BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

YUKON GOVERNMENT

GRUM SULPHIDE CELL COVER, FARO MINE

2015 REVIEW

FINAL

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Suite 200 - 1121 Centre St. NW
Calgary, AB Canada T2E 7K6
Telephone (403) 250-5185
Fax (403) 250-5330

February 29, 2016
Project No.: 0533-012

Dr. Dustin Rainey, Ph.D., P.Geo.
Senior Project Manager – Faro Mine
Assessment and Abandoned Mines,
Government of Yukon – Energy, Mines and Resources
Box 2703 (K-419)
Whitehorse, YT Y1A 2C6

Dear Dr. Rainey,

Re: 2015 Review – Grum Sulphide Cell Cover, Faro Mine

Attached is our report on the above captioned subject, following from our site visit in May 2015. We have attempted to focus on short term cover maintenance and water management issues but also considered some of the medium term aspects herein.

We thank you for the opportunity to provide service again at Faro Mine.

Yours sincerely,

BGC ENGINEERING INC.
per:

James W. Cassie, M.Sc., P.Eng.
Principal Geotechnical Engineer

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1.0 INTRODUCTION

1.1. Background

As part of the early closure activities at Faro Mine in 2010, Yukon Government (YG) managed the design and construction (by third-party engineers and contractors) of a soil and geosynthetic liner cover and related perimeter ditches over the Grum Sulphide Cell (GSC). In May 2011, during spring run-off, significant erosion of the GSC cover occurred and non-compliant water from the GSC was discharged into Vangorda Creek. BGC Engineering Inc. (BGC) was retained in July 2011 to review the root causes of this discharge event and several remedial measures were constructed within the cover system, as documented in BGC (January 30, 2012).

In the original design of the GSC, the run-off water from the cover directly discharged to the environment at the toe of the Grum Dump. Based on the spring 2011 non-compliant discharge event, remedial measures were constructed in the fall 2011. These measures included construction of a lined containment pond and an unlined contingency pond to capture surface water from the cover, coupled with an active pumping system to transfer contact water into the Vangorda Pit for later treatment. As such, YG accepted active water management from the cover run-off versus the previously expected passive system.

Since remedial measures in 2011, BGC has annually attended the site from 2012 to 2014 to assess the cover performance, following freshet and spring thaw conditions; BGC (August 10, 2012), BGC (2013) and BGC (2015) document those results. BGC was again requested to attend and document the GSC cover conditions in May 2015 and this report documents the freshet conditions, related monitoring information, site observations and recommendations for consideration.

1.2. Scope of Work

BGC prepared a proposal dated April 24, 2015, that included the following main tasks:

1. Review of any existing run-off information collected by YG on volumes/rates and photos regarding cover system during 2015 spring freshet.
2. Brief site visit to review the post-freshet condition of the GSC cover and related water management system.
3. Prepare a condition report on the GSC cover and water management system, including a summary of pertinent observations, relevant photographs and recommendations (if any) for additional work and monitoring.

It was noted that the condition assessment and related recommendations are related to the short term performance of the cover, from a physical stability and run off water quality and management perspective, and not towards the longer term closure issues (e.g. landform design) that will require assessment under separate scope. In addition, no evaluation of the infiltration performance is made under this assessment.

Authorization to proceed was provided under Engineering Agreement C00028463 between YG and BGC. Section 2 provides an overview of the GSC cover elements and freshet monitoring that occurred. Section 3 summarizes conditions observed during the BGC inspection, along with a review of site climatic conditions for context. Section 4 provides an overview of water quality data below the waste dump cover while Section 5 provides both short term and medium term recommendations.

2.0 BACKGROUND AND 2015 FRESHET

2.1. Background and Cover Design

Waste rock dumps are composed generally of very coarse grained blast rock and hence, are usually considered as generally free-draining; although placement methods can influence water, gas and heat flow and storage. As part of the closure assessment, water balance assessment work was previously undertaken on both the Faro Mine and the Vangorda Plateau dumps. Janowicz et. al. (2006) undertook Phase 2 of the program to develop a waste dump water balance using the Cold Regions Hydrological Model (CRHM) for the period of December 2003 to September 2005. Two meteorological stations were established on the Faro and Grum dump sites. That study developed the following conclusions, based on noted weather stations and simulated results from the noted hydrological model:

- Snow accumulation is greater at Grum and Vangorda dumps as compared to Faro dump.
- Slightly higher evaporation was simulated for Vangorda site as compared to Faro dump.
- Rainfall infiltration exceeded snowmelt infiltration by close to twice as much.
- Annual simulated recharge values were 208, 229 and 219 mm for the Faro, Grum and Vangorda Dumps respectively. Based on site meteorological data, these recharge rates equate to 53% (208/393), 57% (229/401) and 55% (219/401) of annual precipitation (AP) totals at those sites.
- Flat dump surfaces have the least recharge (impervious nature and high evaporation) while north, east and west facing sloped surfaces have the greatest recharge (lowest evaporation rates. South facing and bubble dump surface have moderate amounts of recharge due to rapid snowmelt and high evaporation rates.
- The 2004/05 study period was significantly wetter and warmer than normal.

The follow up study, Janowicz et. al. (2007) assessed the dump water balance in average and dry climatic conditions and specifically, water balance assessment for test covers constructed on the Vangorda Dump (located on southwest facing slope). Six trial covers were constructed from till and glacio-fluvial materials, at total thickness ranging from 0.75 to 1.11 m for horizontal covers and 1.1 to 2.29 m for sloping covers. Two meteorological stations installed in Vangorda site in June 2005 and the water balance for the horizontal and the slope surfaces were simulated for 2005/06 water year with following results:

- Horizontal till cover / 117 mm recharge / 324 mm AP = 36% AP recharge.
- Sloped till cover / 178 mm recharge / 324 mm AP = 55% AP recharge.
- Slope glacio-fluvial / 196 mm / 324 mm AP = 60% AP recharge.

The study noted that it was not possible to calibrate the simulated results since trial cover data were not yet available.

With regards to the design of the GSC cover over the sulphide cell, SRK (2009) outlined the following design background and details:

- Seepage water at the toe of the Grum Dump started to degrade in 2002 and impacts to water quality in Vangorda Creek were forecast to occur.
- Water quality stations V2 (on Grum Creek upstream of the confluence with Vangorda Creek) and V15 (just below Grum Dump on western tributary of Grum Creek) used to monitor water quality below Grum Dump.
- At V15, the zinc levels have increased by several orders of magnitude since 2002 (were generally below 0.5 mg/L from 1996 to 2002).
- Water quality in many of the seeps along the toe of the Grum Dump have degraded significantly in recent years.
- Table 2-3 outlined the preliminary design criteria for the cover as follows; low infiltration cover with less than 5% of Mean Annual Precipitation (MAP). Also noted that design criterion were revised to bring infiltration down to less than 0.5% MAP which require inclusion of a liner in the cover. Rationale for the 5% and then the 0.5% values as cover closure objectives were not defined in the report or related to any end point water quality objectives.
- Section 4.2 of SRK (2009) outlined the primary design criteria as follows:
    - Infiltration less than 0.5% of MAP[1];
    - Cover should be physically stable;
    - Uncompacted growth medium thickness of 1 m;
    - Ditch surrounding the cover sized for 1:100 year storm event; and
    - No landform engineering factored into preliminary design.

As-built information for the GSC cover is provided in SRK (2011) for the original construction in 2010, as shown in Figure 2-1. Major components of the final design are as follows:

- Resloping of GSC dump slopes to 5H:1V (or flatter) and establishment of benches at horizontal intervals of 60 to 85 m (elevations 1284, 1272, 1258, 1244 and 1227 m).
- Construction of lateral containment ramps (with ditches) on the west and east sides of the cover.
- Construction of a Toe Berm (with clean waste rock) at the base of the GSC cover including geomembrane installation.
- Installation of textured (one side) 60 mil HDPE liner over the resloped GSC surface (totaling approximately 28 ha between GSC cell and Toe Berm areas).
- Placement of 1 m of uncompacted till layer over the liner and Toe Berm. The till material was classified as a low plastic clay from Atterberg Limits test results.
- Placement of 1 m layer of sand / geotextile / waste rock along GSC benches.
- Construction of energy dissipation pools and water management structures to direct surface runoff from the cover to Grum Creek through a half-culvert.

[1] Gartner Lee Ltd. (2003) defines MAP for the site as 304.7 mm based on Faro Airport record from 1978 to 2001.

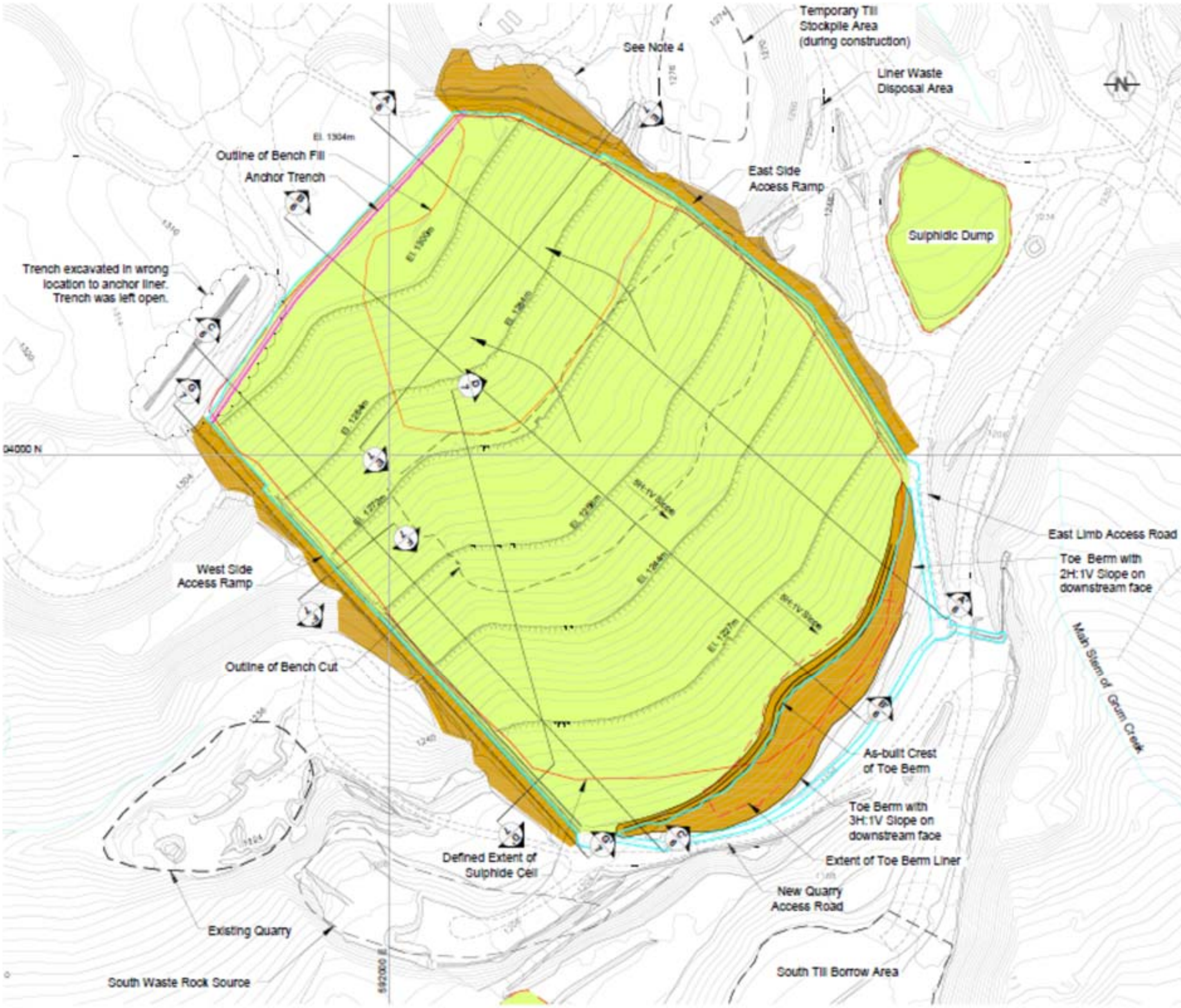

Figure 2-1. As-Built Plan for GSC Cover (after SRK 2011).

The construction project was undertaken between June 21 and November 3, 2010. No hydroseeding work was completed in 2010 as originally planned due the late cover completion; it occurred in 2011 as noted later. In addition, leak detection testing of the HDPE liner was postponed until spring 2011.

Following the cover remedial repairs in late 2011 summarized in BGC (January 30, 2012), the cover run-off from the two access ditches was directed into two surface ponds for pumping to the Vangorda Pit, rather than direct discharge into Grum Creek. Photo 2-1. Aerial view of Grum Dump with GSC Cover, perimeter ditches, ponds and select monitoring stations at the toe.

provides an aerial view of the GSC cover and associated ponds.

Photo 2-1. Aerial view of Grum Dump with GSC Cover, perimeter ditches, ponds and select monitoring stations at the toe.

The GSC cover directs surface water horizontally from the 5 benches to the West and East Access Ditches and around the Toe Berm to the Lined Pond (approximate capacity of 8,000 m^3), located at the toe of the cover. Water from that pond is pumped by pipeline to the Vangorda Pit where it is collected for treatment.

An unlined contingency storage pond, the Unlined Pond, was created within an existing depression on the waste dump level below the Lined Pond. This pond collects water from two sources; excess water from the Lined Pond/pumping system (if the inflow is greater than the pumping capacity and the storage is full) and contact water from other dump runoff sources (unremediated) located southwest from the GSC cover and from the access road on the northeast toe of the dump. Water retained in the Unlined Pond is pumped to the Lined Pond. Seepage can occur into the dump from the Unlined Pond and at higher pond levels, surface flow will occur down over the south face of the waste dump, as has occurred in previous years.

Water from both ponds is currently pumped into the Vangorda Pit for the following two reasons:

1. The run-off from the cover needs to be shown to be compliant consistently before direct discharge can occur.
2. The Unlined Pond receives water from the unremediated portion of the dump surface.

As such, the monitoring of this cover requires water quality testing to supplement the physical condition assessment.

Seepage and runoff water from the Grum Dump not collected in surface or collection ponds ends up in the receiving environment of Vangorda Creek. Water quality downstream from the Grum Dump is monitored in stations V2 and Moose Seep with surface water also monitored at secondary stations V2A (Moose Pond), Grum Creek (GC) Weir and V15; these stations are discussed in more detail in Section 4. Photo 2-2 shows the pond and pumping arrangement located at the confluence of the V15 seepage and Grum Creek seepage, which is operated at peak time to alleviate water quantity reporting to the lower Moose Pond:

Photo 2-2. View of water collection and pumping elements at Pumping Station V15 at the confluence of V15 seep and Grum Creek seep (May 21, 2014). V15 water comes in from the southwest portion of the dump from the left channel. Grum Creek emerges from under the northeast corner of dump and flows over monitoring location GC Weir (white container marking channel at right-center of photo).

Revegetation aspects and monitoring for the cover are discussed in Section 2.4.

It should be noted that non-compliant discharges has occurred in both May 2011 and 2013. The two events caused erosion to occur in different locations (on the cover in 2011 and off the cover in 2013), but the causative mechanism involved aspects of blocked drainage ditches in association with rapid melting of the snow pack (discussed further in Section 3.2).

2.2. 2015 Freshet

In the past, YG, independently, or through their Care and Maintenance Contractor, Tli Cho Engineering and Environmental Services (TEES), provided a brief summary to BGC on the freshet event and some associated photos. In 2015, no such summary was provided. In addition, no water quality information was collected in 2015 from the Lined and the Unlined Ponds, which has been done for the past two years. In summary, YG has indicated that all 2015 run-off was contained within the ponds and was pumped to the Vangorda Pit.

TEES did provide a summary of water moved, both from the Lined Pond to the Vangorda Pit (Unlined Pond values were not provided) and from V15 to the Vangorda Pit, along with select water elevations in the Lined Pond. According to TEES water records, Unlined Pond water was transferred to the Lined Pond on May 6 and 11, 2015 and 3,576 m^3 of Lined Pond water was transferred to the Vangorda Pit over 6 days between May 8 to 16, 2015 inclusive. These dates correlate well with the rise in air temperature as reviewed in Section 3.2.

Based on pumping data supplied by TEES, Figure 2-2 provides a monthly breakdown of the total water quantities pumped from either the Lined Pond or the V15 Collection Station across to the Vangorda Pit for both 2014 and 2015.

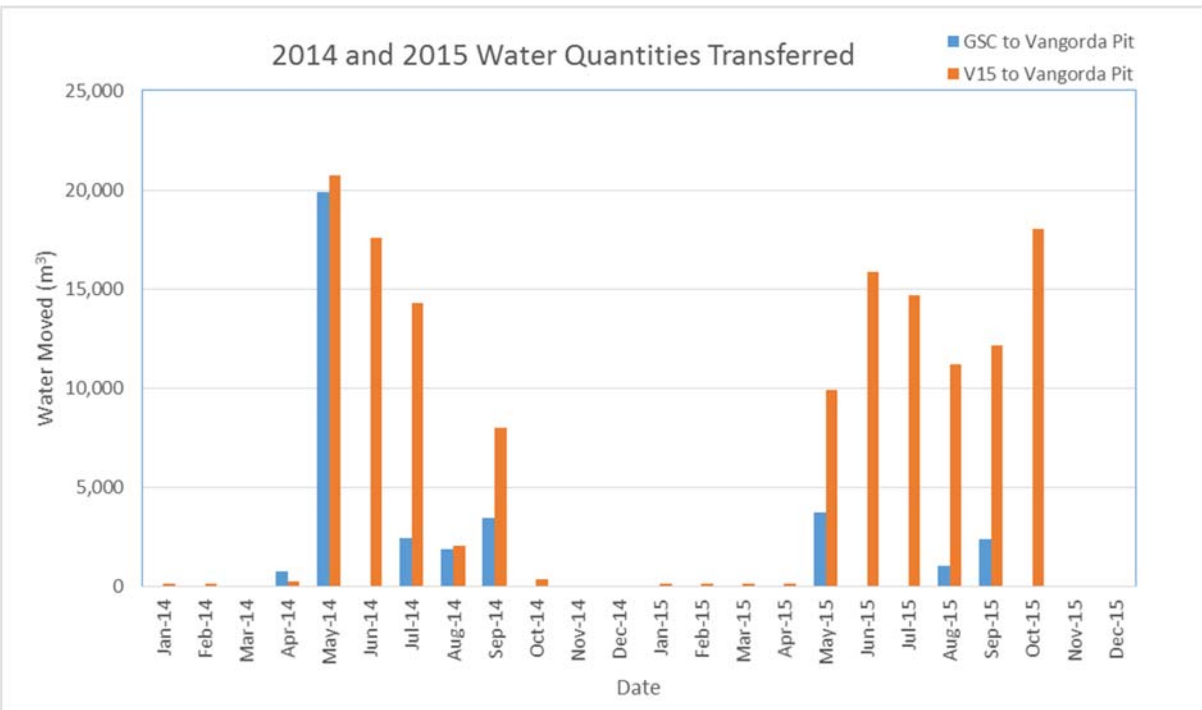

Figure 2-2. Monthly Water Quantities Transferred to Vangorda Pit.

The main transfer quantity occurred in May 2015 as expected, following the inflow of spring freshet, but at approximately one quarter of the quantity pumped in May 2014. Minor quantities were transferred from the Lined Pond in August and September 2015, (likely in response to rainfall events). Monthly transfer quantities ranging from 10,000 to 18,000 m^3 occurred from May until

October 2015 from the V15 collection stations (which collects both surface flow from other areas and seepage from the dump). Total yearly quantities for the Lined Pond and V15 pumping values were 28,526 and 63,876 m^3 in 2014 and 7,166 and 82,367 m^3 in 2015, respectively. Comparing the two years, significantly less water was transferred in 2015 from the Lined Pond while significantly more water was transferred from the V15 station.

If it is assumed that all Lined Pond water comes from the GSC cover (not a completely accurate assumption in that some Lined Pond water comes from the Unlined Pond), and using 28 ha surface area, the equivalent runoff amounts for 2014 and 2015 would be 102 and 26 mm, respectively. As noted later in Section 3.2, the total yearly precipitation amounts recorded at Faro climate station (near the town approximately 20 km from the mine site) were similar for 2014 and 2015; 275 and 284 mm reported in each year respectively. Some snow survey data is reviewed in Section 3.2 but the lack of a complete data record of rainfall and snow fall, based on the annual water year of fall to following summer, impacts the ability to assess these run-off amounts versus the annual water balance for the cover. As such, the water balance for the cover appears to be poorly understood.

2.3. Pond Water Quality

EDI (2011) indicated that the GSC till cover and the South Till Borrow area contained soils with elevated concentrations of zinc. These results suggest that the existing GSC cover material is a potential source of elevated zinc concentrations that is liberated when the cover materials are eroded and become suspended in run-off water. As such, the prevention of any cover erosion and concurrent generation of suspended sediments is an important issue for water quality.

No pond water quality samples were collected in 2015 while Figure 2-3 provides total zinc concentrations for 2013 and 2014 for both ponds as context:

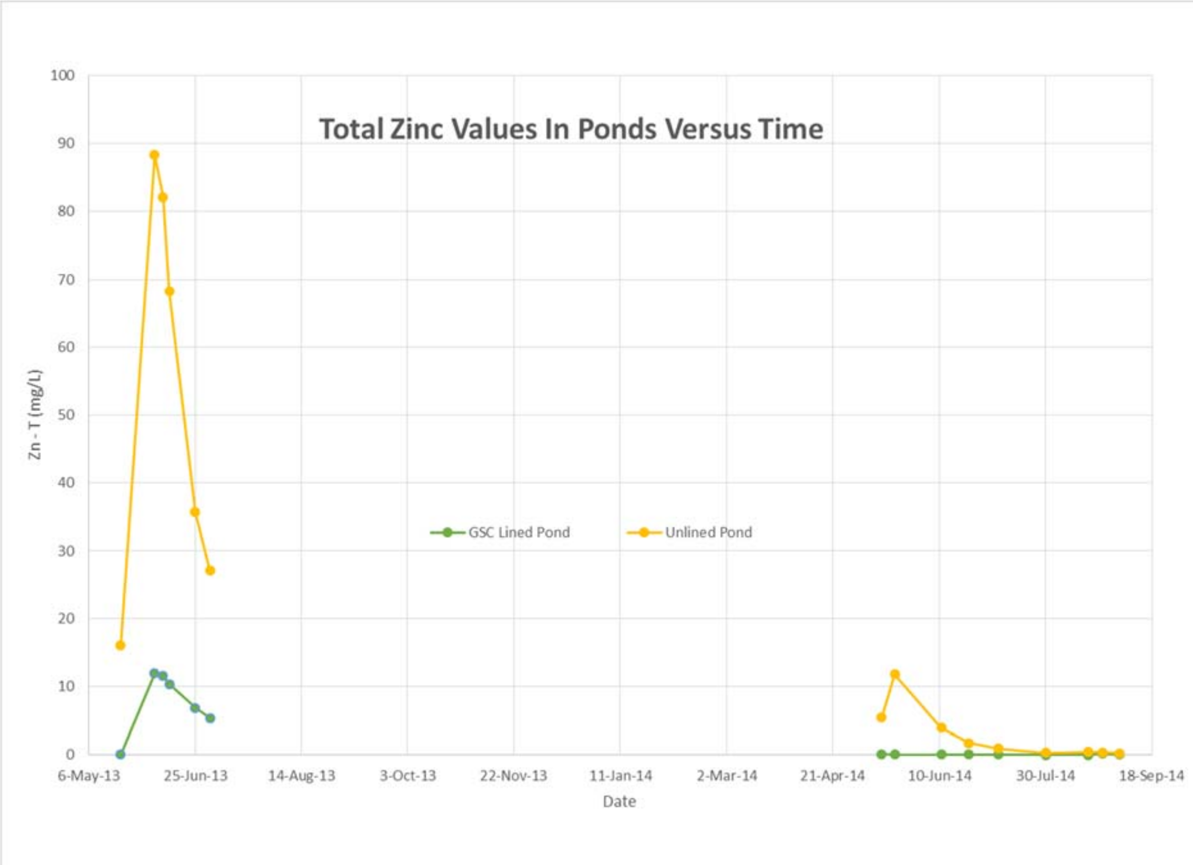

Figure 2-3. 2013 and 2014 Total Zinc Concentrations for Both Ponds

Comparing the total zinc values for the two ponds for 2014, the Lined Pond values were generally lower than 0.1 mg/L (compliant) while the Unlined Pond values ranged from greater than 5 mg/L (non-compliant) to a range of 0.23 to 0.4 mg/L (compliant). These zinc values demonstrate that the Lined Pond has lower concentrations and its run-off comes from the remediated cover surface while the Unlined Pond water comes from the unremediated waste dump surfaces. The zinc concentrations in 2014 were both lower than observed in 2013 and were considered compliant for discharge (although not for TSS on occasion), likely driven by either changes to cover water balance (current understanding is limited) and/or to a reduced amount of cover erosion and vegetative cover taking hold. If the cover contact water was compliant for discharge for all discharge parameters (total zinc and TSS), it would make sense to discharge compliant water to the toe of the dump rather than mixing with non-compliant water in the pit for treatment.

2.4. Revegetation Work and Monitoring

As part of the mine closure planning process, revegetation activities and monitoring have been on-going for the GSC cover and to the Grum overburden revegetation trials, as summarized in EDI (March and April 2014). Specific to the GSC cover revegetation, EDI (March 2014) noted the following:

- GSC was fertilized and hydro-seeded with annual rye grass in 2011.
- In 2012, various revegetation activities were implemented, including soil sampling, soil surface preparation, hydroseeding and fertilizer, installation of experimental trials and planting with woody species (more than 15,000 woody species plugs were planted).
- Prior to planting, the soil surface was prepared with triple rippers mounted on a D7 dozer, creating 10 to 30 cm-deep furrows in the cover surface, generally on contour.
- Approximately 14 out of 26 ha area of the GSC was planted with woody species in either experimental plots or general planting plots.
- All arsenic and some zinc soil samples from 2012 and 2013 exceeded Canadian Council of Ministers of the Environment (CCME) guidelines for industrial land use.
- 2012 hydro-seeding resulted in herbaceous vegetative cover from 6% to 12.4%.
- Deeper furrows resulted in better seed germination and less erosion.
- Erosion rills developed where furrows were shallow. Water also followed dozer track depressions causing rills.
- Overall grass cover was not as high as expected due to relatively dry spring.
- Fertilizer application was recommended for 2014.

Nothing appears in this assessment regarding water availability or growth medium density which would also have implications for vegetation health.

EDI (2014b) provides some other comments and observations from the nearby overburden dumps trials, as follows:

- Trial revegetation plots were established in 2009 to assess various study objectives and included the following aspects; grass seed mixes, woody plant treatments, fertilizer treatments, and soil surface treatments.
- Unfertilized plots had minimal growth.
- Planar and micro-rill treatment areas had erosion channels every 1 to 2 m, increasing in frequency and channel depth where vegetation coverage was less.
- No erosion was observed on the rough-and-loose plots.
- Site preparation methods are very important to prevent surface erosion.

EDI (2015) provides an update on the 2014 revegetation monitoring at the GSC cover. Soil samples were collected for soil fertility nutrient analysis. Herbaceous vegetation cover was assessed, along with the surveys of woody vegetation as well. The following results and observations were provided therein:

- Soil nitrogen levels were very low. Phosphorus and potassium levels increased from 2012 to 2014 while pH decreased each year. Organic matters levels were very low.
- Vegetation cover increased from 2013 overall average of 8% to 21% in 2014, likely in response to higher than average rainfall. Species with the highest relative species composition were northern fescue, slender wheatgrass and fire moss.
- No annual ryegrass was observed in 2014 which accounted for 25% of the overall cover in 2013.

- Surface rock drain on the GSC produced a high level of revegetation, notably higher than all other surface treatments.
- Volunteer stem establishment observed across the site with highest stem counts on the second and third slopes and the rock drains.
- Deeper furrows improved growing conditions for herbaceous and woody species.

In summary, it appears that vegetative growth is increasing on the cover with volunteer species taking hold now and evolution from herbaceous cover to woody cover beginning.

3.0 2015 SITE VISIT

3.1. Observations

Mr. Jim Cassie, P.Eng., (BGC), undertook a site inspection of the GSC cover and associated dump areas on May 26 and 27, 2015, in the company of Dr. Dustin Rainey (YG). Below are some summary comments and observations, accompanied by select site photographs:

1. Generally, the GSC cover water collection system has performed as intended, with run-off water contained within the two ponds, following the spring 2015 run-off. General views of the cover are provided in Photo 3-1 and Photo 3-2:

Photo 3-1. View of the lower portion of the GSC cover, with the Vangorda Access Road in the foreground. Vegetation cover now pronounced. Note the water retained in both the Lined and Unlined Ponds located at the toe of the cover (May 26, 2015).

Photo 3-2. View of the GSC cover, taken from the Vangorda Waste Dump. Note the light gray original waste rock surface around the reclaimed olive brown GSC cover (May 26, 2015).

2. Run-off water flowed into the Lined Pond, shown on Photo 3-3, with all collected water pumped to the Vangorda Pit.

Photo 3-3. View of the Lined Pond and staff gauge (May 26, 2016).

3. Following from that transfer, a small amount of run-off water collected within the Unlined Pond, as shown in Photo 3-4. No surface water was discharged from this pond to the environment.

Photo 3-4. View of the Unlined Pond and associated pump arrangement up to Lined Pond (May 27, 2015).

4. It appears that an excavator accessed the GSC cover during thaw season, presumably with the purpose of removing snow blockages from the benches that provide lateral drainage to the two perimeter ditches. Unfortunately, the excavator tracks has impacted the surface grade and vegetation cover on the first bench (all references from the top), third bench and fourth bench and regrading is necessary. In addition, soil backfill was placed within the East Access Ditch concurrent with the fourth bench level. This soil must

be removed to re-establish the capacity of the ditch. Selected views of the impacts are shown in Photos 3-5 to 3-7.

Photo 3-5. View of the excavator tracks and resultant bench disturbance on third bench and then heading left in downhill direction (May 27, 2015). This disturbance will interrupt surface water flow and lead to erosion in select locations.

Photo 3-6. View of the excavator tracks from third bench looking down onto fourth bench. Note grass cover has been trampled under tracks, along with minor depressions have been formed (May 27, 2015).

Photo 3-7. View of loose ditch cleaning debris placed on vegetated slope above fourth bench; loose material may erode easily in the future (May 27, 2015).

5. New erosional gully formed from fourth bench down onto fifth bench; approximately 0.5 to 1 m wide and 0.3 m deep. This gulley should be regraded at upper end to prevent further erosion.

Photo 3-8. View of erosional gulley from fourth bench (May 27, 2015).

6. New significant erosional gully (0.6 to 0.7 m wide and 0.3 m deep) formed from fifth bench onto toe berm; gulley should be regraded to prevent further erosion.
7. Three small sloughs continue to be active with cracking along the eastern side of the Toe Berm, above the Lined Pond; one shown on Photo 3-9. In addition, some longitudinal cracking noted in base area of the Toe Berm, just above diversion ditch.

Photo 3-9. View of the small slough (one of three) on slope above diversion ditch (May 27, 2015).

8. New significant erosional gulley formed at base Toe Berm slope; requires repairs.
9. Two erosional gullies continue to exist on the eastern side of the West Access Ditch, as shown in Photo 3-10. Minor vegetation beginning to establish in the gullies but gullies appear to be widening.

Photo 3-10. View of two erosional gullies that run into the West Access Ditch (May 27, 2015).

10. Erosional gulley on fourth bench may be source zone for gullies in West Access Ditch.
11. Geotextile exposed in West Access Ramp above first bench, as shown in Photo 3-11.

Photo 3-11. Underlying geotextile exposed in West Access Ramp (May 27, 2015) which should be repaired.

12. The rip rap on the informal spillway at the Unlined Pond appears disturbed with the underlying geotextile now exposed.
13. Numerous pre-existing erosional gullies exist in the waste dump slopes to the west and the north of the Unlined Pond.

Following the site visit, BGC forwarded a field memorandum in July 2015 outlining recommended short term maintenance items which is attached in Appendix A.

3.2. Climate Review

YG provided BGC with a summary of 2014/15 climate data from the Grum Weather Station (data has not been independently assessed or verified herein). The objective of the climate review was to look for atypical weather patterns or events that may have impacted performance of the GSC cover and drainage system, noting that there were non-compliant discharges in spring 2011 and 2013 but not in 2012, 2014 or 2015. Figures 3-1 and 3-2 display the plotted climate station data:

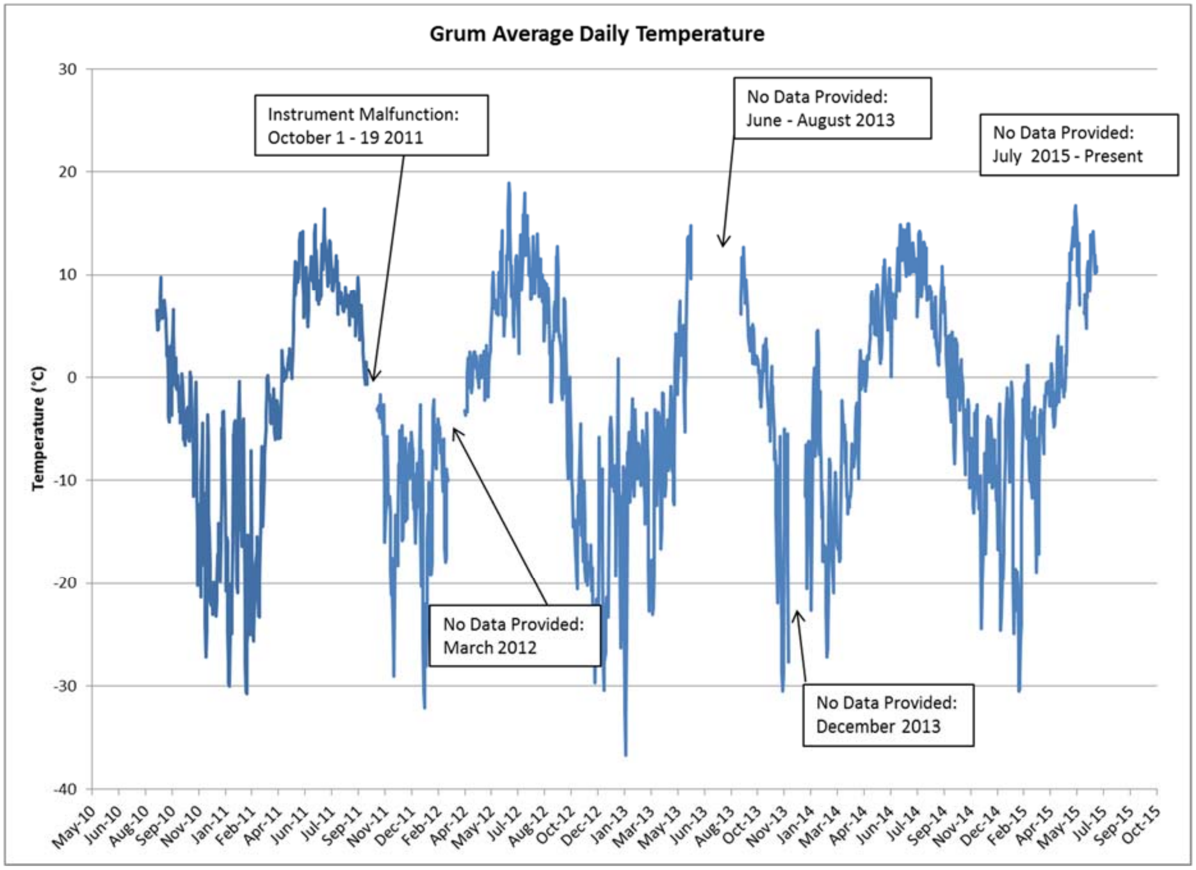

Figure 3-1. Grum Station Average Daily Temperatures since 2010.

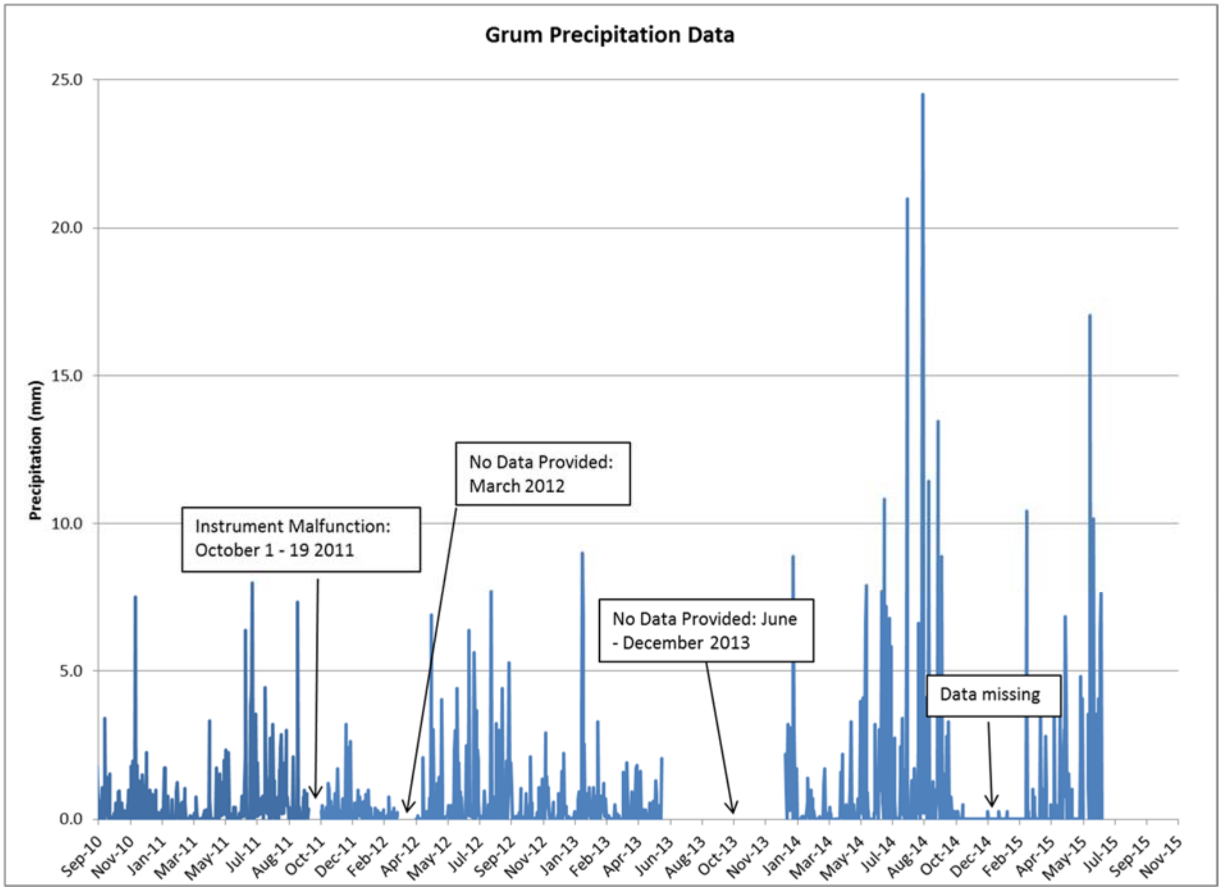

Figure 3-2. Grum Station Daily Precipitation Values[2].

Temperature ranges recorded in 2015 were generally in agreement with previous years, although summer 2015 had higher temperatures than summer 2014 (incomplete data for summer 2013), but lower than peak values from summer 2012. Winter 2014/15 appeared warmer than previous winter values, on average. Precipitation values in 2015 were similar to ranges from previous year with two significant rainfalls events greater than 10 mm per day in summer 2015.

Given the missing data at the Grum Station, the monthly precipitation values for the Faro (Aut) Station located at the airport were also plotted up to compare the precipitation distribution and amounts in 2014 versus 2015, as show on Figure 3-3:

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[2] Precipitation data from Grum Station was correlated with rainfall data from Faro AES station on select dates. Based on this correlation, the unit scale on Y-axis has been revised from previous years.

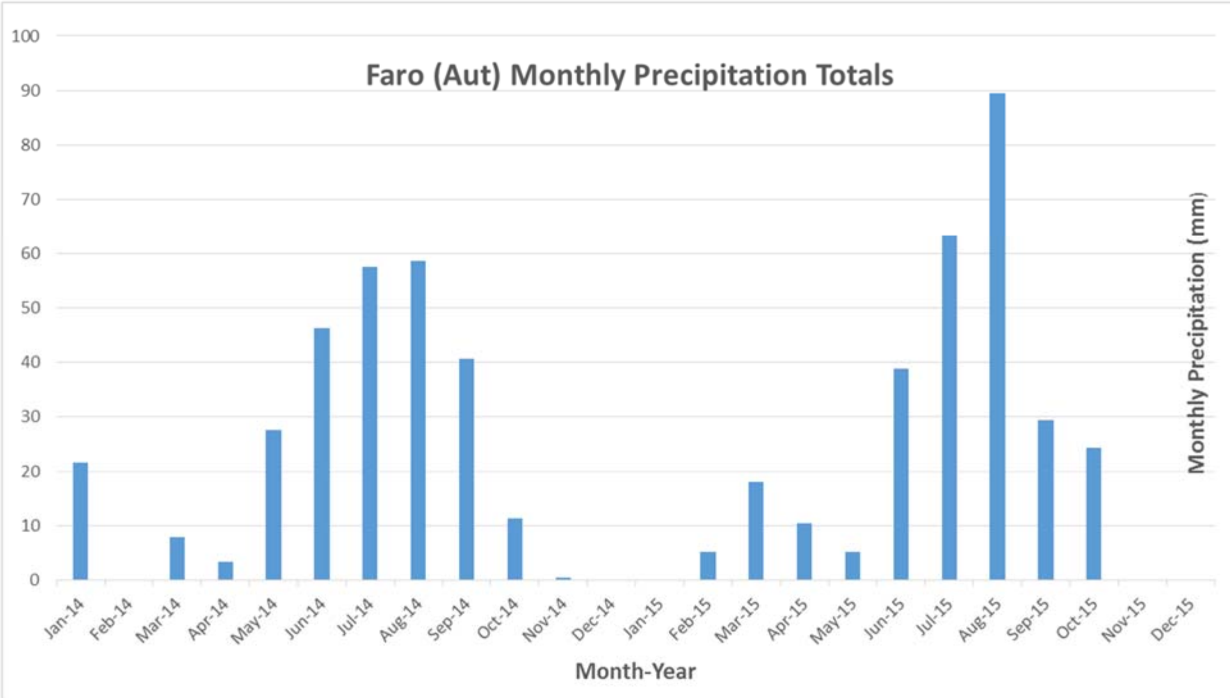

Figure 3-3. Faro (Aut) Monthly Precipitation Values for 2014 and 2015.

Although there is a slight difference in the distribution of the monthly precipitation between the two years, the totals are similar; 275 mm for 2014 and 284 for 2015.

Snow surveys were undertaken by TEES on the GSC cover on May 4, 2015 as noted in TEES (2015) with results as noted below:

- Bench 1 – 0.33 to 1.065 m. Snow density range of 43 to 48%.
- Bench 2 - 0.28 to 0.48 m. Snow density of 46%.
- Bench 3 – 0.58 to 0.85 m. Snow density of 50%.
- Bench 4 – 0.2 to 0.60 m.
- Bench 5 – 0.25 to 0.45 m.

Unfortunately, snow surveys were only taken on this one day, but this day was only two days from date when air temperatures began to stay above zero. As a first approximation, it was assumed that 0.5 m of snow melted at 45% density across 28 ha of cover equals approximately 63,000 m^3 of water. This estimated run-off amount is much higher than the 7,166 m^3 volume transferred from the ponds. This conclusion reinforces that the water balance of the cover appears poorly understood at the current time.

Given the noted gaps and limitations in the Grum climate data, it is not possible to formulate either air freezing or thawing index (AFI and ATI) values or total rainfall and snowfall amounts from the current data. As a simple proxy for the former quantitative indices, the following subzero and above zero temperature "seasons" were subjectively defined, as summarized in Table 3-1:

Table 3-1. Estimated Seasons Since 2010 (Based on Grum Data).

Season	Start Date	End Date	Length (days)
Subzero (2010-11)	11-Oct-10	28-Apr-11	199
Above Zero (2011)	29-Apr-11	29-Sep-11	153
Subzero (2011-12)	30-Sep-11	15-Apr-12	198
Above Zero (2012)	16-Apr-12	9-Oct-12	176
Subzero (2012-2013)*	10-Oct-12	30-Apr-13	202
Above Zero (2013)	1-May-13	20-Oct-13	172
Subzero (2013-2014)**	21-Oct-13	17-Apr-14	178
Above Zero (2014)	18-Apr-14	13-Oct-14	179
Subzero (2014-2015)***	14-Oct-14	18-Apr-15	187

Notes:
* above zero air temperature recorded on January 14, 2013.
** above zero air temperatures recorded on January 17, 18, 23, 24 and 25, 2014.
*** above zero air temperatures recorded on October 19 through 21, 2014, February 22 and 23, 2015 and April 8 and 10, 2015.

The above zero (2014) season of 179 days is on the high side of the three previous years. The subzero season (2014-2015) length of 187 days was in the average range of the last four such seasons.

In order to understand the freshet intensity between various years, Figure 3-4 presents a summary of spring air temperatures for the last 5 years.

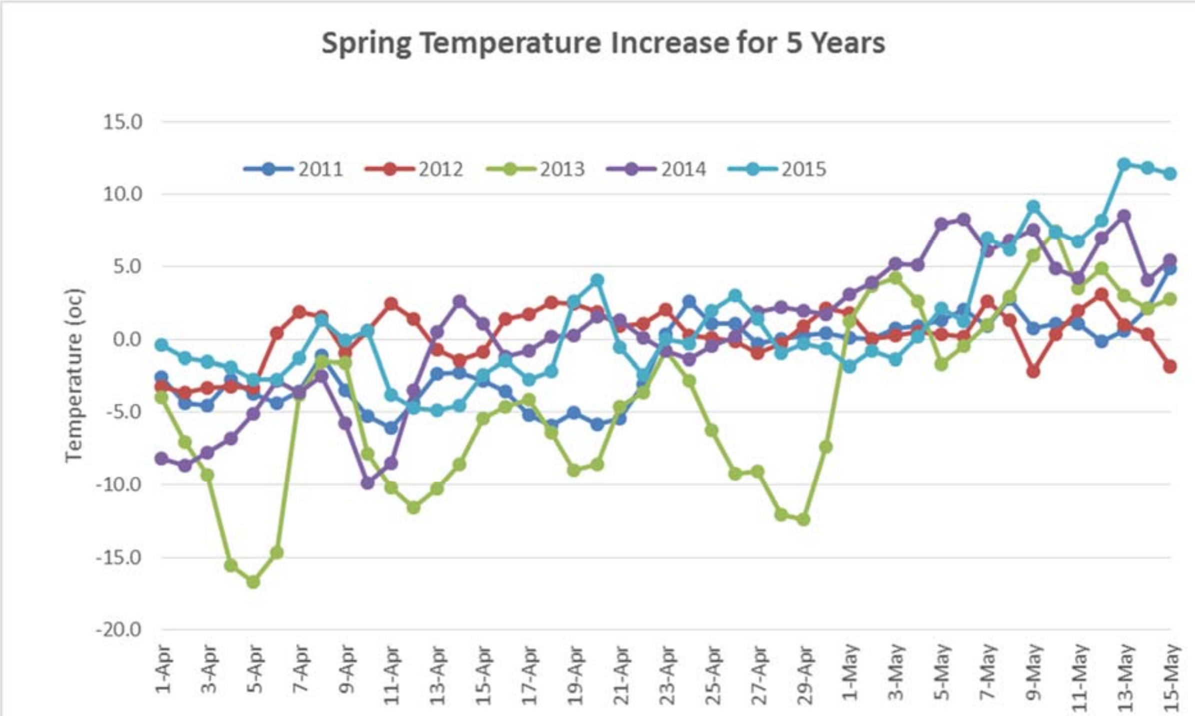

Figure 3-4. Spring Temperature Daily Values for Four Years.

The plot shows that in the springs of both 2011 and 2013, the air temperature rise from subzero to above zero was rather rapid (on the order of four days for 2011 and 2013), resulting in a rapid melting of the snowpack. In spring 2012 though, the daily temperatures oscillate around zero for weeks (perhaps on the order of 30 days), which may have been partially responsible for a slower melt of the snowpack, releasing run-off at a slower rate. The warming trend in 2014 also showed an oscillating behavior (around 0°C) over 13 days, warming above zero consistently thereafter. In 2015, the air temperature oscillated around 0°C from April 7th until May 6th (approximately 30 days) when it consistently stayed above zero thereafter. Although different specific issues occurred in 2011 and 2013, the slower warming of the snowpack appears to result in less erosion to the cover as discharge can occur over longer time.

Based on BGC's experience on site, sloughs and slumping occurs in various cut slopes on the Faro site after either late fall or mid-winter rainfall events. This mechanism would certainly lead to increased surficial moisture levels and likely to increased saturation levels in slopes materials. Sloughs are indicative of near surface marginal stability and generally do not indicate overall slope instability (although additional problems may develop over time if no maintenance is undertaken).

4.0 SEEPAGE WATER QUALITY

As part of this assessment, YG compiled and reviewed water quality data along the toe of the Grum Dump including the following water seepage and quality stations; V2, Moose Seep, V2A, V15 and compiled data for SRK-GD 1, 4, 5, 6, 16 and 21 (assumed to be one station due to closeness). Photo 4-1 shows the locations of these stations under review. Water quality data was reviewed over the approximate time period of 2000 to 2015 with an attempt to discern changes and trends since the placement of the cover in the second half of 2010.

Photo 4-1. Aerial view of water quality and seepage stations located at toe of Grum Dump (after SRK February 2011).

Their water quality plots and associated reviews are compiled in Appendix B for the noted four stations. It should be noted that an Annual Monitoring Program (AMP) exists for water quality parameters at Faro that includes indicators (parameter), location and trigger levels.

Although the YG work reviewed all of the parameters recorded, BGC focused on 4 main parameters of interest related to the sulphidic waste; zinc (dissolved), sulphate (dissolved), total suspended solids (TSS) and pH. The AMP indicators of interest include both total and dissolved zinc and sulphate, along with other metals and alkalinity. Table 4-1 provides a compiled summary of results and interpretations for these four parameters, along with appropriate Effluent Quality Standards (EQS). It should be noted that the cover impact assessment (last row) is based on visual assessment of the data trends and not any form of quantitative analyses:

Table 4-1. Select Water Quality Results from Toe of Grum Dump.

Location	$Zn_{(dis)}$ (mg/L)	$Sulphate_{(dis)}$ (mg/L)	TSS (mg/L)	pH
EQS	< 0.5 mg/L	n/a	< 15 mg/L	>6.5
V2 (below V15)	Only one value greater than EQS in May 2009. After 2010, higher Zn concentrations appears attenuated in summer. Majority of results below 0.05.	Higher concentrations in low flow conditions, around November. No large changes; some lower values before 2010. May be a slow decrease in values since 2010 but more time needed.	Numerous non-compliant samples, usually between March and May. 2003 to 2005 data similar to 2014 values in range of 10 to 25. Several samples greater than 50 in 2008 and 2011.	Quite constant with no visible trend since 2010.
V2A (on main stem of Grum Creek)	Variable but decreasing trend from 2001 until May 2008. Increased to June 2008 (2.8) with general decrease until January 2010 (0.6) and then increase again until August 2011 (1.5). Decreasing trend since that time with 2014 values <0.5.	Increasing trend from 2001 (400 to 600) until September 2010 (1500) and decreasing trend since then. Higher concentrations noted in low flow conditions in the fall.	No information supplied.	Quite constant with no visible trend since 2010.
Moose Seep (seepage below V2)	Very low concentrations since 2005 with three non-compliant events in June 2013 and July 2014.	Increasing trend from 2005 to 2010 (1300) and then seasonal but generally decreasing trend until 2014 (800). Lower values noted in March to May.	No information supplied.	Quite constant with no visible trend since 2010.

Location	$Zn_{(dis)}$ (mg/L)	$Sulphate_{(dis)}$ (mg/L)	TSS (mg/L)	pH
V15 (below main portion of the dump on tributary)	Values BDL before 2006 when values increased until December 2010 (4.1). Dramatic decrease until May 2011 but general overall decreasing trend to 2014; 2014 values in range of 2 to 2.5 (above EQS).	Increasing trend from 2000 with several elevated values in range of 3000 to 4000. Elevated values truncated around 2010 and values have been relatively constant around 1800 to 1900 since then.	Values generally BDL except for sporadic high values (>EQS), with more occurrences in 2000 to 2002 period. High values often occur in April to June period. Since 2010, less non-compliant samples noted.	Values appear more stable after 2010; no values below since 6.5 since 2010.
SRK-GD 1, 4, 5, 6, 16, 21 (seepage along toe)	Possible slight decrease in concentrations after 2010 and appears more consistent. Values still in 3 to 8 range.	Increasing trend from 2002 until 2010 with constrained lower results (1500 to 1900) until early 2012. More variable results from 2012 until 2014 with consistent low values in May/June (ground still frozen).	No information supplied.	Values vary from 6.5 to 8 with some seasonality with some lower values in June and July. No visible trend since 2010.
Interpreted Impact of Cover Placement	Perceived impact	Possible perceived impact (more time required)	Minor perceived impact.	No to minor perceived impact.

It should be noted that the cover design criteria in Section 2.1 did not have any specific water quality objectives for these downstream locations. Water quality improvements that are summarized herein were assumed to be caused by cover construction and changes to the water balance.

Based on this review of the noted parameters, the cover construction and placement appears to have had an impact on water quality as indicated by decreasing zinc concentrations and, to a lesser degree, decreasing sulphate levels. It is important to note, that although zinc concentrations have decreased, they are not at compliance levels yet at V15 or toe seepages but they are at compliance levels at V2 and V2A. No to minor impacts were perceived for the TSS and pH parameters.

These improvements should be viewed in the context that the constructed GSC cover (approximately 28 ha) only covers a portion (estimated to be 30 to 40%) of the entire Grum Dump surface.

5.0 RECOMMENDATIONS

5.1. Summary

The physical condition of the GSC cover is generally good and appears to be increasing run-off to the surrounding ditches and ponds. Several concerns exist regarding physical stability that will require maintenance including several new erosional gullies that have formed on the surface and the localized sloughs and cracking in the Toe Berm (likely due to relatively steep nature and increasing moisture but mechanism not currently understood). The growth medium, the till layer, appears to be supporting an increasing vegetative cover extent, but some nutrients are in very low proportions and no information relative to moisture availability or in situ density exists. In addition, the cover placement appears to have a positive impact on lowering zinc concentrations on seepage and surface water below the Grum Dump but no water balance exists for the cover. Unfortunately, equipment access in early 2015 lead to impacts to the cover that will have both erosion and vegetation consequences if not mitigated. Lastly, no data or assessment of the infiltration performance of the covers exists which is a significant limitation in comparing performance to the original design criteria for the cover.

The following two sections provide recommendations regarding monitoring and maintenance required for the cover.

5.2. Short Term Maintenance Items

BGC's specific scope of work on this project is generally focused on short term maintenance and monitoring issues to address observations with respect to physical integrity of the cover, which are provided herein. For completeness, BGC has also provided a summary of related and medium term issues and recommendations for consideration in Section 5.3.

The following short term maintenance items are recommended for the GSC covers and ditches:

- Numerous impacts occurred to the cover due to dozer tracks and the following repairs are recommended:
    1. Excavator tracks on edge of first bench (all references from the top) need to be smoothly graded to prevent water flow concentration.
    2. Excavator tracks on the third bench also need to be graded smoothly.
    3. Excavator tracks on the fourth bench also need to be graded smoothly.
    4. The surface vegetation between the third and the fourth benches has been "crushed" or destroyed by the tracks in a vertical line between the benches. This is thought to be a concentrated pathway that could lead to erosion. Any machine work here would cause additional impact. Hand work is suggested to break down any track ridges. It is suggested that hand broadcasting of seed mix (and possible fertilizer) be undertaken to quickly re-establish vegetation on this track.
    5. Excavator tracks also noted below fourth bench next to east perimeter ditch. Again, seeding is recommended here for the impacted tracks.

6. An accumulation of loose ditch spoil is located just above the fourth bench. This loose fill would be subject to concentrated erosion. Minor hand work coupled with localized seeding is recommended in the short term to stabilize as best as possible.
7. Soil backfill placed in the East Access Ditch concurrent with fourth bench needs to be removed and channel rip rap repaired so that water conveyance may occur unimpeded.
8. As a general recommendation, no mobile equipment should be accessing the GSC cover surface during thaw season; impacts to both surface drainage and vegetation cover would be thereby prevented. If it is necessary to access the cover during the melt period to remove snow or ice, the mobile equipment should be restricted to the berm surfaces if possible.

- New significant erosional gully formed from fourth to fifth bench. Top of new gully at 62°15'22.3"N / 133°13'20.3"W. Need top of this gulley graded to prevent water concentration.
- New significant erosional gully formed from fifth bench to Toe Berm. Top of new gully at 62°15'20.3"N / 133°13'15.7"W. Need top of this gulley graded to prevent water concentration.
- Seeding recommended on three small sloughs and associated scarps on eastern portion of the Toe Berm slope.
- Visually monitor cracking in the base area of the Toe Berm above the diversion ditch.
- The mechanism driving the sloughs and the toe cracking should be investigated further in 2016 as they may be preliminary indicators of more significant geotechnical issue such as elevated pore pressures above the liner.
- New significant erosional gully formed on Toe Berm slope. Base of this new gully at 62°15'11.5"N / 133°13'24.7"W. Need top of this gulley graded to prevent water concentration.
- Repair and regrade the two erosional gullies and associated slough material into the West Access Ditch; granular material may be required for steep gullies.
- Regrade surface or add small bench berm to prevent concentrated flows at gully on fourth bench (62°15'17.9"N / 133°13'35.4"W). It is understood that snow is sometime stockpiled in this location leading to concentrated flows; snow stockpiling should be discontinued on the GSC cover.
- Erosional gully on West Access Ramp has exposed geotextile (62°15'21.9"N / 133°13'50.4"W) and should be backfilled.
- Continue with all recommended activities to enhance revegetation growth and extent on the GSC cover.

In addition to the maintenance items on the GSC, the following maintenance items on the areas surrounding the GSC cover should be undertaken:

- Place additional rip rap on the informal spillway (no engineering design exists) that discharges from the Unlined Pond to cover exposed geotextile.
- Regrade and repair localized erosional gullies located on the dump faces to the southwest of the Unlined Pond. These gullies are partially generated by run-off that comes down from the old "rock quarry" location higher up in the dump section.
- Review water quality sample results (if any available) from "old rock quarry" area located south of the GSC cover. If compliant for discharge, then construct appropriate surface measures to divert this surface water into the forest and dump toe, rather than letting water drain into the unlined pond area. When undertaking these measures, ensure water is not focused into narrow or singular discharge points where additional erosion and sedimentation could occur. This water diversion is a short term measure only and surface water sampling should continue in parallel such that only compliant water is discharged.

GSC monitoring aspects in 2016 should comprise the following aspects:

1. Snow depths and densities in late April or early May over at least 3 to 5 sampling periods to understand its variability.
2. Dates of run-off generation and pumping.
3. Photos showing snow pack and pond levels right around run-off time.
4. Quantities of water pumped from both ponds over noted durations.
5. Water quality results from both ponds after freshet and later in the summer as well, including total and dissolved zinc, TSS, alkalinity and pH.

5.3. Medium Terms Considerations

The water quality and the water management practices on the Grum Dump are evolving over time. Previously, surface water used to run off the dump faces into the informal seepage collection system at V15, then into the Moose Pond and into Vangorda Creek without any interventions. After the low infiltration cover was constructed, some 28 ha of surface area had a higher run-off value than previous. This increased the surface water run-off component and changed the GSC run-off from a passive discharge system into an actively pumped system, removing the majority of the run-off from reporting to the downstream stations. In addition, the creation on the Unlined Pond, along with some changes to drainage paths on surface, meant that water from outside the GSC cover was also being captured on the dump surface, rather than reporting to the toe of the dump. In addition, the vegetation cover is evolving and growing, leading to enhanced surface soil stability from erosion and to better/improving water quality.

Given this evolution and broadening perspective, BGC has prepared the following recommendations relative to the medium term (next 1 to 3 years) operations of the GSC cover, Grum Dump, and associated water management system:

1. When freshet occurs, it appears that run-off water initially collected in the ponds will be non-compliant with respect to zinc concentrations or TSS. Once pond water is confirmed to meet discharge criteria following settlement of suspended solids, compliant water should be pumped to any appropriate receiving environment rather than be pumped to the

Vangorda Pit for mixing with contact water. By the same rationale, should surface water from the Grum Dump and rock quarry be confirmed to be compliant, these water should be diverted away from the Unlined Pond.

2. The pump at the Lined Pond should be ready to initiate drawdown as soon as run-off flows into that pond, without delay. Site staff need to ensure the pump is ready for use at the appropriate time. Discharge of water from the Lined Pond overflow should only occur in extreme cases.
3. The existing GSC cover materials contain elevated levels of zinc, which are likely liberated during water contact and erosion events. Zinc concentrations in the runoff water captured in the Lined Pond are decreasing over time, likely in response to ongoing biomass establishment on the cover. Ongoing biomass growth and associated reduction in zinc entrainment by surface water should continue in the next few years, but continued monitoring would be required to prove that mechanism. It is likely not practical to excavate and replace portions of the cover that contain elevated zinc concentrations (e.g. hot spots), but this should be considered.
4. All yearly site climate data should be downloaded, plotted, and interpreted relative to mean and estimated ranges for various parameters, but mostly focused on temperatures, rainfall, and snowfall amounts (BGC was provided with raw hourly climate station data only). Yearly climate records provide context for the following year's performance of soil covers, slopes, vegetation success, and water management relative to design criteria, including climate change assumptions. Climate records should be based on the water cycle (fall to summer) as opposed to calendar year.
5. In order to prevent perimeter ditch water from discharging in spring freshet events, site staff should be prepared to clean out any snow and ice blockages before freshet occurs. Cover access may be done carefully to prevent impacts to the cover; access over snow or frozen ground recommended or only on waste rock benches during thaw season. Snow and ice stockpiles should be placed with caution to ensure no blockage or diversion of freshet runoff.
6. BGC provided an outline of monitoring plan recommendations for the GSC ponds and pumps (BGC 2012b) and these recommendations should be implemented to build an experience base on the actual performance of the cover and drainage system.
7. The data review for water quality stations by YG at the toe of the Grum Dump should continue each year. If available, alkalinity should also be tracked and its trend assessed relative to zinc concentrations.

In addition, BGC also provides the following recommendations that tie into the longer term closure plan for the Grum Dump and likely Faro Dumps as well:

- The current GSC cover provides for an engineered cover for only a portion of the entire Grum Dump surface. Initial plans regarding covers and landforms for the entire dump surface should be developed so that potential water management aspects can also be formulated, along with estimated schedule for placement of final closure cover.

- Given that seepage and groundwater below the dump may be non-compliant for years (until final cover placement takes effect), YG should consider the design of a more comprehensive seepage collection trench, pond, and pumping system along the toe of the dump. Rather than focusing energy and resources to internal water management on the GSC cover, it may be more effective to align a water management approach that may be required during transition to, or during final closure anyways.
- No water balance exists for the main elements of the GSC cover and water management systems. One needs to be developed to compare the original design criteria to its actual performance because the water balance and associated water quality are inter-related. As part of the water balance, studies should be carried out to calculate evaporation rates on the covers.
- The GSC cover was designed to be a very low infiltration cover, but no subsurface monitoring data is collected above or below the liner currently. In addition, the moisture content evolution process in the overlying till is not being monitored which will have implications for long term physical stability and possibly for revegetation assessment. It would be useful for closure design to initiate such a program so that baseline and evolving conditions can be measured and extrapolated to other proposed covers for final design.
- Several trial covers were constructed on both flat and sloping surfaces on the Vangorda waste dump and SRK produced numerous data reports on these covers in the mid to late-2000's. It is understood that no interpretation of that data was undertaken to assess infiltration values for those covers; assessment of existing data should be done to understand any learnings. In addition, it may be possible to either undertake in situ testing or in situ monitoring to understand the current performance (infiltration, erosion, soil nutrients, till density, revegetation success, etc.) of these covers that are approximately a decade old.

6.0 CLOSURE

The comments and recommendations provided herein are based on assessment of third party data, observations and data reviews, along with observations and data reviews undertaken by BGC. It is assumed these third party data and observations are accurate; they have been relied upon without independent verification in most cases.

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:

PROFESSIONAL ENGINEER
YUKON TERRITORY
J. W. CASSIE

29-FEB-2016.

James W. Cassie, M.Sc., P.Eng.
Principal Geotechnical Engineer

Reviewed by:

Gerry Ferris, M.Sc., P.Eng.
Principal Geotechnical Engineer

JWC/GWF/gkc/st

PERMIT TO PRACTICE
Signature
Date Feb 29, 2016
PERMIT NUMBER: PP092
Association of Professional Engineers of Yukon

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APPENDIX A
JULY 2015 FIELD MEMORANDUM

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Suite 200 - 1121 Centre St. NW
Calgary, AB Canada T2E 7K6
Telephone (403) 250-5185
Fax (403) 250-5330

July 24, 2015
Project No.: 0533-012

Dr. Dustin Rainey, Ph.D., P.Geo.
Senior Project Manager, Faro Project Management Team
Assessment and Abandoned Mines
Yukon Government
Energy, mines and Resources
Box 2703 (K-419)
Whitehorse, YT, Y1A 2C6

Dear (name),

Re: 2015 Inspection Notes, Grum Sulphide Cell Cover, Faro Mine

1.0 BACKGROUND

The Grum Sulphide Cell (GSC) soil cover and water management system at Faro Mine was constructed in 2010. Following remedial repairs in 2011, BGC Engineering Inc. (BGC) have been involved with inspection of the cover and assessment of its performance. On May 26 and 27, 2015, Mr. Jim Cassie, of BGC, undertook a site inspection in the company of Dr. Dustin Rainey. This letter summarizes the proposed short term (this summer) maintenance items needed at the GSC cover. Issues related to medium term water management are not be covered herein. In addition, the letter outlines the requested data requirements to support the final report preparation.

2.0 SHORT TERM MAINTENANCE

Based on the site inspection visit, the following observations and related recommendations are provided regarding the cover.

It appears that an excavator accessed the GSC cover during thaw season, presumably the purpose of removing snow blockages from the benches that provide lateral drainage to the two perimeter ditches. Unfortunately, the excavator tracks have impacted the surface grade and vegetation cover as outlined below:

- Excavator tracks on edge of first bench (all references from the top) need to be smoothly graded to prevent water flow concentration.
- Excavator tracks on the third bench also need to be graded smoothly.
- Excavator tracks on the fourth bench also need to be graded smoothly.

- The surface vegetation between the third and the fourth benches has been “crushed” or destroyed by the tracks in a vertical line between the benches. This is thought to be a concentrated pathway that could lead to erosion. Any machine work here would cause additional impact. Hand work is suggested to break down any track ridges. It is suggested that hand broadcasting of seed mix (and possible fertilizer) be undertaken to quickly re-establish vegetation on this track.
- Excavator tracks also noted below fourth bench next to east perimeter ditch. Again, seeding is recommended here for the impacted tracks.
- An accumulation of loose ditch soil is located just above the fourth bench. This loose fill would be subject to concentrated erosion. Minor hand work coupled with localized seeding is recommended in the short term to stabilize as best as possible.
- Soil has been placed within the eastern perimeter ditch concurrent with the fourth bench level. This soil must be removed to re-establish the capacity of the ditch.
- Two to three small sloughs are active along the eastern side of the toe berm; seeding also recommended on these sloughs and scarps to establish vegetation cover.
- New erosional gully formed on the toe berm bench. Bottom of new gully at 62o15’11.5”N / 133o13’24.7”W. Need better grading on the top of this bench to prevent water concentration.
- Erosional gully in west access road above first bench (exposed geotextile) should be backfilled to prevent additional erosion.

As a general recommendation, no mobile equipment should be accessing the GSC cover surface during thaw season; impacts to both surface drainage and vegetation would be thereby prevented. If it is necessary to access the cover during the melt period to remove snow or ice, the mobile equipment should be restricted to the berms if possible.

3.0 INFORMATION REQUEST

BGC requests the following information from YG:

- Daily climatic data (temperature and precipitation) for Grum Weather Station from August 2014 until June 2015
- EDI 2014/2015 reports and observations on vegetation surveys on both the Grum test plots and the GSC
- Water pumping rates / durations / quantities for lined and unlined ponds in Spring 2015, along with any water level /depth (staff gauge readings) for these two ponds
- Water quality results for lined and unlined ponds (Spring and Summer 2015)
- Water quality / quantity measurements from V15 seepage station over the last few years, if possible.

The timely delivery of this information is requested in order to finalize our reporting duties on this project.

4.0 CLOSURE

BGC Engineering Inc. (BGC) prepared this document for the account of Yukon Government. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

As a mutual protection to our client, the public, and ourselves, all documents and drawings are submitted for the confidential information of our client for a specific project. Authorization for any use and/or publication of this document or any data, statements, conclusions or abstracts from or regarding our documents and drawings, through any form of print or electronic media, including without limitation, posting or reproduction of same on any website, is reserved pending BGC's written approval. A signed and sealed copy of this document is on file at BGC. That copy is the record document, and takes precedence over any other copy or reproduction of this document.

Yours sincerely,

BGC ENGINEERING INC.
per:

James W. Cassie, M.Sc., P.Eng.
Principal Geotechnical Engineer

Gerry Ferris, M.Sc., P.Eng.
Principal Geotechnical Engineer

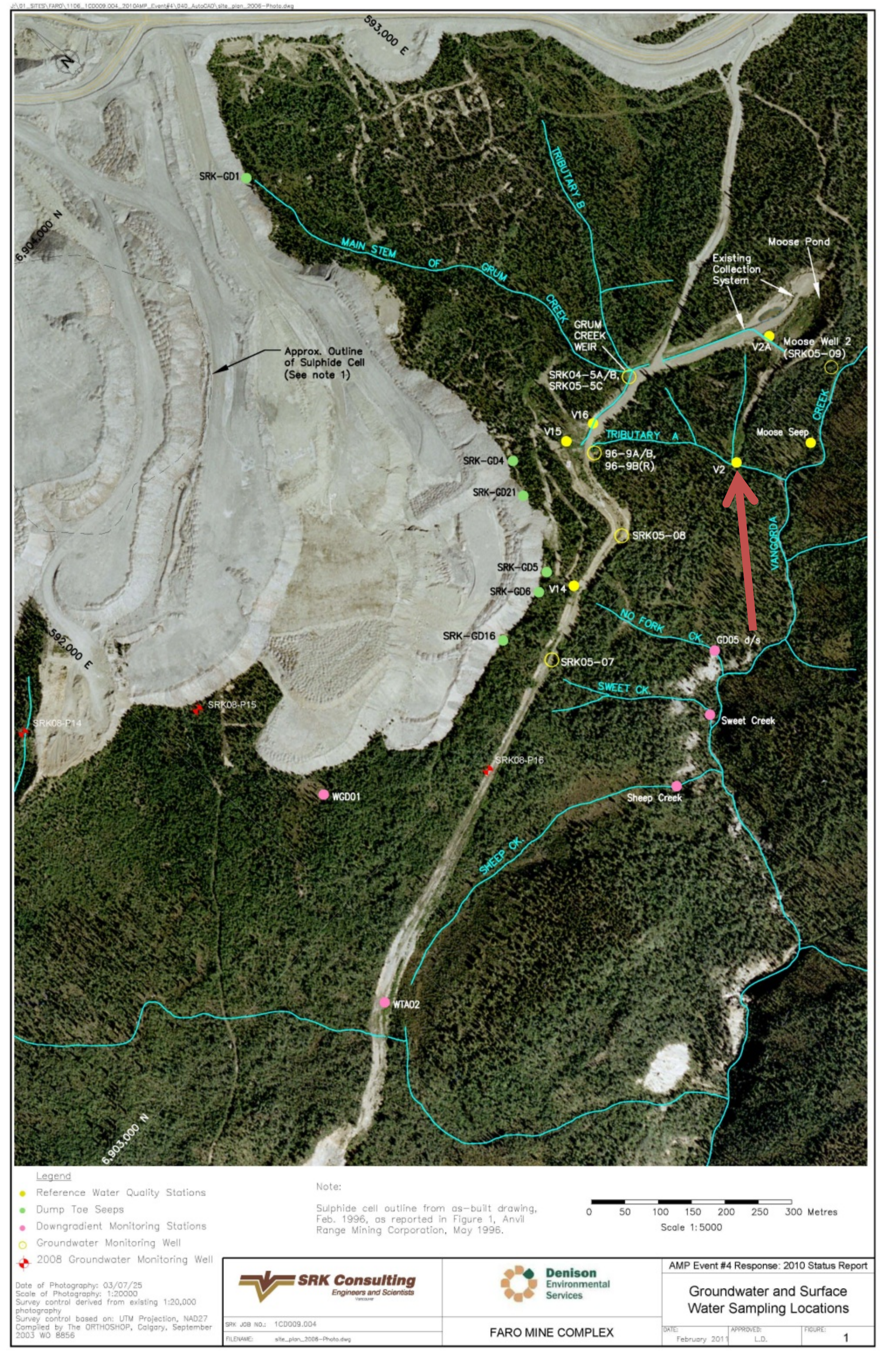
JWC/GF/cs

APPENDIX B
WATER QUALITY STATION DATA REVIEWS AND PLOTS BY YG

GSC Annual Performance Assessment

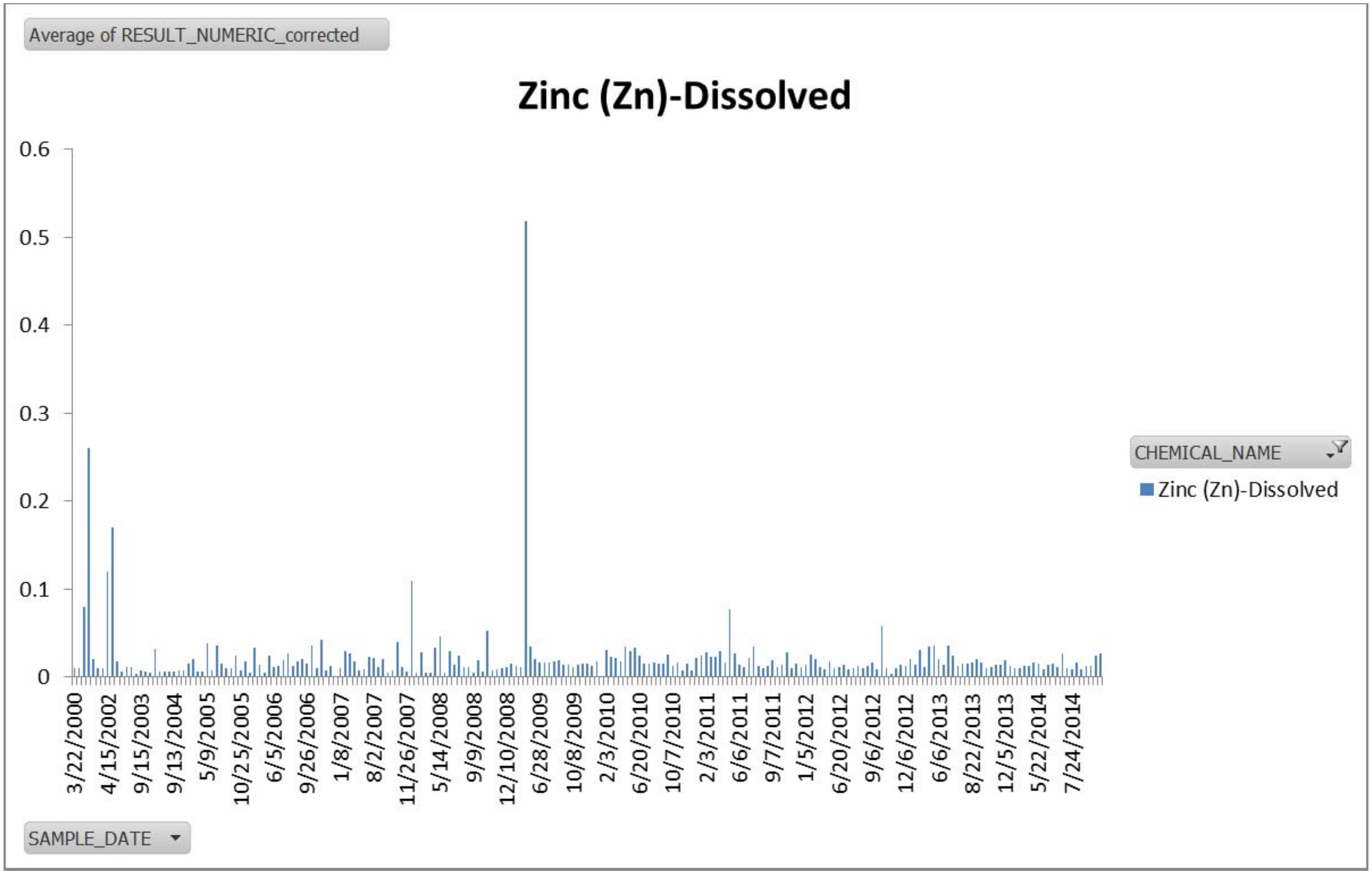
Geochemical Results 2000-2015

Site: V2



Assumptions for GSC Annual Performance Assessment

- Some measurements were reported in µg/L, others in mg/L. To keep consistency, values were transformed to mg/L where relevant.
- If values were reported as less than the detection limit, for visualization purposes, they were graphed as the corresponding reporting limit.
- The scale of the graphs was mostly chosen to see the data in the context of the FMC Effluent Quality Standards. In a scale to show how close the measured values were to these reference values.
- Another focus of the graphs was to compare baseline data with conditions years after the GSC Cover was completed. In this context, the graphs focus on the trends before and after 2010 (when the GSC dry cover was completed).
- No values were discarded as outliers at this stage of the analysis, but in some cases, the maximum values of the graph's scales don't show abnormally high values.
- Construction of the GSC Cover occurred between June 24, 2010 and November 1, 2010. All the earthworks were completed during this summer, except for hydro-seeding, some regarding, and the construction of water management ponds.
- On May 17, 2011 excessive meltwater collapsed the system, causing overflow of hydraulic infrastructure and release on non-compliant water into the Vangorda Creek. See Rainey et al. 2013 report for more information.


Average of RESULT_NUMERIC_corrected
Zinc (Zn)-Dissolved
0.6
0.5
0.4
0.3
0.2
0.1
0
3/22/2000
4/15/2002
9/15/2003
9/13/2004
5/9/2005
10/25/2005
6/5/2006
9/26/2006
1/8/2007
8/2/2007
11/26/2007
5/14/2008
9/9/2008
12/10/2008
6/28/2009
10/8/2009
2/3/2010
6/20/2010
10/7/2010
2/3/2011
6/6/2011
9/7/2011
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6/20/2012
9/6/2012
12/6/2012
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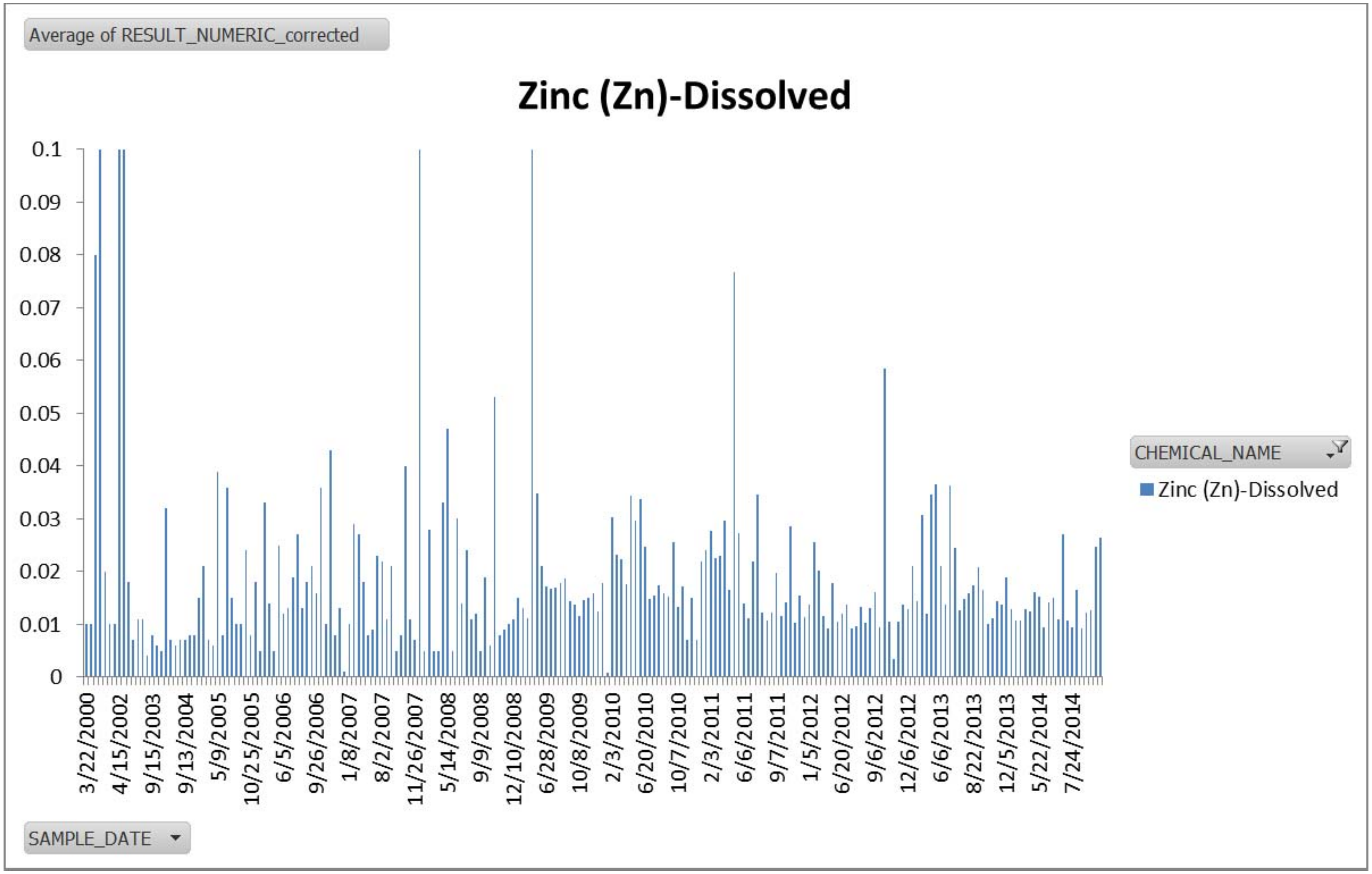
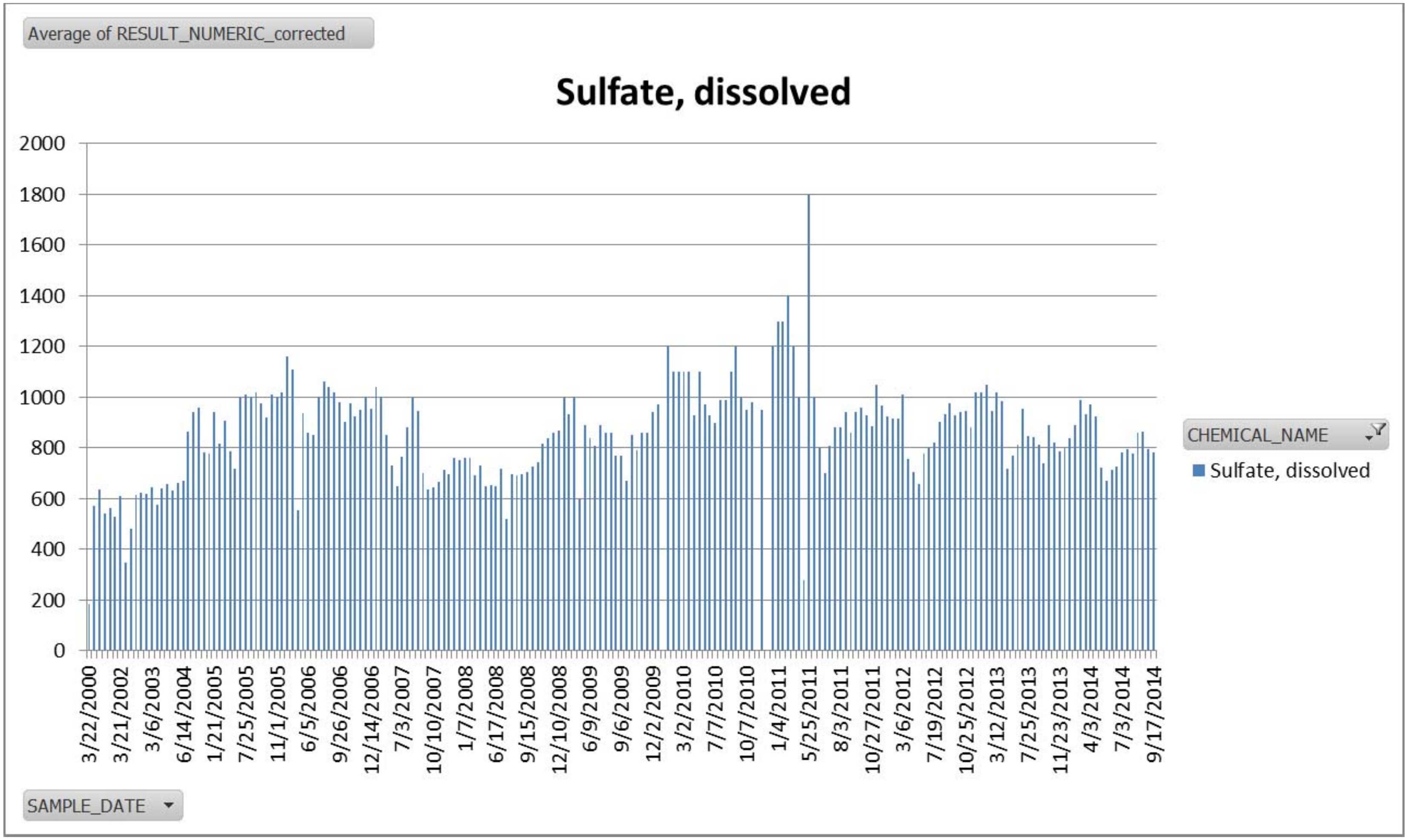
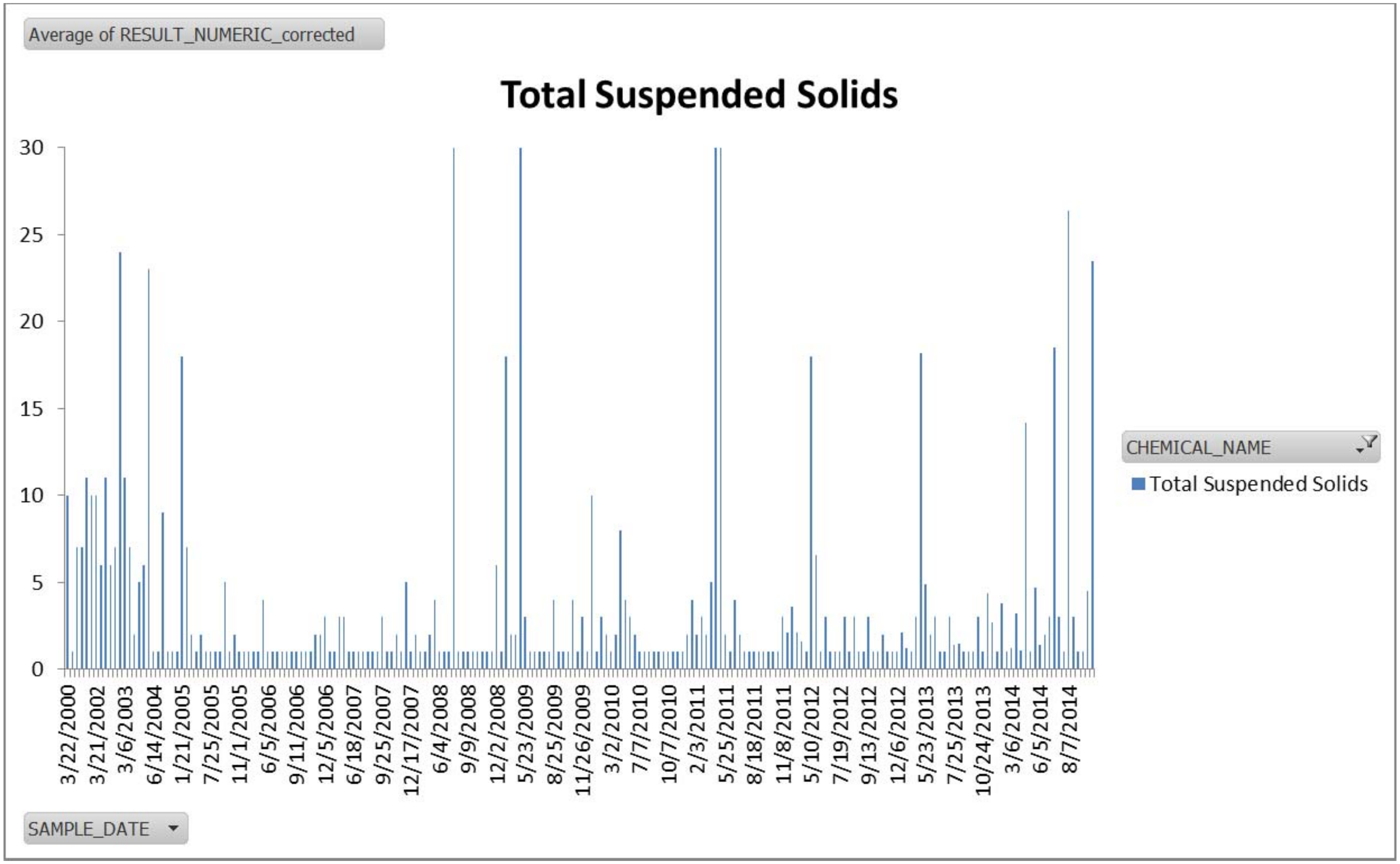
12/5/2013
5/22/2014
7/24/2014
SAMPLE_DATE
CHEMICAL_NAME
Zinc (Zn)-Dissolved



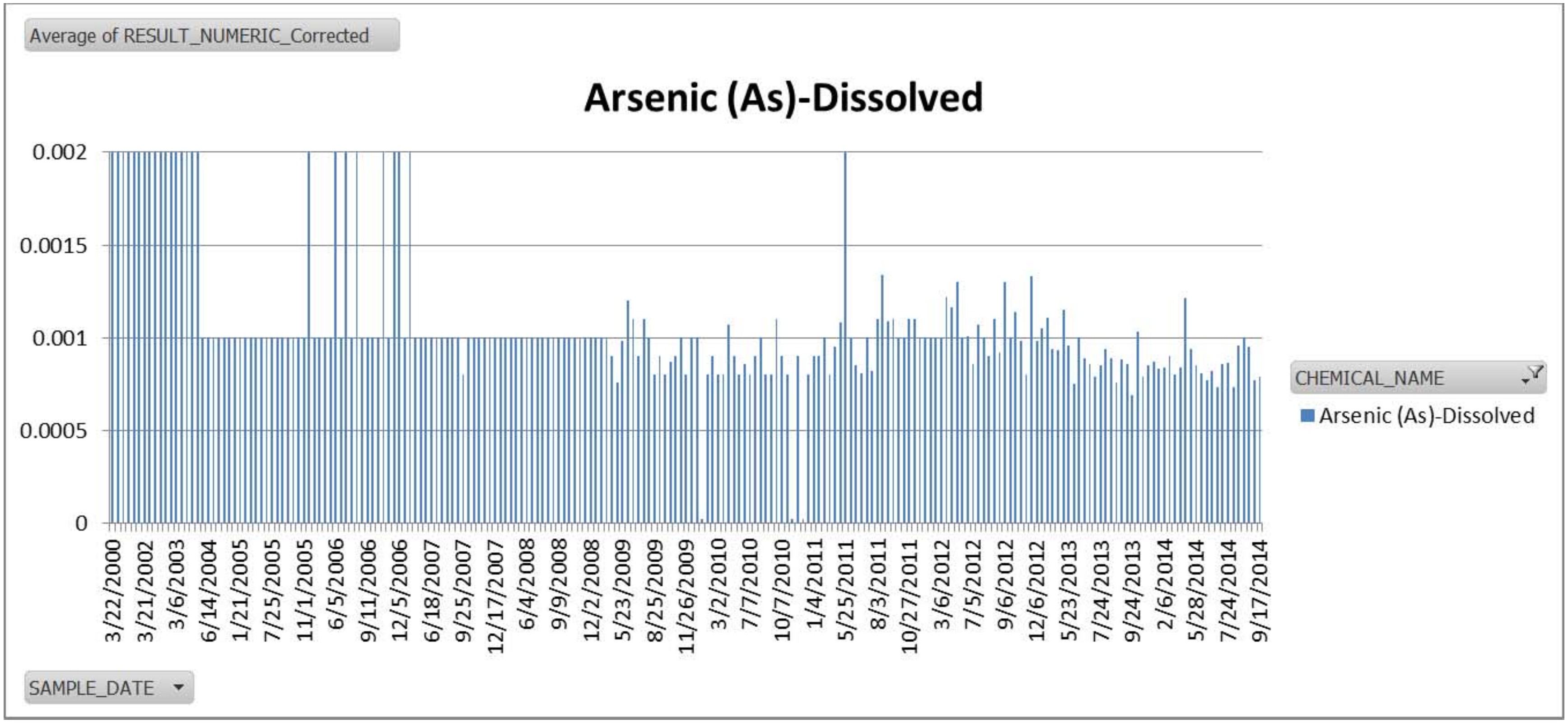
Average of RESULT_NUMERIC_corrected
Zinc (Zn)-Dissolved
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
3/22/2000
4/15/2002
9/15/2003
9/13/2004
5/9/2005
10/25/2005
6/5/2006
9/26/2006
1/8/2007
8/2/2007
11/26/2007
5/14/2008
9/9/2008
12/10/2008
6/28/2009
10/8/2009
2/3/2010
6/20/2010
10/7/2010
2/3/2011
6/6/2011
9/7/2011
1/5/2012
6/20/2012
9/6/2012
12/6/2012
6/6/2013
8/22/2013
12/5/2013
5/22/2014
7/24/2014
CHEMICAL_NAME
Zinc (Zn)-Dissolved
SAMPLE_DATE



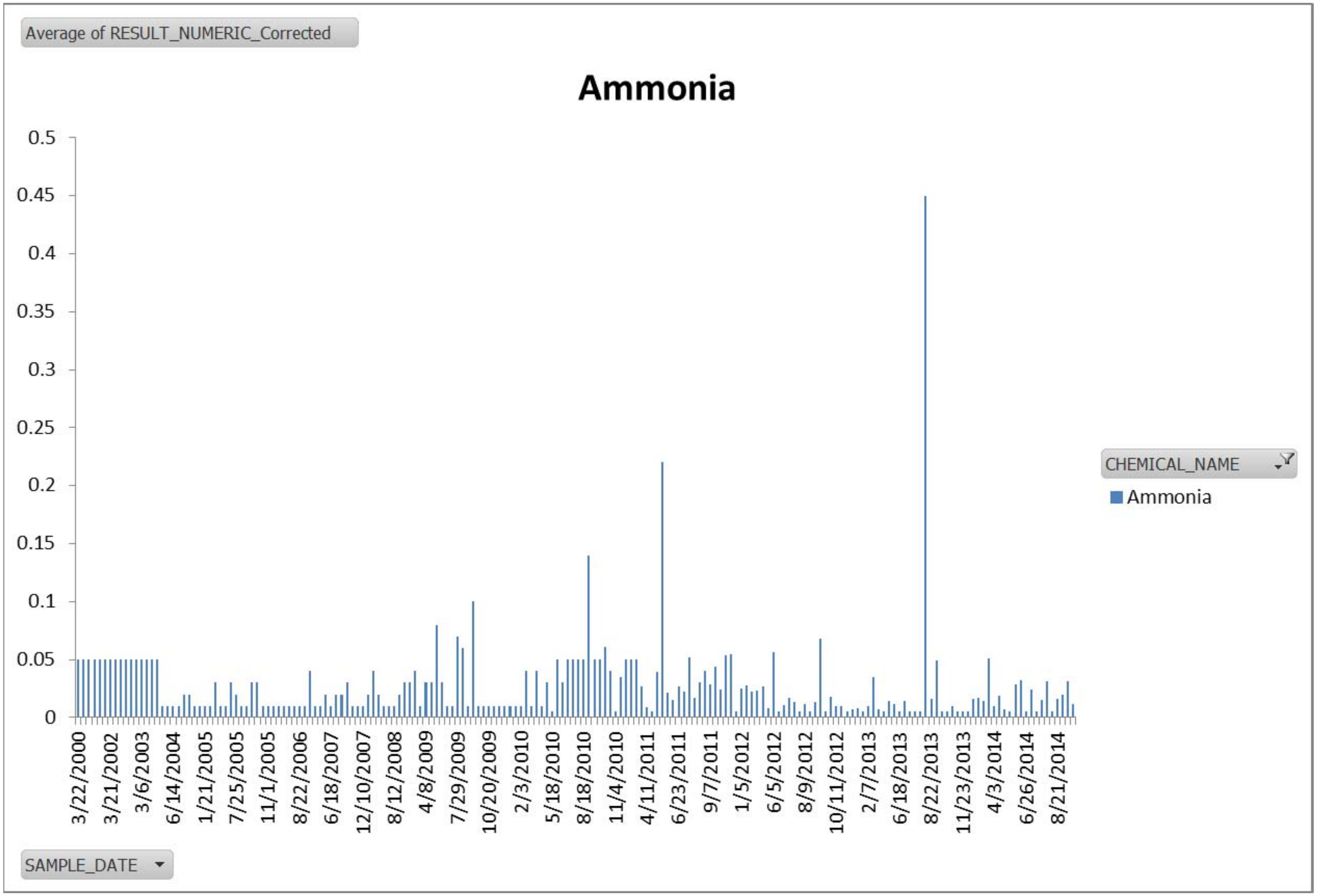
Average of RESULT_NUMERIC_corrected
Sulfate, dissolved
2000
1800
1600
1400
1200
1000
800
600
400
200
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/26/2006
12/14/2006
7/3/2007
10/10/2007
1/7/2008
6/17/2008
9/15/2008
12/10/2008
6/9/2009
9/6/2009
12/2/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/19/2012
10/25/2012
3/12/2013
7/25/2013
11/23/2013
4/3/2014
7/3/2014
9/17/2014
SAMPLE_DATE
CHEMICAL_NAME
Sulfate, dissolved



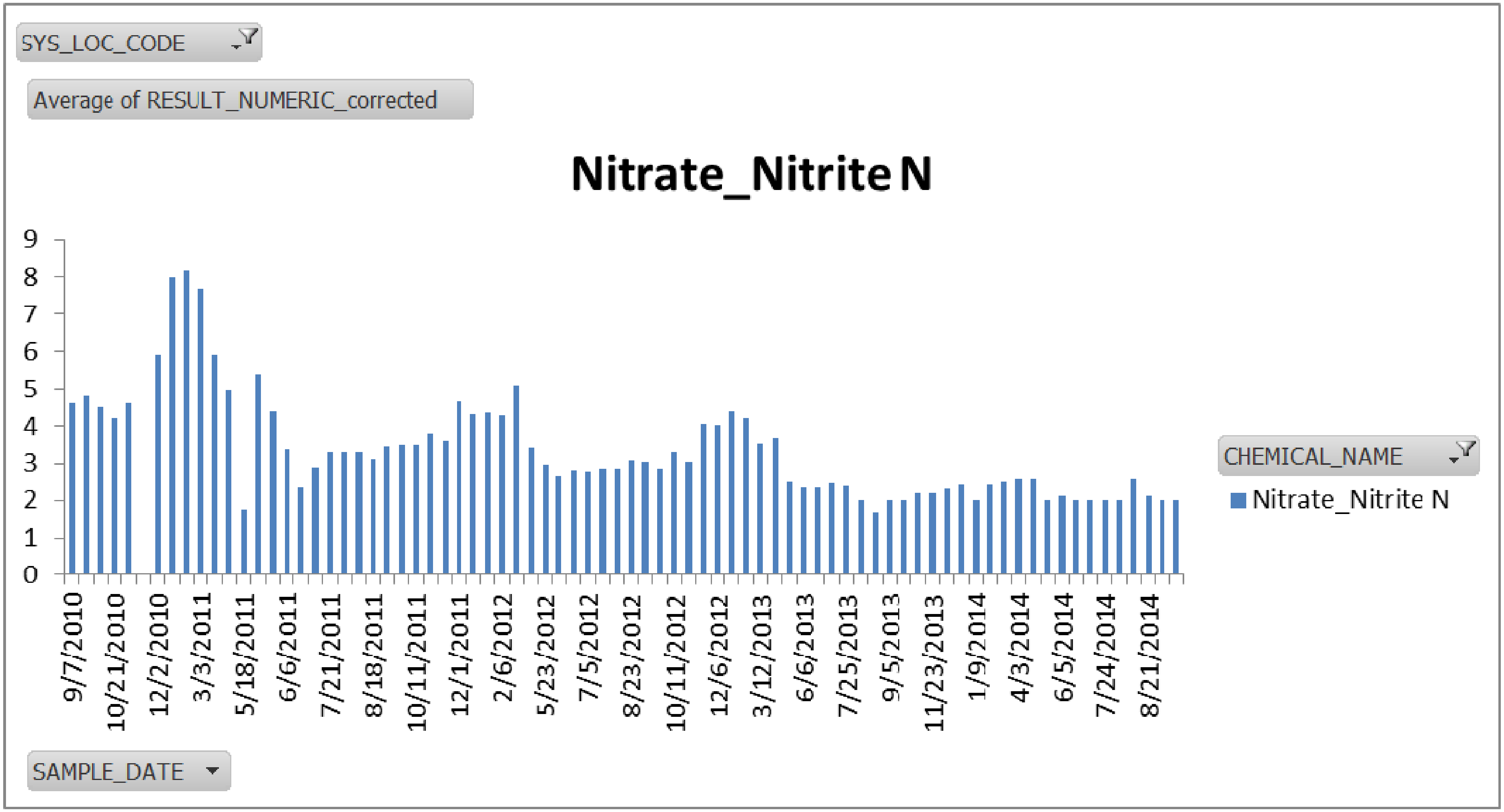
Average of RESULT_NUMERIC_corrected
Total Suspended Solids
30
25
20
15
10
5
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
2/3/2011
5/25/2011
8/18/2011
11/8/2011
5/10/2012
7/19/2012
9/13/2012
12/6/2012
5/23/2013
7/25/2013
10/24/2013
3/6/2014
6/5/2014
8/7/2014
SAMPLE_DATE
CHEMICAL_NAME
Total Suspended Solids



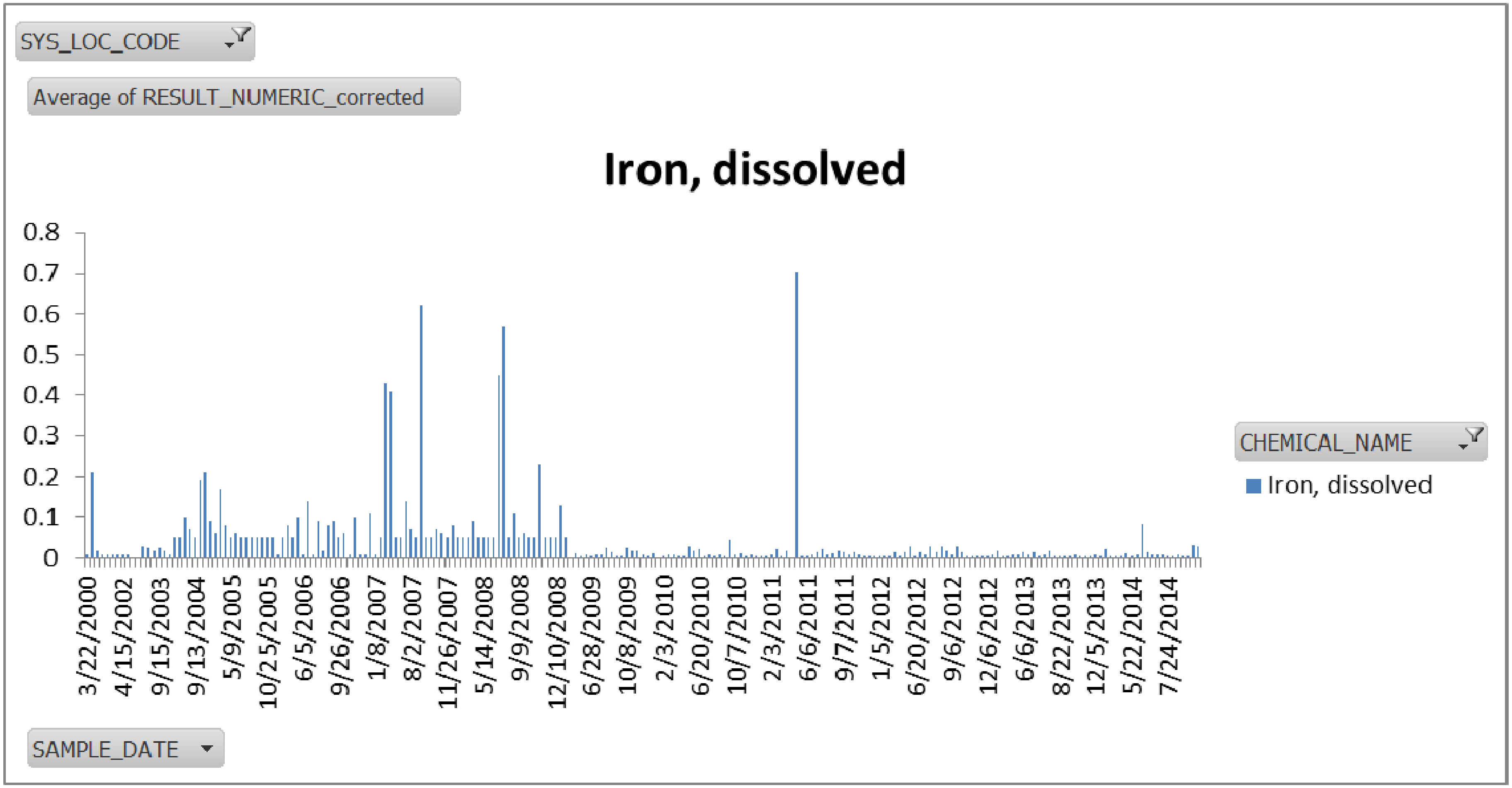
Average of RESULT_NUMERIC_Corrected
Arsenic (As)-Dissolved
0.002
0.0015
0.001
0.0005
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Arsenic (As)-Dissolved
SAMPLE_DATE



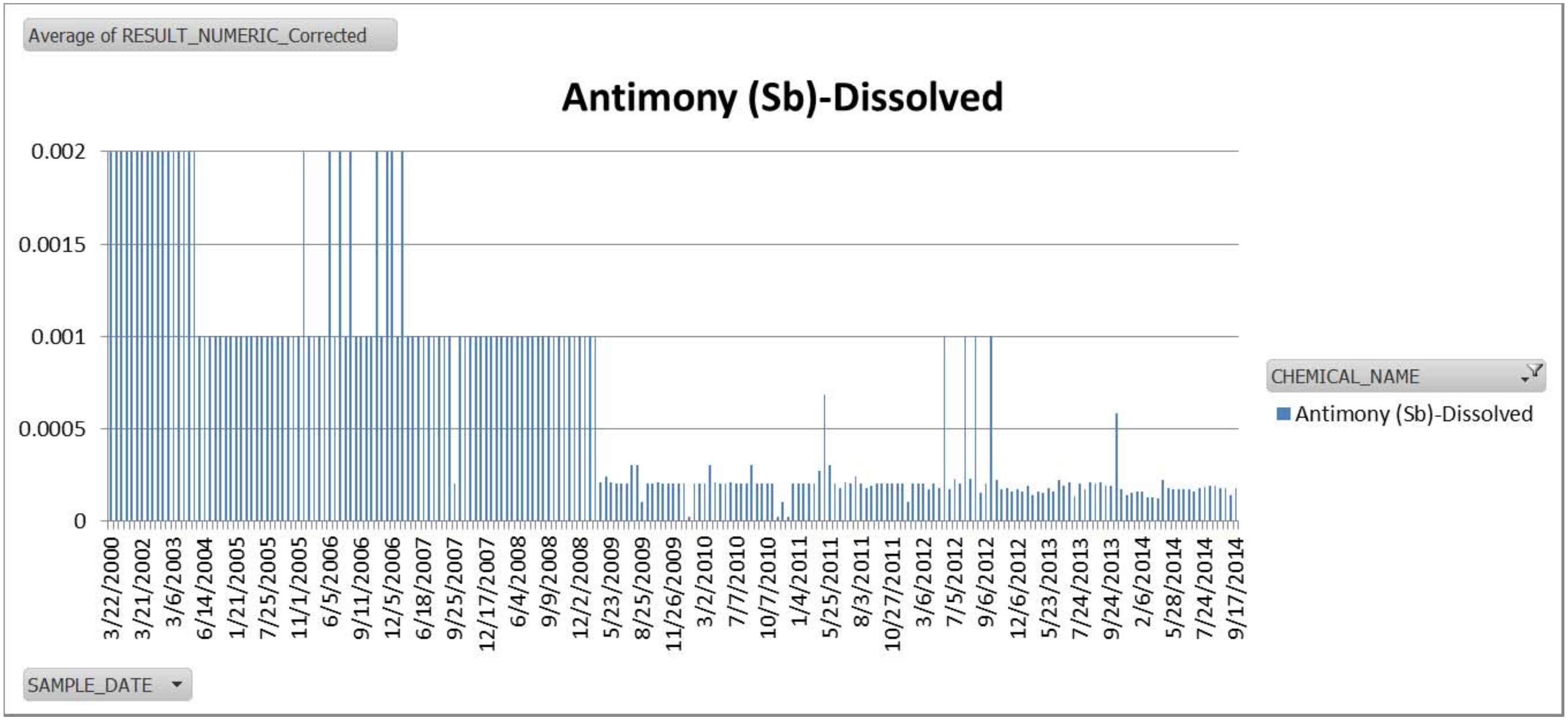
Average of RESULT_NUMERIC_Corrected
Ammonia
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
8/22/2006
6/18/2007
12/10/2007
8/12/2008
4/8/2009
7/29/2009
10/20/2009
2/3/2010
5/18/2010
8/18/2010
11/4/2010
4/11/2011
6/23/2011
9/7/2011
1/5/2012
6/5/2012
8/9/2012
10/11/2012
2/7/2013
6/18/2013
8/22/2013
11/23/2013
4/3/2014
6/26/2014
8/21/2014
CHEMICAL_NAME
Ammonia
SAMPLE_DATE

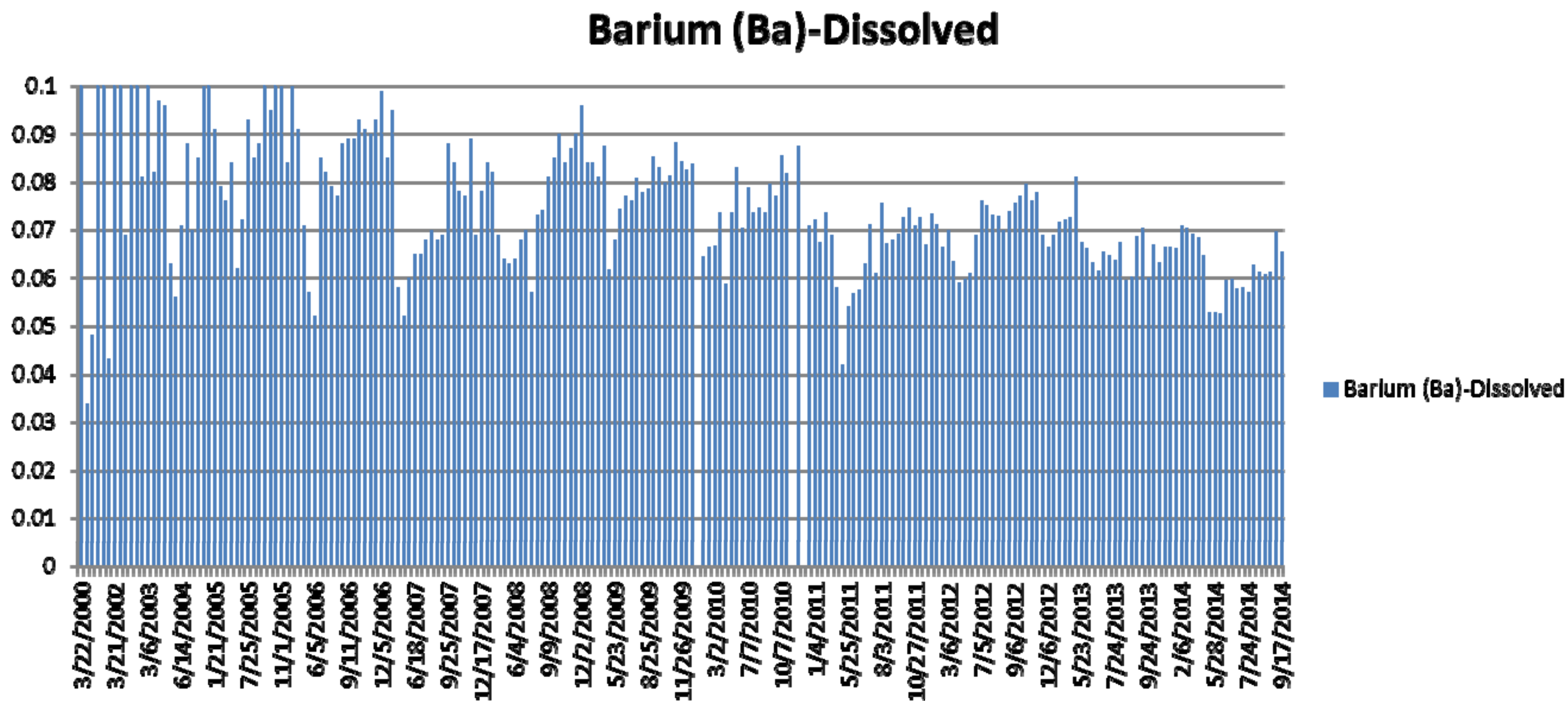


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Nitrate_Nitrite N
9
8
7
6
5
4
3
2
1
0
9/7/2010
10/21/2010
12/2/2010
3/3/2011
5/18/2011
6/6/2011
7/21/2011
8/18/2011
10/11/2011
12/1/2011
2/6/2012
5/23/2012
7/5/2012
8/23/2012
10/11/2012
12/6/2012
3/12/2013
6/6/2013
7/25/2013
9/5/2013
11/23/2013
1/9/2014
4/3/2014
6/5/2014
7/24/2014
8/21/2014
CHEMICAL_NAME
Nitrate_Nitrite N
SAMPLE_DATE

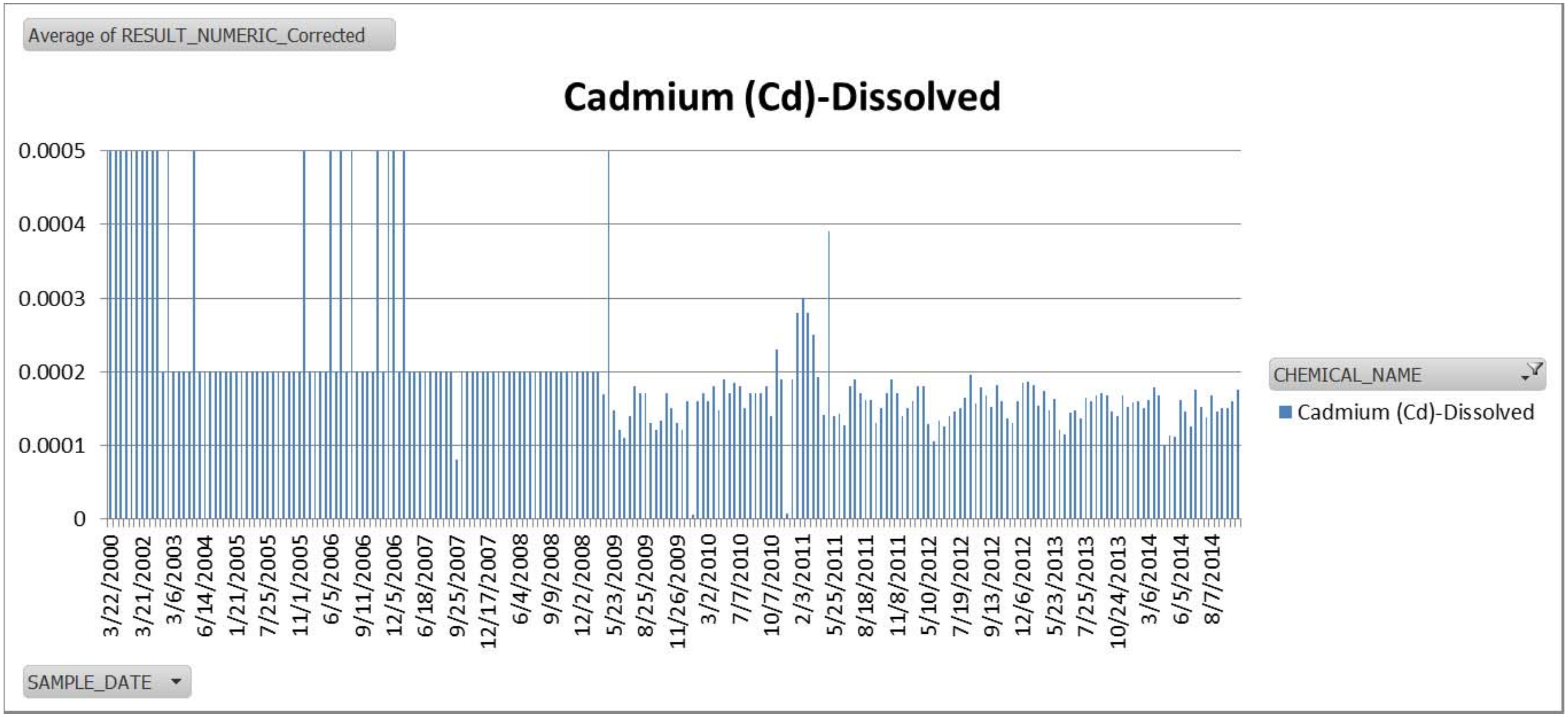


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Iron, dissolved
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/22/2000
4/15/2002
9/15/2003
9/13/2004
5/9/2005
10/25/2005
6/5/2006
9/26/2006
1/8/2007
8/2/2007
11/26/2007
5/14/2008
9/9/2008
12/10/2008
6/28/2009
10/8/2009
2/3/2010
6/20/2010
10/7/2010
2/3/2011
6/6/2011
9/7/2011
1/5/2012
6/20/2012
9/6/2012
12/6/2012
6/6/2013
8/22/2013
12/5/2013
5/22/2014
7/24/2014
CHEMICAL_NAME
Iron, dissolved
SAMPLE_DATE

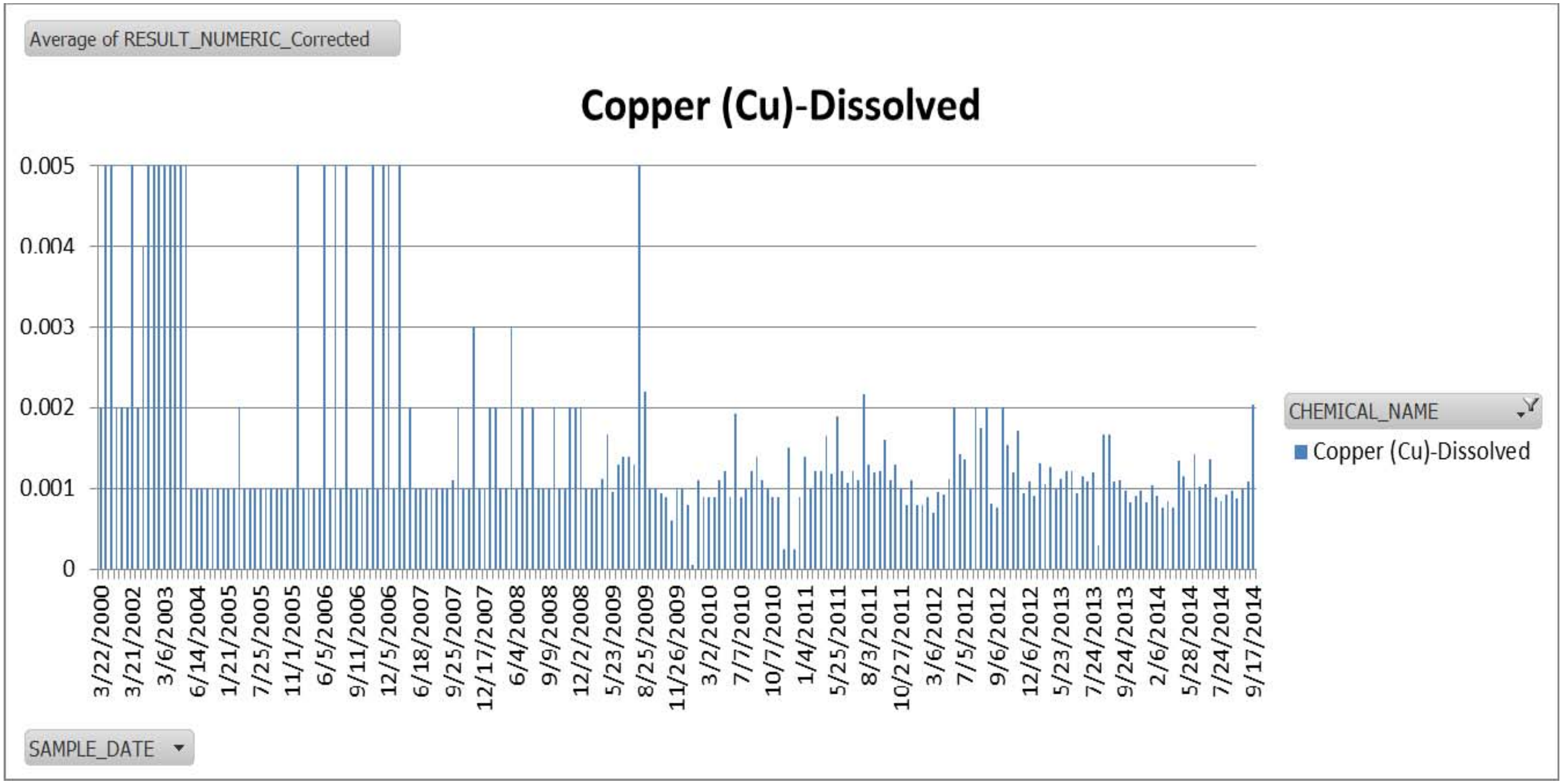

Average of RESULT_NUMERIC_Corrected
Antimony (Sb)-Dissolved
0.002
0.0015
0.001
0.0005
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Antimony (Sb)-Dissolved
SAMPLE_DATE



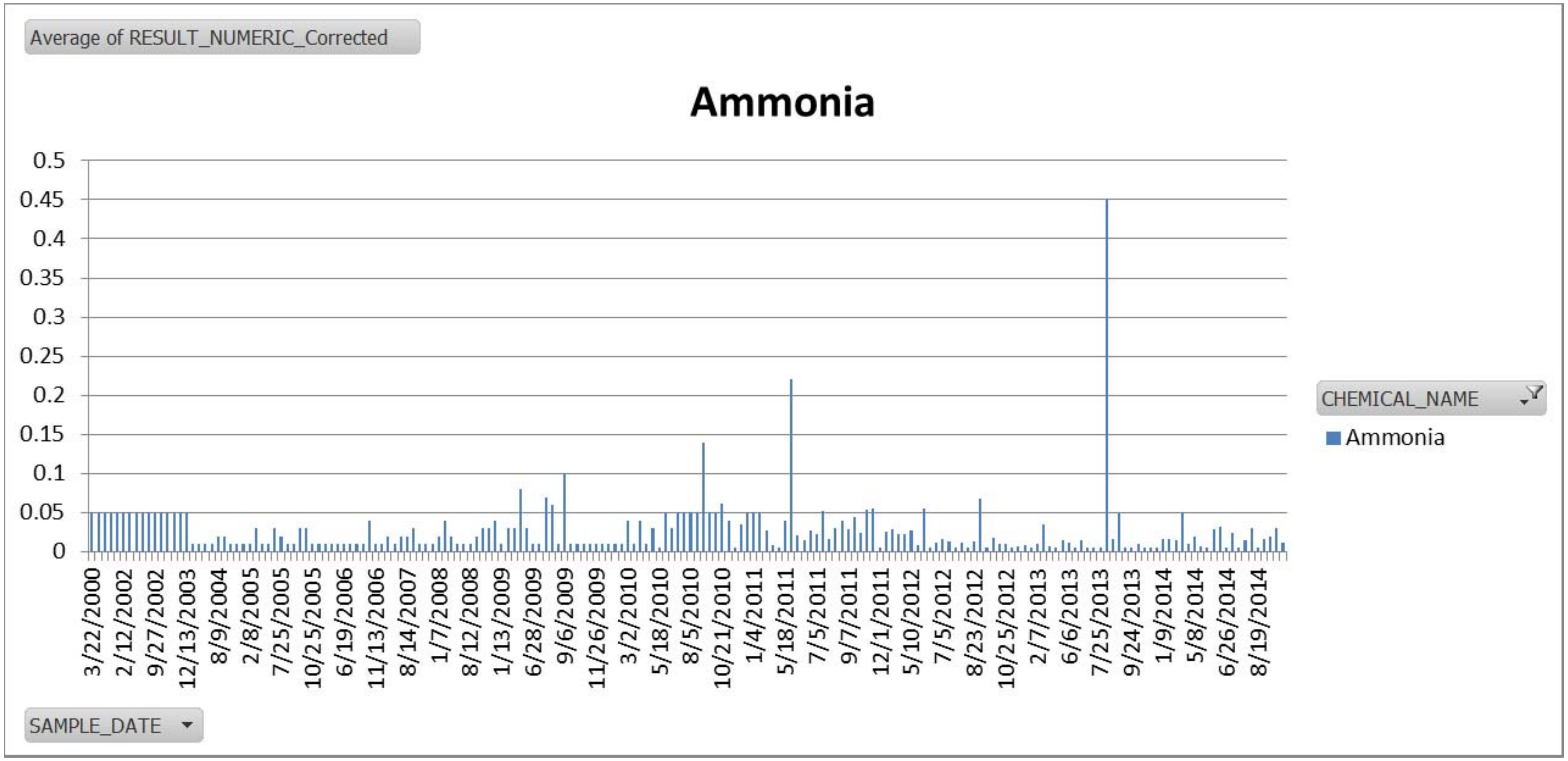
Data available 2000 to 2015



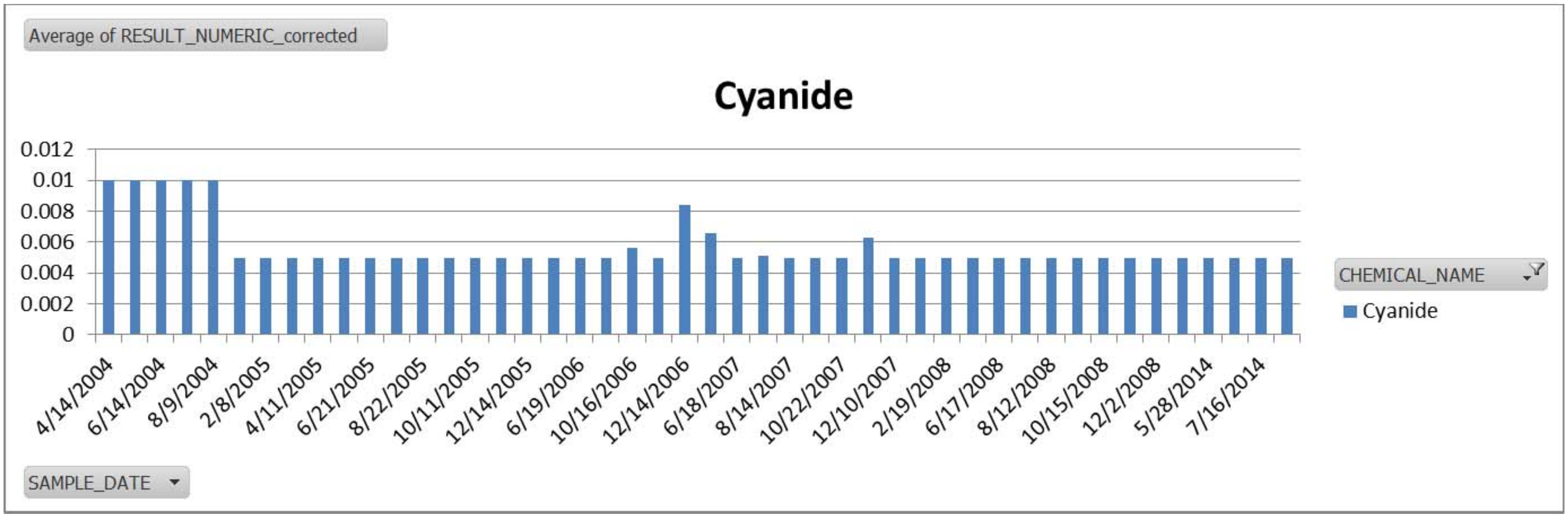
Data available 2000 to 2015



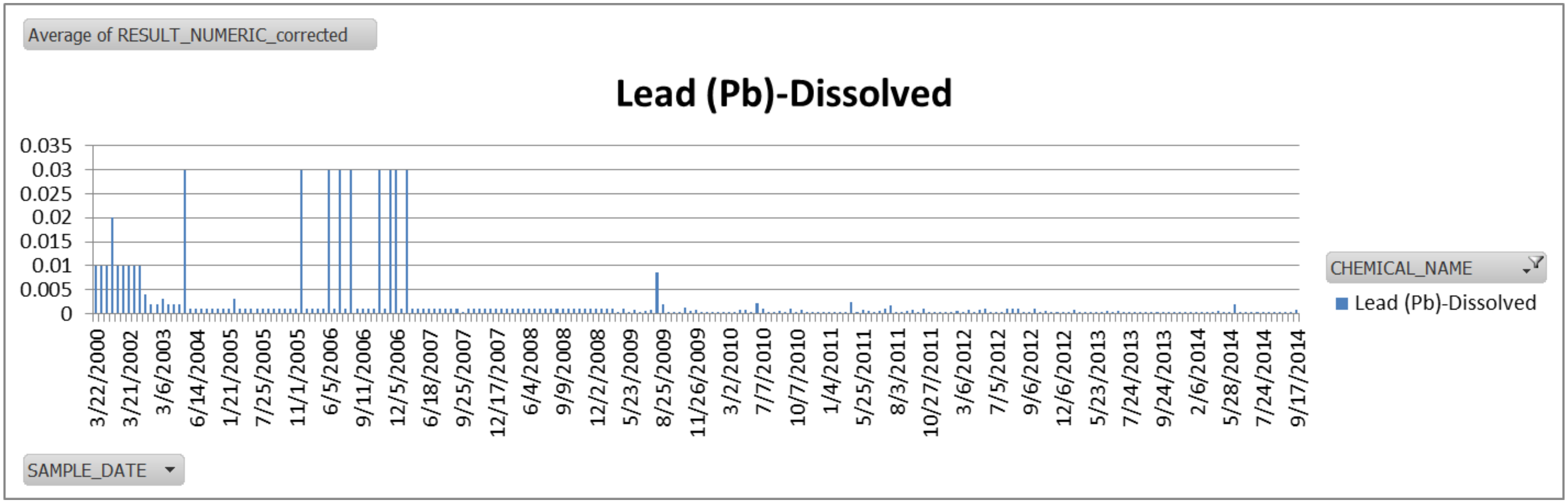
Data available 2000 to 2015



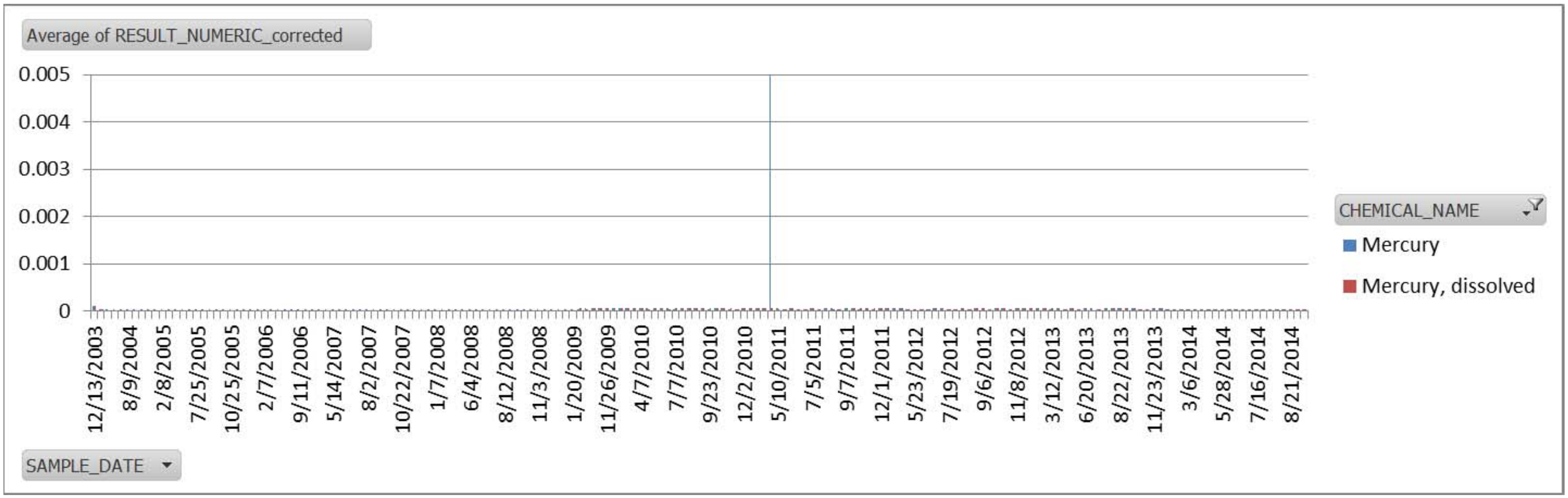
Data available 2000 to 2015

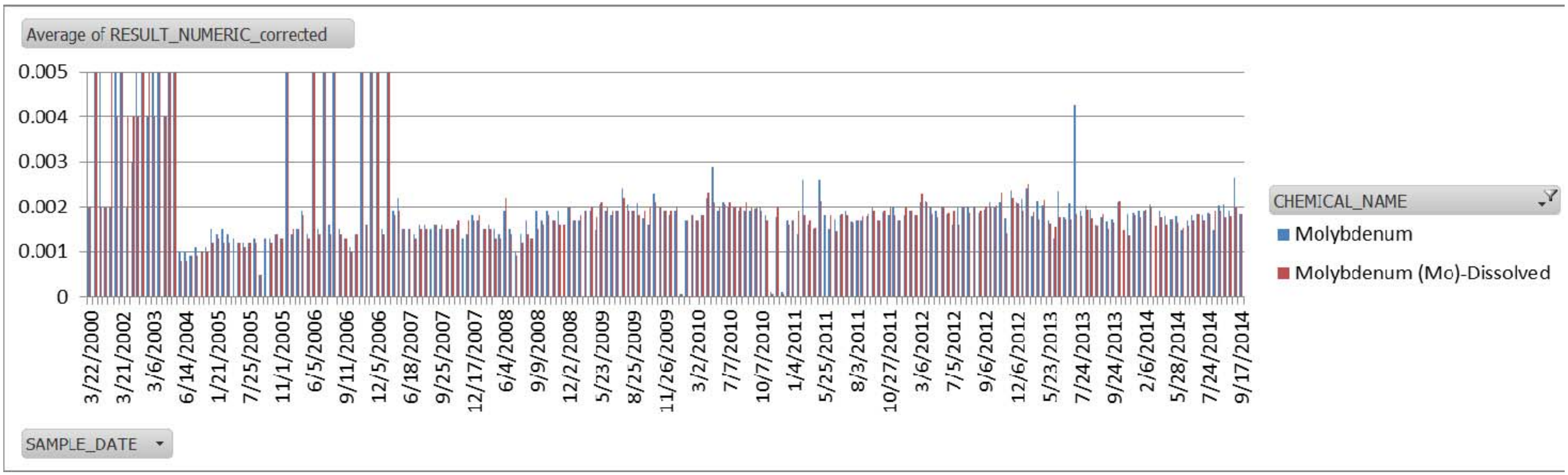


Data available 2000 to 2015

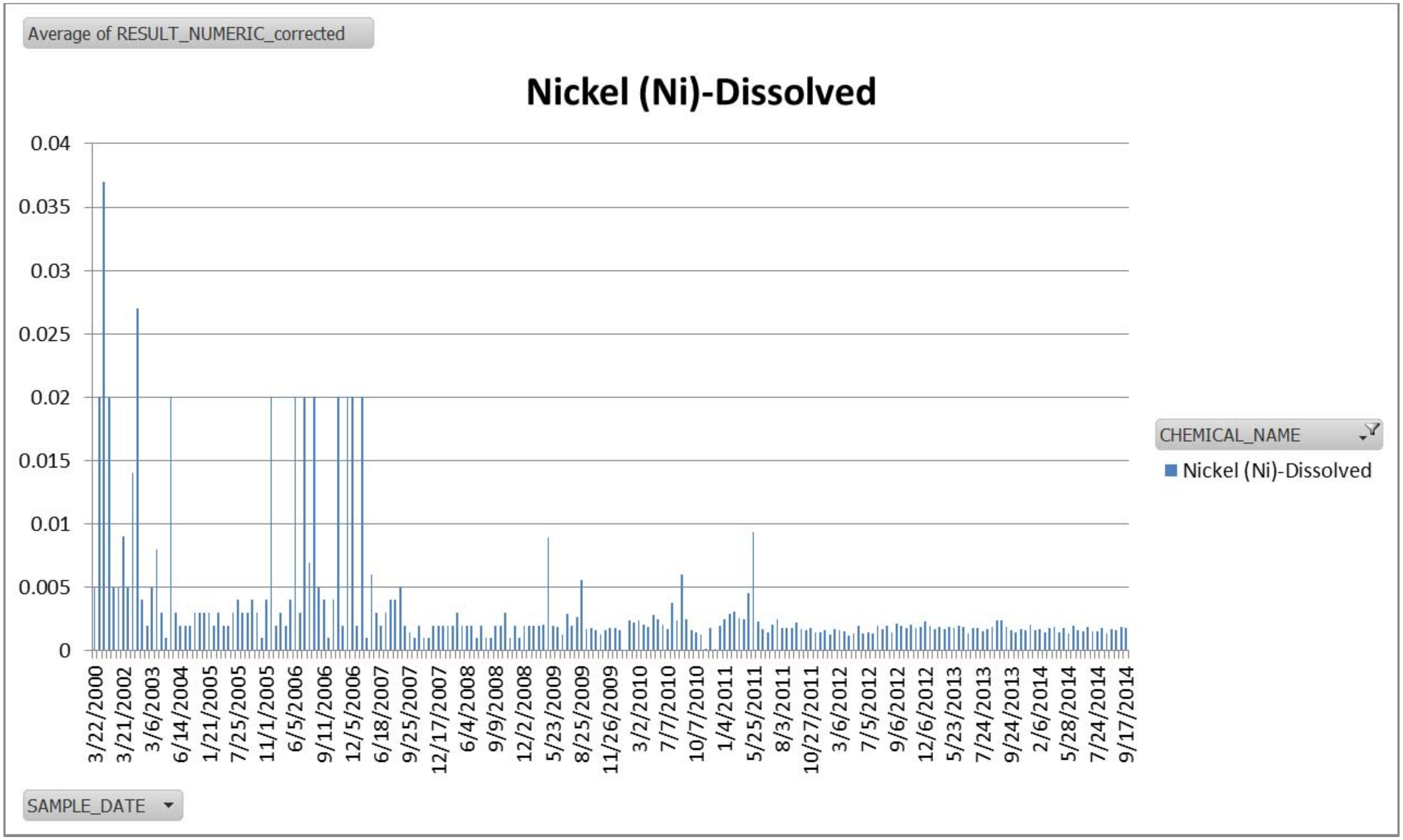


Average of RESULT_NUMERIC_corrected
Lead (Pb)-Dissolved
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Lead (Pb)-Dissolved
SAMPLE_DATE

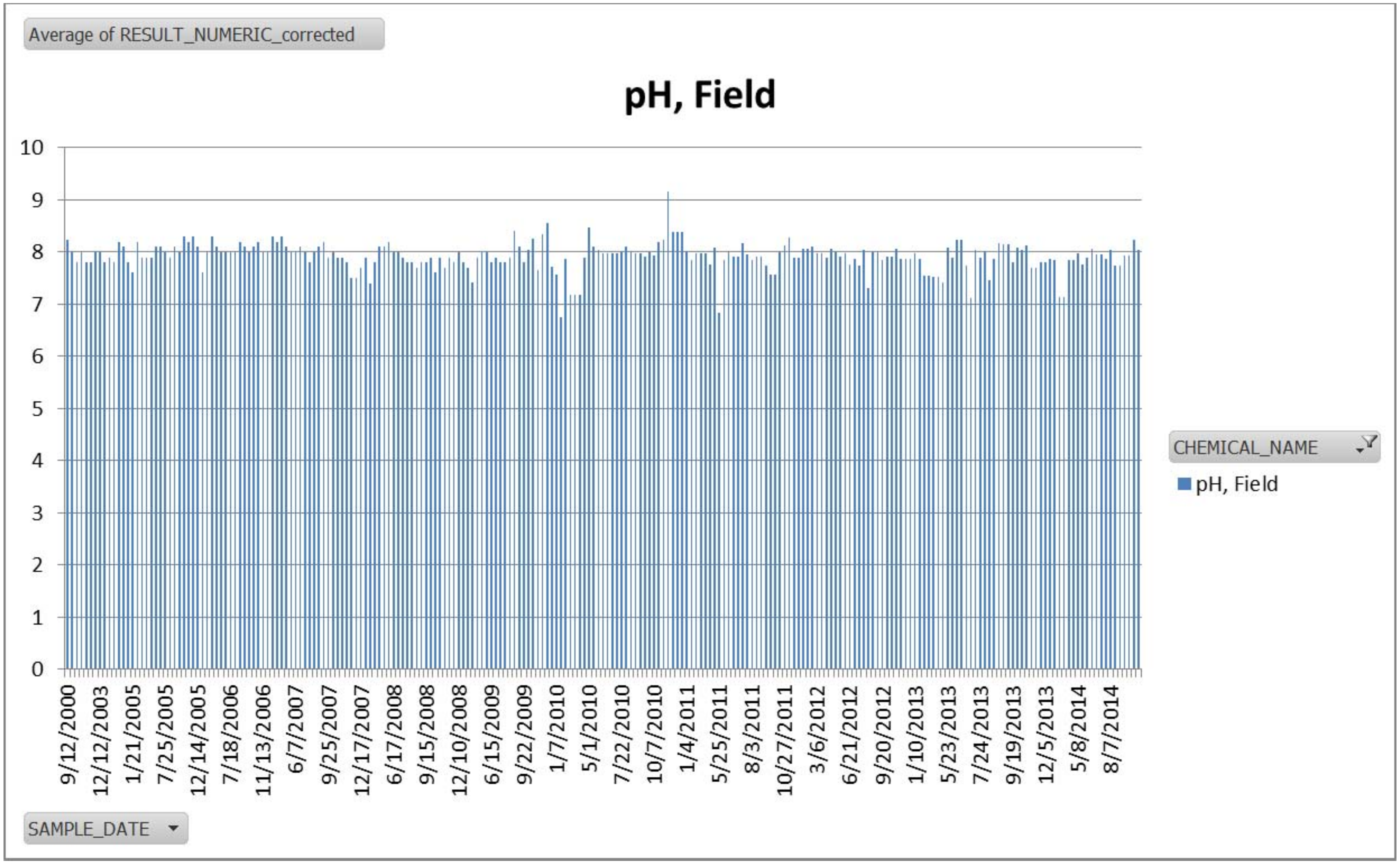

Average of RESULT_NUMERIC_corrected
0.005
0.004
0.003
0.002
0.001
0
12/13/2003
8/9/2004
2/8/2005
7/25/2005
10/25/2005
2/7/2006
9/11/2006
5/14/2007
8/2/2007
10/22/2007
1/7/2008
6/4/2008
8/12/2008
11/3/2008
1/20/2009
11/26/2009
4/7/2010
7/7/2010
9/23/2010
12/2/2010
5/10/2011
7/5/2011
9/7/2011
12/1/2011
5/23/2012
7/19/2012
9/6/2012
11/8/2012
3/12/2013
6/20/2013
8/22/2013
11/23/2013
3/6/2014
5/28/2014
7/16/2014
8/21/2014
SAMPLE_DATE
CHEMICAL_NAME
Mercury
Mercury, dissolved



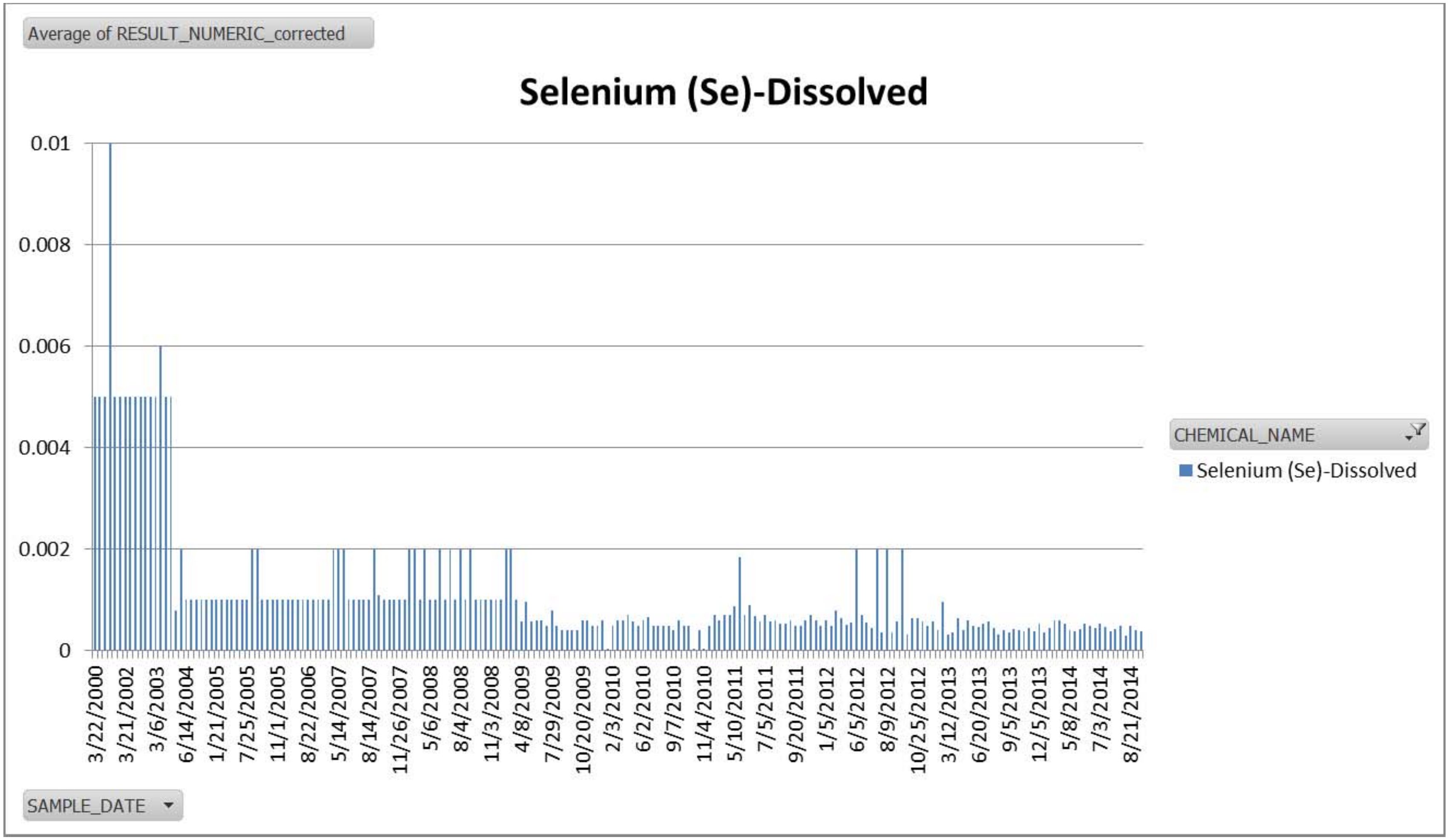
Average of RESULT_NUMERIC_corrected
0.005
0.004
0.003
0.002
0.001
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
SAMPLE_DATE
CHEMICAL_NAME
Molybdenum
Molybdenum (Mo)-Dissolved



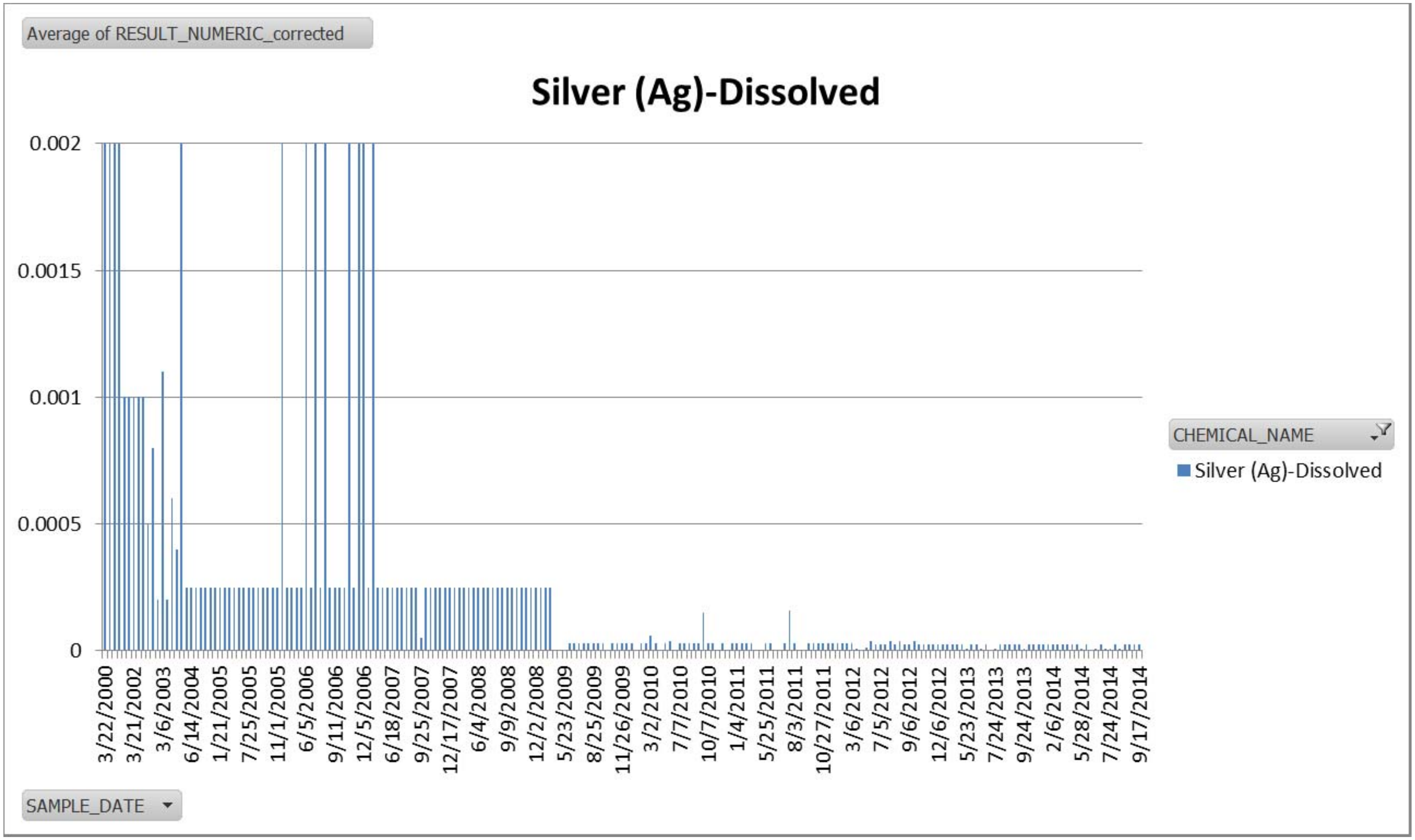
Average of RESULT_NUMERIC_corrected
Nickel (Ni)-Dissolved
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Nickel (Ni)-Dissolved
SAMPLE_DATE



Average of RESULT_NUMERIC_corrected
pH, Field
10
9
8
7
6
5
4
3
2
1
0
9/12/2000
12/12/2003
1/21/2005
7/25/2005
12/14/2005
7/18/2006
11/13/2006
6/7/2007
9/25/2007
12/17/2007
6/17/2008
9/15/2008
12/10/2008
6/15/2009
9/22/2009
1/7/2010
5/1/2010
7/22/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
6/21/2012
9/20/2012
1/10/2013
5/23/2013
7/24/2013
9/19/2013
12/5/2013
5/8/2014
8/7/2014
CHEMICAL_NAME
pH, Field
SAMPLE_DATE



Average of RESULT_NUMERIC_corrected
Selenium (Se)-Dissolved
0.01
0.008
0.006
0.004
0.002
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
8/22/2006
5/14/2007
8/14/2007
11/26/2007
5/6/2008
8/4/2008
11/3/2008
4/8/2009
7/29/2009
10/20/2009
2/3/2010
6/2/2010
9/7/2010
11/4/2010
5/10/2011
7/5/2011
9/20/2011
1/5/2012
6/5/2012
8/9/2012
10/25/2012
3/12/2013
6/20/2013
9/5/2013
12/5/2013
5/8/2014
7/3/2014
8/21/2014
CHEMICAL_NAME
Selenium (Se)-Dissolved
SAMPLE_DATE



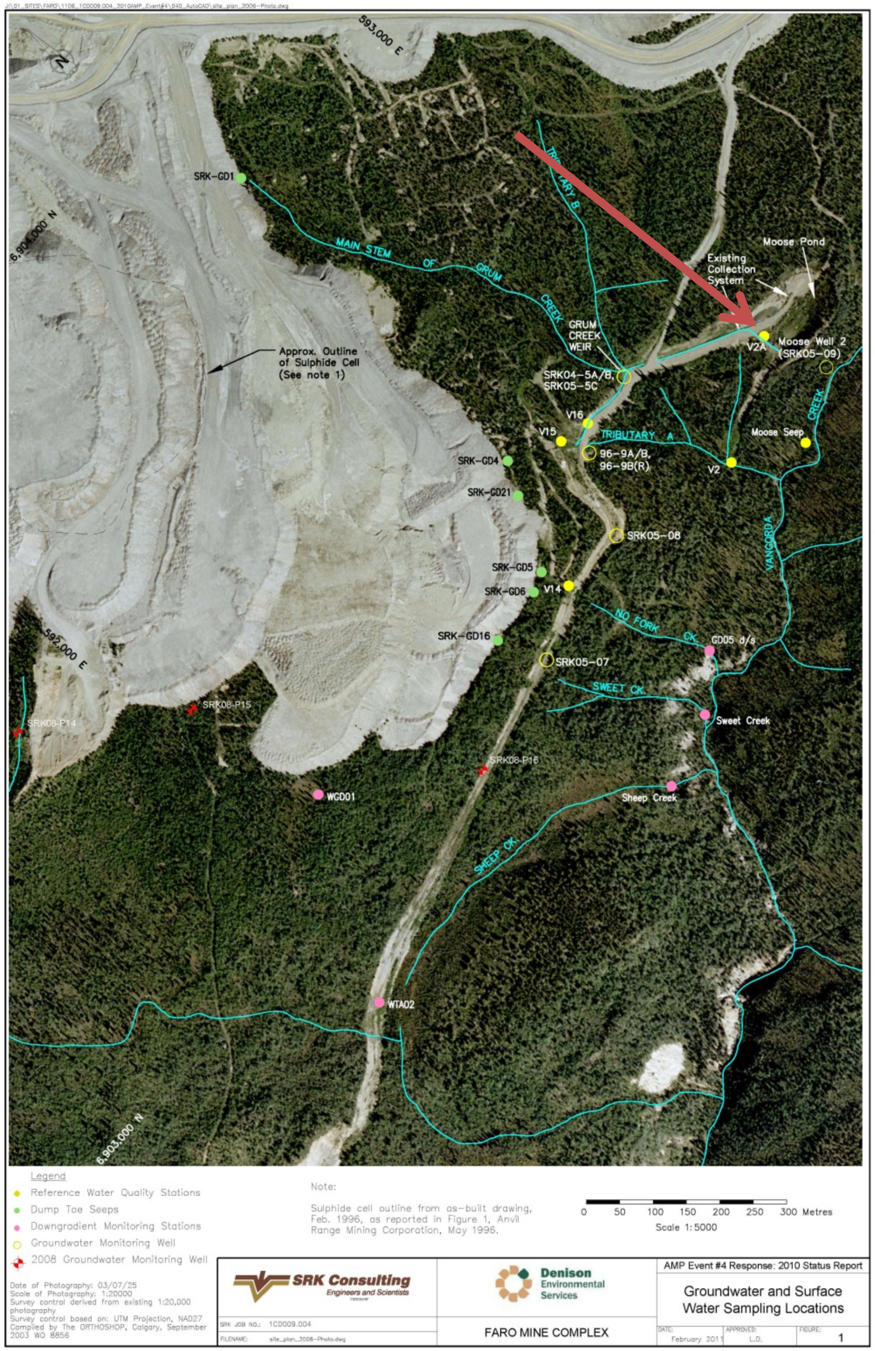
Average of RESULT_NUMERIC_corrected
Silver (Ag)-Dissolved
0.002
0.0015
0.001
0.0005
0
3/22/2000
3/21/2002
3/6/2003
6/14/2004
1/21/2005
7/25/2005
11/1/2005
6/5/2006
9/11/2006
12/5/2006
6/18/2007
9/25/2007
12/17/2007
6/4/2008
9/9/2008
12/2/2008
5/23/2009
8/25/2009
11/26/2009
3/2/2010
7/7/2010
10/7/2010
1/4/2011
5/25/2011
8/3/2011
10/27/2011
3/6/2012
7/5/2012
9/6/2012
12/6/2012
5/23/2013
7/24/2013
9/24/2013
2/6/2014
5/28/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Silver (Ag)-Dissolved
SAMPLE_DATE

pH
Colour
Turb
Ammonia
Antimony
Arsenic
Barium
Cadmium
Copper
Cyanide
Lead
Mercury
Molybdenum
Nickel
Selenium
Silver
Zinc
Bioassay
Oil or grease

GSC Annual Performance Assessment

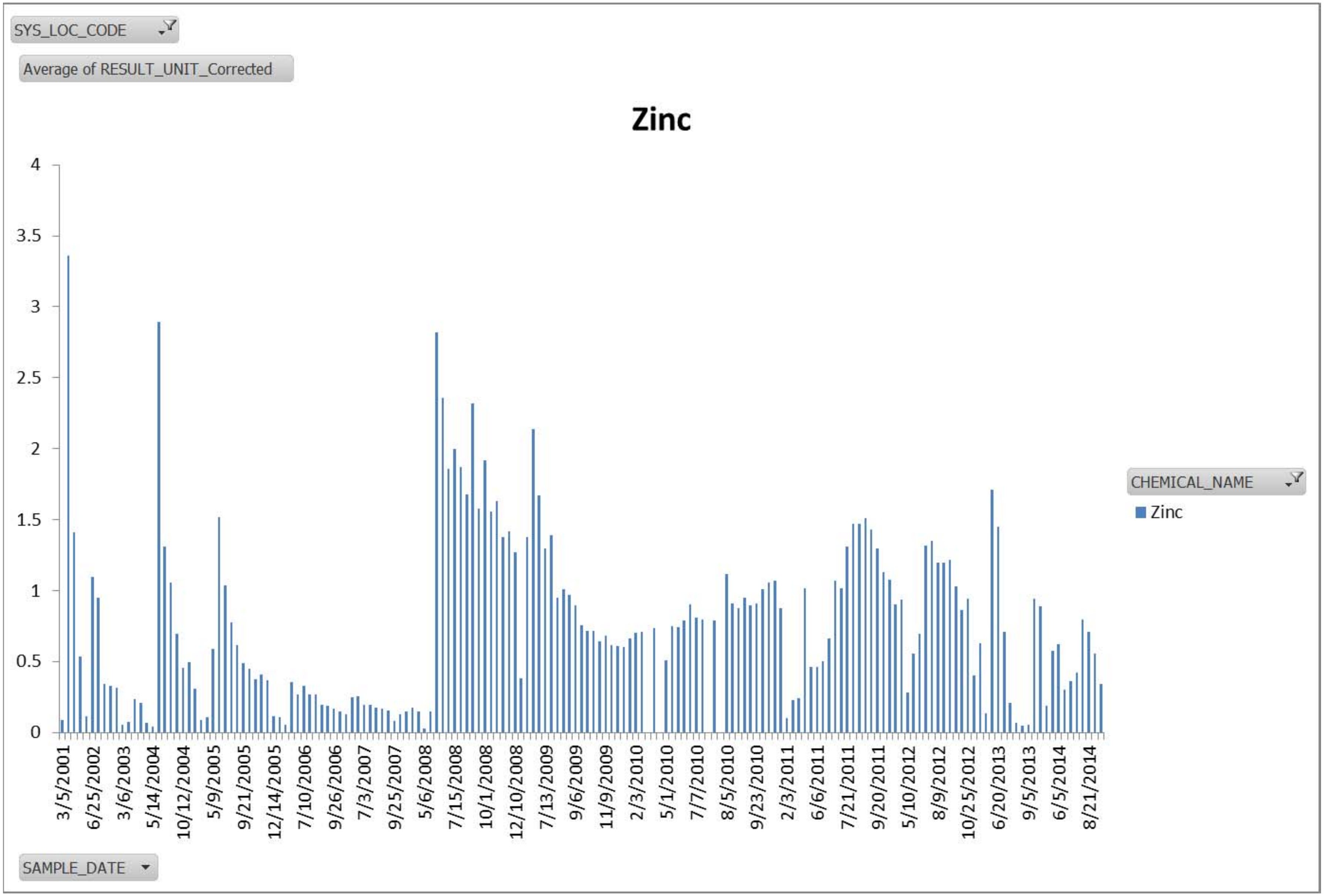
Geochemical Results 2000-2015

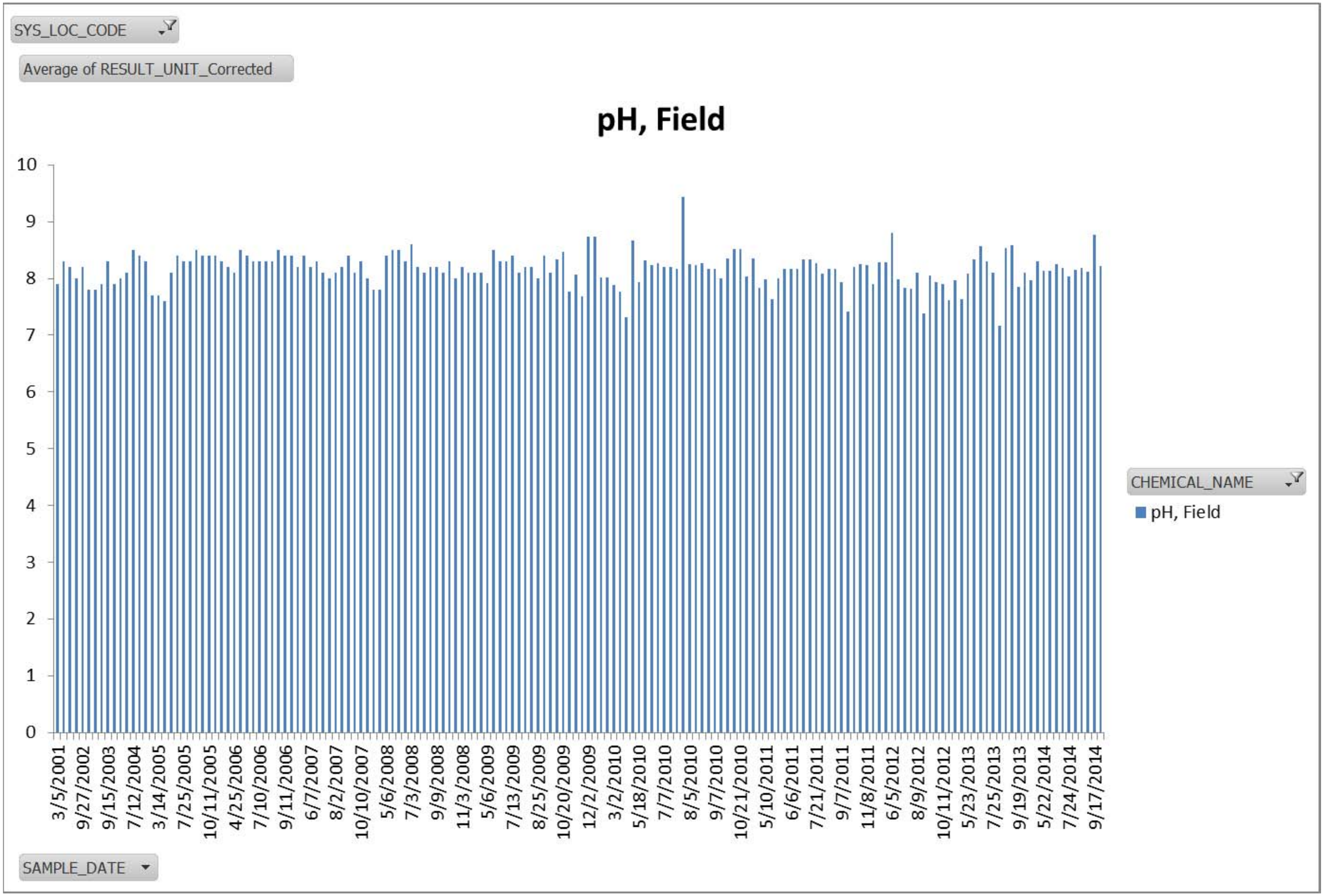
Site: V2A

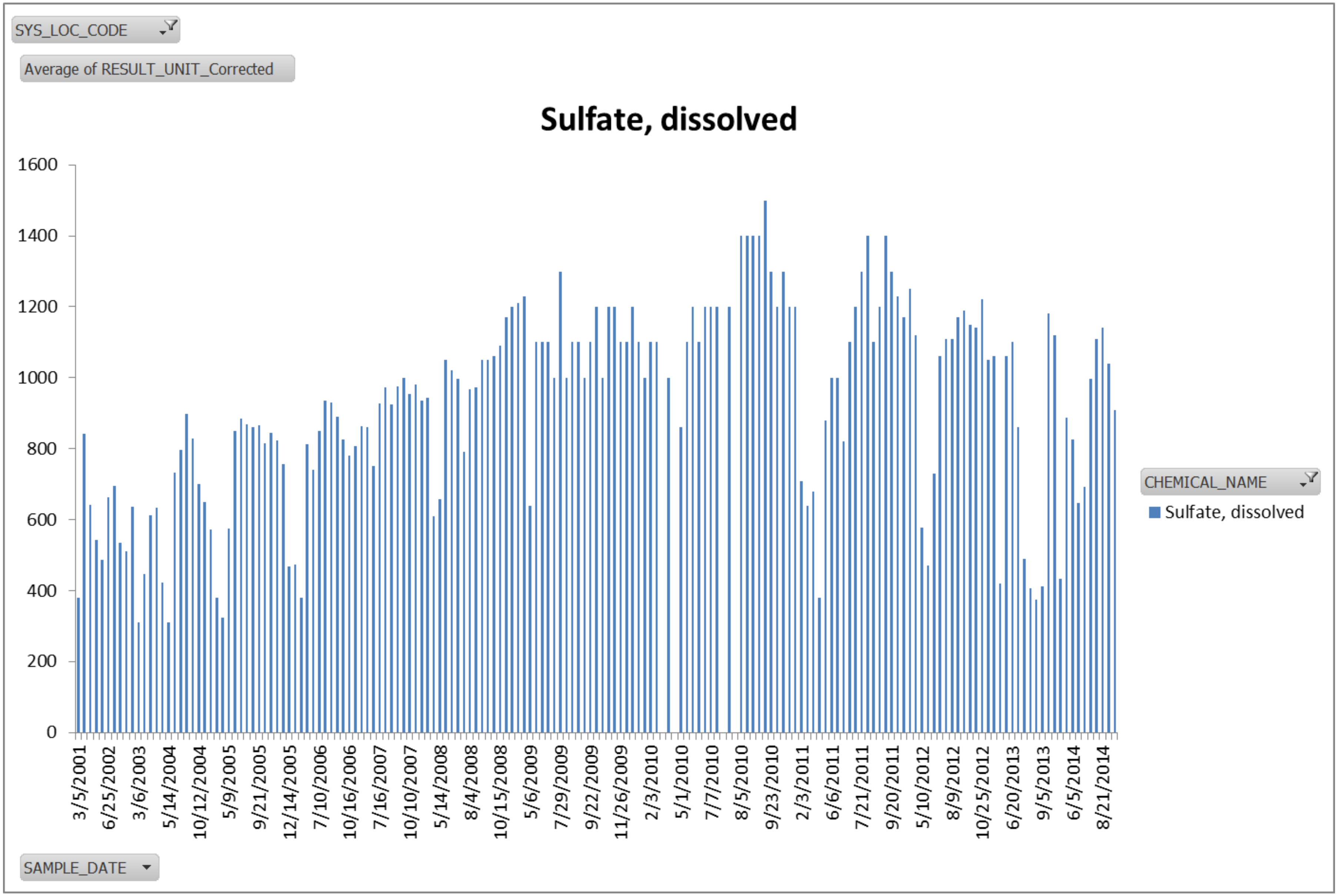


Assumptions for GSC Annual Performance Assessment

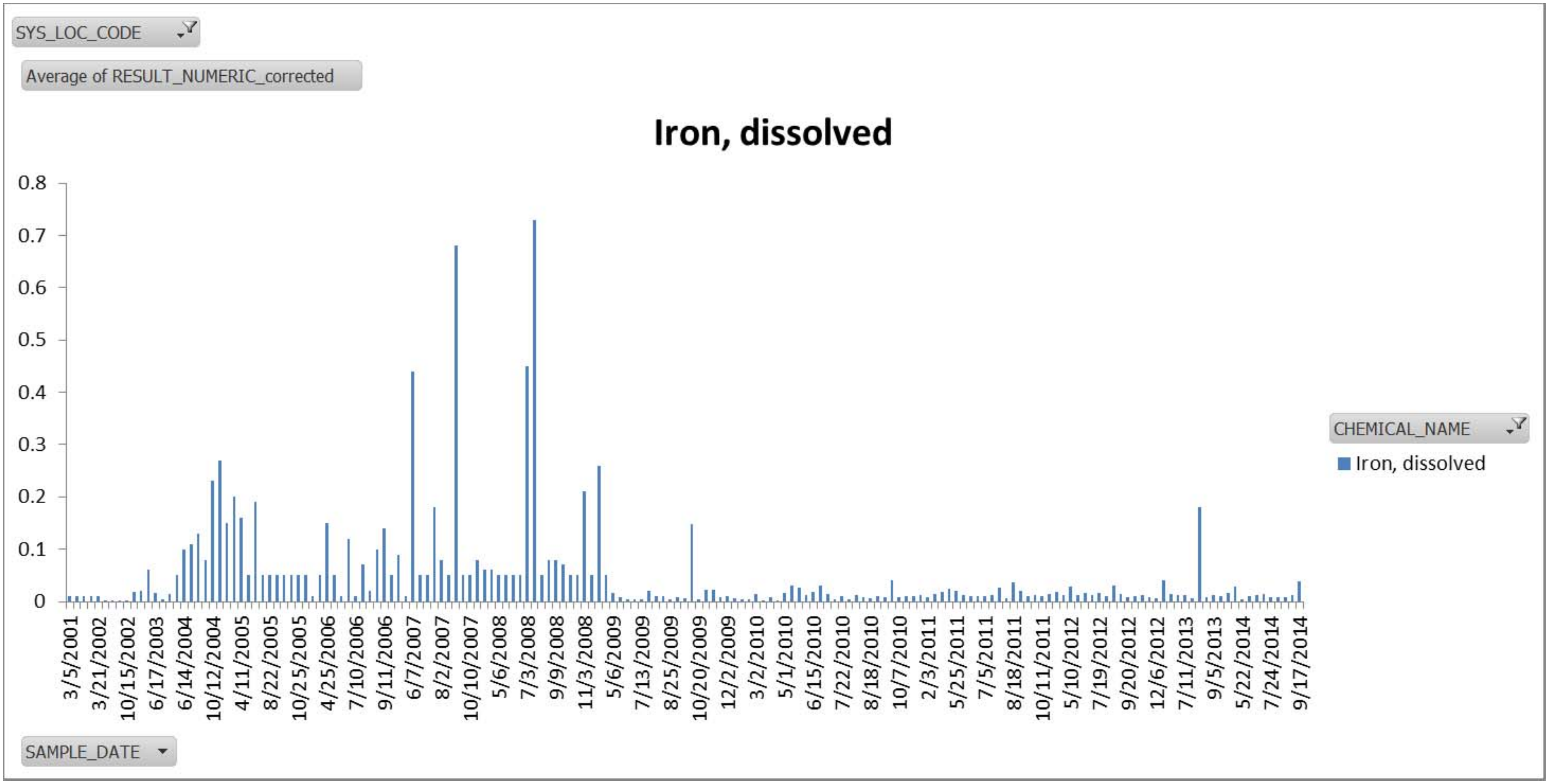
- Some measurements were reported in µg/L, others in mg/L. To keep consistency, values were transformed to mg/L where relevant.
- If values were reported as less than the detection limit, for visualization purposes, they were graphed as the corresponding reporting limit.
- The scale of the graphs was mostly chosen to see the data in the context of the FMC Effluent Quality Standards. In a scale to show how close the measured values were to these reference values.
- Another focus of the graphs was to compare baseline data with conditions years after the GSC Cover was completed. In this context, the graphs focus on the trends before and after 2010 (when the GSC dry cover was completed).
- No values were discarded as outliers at this stage of the analysis, but in some cases, the maximum values of the graph's scales don't show abnormally high values.
- Construction of the GSC Cover occurred between June 24, 2010 and November 1, 2010. All the earthworks were completed during this summer, except for hydro-seeding, some regarding, and the construction of water management ponds.
- On May 17, 2011 excessive meltwater collapsed the system, causing overflow of hydraulic infrastructure and release on non-compliant water into the Vangorda Creek. See Rainey et al. 2013 report for more information.


SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
Zinc
4
3.5
3
2.5
2
1.5
1
0.5
0
3/5/2001
6/25/2002
3/6/2003
5/14/2004
10/12/2004
5/9/2005
9/21/2005
12/14/2005
7/10/2006
9/26/2006
7/3/2007
9/25/2007
5/6/2008
7/15/2008
10/1/2008
12/10/2008
7/13/2009
9/6/2009
11/9/2009
2/3/2010
5/1/2010
7/7/2010
8/5/2010
9/23/2010
2/3/2011
6/6/2011
7/21/2011
9/20/2011
5/10/2012
8/9/2012
10/25/2012
6/20/2013
9/5/2013
6/5/2014
8/21/2014
CHEMICAL_NAME
Zinc
SAMPLE_DATE

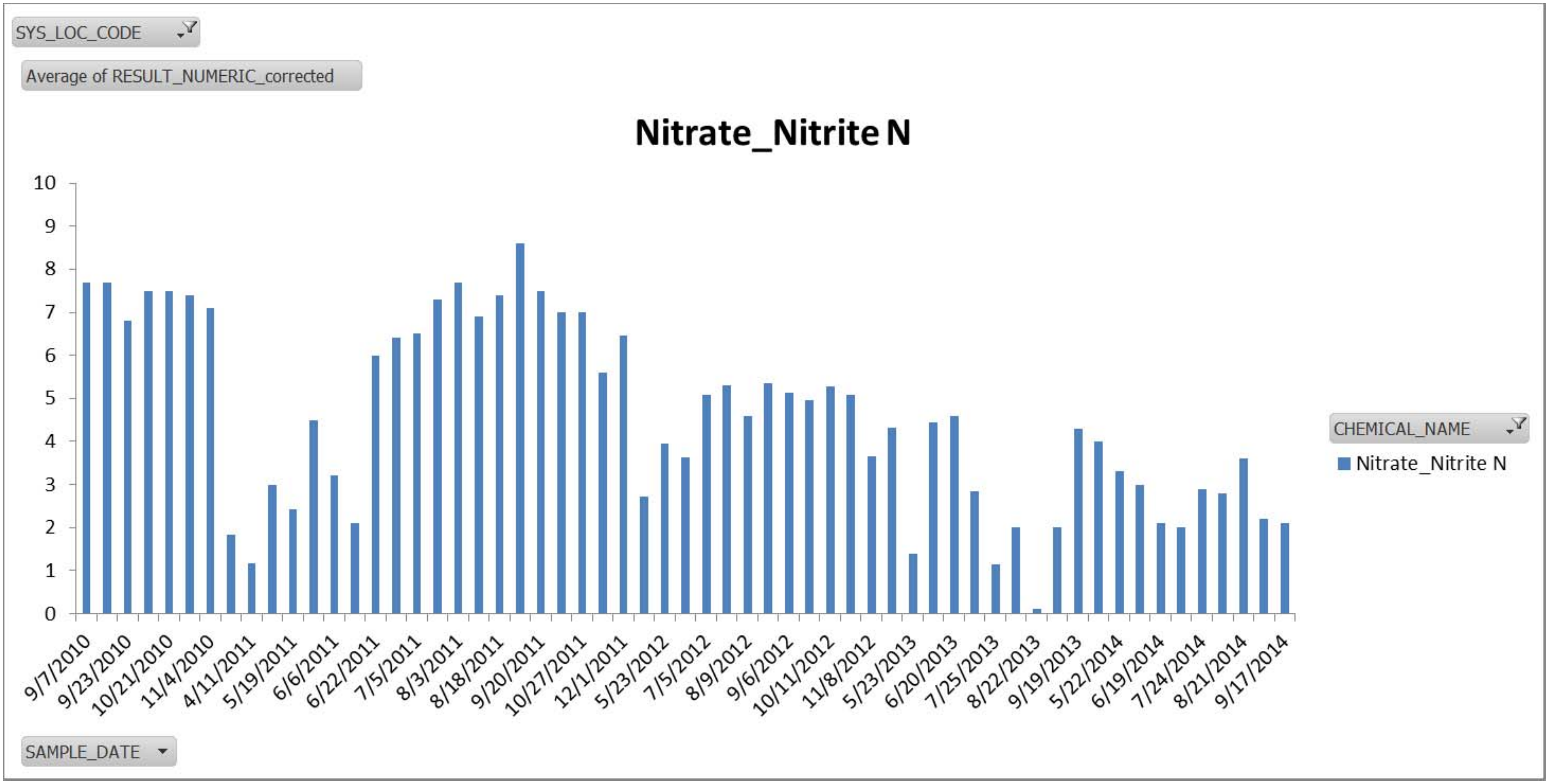

SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
pH, Field
10
9
8
7
6
5
4
3
2
1
0
3/5/2001
9/27/2002
9/15/2003
7/12/2004
3/14/2005
7/25/2005
10/11/2005
4/25/2006
7/10/2006
9/11/2006
6/7/2007
8/2/2007
10/10/2007
5/6/2008
7/3/2008
9/9/2008
11/3/2008
5/6/2009
7/13/2009
8/25/2009
10/20/2009
12/2/2009
3/2/2010
5/18/2010
7/7/2010
8/5/2010
9/7/2010
10/21/2010
5/10/2011
6/6/2011
7/21/2011
9/7/2011
11/8/2011
6/5/2012
8/9/2012
10/11/2012
5/23/2013
7/25/2013
9/19/2013
5/22/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
pH, Field
SAMPLE_DATE



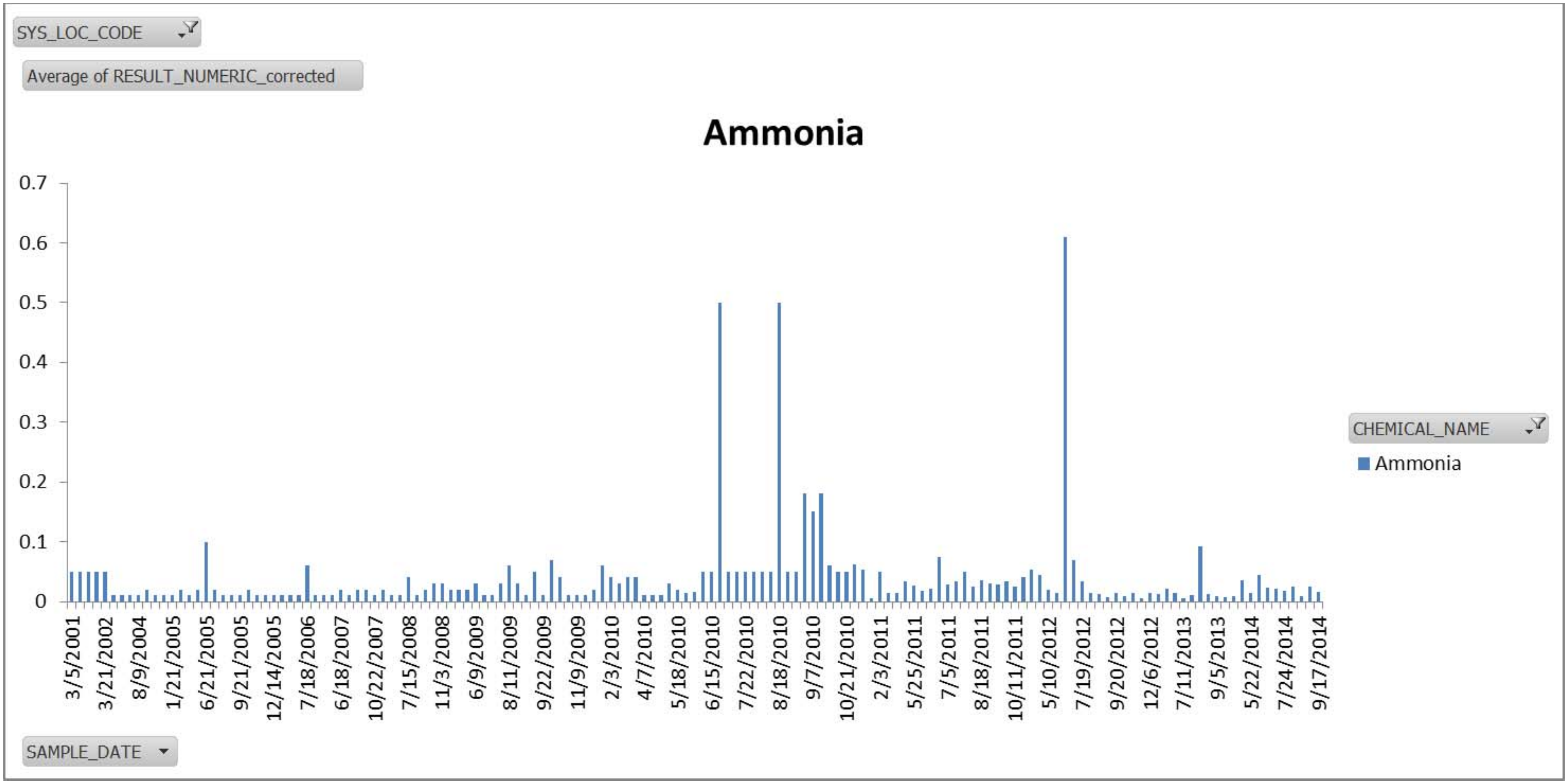
SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
Sulfate, dissolved
1600
1400
1200
1000
800
600
400
200
0
3/5/2001
6/25/2002
3/6/2003
5/14/2004
10/12/2004
5/9/2005
9/21/2005
12/14/2005
7/10/2006
10/16/2006
7/16/2007
10/10/2007
5/14/2008
8/4/2008
10/15/2008
5/6/2009
7/29/2009
9/22/2009
11/26/2009
2/3/2010
5/1/2010
7/7/2010
8/5/2010
9/23/2010
2/3/2011
6/6/2011
7/21/2011
9/20/2011
5/10/2012
8/9/2012
10/25/2012
6/20/2013
9/5/2013
6/5/2014
8/21/2014
CHEMICAL_NAME
Sulfate, dissolved
SAMPLE_DATE

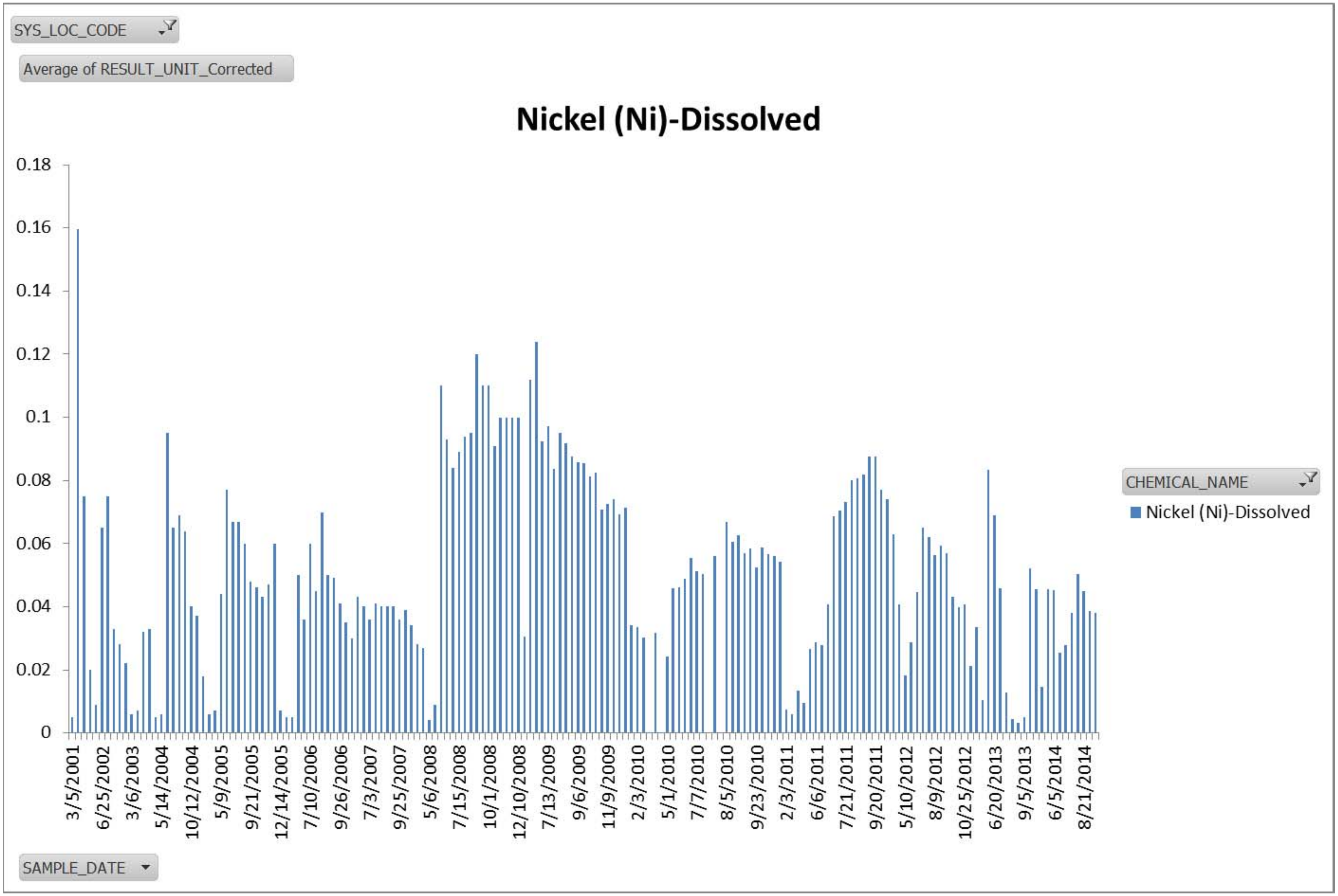


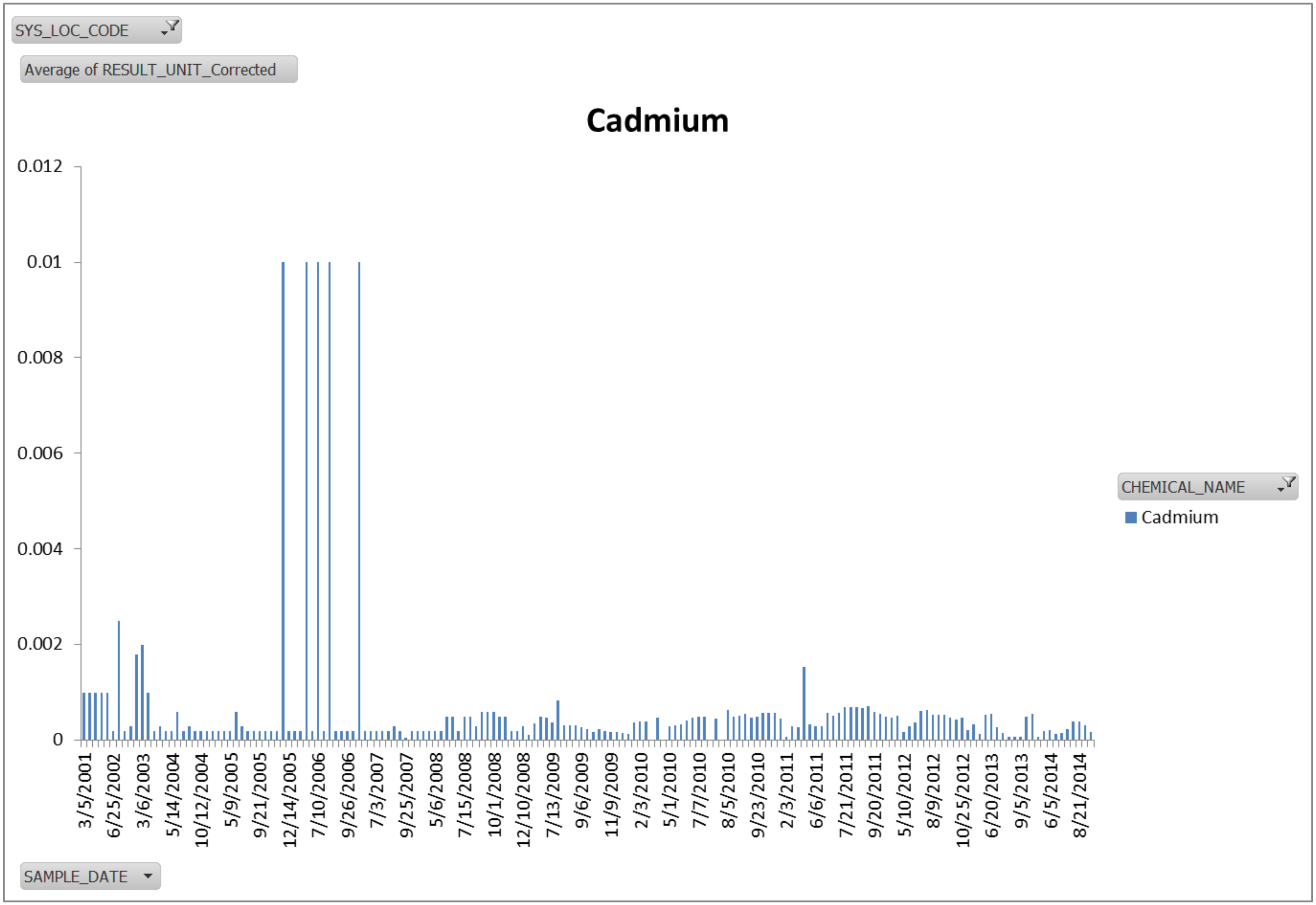
SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Iron, dissolved
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/5/2001
3/21/2002
10/15/2002
6/17/2003
6/14/2004
10/12/2004
4/11/2005
8/22/2005
10/25/2005
4/25/2006
7/10/2006
9/11/2006
6/7/2007
8/2/2007
10/10/2007
5/6/2008
7/3/2008
9/9/2008
11/3/2008
5/6/2009
7/13/2009
8/25/2009
10/20/2009
12/2/2009
3/2/2010
5/1/2010
6/15/2010
7/22/2010
8/18/2010
10/7/2010
2/3/2011
5/25/2011
7/5/2011
8/18/2011
10/11/2011
5/10/2012
7/19/2012
9/20/2012
12/6/2012
7/11/2013
9/5/2013
5/22/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Iron, dissolved
SAMPLE_DATE



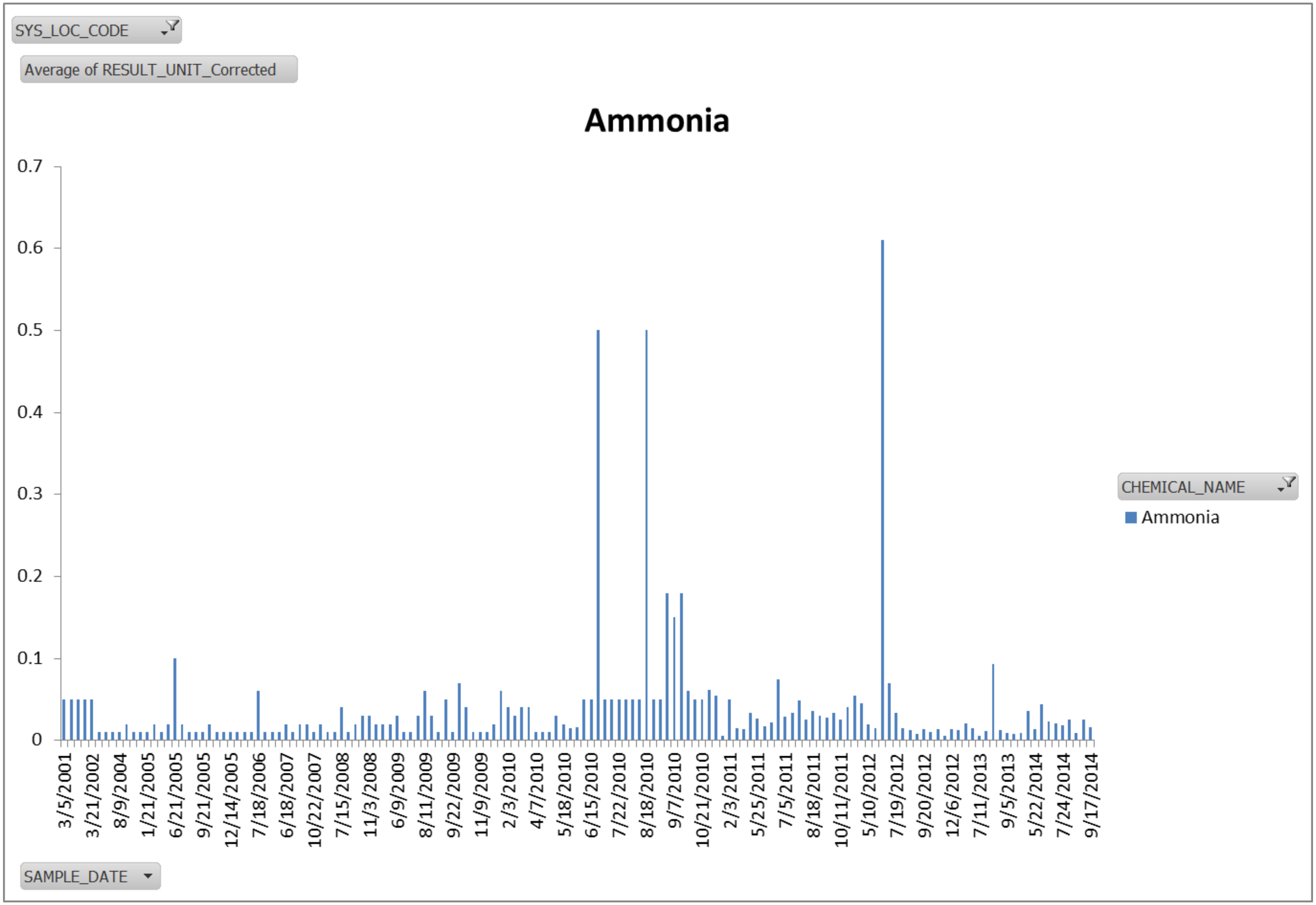
SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Nitrate_Nitrite N
10
9
8
7
6
5
4
3
2
1
0
9/7/2010
9/23/2010
10/21/2010
11/4/2010
4/11/2011
5/19/2011
6/6/2011
6/22/2011
7/5/2011
8/3/2011
8/18/2011
9/20/2011
10/27/2011
12/1/2011
5/23/2012
7/5/2012
8/9/2012
9/6/2012
10/11/2012
11/8/2012
5/23/2013
6/20/2013
7/25/2013
8/22/2013
9/19/2013
5/22/2014
6/19/2014
7/24/2014
8/21/2014
9/17/2014
SAMPLE_DATE
CHEMICAL_NAME
Nitrate_Nitrite N


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Ammonia
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/5/2001
3/21/2002
8/9/2004
1/21/2005
6/21/2005
9/21/2005
12/14/2005
7/18/2006
6/18/2007
10/22/2007
7/15/2008
11/3/2008
6/9/2009
8/11/2009
9/22/2009
11/9/2009
2/3/2010
4/7/2010
5/18/2010
6/15/2010
7/22/2010
8/18/2010
9/7/2010
10/21/2010
2/3/2011
5/25/2011
7/5/2011
8/18/2011
10/11/2011
5/10/2012
7/19/2012
9/20/2012
12/6/2012
7/11/2013
9/5/2013
5/22/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
Ammonia
SAMPLE_DATE


SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
Nickel (Ni)-Dissolved
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
3/5/2001
6/25/2002
3/6/2003
5/14/2004
10/12/2004
5/9/2005
9/21/2005
12/14/2005
7/10/2006
9/26/2006
7/3/2007
9/25/2007
5/6/2008
7/15/2008
10/1/2008
12/10/2008
7/13/2009
9/6/2009
11/9/2009
2/3/2010
5/1/2010
7/7/2010
8/5/2010
9/23/2010
2/3/2011
6/6/2011
7/21/2011
9/20/2011
5/10/2012
8/9/2012
10/25/2012
6/20/2013
9/5/2013
6/5/2014
8/21/2014
CHEMICAL_NAME
Nickel (Ni)-Dissolved
SAMPLE_DATE



SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
Cadmium
0.012
0.01
0.008
0.006
0.004
0.002
0
3/5/2001
6/25/2002
3/6/2003
5/14/2004
10/12/2004
5/9/2005
9/21/2005
12/14/2005
7/10/2006
9/26/2006
7/3/2007
9/25/2007
5/6/2008
7/15/2008
10/1/2008
12/10/2008
7/13/2009
9/6/2009
11/9/2009
2/3/2010
5/1/2010
7/7/2010
8/5/2010
9/23/2010
2/3/2011
6/6/2011
7/21/2011
9/20/2011
5/10/2012
8/9/2012
10/25/2012
6/20/2013
9/5/2013
6/5/2014
8/21/2014
CHEMICAL_NAME
Cadmium
SAMPLE_DATE

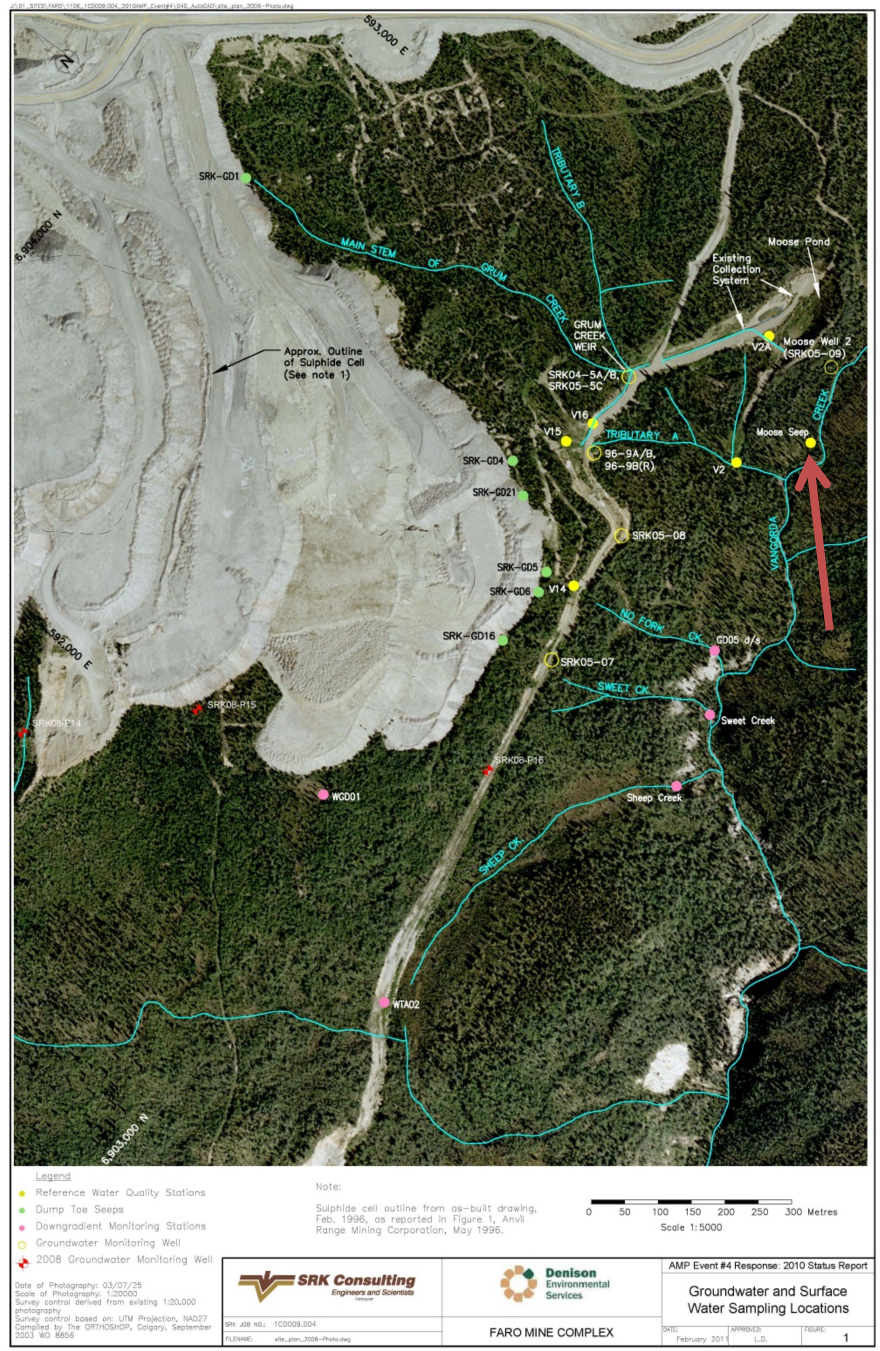


SYS_LOC_CODE
Average of RESULT_UNIT_Corrected
Ammonia
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/5/2001
3/21/2002
8/9/2004
1/21/2005
6/21/2005
9/21/2005
12/14/2005
7/18/2006
6/18/2007
10/22/2007
7/15/2008
11/3/2008
6/9/2009
8/11/2009
9/22/2009
11/9/2009
2/3/2010
4/7/2010
5/18/2010
6/15/2010
7/22/2010
8/18/2010
9/7/2010
10/21/2010
2/3/2011
5/25/2011
7/5/2011
8/18/2011
10/11/2011
5/10/2012
7/19/2012
9/20/2012
12/6/2012
7/11/2013
9/5/2013
5/22/2014
7/24/2014
9/17/2014
SAMPLE_DATE
CHEMICAL_NAME
Ammonia

GSC Annual Performance Assessment

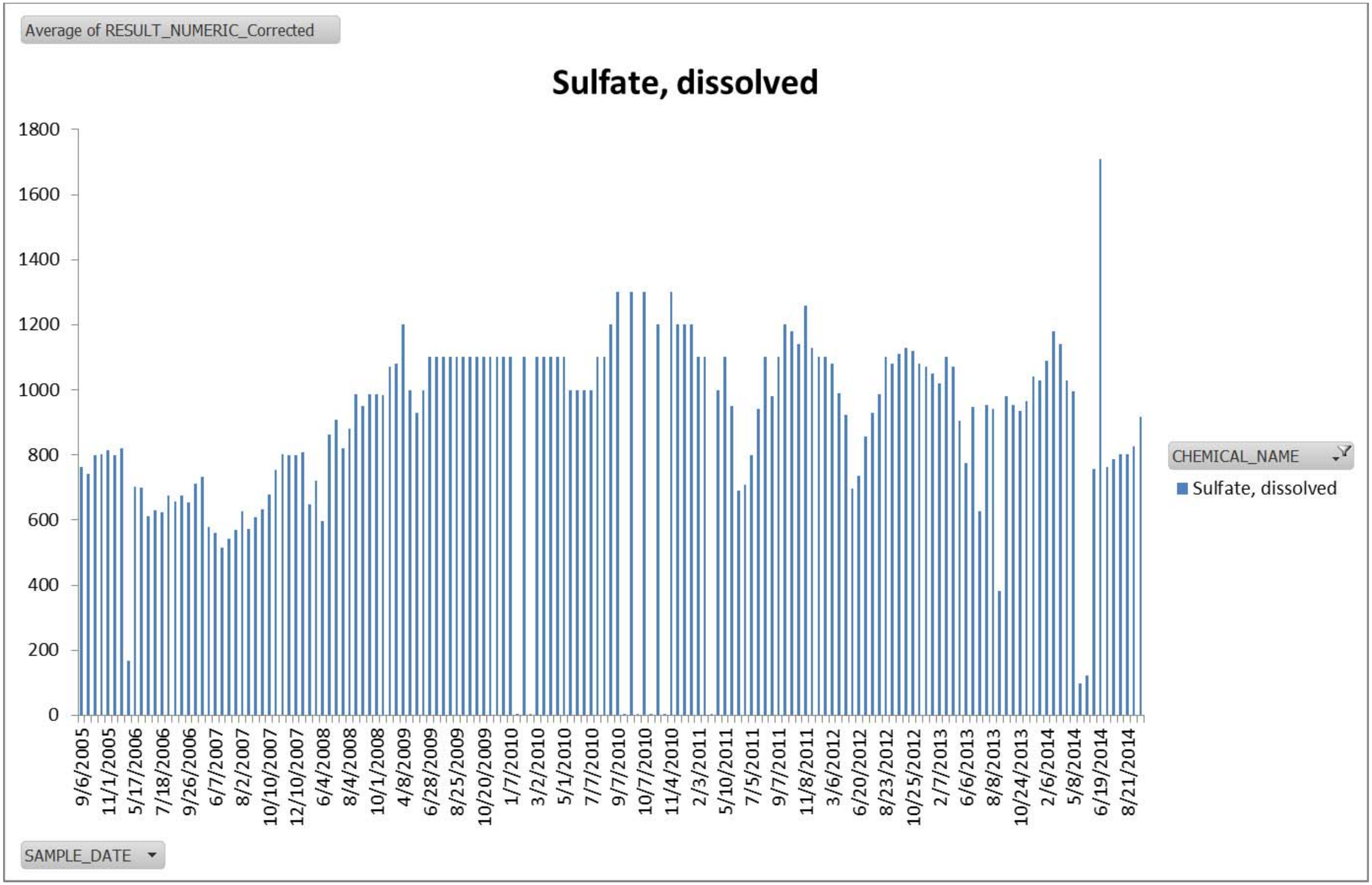
Geochemical Results 2000-2015

Site: Moose Seep

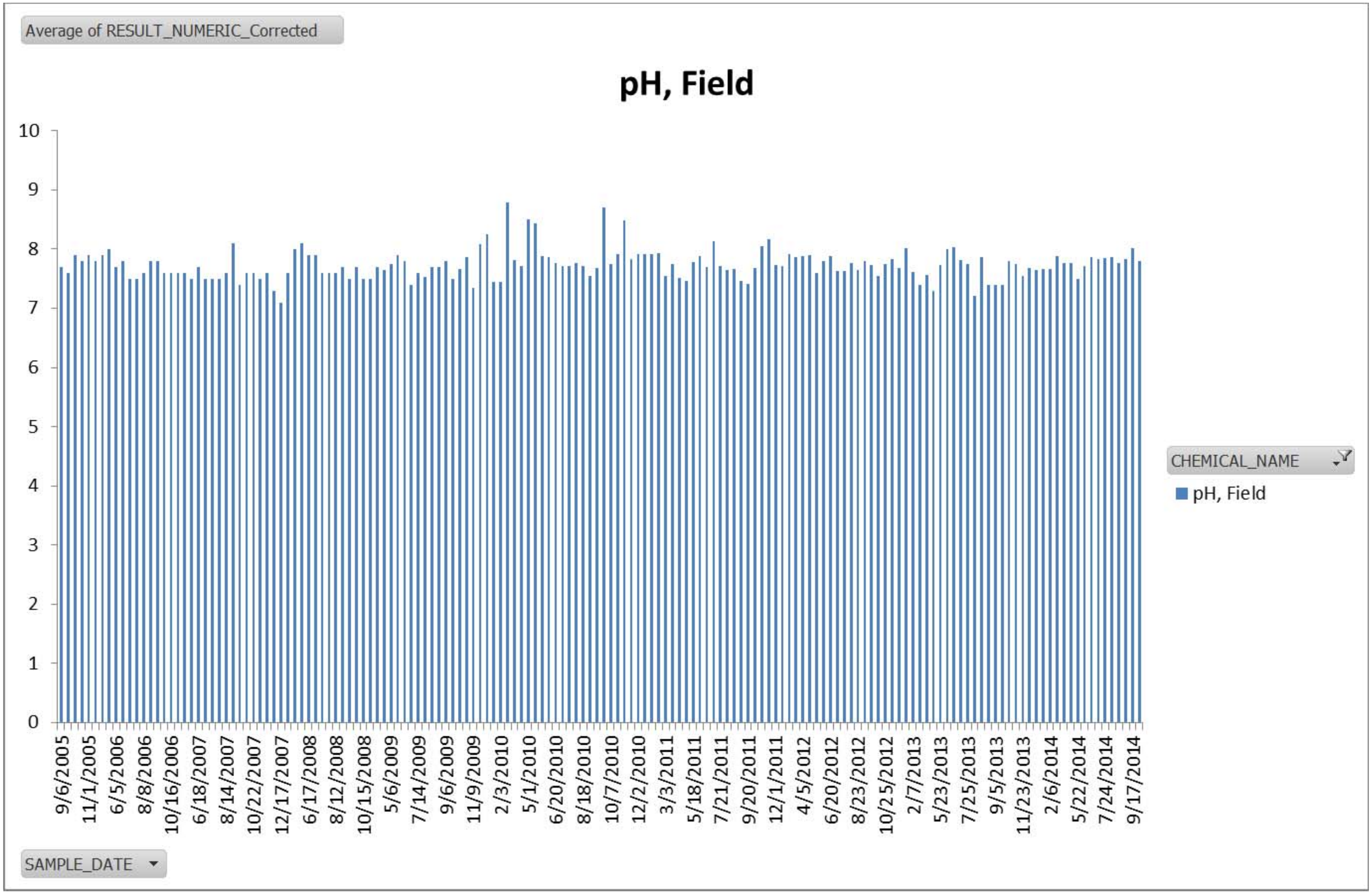


Assumptions for GSC Annual Performance Assessment

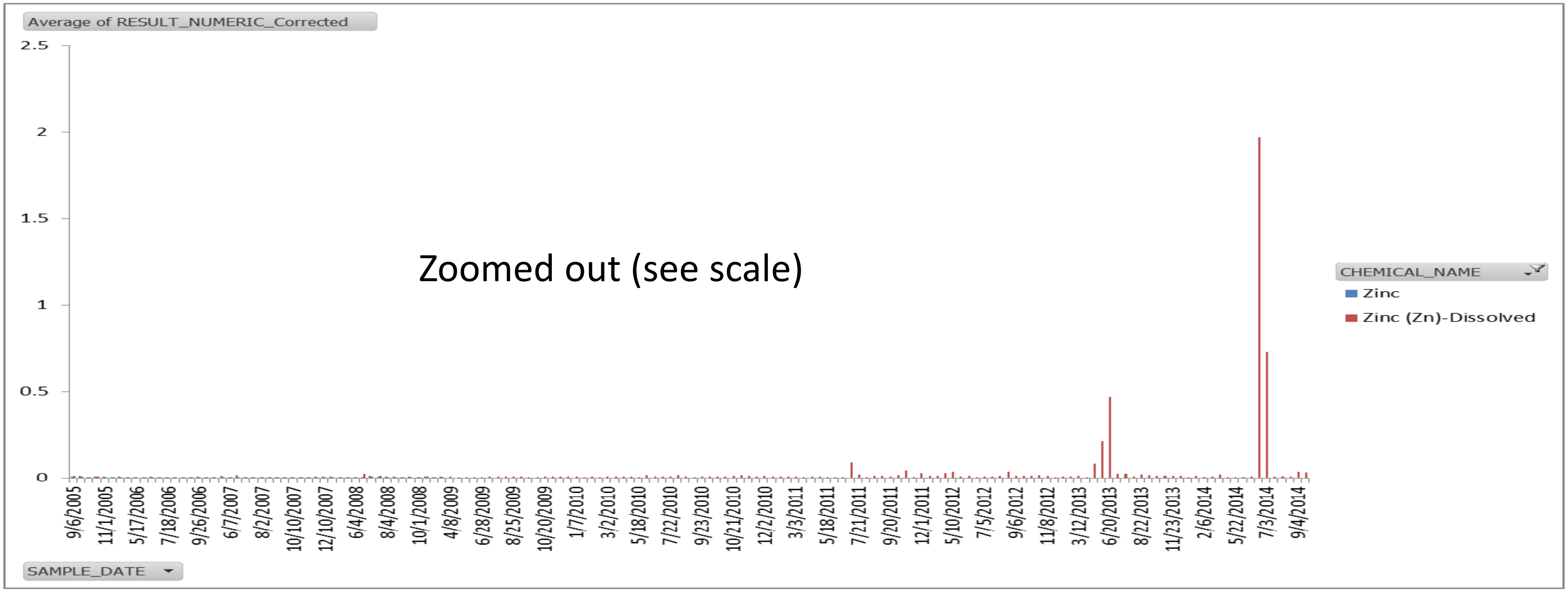
- Some measurements were reported in µg/L, others in mg/L. To keep consistency, values were transformed to mg/L where relevant.
- If values were reported as less than the detection limit, for visualization purposes, they were graphed as the corresponding reporting limit.
- The scale of the graphs was mostly chosen to see the data in the context of the FMC Effluent Quality Standards. In a scale to show how close the measured values were to these reference values.
- Another focus of the graphs was to compare baseline data with conditions years after the GSC Cover was completed. In this context, the graphs focus on the trends before and after 2010 (when the GSC dry cover was completed).
- No values were discarded as outliers at this stage of the analysis, but in some cases, the maximum values of the graph’s scales don’t show abnormally high values.
- Construction of the GSC Cover occurred between June 24, 2010 and November 1, 2010. All the earthworks were completed during this summer, except for hydro-seeding, some regarding, and the construction of water management ponds.
- On May 17, 2011 excessive meltwater collapsed the system, causing overflow of hydraulic infrastructure and release on non-compliant water into the Vangorda Creek. See Rainey et al. 2013 report for more information.

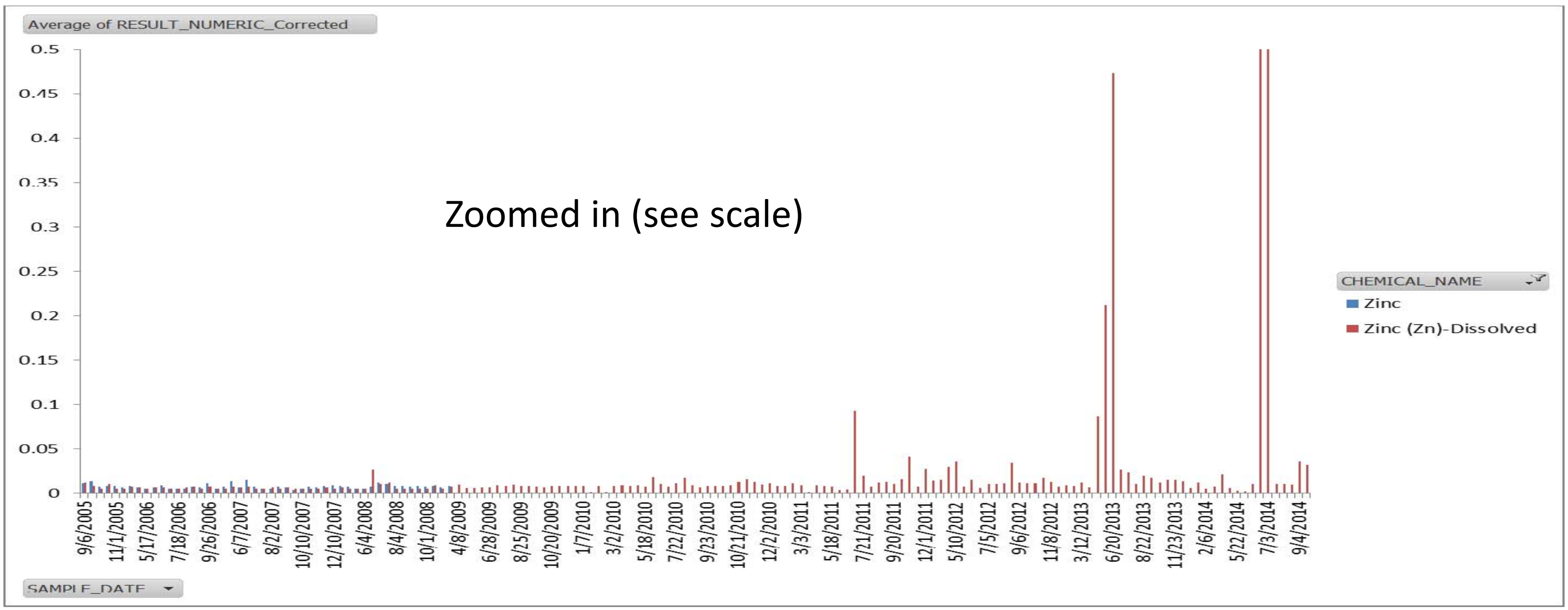


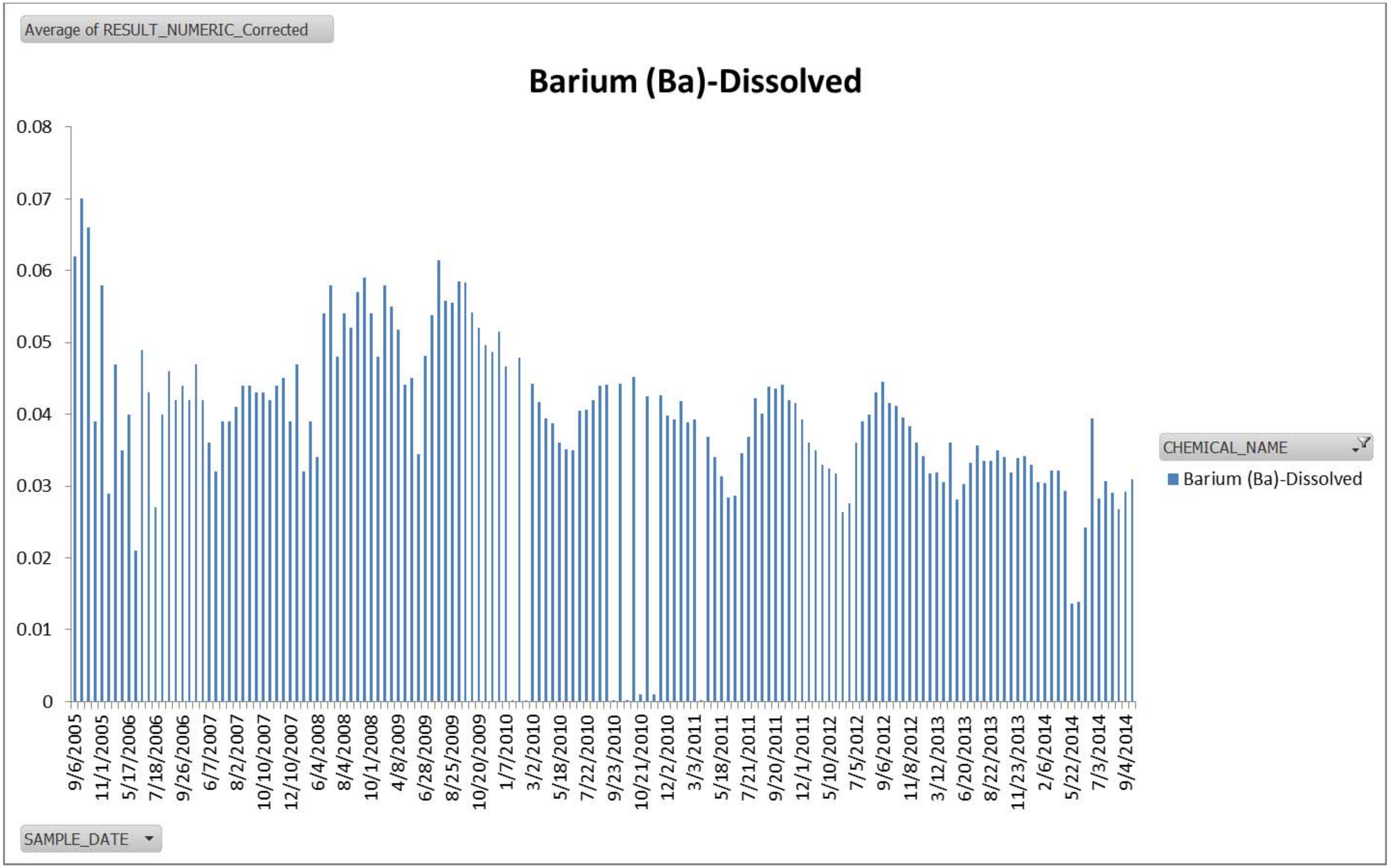
Average of RESULT_NUMERIC_Corrected
Sulfate, dissolved
1800
1600
1400
1200
1000
800
600
400
200
0
9/6/2005
11/1/2005
5/17/2006
7/18/2006
9/26/2006
6/7/2007
8/2/2007
10/10/2007
12/10/2007
6/4/2008
8/4/2008
10/1/2008
4/8/2009
6/28/2009
8/25/2009
10/20/2009
1/7/2010
3/2/2010
5/1/2010
7/7/2010
9/7/2010
10/7/2010
11/4/2010
2/3/2011
5/10/2011
7/5/2011
9/7/2011
11/8/2011
3/6/2012
6/20/2012
8/23/2012
10/25/2012
2/7/2013
6/6/2013
8/8/2013
10/24/2013
2/6/2014
5/8/2014
6/19/2014
8/21/2014
CHEMICAL_NAME
Sulfate, dissolved
SAMPLE_DATE



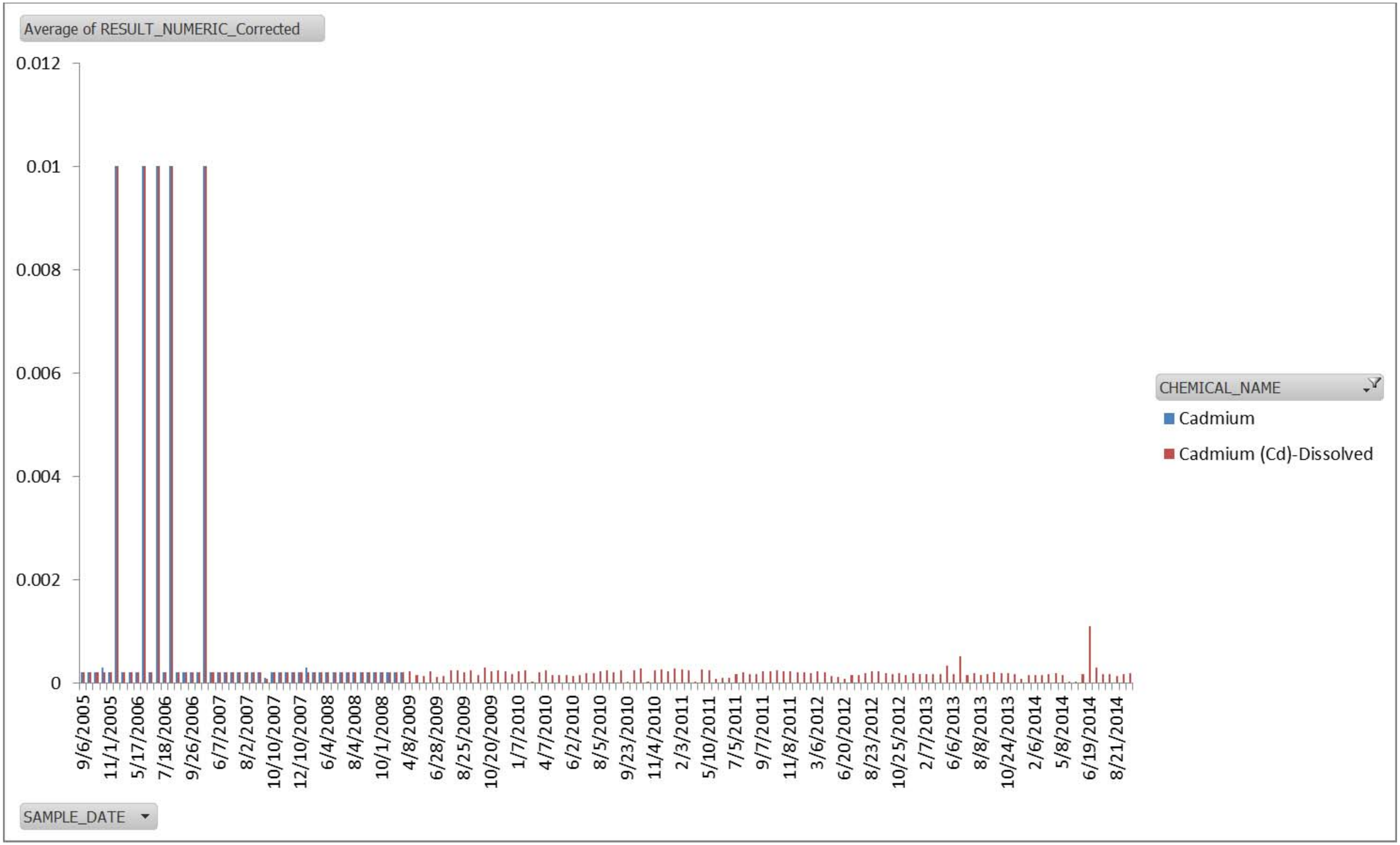
Average of RESULT_NUMERIC_Corrected
pH, Field
10
9
8
7
6
5
4
3
2
1
0
9/6/2005
11/1/2005
6/5/2006
8/8/2006
10/16/2006
6/18/2007
8/14/2007
10/22/2007
12/17/2007
6/17/2008
8/12/2008
10/15/2008
5/6/2009
7/14/2009
9/6/2009
11/9/2009
2/3/2010
5/1/2010
6/20/2010
8/18/2010
10/7/2010
12/2/2010
3/3/2011
5/18/2011
7/21/2011
9/20/2011
12/1/2011
4/5/2012
6/20/2012
8/23/2012
10/25/2012
2/7/2013
5/23/2013
7/25/2013
9/5/2013
11/23/2013
2/6/2014
5/22/2014
7/24/2014
9/17/2014
CHEMICAL_NAME
pH, Field
SAMPLE_DATE

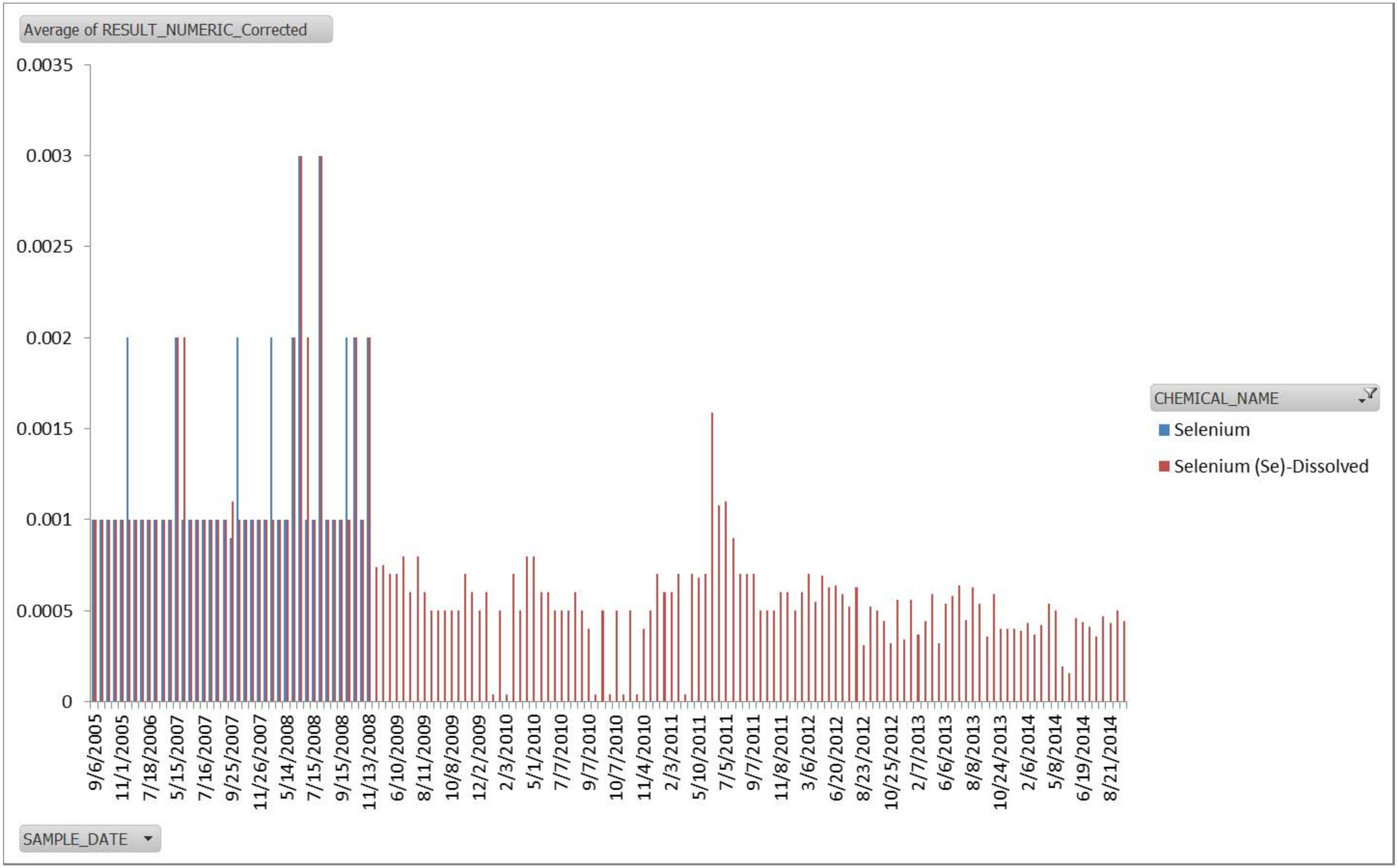

Average of RESULT_NUMERIC_Corrected
2.5
2
1.5
1
0.5
0
Zoomed out (see scale)
CHEMICAL_NAME
Zinc
Zinc (Zn)-Dissolved
9/6/2005 11/1/2005 5/17/2006 7/18/2006 9/26/2006 6/7/2007 8/2/2007 10/10/2007 12/10/2007 6/4/2008 8/4/2008 10/1/2008 4/8/2009 6/28/2009 8/25/2009 10/20/2009 1/7/2010 3/2/2010 5/18/2010 7/22/2010 9/23/2010 10/21/2010 12/2/2010 3/3/2011 5/18/2011 7/21/2011 9/20/2011 12/1/2011 5/10/2012 7/5/2012 9/6/2012 11/8/2012 3/12/2013 6/20/2013 8/22/2013 11/23/2013 2/6/2014 5/22/2014 7/3/2014 9/4/2014
SAMPLE_DATE


Average of RESULT_NUMERIC_Corrected
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Zoomed in (see scale)
CHEMICAL_NAME
Zinc
Zinc (Zn)-Dissolved
9/6/2005 11/1/2005 5/17/2006 7/18/2006 9/26/2006 6/7/2007 8/2/2007 10/10/2007 12/10/2007 6/4/2008 8/4/2008 10/1/2008 4/8/2009 6/28/2009 8/25/2009 10/20/2009 1/7/2010 3/2/2010 5/18/2010 7/22/2010 9/23/2010 10/21/2010 12/2/2010 3/3/2011 5/18/2011 7/21/2011 9/20/2011 12/1/2011 5/10/2012 7/5/2012 9/6/2012 11/8/2012 3/12/2013 6/20/2013 8/22/2013 11/23/2013 2/6/2014 5/22/2014 7/3/2014 9/4/2014
SAMPLE_DATE

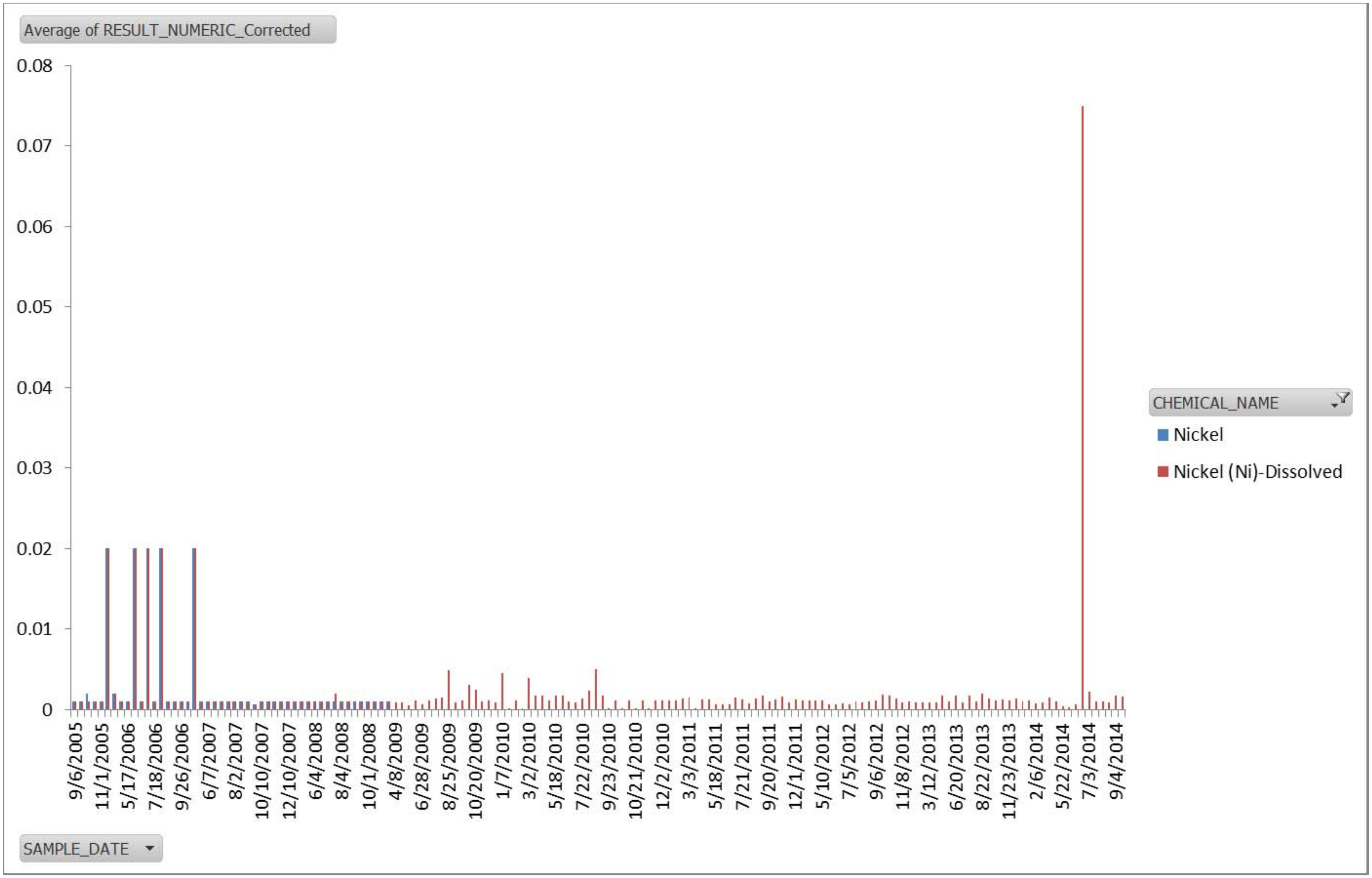


Average of RESULT_NUMERIC_Corrected
Barium (Ba)-Dissolved
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
9/6/2005
11/1/2005
5/17/2006
7/18/2006
9/26/2006
6/7/2007
8/2/2007
10/10/2007
12/10/2007
6/4/2008
8/4/2008
10/1/2008
4/8/2009
6/28/2009
8/25/2009
10/20/2009
1/7/2010
3/2/2010
5/18/2010
7/22/2010
9/23/2010
10/21/2010
12/2/2010
3/3/2011
5/18/2011
7/21/2011
9/20/2011
12/1/2011
5/10/2012
7/5/2012
9/6/2012
11/8/2012
3/12/2013
6/20/2013
8/22/2013
11/23/2013
2/6/2014
5/22/2014
7/3/2014
9/4/2014
CHEMICAL_NAME
Barium (Ba)-Dissolved
SAMPLE_DATE

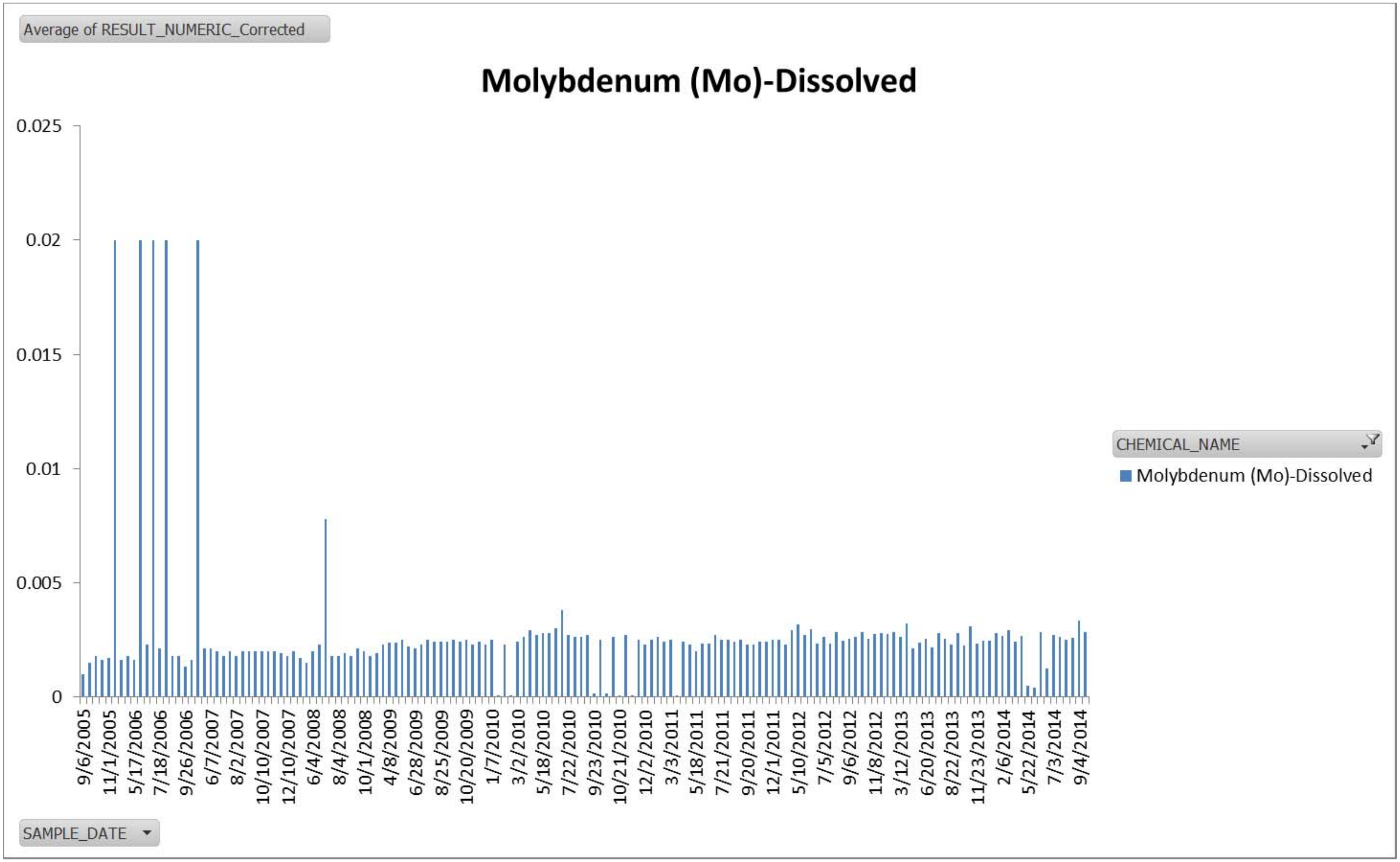

Average of RESULT_NUMERIC_Corrected
0.012
0.01
0.008
0.006
0.004
0.002
0
9/6/2005
11/1/2005
5/17/2006
7/18/2006
9/26/2006
6/7/2007
8/2/2007
10/10/2007
12/10/2007
6/4/2008
8/4/2008
10/1/2008
4/8/2009
6/28/2009
8/25/2009
10/20/2009
1/7/2010
4/7/2010
6/2/2010
8/5/2010
9/23/2010
11/4/2010
2/3/2011
5/10/2011
7/5/2011
9/7/2011
11/8/2011
3/6/2012
6/20/2012
8/23/2012
10/25/2012
2/7/2013
6/6/2013
8/8/2013
10/24/2013
2/6/2014
5/8/2014
6/19/2014
8/21/2014
CHEMICAL_NAME
Cadmium
Cadmium (Cd)-Dissolved
SAMPLE_DATE



Average of RESULT_NUMERIC_Corrected
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
9/6/2005
11/1/2005
7/18/2006
5/15/2007
7/16/2007
9/25/2007
11/26/2007
5/14/2008
7/15/2008
9/15/2008
11/13/2008
6/10/2009
8/11/2009
10/8/2009
12/2/2009
2/3/2010
5/1/2010
7/7/2010
9/7/2010
10/7/2010
11/4/2010
2/3/2011
5/10/2011
7/5/2011
9/7/2011
11/8/2011
3/6/2012
6/20/2012
8/23/2012
10/25/2012
2/7/2013
6/6/2013
8/8/2013
10/24/2013
2/6/2014
5/8/2014
6/19/2014
8/21/2014
SAMPLE_DATE
CHEMICAL_NAME
Selenium
Selenium (Se)-Dissolved



Average of RESULT_NUMERIC_Corrected
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
9/6/2005
11/1/2005
5/17/2006
7/18/2006
9/26/2006
6/7/2007
8/2/2007
10/10/2007
12/10/2007
6/4/2008
8/4/2008
10/1/2008
4/8/2009
6/28/2009
8/25/2009
10/20/2009
1/7/2010
3/2/2010
5/18/2010
7/22/2010
9/23/2010
10/21/2010
12/2/2010
3/3/2011
5/18/2011
7/21/2011
9/20/2011
12/1/2011
5/10/2012
7/5/2012
9/6/2012
11/8/2012
3/12/2013
6/20/2013
8/22/2013
11/23/2013
2/6/2014
5/22/2014
7/3/2014
9/4/2014
CHEMICAL_NAME
Nickel
Nickel (Ni)-Dissolved
SAMPLE_DATE



Average of RESULT_NUMERIC_Corrected
Molybdenum (Mo)-Dissolved
0.025
0.02
0.015
0.01
0.005
0
9/6/2005
11/1/2005
5/17/2006
7/18/2006
9/26/2006
6/7/2007
8/2/2007
10/10/2007
12/10/2007
6/4/2008
8/4/2008
10/1/2008
4/8/2009
6/28/2009
8/25/2009
10/20/2009
1/7/2010
3/2/2010
5/18/2010
7/22/2010
9/23/2010
10/21/2010
12/2/2010
3/3/2011
5/18/2011
7/21/2011
9/20/2011
12/1/2011
5/10/2012
7/5/2012
9/6/2012
11/8/2012
3/12/2013
6/20/2013
8/22/2013
11/23/2013
2/6/2014
5/22/2014
7/3/2014
9/4/2014
CHEMICAL_NAME
Molybdenum (Mo)-Dissolved
SAMPLE_DATE

GSC Annual Performance Assessment

Geochemical Results 2000-2015

Site: V15

Assumptions for GSC Annual Performance Assessment

- Some measurements were reported in µg/L, others in mg/L. To keep consistency, values were transformed to mg/L where relevant.
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- The scale of the graphs was mostly chosen to see the data in the context of the FMC Effluent Quality Standards. In a scale to show how close the measured values were to these reference values.
- Another focus of the graphs was to compare baseline data with conditions years after the GSC Cover was completed. In this context, the graphs focus on the trends before and after 2010 (when the GSC dry cover was completed).
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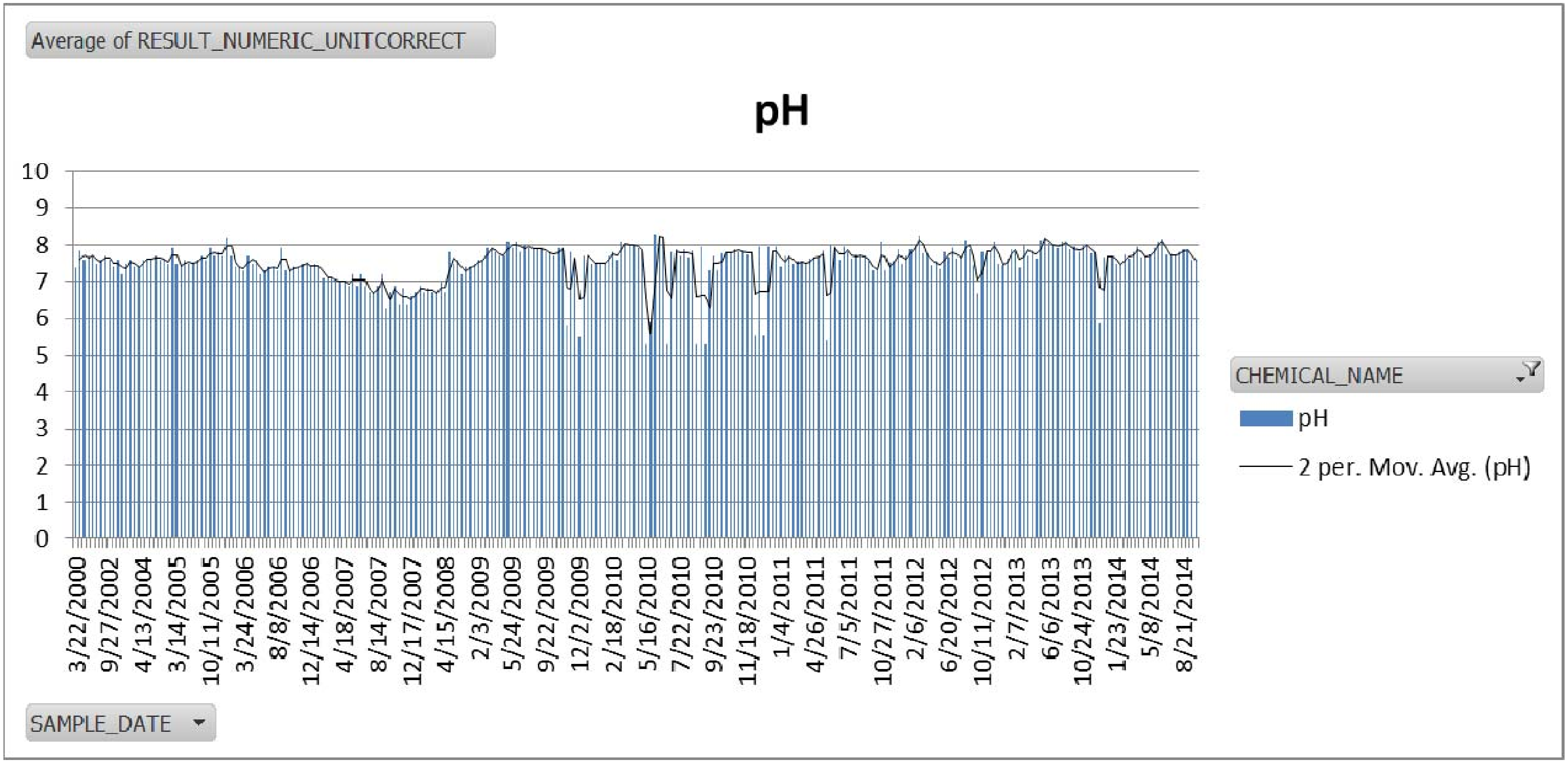
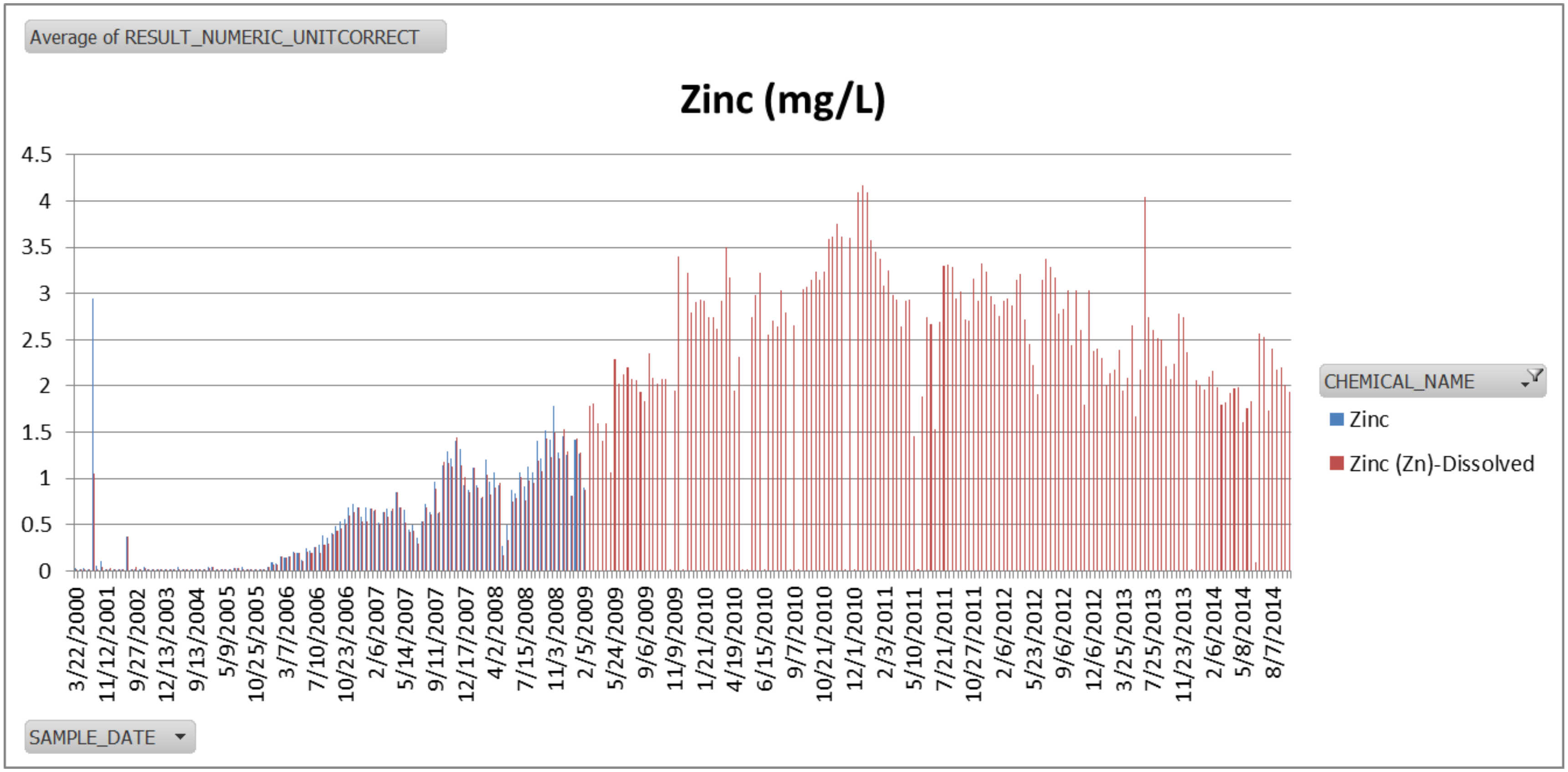
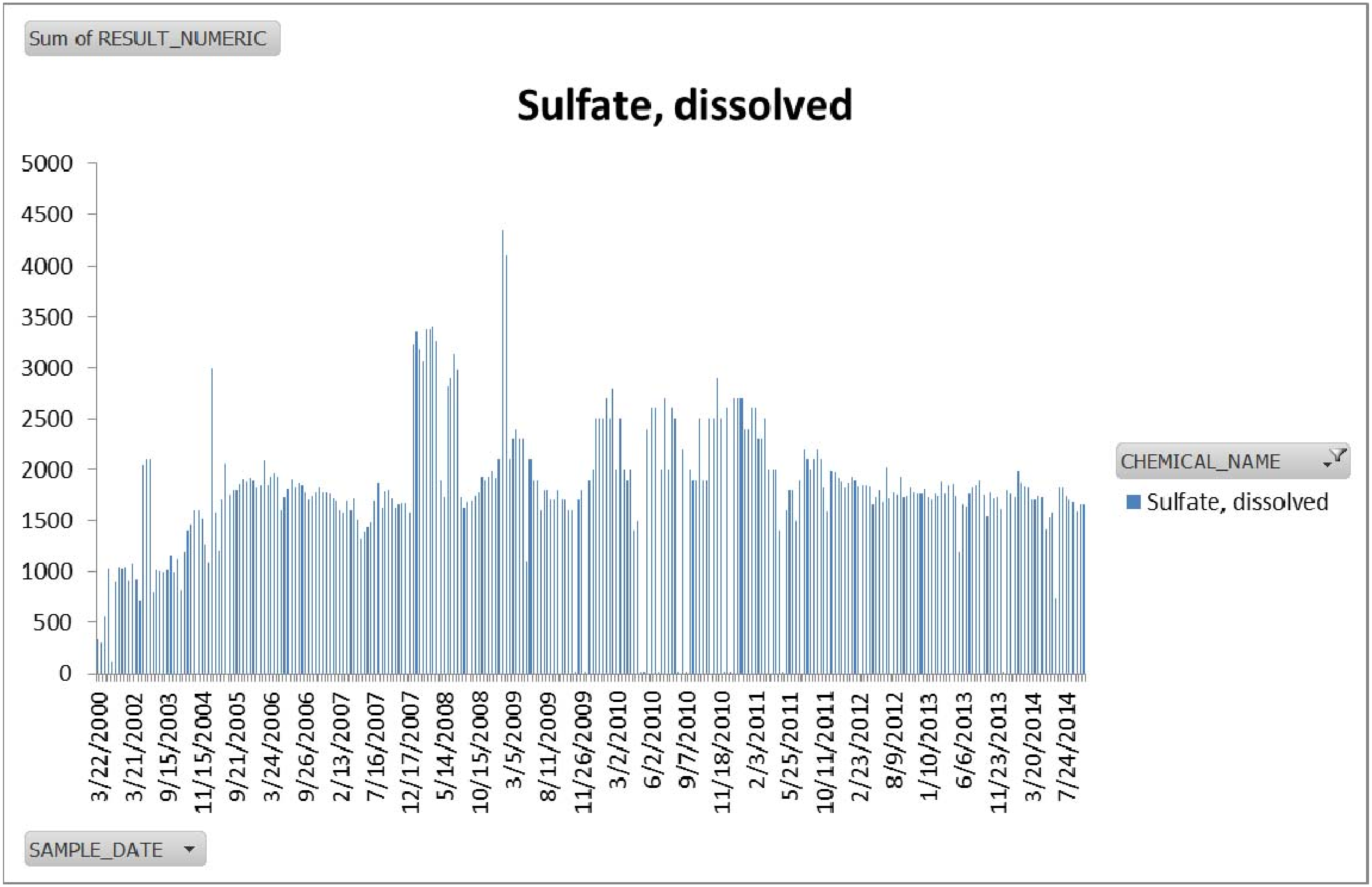
- Construction of the GSC Cover occurred between June 24, 2010 and November 1, 2010. All the earthworks were completed during this summer, except for hydro-seeding, some regarding, and the construction of water management ponds.
- On May 17, 2011 excessive meltwater collapsed the system, causing overflow of hydraulic infrastructure and release on non-compliant water into the Vangorda Creek. See Rainey et al. 2013 report for more information.

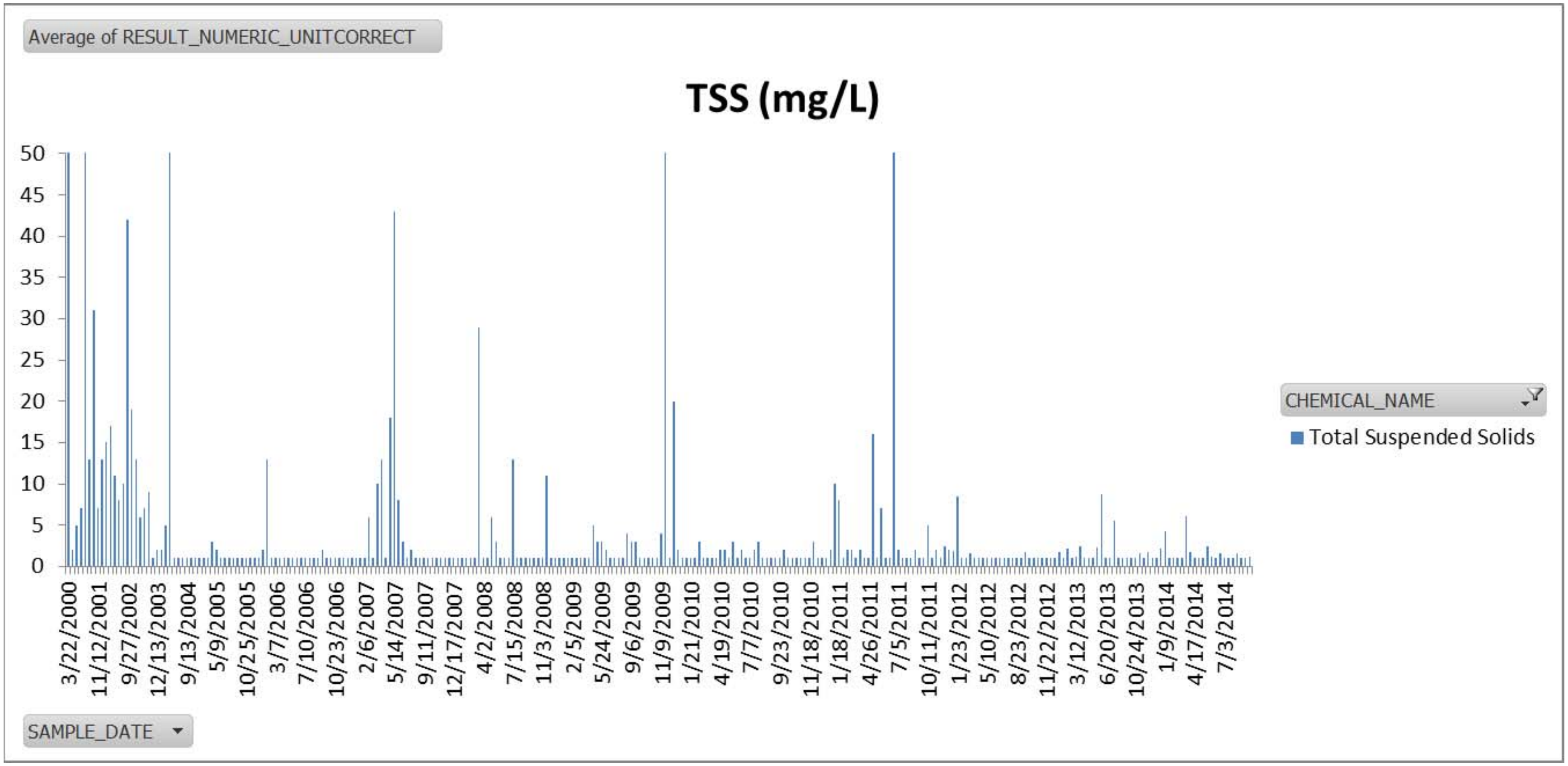

Average of RESULT_NUMERIC_UNITCORRECT
pH
10
9
8
7
6
5
4
3
2
1
0
3/22/2000
9/27/2002
4/13/2004
3/14/2005
10/11/2005
3/24/2006
8/8/2006
12/14/2006
4/18/2007
8/14/2007
12/17/2007
4/15/2008
2/3/2009
5/24/2009
9/22/2009
12/2/2009
2/18/2010
5/16/2010
7/22/2010
9/23/2010
11/18/2010
1/4/2011
4/26/2011
7/5/2011
10/27/2011
2/6/2012
6/20/2012
10/11/2012
2/7/2013
6/6/2013
10/24/2013
1/23/2014
5/8/2014
8/21/2014
SAMPLE_DATE
CHEMICAL_NAME
pH
2 per. Mov. Avg. (pH)



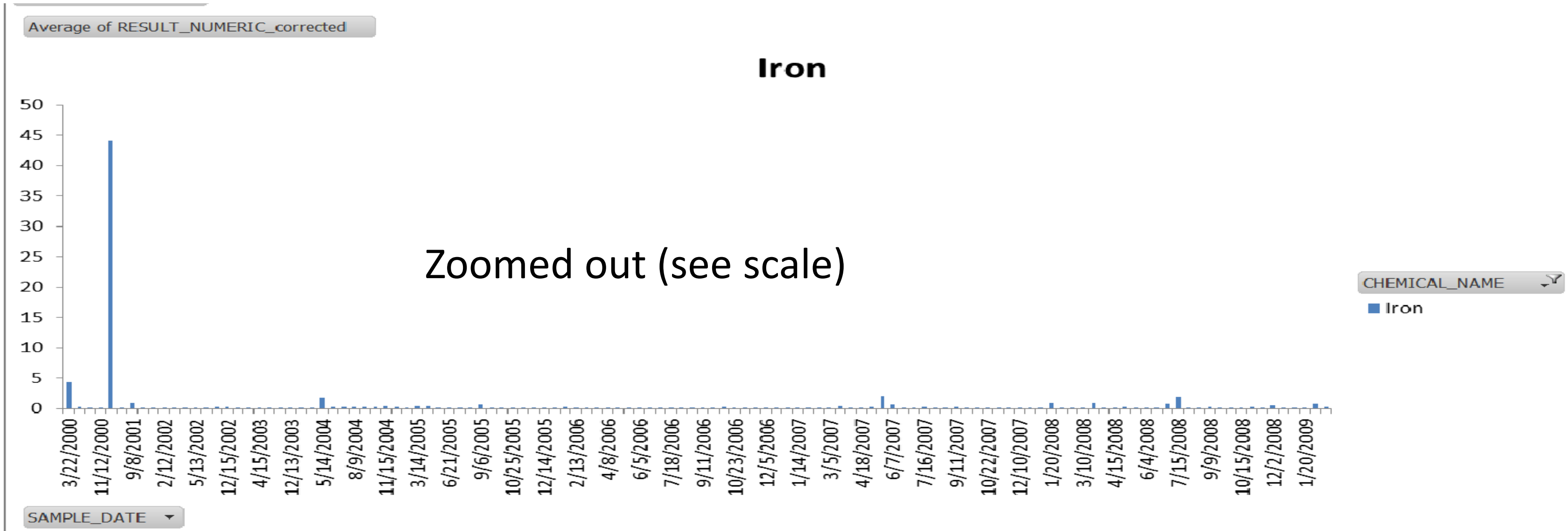
Average of RESULT_NUMERIC_UNITCORRECT
Zinc (mg/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/25/2013
11/23/2013
2/6/2014
5/8/2014
8/7/2014
CHEMICAL_NAME
Zinc
Zinc (Zn)-Dissolved
SAMPLE_DATE



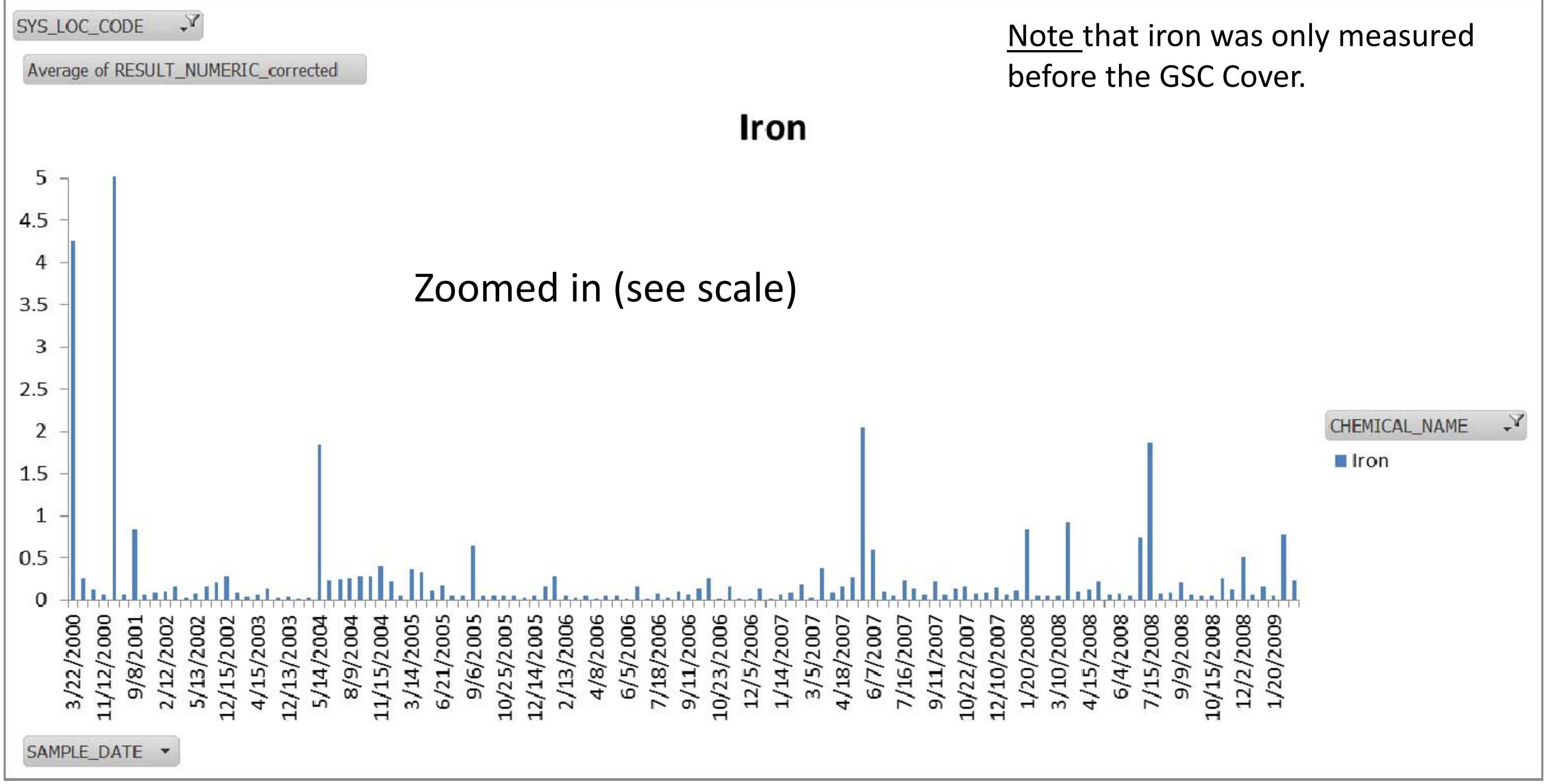
Sum of RESULT_NUMERIC
Sulfate, dissolved
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
3/22/2000
3/21/2002
9/15/2003
11/15/2004
9/21/2005
3/24/2006
9/26/2006
2/13/2007
7/16/2007
12/17/2007
5/14/2008
10/15/2008
3/5/2009
8/11/2009
11/26/2009
3/2/2010
6/2/2010
9/7/2010
11/18/2010
2/3/2011
5/25/2011
10/11/2011
2/23/2012
8/9/2012
1/10/2013
6/6/2013
11/23/2013
3/20/2014
7/24/2014
CHEMICAL_NAME
Sulfate, dissolved
SAMPLE_DATE

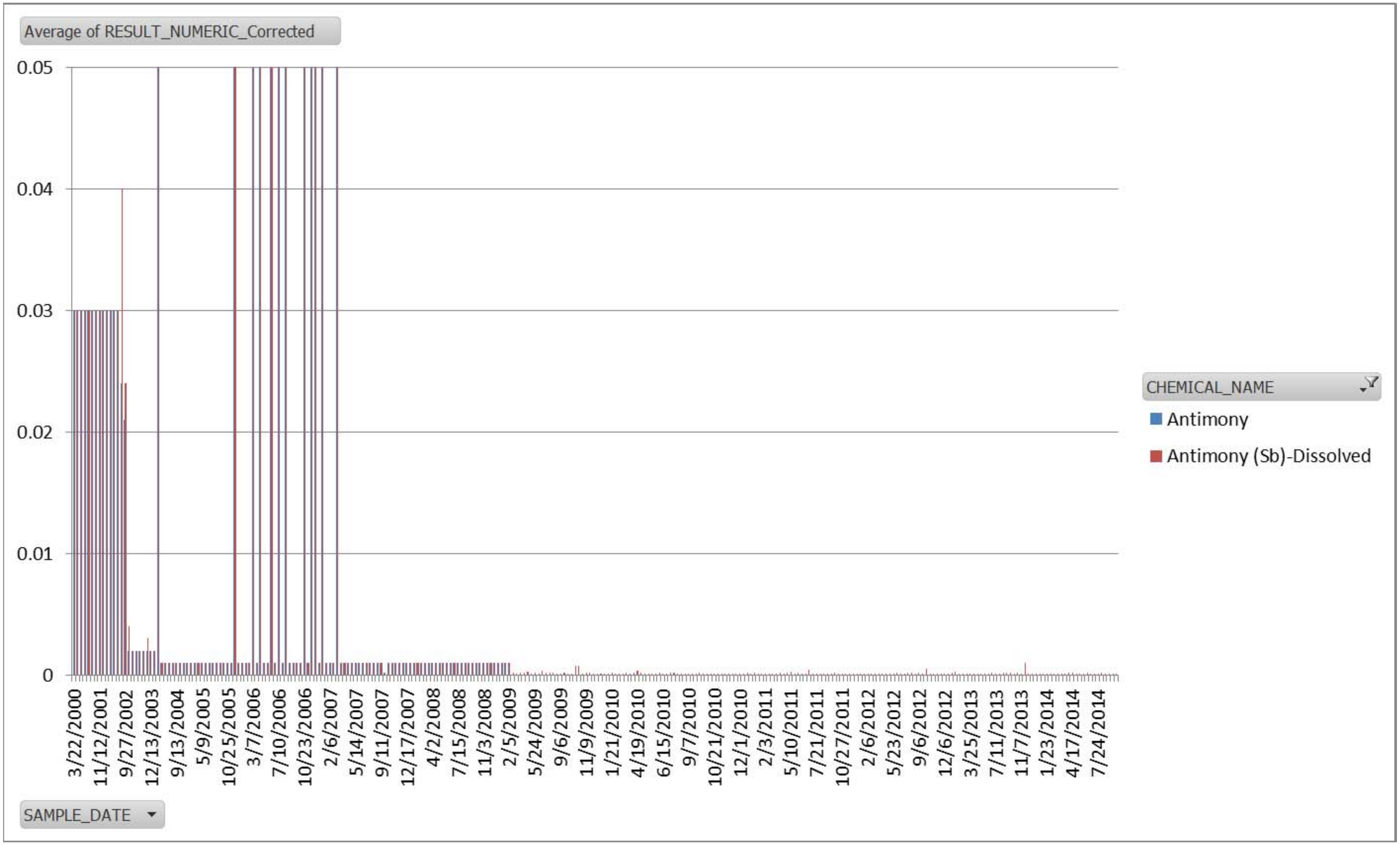


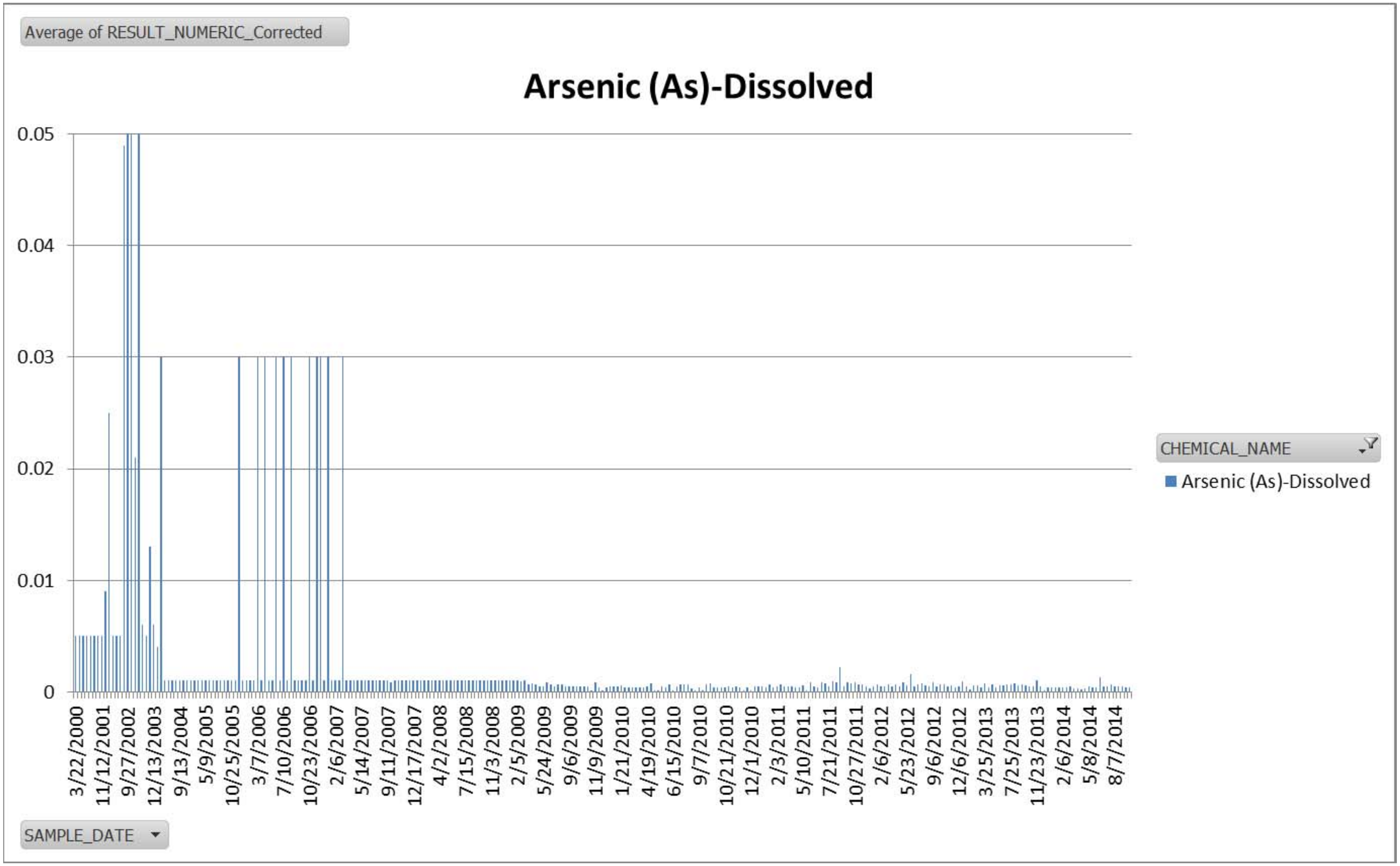
Average of RESULT_NUMERIC_UNITCORRECT
TSS (mg/L)
50
45
40
35
30
25
20
15
10
5
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
7/7/2010
9/23/2010
11/18/2010
1/18/2011
4/26/2011
7/5/2011
10/11/2011
1/23/2012
5/10/2012
8/23/2012
11/22/2012
3/12/2013
6/20/2013
10/24/2013
1/9/2014
4/17/2014
7/3/2014
SAMPLE_DATE
CHEMICAL_NAME
Total Suspended Solids

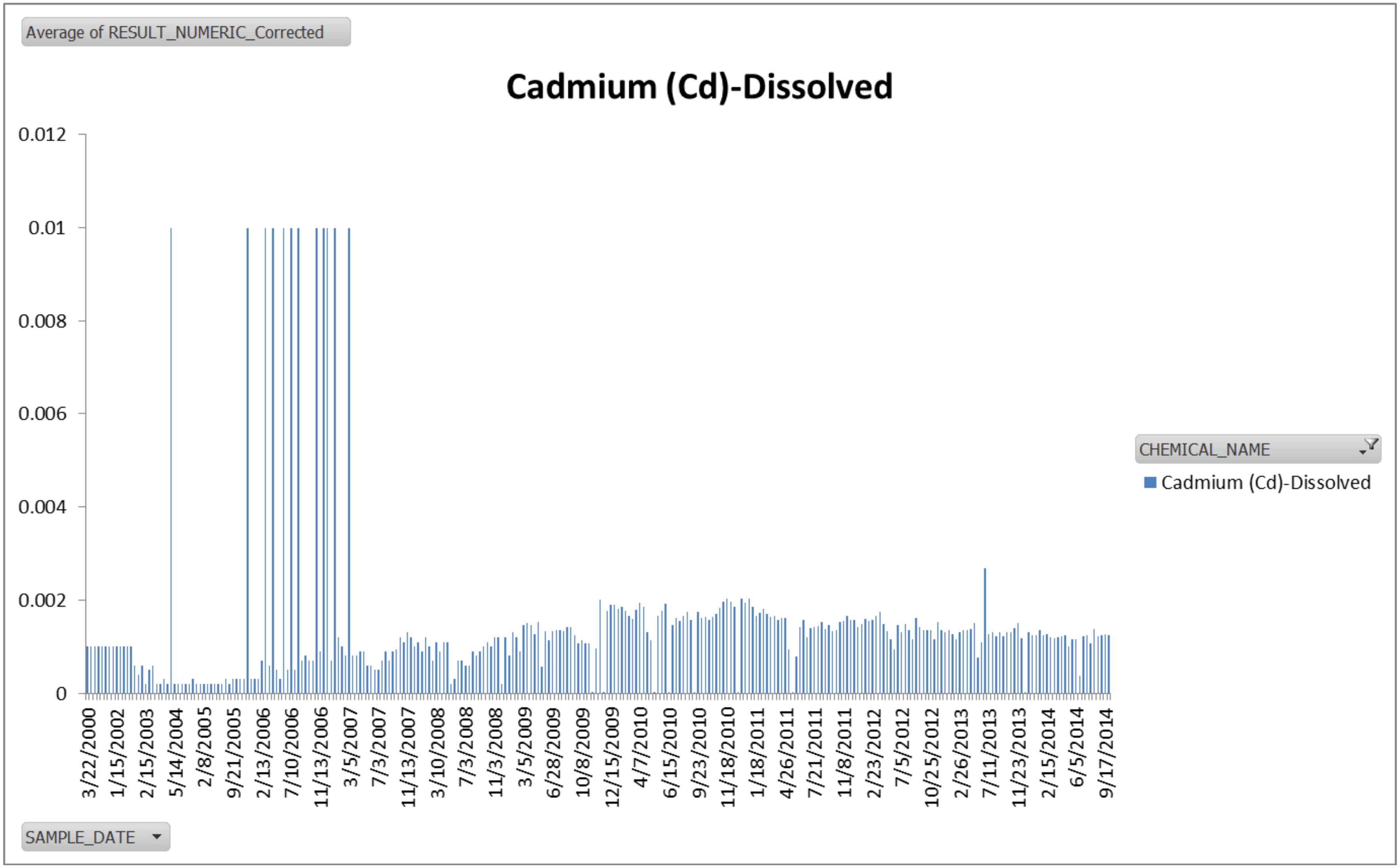


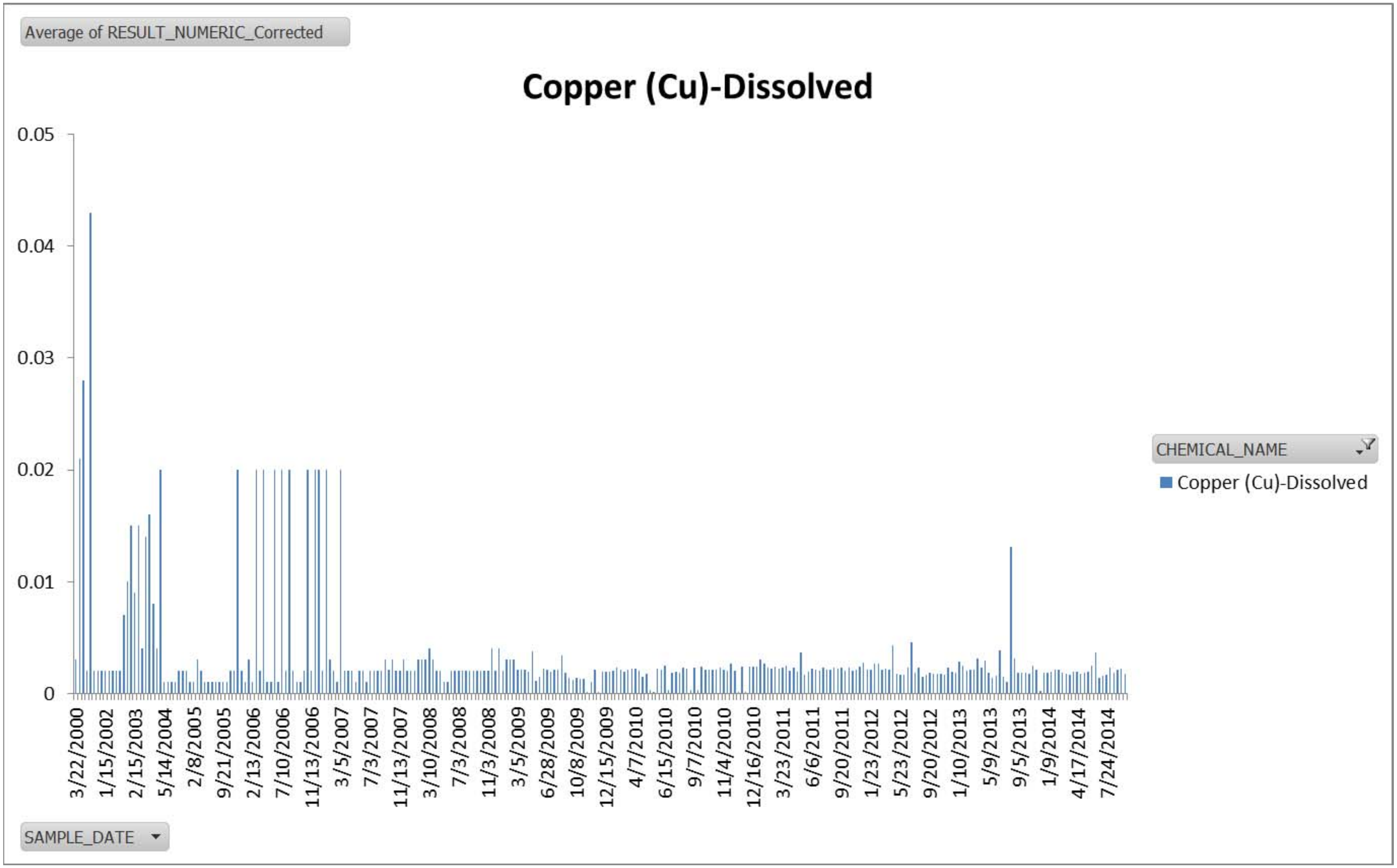
<u>Note</u> that iron was only measured before the GSC Cover.

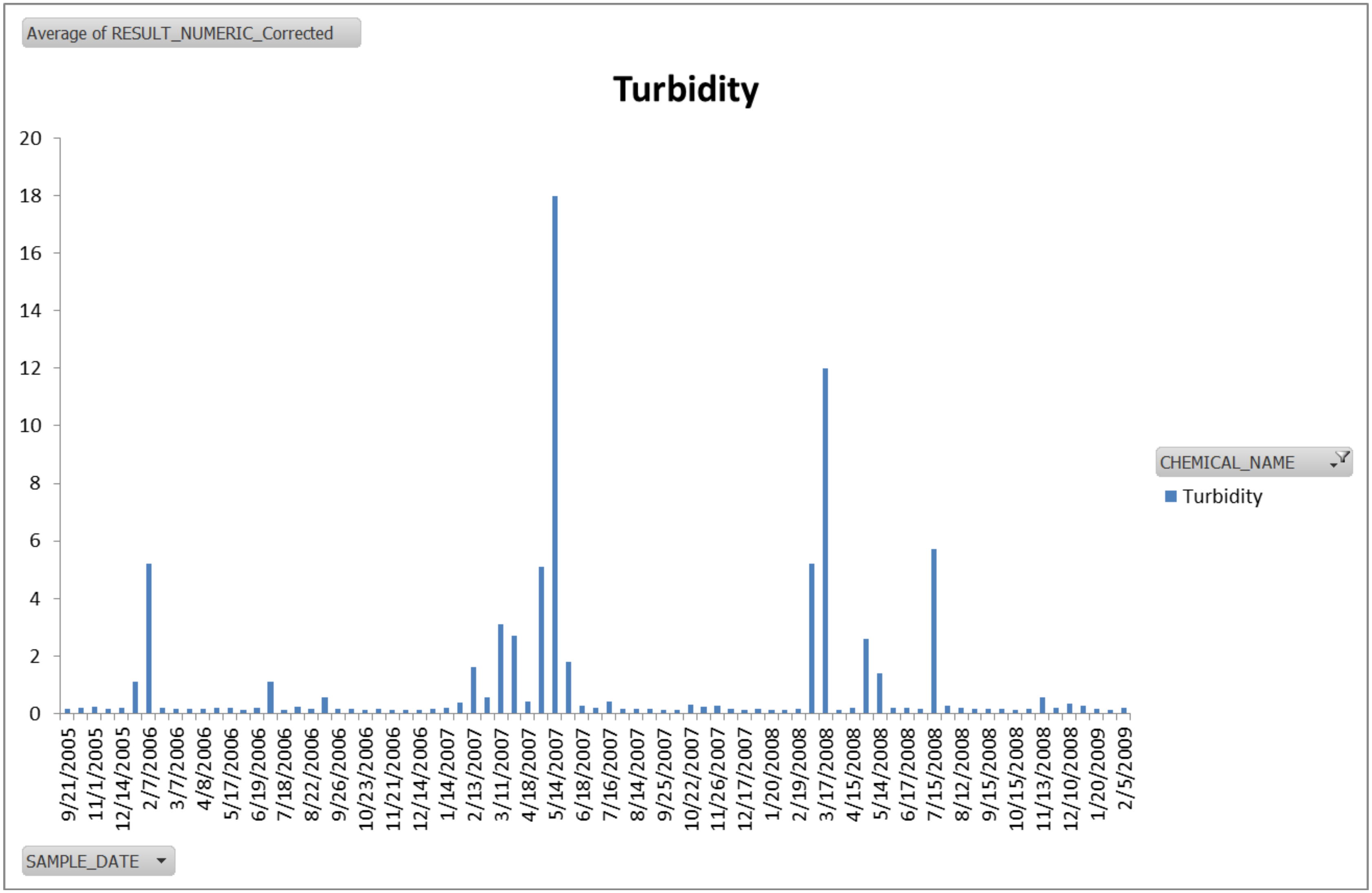


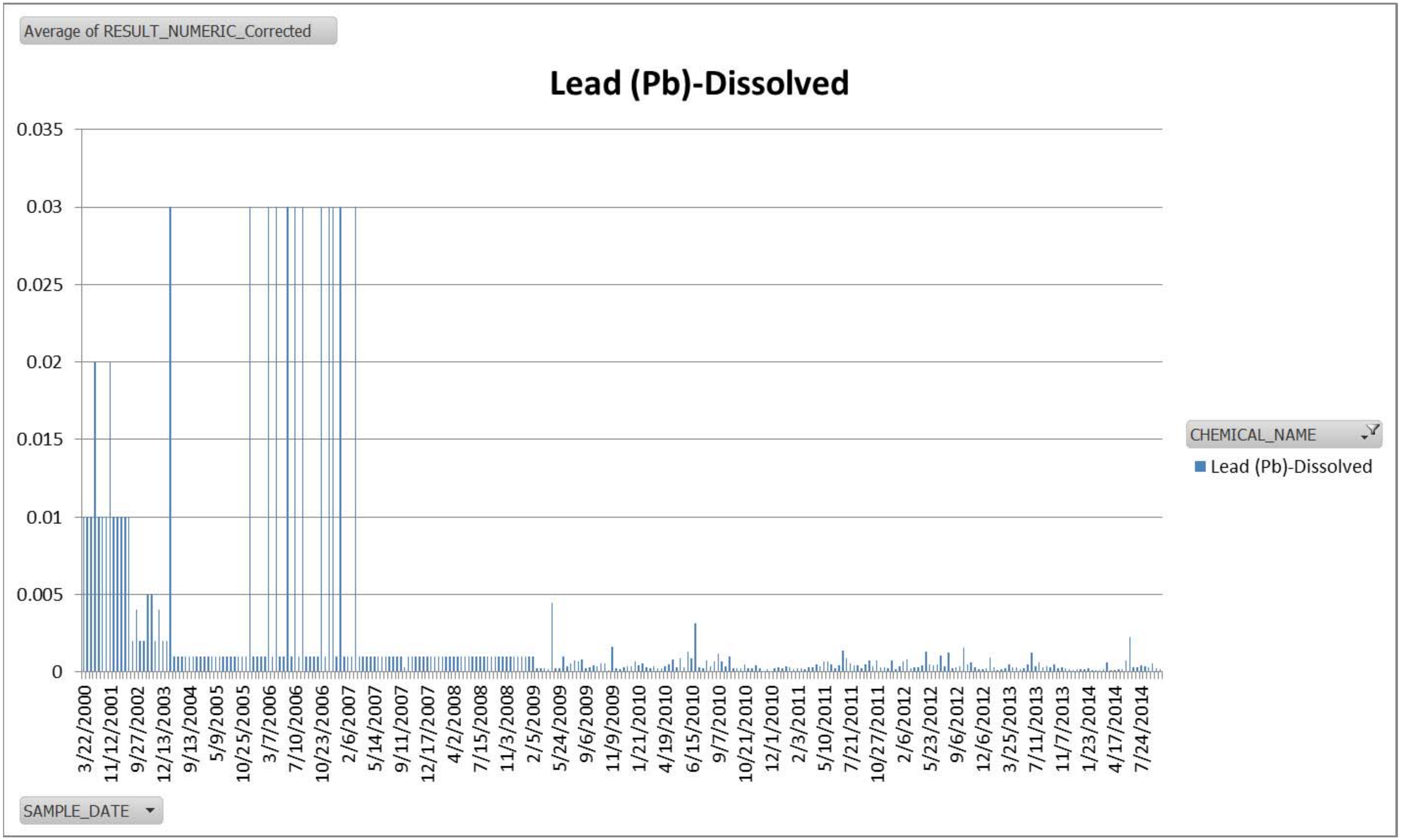

Average of RESULT_NUMERIC_Corrected
0.05
0.04
0.03
0.02
0.01
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/11/2013
11/7/2013
1/23/2014
4/17/2014
7/24/2014
SAMPLE_DATE
CHEMICAL_NAME
Antimony
Antimony (Sb)-Dissolved


Average of RESULT_NUMERIC_Corrected
Arsenic (As)-Dissolved
0.05
0.04
0.03
0.02
0.01
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/25/2013
11/23/2013
2/6/2014
5/8/2014
8/7/2014
CHEMICAL_NAME
Arsenic (As)-Dissolved
SAMPLE_DATE

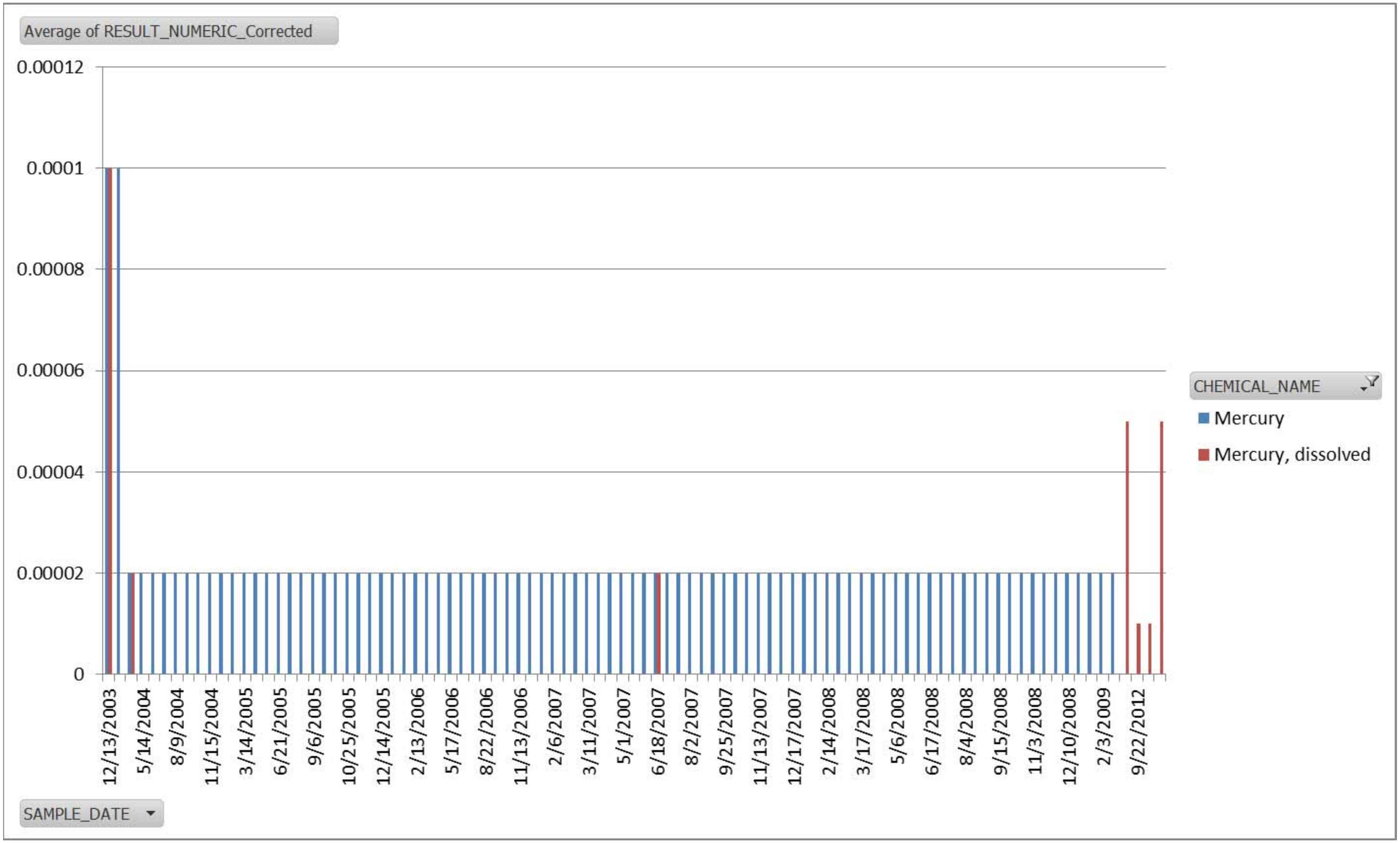

Average of RESULT_NUMERIC_Corrected
Cadmium (Cd)-Dissolved
0.012
0.01
0.008
0.006
0.004
0.002
0
3/22/2000
1/15/2002
2/15/2003
5/14/2004
2/8/2005
9/21/2005
2/13/2006
7/10/2006
11/13/2006
3/5/2007
7/3/2007
11/13/2007
3/10/2008
7/3/2008
11/3/2008
3/5/2009
6/28/2009
10/8/2009
12/15/2009
4/7/2010
6/15/2010
9/23/2010
11/18/2010
1/18/2011
4/26/2011
7/21/2011
11/8/2011
2/23/2012
7/5/2012
10/25/2012
2/26/2013
7/11/2013
11/23/2013
2/15/2014
6/5/2014
9/17/2014
CHEMICAL_NAME
Cadmium (Cd)-Dissolved
SAMPLE_DATE


Average of RESULT_NUMERIC_Corrected
Copper (Cu)-Dissolved
0.05
0.04
0.03
0.02
0.01
0
3/22/2000
1/15/2002
2/15/2003
5/14/2004
2/8/2005
9/21/2005
2/13/2006
7/10/2006
11/13/2006
3/5/2007
7/3/2007
11/13/2007
3/10/2008
7/3/2008
11/3/2008
3/5/2009
6/28/2009
10/8/2009
12/15/2009
4/7/2010
6/15/2010
9/7/2010
11/4/2010
12/16/2010
3/23/2011
6/6/2011
9/20/2011
1/23/2012
5/23/2012
9/20/2012
1/10/2013
5/9/2013
9/5/2013
1/9/2014
4/17/2014
7/24/2014
CHEMICAL_NAME
Copper (Cu)-Dissolved
SAMPLE_DATE

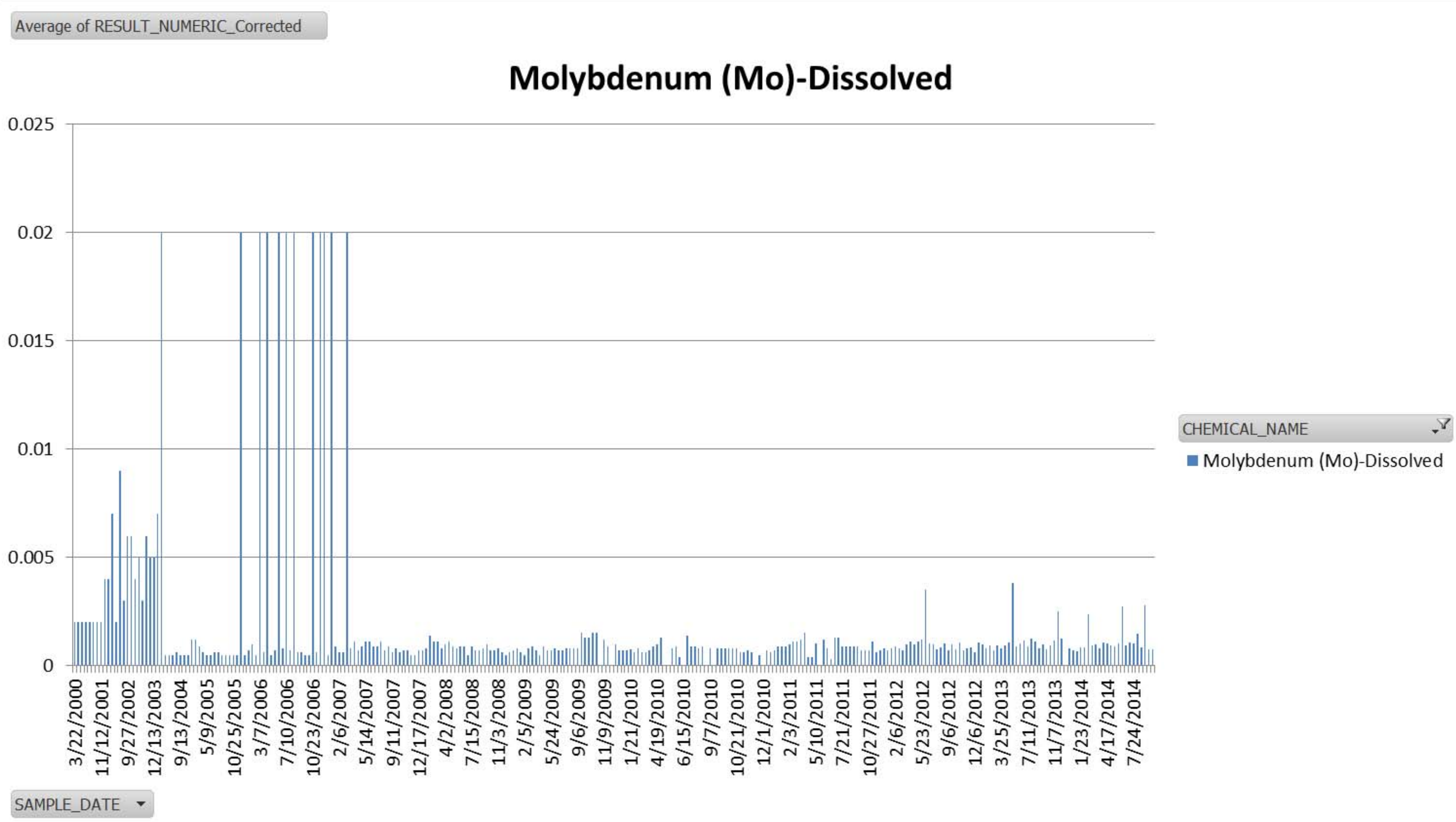

Average of RESULT_NUMERIC_Corrected
Turbidity
20
18
16
14
12
10
8
6
4
2
0
9/21/2005
11/1/2005
12/14/2005
2/7/2006
3/7/2006
4/8/2006
5/17/2006
6/19/2006
7/18/2006
8/22/2006
9/26/2006
10/23/2006
11/21/2006
12/14/2006
1/14/2007
2/13/2007
3/11/2007
4/18/2007
5/14/2007
6/18/2007
7/16/2007
8/14/2007
9/25/2007
10/22/2007
11/26/2007
12/17/2007
1/20/2008
2/19/2008
3/17/2008
4/15/2008
5/14/2008
6/17/2008
7/15/2008
8/12/2008
9/15/2008
10/15/2008
11/13/2008
12/10/2008
1/20/2009
2/5/2009
CHEMICAL_NAME
Turbidity
SAMPLE_DATE



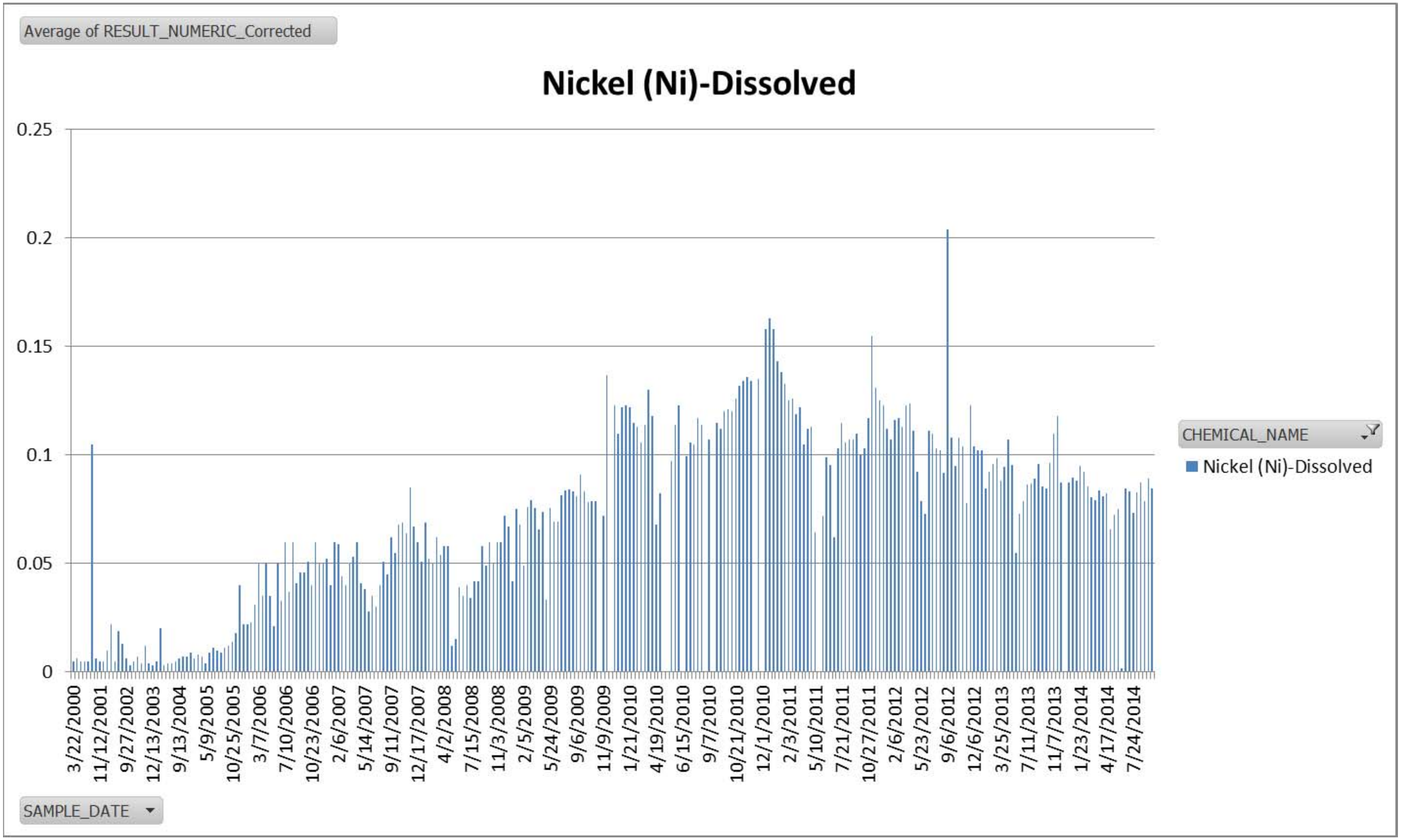
Average of RESULT_NUMERIC_Corrected
Lead (Pb)-Dissolved
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/11/2013
11/7/2013
1/23/2014
4/17/2014
7/24/2014
CHEMICAL_NAME
Lead (Pb)-Dissolved
SAMPLE_DATE



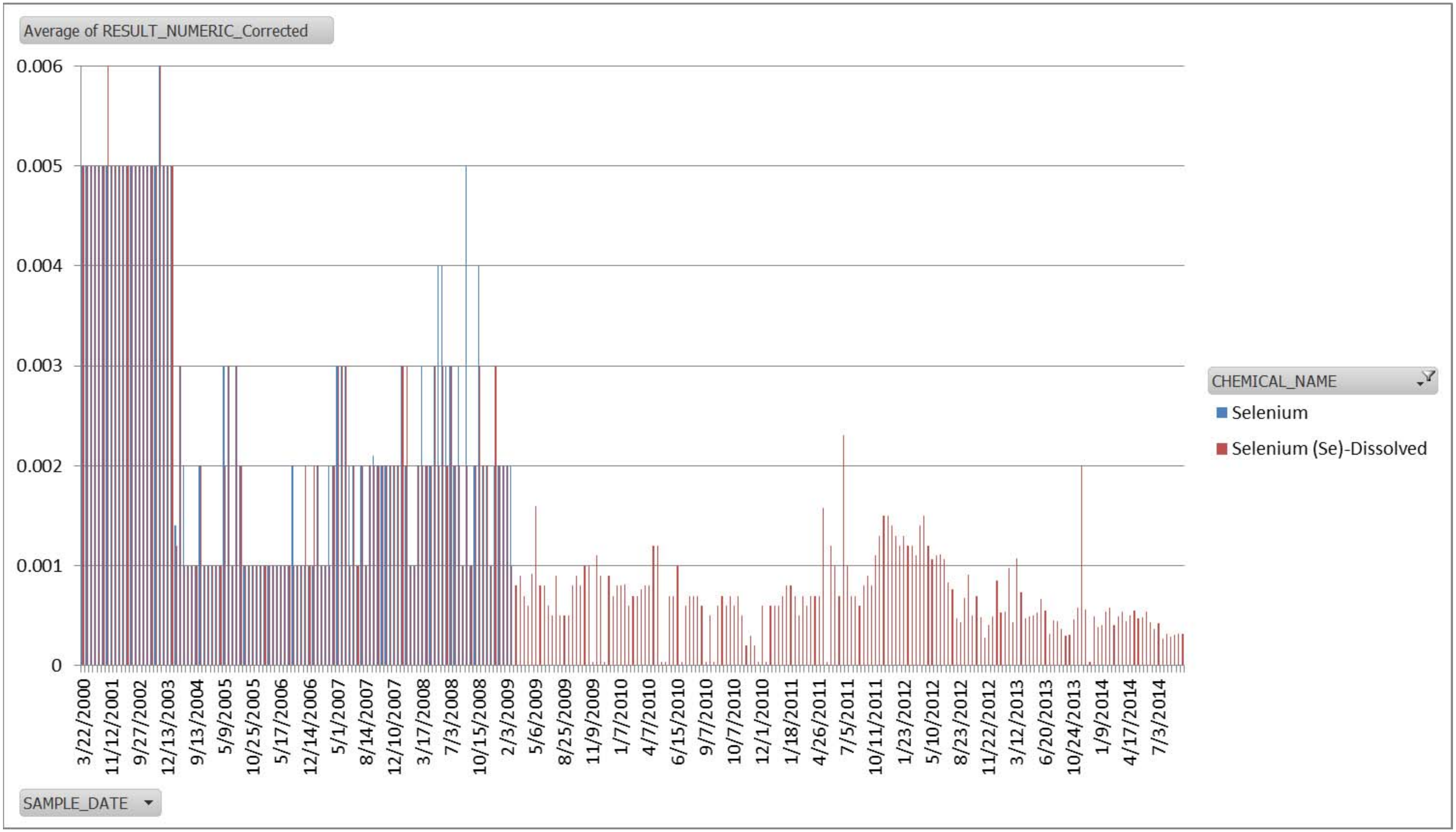
Average of RESULT_NUMERIC_Corrected
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
12/13/2003
5/14/2004
8/9/2004
11/15/2004
3/14/2005
6/21/2005
9/6/2005
10/25/2005
12/14/2005
2/13/2006
5/17/2006
8/22/2006
11/13/2006
2/6/2007
3/11/2007
5/1/2007
6/18/2007
8/2/2007
9/25/2007
11/13/2007
12/17/2007
2/14/2008
3/17/2008
5/6/2008
6/17/2008
8/4/2008
9/15/2008
11/3/2008
12/10/2008
2/3/2009
9/22/2012
CHEMICAL_NAME
Mercury
Mercury, dissolved
SAMPLE_DATE

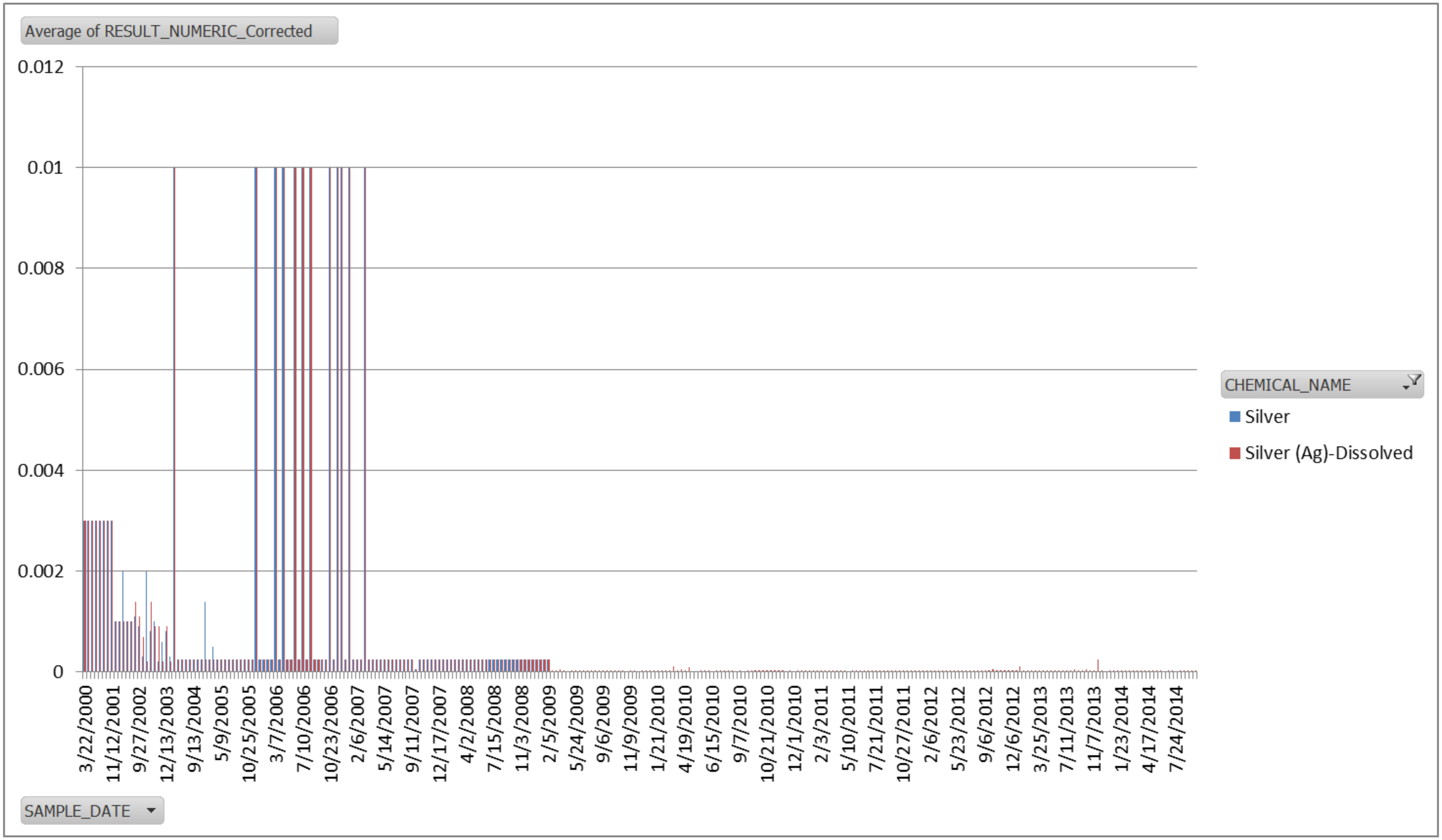


Average of RESULT_NUMERIC_Corrected
Molybdenum (Mo)-Dissolved
0.025
0.02
0.015
0.01
0.005
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/11/2013
11/7/2013
1/23/2014
4/17/2014
7/24/2014
SAMPLE_DATE
CHEMICAL_NAME
Molybdenum (Mo)-Dissolved

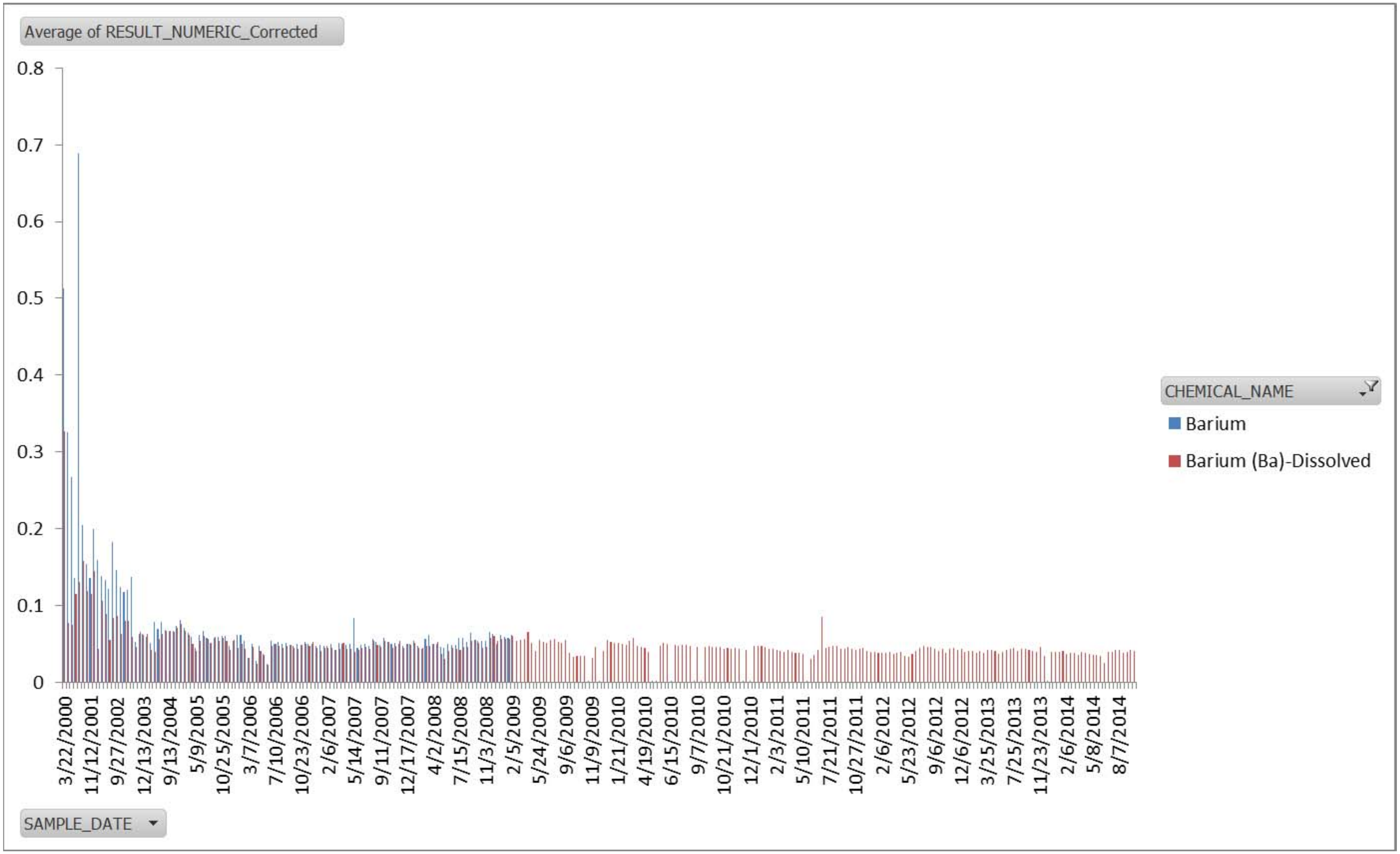


Average of RESULT_NUMERIC_Corrected
Nickel (Ni)-Dissolved
0.25
0.2
0.15
0.1
0.05
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/11/2013
11/7/2013
1/23/2014
4/17/2014
7/24/2014
CHEMICAL_NAME
Nickel (Ni)-Dissolved
SAMPLE_DATE


Average of RESULT_NUMERIC_Corrected
0.006
0.005
0.004
0.003
0.002
0.001
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
5/17/2006
12/14/2006
5/1/2007
8/14/2007
12/10/2007
3/17/2008
7/3/2008
10/15/2008
2/3/2009
5/6/2009
8/25/2009
11/9/2009
1/7/2010
4/7/2010
6/15/2010
9/7/2010
10/7/2010
12/1/2010
1/18/2011
4/26/2011
7/5/2011
10/11/2011
1/23/2012
5/10/2012
8/23/2012
11/22/2012
3/12/2013
6/20/2013
10/24/2013
1/9/2014
4/17/2014
7/3/2014
SAMPLE_DATE
CHEMICAL_NAME
Selenium
Selenium (Se)-Dissolved

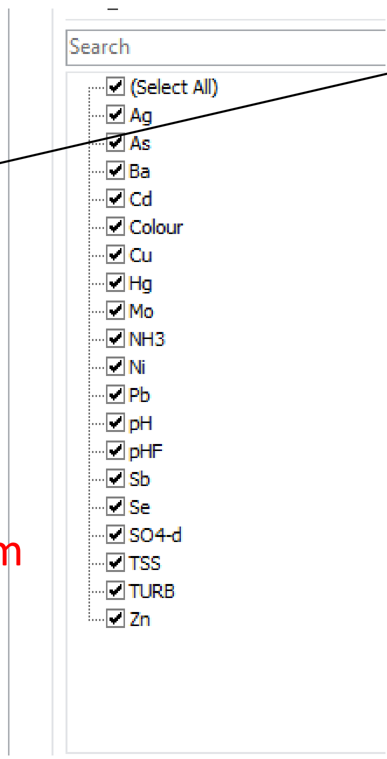


Average of RESULT_NUMERIC_Corrected
0.012
0.01
0.008
0.006
0.004
0.002
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/11/2013
11/7/2013
1/23/2014
4/17/2014
7/24/2014
SAMPLE_DATE
CHEMICAL_NAME
Silver
Silver (Ag)-Dissolved



Average of RESULT_NUMERIC_Corrected
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/22/2000
11/12/2001
9/27/2002
12/13/2003
9/13/2004
5/9/2005
10/25/2005
3/7/2006
7/10/2006
10/23/2006
2/6/2007
5/14/2007
9/11/2007
12/17/2007
4/2/2008
7/15/2008
11/3/2008
2/5/2009
5/24/2009
9/6/2009
11/9/2009
1/21/2010
4/19/2010
6/15/2010
9/7/2010
10/21/2010
12/1/2010
2/3/2011
5/10/2011
7/21/2011
10/27/2011
2/6/2012
5/23/2012
9/6/2012
12/6/2012
3/25/2013
7/25/2013
11/23/2013
2/6/2014
5/8/2014
8/7/2014
CHEMICAL_NAME
Barium
Barium (Ba)-Dissolved
SAMPLE_DATE

pH
Colour
Turb
Ammonia
Antimony
Arsenic
Barium
Cadmium
Copper
Cyanide
Lead
Mercury
Molybdenum
Nickel
Selenium
Silver
Zinc
Bioassay
Oil or grease



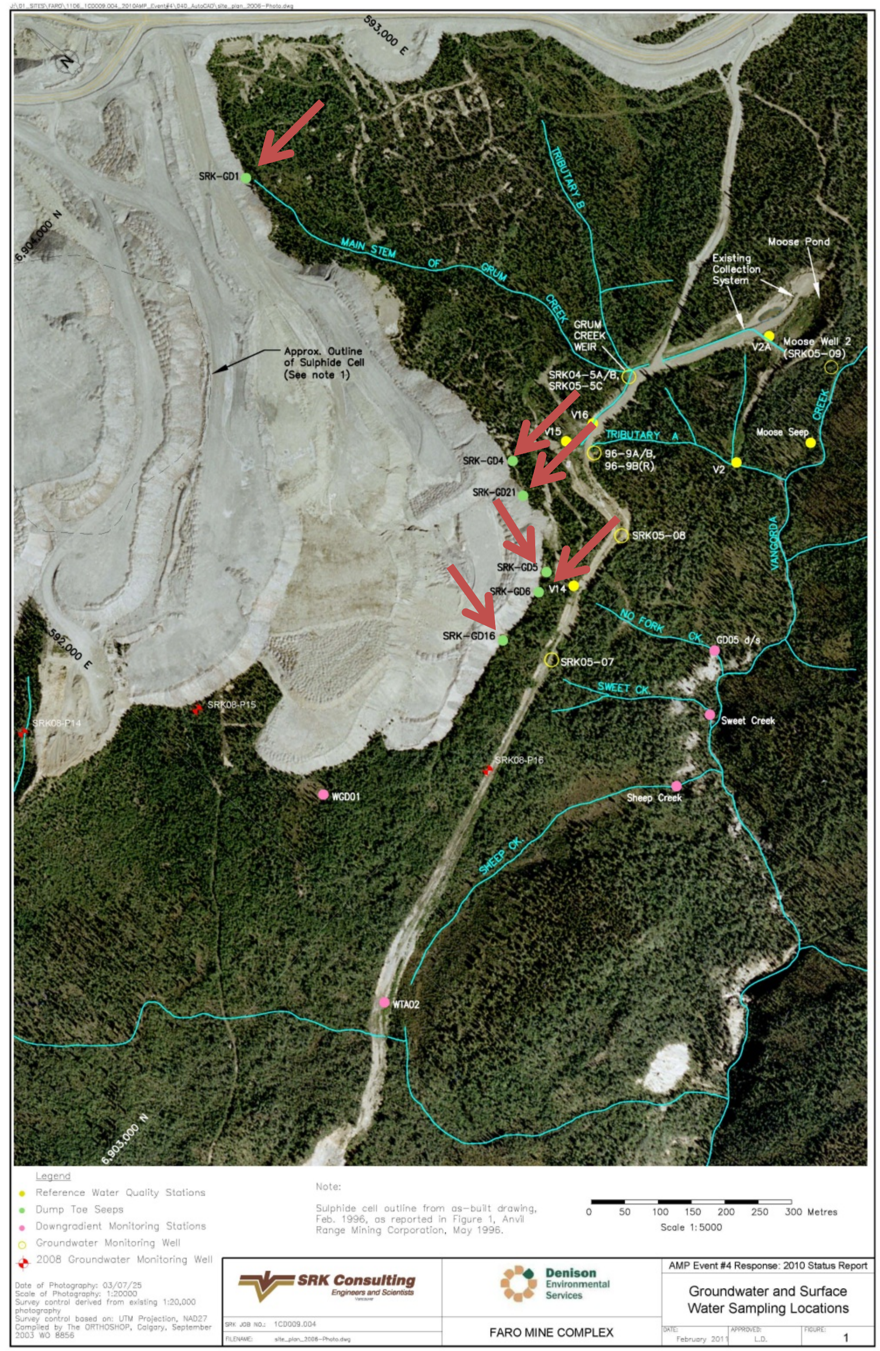
PHF|PH_D|COLOR|COLOR_D|TURB|TURBF|7664-41-7|7664-41-7_D|7440-36-0|7440-36-0_D|7440-38-2|7440-38-2_D|7440-39-3|7440-39-3_D|7440-43-9|7440-43-9_D|7440-50-8|7440-50-8_D|57-12-5|CN4500|7439-92-1|7439-92-1_D|7439-97-6|7439-97-6_DI|7439-97-6_D|7439-98-7|7439-98-7_D|7439-98-7_DI|7440-02-0|7440-02-0_D|7440-02-0_DI|7782-49-2|7782-49-2_D|7440-22-4|7440-22-4_D|7440-66-6|7704-34-9_D|14808-79-8_D|14808-79-8|7440-66-6_D

|7439-92-1|7439-92-1_D|7439-97-6|7439-97-6_DI|7439-97-6_D|7439-98-7|7439-98-7_D|7439-98-7_DI|7440-02-0|7440-02-0_D|7440-02-0_DI|7782-49-2|7782-49-2_D|7440-22-4|7440-22-4_D|7440-66-6|7704-34-9_D|14808-79-8_D|14808-79-8

GSC Annual Performance Assessment

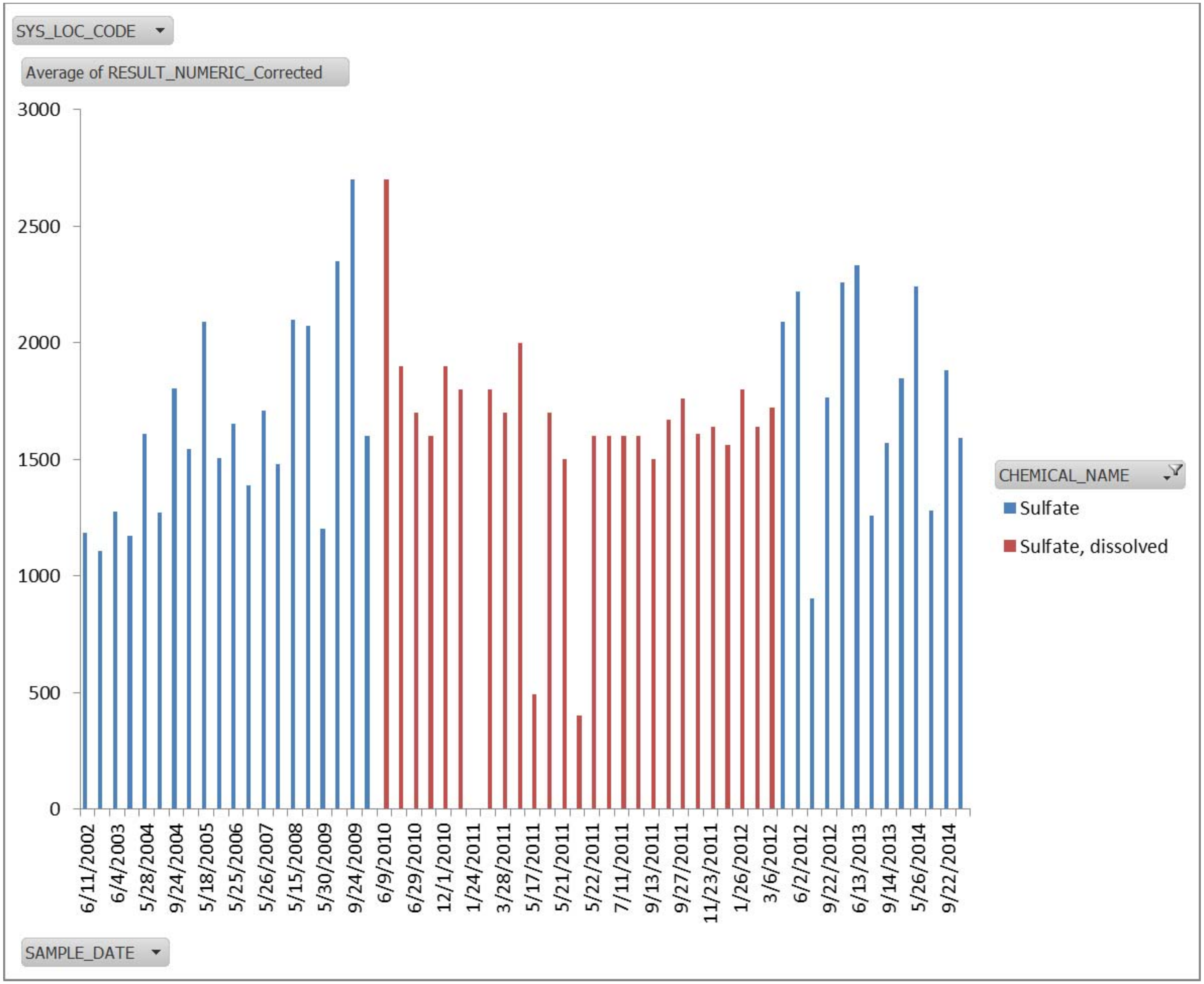
Geochemical Results 2000-2015

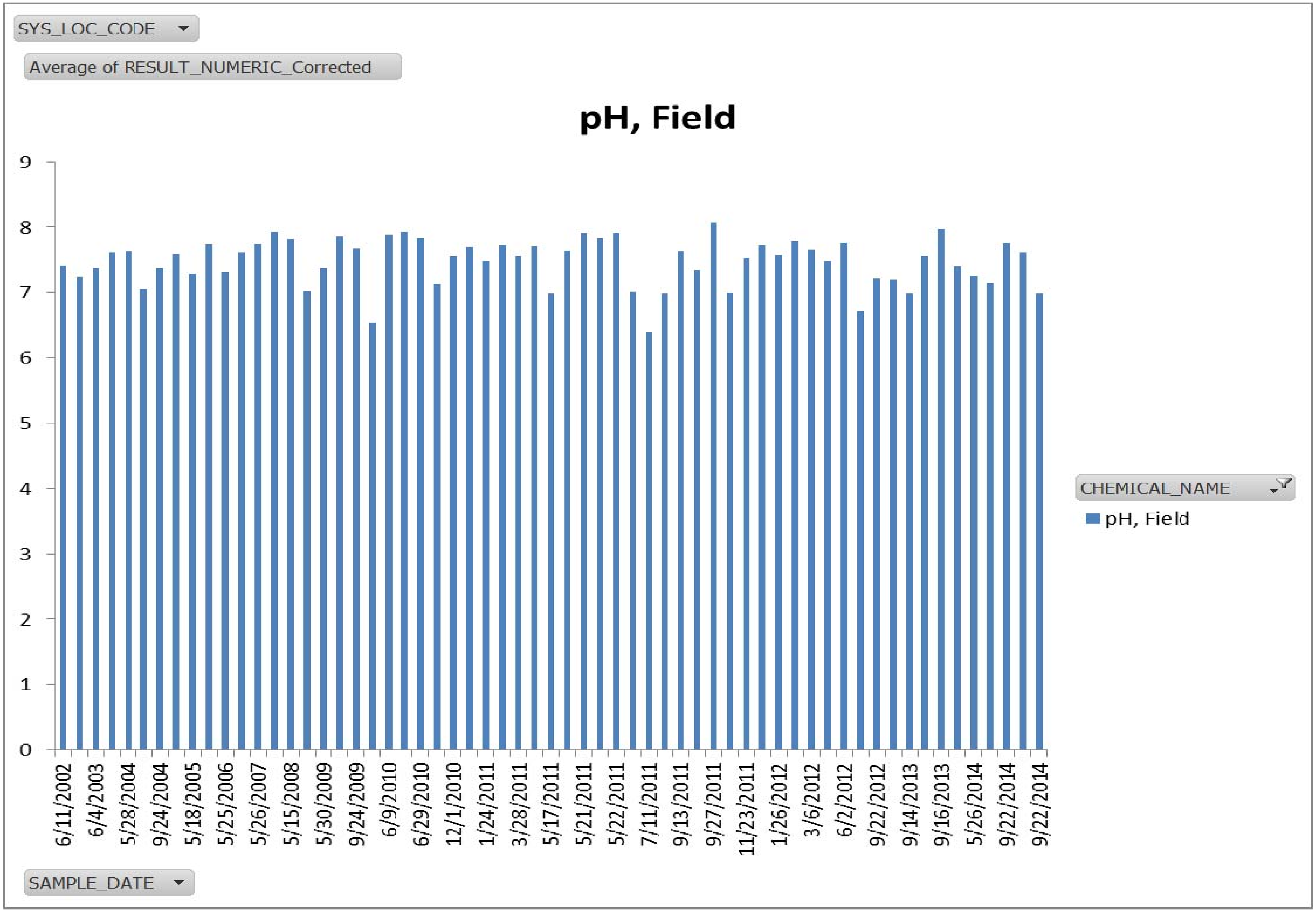
Sites: SRK-GD 1, 4, 5, 6, 16, 21



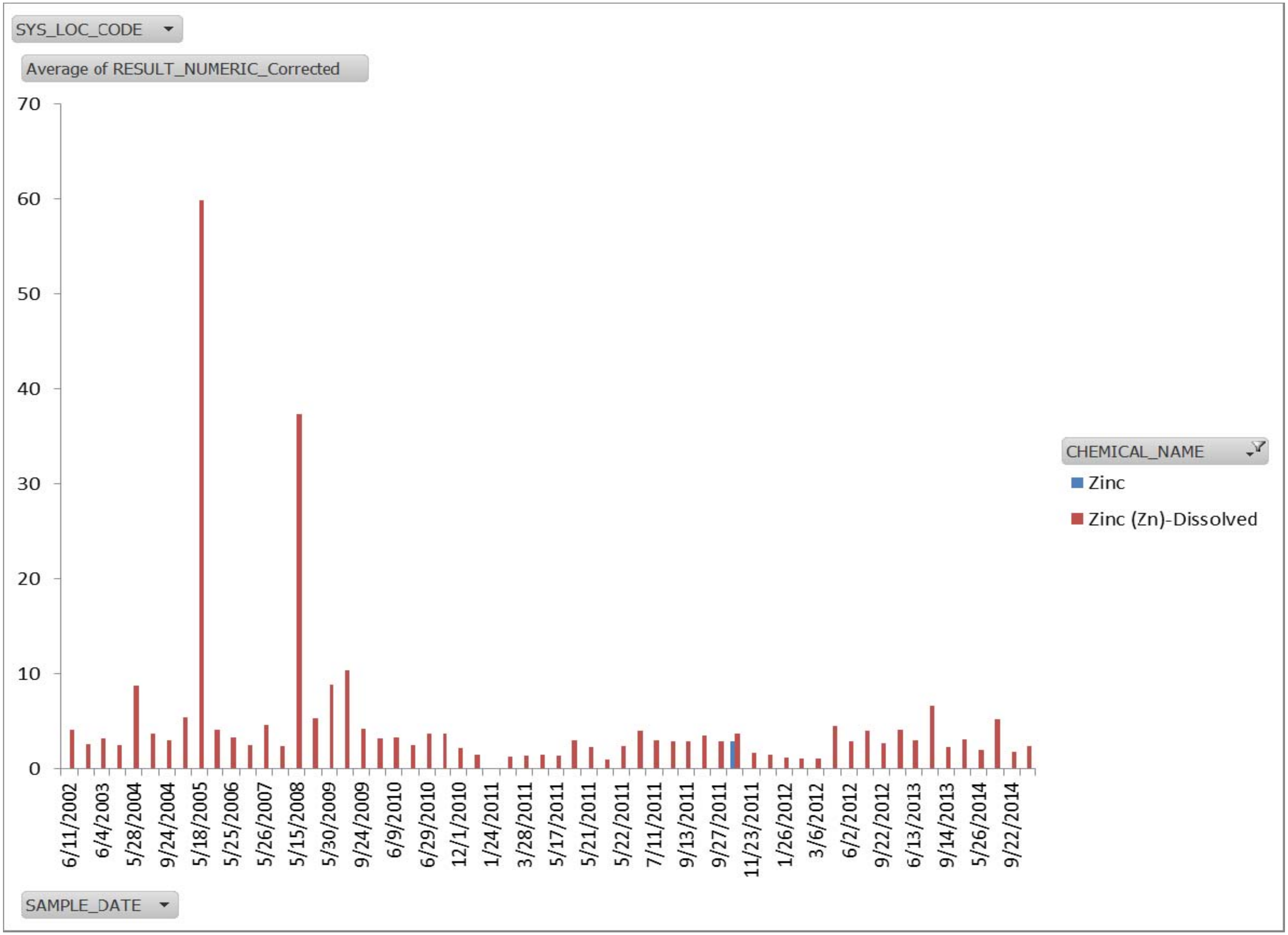
Assumptions for GSC Annual Performance Assessment

- Some measurements were reported in µg/L, others in mg/L. To keep consistency, values were transformed to mg/L where relevant.
- Values are reported as average of SRK-GD 1, 4, 5, 6, 16, 21 considered as one due to the geographical closeness of these seeps.
- If values were reported as less than the detection limit, for visualization purposes, they were graphed as the corresponding reporting limit.
- The scale of the graphs was mostly chosen to see the data in the context of the FMC Effluent Quality Standards. In a scale to show how close the measured values were to these reference values.
- Another focus of the graphs was to compare baseline data with conditions years after the GSC Cover was completed. In this context, the graphs focus on the trends before and after 2010 (when the GSC dry cover was completed).
- No values were discarded as outliers at this stage of the analysis, but in some cases, the maximum values of the graph's scales don't show abnormally high values.
- Construction of the GSC Cover occurred between June 24, 2010 and November 1, 2010. All the earthworks were completed during this summer, except for hydro-seeding, some regarding, and the construction of water management ponds.
- On May 17, 2011 excessive meltwater collapsed the system, causing overflow of hydraulic infrastructure and release on non-compliant water into the Vangorda Creek. See Rainey et al. 2013 report for more information.

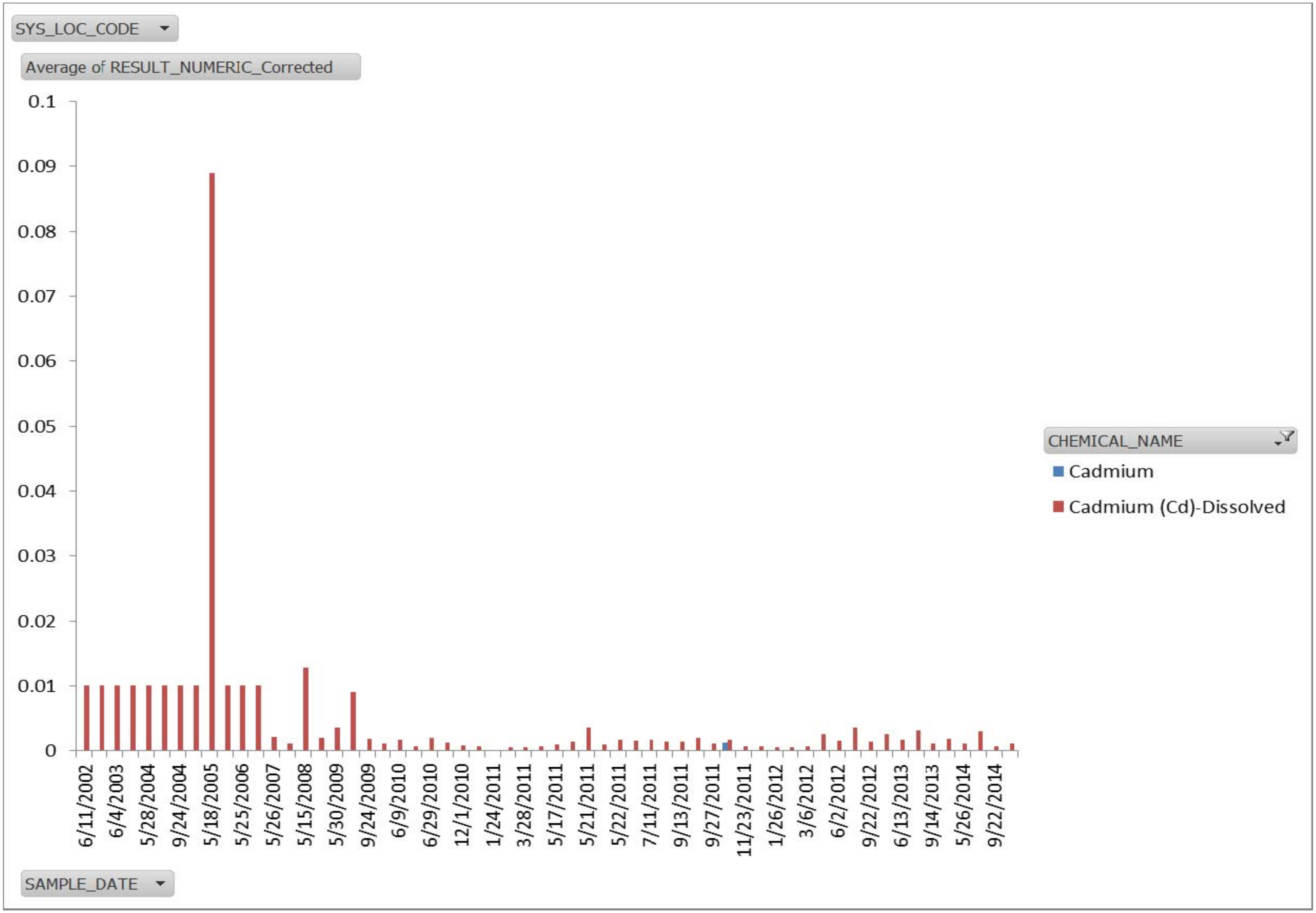

SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
3000
2500
2000
1500
1000
500
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
CHEMICAL_NAME
Sulfate
Sulfate, dissolved
SAMPLE_DATE



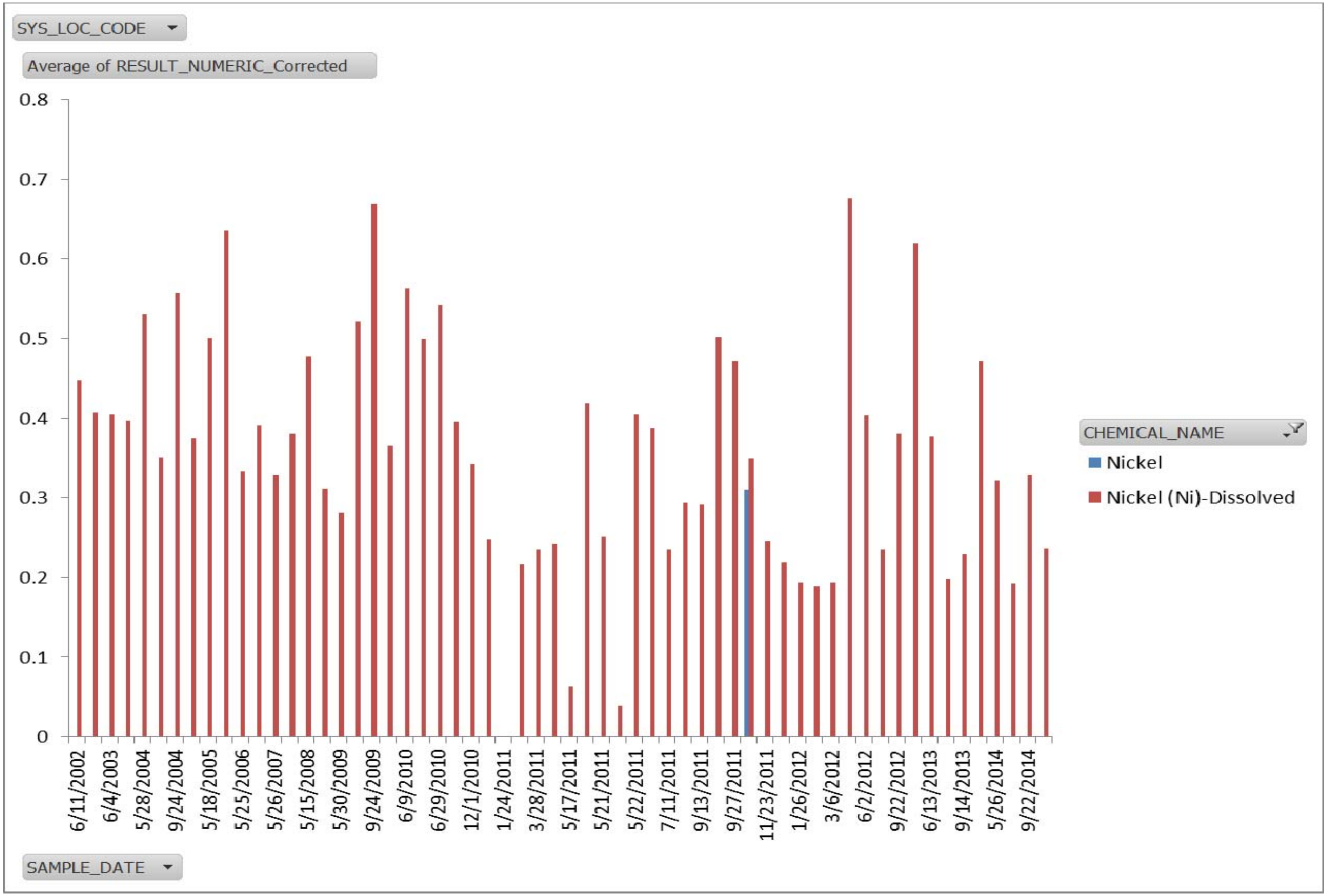
SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
pH, Field
9
8
7
6
5
4
3
2
1
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
9/14/2013
9/16/2013
5/26/2014
9/22/2014
9/22/2014
CHEMICAL_NAME
pH, Field
SAMPLE_DATE



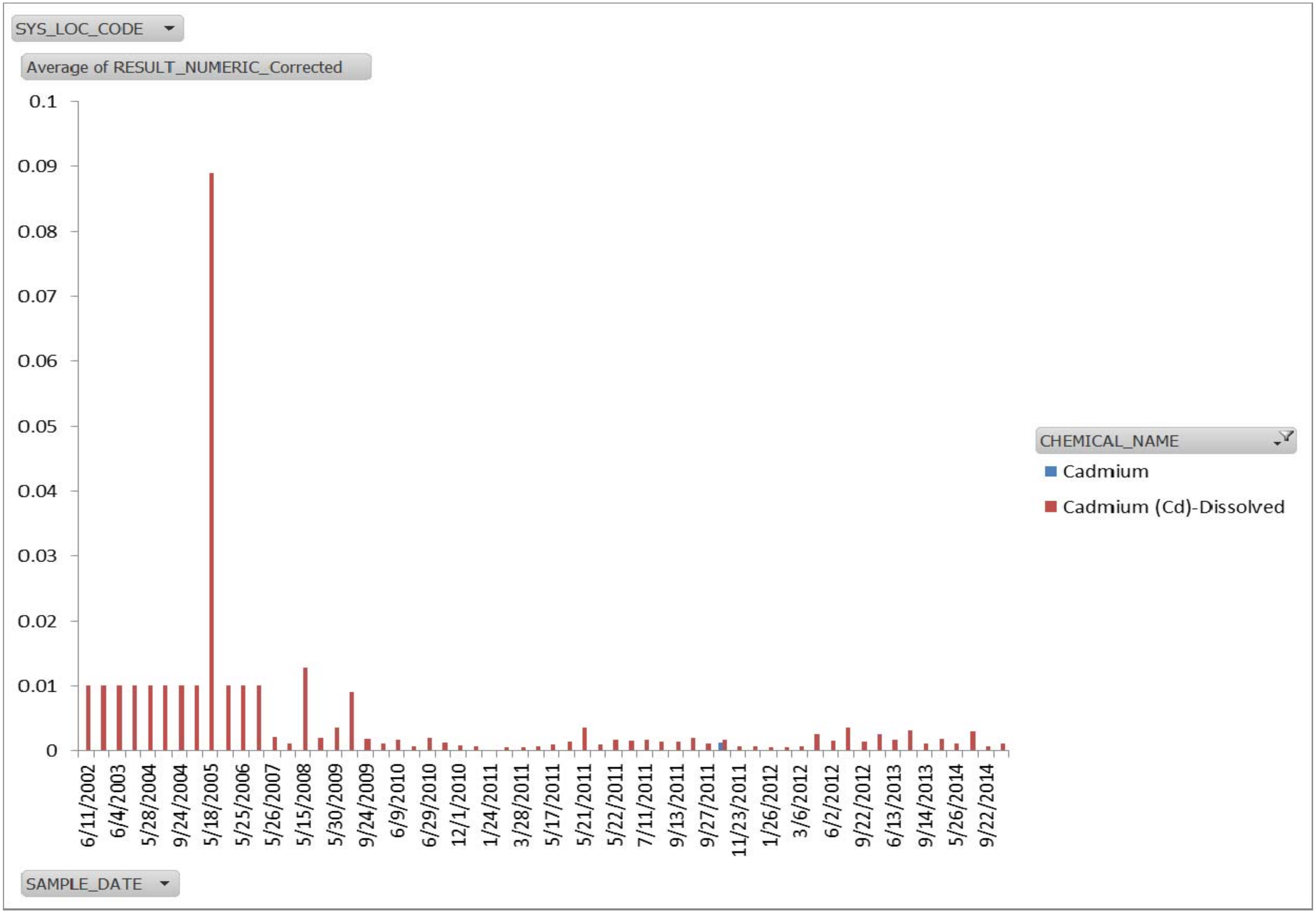
SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
70
60
50
40
30
20
10
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
CHEMICAL_NAME
Zinc
Zinc (Zn)-Dissolved
SAMPLE_DATE



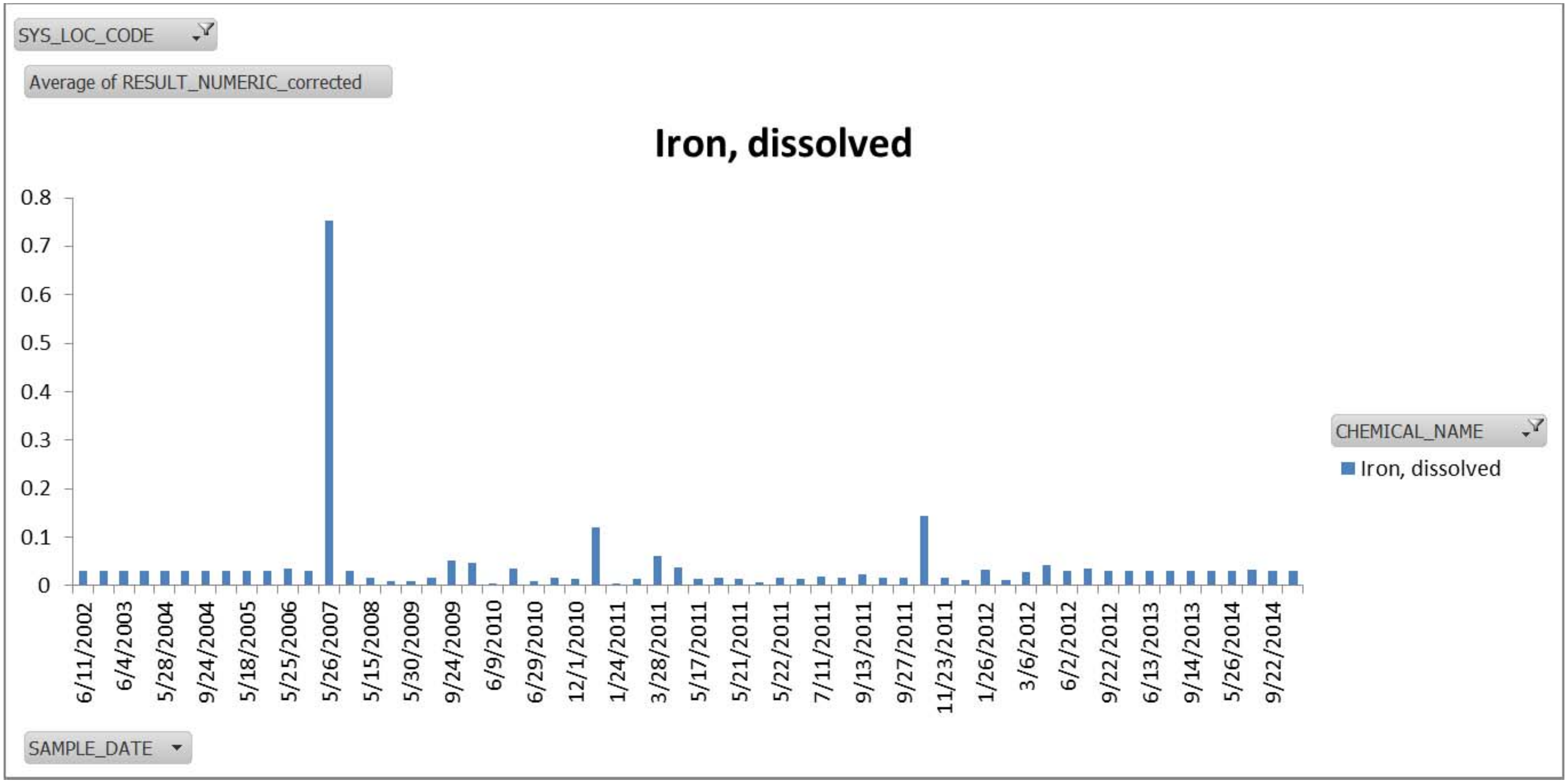
SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
SAMPLE_DATE
CHEMICAL_NAME
Cadmium
Cadmium (Cd)-Dissolved

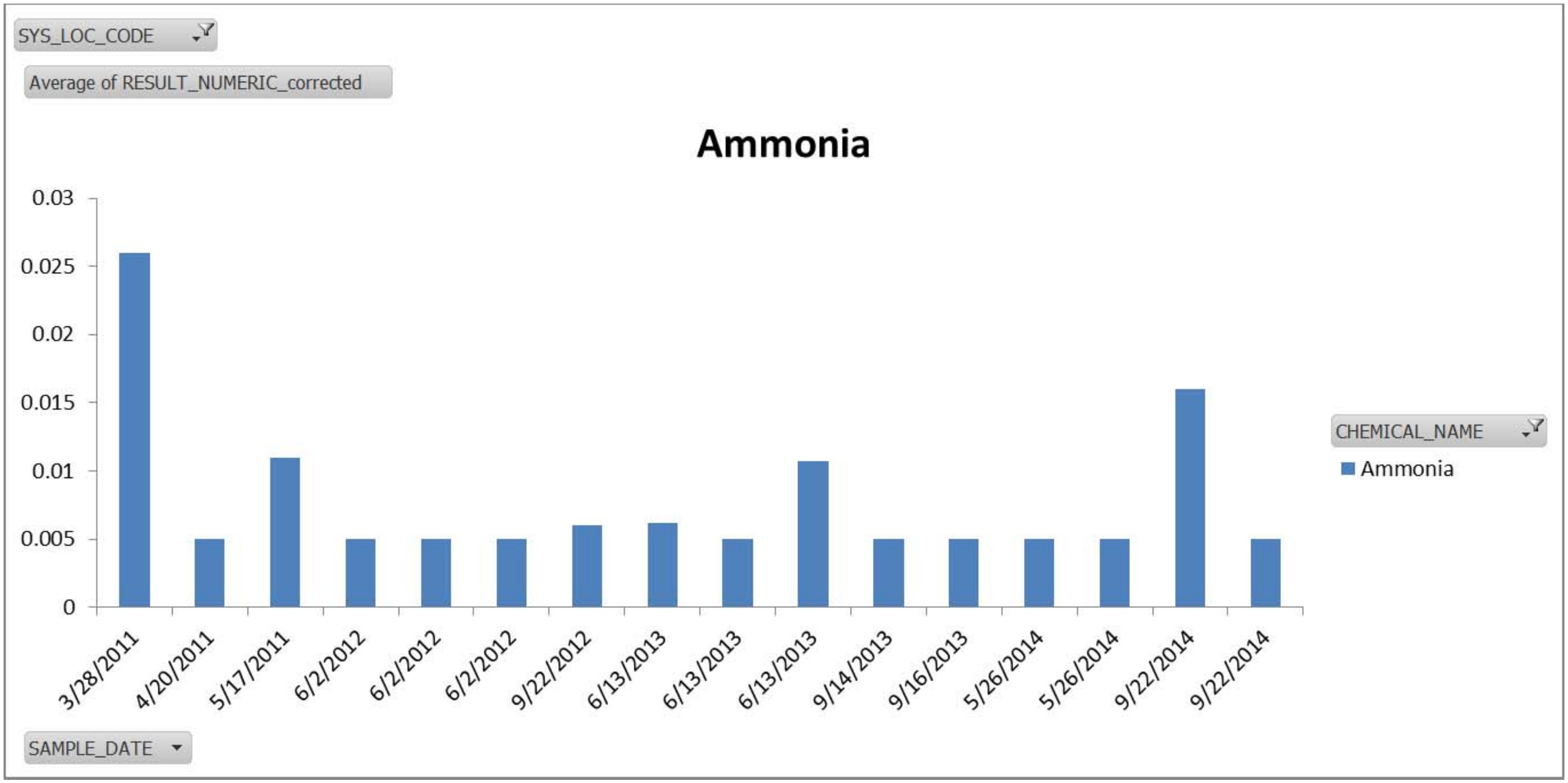


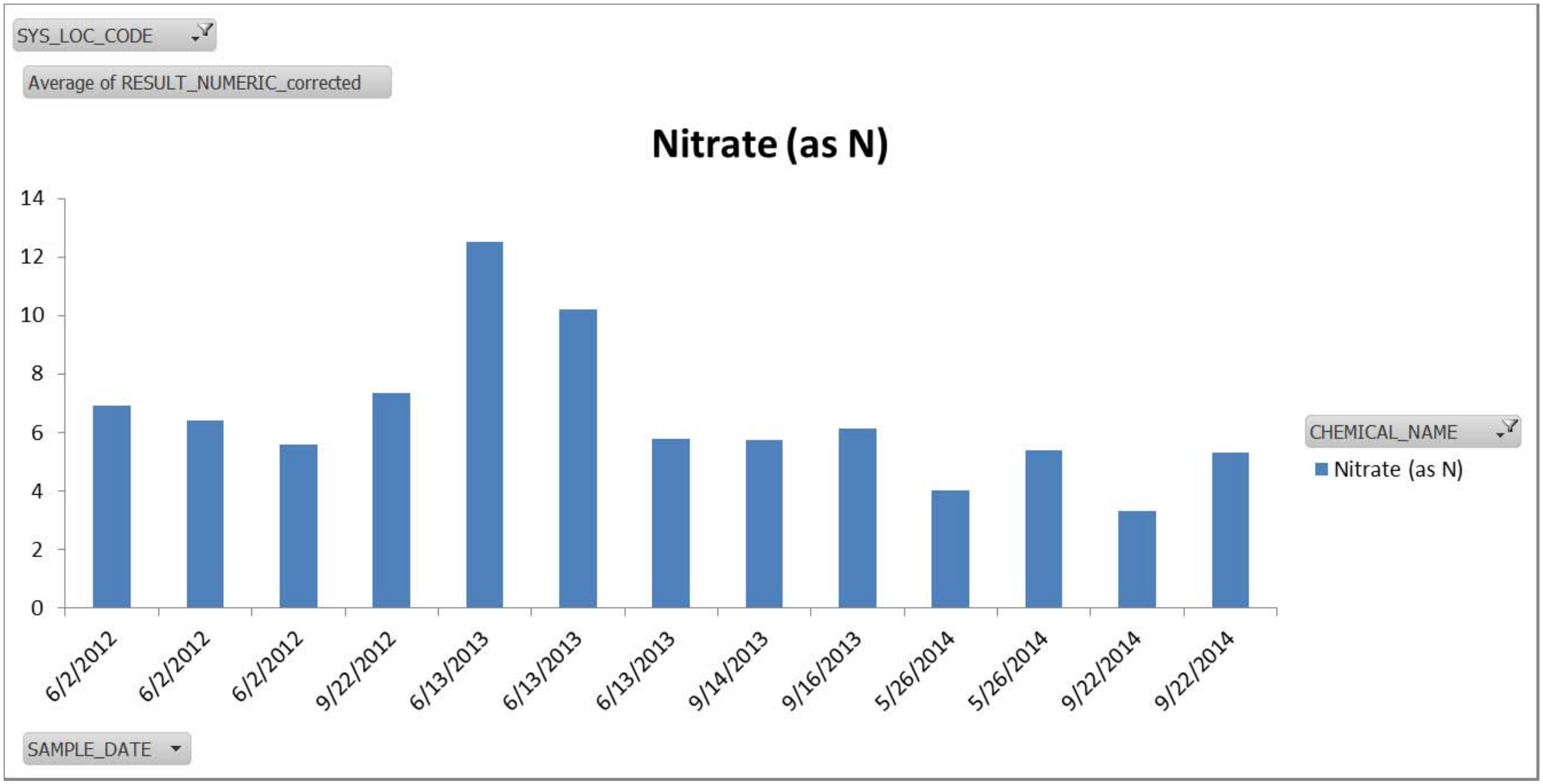
SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
SAMPLE_DATE
CHEMICAL_NAME
Nickel
Nickel (Ni)-Dissolved



SYS_LOC_CODE
Average of RESULT_NUMERIC_Corrected
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
SAMPLE_DATE
CHEMICAL_NAME
Cadmium
Cadmium (Cd)-Dissolved


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Iron, dissolved
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6/11/2002
6/4/2003
5/28/2004
9/24/2004
5/18/2005
5/25/2006
5/26/2007
5/15/2008
5/30/2009
9/24/2009
6/9/2010
6/29/2010
12/1/2010
1/24/2011
3/28/2011
5/17/2011
5/21/2011
5/22/2011
7/11/2011
9/13/2011
9/27/2011
11/23/2011
1/26/2012
3/6/2012
6/2/2012
9/22/2012
6/13/2013
9/14/2013
5/26/2014
9/22/2014
CHEMICAL_NAME
Iron, dissolved
SAMPLE_DATE


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Ammonia
0.03
0.025
0.02
0.015
0.01
0.005
0
3/28/2011
4/20/2011
5/17/2011
6/2/2012
6/2/2012
6/2/2012
9/22/2012
6/13/2013
6/13/2013
6/13/2013
9/14/2013
9/16/2013
5/26/2014
5/26/2014
9/22/2014
9/22/2014
SAMPLE_DATE
CHEMICAL_NAME
Ammonia


SYS_LOC_CODE
Average of RESULT_NUMERIC_corrected
Nitrate (as N)
14
12
10
8
6
4
2
0
6/2/2012
6/2/2012
6/2/2012
9/22/2012
6/13/2013
6/13/2013
6/13/2013
9/14/2013
9/16/2013
5/26/2014
5/26/2014
9/22/2014
9/22/2014
SAMPLE_DATE
CHEMICAL_NAME
Nitrate (as N)