INACTIVE PRODUCTION ROCK SITES AND QUARRIES
2017 ANNUAL REPORT

Hecla Greens Creek Mining Company

April 12, 2018

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TABLES

ATTACHMENTS

1.0 Executive Summary

This annual report has been prepared by Hecla Greens Creek Mining Company (HGCMC) in accordance with the mine's General Plan of Operations Appendix 1, Integrated Monitoring Plan. Monitoring data summaries are presented for five inactive production rock sites (1350, 960, Mill Backslope, Site C and Site E) and four quarries (Pit 405, Pit 6, Pit 174, and Pit 7). A discussion of the 2.5-mile roadcut on the B Road is also included in this report.

This report is separated such that inactive production rock sites are discussed first in Section 2 followed by discussion of the quarries in Section 3. Information that is pertinent to both sections is generally not repeated but is discussed in the most relevant section and identified by reference in the other section. Time-series plots illustrating the available results of water quality monitoring performed at each site since 2003 are provided as attachments. Some of the inactive production rock sites, as well as the 2.5-mile roadcut, have multiple water quality monitoring locations associated with them. To improve the readability and interpretation of the graphs, a separate attachment is provided for each of the inactive production rock sites and the 2.5-mile roadcut. Site E monitoring data is presented on two sets of graphs, one for the locations around the perimeter of the production rock pile and one for the drainages that are further away from the site. There are fewer monitoring sites associated with the quarries; therefore, the water quality data is grouped together on one set of graphs.

Sampling for acid-base accounting (ABA) at inactive production rock sites and quarries is performed on five-year intervals, as per the Integrated Monitoring Plan. There was no ABA sampling at inactive production rock sites or quarries in 2017; therefore, no monitoring results are provided in this report. Refer to the Inactive Production Rock Sites and Quarries 2013 Annual Report for results and discussion associated with the most recent ABA sampling.

Water quality results in 2017 were consistent with past monitoring results. In general, the graphs indicate a long-term trend of improving water quality at most of the sites. This is likely attributable to a combination of ongoing production rock removal activities and decreases in the reactive mineral surface areas through natural weathering processes.

Work performed at inactive production rock sites in 2017 included the removal of 1,020 cubic yards of material from Site E for co-disposal at the tailings facility. The surface runoff collection system at the 1350 Site was also operated from June through November. There was no work performed at quarries in 2017.

2.0 Inactive Production Rock Sites

2.1 Introduction

The term production rock (or waste rock) refers to material removed during mine development to access ore for mineral extraction. Production rock is typically highly mineralized, but does not possess concentrations of target minerals that make it economical for processing. It is therefore disposed of as a mine waste product. Several sites were utilized for disposal of production rock during the early operations of the Greens Creek Mine, including the 1350 Site, 960 Site, Mill Backslope, Site C and Site E. A figure showing these site locations is provided in Attachment A. These sites have been inactive since 1994 or earlier, with Site 23 being the only currently active production rock site.

The initial reclamation plan called for engineered covers to be constructed on each site to prevent acid generation and potential long-term water quality impacts. HGCMC currently plans to remove all production rock from each site for placement underground as backfill or disposal in the tailings facility. Removal activities were initiated in 2000 and have continued intermittently as mining operations allow. However, complete removal of some sites cannot occur until final cessation of mining operations due to the need to protect/maintain site infrastructure. A monitoring program is in place to evaluate potential impacts from each site on water quality and the acid generation potential of the material.

This section of the report provides a summary of all operational and monitoring activities performed at inactive production rock sites in 2017. Refer to GPO Appendix 11 for a description of the facilities and GPO Appendix 1 for associated monitoring. Aspects of the inactive Site D are covered in the Active Tailings and Production Rock Site 2017 Annual Report (HGCMC 2018), which also covers the adjacent active production rock Site 23. Summary statistics for HGCMC's inactive production rock sites are presented in Table 2.1.

Table 2.1 Summary Statistics for Inactive Production Rock Sites
(ND=no data)

	Inactive Sites				
	1350	960	Mill Slope	Site C	Site E
Years Active (approx.)	1978-1985	1987-1988	1987-1988	1987-1988	1988-1994
Acreage	5	1	20	2	10
Approx. Total Original Volume (yds)	60,000	10,000	ND	50,000	270,000
Approx. Volume Removed (yds)	50,860	16,000	1,500	0	106,600
Approx. Volume Remaining (yds)	9,140	ND	ND	50,000	163,400

Previous annual reports incorrectly showed a higher volume of production rock having been removed from Site E. Based on comparison of a baseline site survey conducted prior to the 2009 material removal with surveys conducted in 2017, a calculated volume of approximately 106,600 cubic yards of production rock has been removed for co-disposal in the tailings facility.

Graphs illustrating water quality results for monitoring performed from 2003 through 2017 are provided as attachments to this report, with a separate set of graphs for each inactive production rock site. Water quality monitoring associated with Site E is presented on two sets of graphs, one for the intermittent low flow seeps around the perimeter of the pile, and one for the drainages below the site that flow into Greens Creek.

Sample results that were less than the analytical method detection limit are plotted on the graphs at a value equal to one-half the method detection limit. This causes some non-detect results to appear more concentrated than they actually are due to high method detection limits. Detection limits have varied with time and are often evident on the graphs as horizontal groupings of symbols.

The inactive production rock sites contain a mixture of acid generating and acid neutralizing rock, as determined through extensive ABA sampling. Refer to the Inactive Production Rock Sites and Quarries 2013 Annual Report for results and discussion associated with the most recent ABA sampling. Drainage from the inactive sites remains near neutral because the bulk of the material in the piles contains sufficient carbonate to neutralize acidity formed by pyrite oxidation near the pile surface. Water quality monitoring shows that drainage from the inactive sites continues to maintain measurable alkalinity provided by dissolution of carbonate minerals, and remains above pH 6.0.

Conductivity measurements indicate the quantity of dissolved constituents in the water. Water that has contacted production rock is expected to have higher conductivity than background waters. Samples having higher conductivity values usually have higher sulfate, calcium and magnesium (hardness) concentrations, reflecting influences from sulfide oxidation and carbonate mineral dissolution. Metals concentrations also generally correlate with conductivity values. Through natural weathering processes, the reactive surface area decreases as reactants are consumed and mineral surfaces become coated with oxidation products. The water quality graphs indicate a long-term trend of improving water quality at most of the sites, which is consistent with the concept of generally decreasing or static reactive surface area.

The trend of improving water quality at several of the monitoring sites can also be attributed to ongoing production rock removal activities. However, production rock removal can result in short-term increases in the concentrations of several metals, as evidenced by the monitoring data from the 960 Site and 1350 Site. This is due to exposing fresh, relatively unoxidized mineral surfaces for subsequent weathering reactions. As the mineral surfaces become coated with oxidation products the metals concentrations in the drainage decreases. The monitoring data for the 960 Site and 1350 Site indicate that it takes about three years post-removal before the water quality shows substantial improvement compared to the pre-removal water quality.

2.2 1350 Site

The 1350 Site is located at 1,350 feet above mean sea level (AMSL), up-slope from the main portal and concentrator facility (Attachment A). The site contained an estimated 60,000 cubic yards of material derived from advancement of the 1350 adit, which began in 1978 and continued intermittently through 1985. After evaluating reclamation alternatives for the 1350 Site, it was determined that removal of the production rock for disposal in the underground mine as backfill was the best option for this site. Removal activities commenced in 2005 and continued on an intermittent seasonal basis. From 2005 through 2015, a total of approximately 50,860 cubic yards of material was removed from the 1350 Site. It is estimated that 9,000 to 10,000 cubic yards remain, all of which is in the immediate vicinity of the 1350 adit. This material is not planned for removal until final closure of the mine due to the need to maintain access for the mine ventilation system. The area around the adit has been graded so that surface runoff is directed into the mine water collection system.

There are two surface water monitoring sites associated with the 1350 Site, designated as Site 13 and Site 307. Site 13, located in a drainage east of the 1350 adit, was established to monitor surface runoff quality from a large portion of the production rock pile. This site has been routinely monitored since 1985 and is included in the Fresh Water Monitoring Program, and is also a permitted storm water outfall in the HGCMC APDES Permit. Site 307 is a small seep located below what was called the east lobe of the production rock pile. This site was monitored periodically between 2003 and 2009, and has been monitored two times per year since 2015. Water quality graphs for these sites, provided in **Attachment B**, illustrate the benefits of the production rock removal and reclamation work.

The material in the east lobe above Site 307 was removed in 2010 and 2011. There was no monitoring at Site 307 from 2010 through 2014, so it is not known if there was a short-term spike in metals concentrations following the removal activities. The monitoring results since 2015 have shown consistent, excellent water quality with neutral pH and a substantial reduction in all measured constituents compared to the pre-removal data.

The last, large production rock removal campaign occurred in June 2014. Approximately 11,200 cubic yards of material were removed, primarily from the runoff catchment that drains to water quality monitoring Site 13. Following completion of the 2014 removal activities, there was a substantial spike in metals concentrations at Site 13, including cadmium, copper, lead, manganese, nickel and zinc. This was expected since the removal activities were up-gradient of the monitoring site and resulted in exposing relatively unoxidized production rock at the edge of the removal area near the 1350 adit. It was also expected that there would be a relatively short flushing period of residual oxidation products from the underlying soils beneath the recently removed production rock. A similar spike in metals was observed in 2003 and 2004 at the 960 Site following production rock removal, and by 2005 concentrations decreased significantly to well below pre-removal levels. Monitoring results from Site 13 show that metals concentrations are trending downward. Measurements of conductivity, sulfate and hardness in 2017 were the lowest ever measured at Site 13 since monitoring began in 1985.

Though trending downward, cadmium and zinc concentrations at Site 13 continue to be elevated above Alaska Water Quality Standards due to runoff from the remaining production rock near the 1350 Adit. To remedy this, HGCMC installed a collection trench below the eastern edge of the production rock to intercept runoff and drainage and route it to treatment facilities. The collection system was operated from September through November in 2016, and from June until November in 2017. HGCMC intends to continue operating the collection system seasonally until cadmium and zinc concentrations decrease to below water quality criteria.

Comparison of results from water samples taken from the collection trench during the late summer of 2016 and 2017 show a substantial reduction in the conductivity, sulfate and metals concentrations. This supports the prediction that weathering of the production rock exposed by the 2014 removal activities is resulting in decreased reactive surface area and flushing of residual oxidation products. The water quality results are shown in Table 2.2 below.

Table 2.2 1350 Collection Trench Water Quality

	pH	**Cond.**	**SO_4**	**Cd**	**Cu**	**Pb**	**Mn**	**Ni**	**Zn**
Date	s.u.	µS/cm	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
8/15/16	6.99	1067	262	19.7	2.6	1.6	1540	14.4	5150
9/7/17	6.88	359	106	4.6	0.6	0.2	105	8.2	1510

2.3 960 Site

The 960 Site is located just above the 920 Portal on the road to the 1350 level. Approximately 10,000 cubic yards of production rock were placed at the site in 1987 and 1988 during development of the 920 Portal and access road to the 1350 level. Placement was terminated when signs of slope instability developed below the site. The 960 Site is relatively small in extent (1 acre) and drainage flows are low.

Between 2000 and 2004, approximately 16,000 cubic yards of production rock and underlying soils were removed and placed into the underground mine as backfill. The site was then recontoured and allowed to naturally reseed with native species.

The 960 Site showed some elevated copper, zinc and cadmium concentrations in 2003 and 2004 as illustrated on the graphs provided in **Attachment C**. This was likely due to the removal activities, which exposed some additional production rock materials in the base of the road and altered drainage patterns. Water quality from this site has been consistently good since 2005 and meets the Alaska Water Quality Standards for all measured parameters.

A small volume of pyritic material remains within the road prism, as evidenced by localized iron staining. An ABA sample of this material collected in 2013 showed a NNP of -30.3 (tCaCO3/kt) and a paste pH of 3.6. HGCMC plans to remove this material during final reclamation of the 1350 access road following cessation of mining operations. The 960 Site will continue to be monitored for water quality changes and potential impacts on Greens Creek.

2.4 Mill Backslope

A bench was cut into the valley floor at the 920 elevation providing level ground to facilitate construction of the Mill/concentrator facility in 1987. Glacial till excavated from the site was hauled to Site D and Site E. During construction of the Mill and related facilities, tension cracks developed above the excavated slope. Approximately 100 dewatering drains were drilled into the slope to lower the water table and reduce pore pressures. Two benches of production rock were placed on the lower half of the bank to buttress the slope and protect the drain manifold system. Pyritic rock was also used in the construction of an access road above the cut slope. Numerous piezometers were installed throughout the Mill Backslope at varying depths to monitor the pore water pressure.

Drainage from the Mill Backslope is a combination of groundwater intercepted by the dewatering drains, seepage from the surface expression of shallow groundwater, and surface runoff from precipitation. Average flows from combined Mill Backslope sources are low (less than 10 gpm). Sample site MBS 341 was established in 2003 and represents a composite of the groundwater and surface runoff. As shown on the water quality graphs provided in **Attachment D**, this site typically has the lowest pH and highest metals concentrations of all inactive production rocks sites. Water quality at site MBS 341 is monitored infrequently since all flow is captured and routed to water treatment facilities. This site was sampled once in 2017 and the results were generally consistent with past monitoring data, though the pH was neutral.

Collection and treatment of slope drainage remain the preferred near-term options for this site because removal of all of the production rock would destroy the dewatering system that maintains slope stability. Long term closure options for the slope include removing the pyritic material and either replacing it with non-pyritic fill or decreasing the slope angle to ensure long-term slope stability for closure.

2.5 Site C

Site C is located near the end of the B Road just below the 920 Mill/concentrator facilities. The site received producton rock in 1987 and 1988 and currently contains approximately 50,000 cubic yards of material. Results of ABA analyses indicate that some of the material is potentially acid generating, however the pH of the site’s drainage remains near-neutral. The 860 safety building and assay lab have been constructed on this site, therefore removal of the material will not occur until final cessation of mining activities.

During construction of the assay lab, glacial till from Site 23 was placed over much of the exposed production rock. The Site 23 material is not potentially acid generating and reduces exposure of the covered production rock to precipitation and oxygen. A network of drains and catchments diverts surface water away from the underlying production rock. Two stormwater retention ponds were constructed below Site C, the upper and lower Pond C, to contain sediments from Site C as well as from the B Road below the 920 area. The collected stormwater is pumped to water treatment facilities and discharged at the permitted outfall.

Drainage from Site C has been monitored routinely since 2002 from a seep located at the toe of the slope that is within the lower Pond C (Site 308). Flow at this site is low (generally less than 1 gpm), remains near-neutral, and contains elevated manganese concentrations, as well as moderate sulfate, zinc, cadmium and iron concentrations. Water quality graphs are provided as **Attachment E**.

As a result of water management improvements implemented in the Site C area in 2011, the flow at the monitoring site is now intermittent. There was insufficient flow for sampling when the site was visited in 2013, 2015 and 2017.

2.6 Site E

Site E is located 4.6 miles up the B Road halfway between the Hawk Inlet port facility and the 920 Mill facility (Attachment A). Approximately 95,000 cubic yards of glacial till and 270,000 cubic yards of production rock were placed at the site from 1988 to 1994. The glacial sediments were excavated from the 920 site during construction of the Mill facility. Once the sediments were naturally dewatered in the placement cells constructed at this site, production rock was placed on top of those sediments at Site E. Flows from the site are minimal because it sits on a topographic high and only receives water from direct precipitation (i.e., no run-on or groundwater input).

Greens Creek compared the relative costs of recountouring and covering the pile versus consolidating it with one of the other surface facilities, and found that relocating the material to the surface tailings facility for co-disposal is the most economical and environmentally protective solution. Removal of production rock from Site E for disposal at the tailings facility commenced in 2006, with the majority of the removal occurring from 2009-2011. Between 2006 and 2017, a total of approximately 106,600 cubic yards of material were removed from Site E. The quantity removed in 2017 was approximately 1,020 cubic yards. HGCMC plans to remove the remaining production rock from Site E for disposal in the tailings facility.

The current water quality monitoring program associated with Site E consists of sampling six surface water sites. Three sites are intermittent low flow seeps around the toe of the production rock pile (sites 708, 709 and 710), and three sites are in drainages down-gradient from the pile that report to Greens Creek (sites 356, 703 and 704). A figure showing the monitoring locations is provided in Attachment A. There are also two sites in Greens Creek that are sampled under the Fresh Water Monitoring Program; water quality information for those site is provided in the annual FWMP report. Water quality graphs for the toe seeps are provided in **Attachment F** and water quality graphs for the down-gradient drainages are provided in **Attachment G**.

As shown in Attachment F, the water quality of the toe seeps is highly variable. This is likely attributed to the low flow rates where only a slight change in flow from precipitation events could cause a large change in concentration. The graphs indicate there has been a substantial decrease in concentration for several of the monitored constituents at site 709 when comparing the data from pre-2010 to the results from after 2010. Site 709 is a toe seep located on the east side of Site E. Most of the production rock removed from Site E was from the eastern portion of the pile, which eliminated a significant source of the chemical loading to this seep.

The water quality of the three down-gradient drainages below Site E, shown in Attachment G, remains fairly consistent due to the higher flow rates. Of the three drainages, site 703 has the highest flows. Based on its location, site 703 is the most likely drainage to have been influenced by the production rock removal that has occurred. However, there are no obvious water quality trends due to the limited amount of data collected prior to 2009, which was the first year with large scale material removal.

2.7 2.5 Mile B Road Cut

Pyritic rock was exposed in the road cut at 2.5-mile during construction of the B Road in 1988. Weathering has decreased the reactive surface area of pyrite grains in the outcrop, and precipitation of hydroxide coatings has further decreased the reactivity of the rock. This section of the road parallels Zinc Creek. Monitoring of Zinc Creek above and below this road segment will determine if the pyritic rock in the road cut is having a detrimental effect on water quality.

Site 368 is located on Zinc Creek down-gradient of the 3-mile bridge, and at the upstream end of the road cut. Monitoring at this site, typically on an annual basis, began in 2004. Twice yearly sampling, in the spring and fall, began in 2015. Site 8 is located above the confluence of Tributary Creek with Zinc Creek, and is downstream of the road cut. Very limited sampling occurred at this site prior to 2015, but it is currently monitored semi-annually with Site 368. Water quality graphs for these sites, along with the Zinc Creek background Site 371, are provided as **Attachment H**. The limited amount of data shows a slight, but consistent, increase in sulfate between the upstream Site 368 and Site 8.

Two areas along the B road corridor were filled with material from the 2.5 mile B Road cut: 1.8 mile pullout and Zinc Creek Bridge Abutment.

1.8 Mile Pullout

Pyritic rock from the road cut at 2.5-mile B Road was used as fill for the 1.8-mile B Road pullout. HGCMC redirected road ditch water around the pad to reduce infiltration through the pyritic rock. HGCMC plans to continue monitoring this site, with removal of the pyritic material following removal of other higher priority sites.

Zinc Creek Bridge Abutment

Pyritic rock from the road cut at 2.5-mile B Road was also used as fill in the abutment of the Zinc Creek Bridge during road construction. Iron staining and poor quality runoff has been observed at the site. HGCMC maintains an APDES storm water monitoring point at the site and has sampled the water composition of Zinc Creek above (Site 371) and below (Site 368) the bridge. Monitoring data (Attachment H) show there is a consistent increase in the concentrations of sulfate, iron and manganese in this stream segment. HGCMC applied lime to the fill in 2013 and again in 2017. Additional treatments will be applied as needed prior to mine closure, when the pyritic rock will be removed with recovery and reclamation of the road. The available monitoring data does not indicate any apparent long-term water quality trends.

3.0 Quarries

3.1 Introduction

Five quarry sites were developed in 1987 and 1988 to provide rock for constructing roads and other infrastructure at the Greens Creek facilities. Pit 5 was incorporated into the Northwest Tailings Expansion in 2008 and has been completely backfilled with tailings. All other quarries are currently inactive and are being used to stockpile reclamation materials (rock, organic soils and glacial till). A summary of all operational and monitoring activities performed at these quarry sites is provided. Refer to GPO Appendix 1 for a description of the monitoring.

Summary statistics for HGCMC's quarry sites are presented in Table 3.1. The sites are discussed individually in subsequent sections. Refer to **Attachment A** for a figure showing site locations.

Table 3.1 Summary Statistics for Quarry Sites

	Quarries				
	Pit 405	Pit 6	Pit 174	Pit 5	Pit 7
Years Active (approx)	1987-1988	1987-1988	1987-1988	1987-2003	1987-1997
Acreage	3	3	2	Part of NW Tailings Expansion	4
Total Volume (cy)	17,000	22,800	10,000		183,900
Prod Rock/Other Vol (cy)	13,000	0	0		0
Reclamation Material (cy)	4,000	22,800	10,000		183,900

Sampling for Acid Base Accounting (ABA) from the quarry walls is performed on five-year intervals. There was no ABA sampling in 2017. Refer to the Inactive Production Rock Sites and Quarries 2013 Annual Report for results and discussion associated with the most recent ABA sampling.

Graphs presenting monitoring data collected since 2002 are provided in **Attachment I**. Sample results that were less than the analytical method detection limit are plotted on the graphs at a value equal to one-half the method detection limit. This causes some non-detect results to appear more concentrated than they actually are due to high method detection limits. Detection limits have varied with time and are often evident on the graphs as horizontal groupings of symbols.

Much of the flow data were collected during or shortly following storm events and represents maximum flow values. Flow estimates vary from 60 gpm to less than 1 gpm with most less than 10 gpm. The bowl-shaped geometry and low permeability of the quarry walls and floors tend to focus flow toward the entrance of the pits.

The amount of reactive surface area available for sulfide oxidation is considerably less for quarries than for production rock piles. Oxidation is limited to the non-coated outer face of the near-vertical quarry wall and near surface fractures. Lower sulfide contents and smaller surface area yield a lower flux of oxidation products from quarries compared to production rock sites.

The graph for pH monitoring shows there was only one sample since 2002 that was below 6.0. This sample was measured at 5.93 and was collected in 2009 from the wetlands below Pit 7. Alkalinity data are consistent with the pH results, with all sites maintaining measurable alkalinity provided by dissolution of carbonate minerals. The lower alkalinity values from Pit 6 represent influences from organic acids derived from forest soils (note associated low conductivities of Pit 6 samples). The high alkalinity measured at Pit 7 (Site 521) in 2017 is likely associated with the additional reclamation material (organic soils and glacial till) stockpiled at Pit 7 in 2016.

Conductivity indicates the amount of dissolved constituents in the water. Samples having higher conductivity values usually have higher sulfate, calcium and magnesium (hardness) concentrations, reflecting influences from sulfide oxidation and carbonate mineral dissolution. Conductivity data are consistent with waters derived from freshly exposed low to moderately mineralized quarry rock. The results for sulfate, magnesium and hardness correlate with conductivity results. The elevated conductivity, iron and manganese concentrations measured at Pit 7 (Site 521) in 2017 were the result of organic materials/overburden stockpiled in Pit 7 in 2016.

The results for metals generally correlate with conductivity values. Zinc and manganese concentrations reflect the higher solubility of these elements relative to the others at the near-neutral pH conditions. Dissolved metal loads from quarry sites have been consistently low and generally either remained fairly constant or decreased with time. The decrease in dissolved metal loading is attributed to a reduction of reactive surfaces as reactants are consumed and coatings form on mineral surfaces.

Closure options for pyritic pit walls are relatively limited. Since there are no proven long-term surface treatments available, it is best to let naturally occurring coatings that have formed over the past 20+ years continue to form. As the coatings form and the amount of available pyrite decreases, so too will the relatively small dissolved load generated by these surfaces.

3.2 Pit 405

Pit 405 is located at 7.6 mile on the B Road. The rock from this quarry was used for construction of the B Road and other mine infrastructure. Mine records indicate that approximately 13,000 cubic yards of production rock were backfilled into the quarry in 1988. The quarry received reclamation materials (colluvium and glacial till) in 1994, 1995 and 1998 for use in future reclamation projects. HGCMC drilled a hole through the fill material in June of 2005 to characterize the materials. The profile at the center of the pit from the surface down consists of approximately two feet of glacial till and organics (fill), 15 feet of sericitic phyllite (waste rock) and 22 feet of grey silty till (fill). The foundation of the pit is fractured, pyritic, chloritic rock.

Monitoring of drainage downgradient of the quarry demonstrates that influences from the site are negligible. The site will be reclaimed when the reclamation materials stored in the quarry have been utilized at other sites. The production rock in the quarry will either be removed or covered in-situ. Removal of the rock could prove detrimental as this would increase exposure of the now covered pyritic quarry wall.

3.3 Pit 6

Pit 6 is located at 4.6 mile on the B Road across from Site E. The quarry produced rock for construction of the B Road in 1987. Reclamation materials were hauled to the site from Site 23 and the 920 facility during various construction seasons. Monitoring of surface drainage from the pit access ramp indicates no significant influence from the pit walls or stored material. Reclamation materials will be used to reclaim other mine facilities. Approximately 3,800 cubic yards of reclamation materials from the backslope of Site 23 were hauled and stored at Pit 6 in 2007. Reclamation material (6,500 cy) from the top of Site E was hauled to Pit 6 in 2009. Water quality at the storm water sampling site at Pit 6 showed increases in total lead and zinc in 2009, potentially attributable to hauling the reclamation materials from Site E to Pit 6. Since 2010, lead and zinc levels have returned to within historical levels at this site. The elevated lead levels shown on the graph in 2013 and 2014 are the result of analytical error in which the incorrect MDL was used for the analyses. The actual results were non-detect, but are plotted on the figure at one-half the MDL. Lead levels in 2017 were non-detect at a MDL of 0.1 µg/L.

3.4 Pit 174

Pit 174 is located at 3.3 mile on the B road and was used for road construction in 1987. The pit has been partially backfilled with reclamation materials that will be used to reclaim other site facilities. A runaway truck ramp was installed at Pit 174 following a haul truck incident at the site in 2006. Sulfate and metal concentrations in the pit drainage are moderate, however flows are generally low (typically less than 10 gpm during rain events). Iron staining periodically occurs in the drainage below the site which collects runoff from this quarry and surrounding areas. Once the stored reclamation materials (rock, organic soils and glacial till) are utilized, the site will be reclaimed. Reclamation goals include minimizing runoff from the exposed pit wall and covering as much of the exposed pyritic rock as possible by placing a wedge of glacial till at the base of the wall.

3.5 Pit 5

Pit 5 was located in the northern portion of the Tailings Facility at 0.8 mile on the B Road, and until 2008 housed the water treatment plant. The Pit 5 water treatment plant was decommissioned in June of 2008. Rock from the pit was originally used for construction of roads and other surface facility infrastructure. Approximately 13,500 cubic yards of rock were quarried from Pit 5 in 2002. Between 2006 and 2008 approximately 268,110 cubic yards of shot rock were taken from Pit 5 in conjunction with the tailings expansion. The expansion of the Tailings Facility in the Pit 5 area was completed in 2008. The Pit 5 area is now completely backfilled with tailings (northwest area) which is underlain with an HDPE liner tied into the natural till underlying the tailings pile to the south.

3.6 Pit 7

Pit 7 is located at 1.8 mile on the A Road between Hawk Inlet and Young Bay. The pit was initially developed in 1987 to support construction of the roads and other mine facilities. Pit 7 has been mostly backfilled with overburden derived during expansion of the tailings pile and development of the sand pit at 1.4 mile on the A Road. Approximately 30,100 cubic yards of material were placed in Pit 7 in 2016 from expansion of the sand pit. Pit 7 currently contains approximately 183,900 cubic yards of reclamation materials. Following removal of stockpiled materials for reclamation of other sites, the Pit 7 site will be contoured and hydroseeded.

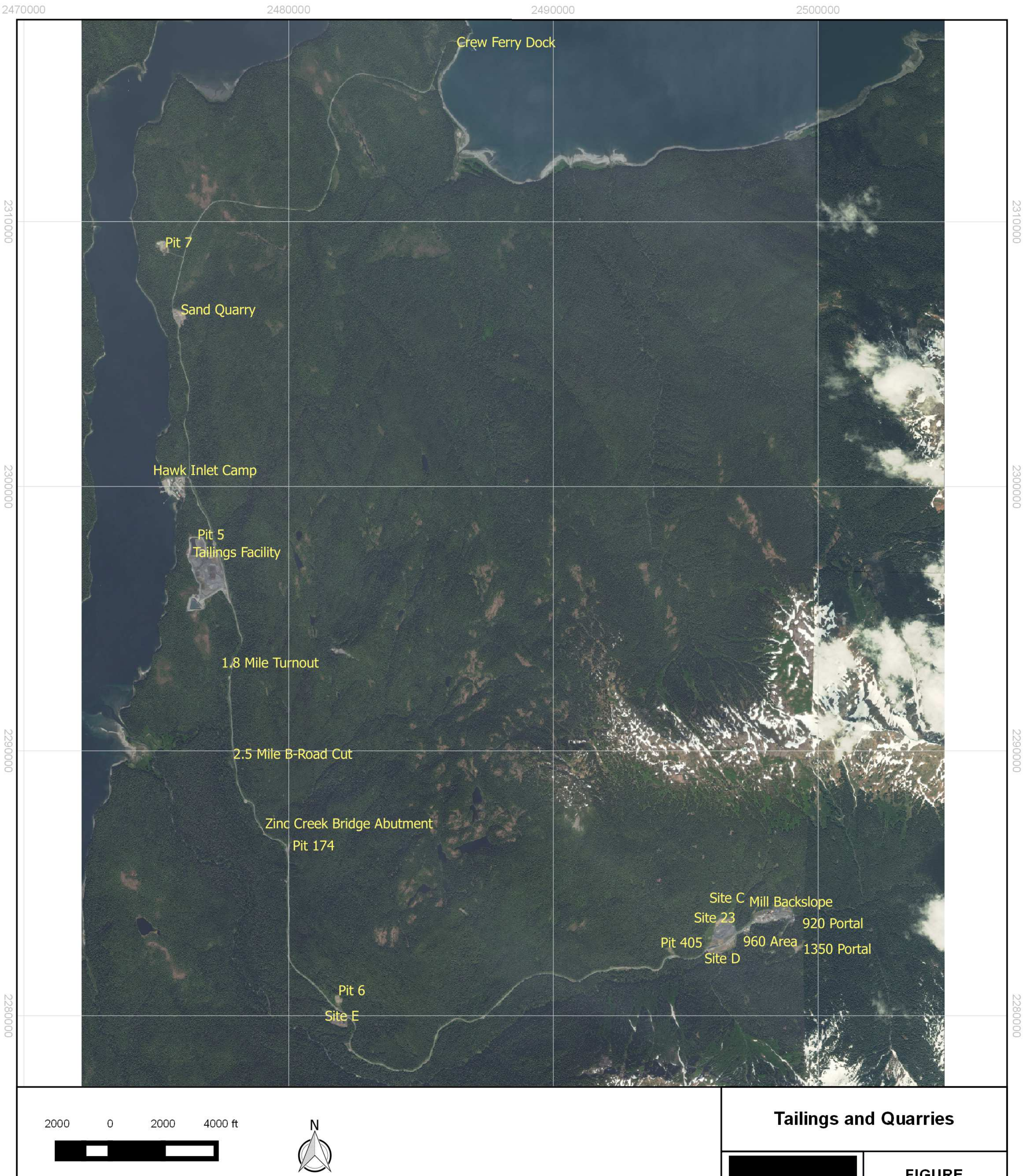
4.0 References

Hecla Greens Creek Mining Company (HGCMC), 2018, Active Tailings and Production Rock Site 2017 Annual Report, April 2018.

Hecla Greens Creek Mining Company (HGCMC), 2014, General Plan of Operations, Appendix 1, Integrated Monitoring Plan, November 2014.

Hecla Greens Creek Mining Company (HGCMC), 2014, General Plan of Operations, Appendix 11, Waste Rock Management Plan, November 2014.

ATTACHMENT A



Tailings and Quarries

FIGURE

1

Hecla MINING COMPANY

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

EDE

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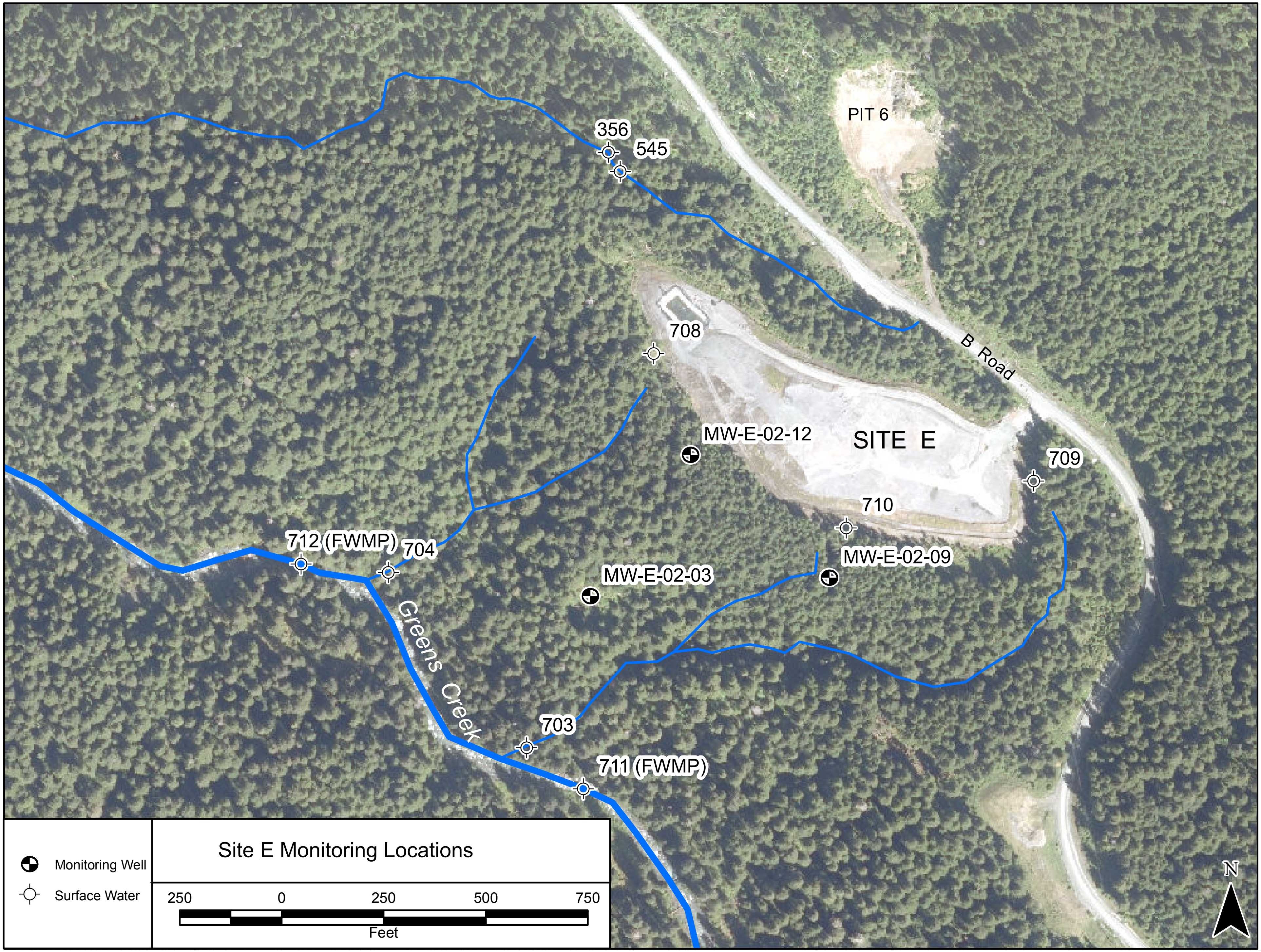
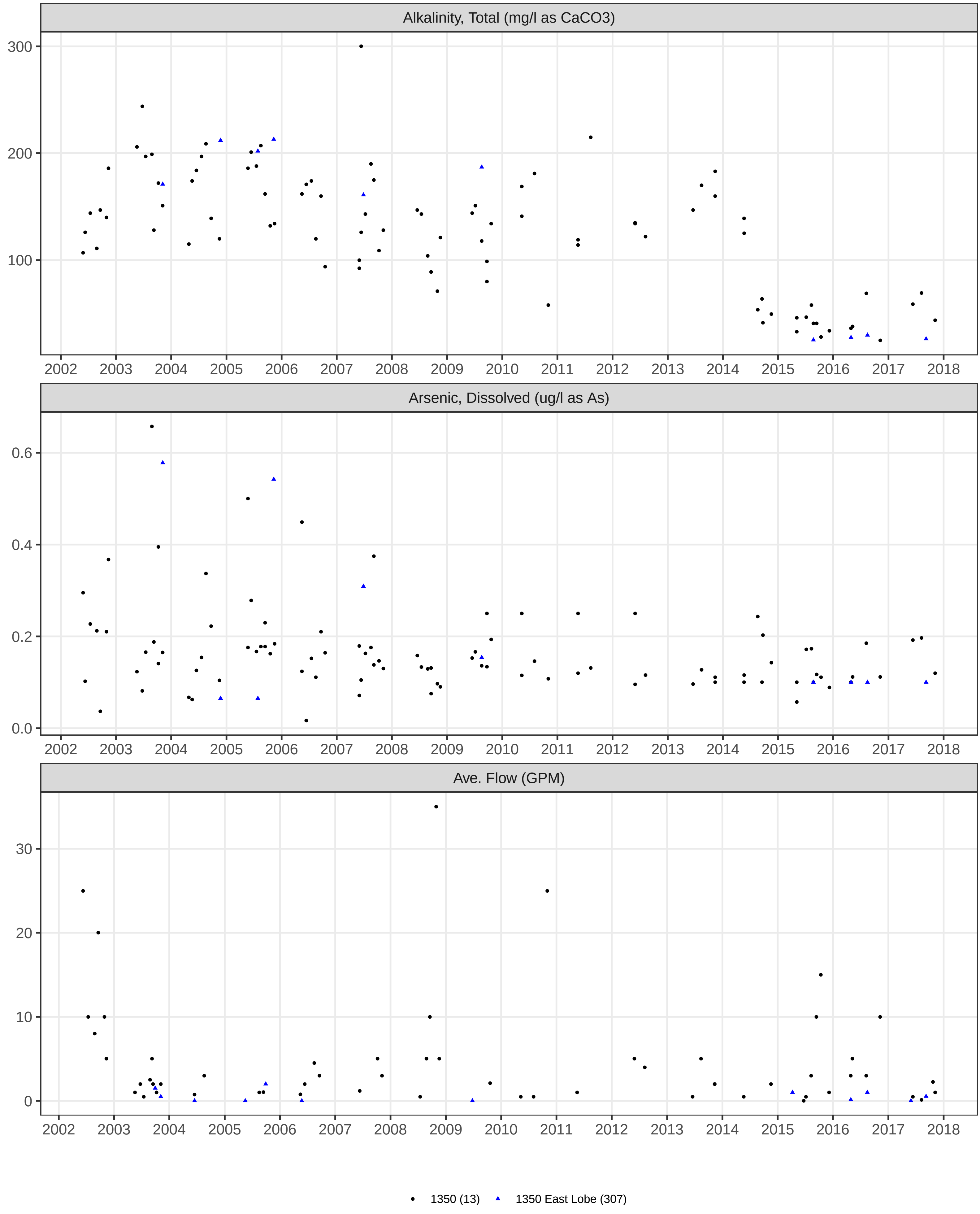
SCALE: 1:60,000
DATE: 9/27/2017
PRJCTN: AK State Plane NAD83
DRAWN: MNN


PIT 6
356
545
708
B Road
MW-E-02-12
SITE E
709
710
712 (FWMP)
704
MW-E-02-09
MW-E-02-03
Greens Creek
703
711 (FWMP)
Monitoring Well
Surface Water
Site E Monitoring Locations
250
0
250
500
750
Feet
N

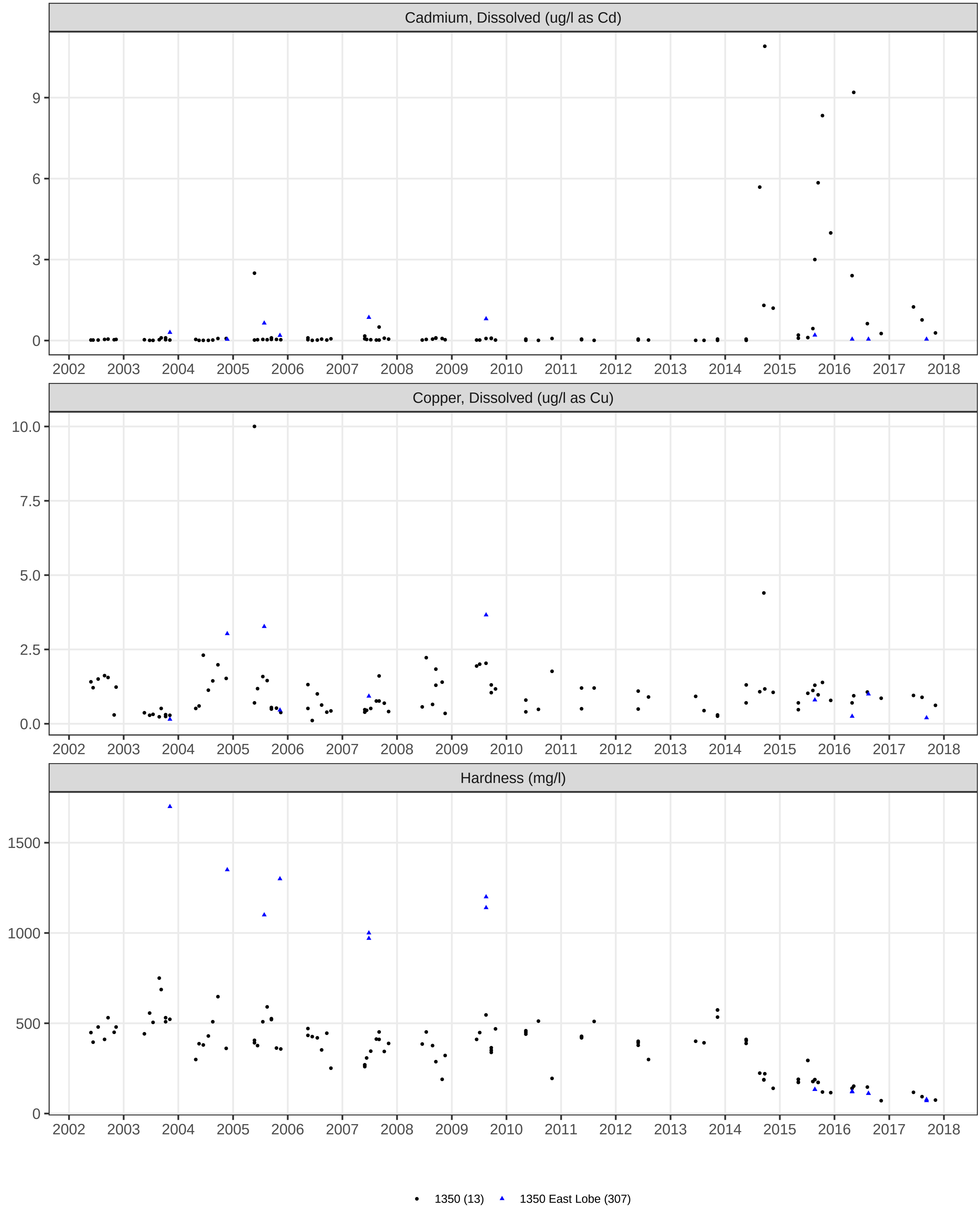
ATTACHMENTS B-I
WATER QUALITY GRAPHS

Attachment B	1350 Site
Attachment C	960 Site
Attachment D	Mill Backslope
Attachment E	Site C
Attachment F	Site E Toe Seeps
Attachment G	Site E
Attachment H	Zinc Creek
Attachment I	Quarry Sites

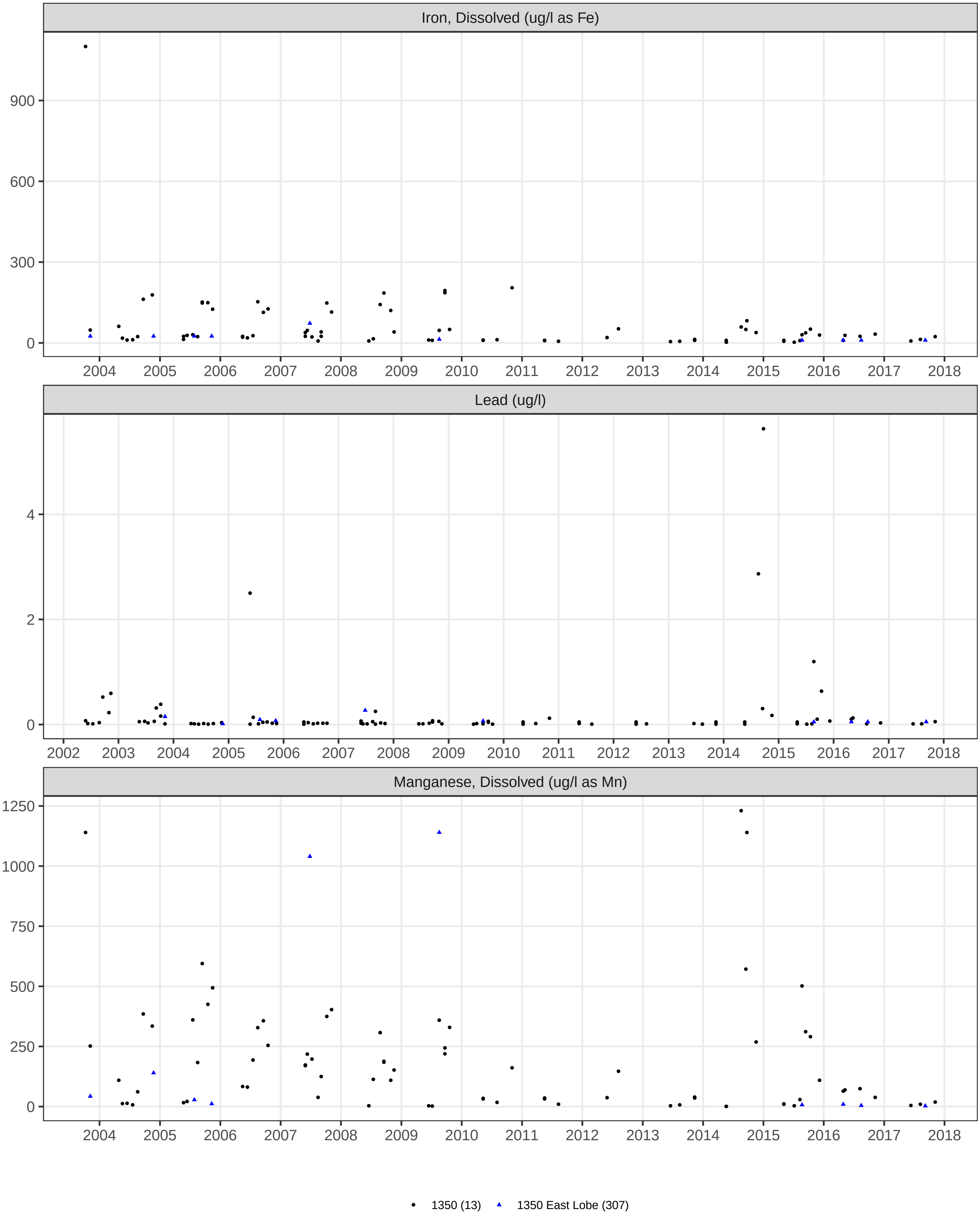
ATTACHMENT B
1350 Site



ATTACHMENT B
1350 Site



ATTACHMENT B
1350 Site



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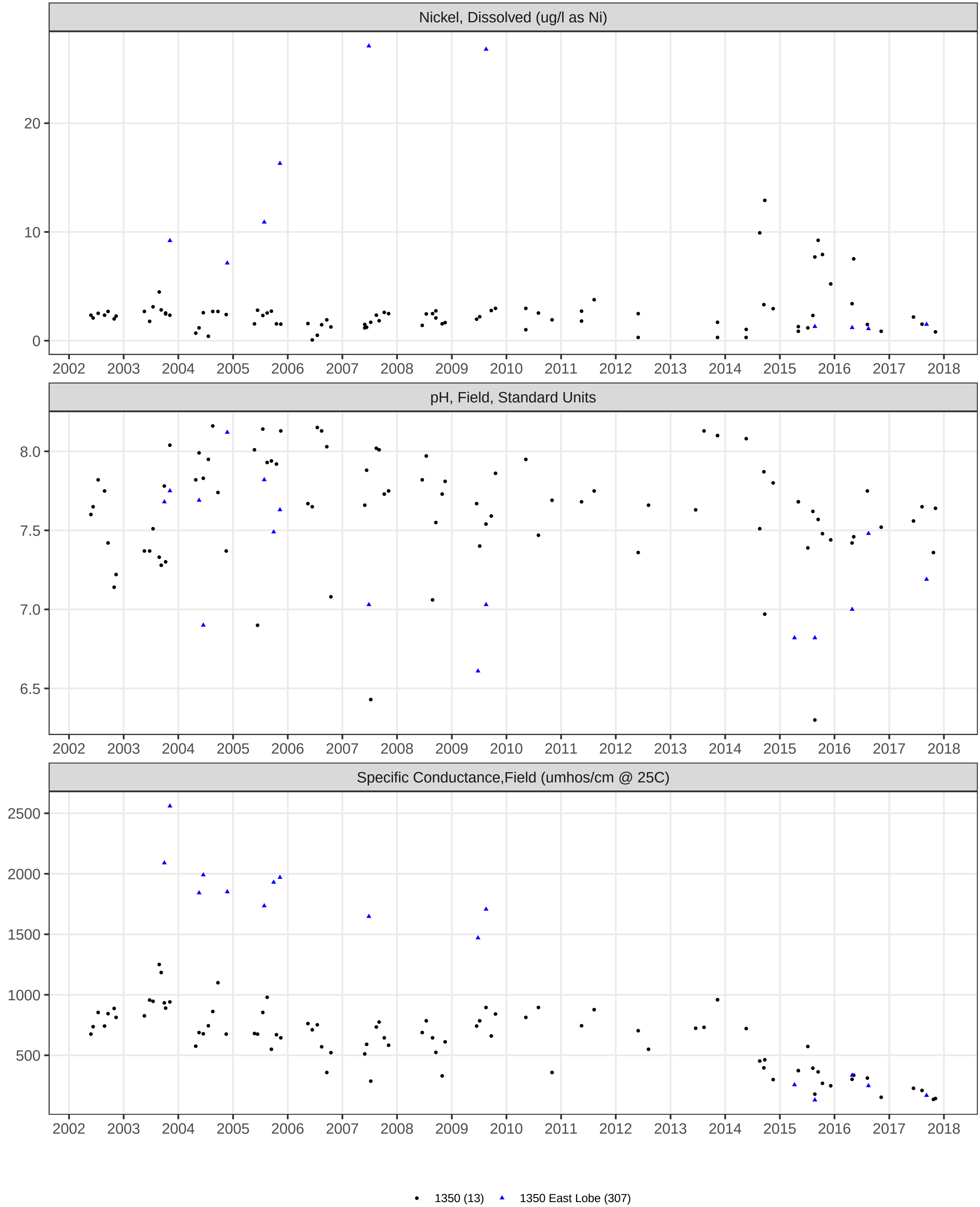

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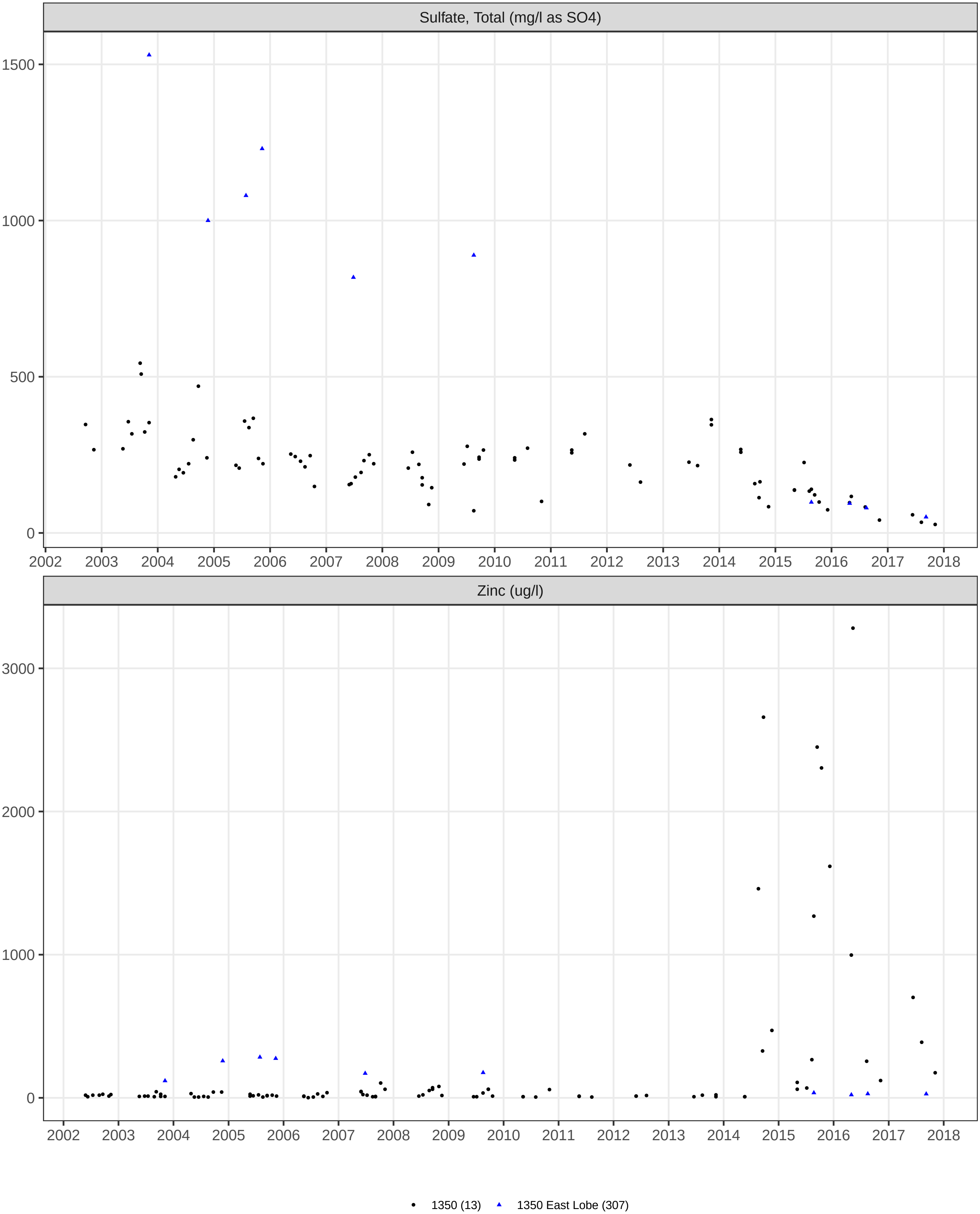

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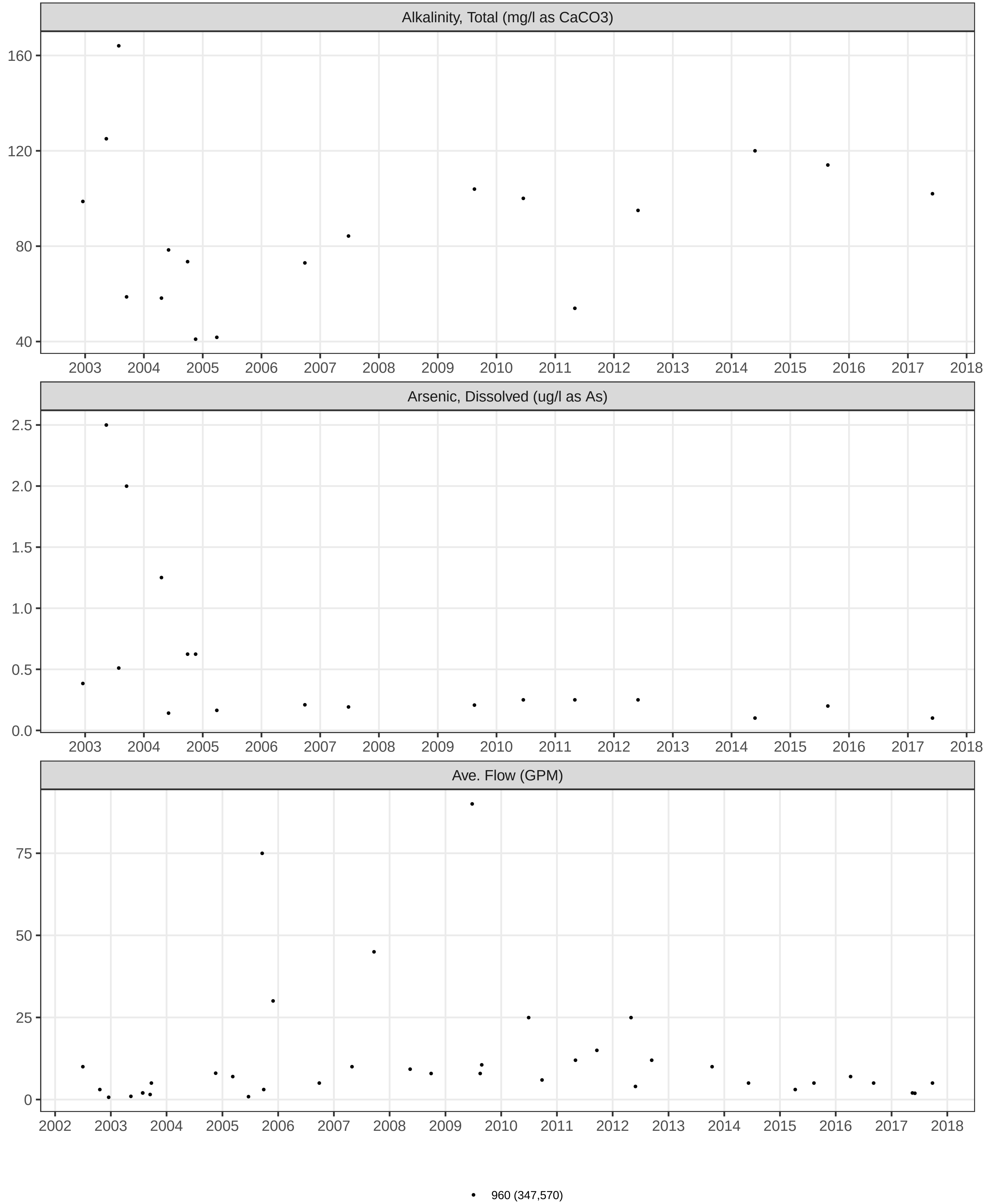

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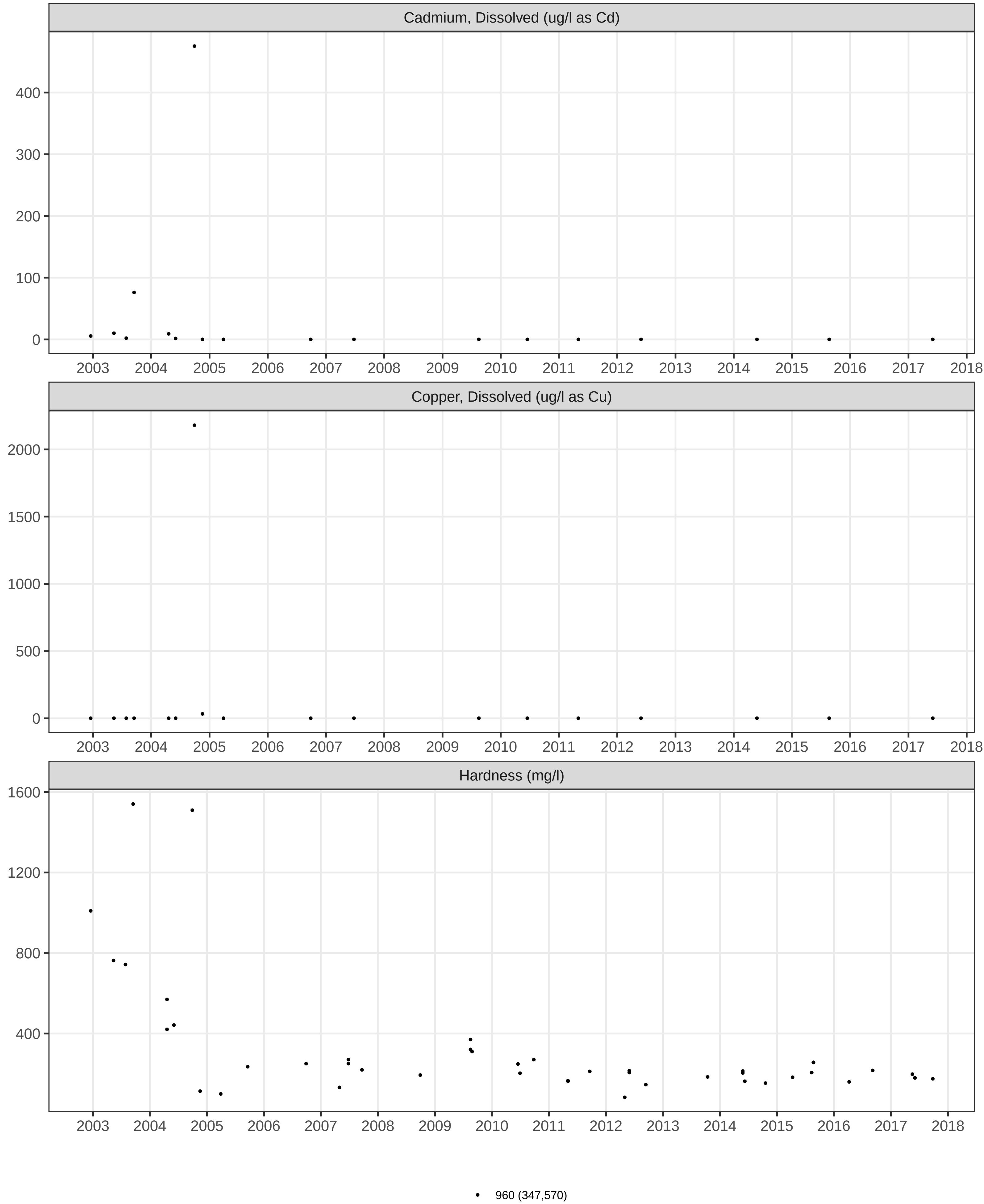

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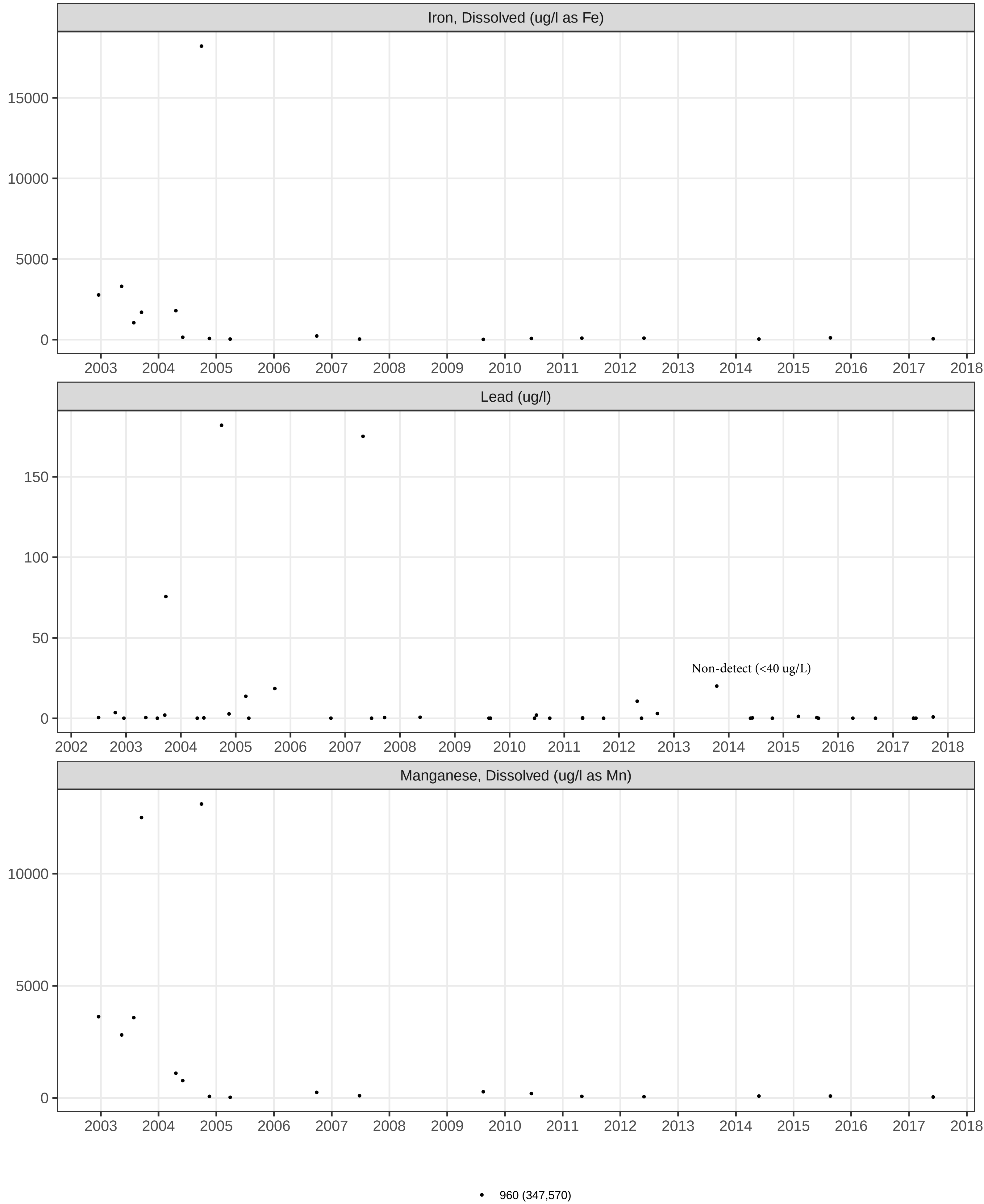

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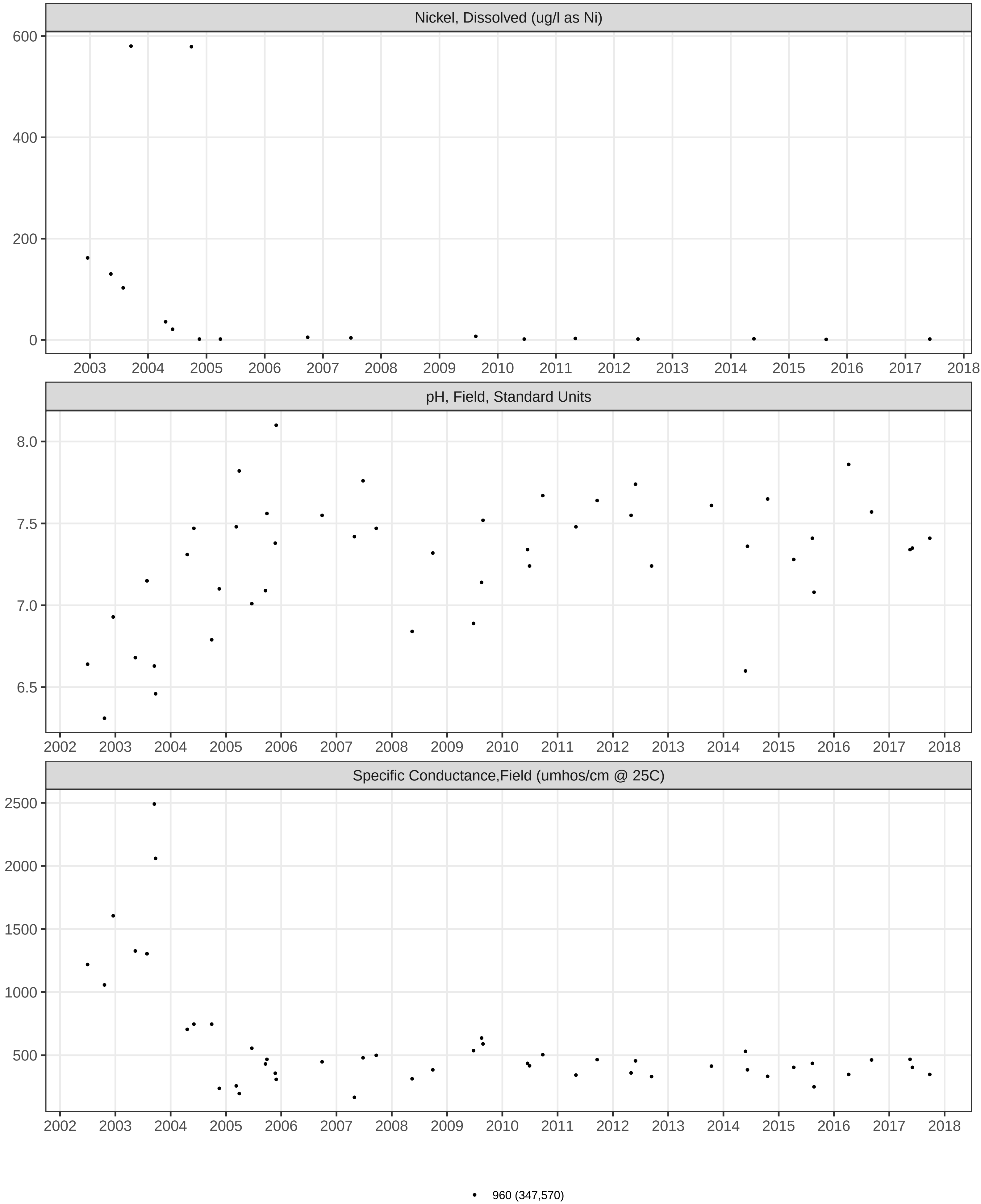

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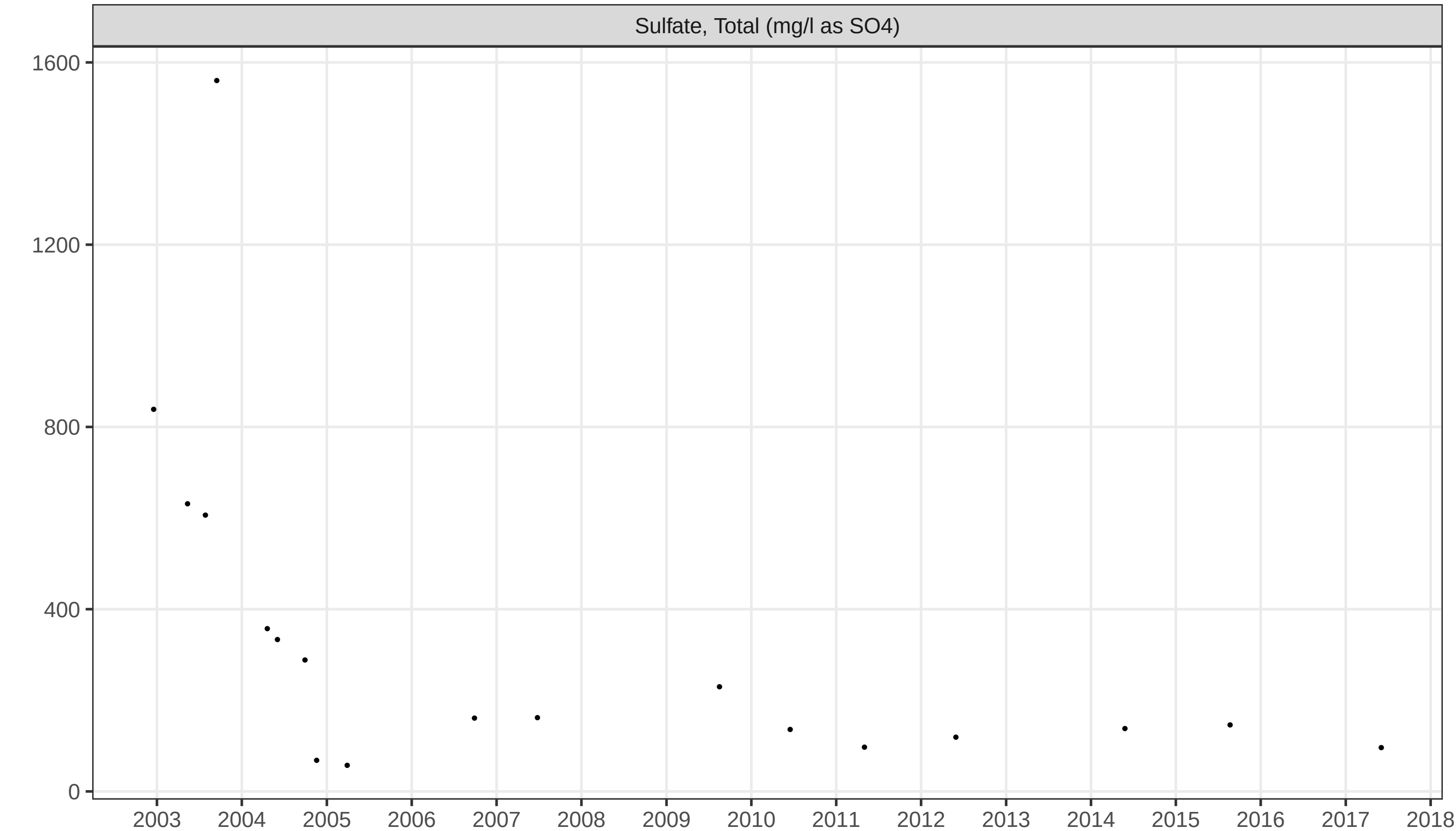

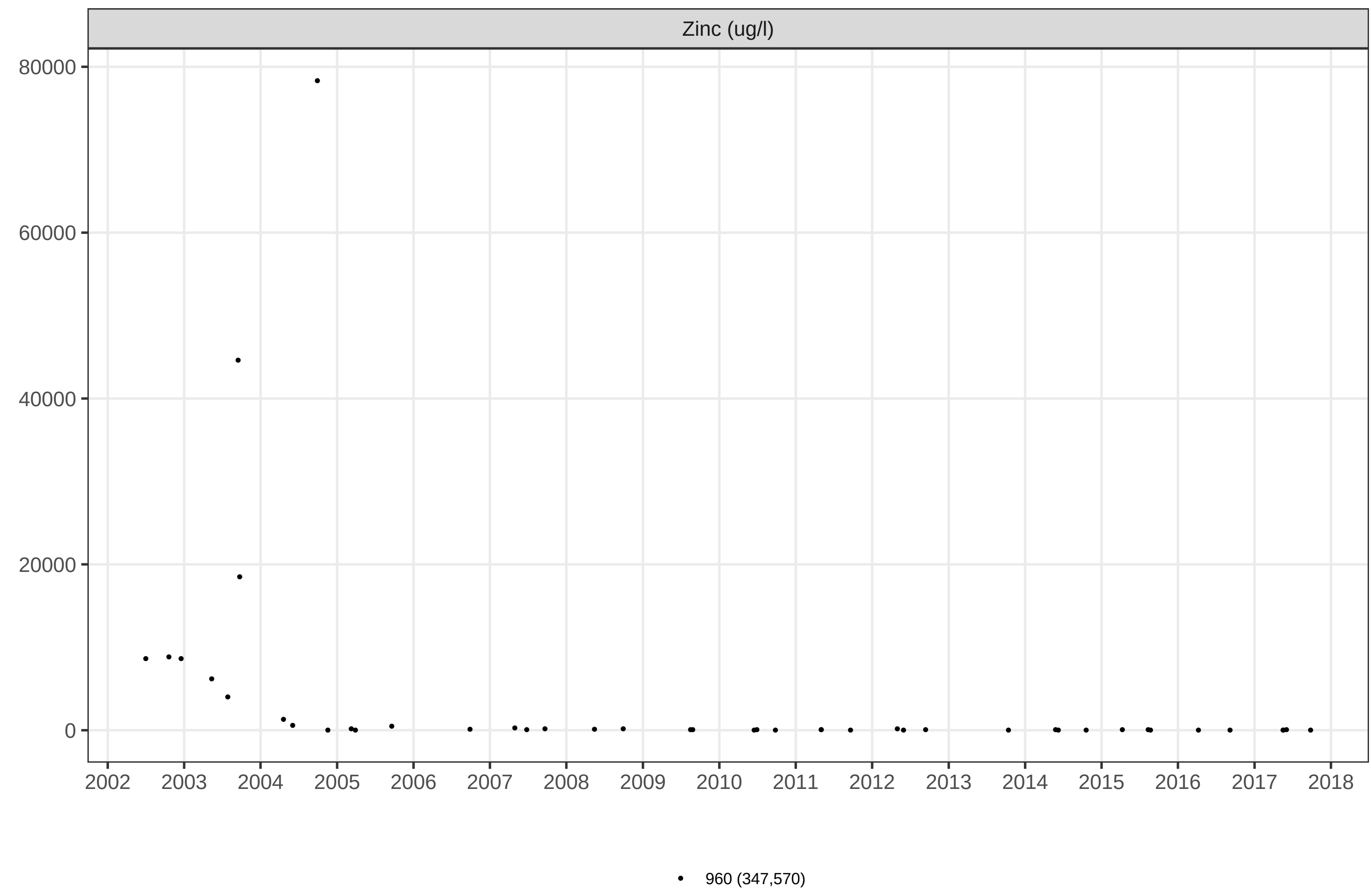

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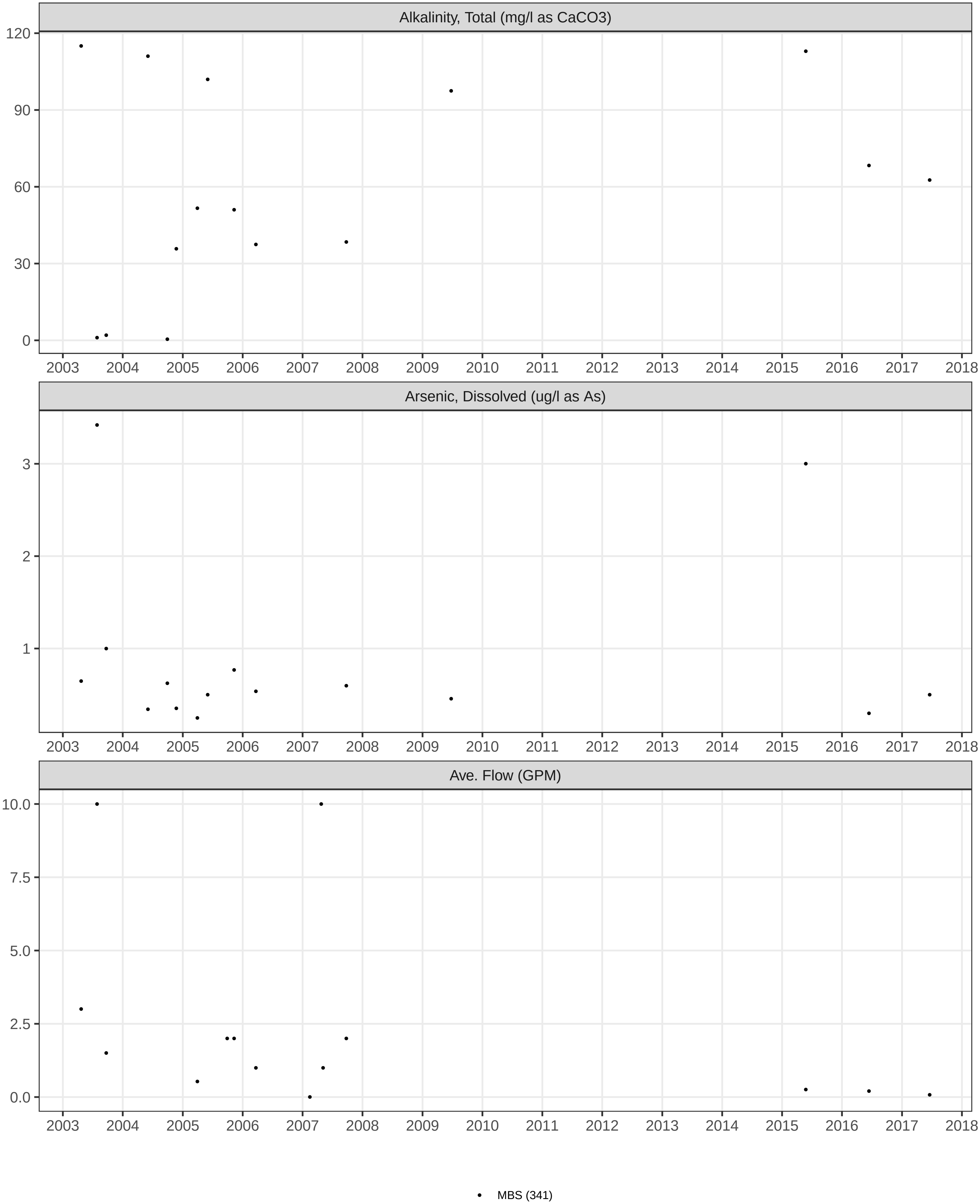

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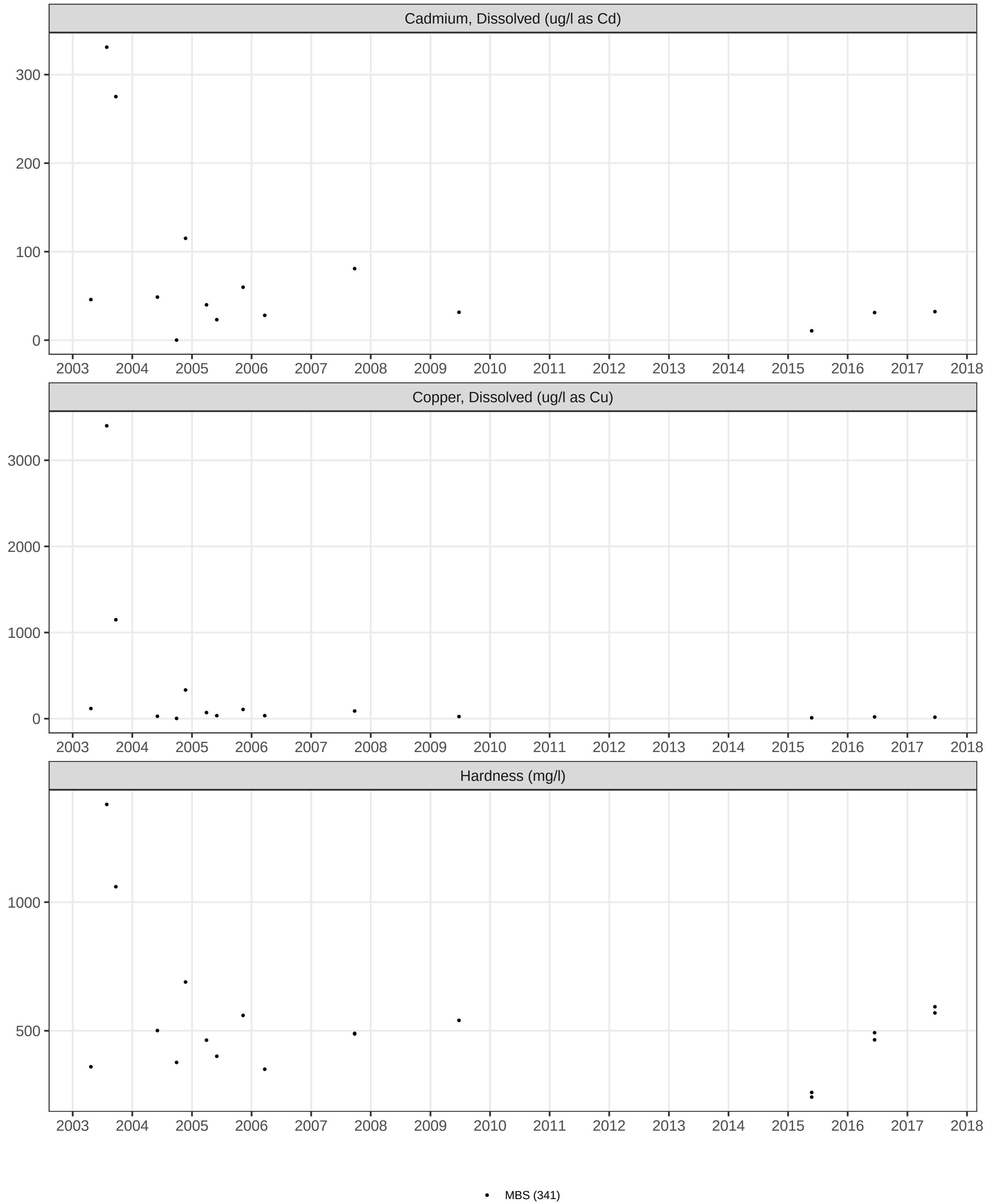

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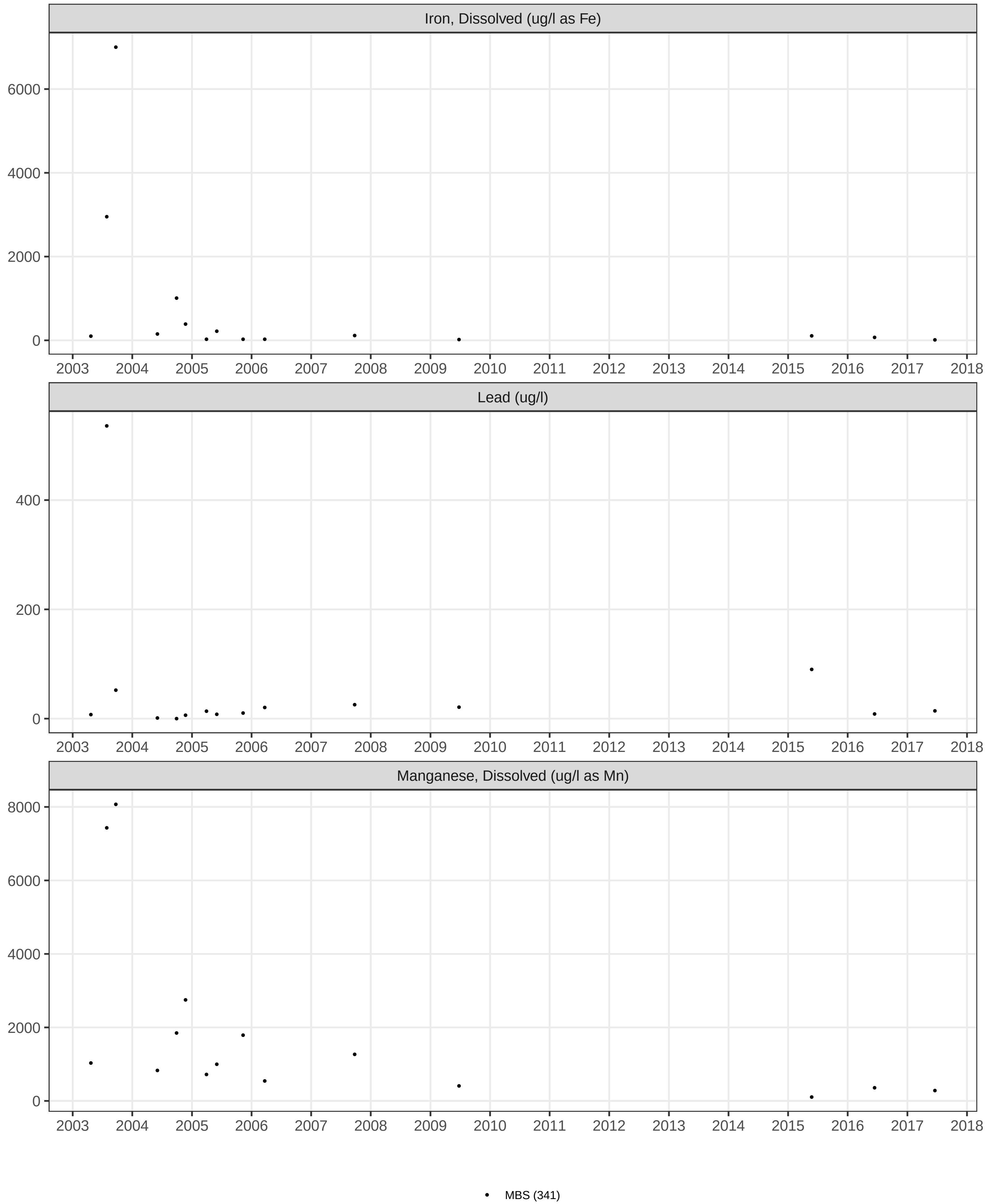

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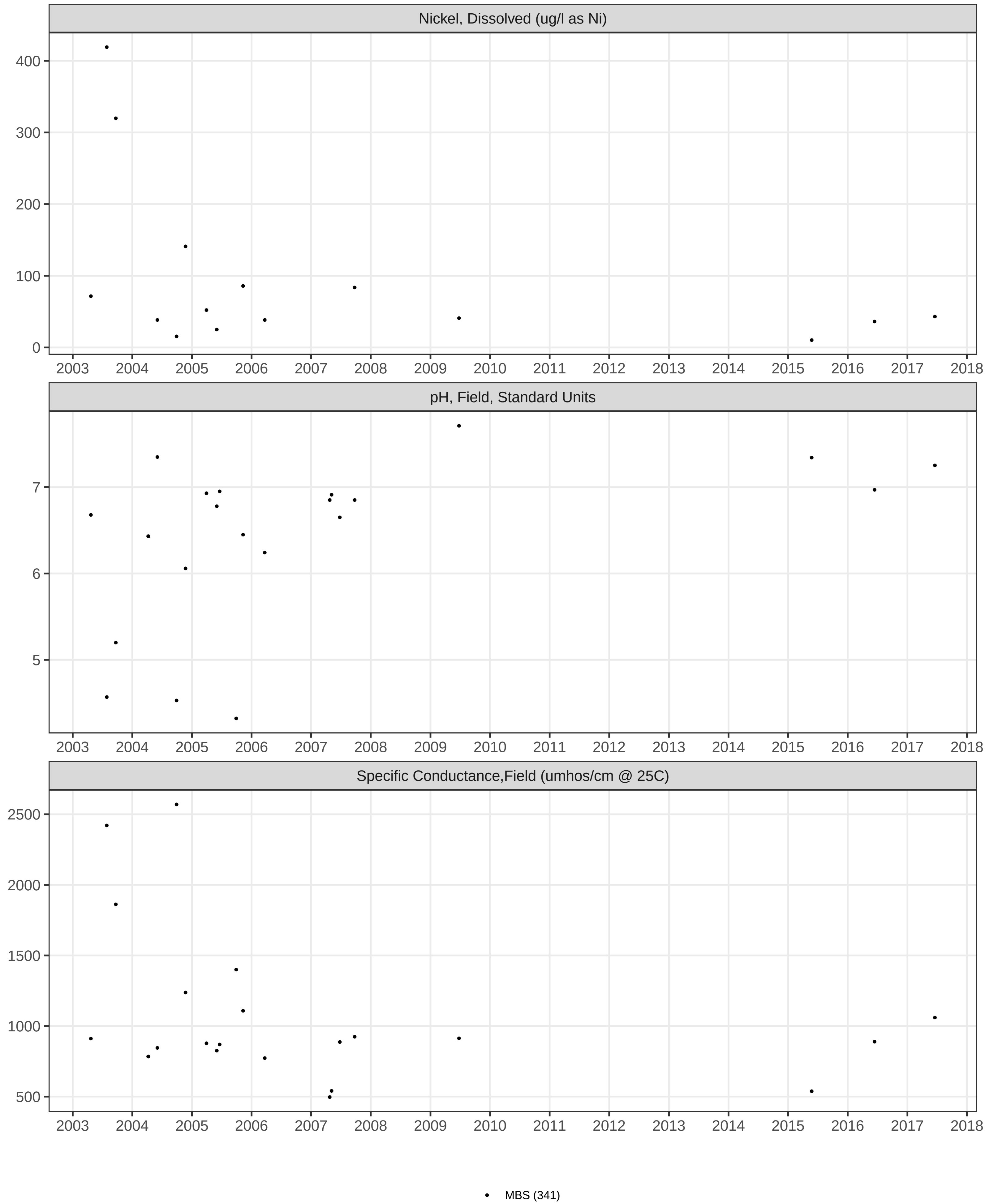

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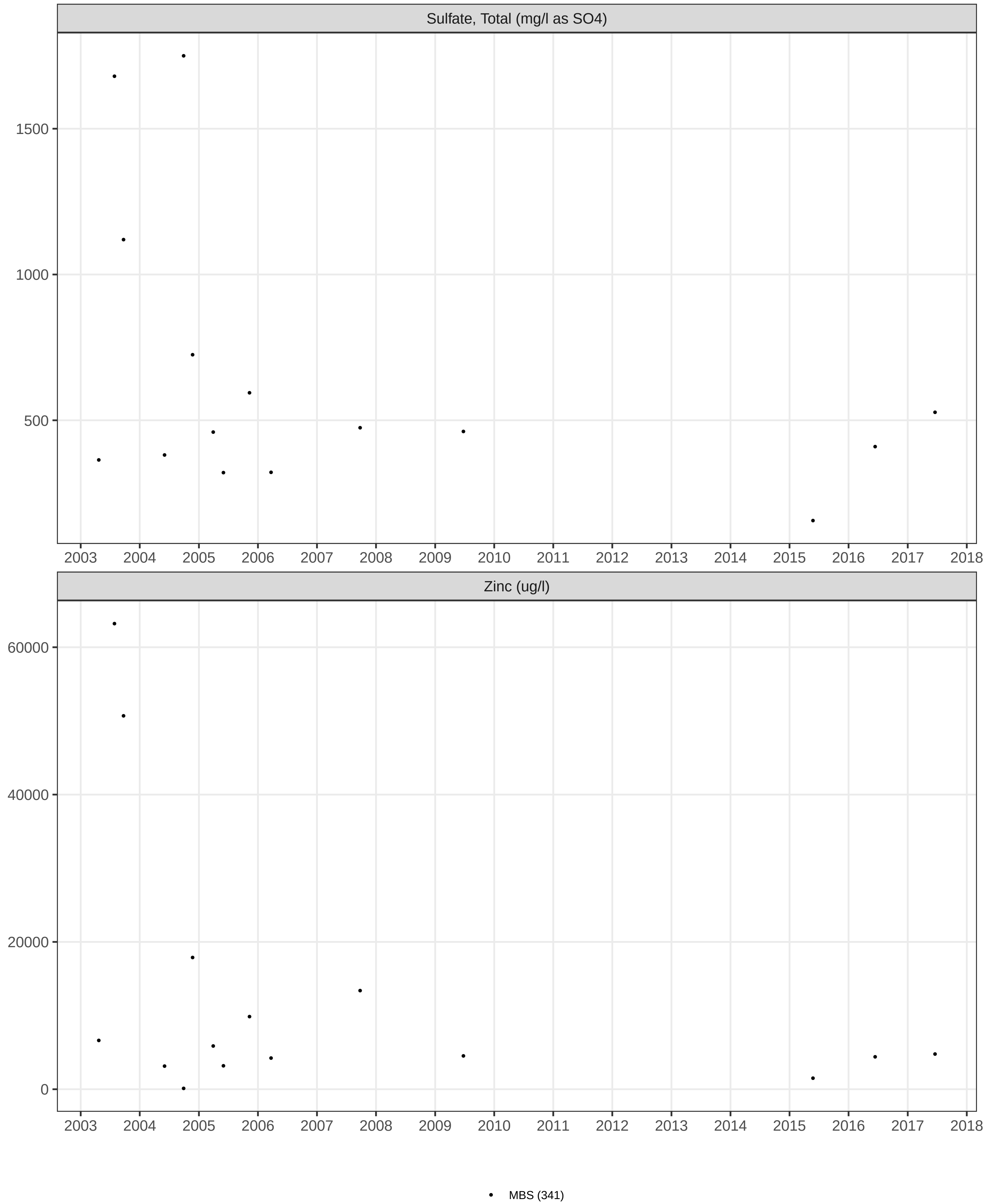

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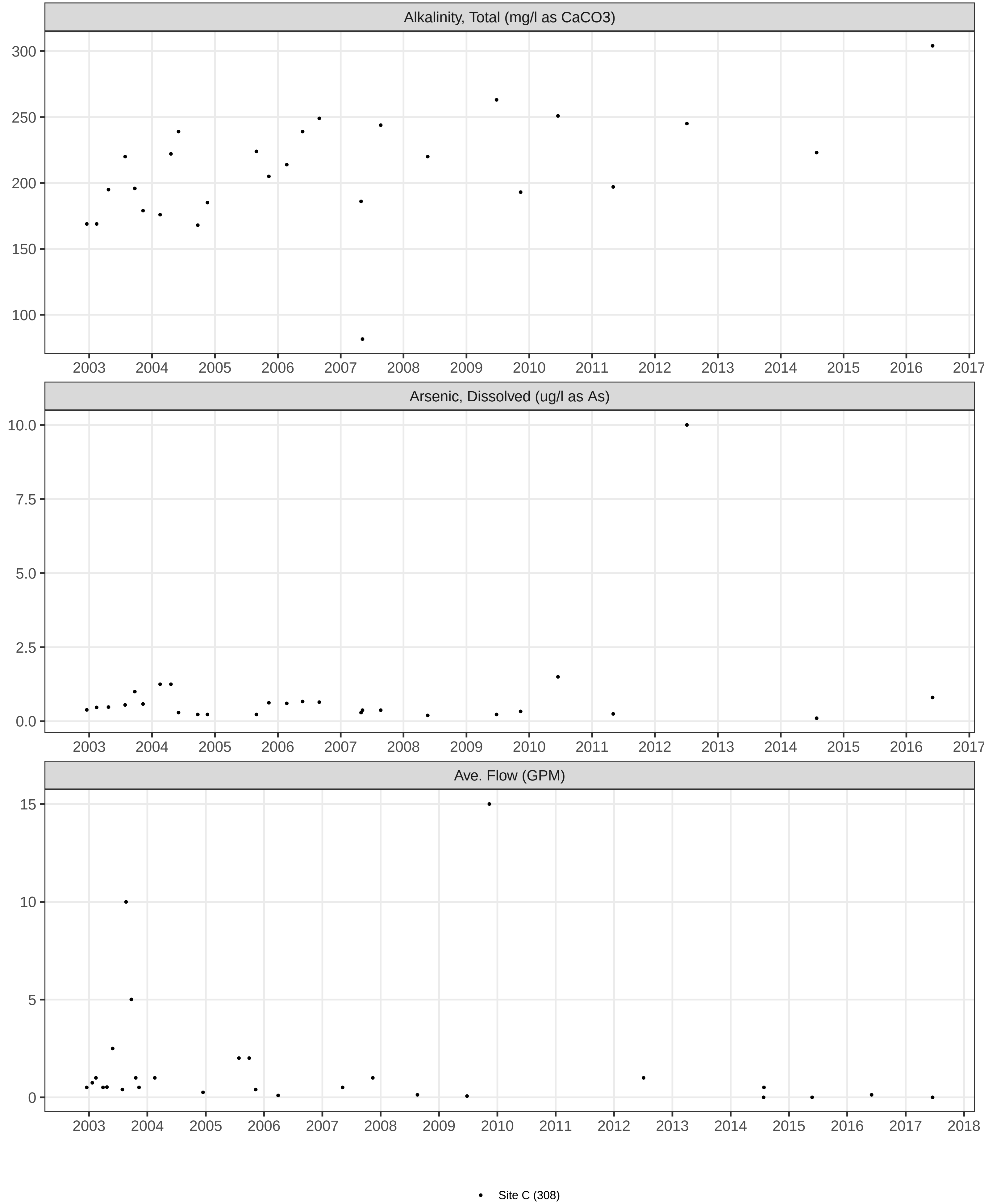

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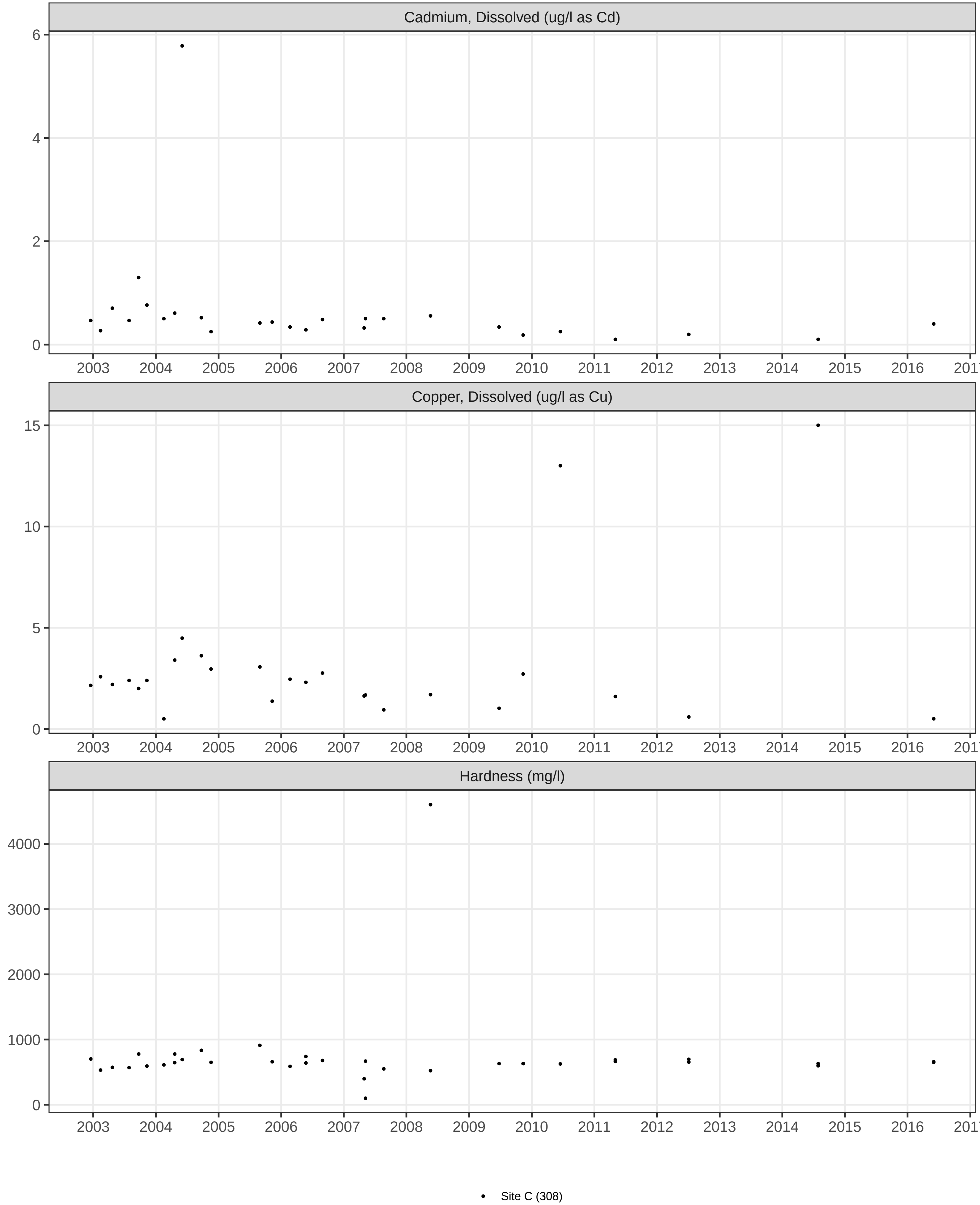

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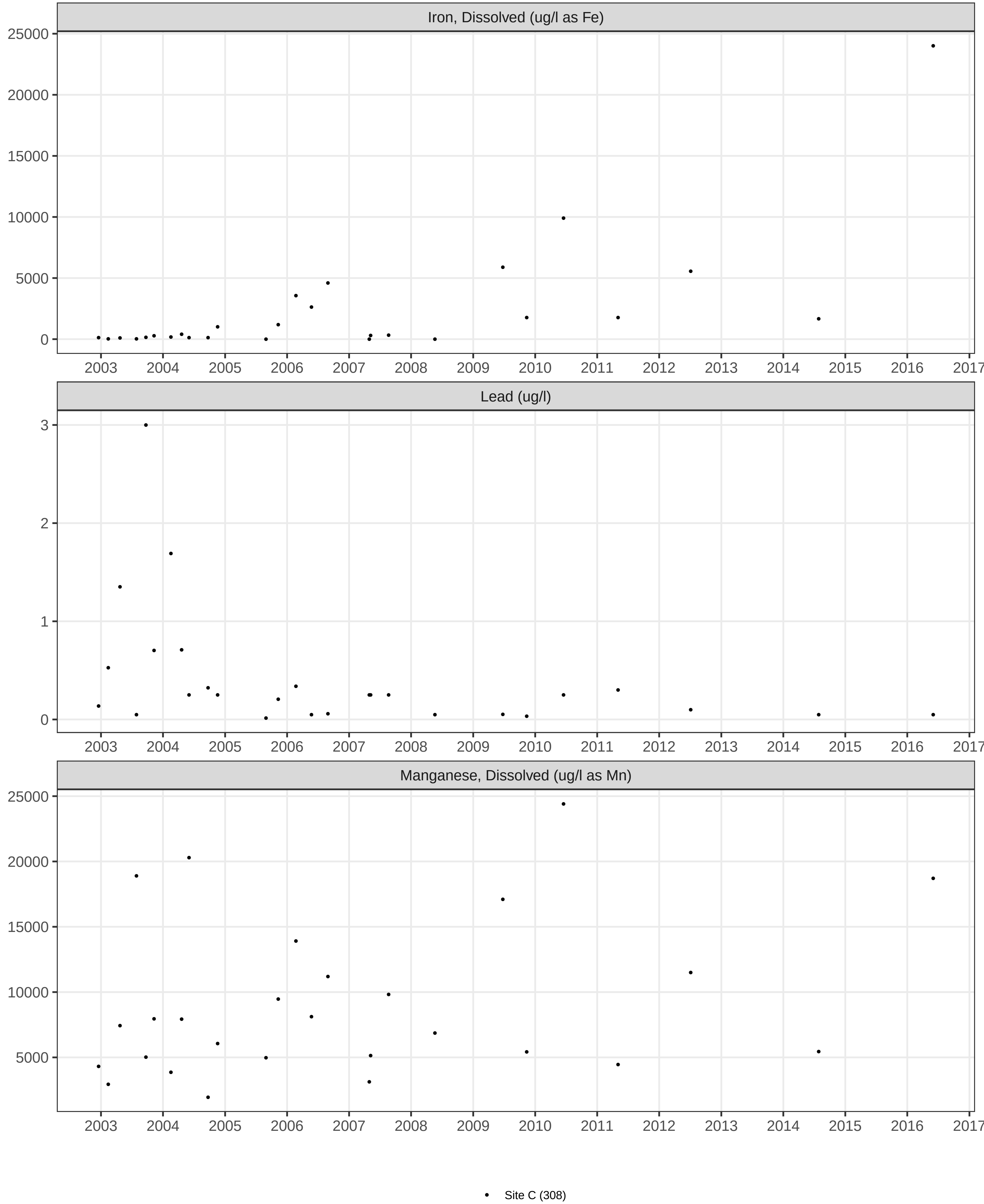

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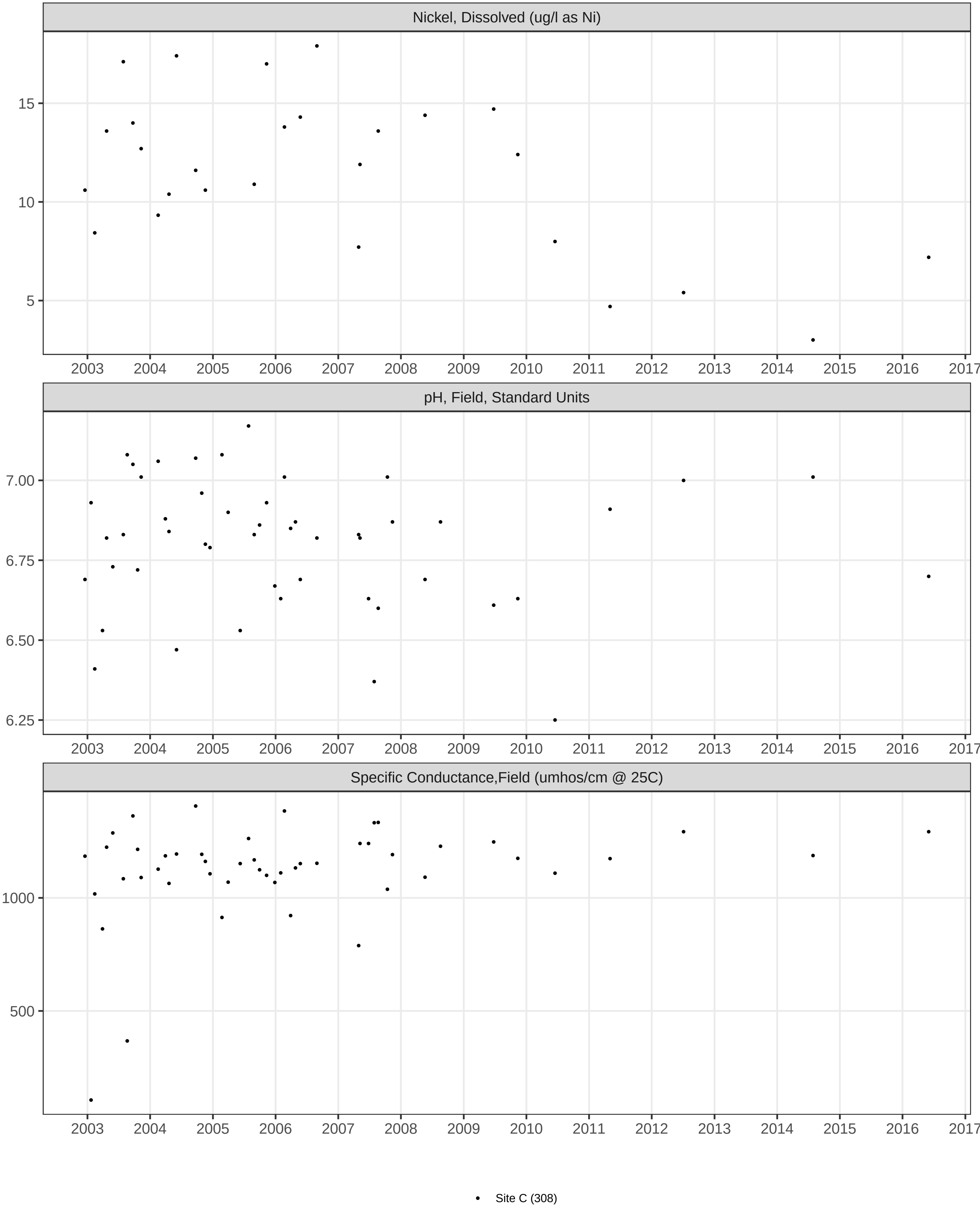

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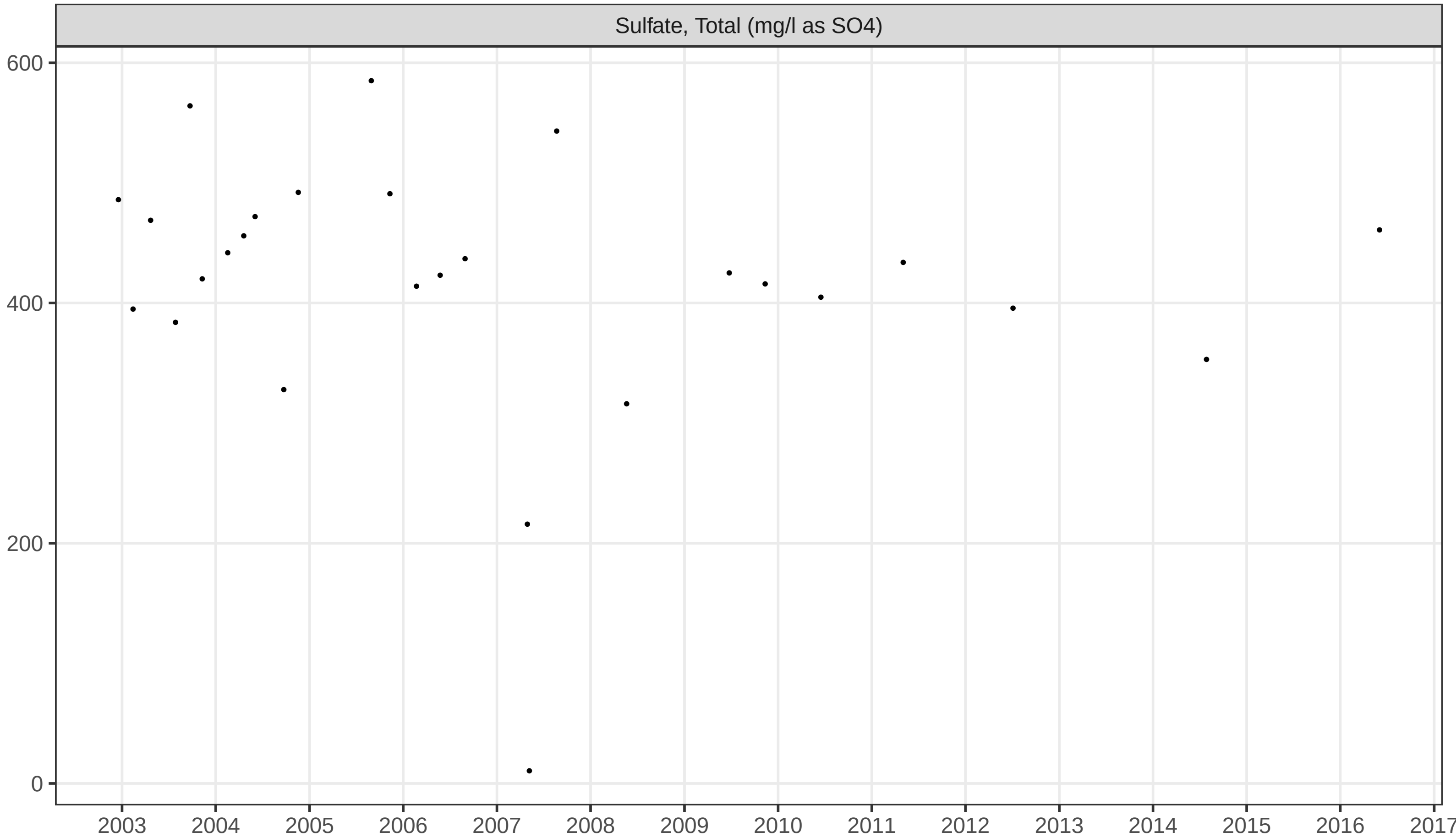

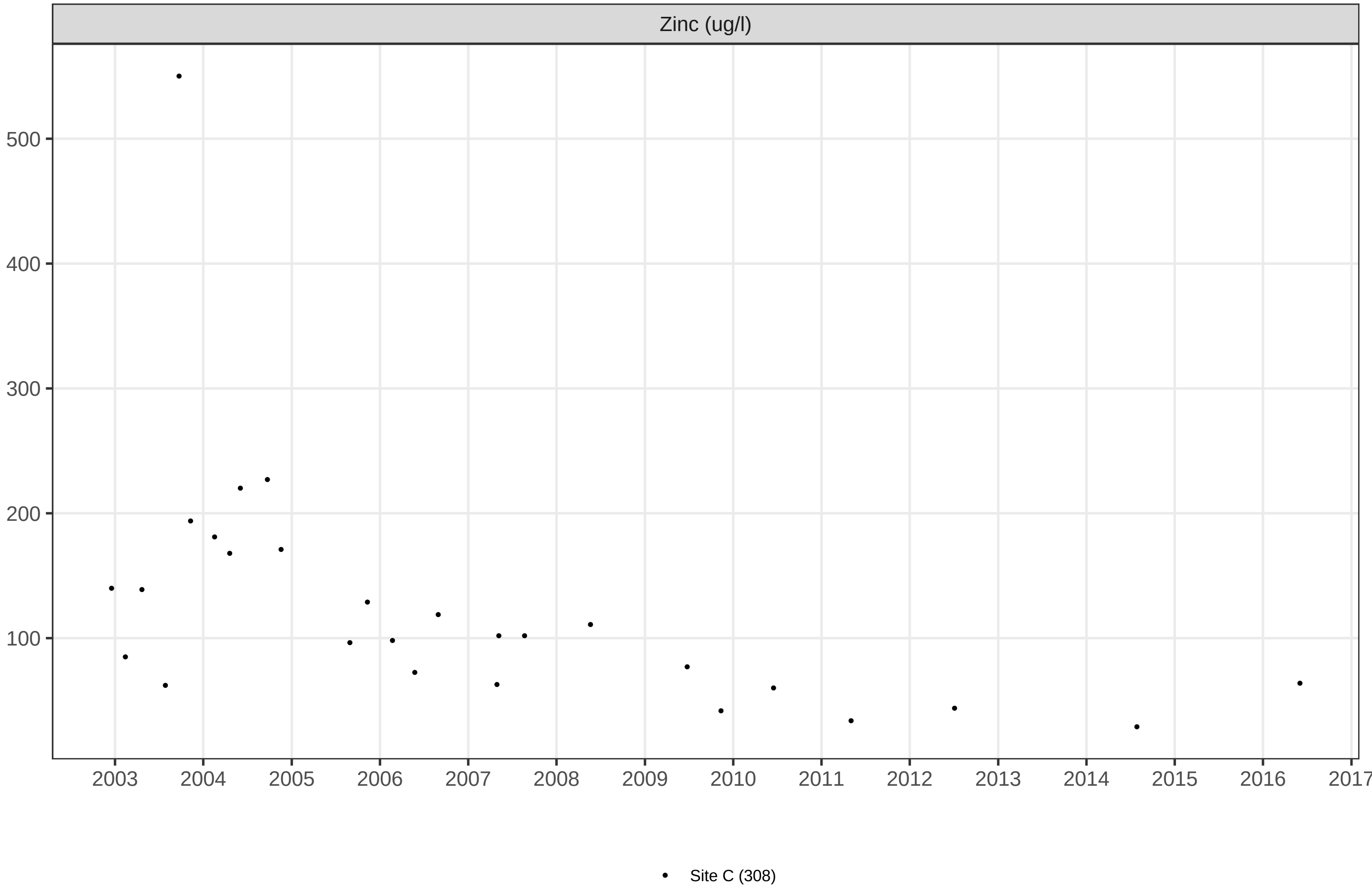

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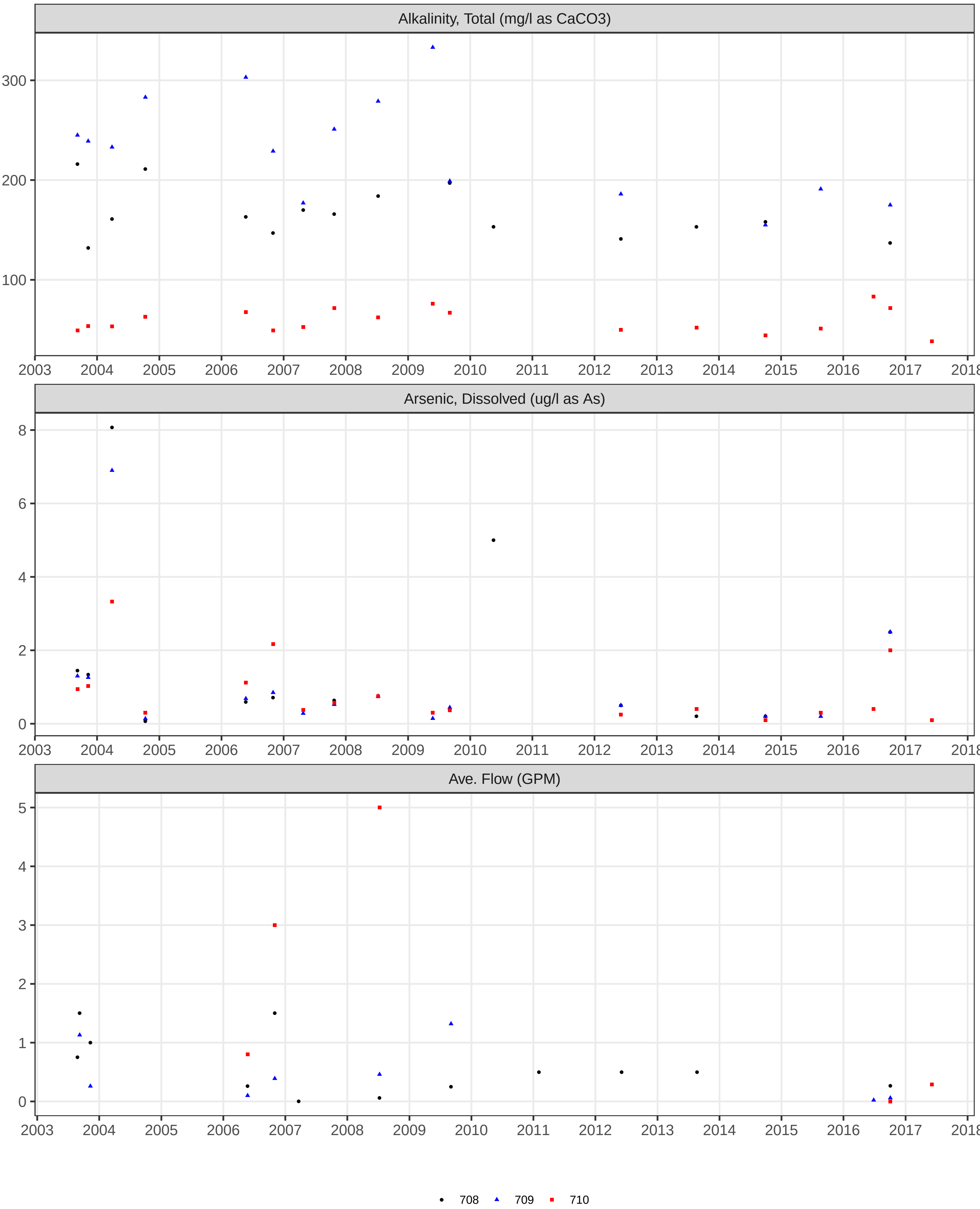

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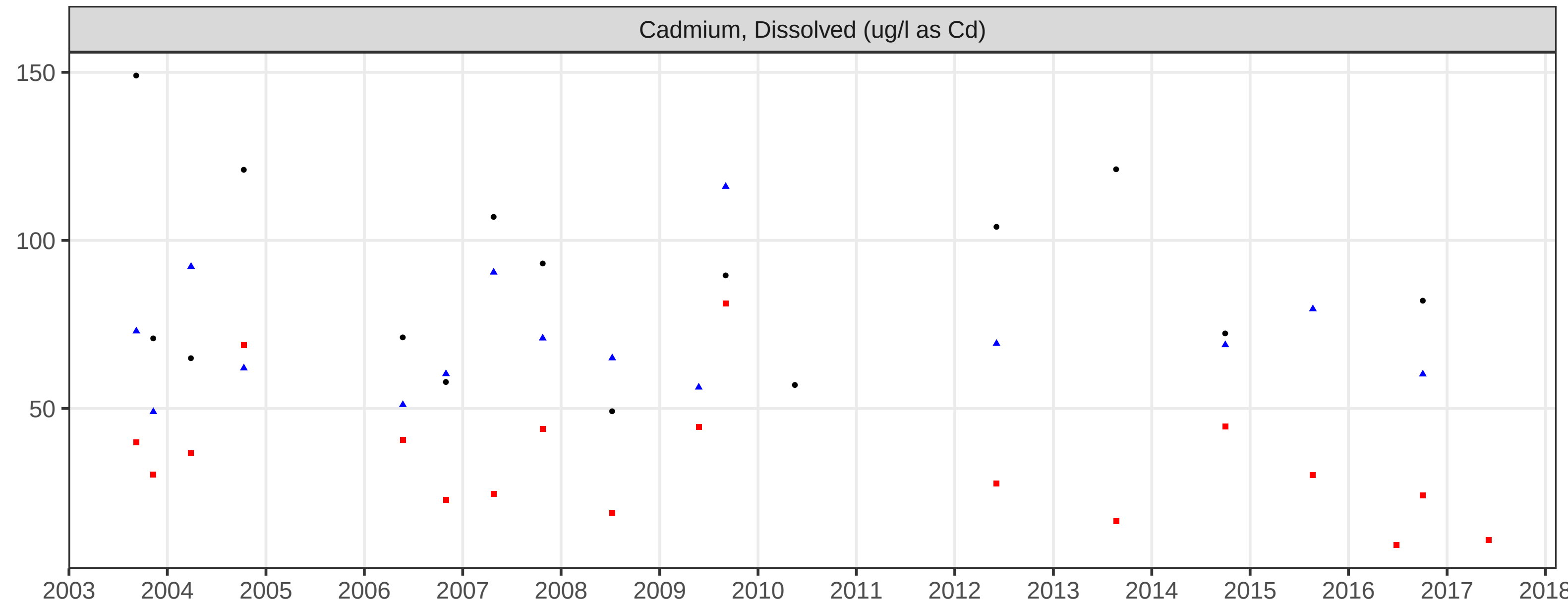

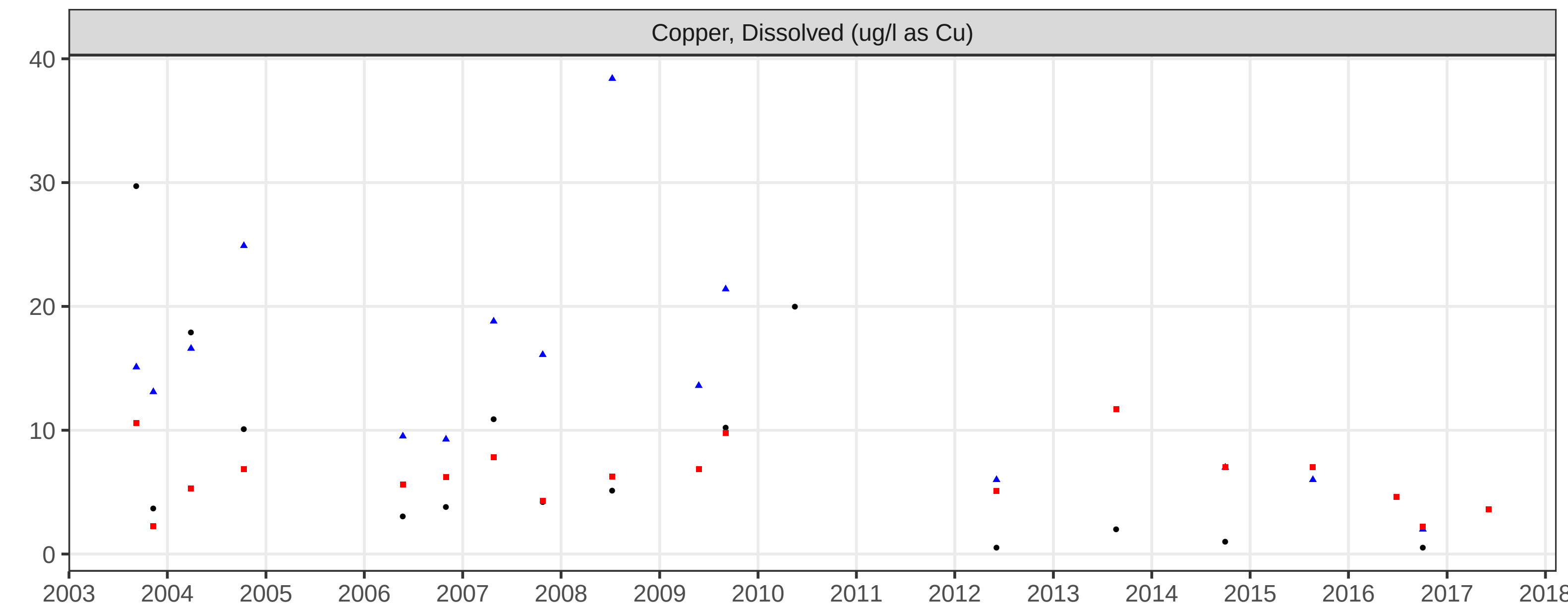

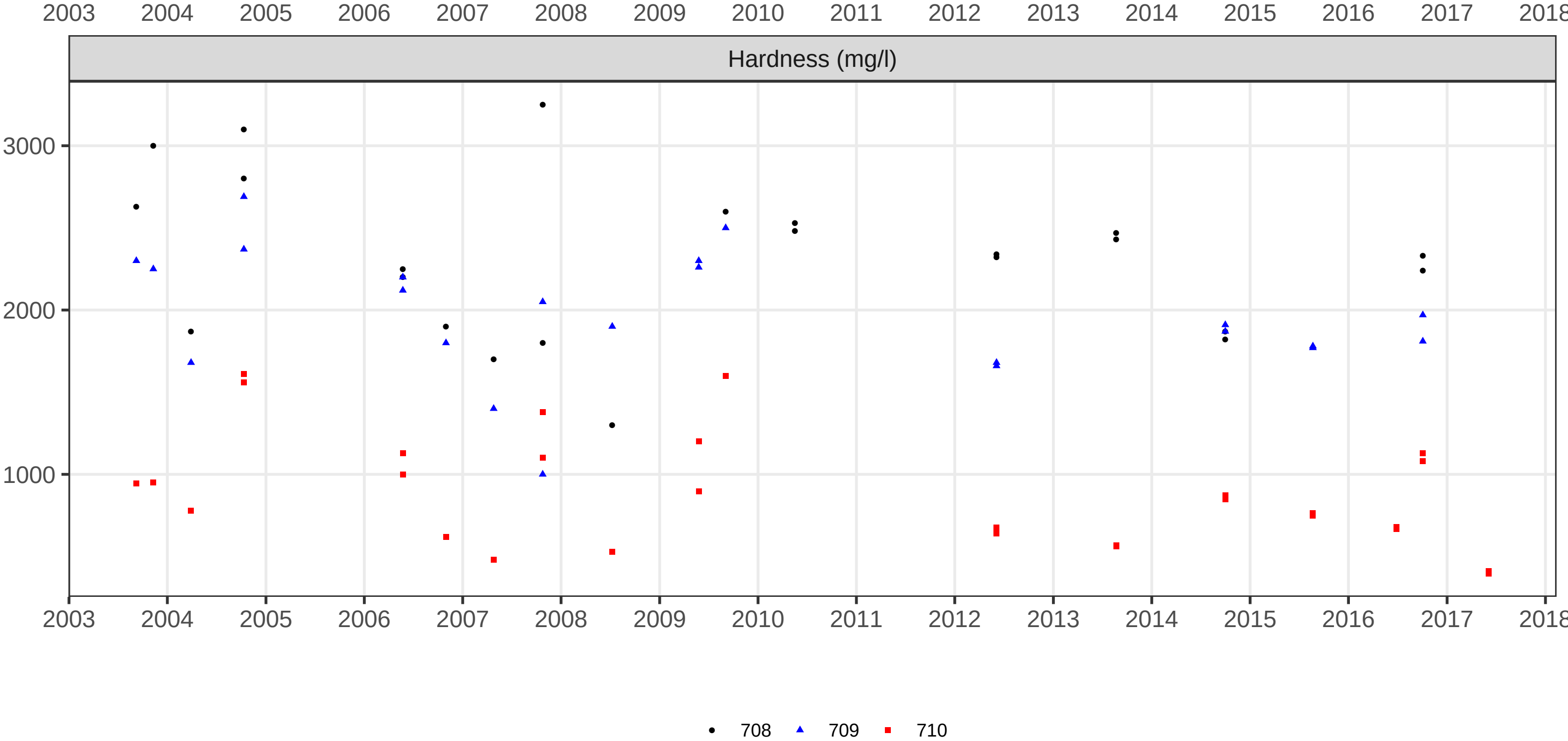

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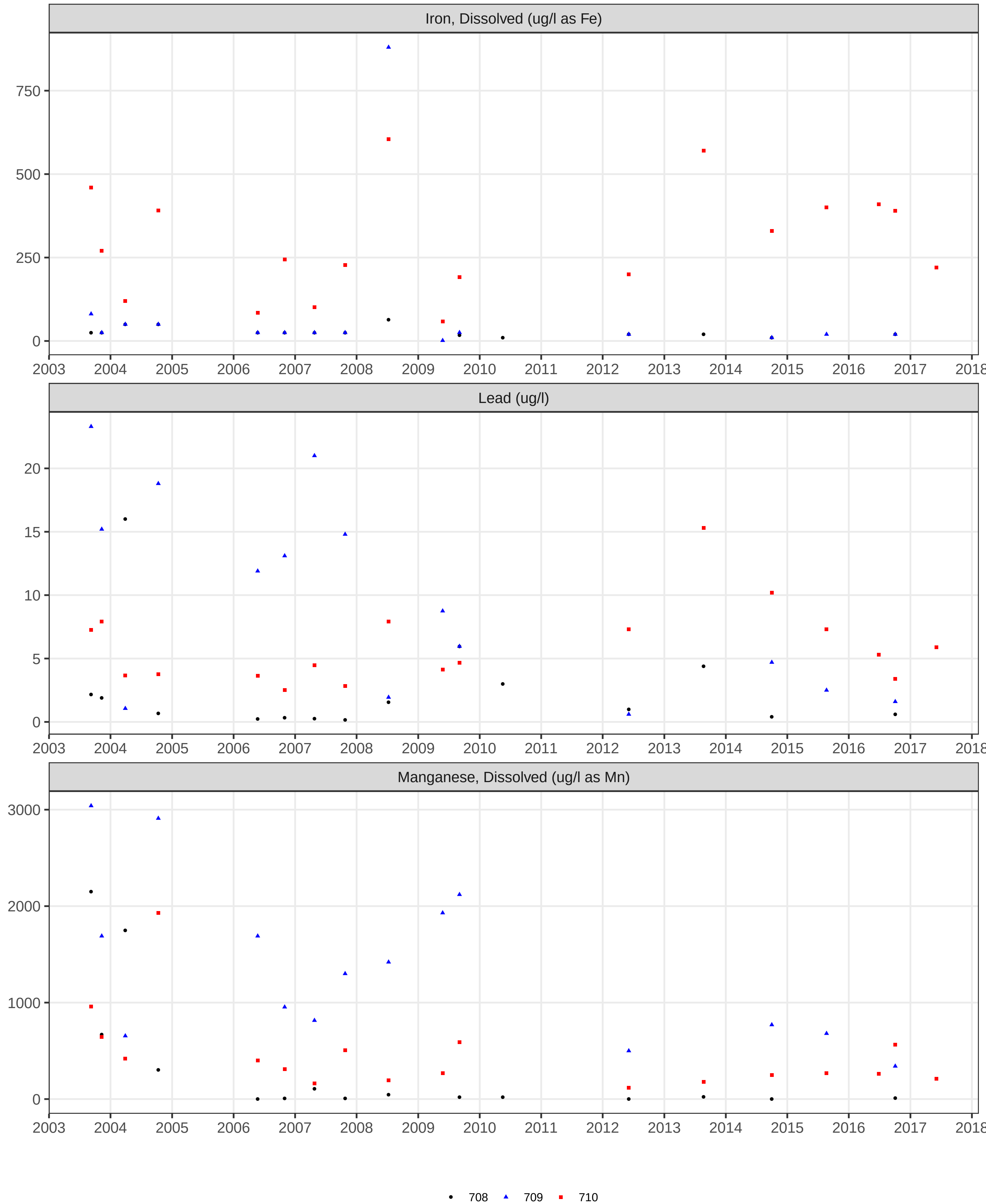

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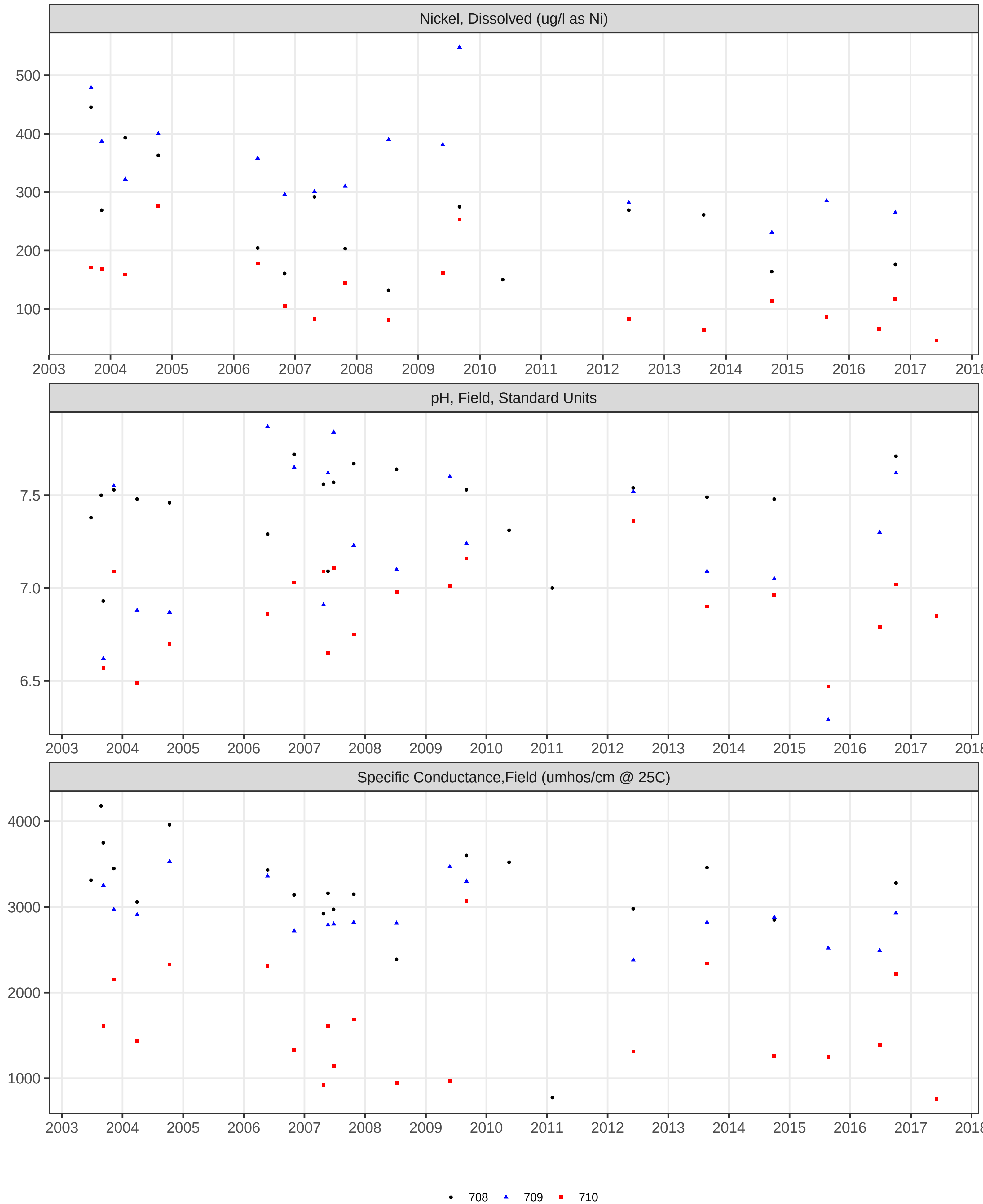

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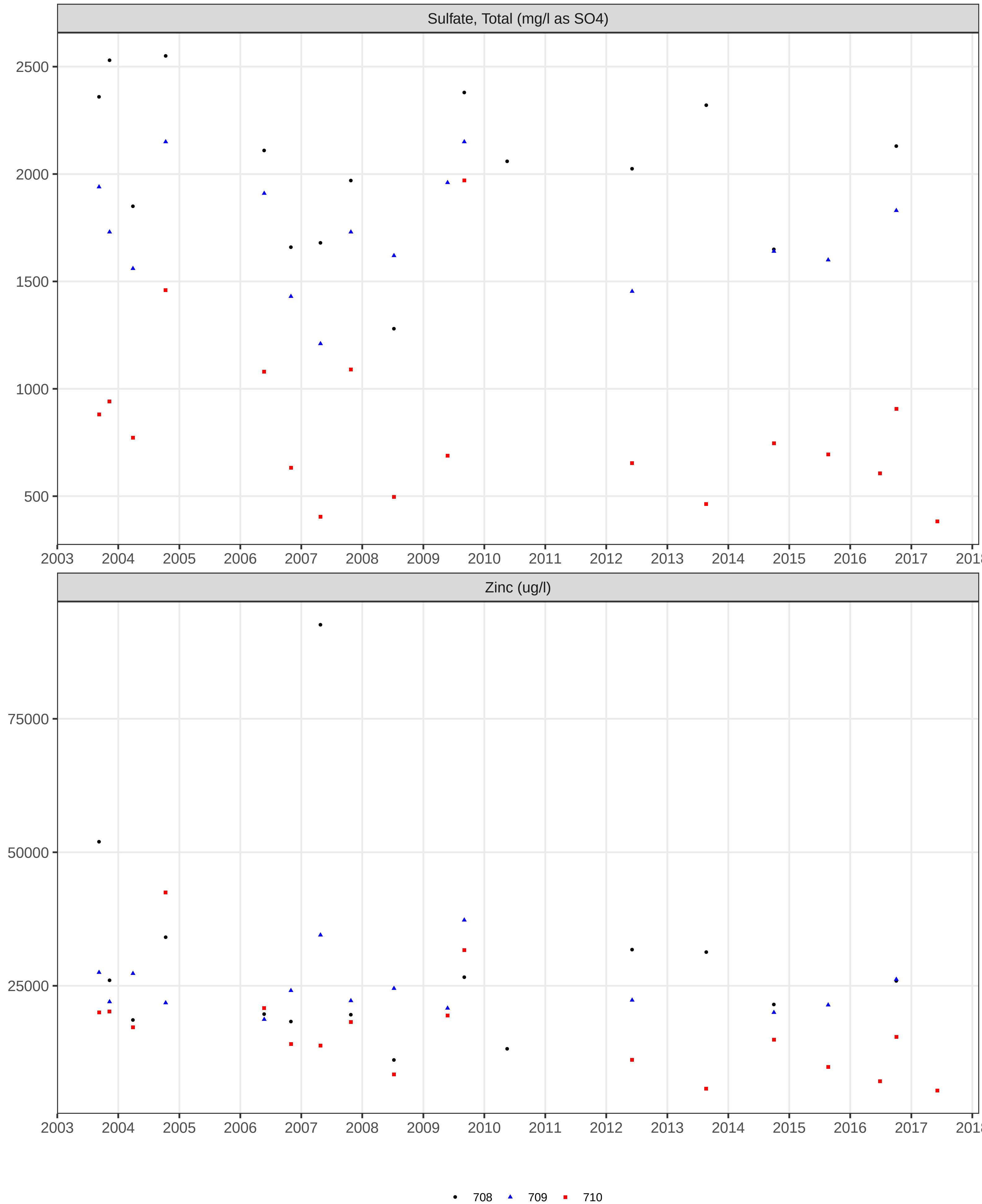

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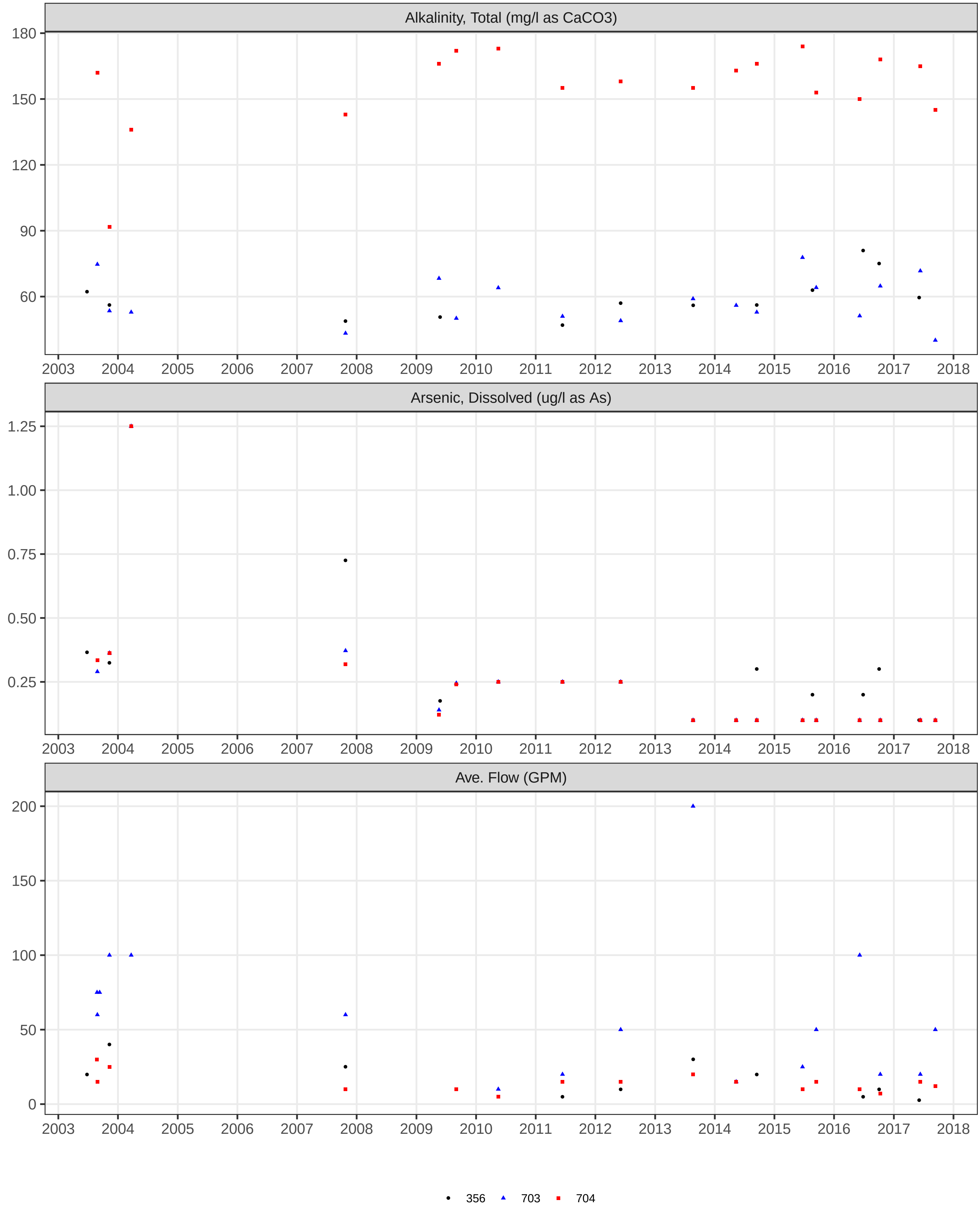

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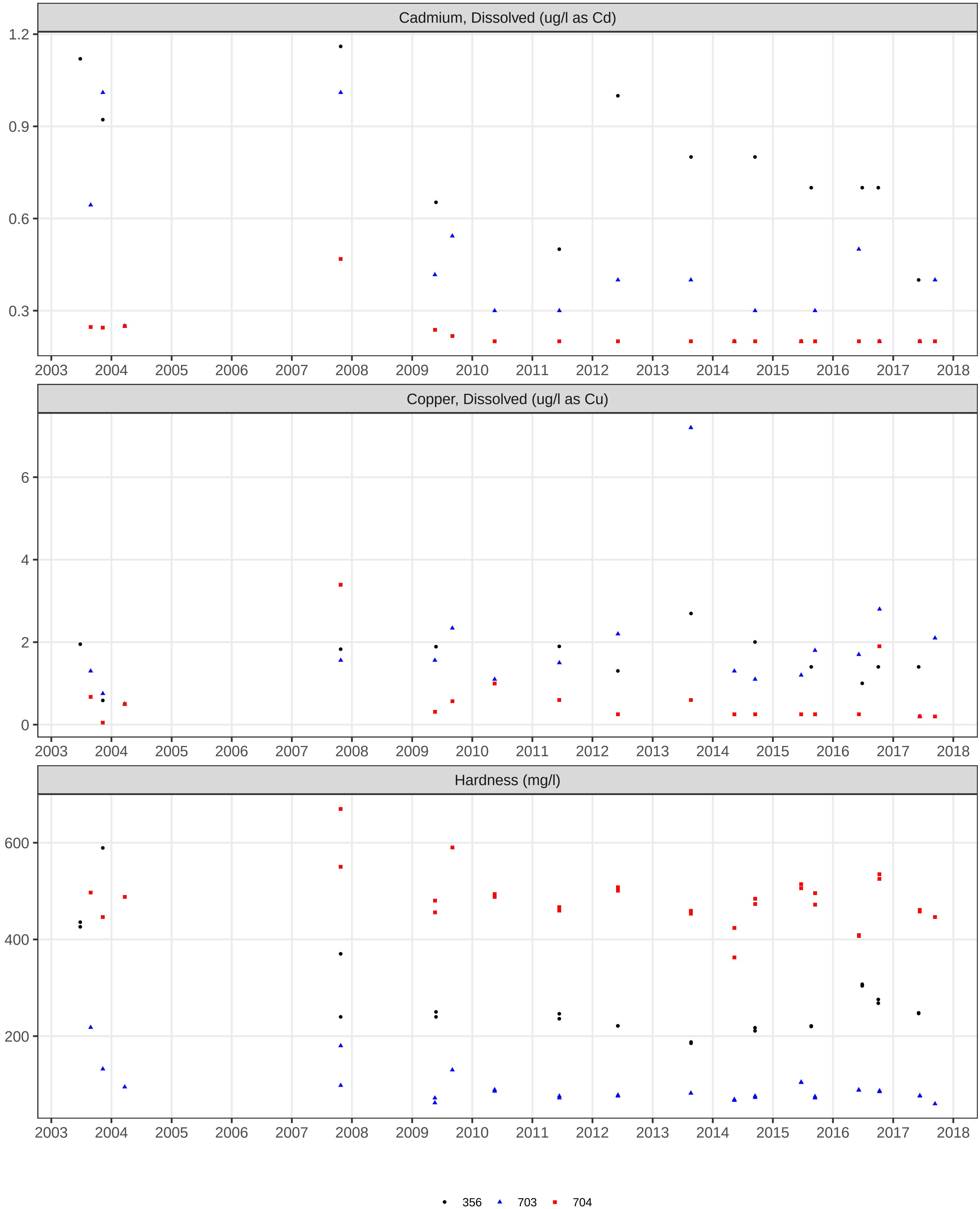

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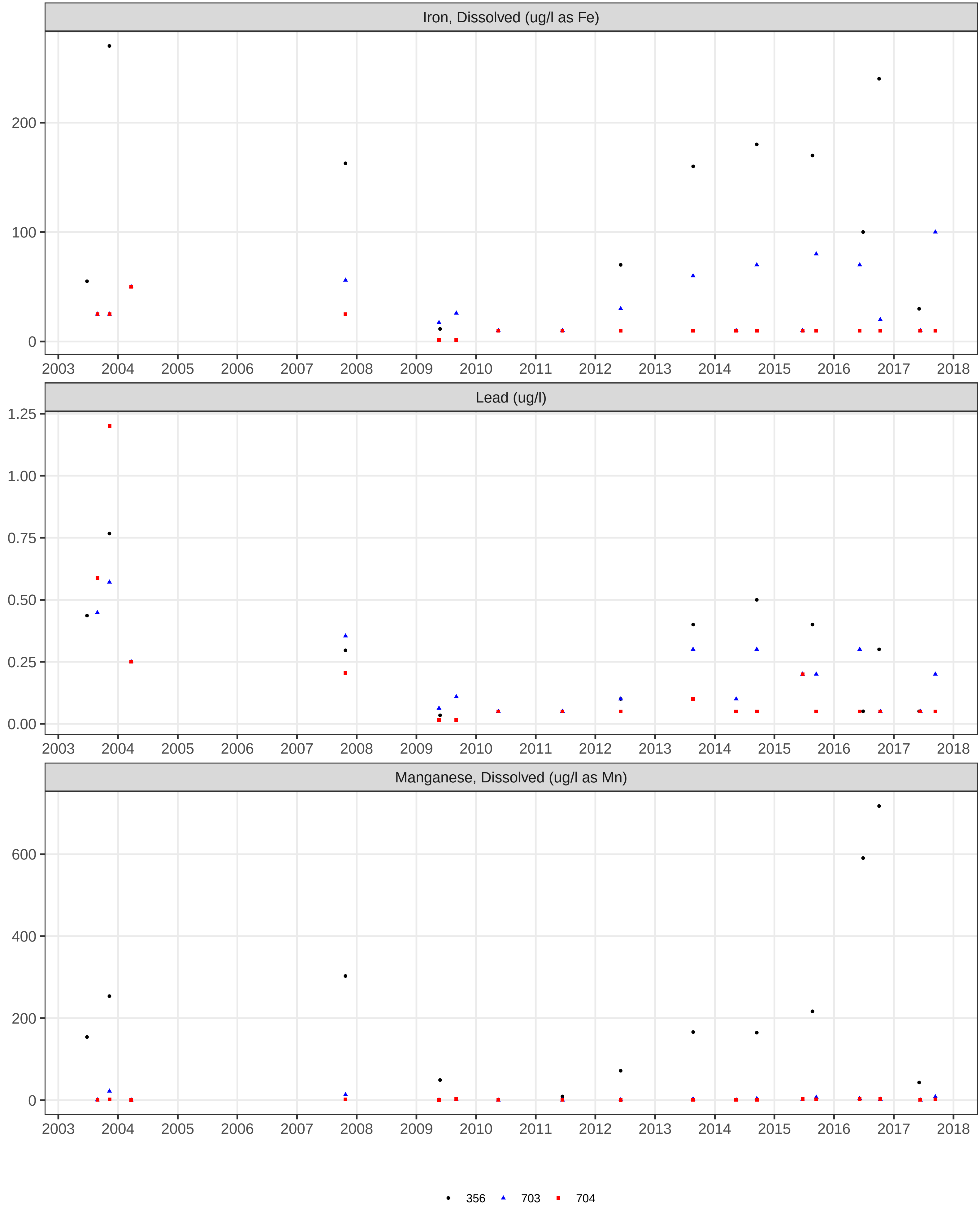

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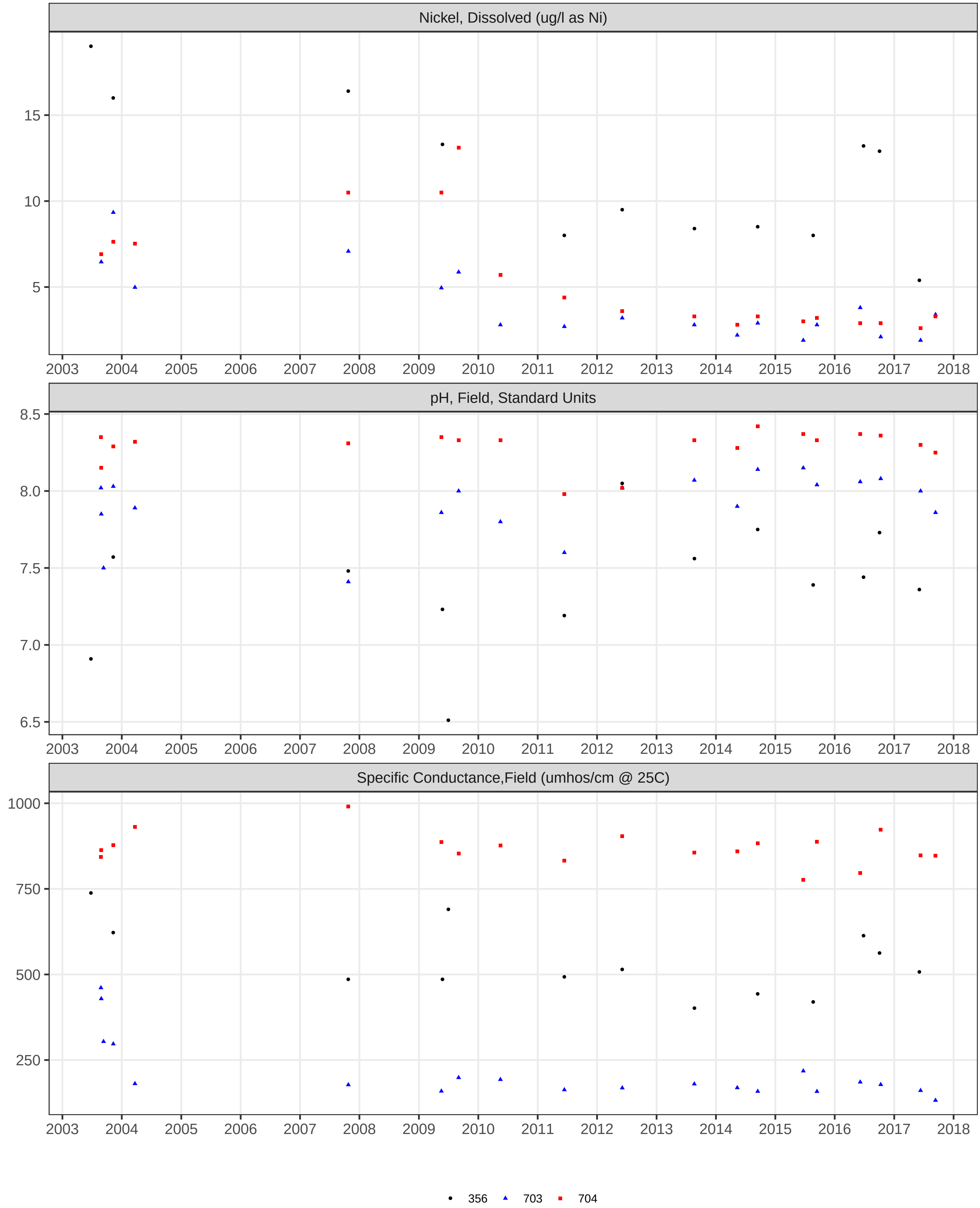

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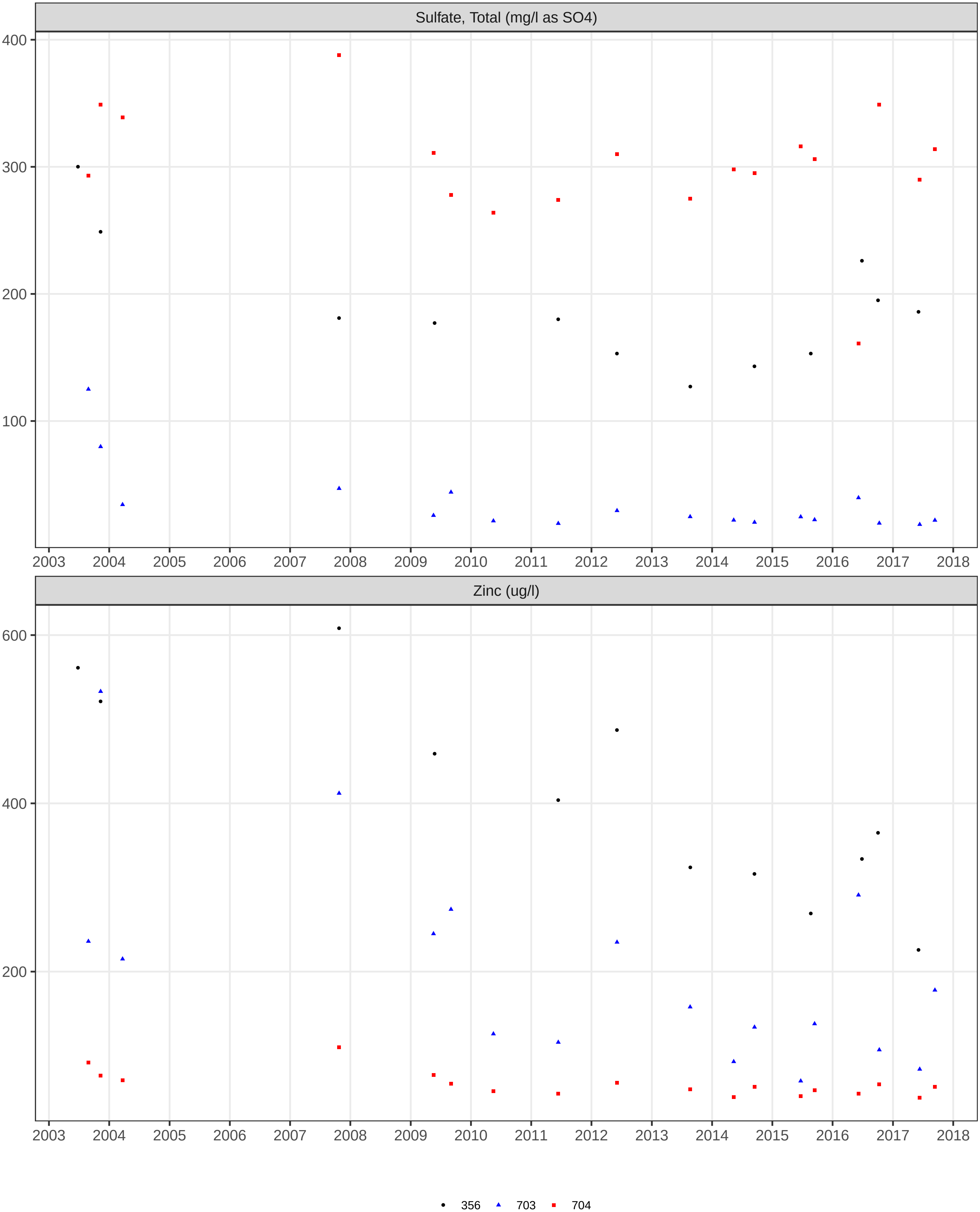

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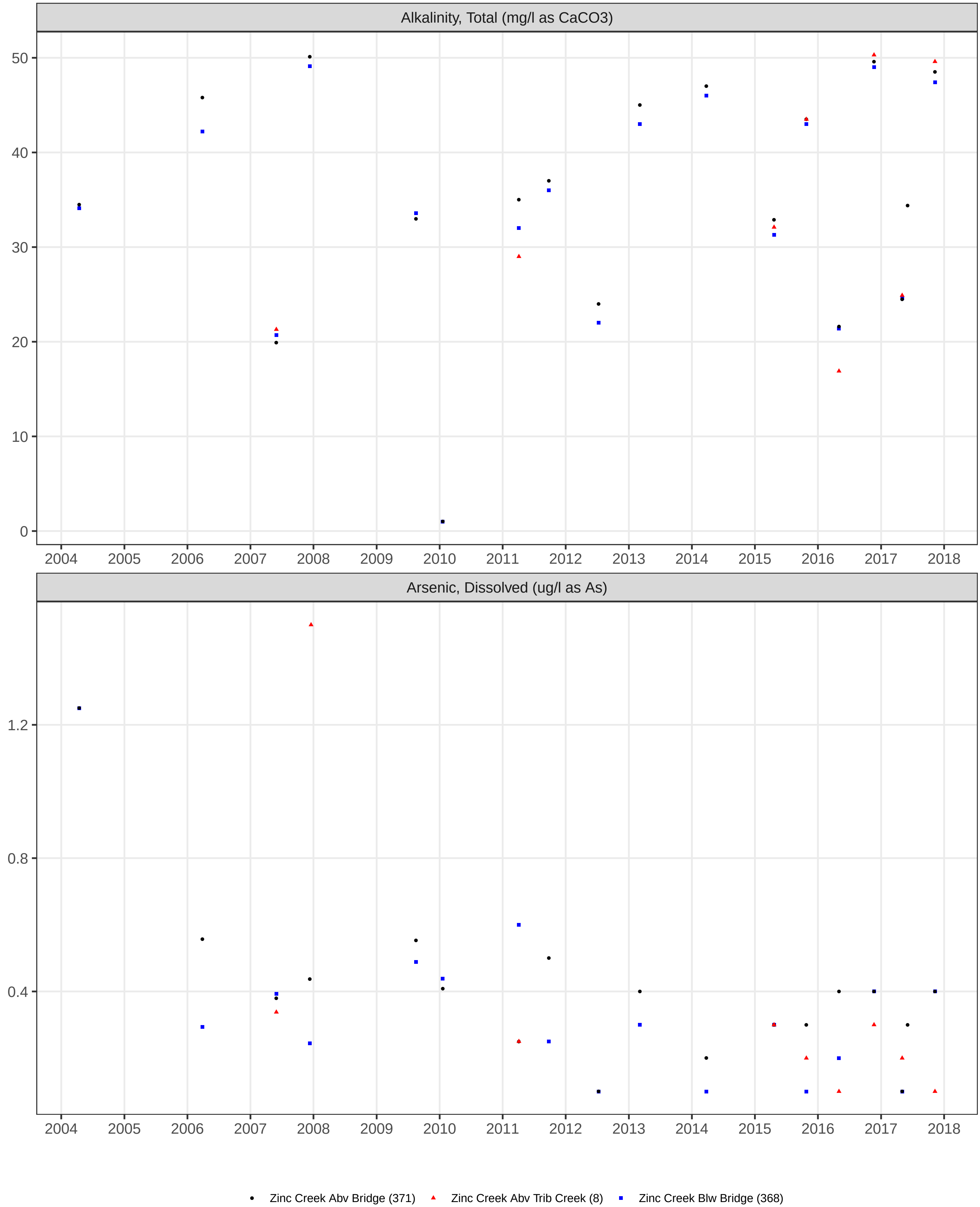
Zinc Creek



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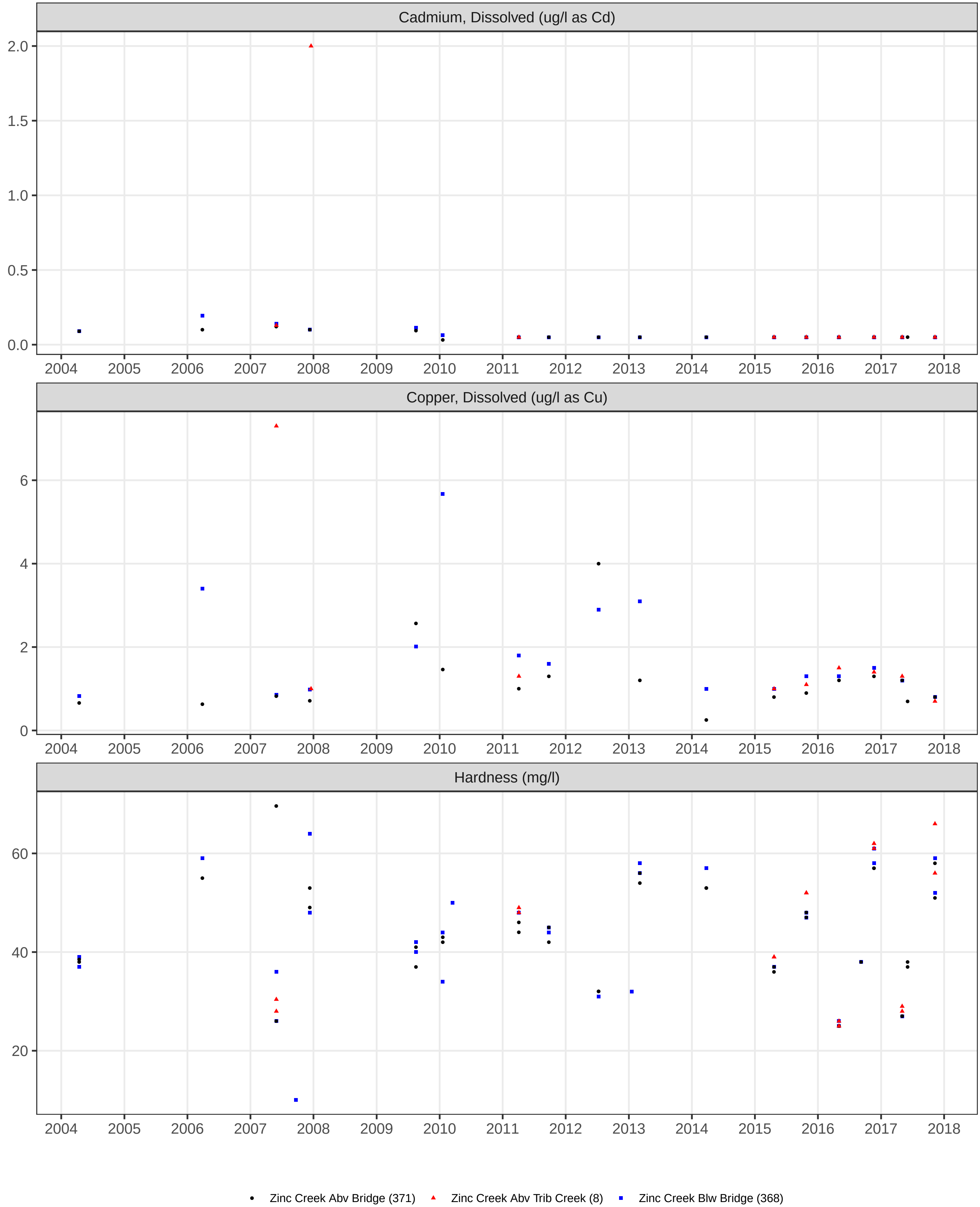

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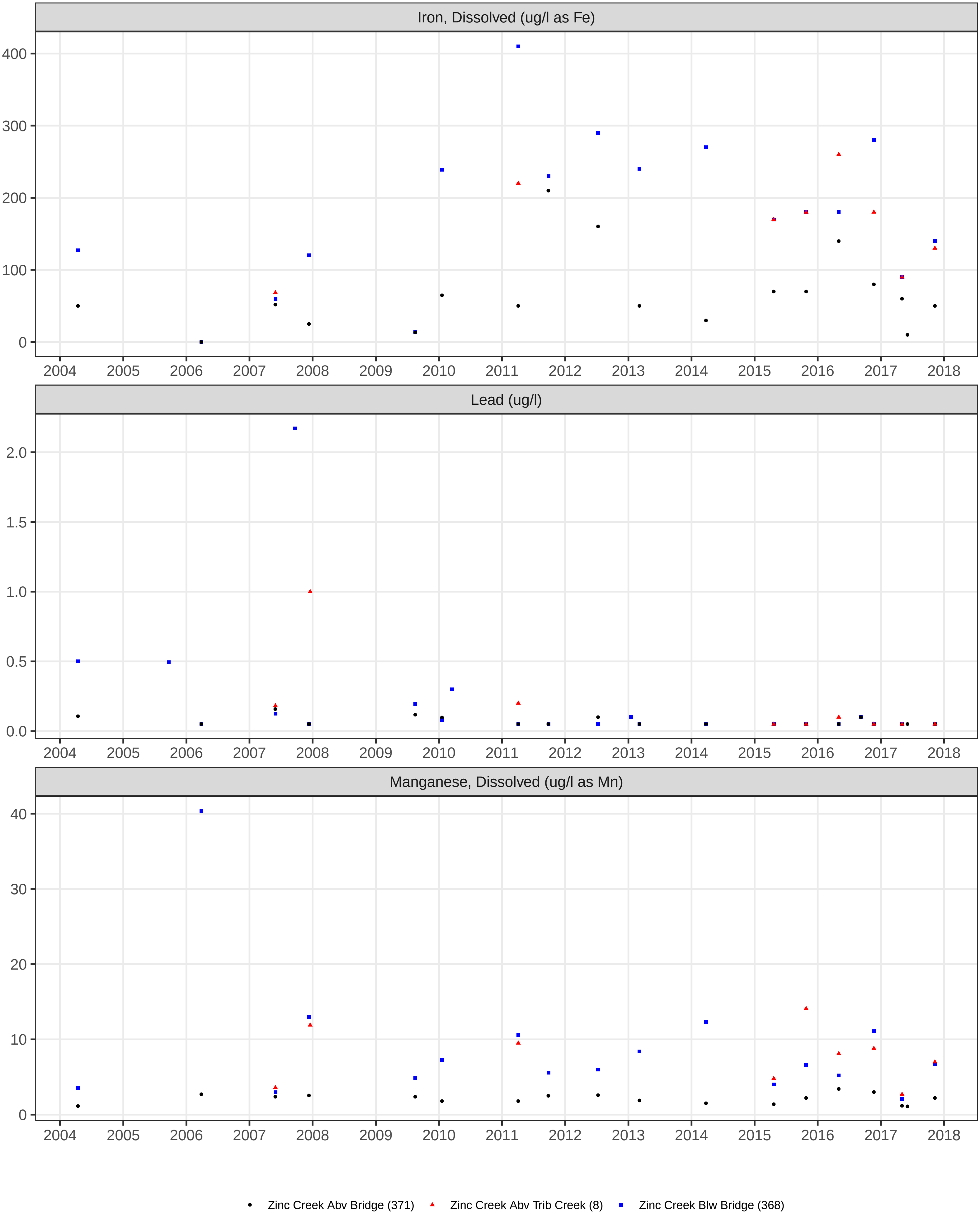

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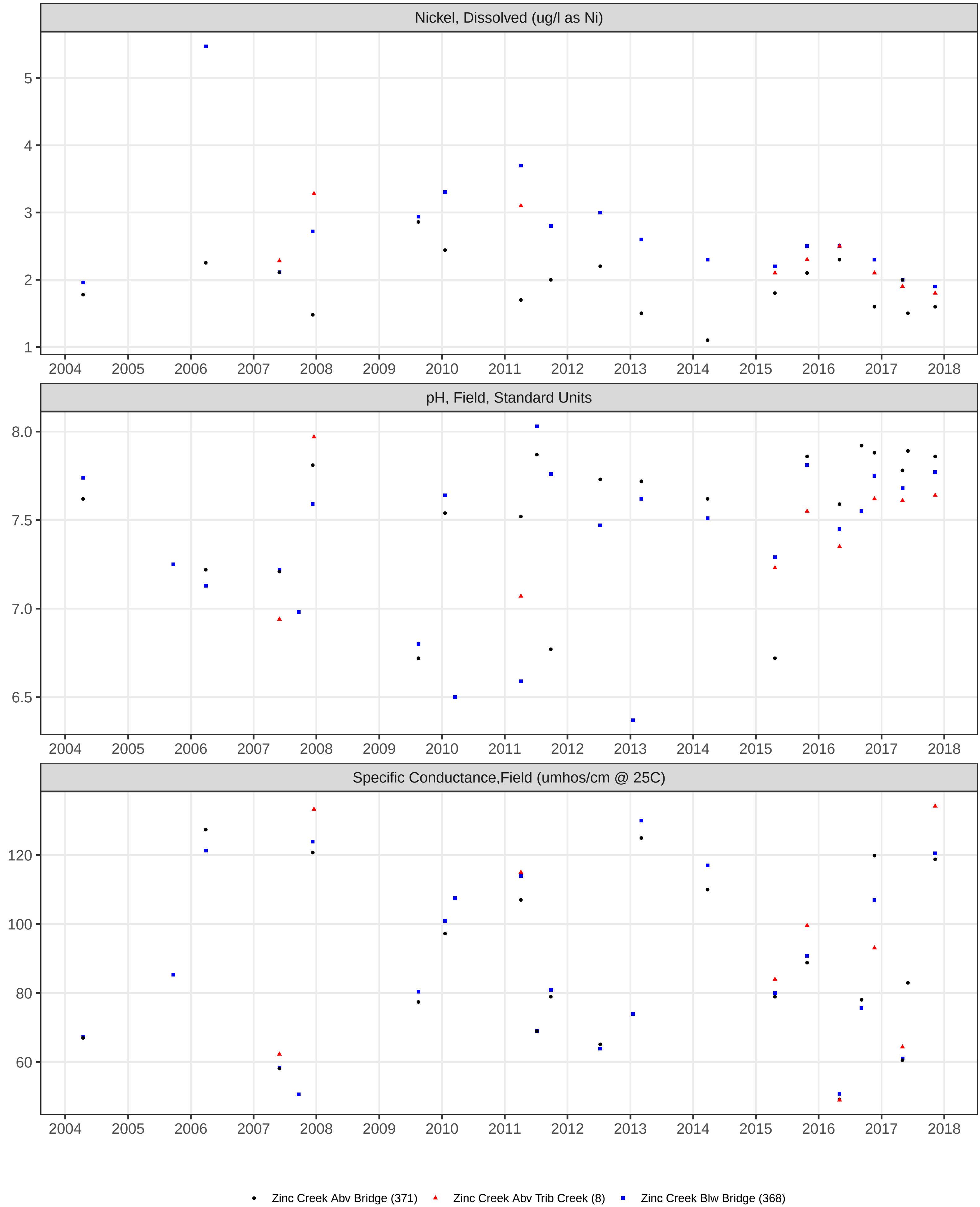

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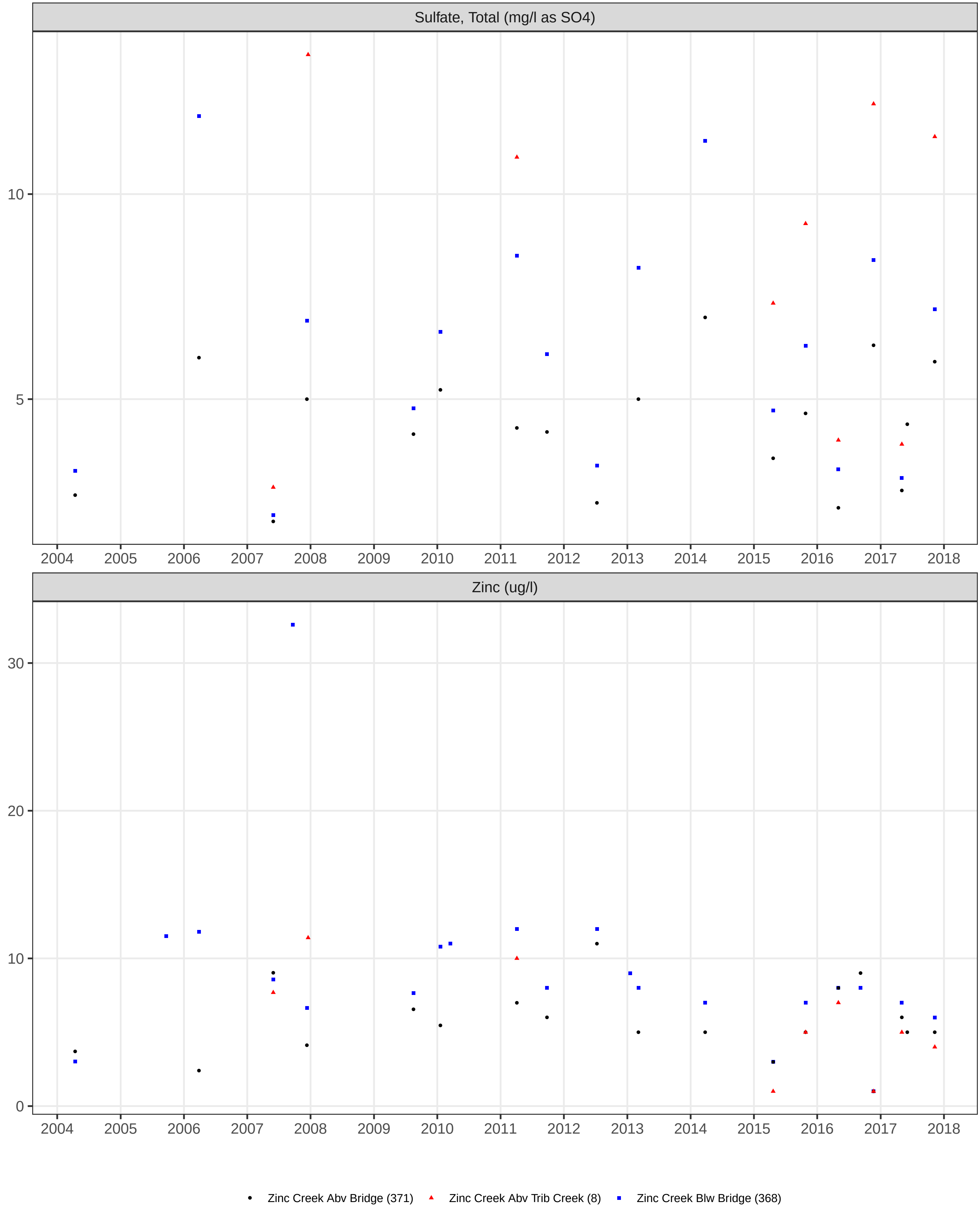

ATTACHMENT I
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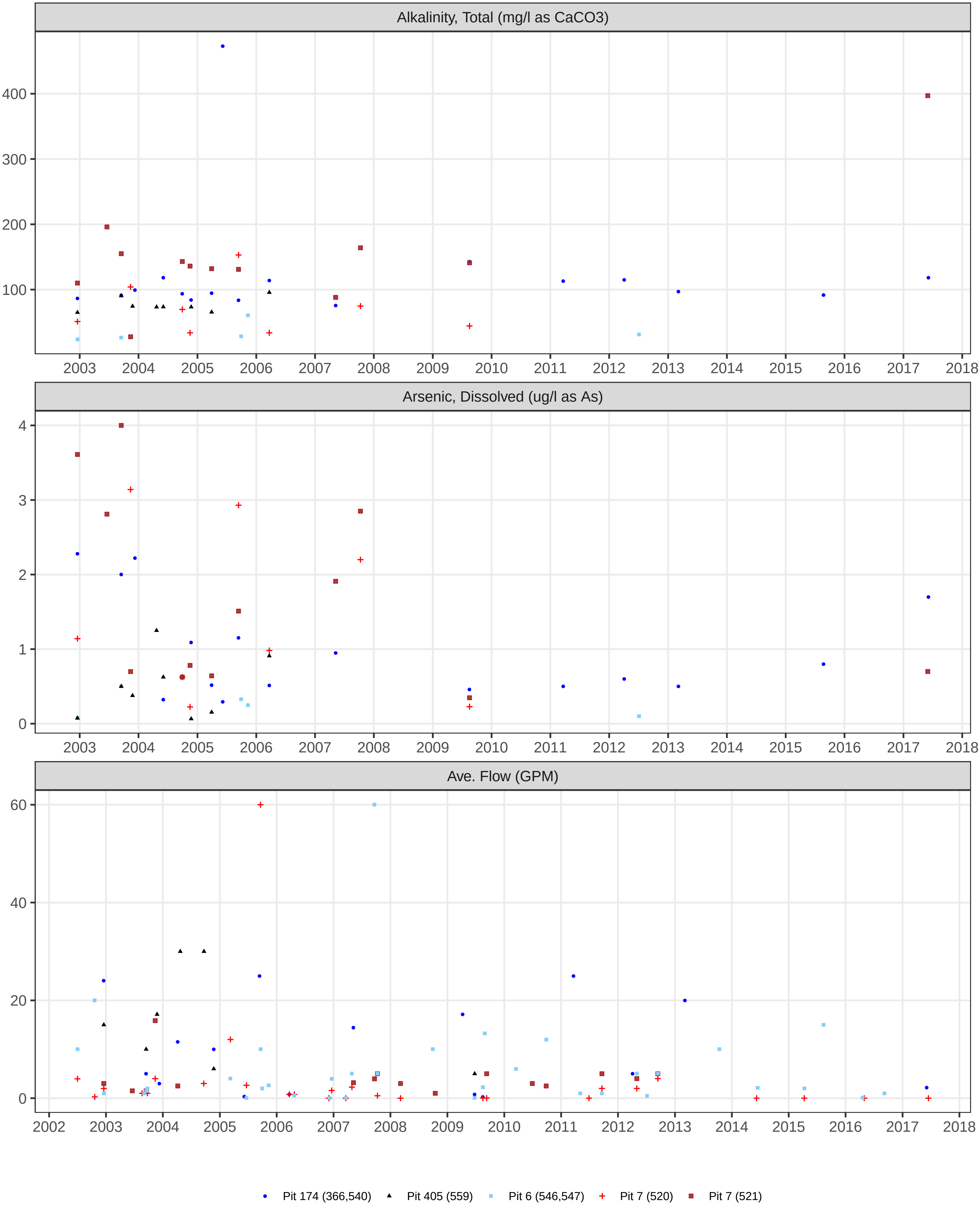

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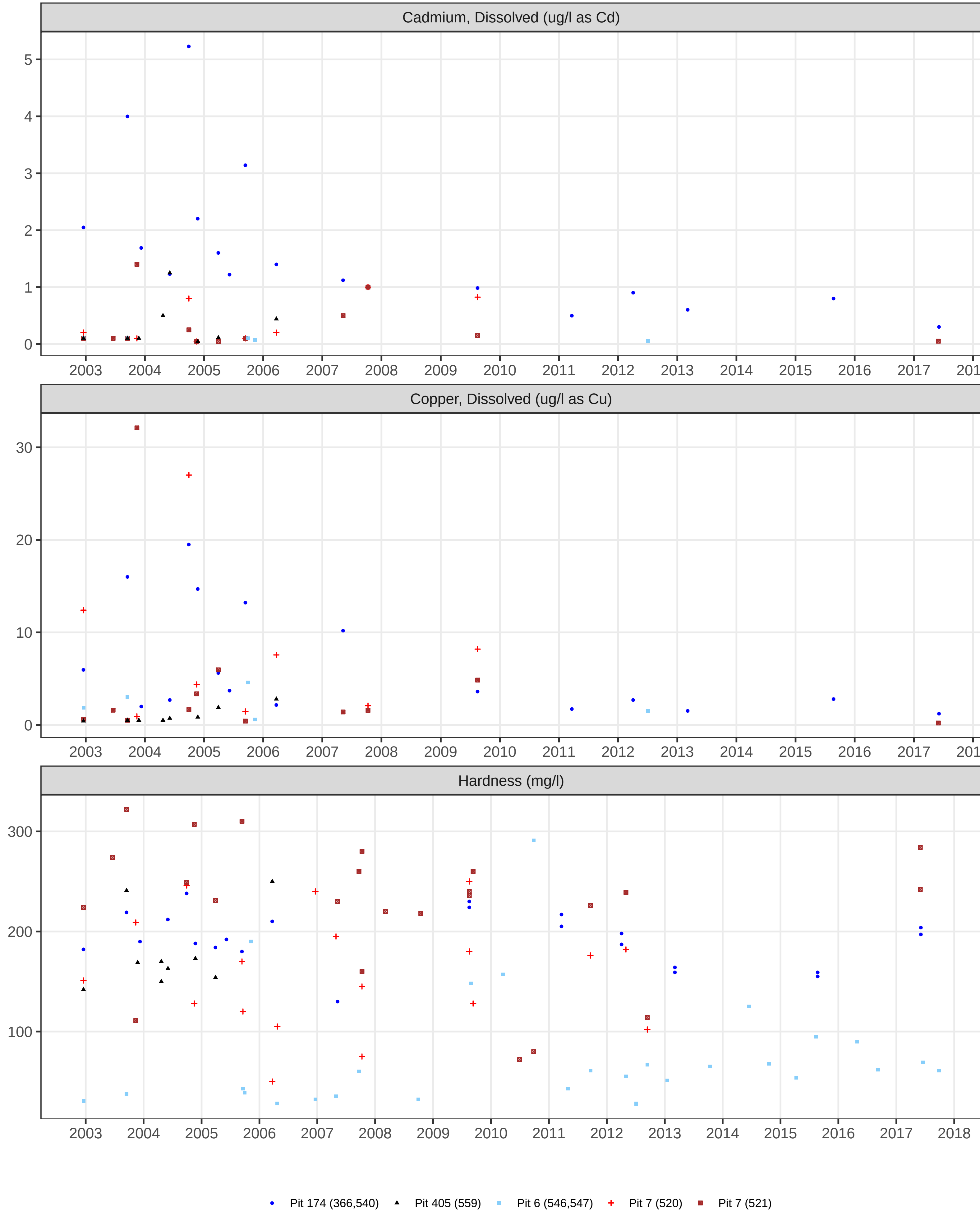

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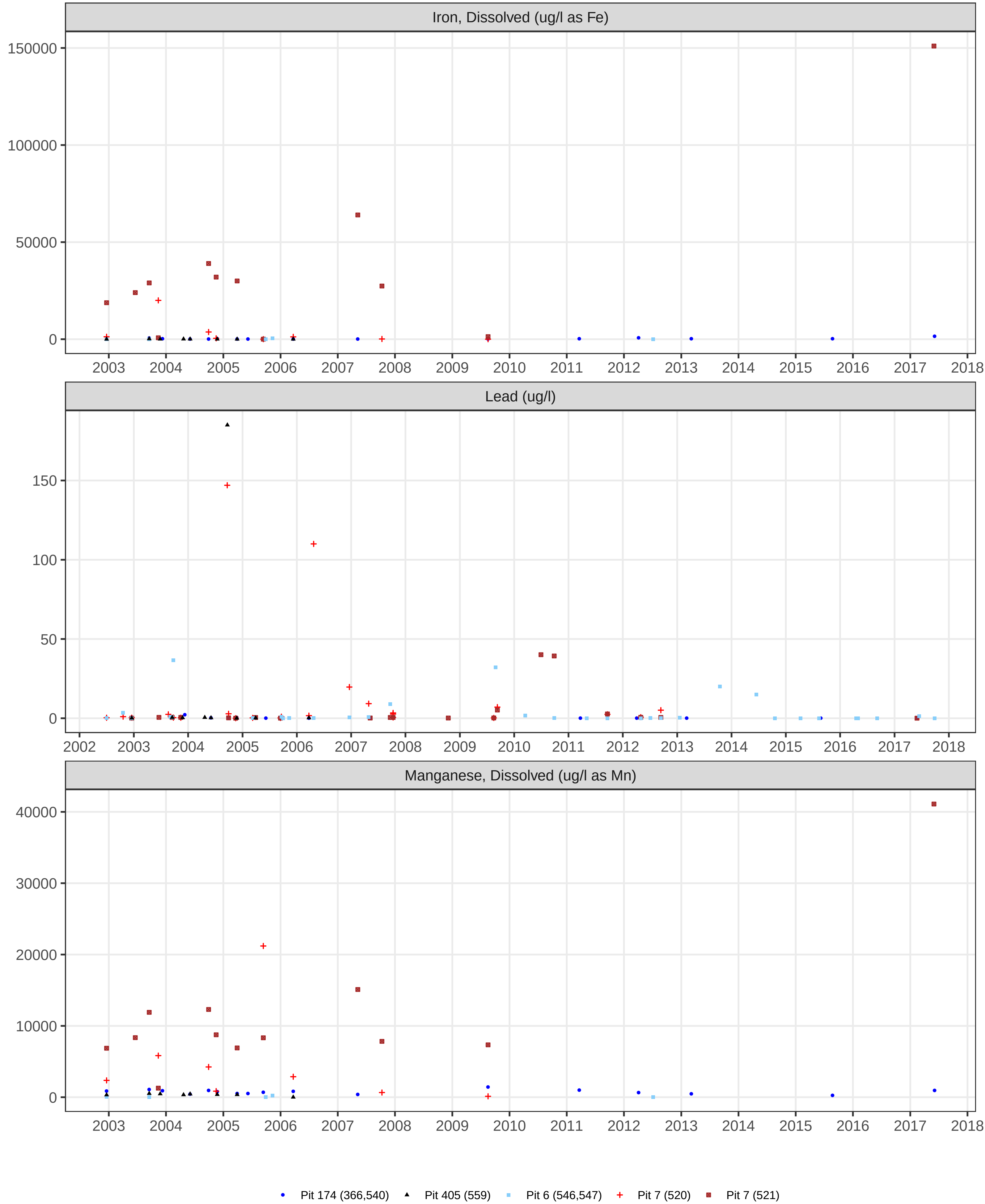

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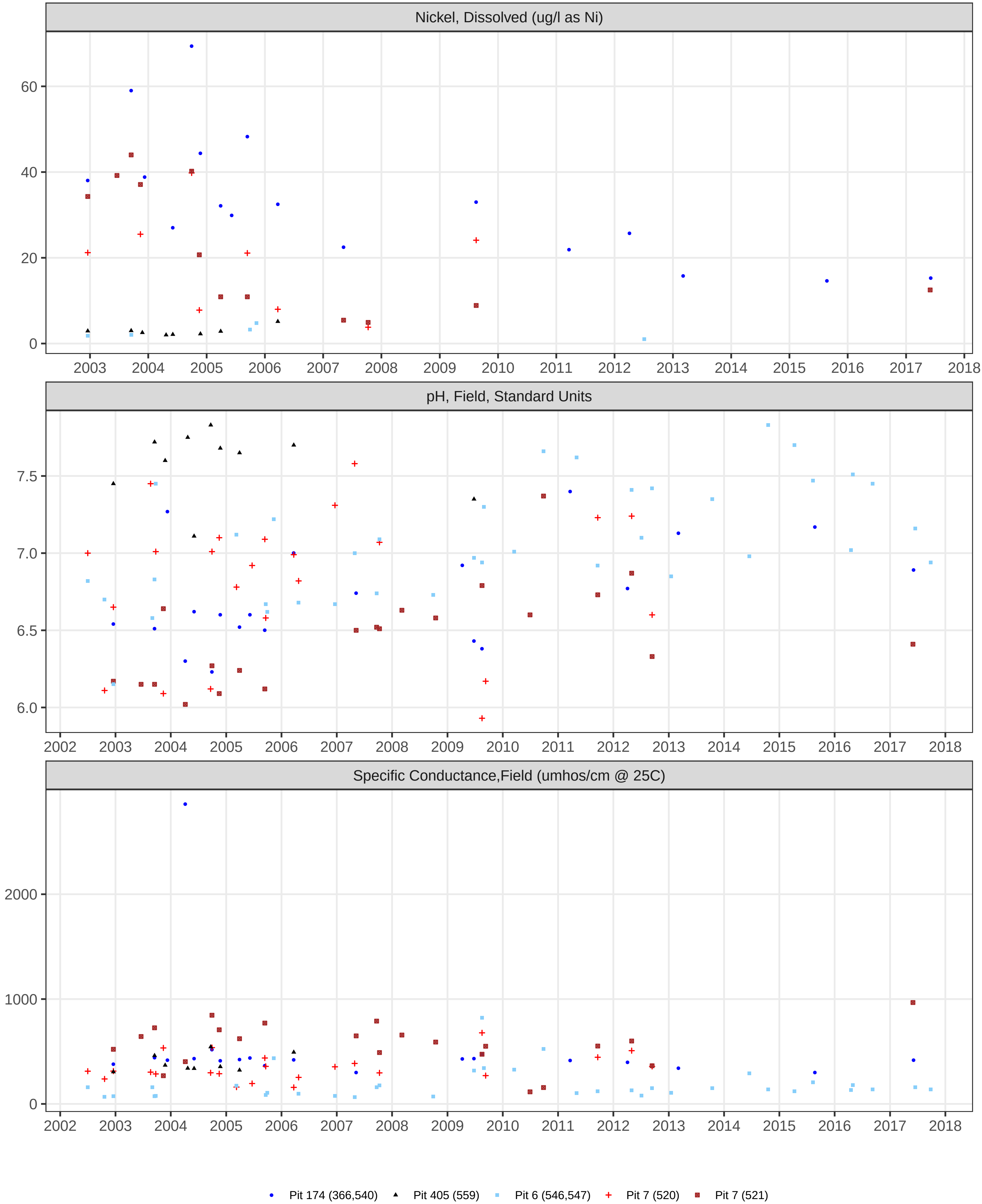

ATTACHMENT I
Quarries