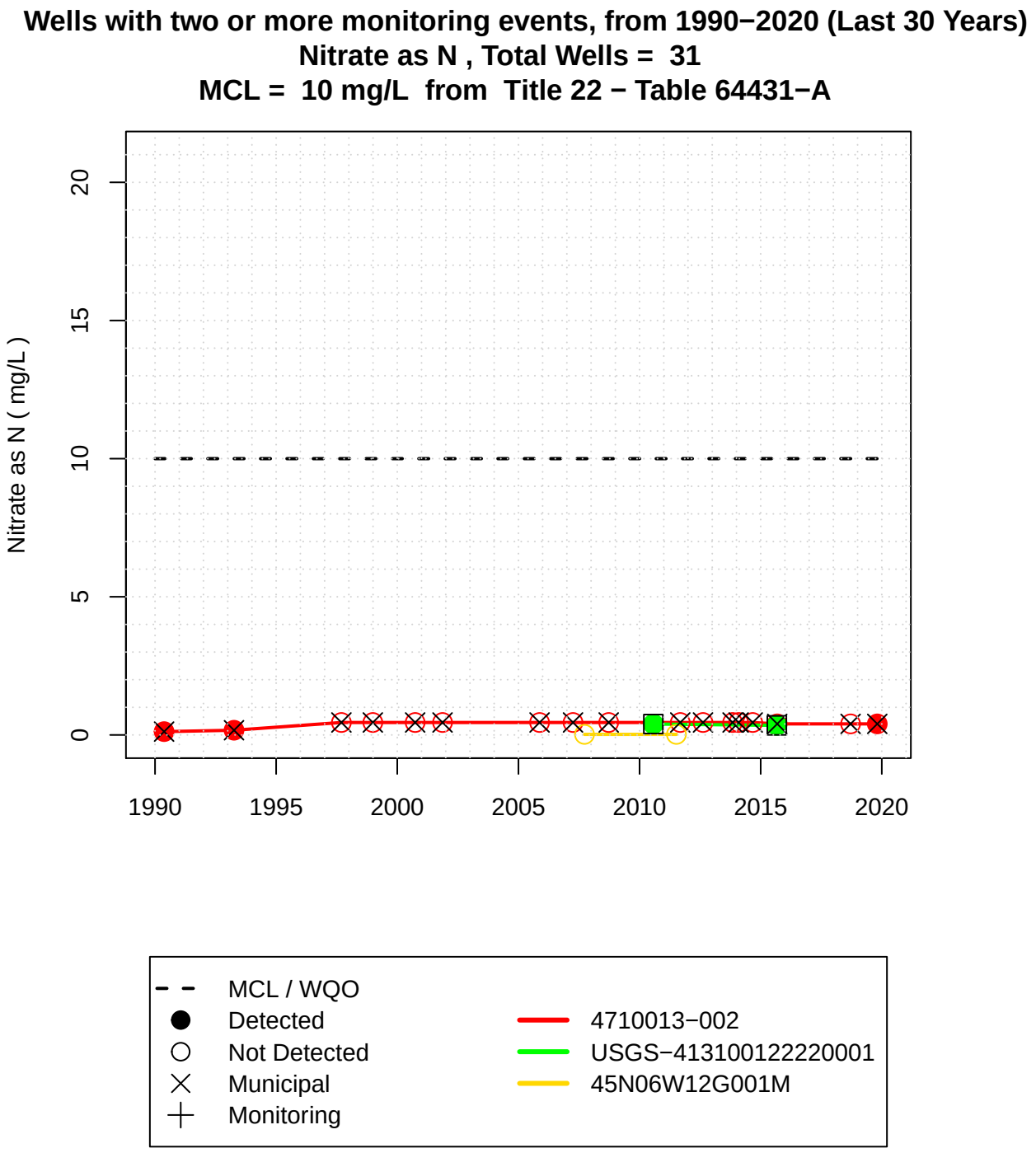

Figure 37: Filtered Groundwater Quality Observations of the Constituent Short List

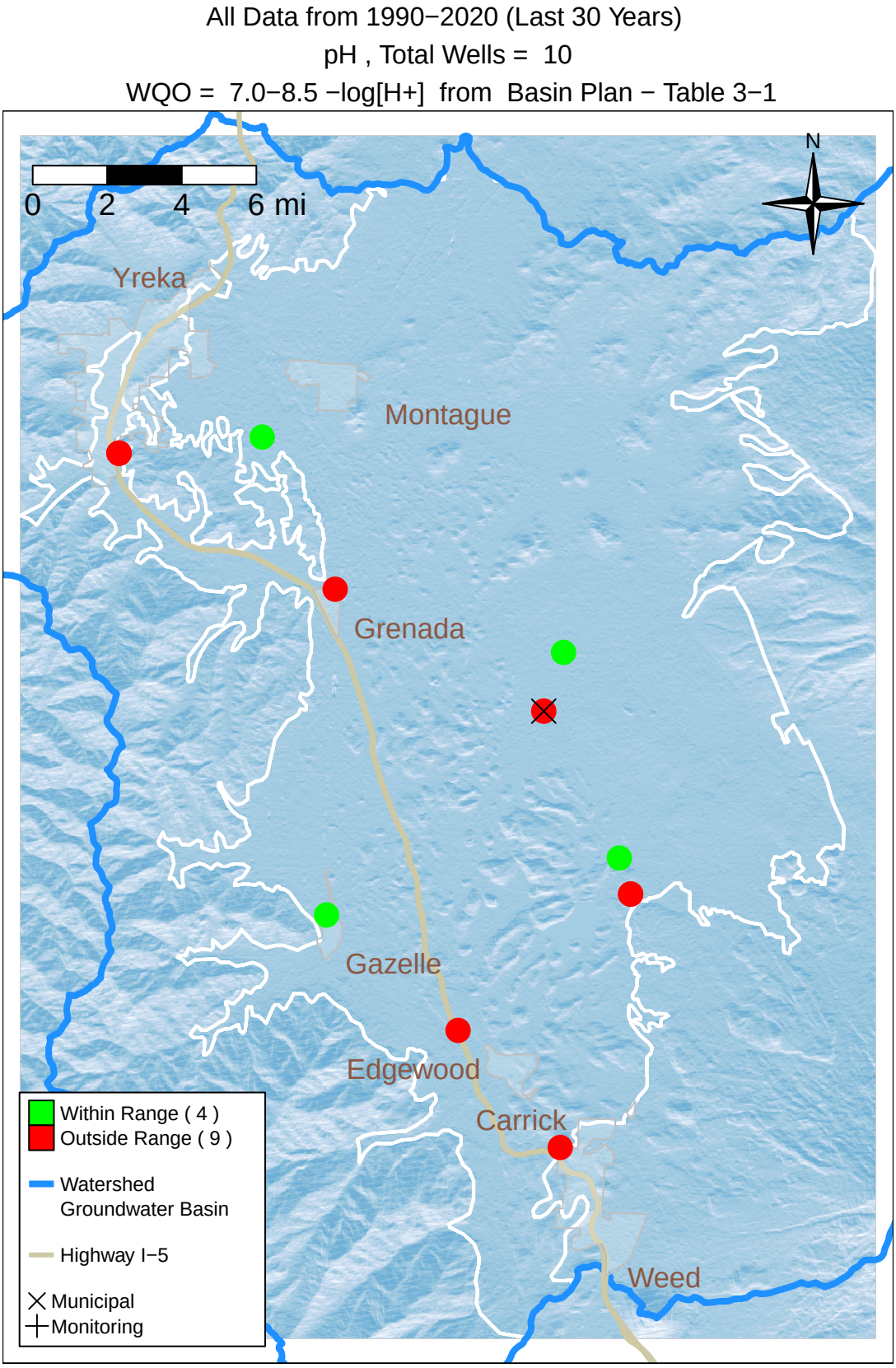

Figure 38: Groundwater Quality Observations of the Constituent Short List

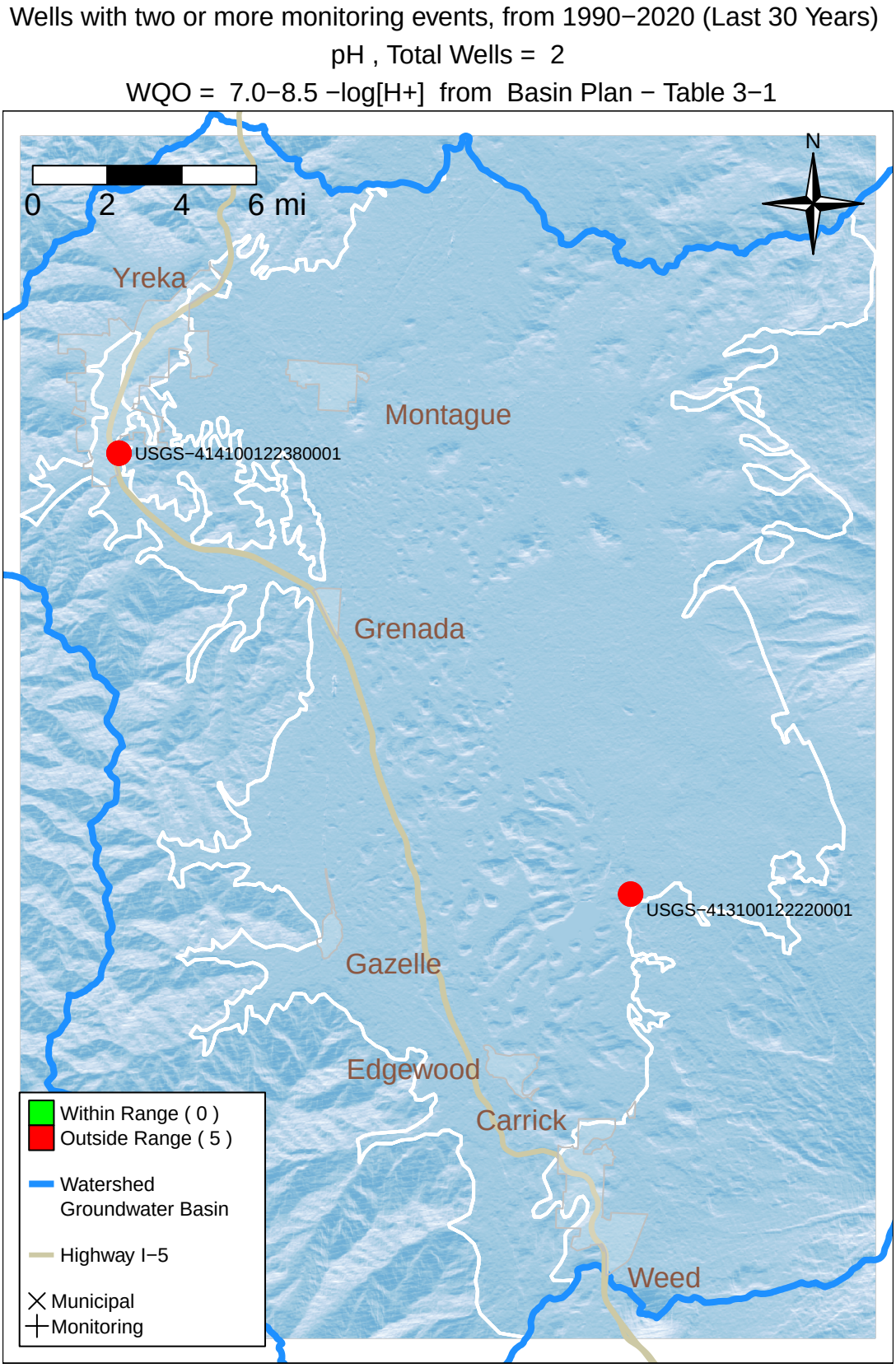

Figure 39: Filtered Groundwater Quality Observations of the Constituent Short List

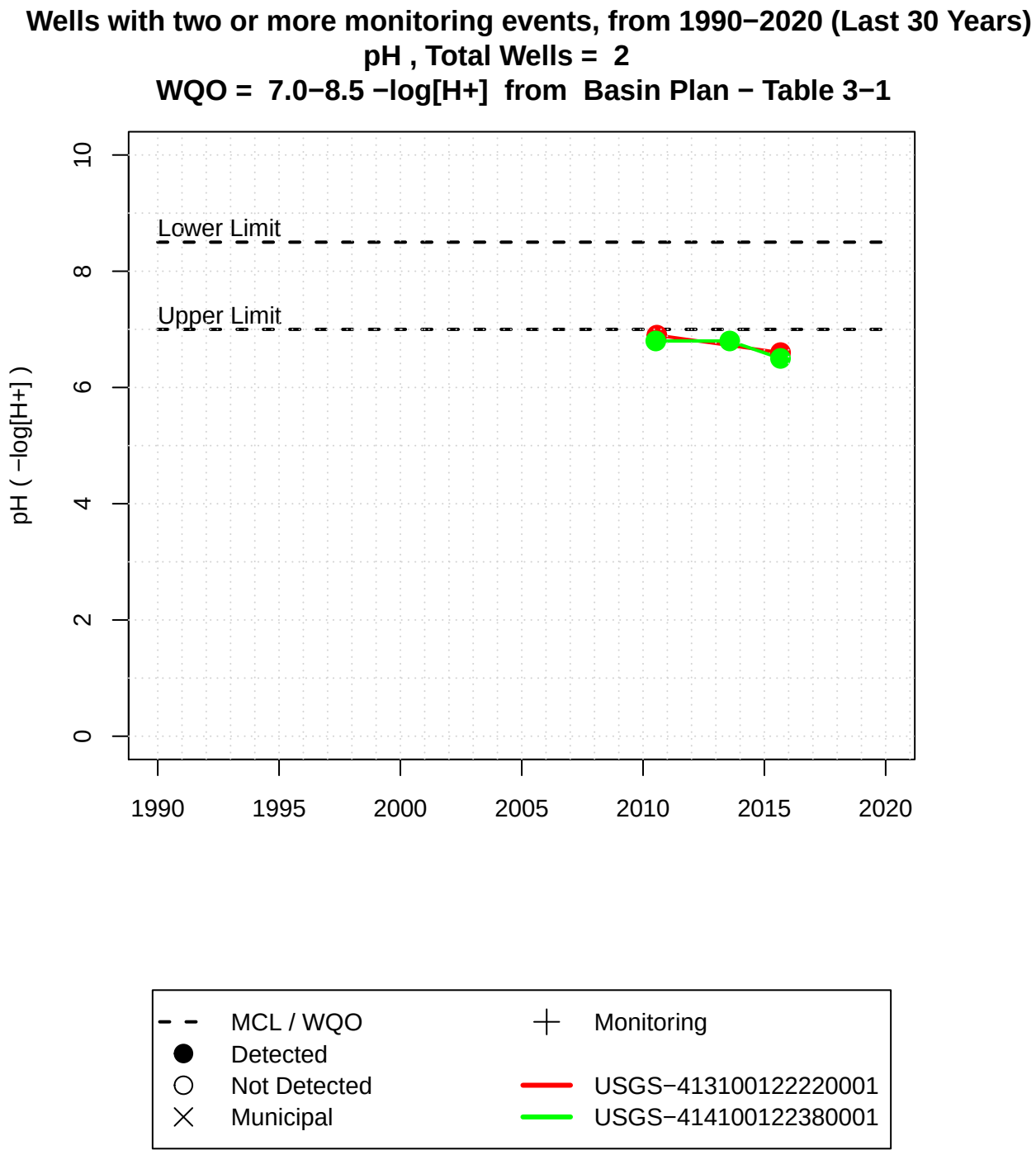

Figure 40: Filtered Groundwater Quality Observations of the Constituent Short List

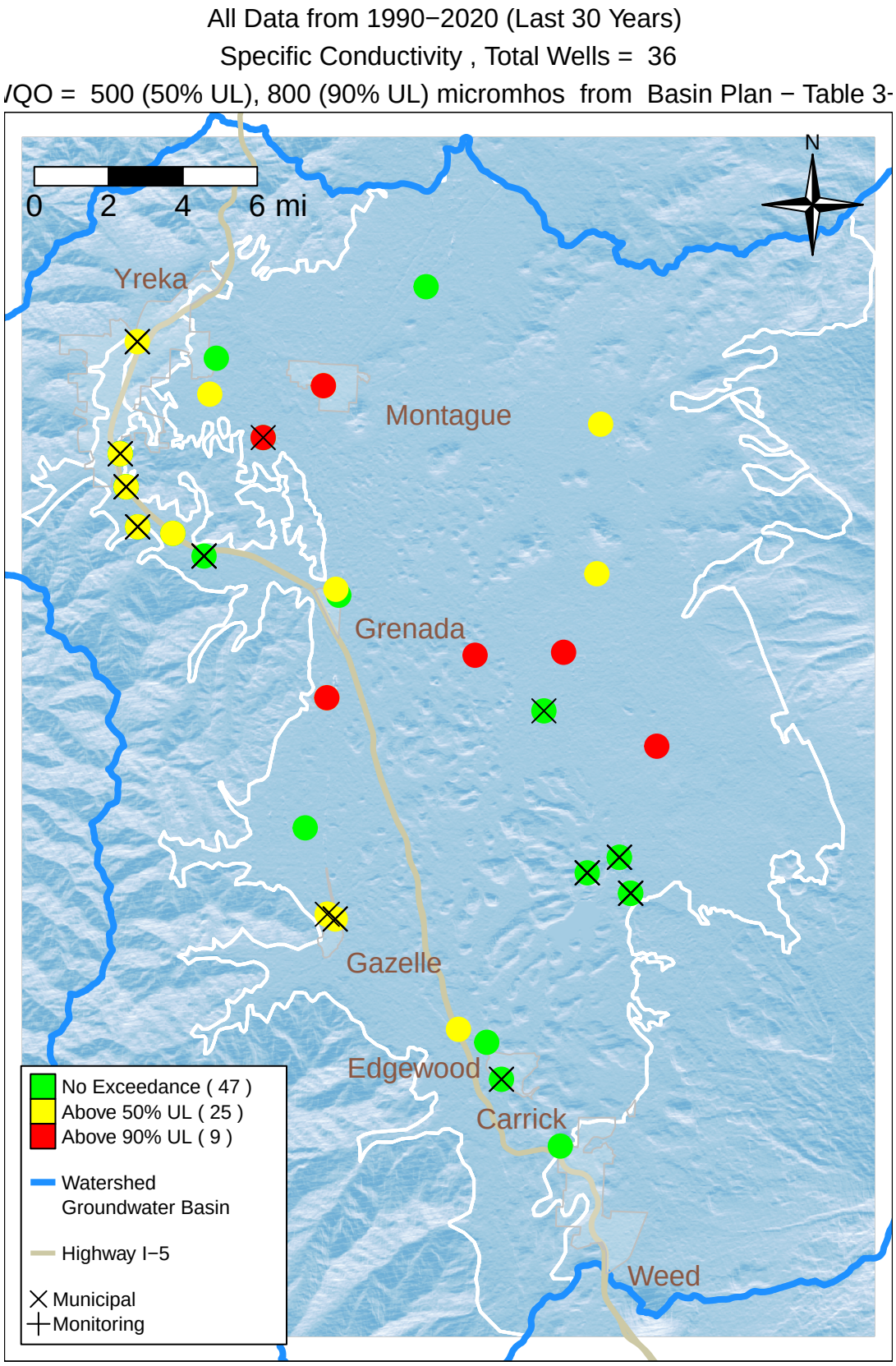

Figure 41: Groundwater Quality Observations of the Constituent Short List

Wells with two or more monitoring events, from 1990−2020 (Last 30 Years)
Specific Conductivity , Total Wells = 24
/QO = 500 (50% UL), 800 (90% UL) micromhos from Basin Plan − Table 3-

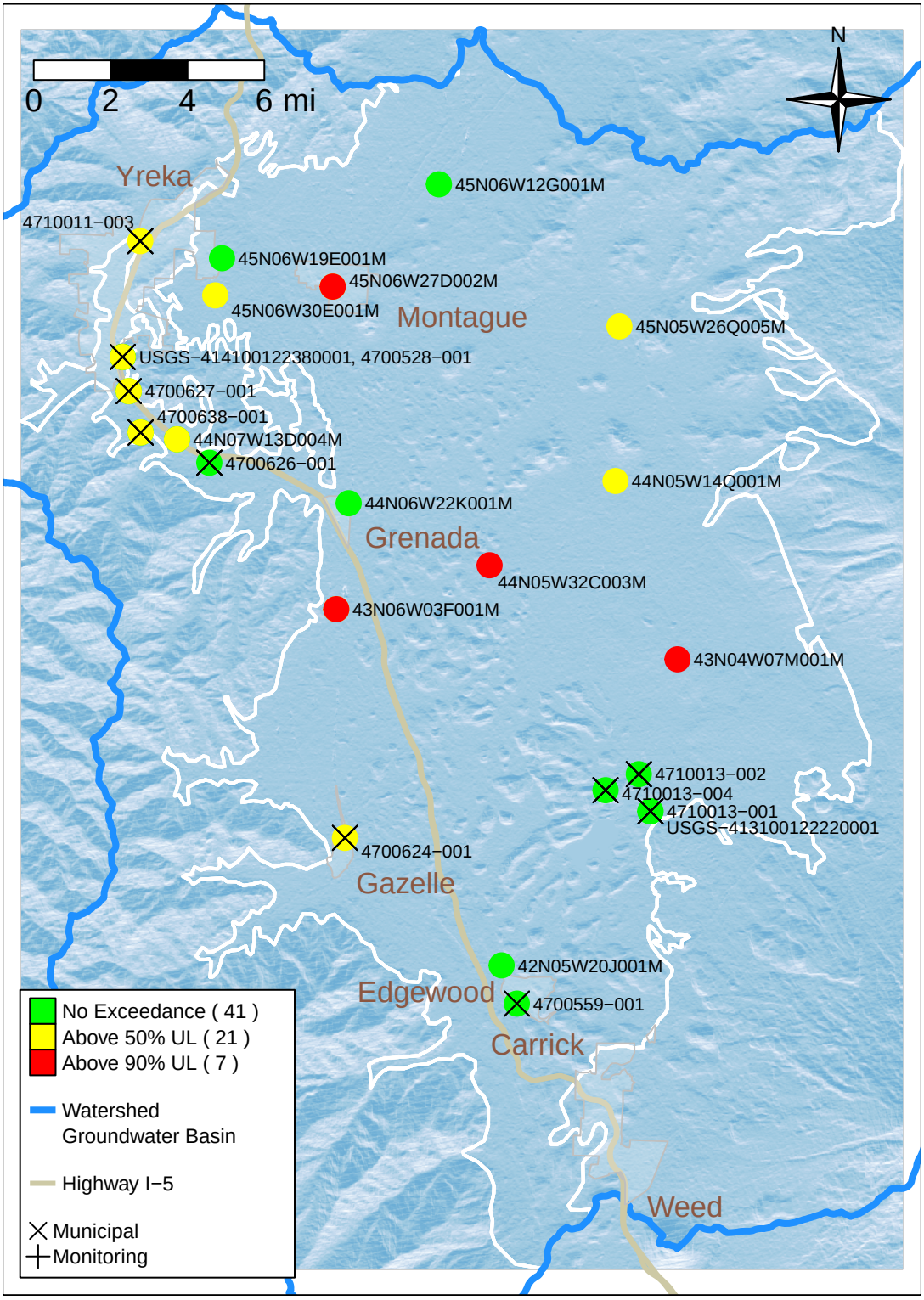

Figure 42: Filtered Groundwater Quality Observations of the Constituent Short List

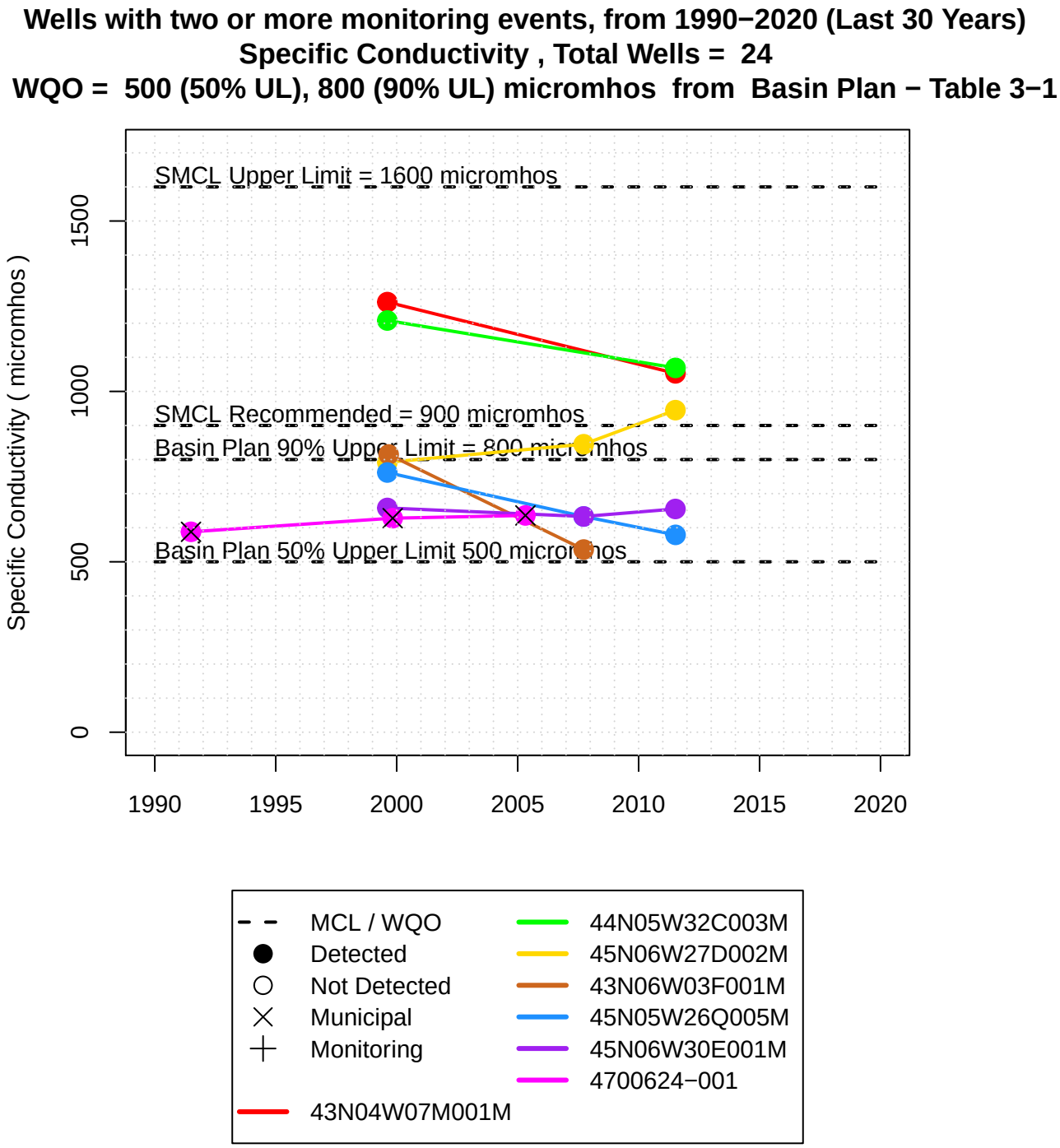

Figure 43: Filtered Groundwater Quality Observations of the Constituent Short List

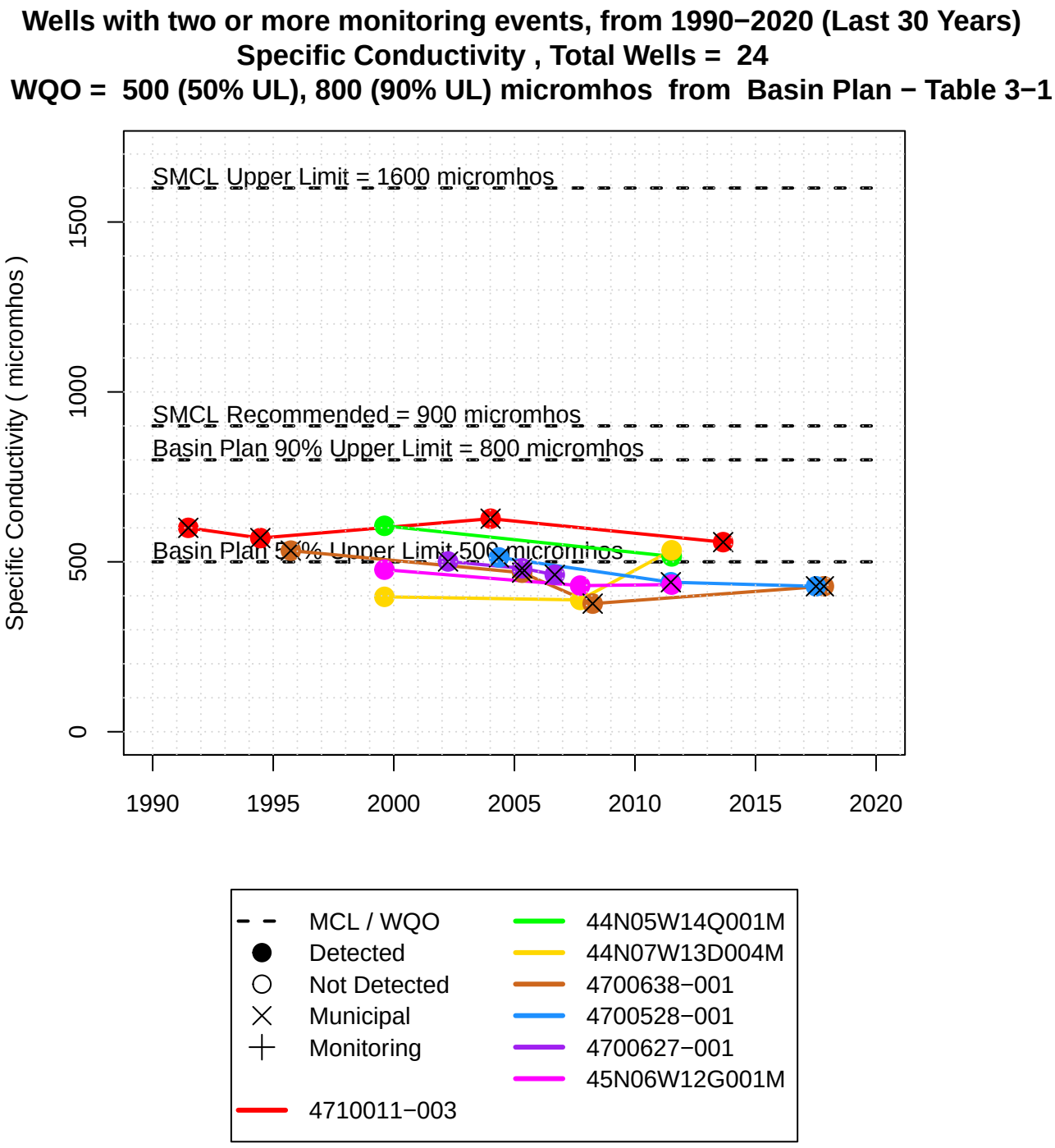

Figure 44: Filtered Groundwater Quality Observations of the Constituent Short List

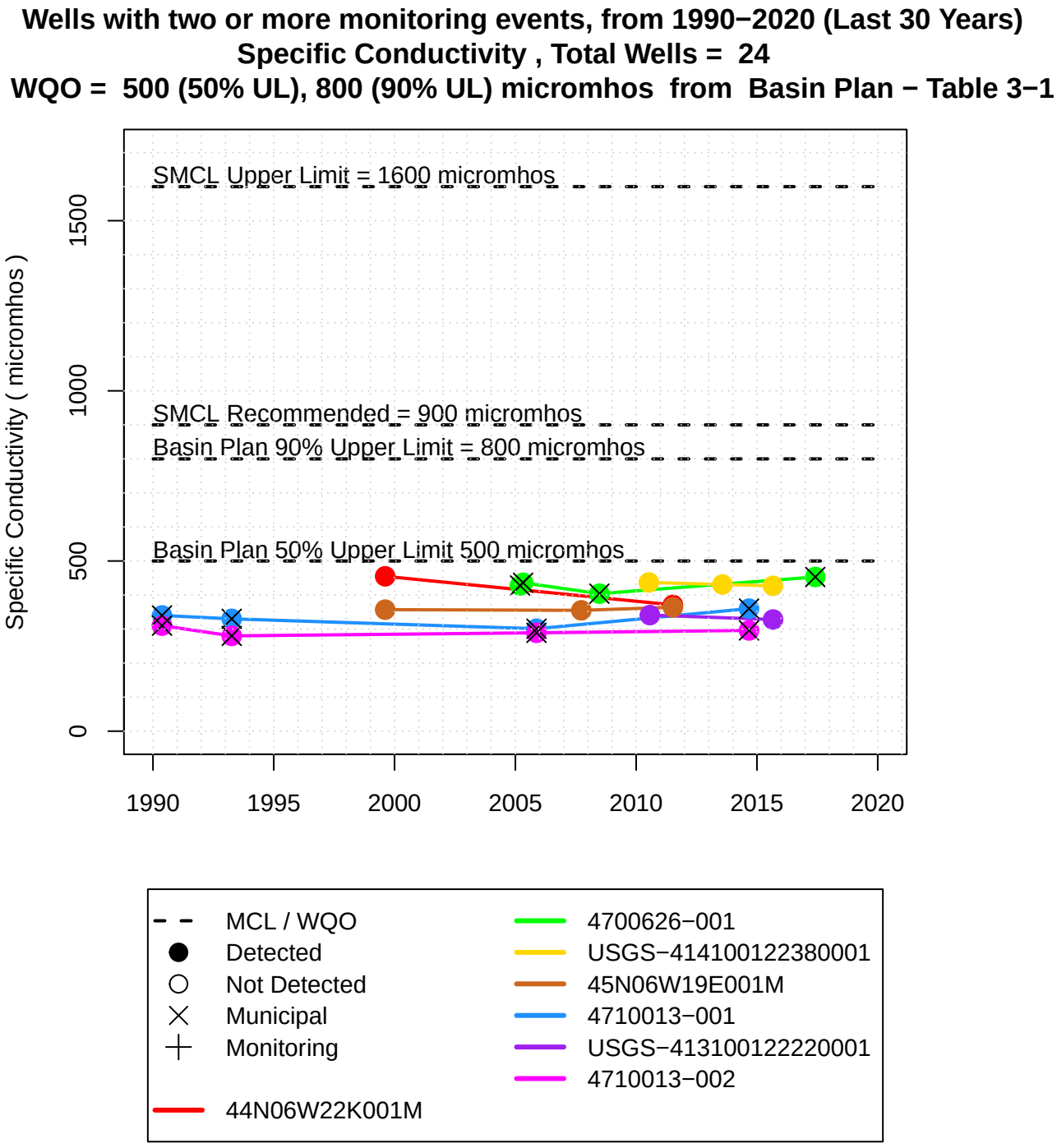

Figure 45: Filtered Groundwater Quality Observations of the Constituent Short List

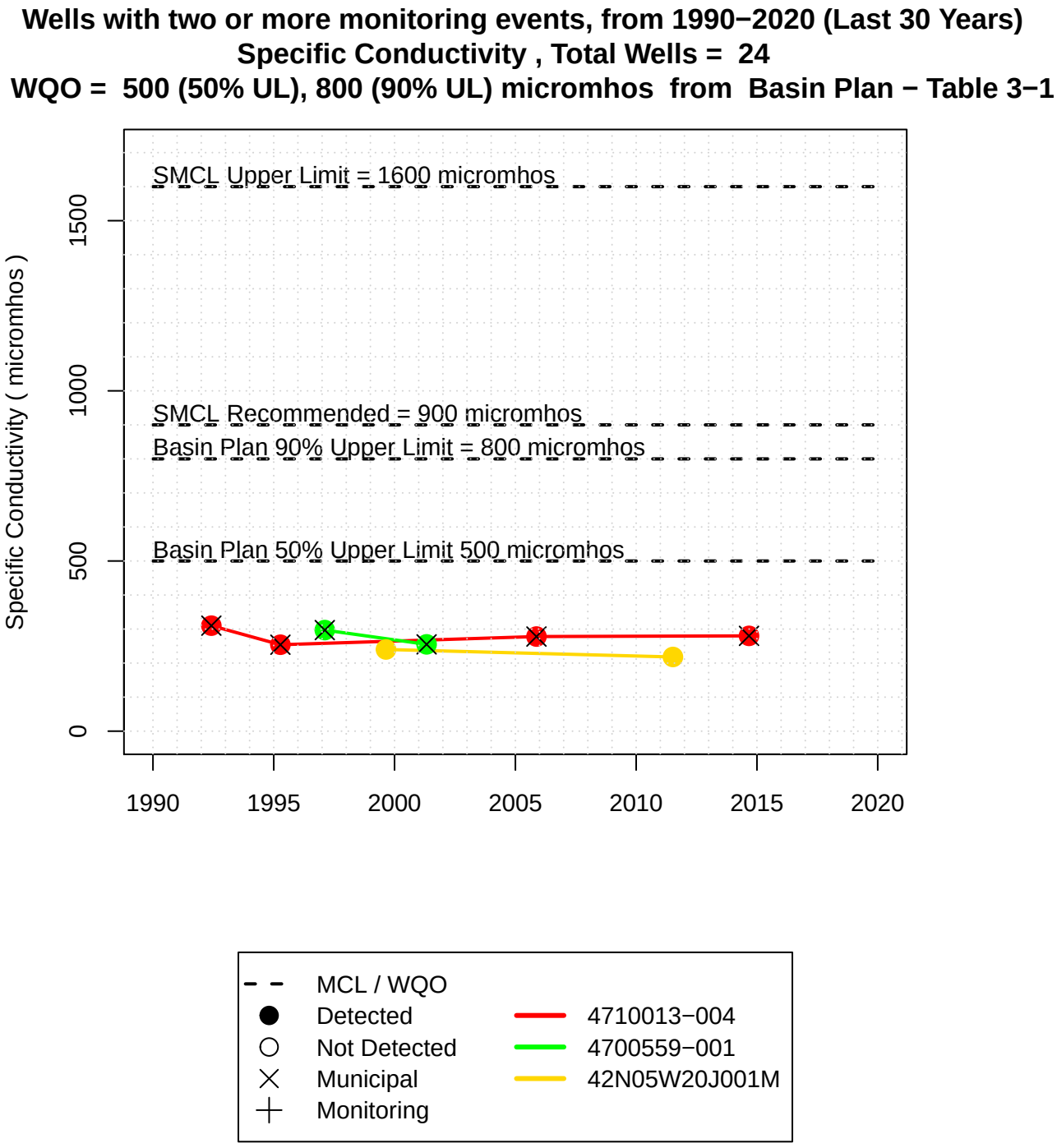

Figure 46: Filtered Groundwater Quality Observations of the Constituent Short List

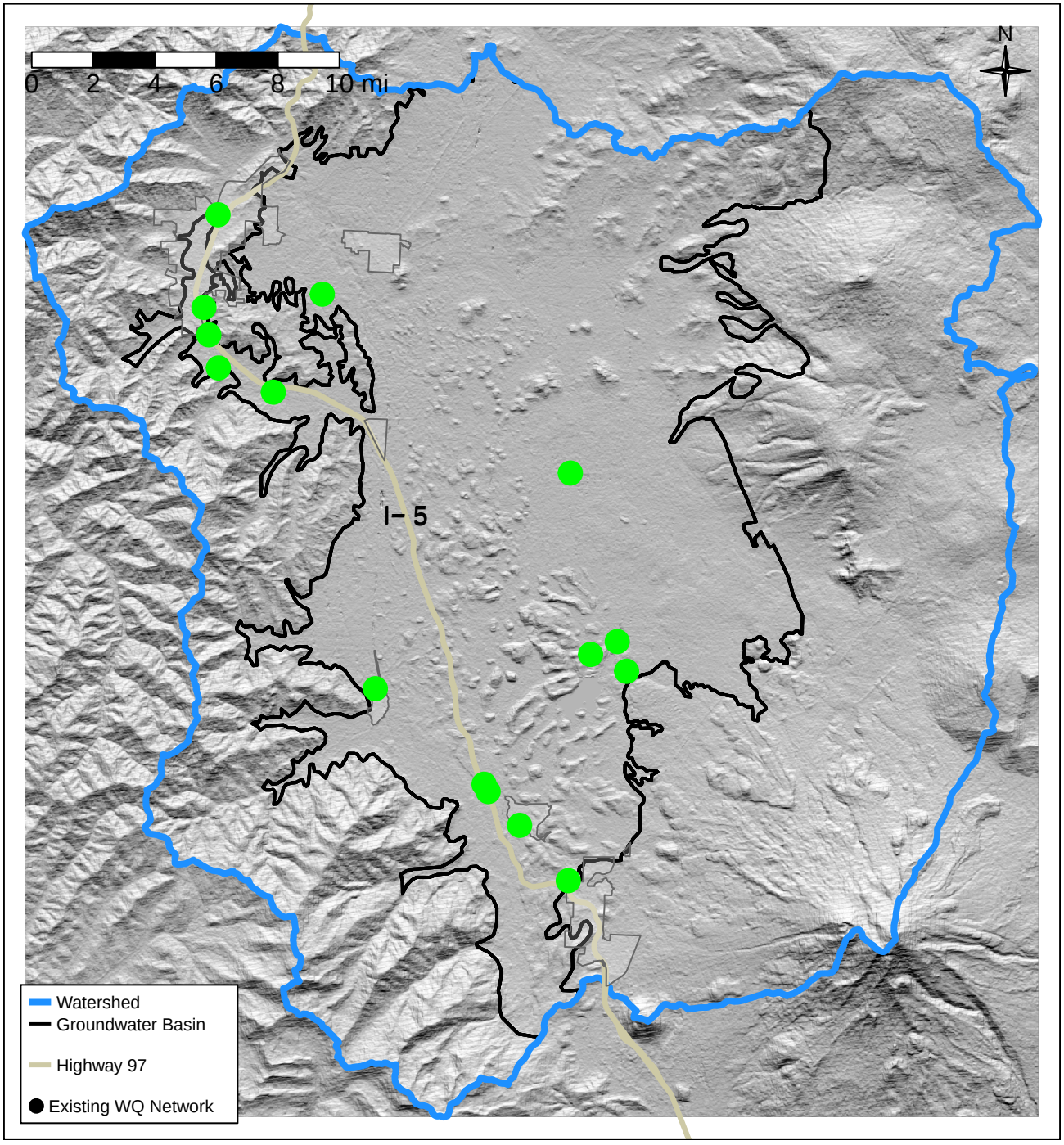

Figure 47: Water quality SMC Well Network.

References

California North Coast Regional Water Quality Control Board. 2018. “North Coast Basin Plan Chapter 2: Beneficial Uses.” June.