Hydrometrics, Inc.

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TECHNICAL MEMORANDUM

DATE: May 25, 2021

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FROM: Al Hilty - Hydrometrics, Inc.

SUBJECT: March 24, 2021 East Fork Armells Creek Synoptic Run

EXECUTIVE SUMMARY

A synoptic surface water monitoring event (synoptic run) was conducted on East Fork Armells Creek (the Creek) on March 24, 2021. This was the 24th synoptic run conducted on the Creek since 1993. The 2021 synoptic run included monitoring at twelve sites on the Creek, a sewage treatment pond (NSTP) operated by the City of Colstrip, and a tributary to the Creek known herein as the Power Road Tributary (PRT). Surface water quality samples were collected at 12 sites along the Creek and from the NSTP. No flow was observed at PRT and samples were not collected. Flow was measured at each of the sites where flow was observed. Survey grade GPS equipment was used to measure surface water elevations in the Creek. In addition, groundwater elevations were surveyed at 19 sites immediately adjacent to the Creek in either open boreholes or piezometers. Paired surface water/groundwater elevations were used in combination with measured flows to evaluate gaining and losing patterns along East Fork Armells Creek and to prepare a water table map.

Precipitation records indicate 0.18 inches of precipitation were recorded in Colstrip during the week prior to the 2021 synoptic run. No precipitation was recorded during the two days prior to or during the synoptic run. Precipitation during water year 2020 (September 2019 through October 2020) was below average with 11.42 inches recorded. The 30-year average annual precipitation in Colstrip is 16.0 inches (based on 21 complete years). Approximately 1.7 inches

of precipitation were recorded in Colstrip in 2021 prior to the synoptic run (January through March), which is below the average for the period of record of 2.1 inches.

Flows measured in the Creek during the March 2021 synoptic run were below average, ranging from 38 gallons per minute (gpm) at AR-12, to 417 gpm at AR-6. Overall flow patterns generally followed historical trends with gaining flows downstream of AR-12 to AR-6 and then a transition to losing flow downstream of AR-6.

Site specific gaining and/or losing conditions were also evaluated using the comparison of surveyed elevations of paired groundwater and surface water sites. Water level relationships indicated gaining conditions at all sites except AR-4-W, AR-7-2W, CHE, and AR-6, where losing conditions were observed. Water level relationships were considered inconclusive of gaining or losing conditions at AR-7-1W and BPE due to measurements that were within the margin of error.

Total dissolved solids (TDS) concentrations and specific conductance (SC) are indicators of overall water quality. In March 2021, SC and TDS levels in East Fork Armells Creek were below the long-term averages indicating slightly improved water quality. However, concentrations of chloride and sulfate were above the long term averages at some sites. These trends are considered a function of the Creek water quality being at, or near, natural concentrations such that concentrations of chemical constituents are expected to fluctuate near or below the historical averages.

INTRODUCTION AND SCOPE

The synoptic run described in this technical memorandum was completed on East Fork Armells Creek (the Creek) on March 24, 2021. Work was conducted in accordance with the recently revised facility Water Resources Monitoring Plan (Talen Montana, LLC Colstrip Power Plant Water Resources Monitoring Plan Rev. 7 December 8, 2020). Work completed in 2021 was also consistent with the 2020 work plan (Talen Montana Colstrip Steam Electric Station 2020 East Fork Armells Creek Synoptic Run Work Plan, Hydrometrics, Inc.) that was approved by the Department of Environmental Quality (MDEQ).

Water quality samples were collected from 12 surface water sites in the Creek and a sewage treatment pond (NSTP), operated by the City of Colstrip, adjacent to the Creek. Since 2008, samples have also been collected when flow is present from a small tributary that enters the Creek directly north of Power Road (identified as Power Road Tributary (PRT)). Flow was measured at all of the Creek sites in 2021. No flow was observed at PRT. Locations for all the monitoring sites included in the 2021 synoptic run are shown on Figure 1. Descriptions and photographs of each site are included in Attachment 1.

Twenty-three previous synoptic runs have been conducted on the Creek. The first synoptic run was conducted in 1993. Since 2003, the synoptic runs have been conducted on an annual basis. All of the synoptic runs have been conducted in the spring, except in 2015, when a second synoptic run was conducted during the fall. Synoptic runs conducted in 1993, 1994, and 1996 included sites AR-1 through AR-5. Sites AR-6 through AR-11 were added in 2000. Site AR-12, located directly upstream of the Highway 39 culvert at the south end of Colstrip, was added in 2005.

Flow was measured using a Hach FH950 handheld flow meter at sites AR-1, AR-3, AR-5, AR-6, AR-7, AR-8, AR-9, AR-10, AR-11, and AR-12, a portable Montana flume (site AR-4), and a permanent Parshall flume at AR-2. Note that Hach FH950 flow meter flows were measured at AR-1 flume and AR-10 weir in addition to stage height, since submergence conditions were observed which affect the accuracy of flumes and weirs.

Water quality samples were collected from each surface water site prior to, and upstream of the flow measurement location to eliminate the potential for disturbance and entrapment of sediment in the sample due to channel disturbance. Samples were submitted to Energy Laboratories in Billings, Montana for analysis of the parameters listed in Table 1. Work proceeded from the farthest downstream site, PBR Flume AR-10, upstream to site AR-12. Note, that when discussing water quality results, sites will typically be listed from the site farthest upstream to the site furthest downstream.

Evaluation of gaining and losing reaches of a creek can be evaluated based on changes in flow across a reach. Further evaluation of gaining and losing reaches can be conducted based on the elevation relationship between the groundwater elevations and adjacent creek elevations. This type of evaluation is more selective in that it indicates flow at given points rather than over a reach. In 2021, groundwater levels were measured in hand augured boreholes adjacent to the Creek at 19 locations (AR-5-E, AR-5-W, AR-4-E, AR-4-W, AR-3-E, AR-3-W, AR-2-W, TPlant-W, AR-1-E, AR-1-W, AR-7-E, AR-7-W, BPW, BPE, CHE, AR-6-E, AR-6-W, AR-11-E, and AR-11-W. Surface water elevations in the adjacent Creek were surveyed at the time of groundwater level measurement. Groundwater monitoring locations are shown on Figure 1. Surface and groundwater elevations were measured using a survey grade GPS.

This technical memorandum presents results of the spring 2021 synoptic run and a comparison of these data to results from previous synoptic runs.

SITE CONDITIONS

Precipitation records which cover the period 1927 through April 2021 were obtained from the Western Regional Climate Center, National Climatic Data Center Co-Op (Site ID 241905). 0.18 inches of precipitation was recorded in Colstrip during the week prior to the 2021 synoptic run. No precipitation was recorded during the two days prior to or during the synoptic run. Precipitation during water year 2020 (September 2019 through October 2020) was below average with 11.42 inches recorded. The 30-year average annual precipitation in Colstrip is 16.0 inches (based on 21 complete years) and the annual average for the period of record (1927 to 2019) is 15.0 inches. Approximately 1.7 inches of precipitation were recorded in Colstrip in 2021 prior to the synoptic run. The average for these three months (January through March) for the period of record is 2.1 inches.

Figure 2 illustrates monthly precipitation totals for 2018, 2019, 2020 and 2021 and the mean monthly precipitation observed at the Colstrip Weather Station for the period of record from 1927. A plot of daily accumulation for January through April 30, 2021 is included in the figure inset to illustrate precipitation patterns preceding the synoptic run event.

Air temperatures the day of the synoptic run ranged from below freezing up to about 55^{o} Fahrenheit. Snow had all melted except for a small amount that was present under an accumulation of tumbleweeds adjacent to and in the streambed at AR-12. Overland flow was not observed during the synoptic run that would affect water quality or flow. As during previous synoptic runs, fish and aquatic insects were observed in the Creek. Plant growth was in the initial stages for the season, and some minor greening of grasses was noted. No fertilizer or water had been applied to the golf course.

SURFACE WATER

Measured Flow in East Fork Armells Creek

East Fork Armells Creek is categorized as an intermittent stream because surface water flow is not continuous in the Creek from its headwaters (approximately 13 miles west of Colstrip) to the confluence of West Fork Armells Creek (approximately 17 miles north of Colstrip). However, the reach through Colstrip generally exhibits perennial flow except during drought conditions when portions of it may be dry. Intermittent flow is attributable to limited contribution from bedrock sources or from groundwater stored in unconsolidated sediments along the Creek. In other words, flow stops when the groundwater level drops to below the Creek bed.

Flow was present throughout the entire reach (AR-12 to AR-10) during the March 2021 synoptic run. Synoptic runs are conducted at times when flows are not expected to be affected by runoff, prior to the onset of the growing season when evapotranspiration is minimal, prior to golf course irrigation and/or fertilization, and when groundwater discharge (bedrock or unconsolidated strata) is the primary component of surface water flow. No snow melting or overland flow that would affect surface water flow or water quality was noted during the 2021 synoptic run. However, as noted previously, a small amount of snow was observed below a large tumbleweed pile at AR-12 but no overland flow or melting was observed.

Gaining reaches are those that show an increase in flow, typically due to groundwater issuing to the Creek. Groundwater contributions may be from inflow of a regional bedrock system, from release of water from storage near the Creek, seepage from surface water bodies, higher alluvial groundwater levels, or a combination thereof. Other factors, such as surface water inflow from tributaries, precipitation runoff, and runoff from water usage in the town could also potentially result in gaining stream reaches. Surface water was not observed to be flowing into the Creek from any tributaries in March 2021 including the PRT.

Losing reaches are those characterized as having decreases in flow, typically due to infiltration through the Creek bottom and/or banks. Pumping groundwater from the alluvium or bedrock near the Creek may lower the water table and accentuate losses in losing reaches. The relationship between groundwater table elevations and surface water elevations is discussed later in this section. Other factors, such as evapotranspiration, diversions, or pumping directly from the Creek may also result in losing reaches. No diversions or direct pumping from the Creek were observed during the March 2021 event.

Stream flow measurements presented in Table 2 and on Figure 3 demonstrate an overall net gain in the Creek through the study area. In 2021, flow increased from about 38 gpm at AR-12 to 215 gpm at downstream site AR-10. However, various reaches showed gains or losses. Note also, that there is inherent error in measurement of stream flow. Depending on site conditions, this error can be as high as 20%. For example, an uneven, slightly curved, non-symmetrical channel with numerous cobbles will likely result in high error; whereas a straight, symmetrical, sandy channel will yield more accurate flow measurement results. Open channel flow conditions encountered during the 2021 synoptic run ranged from fair to very poor so the accuracy of the flow measurements (measured with Hach velocity meter) were estimated to vary from 8% to 20%. Nonetheless, paired data from stream gaging and water level measurements demonstrate that the Creek has multiple areas that either gain or lose water locally.

Permanent flume (AR-1) and weir (AR-10) measurements were affected by submerged conditions in 2021 caused by the flat topography, sedimentation, or vegetation near the flow devices. Flow at these sites was measured using a Hach flow meter due to these conditions. Flow at AR-1 was measured at the mouth of the flume. Flow at AR-10 was measured across the top of the weir plate. Accuracy of flow measured with the Hach at these sites is considered to be +/- 10%.

Heavy riparian vegetation was present at AR-2 but did not appear to cause irregular flow through the throat of the flume and calculated flows are considered to be accurate within 5 to 10%. Portable flume measurement conditions were good at AR-4 so the accuracy of the flow measurement can be expected to be within 5%.

Flows measured during synoptic runs conducted along the Creek in 2017, 2018, 2019, 2020 and 2021 are presented in Figure 3. Also shown are the maximum, minimum, and median flows that have been measured during all of the previous synoptic runs. Flow observations during the 2021 synoptic run were at or below median flows throughout the reach. Flow patterns in 2021 generally followed the median flow pattern with the following exceptions.

- Median flows for all synoptic runs have typically shown a very slight increase between AR-5 and AR-4. However, in 2021 as in 4 years previous, a decrease in flow was observed across this reach. The reduction in flow may be attributable to a combination of factors including lower lawn irrigation rates, lower overall water inputs from the south portion of Colstrip, a function of closing and capping Units 1&2 A Pond, and from capture well pumping on the Plant Site adjacent to this reach.
- Flow typically increases between AR-2 and AR-1. However, in 2021, as in 2017, flow decreased in this reach. Factors that could result in reduced flow at AR-2 include lower inputs from the north end of Colstrip and housing area directly east of AR-1, lower release of shallow groundwater from storage due to lower than average precipitation, less seepage from the Colstrip Treated Sewage Effluent Ponds and/or lower inputs from the Surge Pond. It is unlikely that increased flow has occurred from the Surge Pond, however, due to a lack of flow observed at PRT.

  Variations of reported flow at AR-1 may also be a function of flow conditions and measurement methods. Totally submerged conditions were present at AR-1 (no change between the H_a and H_b or the depth in the throat of the flume and depth downstream of the designed hydraulic drop water height). So flow through flume was basically a function of water height and cross sectional area. Flow calculated strictly on total cross sectional area and average measured velocity were 251 gpm, similar to the 223 gpm calculated using the Hach flow meter.

- Flow increased between AR-1 and AR-9. This increase in flow is believed to be attributable to flow measurement variations at AR-1 as described in the previous bullet point.
- A lower than normal drop in flow occurred between AR-11 and AR-10. The higher than normal reduction in flow is thought to be from lower than average precipitation that results in higher losses of surface water to groundwater.

Groundwater/Creek Elevation Survey

Groundwater elevations were measured at 19 piezometers and/or shallow augured boreholes adjacent to the Creek during the March 2021 synoptic run. Surface water elevations in the Creek were also measured. The purpose of the measurements was to collect data to evaluate the relationship of groundwater to surface water at each location. Groundwater and surface water elevations were measured directly using a survey grade GPS. To obtain the data, water levels were surveyed in boreholes or piezometers located on the stream bank and the upper surface of the adjacent Creek. These data were intended to supplement streamflow evaluations for gaining and losing areas.

Measurements were taken on each side of the creek at AR-5, AR-4, AR-3, AR-1, AR-6, AR-11 and in the vicinity of the ball park (BPE & BPW). Single measurements were taken at three sites: 1) TPLANT-W (west bank of the Creek downstream of the treated sewer ponds), 2) AR-2W, and 3) CHE (Club House East) located east of the Creek near the Ponderosa Butte Golf Course Club House). Two measurements on the west side of the Creek were taken at AR-7. Groundwater and paired surface water elevations are presented in Table 3.

Accuracy of GPS individual readings is considered to be 0.03 feet. Hence, differences of greater than 0.06 feet are consider either gains (groundwater flowing into creek) or losses (Creek water recharging groundwater) as they would fall outside of the margin of error. Differences of less than 0.06 may also indicate gains and losses but with much lower degree of confidence. These measurements provide an indication of site specific gains or losses as opposed to stream flow measurements which provide an indication in flow characteristics over an entire reach.

Surface Water Quality

Water quality data for the surface water samples collected during the March 2021 synoptic run are presented in Table 2. A tri-linear Piper diagram, illustrating relative quantities of major ionic constituents present in surface water samples from each site, is included as Figure 4. As shown on the Piper diagram, water sampled from all the Creek locations is a magnesium-calcium sulfate type. Water from the North Treated Sewage Lagoon (NSTP) exhibited no dominant cations or anions. Note that as indicated on the Piper diagram, contributions to surface water from the treated sewage effluent ponds do not appear to change the overall ionic balance in the Creek.

Figure 4 includes cation and anion distribution for water sampled from Units 1&2 B Pond (B Pond) collected in November 2018. As shown, water in B Pond is strongly magnesium-sulfate type water. B Pond is double lined pond with between and underliner collection, located east of the Creek, near AR-4. This pond typically received scrubber return water during operation of Units 1&2. Figure 4 illustrates the strong magnesium-sulfate type of water in B Pond. Although water sampled from the Creek is a magnesium-sulfate type water, it is much less so than in B Pond. Furthermore, Creek water is clustered suggesting little or no mixing with process water.

Decadal trends in SC, a general indicator of surface water quality, are presented in Figure 5 and show that overall water quality has improved in the Creek since beginning the synoptic run program. This improvement is indicated by the reduction in SC during subsequent decades. Only two data points are currently available for the 2020's. However, data collected during these two events suggest similar to slightly improved quality compared to the 2010's averages. It appears that SC may be at or near natural levels for the reach and further improvement may be limited. This would be indicated by year to year fluctuations near the lower measured levels, similar to what has been observed the past two years.

Additional spatiotemporal trends for individual indicator parameters (SC, sulfate, TDS, boron, chloride, and Calcium/Magnesium Ratio (Ca:Mg)) for all synoptic runs are displayed in Exhibits 1 and 2. Specifically, time series plots of SC, TDS, and sulfate observations are presented in Exhibit 1 and time series plots of boron, chloride, and Ca:Mg are shown in Exhibit 2. Graphs presented on Figures 6 through 12 illustrate results for SC, TDS, chloride, boron, sulfate, nitrate plus nitrite (N+N), and the calcium to magnesium ratio from the March 2017, April 2018, April 2019, March 2020 and March 2021 synoptic run events. These figures include the maximum, minimum, and average levels recorded during all of the synoptic runs for the specified parameters. Graphs that include data for each indicator parameter for all synoptic run events are contained in Attachment 2. A data validation and summary analysis report for the March 2021 samples are presented in Attachment 3.

Overall water quality was better in March 2021 than long-term averages. Water from AR-5 down to AR-9 had a higher SC than the 2010 to 2019 decade. The SC downstream of AR-9 was below the average for the 2010-2019 decade. In 2021, water in the Creek continued to be better than that observed in the 1990's and 2000's and was generally similar to water sampled in the 2010's. The exception is at site AR-3 where higher concentrations of chemical constituents were measured in 2021 when compared to 2010. Year to year fluctuations may be expected in future events due to rain and snowfall conditions, temperatures, city water use, upstream conditions, and recreational uses and runoff. Observations for individual indicator parameters observed during the March 2021 synoptic run are included under the following headings:

Specific Conductance

As mentioned previously, specific conductance (SC) is an indicator of overall water quality (http://water.usgs.gov/edu/characteristics.html#). Lower SC levels typically indicate better quality water, while higher levels are typical of poorer water quality. SC measured during synoptic runs, presented by average levels per decade at each site, are used to illustrate longer term water quality trends. The average SC at each site per decade (1990's, 2000's and 2010's) is shown in Figure 5. Note the average SC before 2010 are not true decadal averages because none of the "decades" have ten years of observation. However, use of averages of SC measured during each decade allows for comparisons while discounting normal year to year fluctuations. As illustrated in Figure 5, the average SC measured at each site has decreased each decade suggesting improved overall water quality. SC values in 2021 continued to be below average values (Figure 5) except at AR-3 where the values were near the period of record average. Higher values at AR-3 may be a function of:

- Inputs to the system from the small tributary drainage that enters the Creek from the east a short distance upstream of the site,
- heavy riparian vegetation in the tributary and main drainage upstream of the site which would tend to increase evapotranspiration,
- runoff from the sand, gravel and cement facility directly east of the site.

A longitudinal profile of SC from upstream to downstream is plotted in Figure 6. The plot includes minimum, maximum, and average SC observations for the period of record, and individual results for synoptic runs completed in March 2017, April 2018, April 2019, March 2020 and March 2021. In 2021, SC measured in the field ranged from 3,189 at AR-6 to 4,086 umhos/cm at AR-3 with an average of 3,311 umhos/cm, similar to the average for 2020. The relative percent difference (RPD) between the highest and lowest SC was about 25%.

<u>Total Dissolved Solids</u>

Figure 7 is a graph of TDS concentrations for the March 2021 synoptic run. The plot also includes minimum, maximum, and average TDS concentrations for the period of record, individual results for March 2017, April 2018, April 2019, March 2020 and March 2021 synoptic runs. In March 2021, TDS concentrations closely followed the SC profile previously discussed. TDS concentrations were below averages at all sights but higher than the previous two years.

<u>Chloride</u>

Chloride concentrations observed along the Creek in March 2021 and previous 4 events are illustrated on Figure 8. Figure 8 includes chloride concentrations from the past five synoptic runs plus minimum, maximum, and average concentrations for the all of the synoptic runs. All synoptic run chloride concentrations are shown on a graph in Exhibit 2.

Chloride concentrations have typically been highest at the uppermost AR-12 site and decreased downstream to AR-7. Average values of chloride show a very slight increase downstream of AR-7. In 2021, however, chloride concentrations increased slightly between AR-12 and AR-3 then decreased downstream to AR-7. Chloride concentrations showed a slight overall increase downstream of AR-7. Overall variations of chloride concentrations through the reach were minor (69 mg/L at AR-7 to 115 mg/L at AR-3).

<u>Total Recoverable Boron</u>

Figure 9 presents the longitudinal distribution of reported concentrations of total recoverable (TR) boron for 2021 and the previous four synoptic runs. The figure includes minimum, maximum, and average TR boron concentrations for all synoptic runs on the Creek. Total recoverable boron concentrations recorded in March 2021 were below long-term averages at all sites along the Creek. The overall pattern followed long term trends, with concentrations increasing from AR-12 to AR-3, then decreasing downstream of the Colstrip treated sewage effluent ponds. Concentrations ranged from 0.59 mg/L at AR-12 to 1.65 mg/L at AR-3. Total recoverable boron concentrations from all previous synoptic runs are also illustrated on Exhibit 2.

<u>Sulfate</u>

Sulfate concentrations along the Creek are plotted on Figure 10. The plot includes sulfate concentrations for the last four synoptic runs and minimum, maximum, and average concentrations for the period of record.

Sulfate concentrations in 2021 generally followed the overall patterns from previous synoptic runs. Reported sulfate concentrations were higher than the long-term average at sites AR-12, AR-4, AR-3, AR-1 and AR-9 and below average at AR-2, AR7, AR-6, AR-11, and AR-10. Concentrations were near average at AR-5 and AR-8. Fluctuations around the average are expected due to normal environmental fluctuations.

<u>Nitrate plus Nitrite</u>

A longitudinal profile of nitrate plus nitrite (N+N) concentrations for the period 2017 through 2021 are plotted on Figure 11. Historical minimum, maximum and average values for the period of record are included. Values below the reporting limit were plotted as zero. N+N concentrations in water samples collected in March 2021 were low, ranging from below the reporting limit of 0.01 mg/L (AR-8 and AR-11) to 0.26 mg/L at AR-5.

Note that anomalously high N+N concentrations (typically the maximum observed) were reported at most sites during the 2012 synoptic run; specifically, N+N concentrations were 20 to 200+ times above historic concentrations at AR-5 and sites downstream of AR-2. Although these data appeared to be anomalous, the contract analytical laboratory (Energy Labs) validated the 2012 N+N results. The high concentrations recorded in 2012 skewed the data resulting in a notable increase in the long-term average at sites downstream of AR-2. In 2020, N+N concentrations were 0.26 mg/L (AR-5) or less at all Creek sites. N+N concentrations in the NSTP were reported at 1.08 mg/L. The higher concentrations at NSTP were not reflected in Creek samples.

<u>Calcium/Magnesium Ratio (Ca:Mg)</u>

With a few exceptions, process water is enriched in magnesium in relation to calcium. As a result, low Ca:Mg ratios in local groundwater and/or surface water are possibly indicative of mixing with process water. Note, however, that calcium chloride and magnesium chloride have commonly been used for road treatment. Depending on the chemical used, runoff characteristics, precipitation, evapotranspiration, and other factors, the ratio of calcium to magnesium could vary widely in the Creek.

A longitudinal profile of Calcium/Magnesium Ratios (Ca:Mg) along the Creek for the last five synoptic runs, plus the maximum, minimum and average, is presented in Figure 12. In March 2021, Ca:Mg were well above average at all sites for the period of record. The Ca:Mg ratios were near all-time highs at AR8, AR-7, AR-6 and AR11.

<u>Bromide</u>

Operators began adding calcium bromide ($CaBr_2$) to the wet scrubber process in 2009 to enhance mercury removal; as such, increased concentrations of bromide may be present in process water. Bromide has been included on the synoptic run parameter list since 2012 as a potential indicator of recent process water impacts. Note, however, that bromide may also be found in road treatment and other products typically used in industrial and urban areas. Detectable concentrations of bromide have been observed sparingly in the Creek (Figure 13). In 2021, bromide was detected at AR-12, AR-3, AR-2, AR-9 and AR-8. All other sites had non-detectable concentrations.

Power Road North Side Tributary Surface Water Site (PRT)

Water was present in the drainage but no flow was observed. Hence, flow was not measured and water quality samples were not collected.

North Sewage Treatment Pond (NSTP)

A water quality sample was collected from the NSTP during the April 2021 synoptic run event. The water quality results from this site are included on Table 2. As in the past, water from site NSTP generally had lower constituent concentrations than any of the Creek sites. Concentrations of indicator parameters in the NSTP were: SC = 1,750 µmhos/cm; sulfate = 608 mg/L, total recoverable boron = 0.76 mg/L, chloride = 91 mg/L, Ca:Mg = 0.86 and bromide = <0.5 mg/L. Laboratory and field pH were both 9.7 and 9.3 s.u. respectively, higher than any of the synoptic run sites.

Alluvial Groundwater Flow along the Creek

Figure 14 is a potentiometric map constructed using water levels measured in March 2021 from the Creek, piezometers, augured boreholes and monitoring wells located near the Creek. In general, water table contours are perpendicular to the Creek or curve around the Creek with an upstream apex. This suggests a flow path that is either parallel to or convergent (gaining) with the Creek.

TABLES

TABLE 1. EAST FORK ARMELLS CREEK SYNOPTIC RUN SURFACE WATER ANALYTICAL PARAMETERS - 2021

Constituent	USEPA Analytical Method	Requested Laboratory Reporting Limit (mg/L) Unless Noted
Dissolved Oxygen	Field	
pH		
Temperature		
Specific Conductivity @ 25° C		
ORP (Oxidation Reduction Potential)	Field	
pH	150.2/A 4500 H B	0.1 s.u.
Specific Conductivity @ 25° C	120.1/A 2510 B	1 µmhos/cm
Total Dissolved Solids, filterable	A2540 C	10
Total Alkalinity as $CaCO_3$ (Hardness)	310.1 or SM A2320B	4
Bicarbonate	SM A2320B	4
Carbonate	310.1 or SM A2320B	4
Bromide	300.0	0.5
Sulfate	300.0	1.0
Chloride	300.0	1.0
Calcium(1)	200.7/200.8	1.0
Magnesium(1)	200.7/200.8	1.0
Sodium(1)	200.7/200.8	1.0
Potassium(1)	200.7/200.8	1.0
Nitrate+Nitrite as Nitrogen	353.2	0.01
Boron(2)	200.7/200.8	0.05
Cobalt(2)	200.7/200.8	0.005
Lithium(2)	200.7/200.8	0.01
Manganese(2)	200.7/200.8	0.001
Mercury(2)	245.1	0.0001
Molybdenum(2)	200.7/200.8	0.001
Selenium(2)	200.7/200.8	0.0006

(1) Dissolved analysis only
(2) Metals will be analyzed as Total Recoverable and Dissolved

TABLE 2. EAST FORK ARMELLS CREEK SYNOPTIC RUN FLOW MEASUREMENTS AND SURFACE WATER QUALITY RESULTS - 2021

Flow Direction → Downstream →

Parameter/Site Physical Properties	AR-12	AR-5	AR-4	AR-3	NSTP	AR-2 South Flume	Power Road Tributary	AR-1 North Flume	AR-9	AR-8	AR-7	AR-6	AR-11	AR-10 PBR Flume
Flow (GPM)	38	88	40	96		246	No Sample	223	340	389	327	417	399	215
Flow (CFS)	0.086	0.196	0.089	0.215		0.548		0.497	0.758	0.868	0.729	0.928	0.889	0.478
Dissolved Oxygen, Field (mg/L)	7.67	7.32	7.23	8.4	23.17	12.72		9.34	10.46	9.76	10.63	11.32	10.99	15.9
pH, Field (standard units)	8.2	7.97	8.2	7.87	9.72	8.08		8.17	8.24	8.32	8.27	8.33	8.3	8.09
pH, Lab (standard units)	7.8	7.7	7.9	7.7	9.3	8		8	8.1	8.1	8.1	8.2	8.1	8.1
Specific Conductance, Lab 25^{o}C umhos/cm	4100	3870	3840	4260	1750	3490		3420	3360	3320	3300	3300	3350	3440
Specific Conductance, Field	3947	3599	3696	4086	1654	3329		3346	3209	3209	3203	3189	3233	3348
Solids,Total Dissolved TDS @ 180^{o}C (mg/L)	3840	3560	3600	3970	1220	3160		3030	2940	2960	2960	2940	3040	3110
Temperature, Field (^{o}C)	1.7	3.7	3.1	3.4	7	6.4		1.6	1.5	0.8	0.5	0.1	0.5	0.4
Common Ions (mg/L)														
Bicarbonate as HCO_3	648	587	577	644	249	521		559	542	529	530	528	531	536
Calcium (Ca)	334	324	324	362	93.2	305		283	275	270	267	266	266	263
Carbonate as CO_3	<4	<4	<4	<4	67	<4		<4	<4	<4	<4	<4	<4	<4
Chloride (Cl)	107	100	109	115	91	91		81	80	75	69	71	78	73
Magnesium (Mg)	410	385	382	426	109	317		305	300	295	289	292	293	304
Potassium (K)	17	16	15	13	24	14		13	13	13	13	13	13	13
Sodium (Na)	231	203	200	237	144	181		191	191	188	190	188	195	207
Sulfate (SO_4)	2600	2220	2430	2480	608	1950		2100	2080	1940	1790	1860	1980	1880
Alkalinity, Total as $CaCO_3$	531	481	474	528	316	427		458	444	434	435	433	436	439
Bromide	0.5	<0.5	<0.5	1.4	<0.5	0.6		<0.5	0.5	0.5	<0.5	<0.5	0.5	<0.5
Calcium/Magnesium Ratio	0.81	0.84	0.85	0.85	0.86	0.96		0.93	0.92	0.92	0.92	0.91	0.91	0.87
Nutrients (mg/L)														
Nitrogen, Nitrate+Nitrite as N (NO_3+NO_2)	0.04	0.26	0.05	0.05	1.08	0.13		0.04	0.02	<0.01	0.02	0.02	<0.01	0.02
Metals (mg/L)														
Boron, Dissolved (B)	0.6	0.9	0.9	1.7	0.76	1.36		1.15	1.15	1.13	1.12	1.14	1.14	1.08
Boron, Total Recoverable (B)	0.59	0.92	0.96	1.65	0.75	1.34		1.18	1.17	1.12	1.13	1.11	1.14	1.13
Cobalt, Dissolved (Co)	<0.005	<0.005	<0.005	0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt, Total Recoverable (Co)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lithium, Dissolved (Li)	0.13	0.09	0.08	0.09	0.06	0.08		0.07	0.08	0.07	0.08	0.07	0.07	0.08
Lithium, Total Recoverable (Li)	0.12	0.09	0.09	0.09	0.06	0.08		0.07	0.08	0.08	0.08	0.08	0.08	0.07
Manganese, Dissolved (Mn)	0.518	0.34	0.01	1.63	0.009	1.31		0.095	0.071	0.172	0.131	0.116	0.136	0.133
Manganese, Total Recoverable (Mn)	0.57	0.46	0.011	1.61	0.033	1.3		0.096	0.079	0.178	0.139	0.116	0.176	0.145
Mercury, Dissolved (Hg)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mercury, Total Recoverable (Hg)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum, Dissolved (Mo)	0.002	0.003	0.002	0.002	0.001	0.002		0.002	0.002	0.002	0.002	0.002	0.002	0.002
Molybdenum, Total Recoverable (Mo)	0.003	0.003	0.002	0.002	0.001	0.002		0.002	0.001	0.002	0.004	0.002	0.002	0.002
Selenium, Dissolved (Se)	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006		<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0007
Selenium, Total Recoverable (Se)	0.0007	0.0007	0.0007	<0.0006	<0.0006	<0.0006		<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0007

NA - Not Applicable
NSTP - North Sewage Treatment Pond

TABLE 3.
COMPARISON OF SURFACE WATER AND GROUNDWATER ELEVATIONS
EAST FORK ARMELLS CREEK SYNOPTIC RUN - 2021

Site	Groundwater	Surface Water	Difference	Stream (Gaining or Losing)
AR-5-E	3231.48	3230.73	0.75	Gaining
AR-5-W	3230.86	3230.73	0.14	Gaining
AR-4-E	3224.61	3224.53	0.07	Gaining
AR-4-W	3224.44	3224.53	0.09	Losing
AR-3-E	3214.13	3213.96	0.17	Gaining
AR-3-W	3214.10	3213.96	0.14	Gaining
AR-2-W	3209.46	3209.13	0.33	Gaining
Tplant-W	3202.13	3201.55	0.58	Gaining
AR-1-E	3186.34	3185.46	0.88	Gaining
AR-1-W	3186.74	3185.04	1.71	Gaining
AR-7-2W	3165.88	3166.10	0.22	Losing
AR-7-1W	3164.92	3164.90	0.02	No Gain or Loss
CHE	3162.30	3162.40	0.10	Losing
BPE	3160.37	3160.33	0.04	No Gain or Loss
BPW	3156.65	3156.55	0.10	Gaining
AR-6-E	3153.29	3154.17	0.87	Losing
AR-6-W	3151.35	3151.71	0.37	Losing
AR-11-E	3146.01	3145.44	0.56	Gaining
AR-11-W	3145.99	3145.44	0.55	Gaining

Difference measured with laser level

BPW - Ball Park West, BPE - Ball Park East, CHE - Clubhouse east, Tplant-W - Treatment plant West

FIGURES

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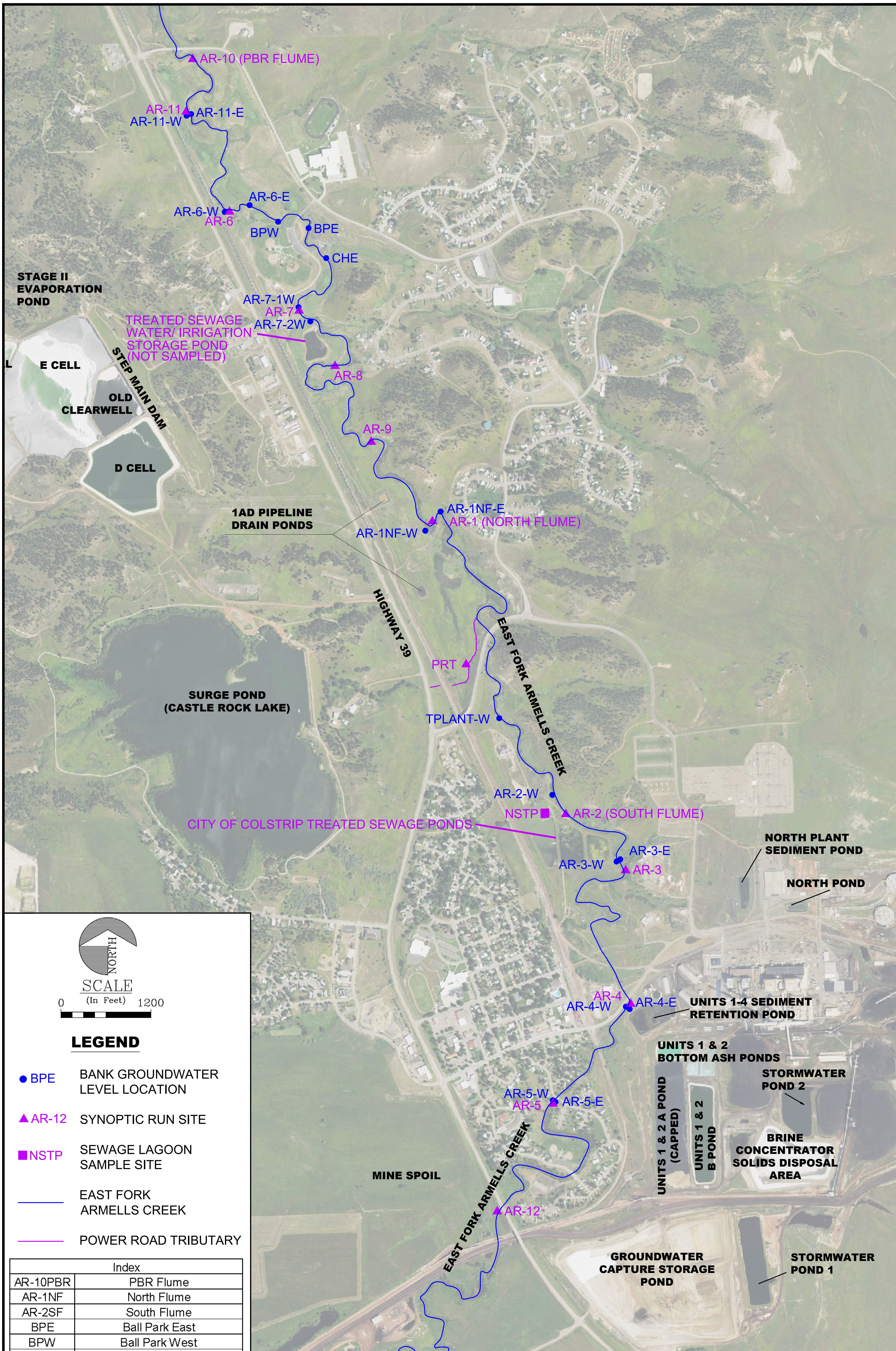


LEGEND

- ● BPE — BANK GROUNDWATER LEVEL LOCATION
- ▲ AR-12 — SYNOPTIC RUN SITE
- ■ NSTP — SEWAGE LAGOON SAMPLE SITE
- EAST FORK ARMELLS CREEK
- POWER ROAD TRIBUTARY

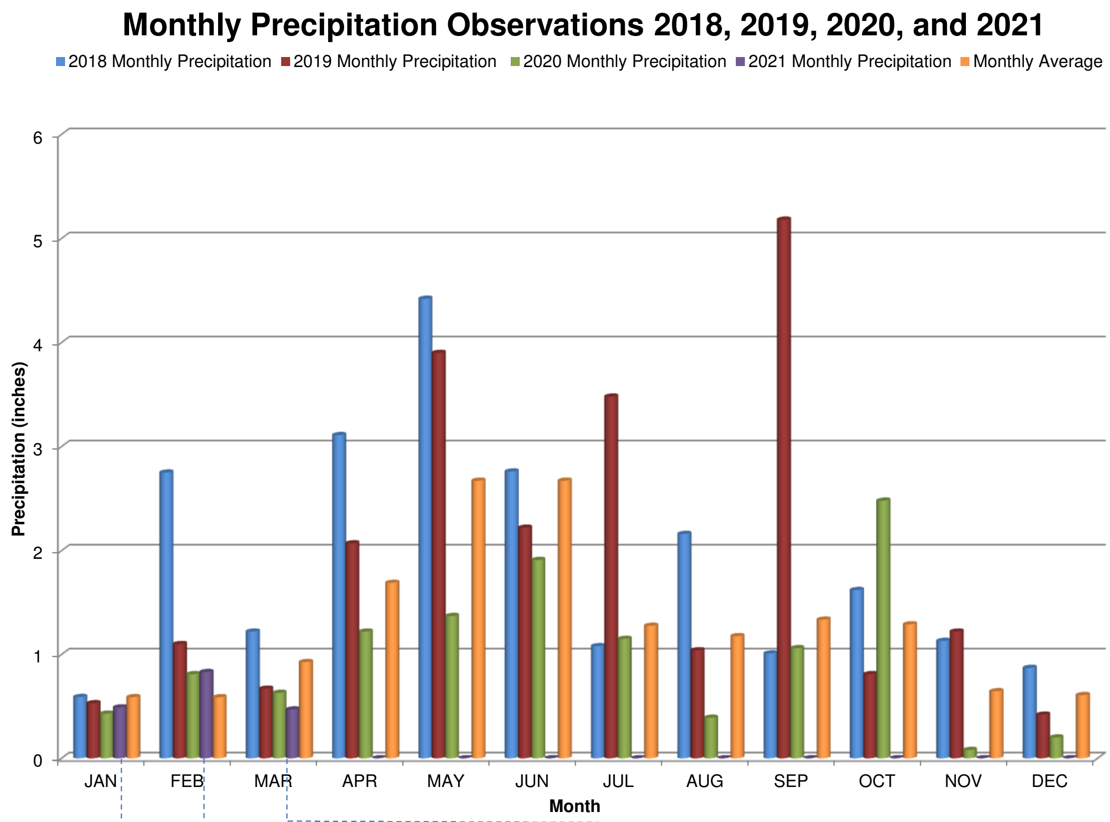
Index	
AR-10PBR	PBR Flume
AR-1NF	North Flume
AR-2SF	South Flume
BPE	Ball Park East
BPW	Ball Park West
CHE	Club House East
NSTP	North Sewage Treatment Pond
PRT	Power Road Tributary
TPLANT-W	Treatment Plant West

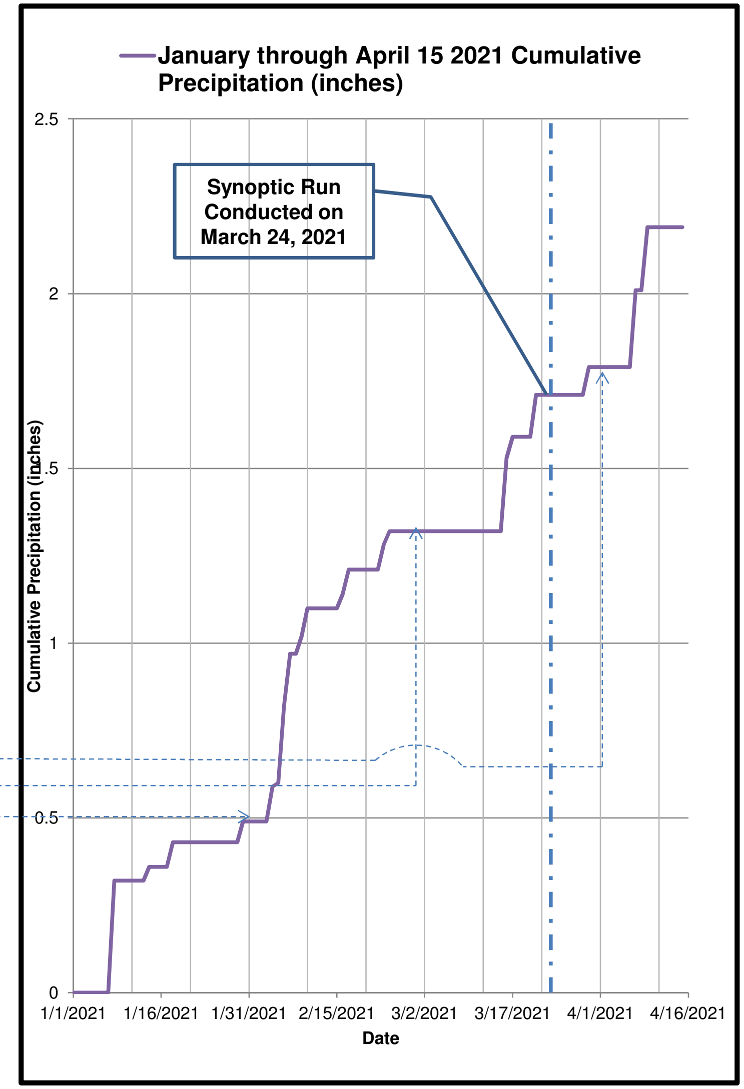
Hydrometrics, Inc.
Consulting Scientists and Engineers

TALEN MONTANA, LLC
MARCH 2021 EAST FORK ARMELLS CREEK
SYNOPTIC RUN

2021 SYNOPTIC RUN SITES

FIGURE
1





Note: Monthly averages for 2021 only shown for months leading up to Spring 2021 Synoptic Run (January, February, and March). Monthly Average is average for period of record through 2020.

Data from Western Regional Climate Center, National Climatic Data Center Co-Op Site ID 241905.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt1905

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MARCH 2021 EAST FORK ARMELLS CREEK SYNOPTIC RUN TALEN MONTANA, LLC	MONTHLY PRECIPITATION OBSERVATIONS COLSTRIP, MT	FIGURE 2

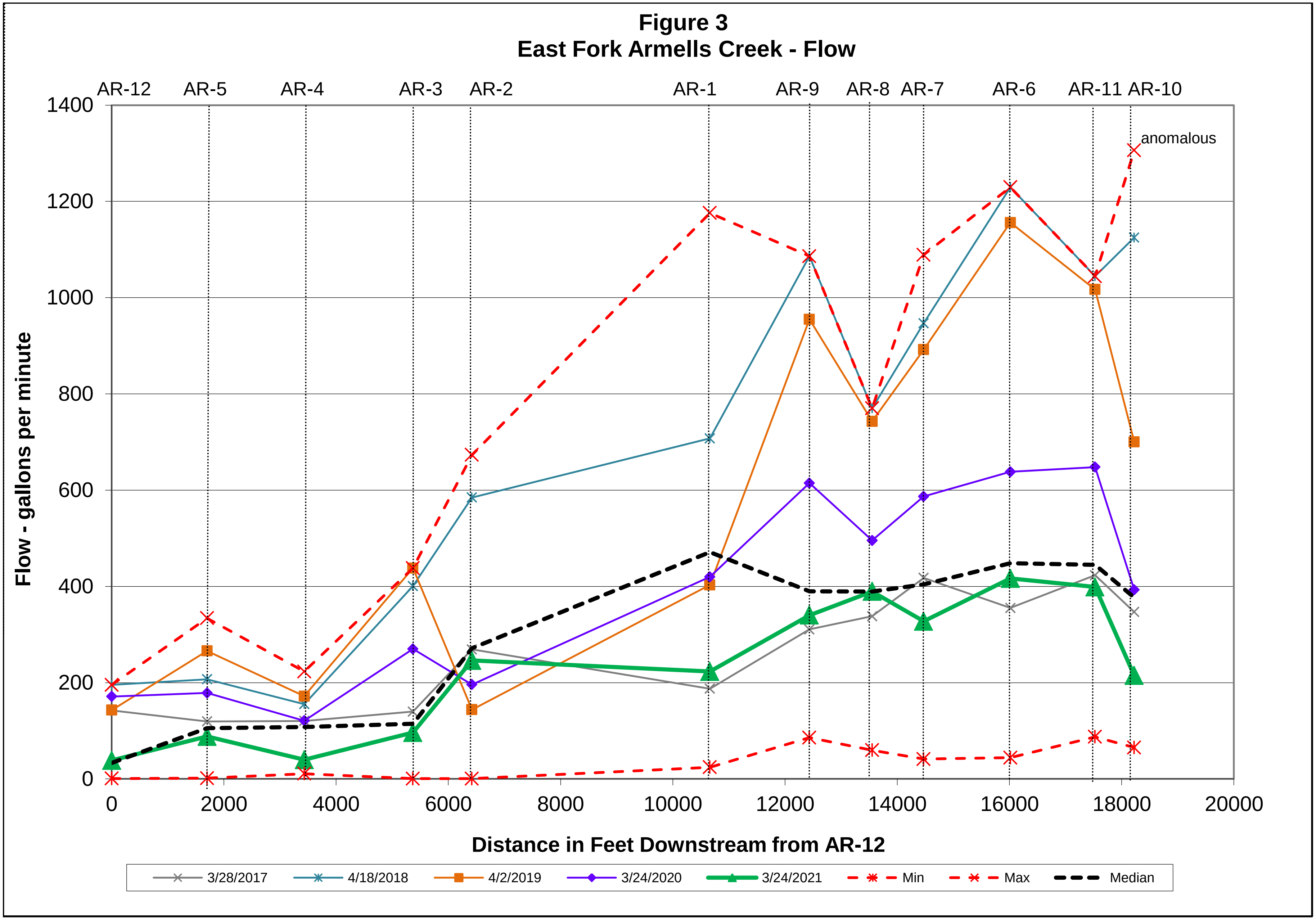
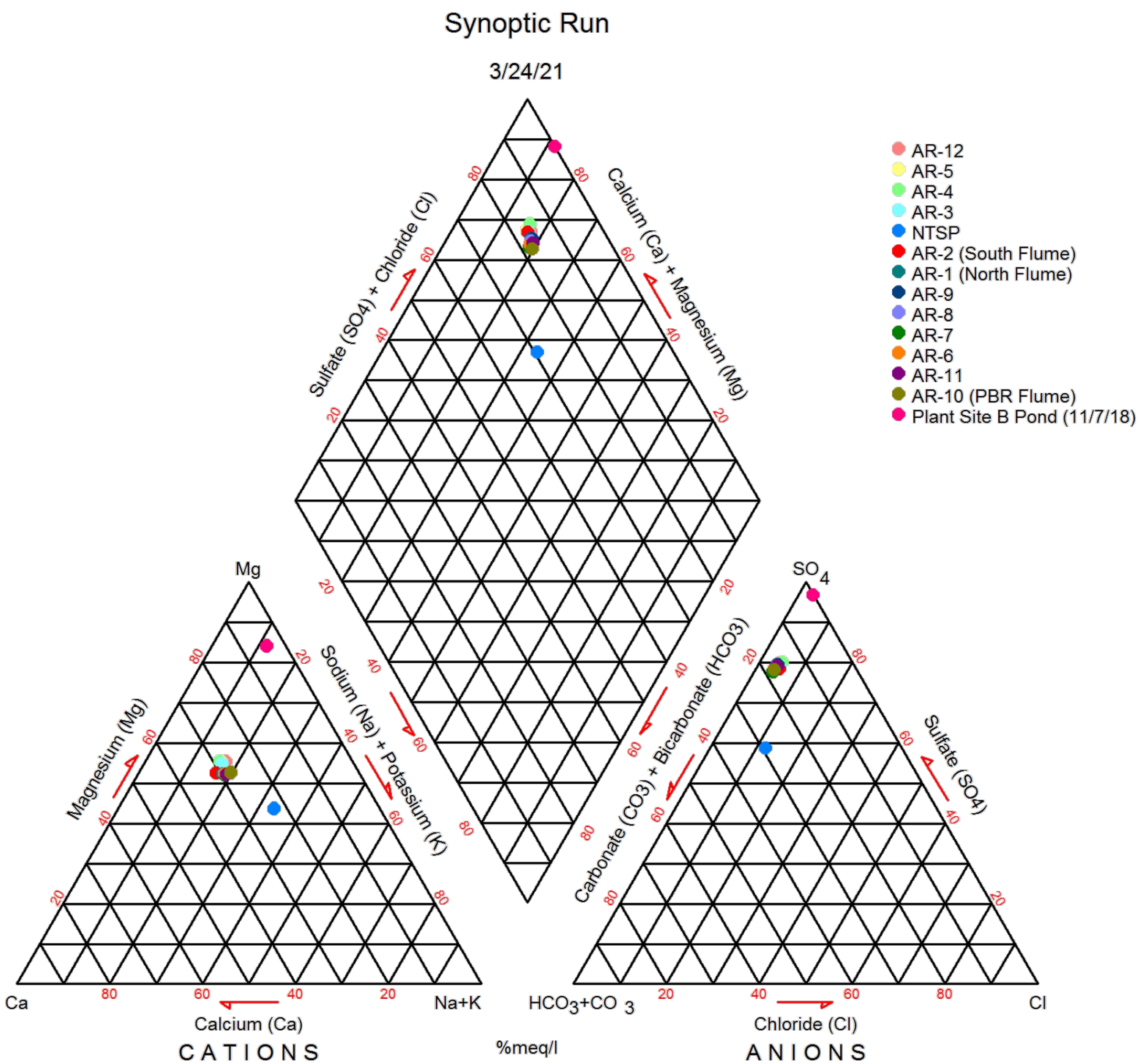


Figure 3
East Fork Armells Creek - Flow
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
anomalous
1400
1200
1000
800
600
400
200
0
Flow - gallons per minute
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Median



TALEN MONTANA, LLC MARCH 2021 EAST FORK ARMELLS CREEK SYNOPTIC RUN	**PIPER DIAGRAM**	FIGURE **4**

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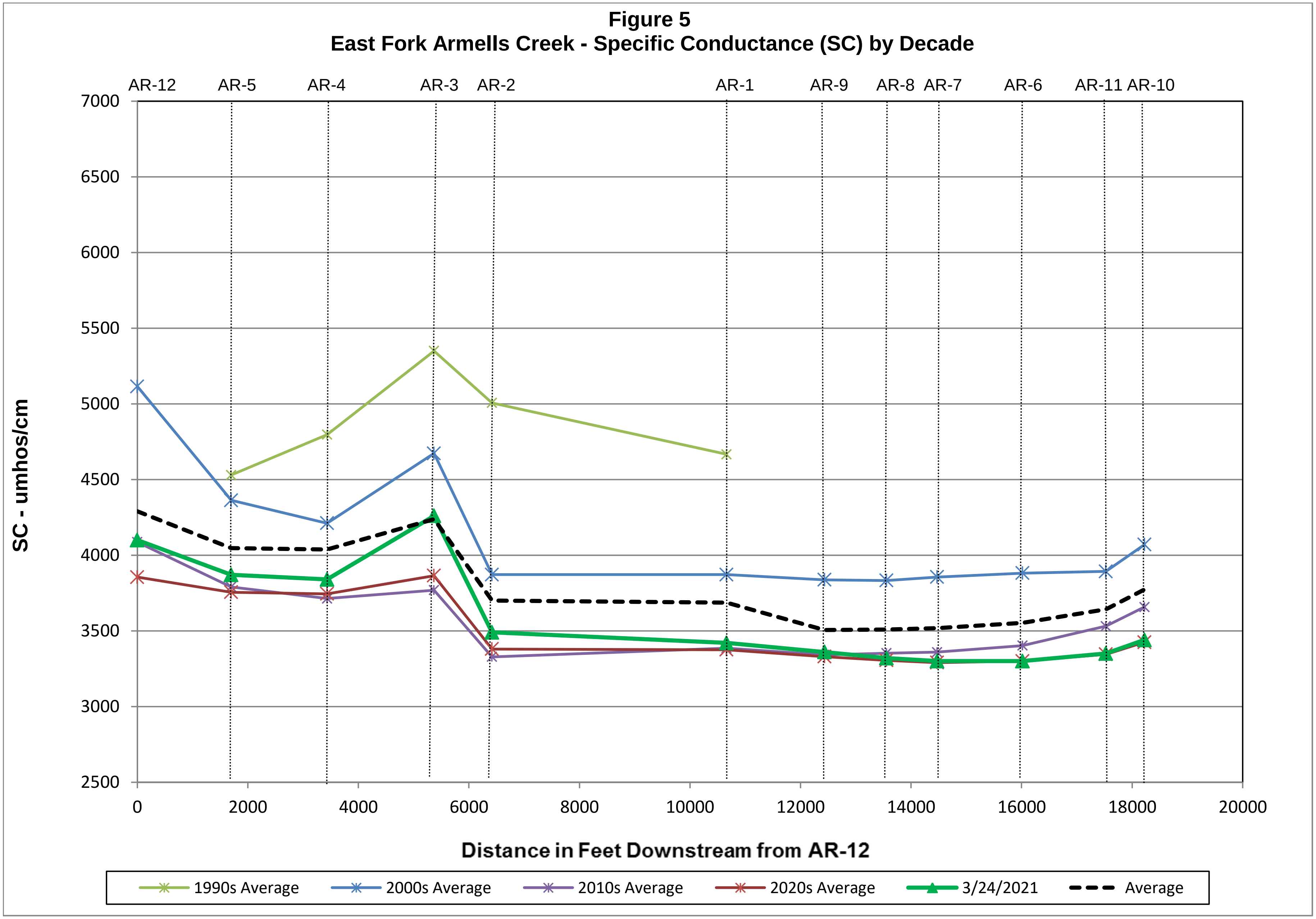


Figure 5
East Fork Armells Creek - Specific Conductance (SC) by Decade
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
SC - umhos/cm
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
1990s Average
2000s Average
2010s Average
2020s Average
3/24/2021
Average

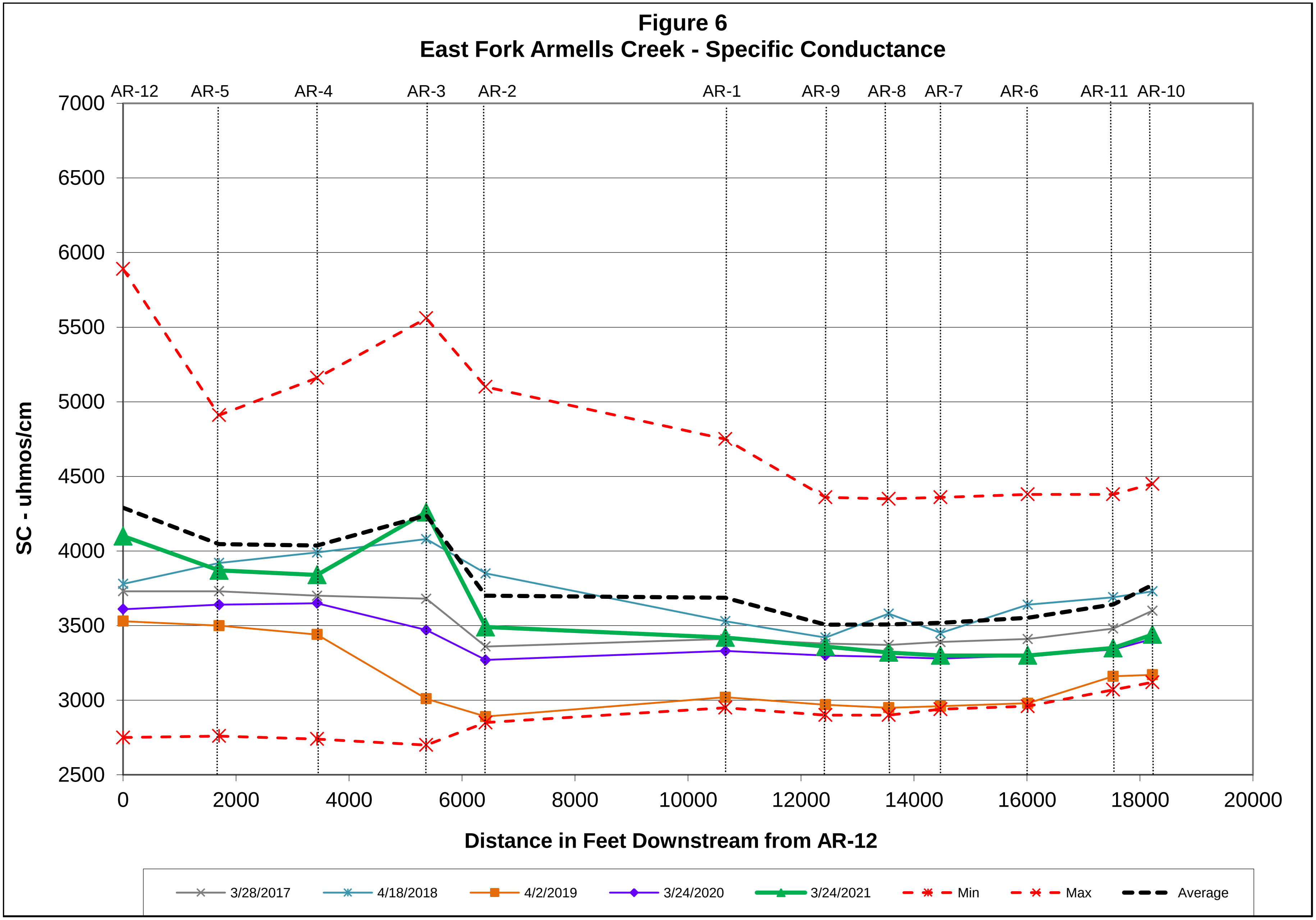


Figure 6
East Fork Armells Creek - Specific Conductance
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
SC - uhmos/cm
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

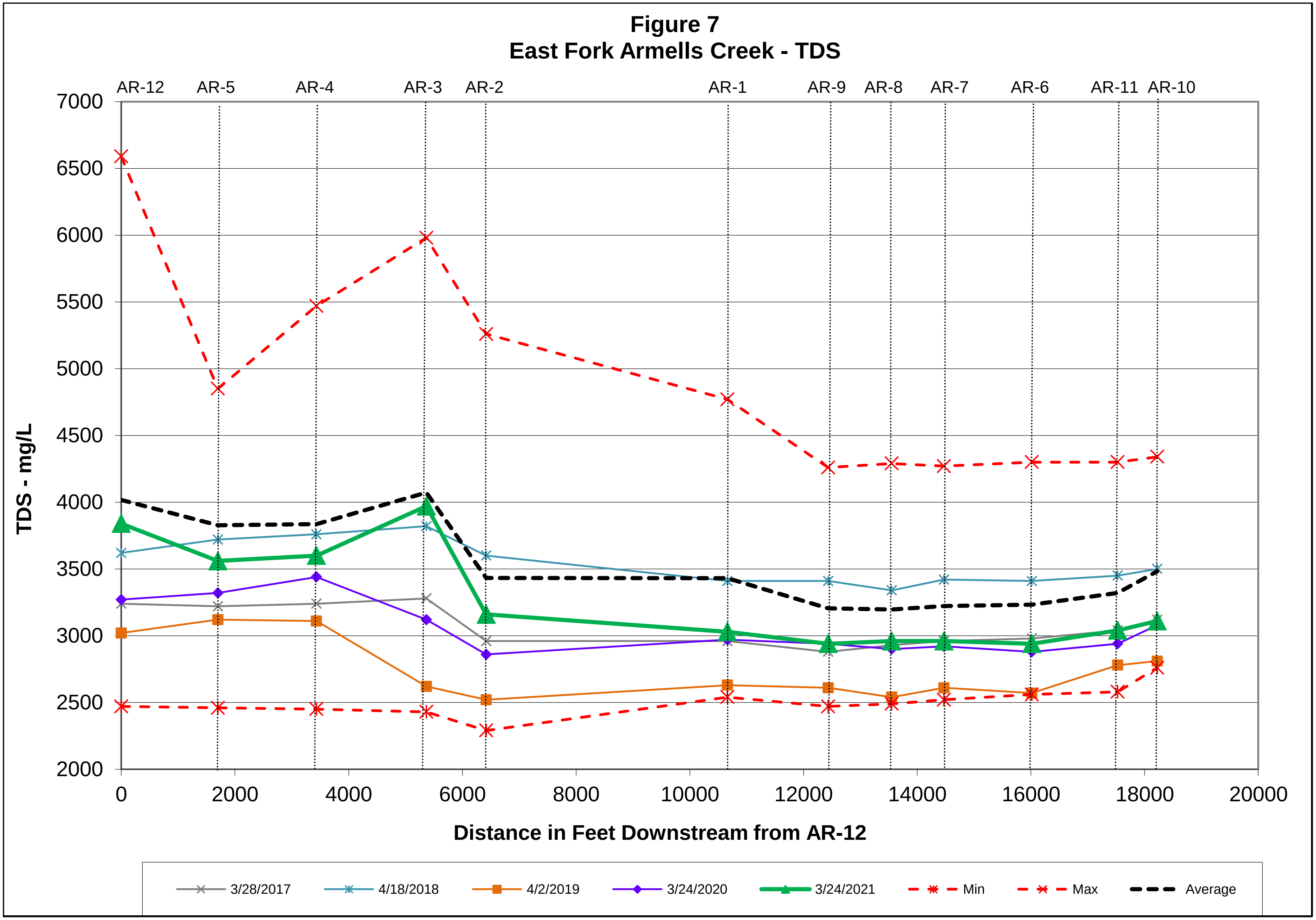


Figure 7
East Fork Armells Creek - TDS
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
TDS - mg/L
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

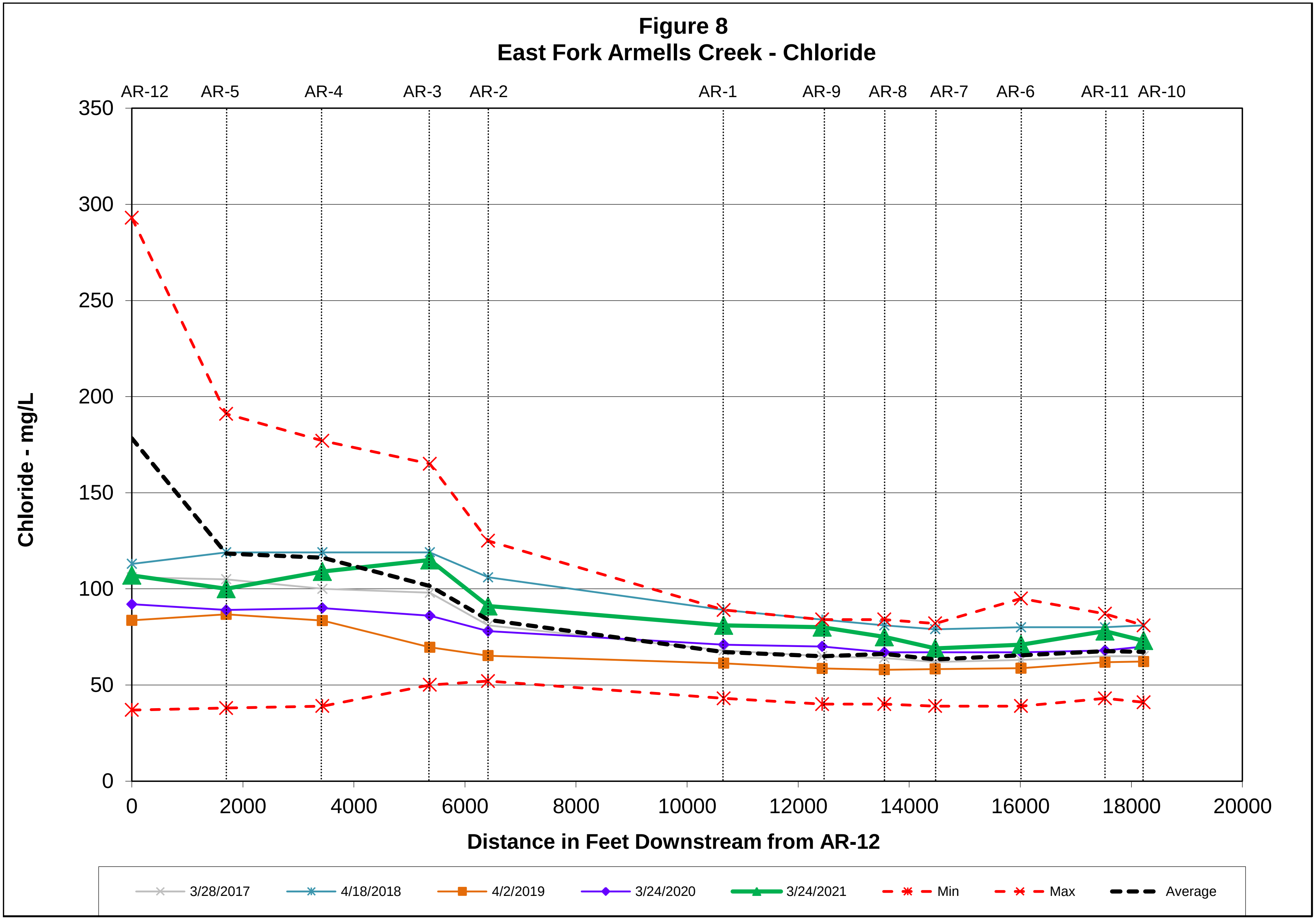


Figure 8
East Fork Armells Creek - Chloride
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Chloride - mg/L
350
300
250
200
150
100
50
0
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

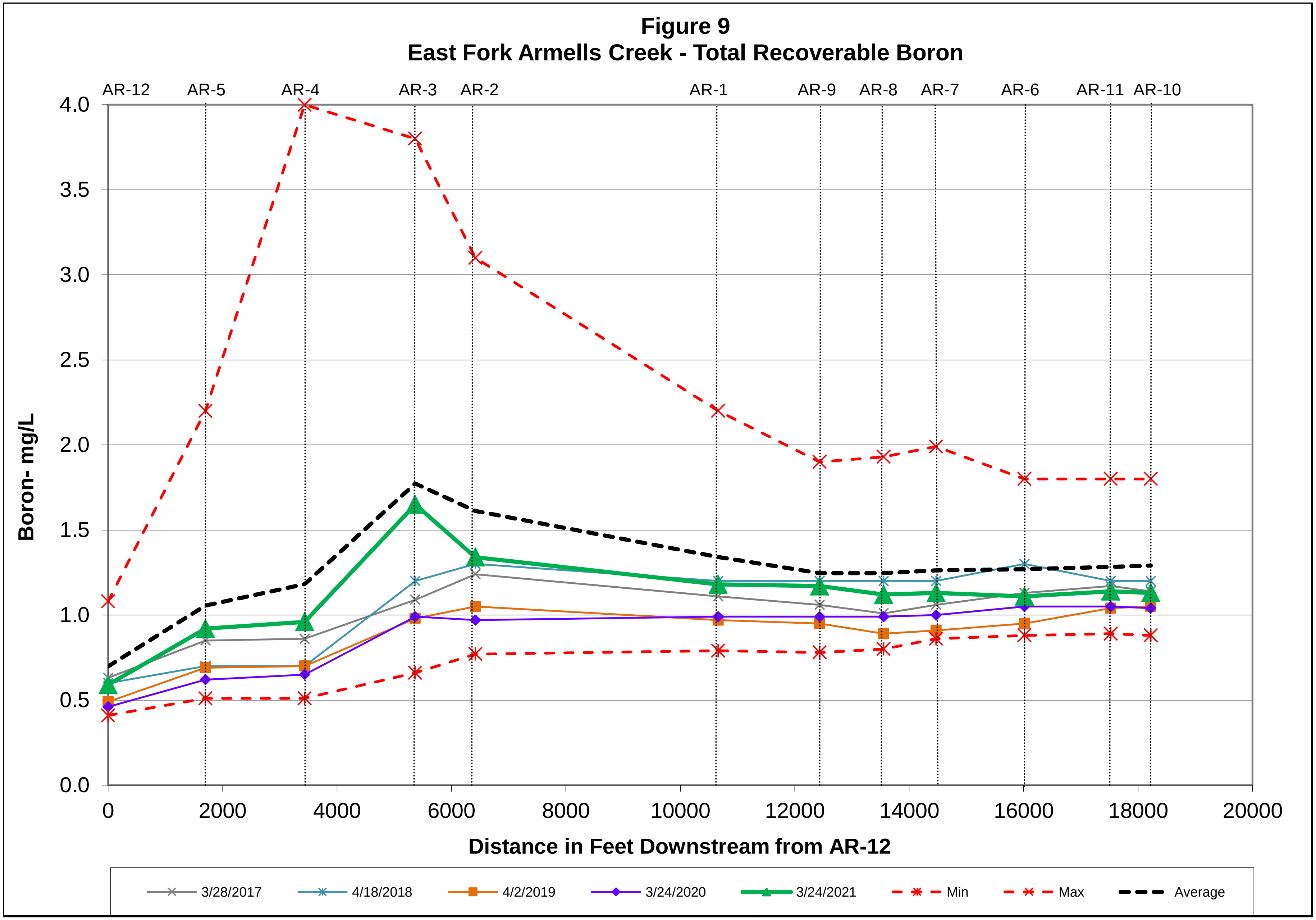


Figure 9
East Fork Armells Creek - Total Recoverable Boron
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Boron- mg/L
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

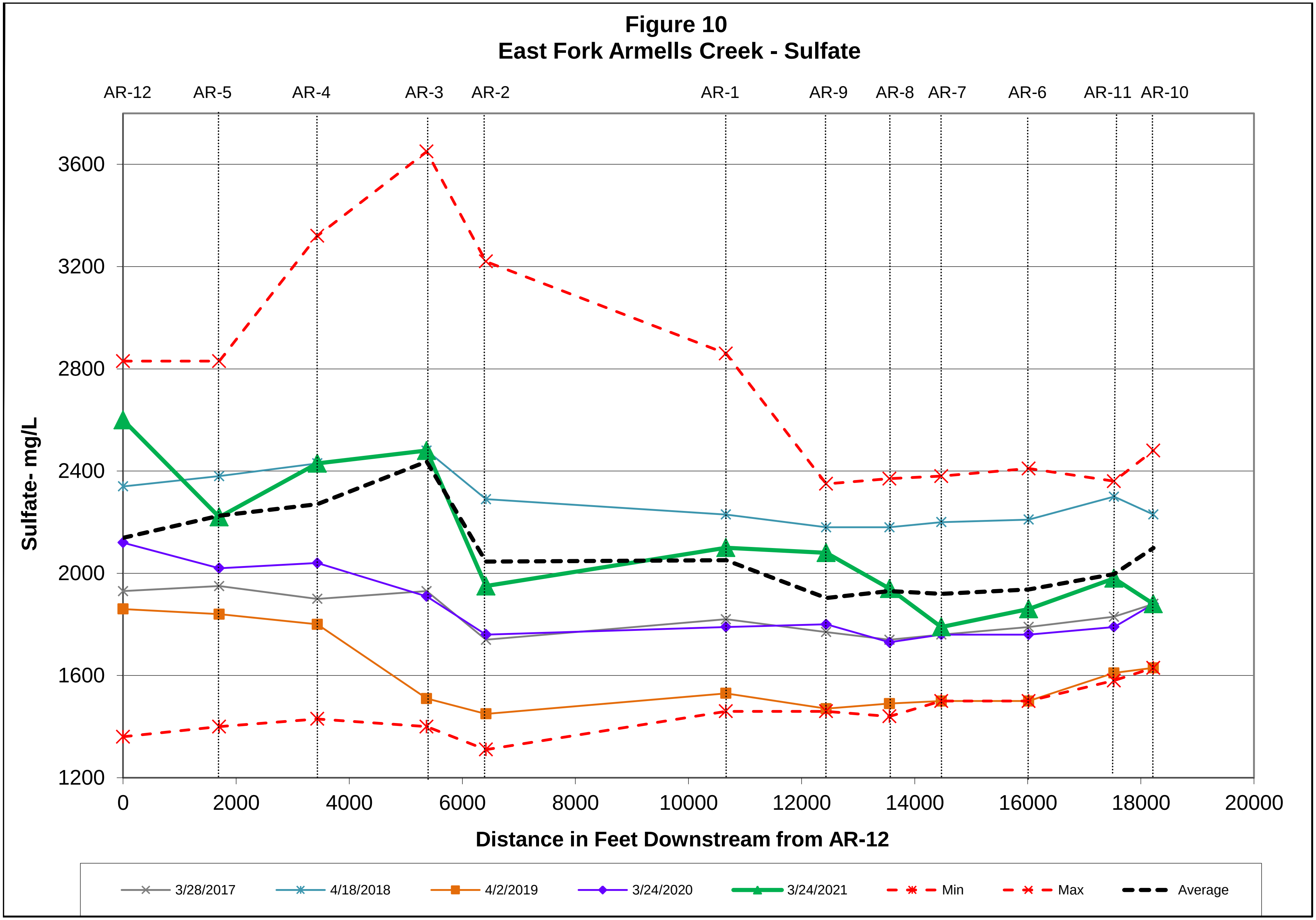


Figure 10
East Fork Armells Creek - Sulfate
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Sulfate- mg/L
3600
3200
2800
2400
2000
1600
1200
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

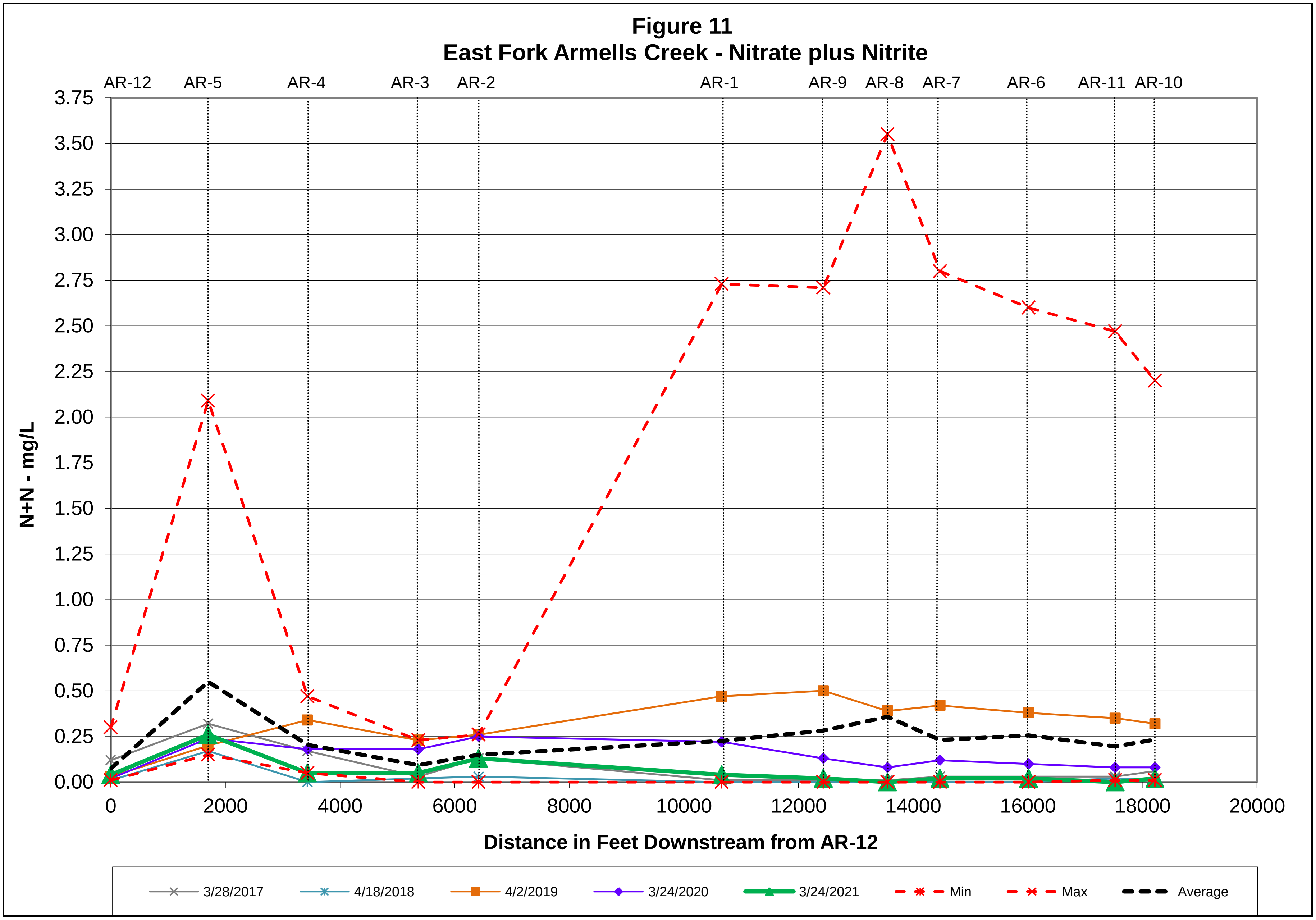


Figure 11
East Fork Armells Creek - Nitrate plus Nitrite
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
N+N - mg/L
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average

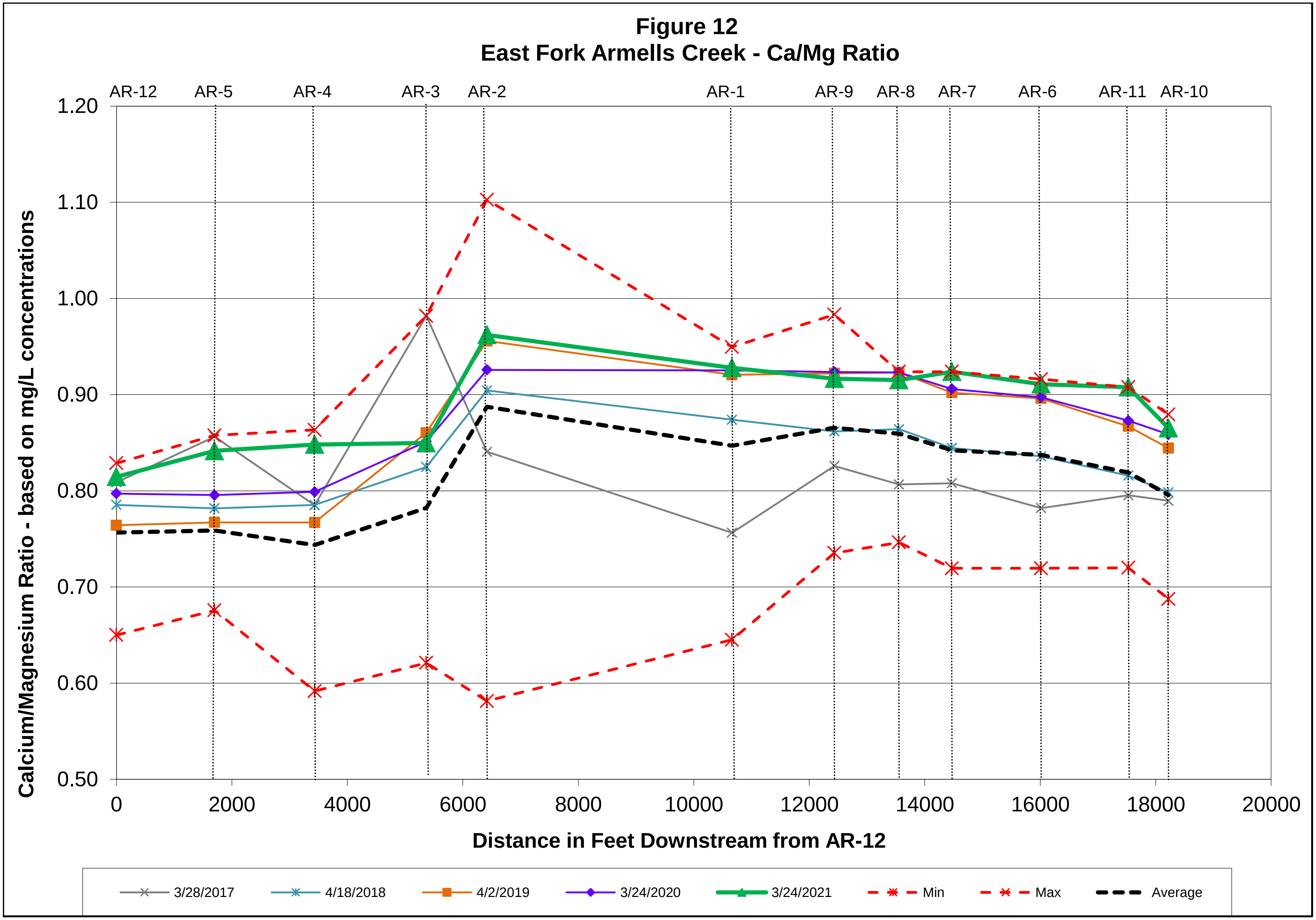
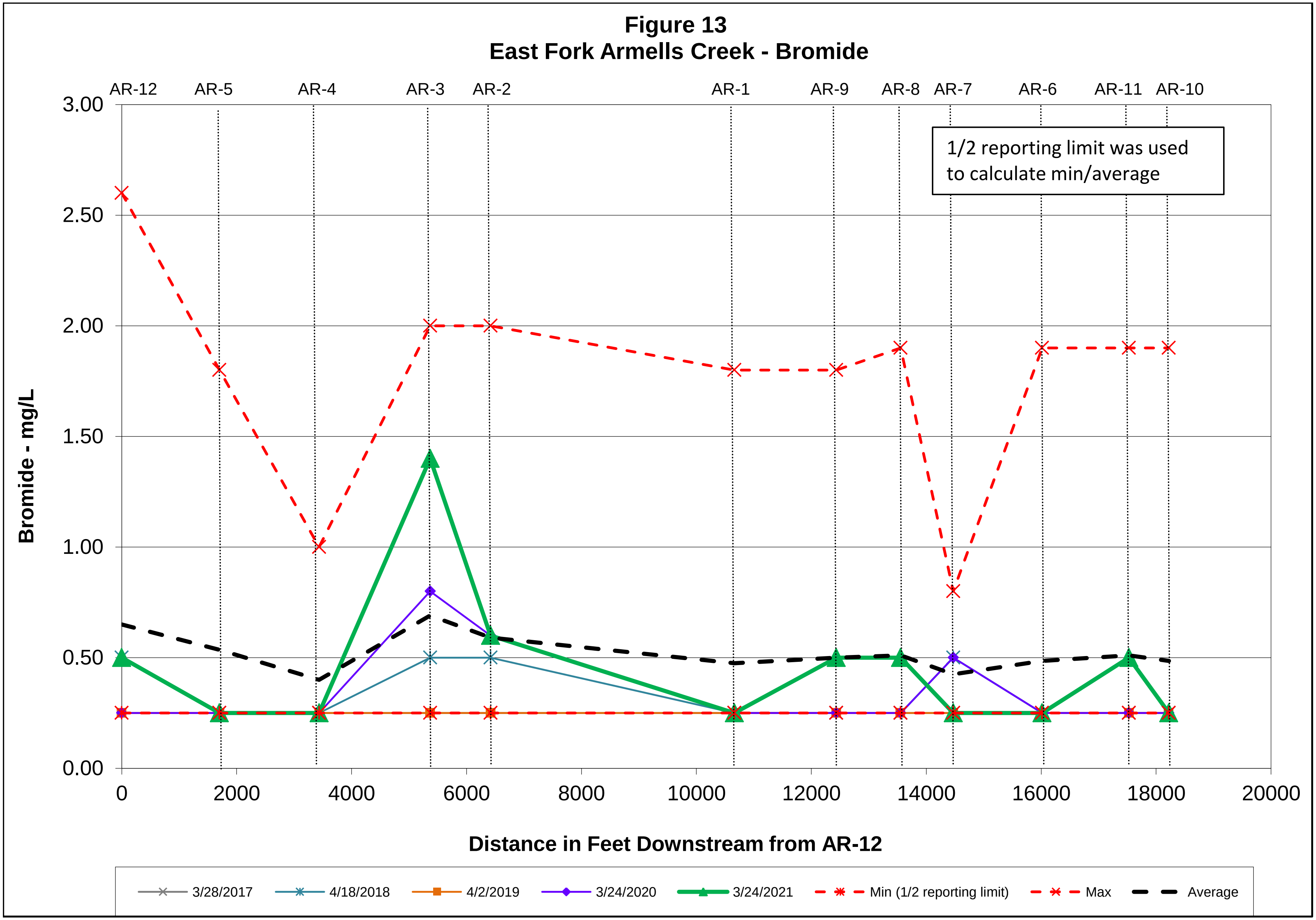


Figure 12
East Fork Armells Creek - Ca/Mg Ratio
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
Calcium/Magnesium Ratio - based on mg/L concentrations
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021
Min
Max
Average



H:\PROJECTS\TALEN\9036 Synoptic Run\2021\2021 GRAPHS Synoptic Run Graphs & Data.xlsxFig13 Bromide graph

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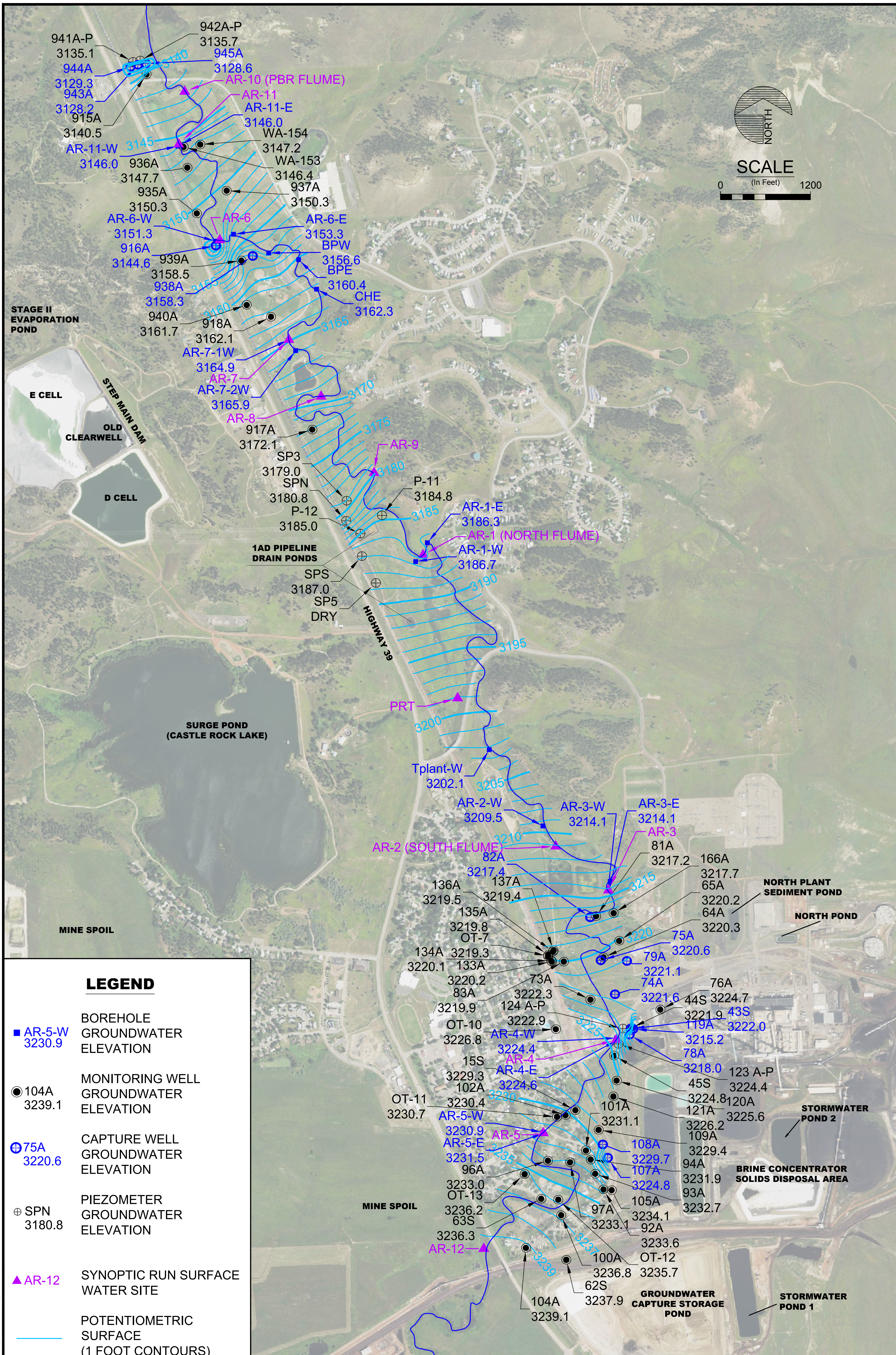

LEGEND

■ AR-5-W 3230.9	BOREHOLE GROUNDWATER ELEVATION
◉ 104A 3239.1	MONITORING WELL GROUNDWATER ELEVATION
⊕ 75A 3220.6	CAPTURE WELL GROUNDWATER ELEVATION
⊕ SPN 3180.8	PIEZOMETER GROUNDWATER ELEVATION
▲ AR-12	SYNOPTIC RUN SURFACE WATER SITE
——	POTENTIOMETRIC SURFACE (1 FOOT CONTOURS)
——	EAST FORK ARMELLS CREEK

Hydrometrics, Inc.
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TALEN MONTANA, LLC
MARCH 2021 EAST FORK ARMELLS CREEK SYNOPTIC RUN

SURFACE WATER AND SHALLOW GROUNDWATER ELEVATIONS

FIGURE 14

ATTACHMENT 1
EAST FORK ARMELLS CREEK SPRING SYNOPTIC RUN
MARCH 2021 PHOTO LOG and SITE DESCRIPTIONS

AR-12

AR-12 is upstream of Plant Site and directly upstream of Highway 39. The Highway 39 culvert tends to cause ponding of water at the inlet. Furthermore, as can be seen from the photo above, dead vegetation, mostly tumbleweeds in this case accumulate at the inlet. Not obvious in this picture are cattails that inhabit the area for about 300 yards or more upstream of the site. Sediments at this location typically contain a very high organic content due to the slow velocity of water typical of the site, the amount of decomposed vegetation that likely becomes entrapped directly upstream of the culvert, and the abundant riparian vegetation upstream of the site. Sediment at this site is likely underlain by near source clinker gravels or cobbles – very angular and flattened. One other note, the sediments are black and mucky with slight sulfide odors indicating anaerobic conditions.

AR-5

AR-5 is directly at a creek crossing on Currant Drive. This location is west of the Units 1 & 2 A and B Ponds and northwest of Units 1 & 2 Blowdown Pond C North and South Ponds. This site is upstream of Currant Drive culverts and downstream of a large area of riparian vegetation. The sediment does not seem to be as thick here and clinker gravels underlie streambed at a depth of about 6 inches. There is a small tributary that enters the creek a short distance upstream of this site from the west and drains a portion of the town site. This drainage is typically dry although flow has been observed during past synoptic runs. H_2S odors are frequently observed along with dark brown to black soils suggesting anaerobic conditions. The AR-5 site has a significant amount of garbage, comprised mostly of plastic and paper debris, presumably blown in from the nearby housing areas.

AR-4

AR-4 is located a very short distance west of the Units 1-4 Sediment Retention Pond. This site is directly upstream of the culvert that conveys water under Willow Avenue and downstream of a large area of riparian vegetation. Cattails are present in the channel and need to be removed for gaging. The sediment thickness is about three to six inches, fine grained. Sediment is generally a light brown although some isolated black anaerobic patches exist.

AR-3

AR-3 is located upstream and up-gradient from the City of Colstrip Wastewater Treatment Plant settling ponds. This site is located in an area with Cottonwood and Russian olive trees. The sediment is minimal with clinker gravels underlying the streambed at a depth of less than two inches.

AR-2SF

AR-2SF, also known as the South Flume, is located downgradient and downstream of the two easternmost City of Colstrip Wastewater Treatment Plant settling ponds and adjacent to the westernmost pond (North Sewage Treatment Pond). This 2-foot Parshall flume is instrumented with a continuous recorder to monitor the stage height. This site is located in a large area of riparian vegetation. Cattails are present in the channel and need to be removed for gaging. The sediment is thicker here at a depth of about 12 inches or so. Soil upstream of the flume is, black, highly organic, reduced, and exhibits an H_2S odor suggesting anaerobic conditions.

PRT

Power Road Tributary (PRT) is located downstream of the Power Road overpass and downstream of the Surge Pond (Castle Rock Lake) and drains portions of the northern town site. This site is located in an area of riparian vegetation. Cattails are present in the channel and need to be removed for gaging. Clinker cobbles are common along the channel bottom. No flow was observed in 2021 which is not uncommon.

AR-1NF

AR-1NF, also known as the North Flume, is located downstream from the City of Colstrip Wastewater Treatment Plant settling ponds, downstream of a tributary that drains the town site, downgradient from the Surge Pond, and downstream from Power Road. This 2-foot Parshall flume is instrumented with a continuous recorder to monitor the stage height. This site is located in an area of riparian vegetation. Cattails are present on side of the channel. The sediment is deep directly upstream of the flume, likely more than a foot thick. Anaerobic conditions are indicated by black streambed sediment, H_2S odor, and a significant amount of organic matter.

AR-9

AR-9 is located about midway between AR-1 and the Ponderosa Butte Golf Course. Over the years this site has transformed from a narrow channel, approximately 2 feet width, to a slower reach with multiple small channels. Riparian growth is abundant. The channel is eroded into the underlying claystone of the Fort Union Formation. Sediment depth is highly variable. Conditions appear to be oxidizing.

AR-8

AR-8 is located on Ponderosa Butte Golf Course upstream of a culvert that conveys water under a cart path. The site is also upstream of a pond used to hold treated city water for golf course irrigation. This pond receives treated water via a pipeline from the City of Colstrip Wastewater Treatment Plant. This site is located in an area of riparian vegetation. Cattails are present on the side of the channel. Water backs up behind the culvert creating a small ponded area with slow stream velocities that result in thicker sediment accumulation than on outlet of the culvert. Sediment upstream of the culvert is black and organic rich. Cobbles line the channel directly downstream of the culvert. Aquatic insects are common on the rocks at this location.

AR-7

AR-7 is located at a culvert under a cart path at Ponderosa Butte Golf Course. The site is downstream from the irrigation holding pond and upstream from the confluence of the tributary that holds the SOEP and STEP. The sediment is minimal with rounded cobbles that underlie the streambed at a depth of less than six inches.

AR-6

AR-6 is located on Ponderosa Butte Golf Course downstream from the City of Colstrip sports fields (baseball, softball, soccer, etc.) and downstream from the confluence of the tributary that holds the SOEP and STEP. The site is located at a culvert that conveys water under a golf cart path. This site is mainly grass vegetation with cattails on the edge of the stream. The sediment is minimal with rounded cobbles comprising the streambed immediately upstream and downstream of the culvert. More anaerobic conditions appear to exist a short distance (20 yards) downstream of the site.

AR-11

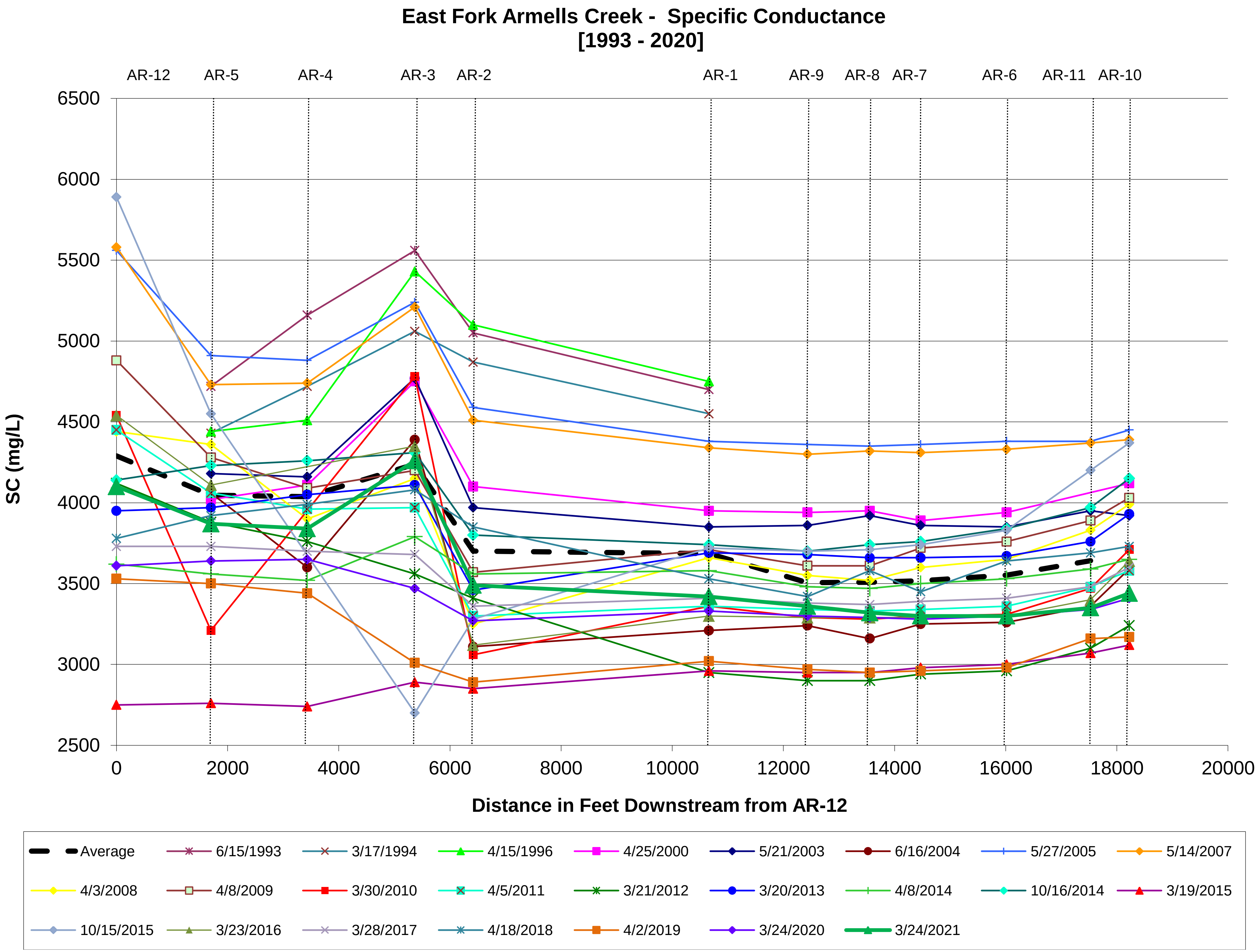
AR-11 is located on the Ponderosa Butte Golf Course between sites AR-6 and AR-10. Flow is measured at a foot bridge on the right side of the third hole fairway. Cattails and other riparian vegetation are present on both banks. However, the streambed is mostly coarse sand to pebble and granular gravel with little small grained sediment.

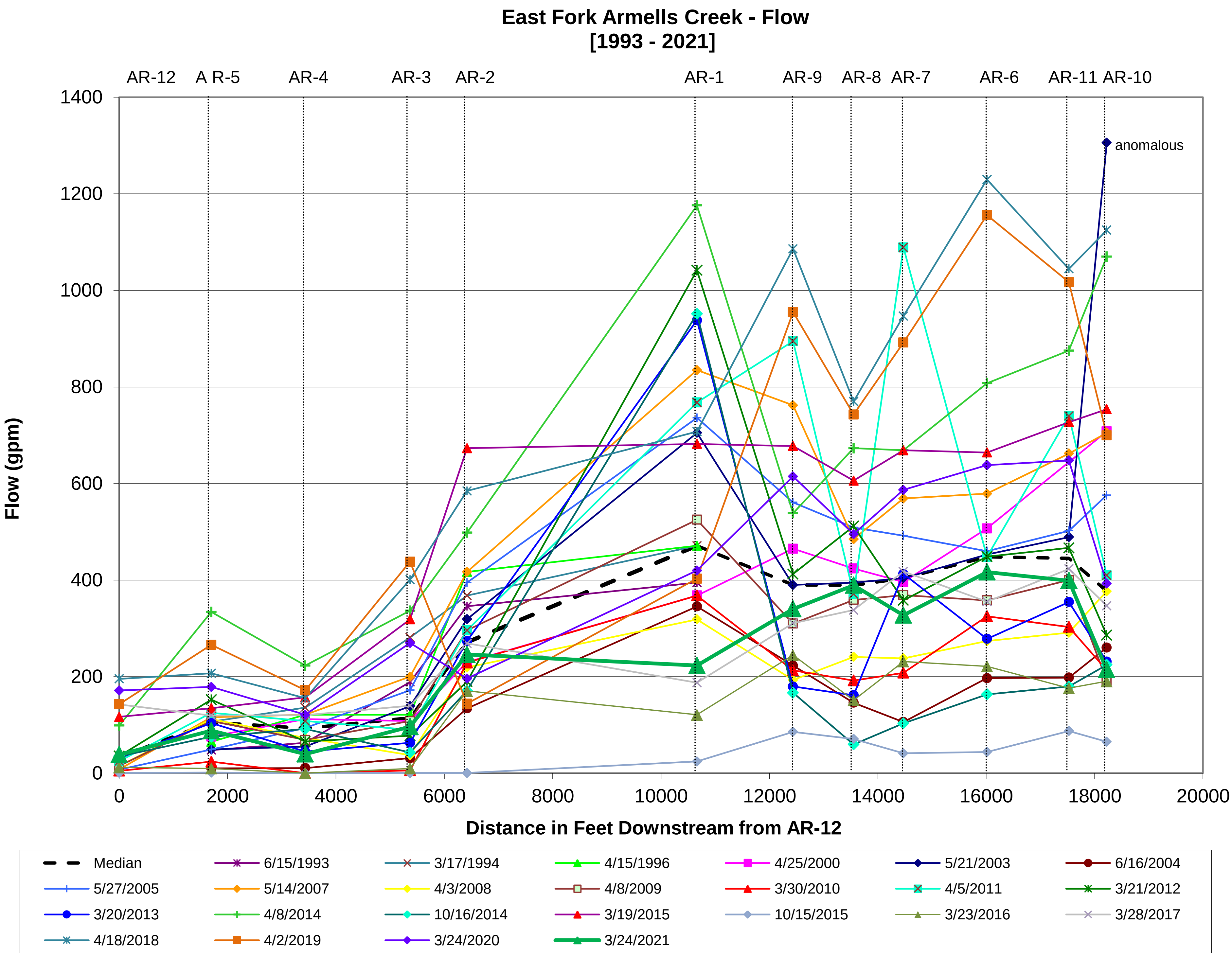
AR-10PBR

AR-10PBR, also known as the Pine Butte Road (PBR) Flume, is located at the northern edge of the Ponderosa Butte Golf Course and upstream of Pine Butte Road. Flow is gaged using a compound weir (90-degree v-notch bottom with rectangular upper portion). This site is located in an area of riparian vegetation. Cattails are present on the sides of the channel. About 6 inches of fine-grained, organic rich sediment overlie coarser sand and gravel directly upstream of the weir. The creek is backed up by the weir and the flat topography creates ponding downstream as well. Streambed sediments both up and downstream of the site are black, exhibit an H_2S odor, and contain substantial organic matter suggesting anaerobic conditions.

ATTACHMENT 2

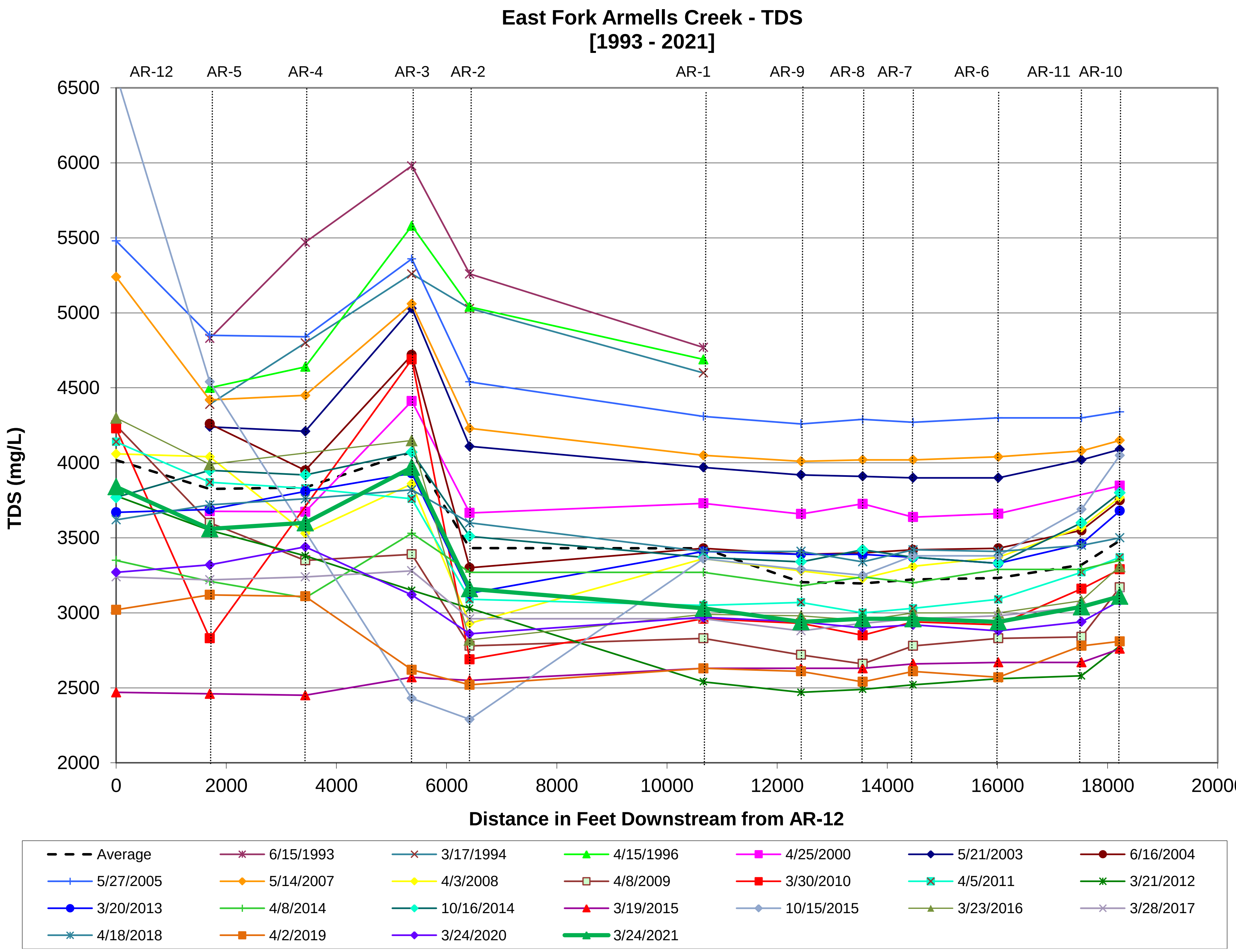
EAST FORK ARMELLS CREEK SPRING SYNOPTIC RUN
WATER QUALITY AND FLOW GRAPHS
THROUGH MARCH 2021

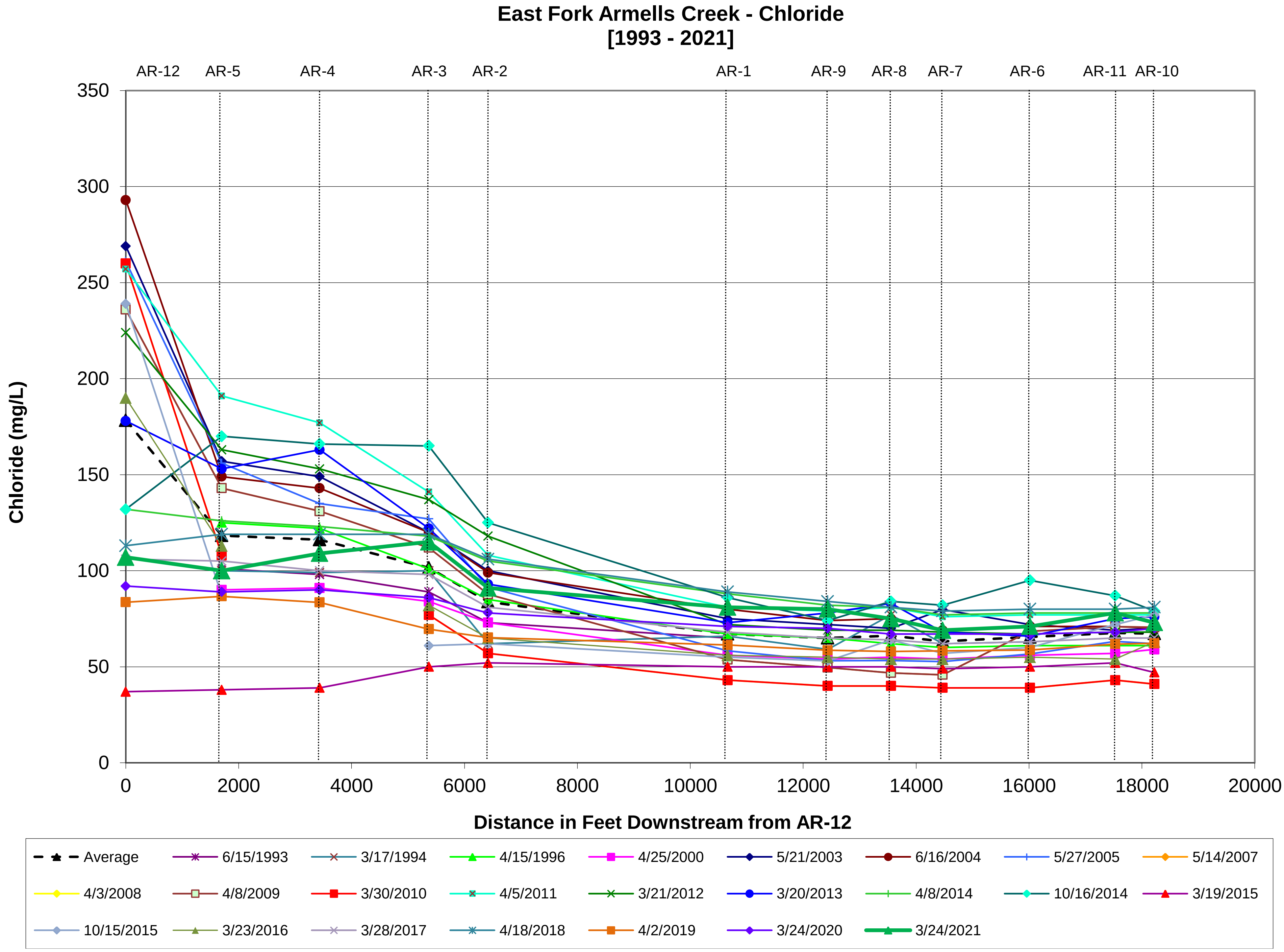

East Fork Armells Creek - Specific Conductance
[1993 - 2020]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
SC (mg/L)
Distance in Feet Downstream from AR-12
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021

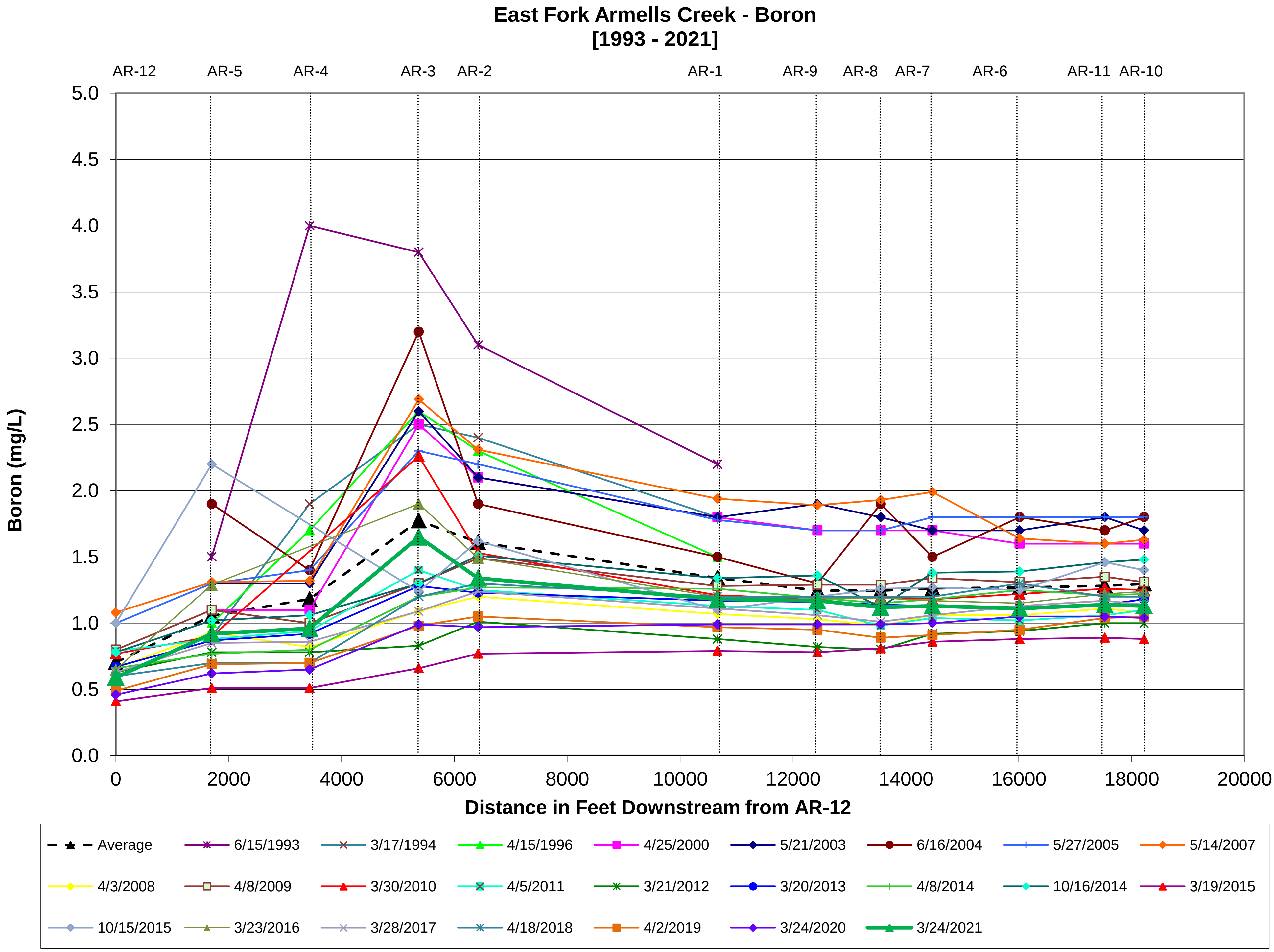


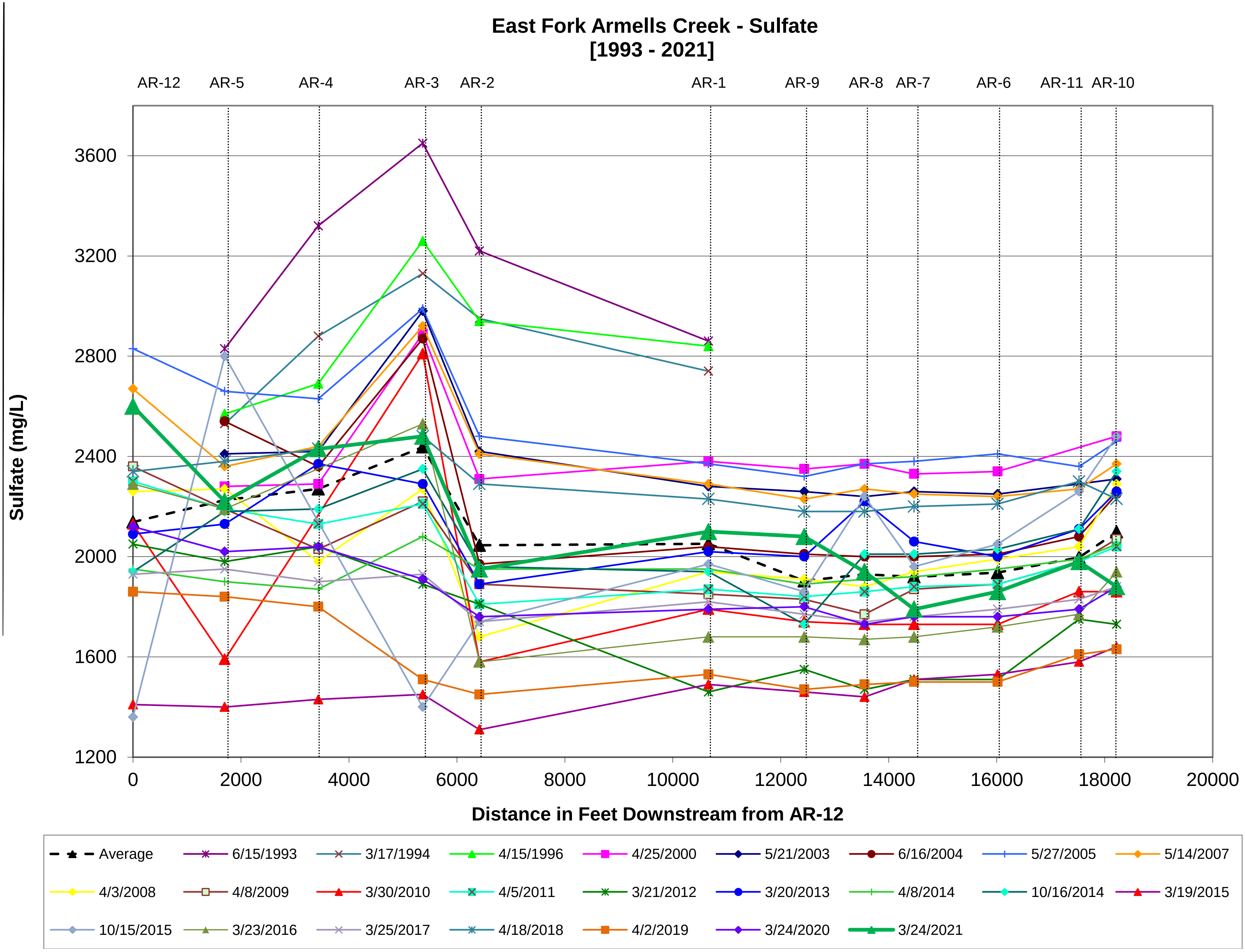
H:\PROJECTS\TALEN\9036 Synoptic Run\2021\2021 GRAPHS Synoptic Run Graphs & Data_Extended.xlsxAttach2 Flow graph
Hydrometrics, Inc.

Attachment 2
5/6/2021


East Fork Armells Creek - TDS
[1993 - 2021]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
TDS (mg/L)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021

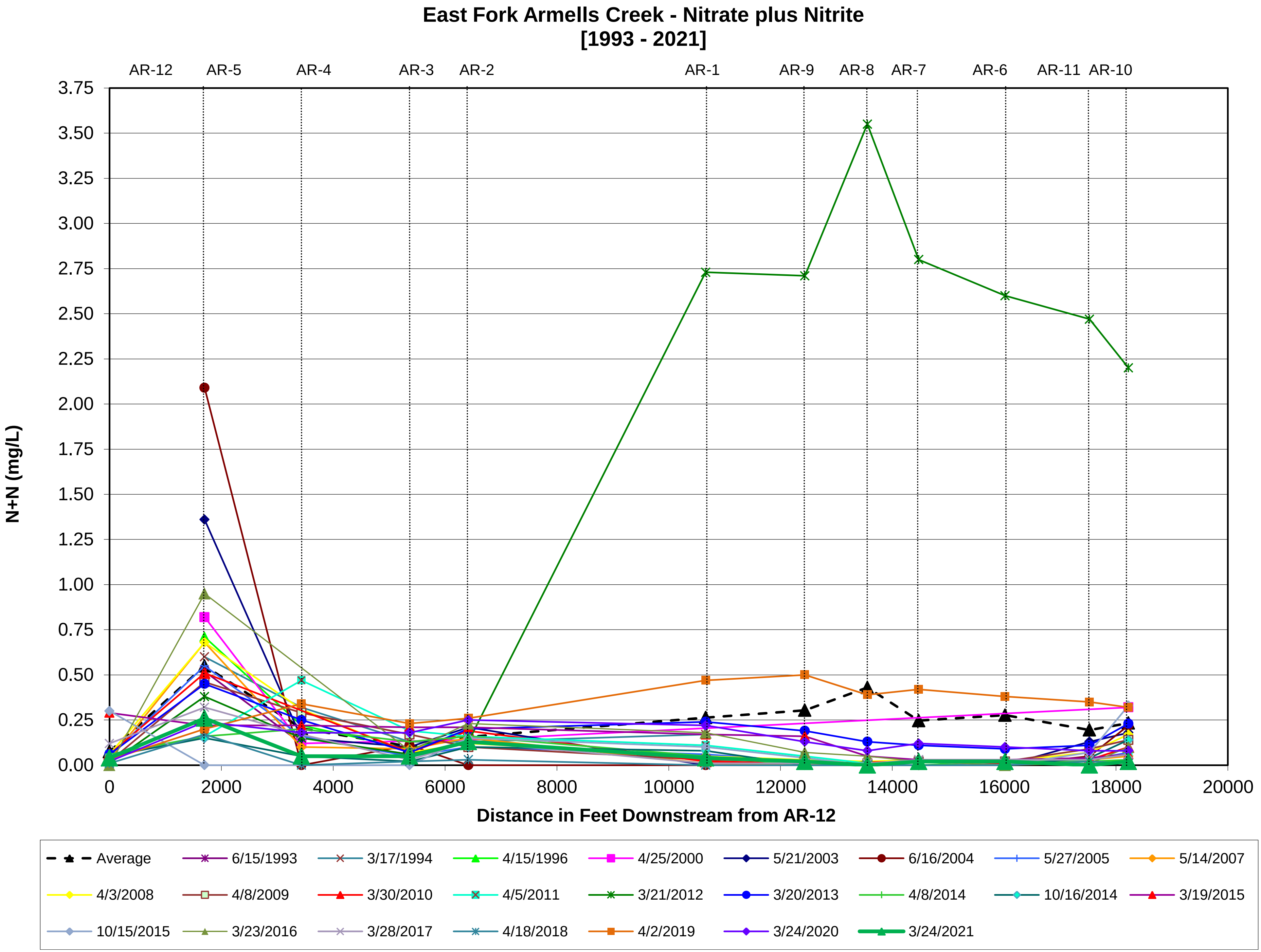

East Fork Armells Creek - Chloride
[1993 - 2021]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Chloride (mg/L)
Distance in Feet Downstream from AR-12
0
50
100
150
200
250
300
350
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021

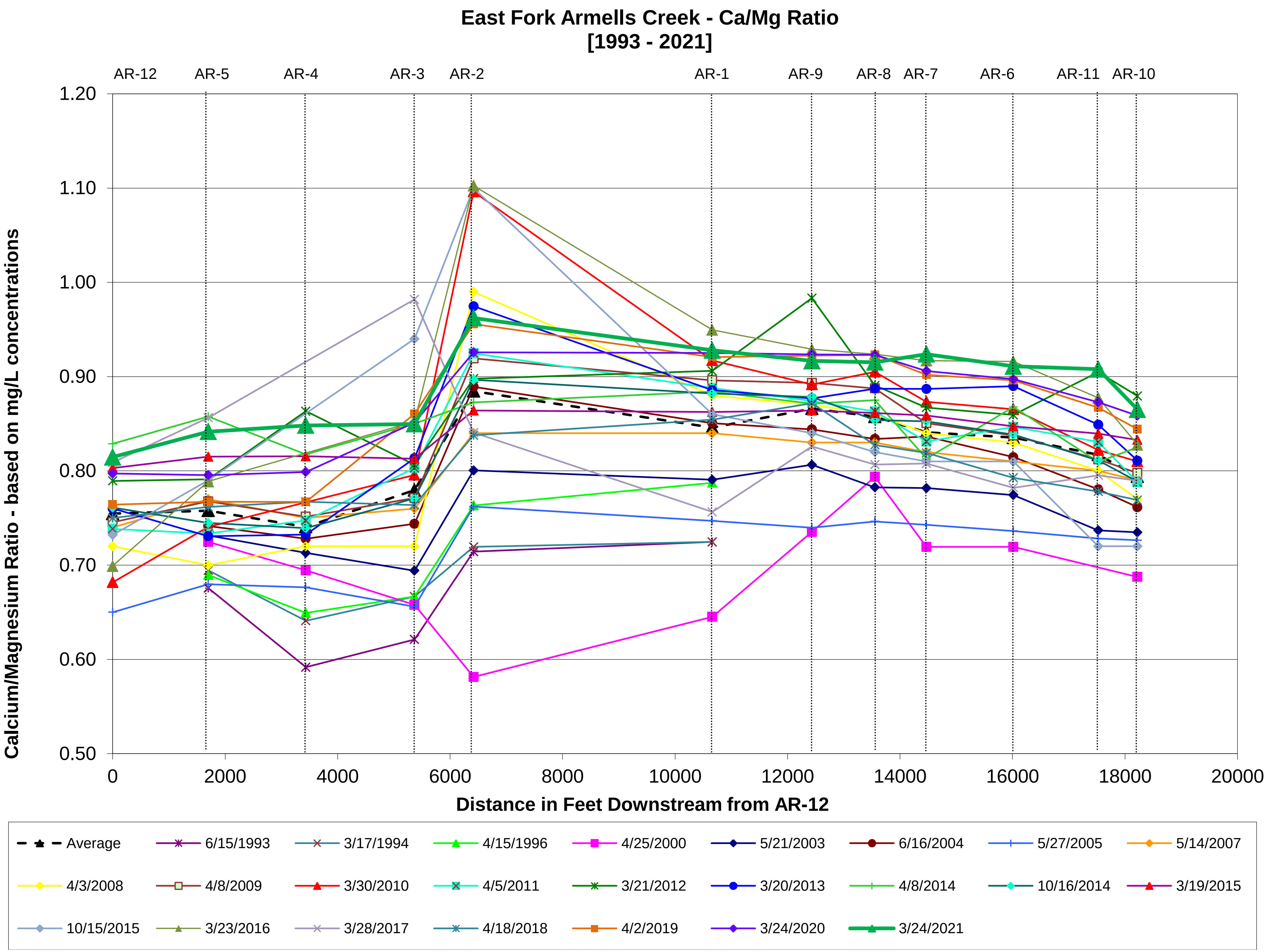

East Fork Armells Creek - Boron
[1993 - 2021]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Boron (mg/L)
Distance in Feet Downstream from AR-12
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021



H:\PROJECTS\TALEN\9036 Synoptic Run\2021\2021 GRAPHS Synoptic Run Graphs & Data_Extended.xlsxAttach2 Sulfate graph
Hydrometrics, Inc.

Attachment 2
5/6/2021


East Fork Armells Creek - Nitrate plus Nitrite
[1993 - 2021]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
N+N (mg/L)
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021


East Fork Armells Creek - Ca/Mg Ratio
[1993 - 2021]
AR-12
AR-5
AR-4
AR-3
AR-2
AR-1
AR-9
AR-8
AR-7
AR-6
AR-11
AR-10
Calcium/Magnesium Ratio - based on mg/L concentrations
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance in Feet Downstream from AR-12
Average
6/15/1993
3/17/1994
4/15/1996
4/25/2000
5/21/2003
6/16/2004
5/27/2005
5/14/2007
4/3/2008
4/8/2009
3/30/2010
4/5/2011
3/21/2012
3/20/2013
4/8/2014
10/16/2014
3/19/2015
10/15/2015
3/23/2016
3/28/2017
4/18/2018
4/2/2019
3/24/2020
3/24/2021

ATTACHMENT 3
EAST FORK ARMELLS CREEK SPRING SYNOPTIC RUN DATA VALIDATION SUMMARY 2021

Hydrometrics, Inc.
Consulting Scientists and Engineers

TALEN MONTANA, LLC
EAST FORK ARMELLS CREEK SPRING SYNOPTIC RUN
DATA VALIDATION SUMMARY 2021

GENERAL INFORMATION:

Site/Facility Name	Talen Montana, LLC
Project Name	Talen East Fork Armell's Creek Spring 2021 Synoptic Run
Name of DEQ Approved Sampling Plan	Talen Montana Colstrip Steam Electric Station 2021 East Fork Armells Creek
	Synoptric Run Work Plan
Date of DEQ Approved Sampling Plan	3/23/2020
Name of Data Validator	Jennifer Vanek
Phone	(406) 656-1172 Extension (304)
Date Validated	April 2021

FIELD COLLECTION INFORMATION:

Sample Matrix	Water
Sample Collection Start Date	March 24, 2021
Sample Collection End Date	March 24, 2021
Analytical Methods Used	See Table 1. Summary of Laboratory Methods and Detection Limits

GENERAL LABORATORY INFORMATION:

Laboratory Names and Locations	Energy Laboratories, Billings, MT
Laboratory Project IDs - Batch Numbers	See Table 2. Summary of Samples Evaluated

All Data Conforms to Analytical Methods and Data Quality Objectives Specified for this Project?			**Comments**
	Yes	X	
	No		

Reported methods and data quality objectives were in compliance with those requested in the Talen Montana Colstrip Steam Electric Station 2021 East Fork Armells Creek Synoptic Run Work Plan.

Samples Received in Good Condition and at Appropriate Temperature? (4° C+/-2°)			**Comments**
	Yes	X	
	No		

Comments

All samples were received in good condition and at the appropriate temperature.

Chain-of-Custody Forms Complete?			**Comments**
	Yes	X	
	No		

Comments

COC records from field to laboratory were complete, and custody was maintained as evidenced by personnel signatures, dates, and times of receipt.

All Samples Analyzed Within Method Specified or Technical Holding Times?			**Comments**
	Yes	X	
	No		

**Holding times were exceeded for laboratory pH. However, as a rule, holding times for laboratory pH measurements are frequently exceeded because measurements are typically not conducted "immediately", but rather as soon as practicable. Therefore, no validation qualifiers are placed on the data. All pH measurements have been qualified by the laboratories to indicate that the recommended holding times were exceeded.*

Comments

All analysis were within the specified holding time with the exception of the above mentioned pH.

LABORATORY QUALITY CONTROL EVALUATION:

Laboratory Complied With Quality Control Procedures. Data is Validated With Qualifiers?			**Comments**
	Yes	X	
	No		

Comments

All Laboratory Quality Control procedures were followed. All of the data has been validated and assigned appropriate data validation qualifiers, if necessary.

Were All Laboratory Quality Control Samples of the Same Matrix as Samples and Prepared the Same?			**Comments**
	Yes	X	
	No		

Comments

All laboratory quality control samples were of the same matrix and prepared the same as all samples analyzed.

Were All Calibration Verification Results Within Acceptable Limits?			**Comments**
	Yes	X	
	No		

Comments

All instrument calibrations were within method or data validation control limits and were performed in accordance with published procedures.

Were All Laboratory Blank Samples Free of Contamination?	Comments		
	Yes	X	
	No		

Comments

Reported laboratory blanks were free of target analyte contamination.

Are All Matrix Spike and Matrix Spike Duplicate Relative Percent Difference (RPDs) Within Quality Control Limits?	Comments		
	Yes	X	
	No		

Comments

All laboratory Matrix Spike and Matrix Spike duplicates were within control limits.

Were All Laboratory Duplicate Relative Percent Differences (RPDs) Within Quality Control Limits?	Comments		
	Yes	X	
	No		

Comments

All laboratory duplicate RPDs were within control limits.

Was the Total Number of Laboratory Method Blanks at Least 5% of the Total Number of Samples Analyzed or as Required by the Method?	Comments		
	Yes	X	
	No		

Comments

All laboratory blank samples met the above suggested frequency as recommended in the Montana Department of Environmental Quality Data Validation Guidelines for Evaluating Analytical Data, January 26, 2018.

Was the Total Number of Laboratory Matrix Spike Samples at Least 5% of the Total Number of Samples Analyzed or as Required by the Method?	Comments		
	Yes	X	
	No		

Comments

All laboratory matrix spike samples met the above suggested frequency as recommended in the Montana Department of Environmental Quality Data Validation Guidelines for Evaluating Analytical Data, January 26, 2018.

Was the Total Number of Laboratory Control Samples at Least 5% of the Total Samples Analyzed?			Comments
	Yes	X	
	No		

Comments

The total number of laboratory control samples met the above suggested frequency as recommended in the Montana Department of Environmental Quality, 2018. Montana Department of Environmental Quality Data Validation Guidelines for Evaluating Analytical Data, January 26, 2018.

Please List Any Project Samples Used For Matrix Spike (MS)/Matrix Spike Duplicate(MSD)

Lab ID	Project Sample ID	Comments

VALIDATOR SUMMARY INFORMATION:

Are the Detection Limits Appropriate for the Project (i.e. at or below screening levels)?			Comments
	Yes	X	
	No		

Comments

Reported detection limits were in compliance with those requested in the Talen Montana Colstrip Steam Electric Station 2021 East Fork Armells Creek Synoptic Run Work Plan.

Are the Reported Units Appropriate for the Matrix? (i.e. mg/L water, ug/L soil)			Comments
	Yes	X	
	No		

Comments

Correct and appropriate concentration units were reported for all water samples evaluated in this report.

Do the Laboratory Reports Include all Constituents Requested to be Analyzed on the Chain-Of-Custody or Under the Sampling Plan or Other Applicable Document?			Comments
	Yes	X	
	No		

Comments

All requested analyses as documented on original COCs were completed by the laboratory.

Was the Number of Sample Collection Blanks (i.e. Field Blanks, Rinsate, DI) Equal to at Least 10% of the Total Samples Collected or as Otherwise Required?			**Comments**
		X	
	No		

Comments
The total number of sample collection blank samples met the above suggested frequency as recommended in the Montana Department of Environmental Quality, 2018. Montana Environmental Quality Data Validation Guidelines for Evaluating Analytical Data, January 26, 2018.

Were all of the Sample Collection Blanks Free of Analyte Contamination?			**Comments**
	Yes	X	
	No		

Comments

Were Sample Collection Duplicates Collected as Required?			**Comments**
	Yes	X	
	No		

Comments
The total number of sample collection duplicates met the suggested frequency of 1/20 (one duplicate per twenty samples collected) as listed in the Talen Montana Colstrip Steam Electric Station 2021 East Fork Armells Creek Synoptic Run Work Plan.

Were Sample Collection Duplicates Within the Relative Percent Differences (RPD) or low level +/- PRDL Data Validation Quality Control Limits?			**Comments**
	Yes	X	
	No		

Comments
The sample collection duplicate parameters were all within data validation quality control limits.

DATA QUALITY OBJECTIVES:

PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY

PRECISION

Was the precision acceptable?			**Comments**
	Yes	X	
	No		

Comments

Precision is the measure of variability of individual sample measurements. Field precision was determined by comparison of field sample collection duplicate results. Laboratory precision was determined by examination of laboratory duplicate results. Evaluation of field and laboratory duplicates for precision was done using the Relative Percent Difference (RPD). The RPD is defined as the difference between two duplicate samples divided by the mean and expressed as a percent. Control limits are taken from the US EPA, 2017. National Functional Guidelines for Inorganic Superfund Data Review (2017).

The suggested precision objective goal is for 90% of aqueous field sample collection duplicates to be in agreement with duplicate sample results within a RPD of 20% when both the sample concentrations (original and duplicate) are greater than five times the PRDL and one times the PRDL when either of the sample concentrations are less than five times the PRDL.

Laboratory and field precision is calculated at 100%.

Overall field and laboratory precision is acceptable.

ACCURACY

Was the accuracy acceptable?			**Comments**
	Yes	X	
	No		

Comments

Accuracy is the agreement between a measured value and a 'true' value. Accuracy is assessed using field collection blanks (field collection equipment/rinsate blanks), field collection reference standards, laboratory matrix spikes, laboratory control standards (LCS), laboratory method blanks, and laboratory fortified blanks. Control limits are taken from the US EPA, 2017 National Functional Guidelines for Inorganic Superfund Data Review (2017).

The suggested target accuracy is evaluation of 90% of all the applicable QC samples as listed above to be within control limits.

The overall field and laboratory accuracy is acceptable.

REPRESENTATIVENESS			
Was the data accurately represented?	**Comments**		
	Yes	X	
	No		

Comments

Representativeness is the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent.

All sample data was accurately represented. The 2021 synoptic run monitoring was carried out correctly and followed established field and laboratory procedures.

COMPLETENESS			
Was the Completeness Goal Met for this Project?	**Comments**		
	Yes	X	
	No		

Comments

Completeness is the overall ratio of the number of samples planned versus the number of samples collected with valid analyses.
A total of 17 samples were planned and 16 were collected. A sample could not be collected from PRT (Power Road Tributary) as it was dry. Determination of completeness included a review of chain of custody records, laboratory analytical methods and detection limits, and laboratory case narratives. Completeness also included 100% review of the laboratory sample data results and QC summary reports. All of the data received by the laboratory are usable, and no data were missing or rejected.
Completeness goals are set at 90-100%. Completeness for the Talen Montana, Synoptic Run project is calculated at 100%.

What Was the Percent Completeness?

Comments

Completeness of the data is calculated at 100% and is acceptable.

COMPARABILITY			
Was the Comparability Goal Met for this Project?	**Comments**		
	Yes	X	
	No		

Comments

Comparability is the expression of confidence with which one data set can be compared with another. Comparability of data is achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

All of the data compared well with previous data sets.

Other General Comments or Observations.

Comments:

QUALIFIERS:

Laboratory Qualifiers

Energy Laboratories Qualifiers

D - RL increased due to sample matrix.

L - Lowest available reporting limit for the analytical method used.

H - Analysis performed past recommended holding time.

E - Estimated value. Result exceeds the instrument upper quantitation limit.

Pace Analytical Services Qualifiers

D3 - Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

D4 - Sample diluted due to the presence of high levels of target analytes.

E - Analyte concentration exceeded the calibration range, result is estimated.

H6 - Analysis performed past recommended holding time.

J - Estimated

M1 - Matrix spike recovery exceeded QC limits, accepted based on laboratory control sample (LCS) recovery.

M6 - Matrix spike and matrix spike duplicate recovery not evaluated due to sample dilution.

R3 - RPD value was outside control limits due to uncertainty of values at or near the PRL.

Hydrometrics Data Validation Qualifiers

Hydrometrics Validation Qualifiers

U - Analyte analyzed for, but not detected

J - Analyte identified, but value is estimated

J+ - Result is estimated and may be biased high

J- - Result is estimated and may be biased low

A - Anomalous value

E - Value is estimated

R - Rejected, data are unusable.

H - Holding Time

REFERENCES:

US EPA, 2017. US Environmental Protection Agency National Functional Guidelines for Inorganic Superfund Methods Data Review EPA-540-R-2017-001; January 2017.

US EPA, 2012. US Environmental Protection Agency Contract Laboratory Program, Statement of Work For Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM02.0; November 2012.

Montana Department of Environmental Quality Data Validation Guidelines for Evaluating Analytical Data, January 26, 2018.

Talen Montana Colstrip Steam Electric Station 2021 East Fork Armells Creek Synoptic Run Work Plan

ATTACHMENTS

Tables:

Table 1. Summary of Laboratory Methods And Detection Limits

Table 2. Summary of Samples Evaluated

Water Quality Report:
Data Summary Analysis Report

TABLES

Hydrometrics, Inc.
Consulting Scientists and Engineers

Table 1. Summary Of Samples Evaluated

Lab	Lab Project Batch ID	Location Code	Sample Code	Date	Location Area	Sample Type	Matrix
EL	B21031821	AR-10PBR	TLN-2103-100	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-11	TLN-2103-101	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-6	TLN-2103-102	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-7	TLN-2103-103	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-8	TLN-2103-104	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-9	TLN-2103-105	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-1NF	TLN-2103-106	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-2SF	TLN-2103-108	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	NSTP	TLN-2103-109	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-3	TLN-2103-110	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-4	TLN-2103-111	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-5	TLN-2103-112	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	AR-12	TLN-2103-113	3/24/2021	EF Armells Creek	Planned Monitoring Sample	W
EL	B21031821	DI Blank	TLN-2103-114	3/24/2021	Field QC	Field QC Blank	W
EL	B21031821	AR-9 (Dup)	TLN-2103-115	3/24/2021	Field QC	Field QC Duplicate	W
EL	B21031821	PRT	TLN-2103-107	3/24/2021	Field QC	Observation	W

SUMMARY ANALYSIS REPORT

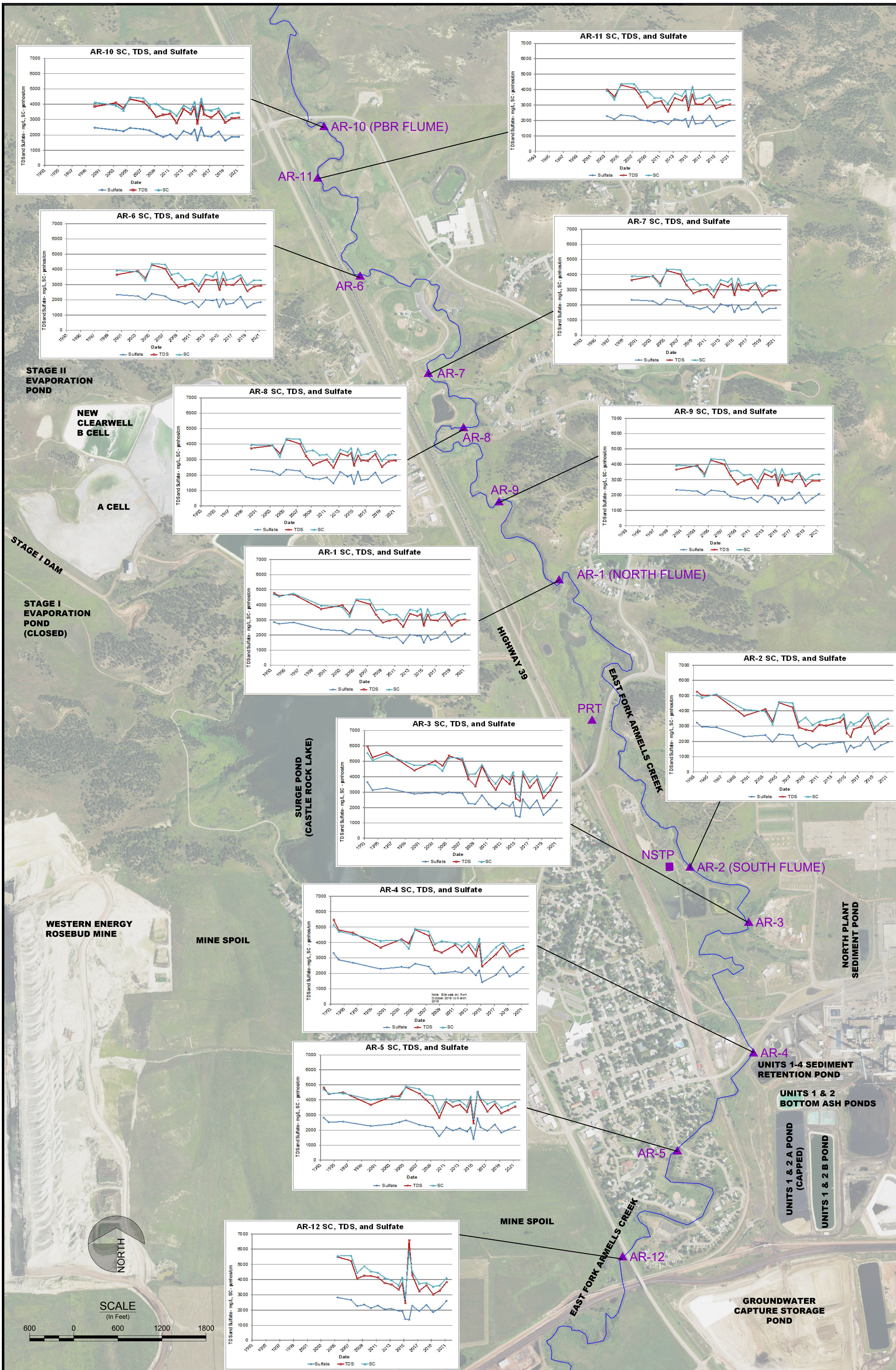
Talen - Synoptic Run March 2021

Station Name			AR-10PBR	AR-11	AR-12	AR-1NF	AR-2SF	AR-3	AR-4	AR-5	AR-6	AR-7
Sample ID			TLN-2103-100	TLN-2103-101	TLN-2103-113	TLN-2103-106	TLN-2103-108	TLN-2103-110	TLN-2103-111	TLN-2103-112	TLN-2103-102	TLN-2103-103
Sample Date			3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021
Physical												
FLOW		gpm	215	399	38	223	246	96	40	88	417	327
OXYGEN (O) (FLD)		mg/L	15.9	10.99	7.67	9.34	12.72	8.4	7.23	7.32	11.32	10.63
pH - FLD		s.u.	8.09	8.3	8.2	8.17	8.08	7.87	8.2	7.97	8.33	8.27
OXIDATION REDUCTION POTENTIAL		mV	65.5	NA	NA	61.9	-50.3	-31.3	27	NA	74	85.1
pH - LAB		s.u.	8.1	8.1	7.8	8.0	8.0	7.7	7.9	7.7	8.2	8.1
SC (UMHOS/CM AT 25 C)		umhos/cm	3,440	3,350	4,100	3,420	3,490	4,260	3,840	3,870	3,300	3,300
SC (UMHOS/CM AT 25 C) (FLD)		umhos/cm	3,348	3,233	3,947	3,346	3,329	4,086	3,696	3,599	3,189	3,203
TDS (MEASURED AT 180 C)		mg/L	3,110	3,040	3,840	3,030	3,160	3,970	3,600	3,560	2,940	2,960
WATER TEMPERATURE (FLD)		C	0.4	0.5	1.7	1.6	6.4	3.4	3.1	3.7	0.1	0.5
Major Costituents												
BICARBONATE ALK AS HCO3		mg/L	536	531	648	559	521	644	577	587	528	530
BROMIDE (BR)		mg/L	<0.5	0.5	0.5	<0.5	0.6	1.4	<0.5	<0.5	<0.5	<0.5
CARBONATE AS CO3		mg/L	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
CHLORIDE (CL)		mg/L	73	78	107	81	91	115	109	100	71	69
SULFATE (SO4)		mg/L	1,880	1,980	2,600	2,100	1,950	2,480	2,430	2,220	1,860	1,790
TOTAL ALKALINITY AS CACO3		mg/L	439	436	531	458	427	528	474	481	433	435
CALCIUM (CA)	DIS	mg/L	263	266	334	283	305	362	324	324	266	267
MAGNESIUM (MG)	DIS	mg/L	304	293	410	305	317	426	382	385	292	289
POTASSIUM (K)	DIS	mg/L	13	13	17	13	14	13	15	16	13	13
SODIUM (NA)	DIS	mg/L	207	195	231	191	181	237	200	203	188	190
Nutrients												
NITRATE + NITRITE AS N		mg/L	0.02	<0.01	0.04	0.04	0.13	0.05	0.05	0.26	0.02	0.02
Metals & Minor Constuents												
BORON (B)	DIS	mg/L	1.08	1.14	0.6	1.15	1.36	1.7	0.9	0.9	1.14	1.12
BORON (B)	TRC	mg/L	1.13	1.14	0.59	1.18	1.34	1.65	0.96	0.92	1.11	1.13
COBALT (CO)	DIS	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005
COBALT (CO)	TRC	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
LITHIUM (LI)	DIS	mg/L	0.08	0.07	0.13	0.07	0.08	0.09	0.08	0.09	0.07	0.08
LITHIUM (LI)	TRC	mg/L	0.07	0.08	0.12	0.07	0.08	0.09	0.09	0.09	0.08	0.08
MANGANESE (MN)	DIS	mg/L	0.133	0.136	0.518	0.095	1.31	1.63	0.010	0.340	0.116	0.131
MANGANESE (MN)	TRC	mg/L	0.145	0.176	0.57	0.096	1.30	1.61	0.011	0.46	0.116	0.139
MERCURY (HG)	DIS	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
MERCURY (HG)	TRC	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
MOLYBDENUM (MO)	DIS	mg/L	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002
MOLYBDENUM (MO)	TRC	mg/L	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.003	0.002	0.004
SELENIUM (SE)	DIS	mg/L	0.0007	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
SELENIUM (SE)	TRC	mg/L	0.0007	<0.0006	0.0007	<0.0006	<0.0006	<0.0006	0.0007	0.0007	<0.0006	<0.0006

Talen - Synoptic Run March 2021

Station Name			AR-8	AR-9	AR-9 (Dup)	NSTP	PRT	DI Blank
Sample ID			TLN-2103-104	TLN-2103-105	TLN-2103-115	TLN-2103-109	TLN-2103-107	TLN-2103-114
Sample Date			3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021	3/24/2021
Physical								
FLOW		gpm	389	340		PONDED	NO SAMPLE	
OXYGEN (O) (FLD)		mg/L	9.76	10.46		23.17		
pH - FLD		s.u.	8.32	8.24		9.72		
OXIDATION REDUCTION POTENTIAL		mV	86.1	36.4		-17.1		
pH - LAB		s.u.	8.1	8.1	8.1	9.3		6.1
SC (UMHOS/CM AT 25 C)		umhos/cm	3,320	3,360	3,350	1,750		<5
SC (UMHOS/CM AT 25 C) (FLD)		umhos/cm	3,209	3,209		1,654		
TDS (MEASURED AT 180 C)		mg/L	2,960	2,940	2,970	1,220		<10
WATER TEMPERATURE (FLD)		C	0.8	1.5		7		
Major Costituents								
BICARBONATE ALK AS HCO3		mg/L	529	542	541	249		<4
BROMIDE (BR)		mg/L	0.5	0.5	0.6	<0.5		<0.5
CARBONATE AS CO3		mg/L	<4	<4	<4	67		<4
CHLORIDE (CL)		mg/L	75	80	74	91		<0.5
SULFATE (SO4)		mg/L	1,940	2,080	1,810	608		<1
TOTAL ALKALINITY AS CACO3		mg/L	434	444	444	316		<4
CALCIUM (CA)	DIS	mg/L	270	275	275	93.2		<0.5
MAGNESIUM (MG)	DIS	mg/L	295	300	300	109		<0.5
POTASSIUM (K)	DIS	mg/L	13	13	12	24		<1
SODIUM (NA)	DIS	mg/L	188	191	191	144		<0.3
Nutrients								
NITRATE + NITRITE AS N		mg/L	<0.01	0.02	0.02	1.08		<0.01
Metals & Minor Constuents								
BORON (B)	DIS	mg/L	1.13	1.15	1.15	0.76		<0.05
BORON (B)	TRC	mg/L	1.12	1.17	1.16	0.75		<0.05
COBALT (CO)	DIS	mg/L	<0.005	<0.005	<0.005	<0.005		<0.005
COBALT (CO)	TRC	mg/L	<0.005	<0.005	<0.005	<0.005		<0.005
LITHIUM (LI)	DIS	mg/L	0.07	0.08	0.08	0.06		<0.01
LITHIUM (LI)	TRC	mg/L	0.08	0.08	0.07	0.06		<0.01
MANGANESE (MN)	DIS	mg/L	0.172	0.071	0.072	0.009		<0.001
MANGANESE (MN)	TRC	mg/L	0.178	0.079	0.081	0.033		<0.001
MERCURY (HG)	DIS	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
MERCURY (HG)	TRC	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
MOLYBDENUM (MO)	DIS	mg/L	0.002	0.002	0.002	0.001		<0.001
MOLYBDENUM (MO)	TRC	mg/L	0.002	0.001	0.002	0.001		<0.001
SELENIUM (SE)	DIS	mg/L	<0.0006	<0.0006	<0.0006	<0.0006		<0.0006
SELENIUM (SE)	TRC	mg/L	<0.0006	<0.0006	<0.0006	<0.0006		<0.0006

EXHIBITS 1&2



LEGEND

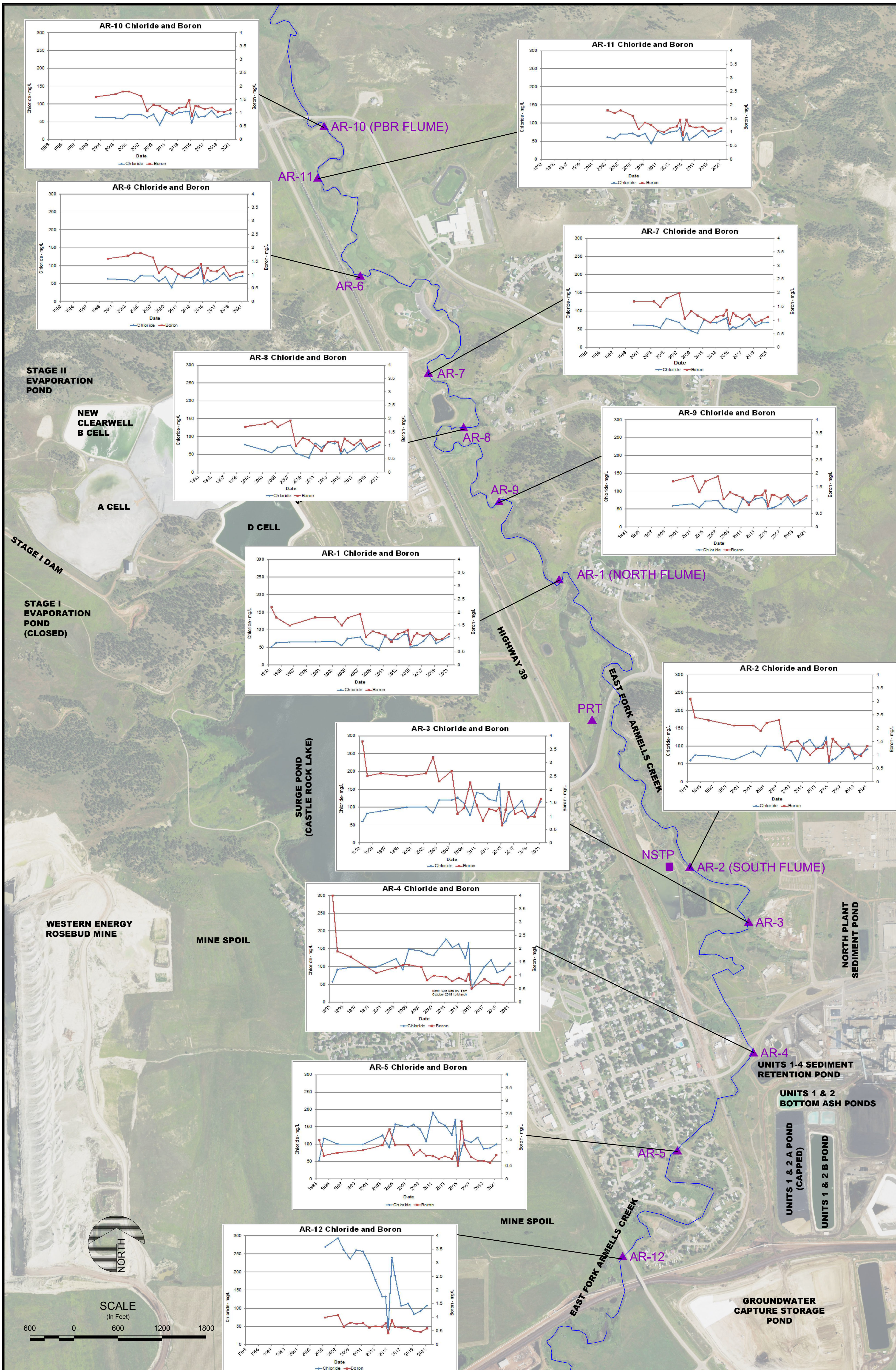
▲ AR-12 SYNOPTIC RUN SURFACE WATER SITE

Hydrometrics, Inc.
Consulting Scientists and Engineers
3602 Hesper Road
Billings, Montana 59106
(406) 656-1172

TALEN MONTANA, LLC
MARCH 2021 EAST FORK ARMELLS CREEK
SYNOPTIC RUN

TOTAL DISSOLVED SOLIDS, SPECIFIC CONDUCTANCE AND SULFATE

DRAWING FILE NUMBER	903621B003
AUTOCAD 2000 DRAWING (DWG)	
EXHIBIT	1



LEGEND

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TALEN MONTANA, LLC
MARCH 2021 EAST FORK ARMELLS CREEK
SYNOPTIC RUN

CHLORIDE AND BORON

DRAWING FILE NUMBER
903621B003
AUTOCAD 2000 DRAWING (DWG)
EXHIBIT
2