FOOTHILL ASSOCIATES

ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

December 2, 2010

Tami Leathers
Yolo County
County Administrator's Office
625 Court Street, Room 202
Woodland, CA 95695
tami.leathers@yolocounty.org

Re: Cache Creek Water Quality Analysis Results collected over a 10-Year Period (September 1, 1999 to February 24, 2010)

Dear Ms. Leathers:

This letter contains trend results from the graphical analysis of the Cache Creek water quality data collected over a 10 year period (September 1, 1999 to February 24, 2010). The data was analyzed "Spatially" (i.e. by site), "Temporally" (i.e. by monitoring event) and "Seasonally" (i.e. by time of year). Enclosed are copies of all the Analysis Graphs. The data was pulled from all past Laboratory Reports, which was previously sent to Yolo County.

Interpreting Analysis Graphs

The Graphical Analysis used for this study is based upon a Box Plot format often referred to as Box-n-Whiskers Plots. Following is a quick summary of how to interpret the graphs.

Box-n-Whiskers Plots do not show the data, but rather statistics about the data. They are an easy way to visually summarize 1) the center of the data, 2) the variation or spread, 3) the skewness and 4) presence or absence of extreme values. Each part of the graph represents a different statistical value, as described below.

- The bottom of each box (edge closest to zero) shows the 25th percentile, where 25 percent of the data is either less than or equal to this value.
- The top of each box shows the 75th percentile, where 25 percent of the data is either less than or equal to this value.
- The horizontal line in the box shows the median.
- The diamond shows the mean. The diamonds are connected by a single solid line to help show trends.
- The lower whisker shows the 10th percentile.
- The upper whisker shows the 90th percentile.
- The plus signs show any outlying data points that are either below the 10th percentile or above the 90th percentile.

Data Trends

- **Dissolved Oxygen (DO)**
  - Spatial: Little difference was observed between sample sites located directly on the creek. However, Gordon Slough demonstrated significantly lower concentrations. This trend was expected due to the build up of organic matter, potentially from agricultural runoff in the upstream drainage area, and the reduced mixing of water in Gordon Slough.
  - Seasonal: Decreases in DO concentrations from First Flush through Summer were observed. This trend was expected because DO concentrations are dependent upon temperature and mixing of water.
  - Temporal: No trends were observed with this analysis.
- **pH**
  - Spatial: Little difference was observed between sample sites located directly on the creek. Lower concentrations were observed in Gordon Slough. The only result that did not meet the water quality criteria was the I-5 Bridge Summer 2005 sample which had a value of 5.3.
  - Seasonal: A slight decrease in pH during the Summer was observed, which was likely due to the low I-5 Bridge Summer 2005 results.
  - Temporal: No trends were observed with this analysis.
- **Temperature**
  - Spatial: A slight decrease in temperature was observed upstream to downstream between sample sites located directly on the creek. Slightly lower temperatures were observed at Gordon Slough.
  - Seasonal: An expected increase in temperature from First Flush to Summer was observed. All Summer samples exceeded the water quality criteria.
  - Temporal: No trends were observed with this analysis.
- **Color**
  - Spatial: An increase in color from Capay Bridge to Upstream of Gordon Slough to Stevens Bridge was observed, with a decrease at I-5 Bridge. Further investigation should be done to identify the cause of this trend. Gordon Slough had significantly higher color; this is expected due to the higher organic material, decomposition of vegetation, and suspended sediment.
  - Seasonal: A seasonal decrease in color was observed from First Flush to Summer. This was expected because color closely tracks suspended sediment, which is primarily controlled by available material and stream velocity.
  - Temporal: Continued sampling with respect to the storm hydrograph would be necessary to identify trends because of its dependence to stream velocity. No trends were observed with this analysis.
- **Odor**
  - A large spike in Odor was observed during the First Flush 2005 sampling, likely due to the timing of sample collection with respect to the storm hydrograph. This

spike significantly skewed the results. No trends were observed with this analysis.

- **Total Dissolved Solids (TDS)**
  - Spatial: Concentrations remained relatively constant between sampling sites.
  - Seasonal: High concentrations during First Flush were observed, likely due to flushing of the system. Low concentrations were observed during Winter Storms, probably because of dilution. Summer concentrations were similar to the Winter Storms, representing low flow and already leached conditions.
  - Temporal: A possible increasing trend temporally may be occurring. Continued sampling with respect to the storm hydrograph would be necessary to identify trends. No trends were observed with this analysis.
- **Total Suspended Solids (TSS)**
  - Spatial: An increasing trend between sites on the creek was observed. This was expected because downstream sites have a larger watershed and more potential erosion from runoff and stream velocities.
  - Seasonal: Concentrations decrease from First Flush to Summer due to the availability of fine material and required velocities.
  - Temporal: No trends were observed with this analysis.
- **Turbidity**
  - Spatial: An increasing trend between sites on the creek was observed. Gordon Slough had a higher concentration. This was predictable due to watershed erosion, particulate matter, and summer algal growth.
  - Seasonal: Turbidities decrease from First Flush to Summer due to the availability of fine material and required velocities.
  - Temporal: No trends were observed with this analysis.
- **Ammonia Nitrogen**
  - Spatial: A trend of increasing Ammonia Nitrogen from upstream to downstream was observed. Further analysis is recommended.
  - Seasonal: First Flush has higher concentrations than Winter Storm or Summer, both of which typically do not exceed the reporting limit.
  - Temporal: No trends were observed with this analysis.
- **Nitrate Nitrogen**
  - Spatial: Capay Bridge displayed the lowest concentrations, with an increase at Upstream of Gordon Slough and Stevens Bridge. Concentrations then dropped slightly at I-5, possibly because of dilution. Gordon Slough exhibited lower concentrations than all of the creek sites except Capay Bridge. This is likely due to upstream land practices in the area and the sample location is not influenced by the land practices along the creek.
  - Seasonal: Winter Storm had the lowest concentrations, likely due to dilution. First Flush did not have the highest concentrations as would typically be expected. Instead, Summer had considerably higher concentrations than any other sample time. Two possible explanations are: 1) First Flush samples have not

properly captured the true first flush, or 2) Summer inputs, likely from land use, are greater than anticipated. Further analysis and investigation is recommended.

- Temporal: A possible decreasing trend was observed from Winter 2001 to present. Further analysis and investigation is recommended.

- **Nitrite Nitrogen**
  - Spatial: Only three samples sites had detectable levels of Nitrite. The small available data set does not show any trends at this time.
  - Seasonal: A flushing trend with the highest concentrations during First Flush, decreasing during Winter Storm, and the lowest in Summer was observed.
  - Temporal: Nitrite was only detected in the Winter 2005, Summer 2005, and Winter 2006 sampling events. No trends were observed with this analysis.
- **Total Kjeldahl Nitrogen (TKN)**
  - Spatial: Concentrations at Capay Bridge, Upstream of Gordon Slough and I-5 Bridge were all relatively similar. However, Gordon Slough and Stevens Bridge were greater than and less than, respectively, the other three sites.
  - Seasonal: A flushing trend with the highest concentrations during First Flush, decreasing during Winter Storm, and the lowest in Summer was observed.
  - Temporal: No trends were observed with this analysis.
- **Orthophosphate Phosphorus**
  - Spatial: Only two sample sites had detectable levels of Orthophosphate phosphorus, Upstream of Gordon Slough and Gordon Slough. The small available data set does not show any trends at this time.
  - Seasonal: Orthophosphate phosphorus was only detected in three sampling events. The small available data set does not show any trends at this time.
  - Temporal: Orthophosphate phosphorus was detected in the last two sampling events. This may be indicative of a decreasing trend. Further analysis and investigation is recommended.
- **TPH as Diesel**
  - Spatial: An increasing trend between sites on the creek was observed. Gordon Slough had a higher concentration than all of the creek sites. This is likely due to land use practices in the area. Further analysis is recommended.
  - Seasonal: First Flush has higher concentrations than Winter Storm or Summer, both of which typically do not exceed the reporting limit.
  - Temporal: An increasing trend was observed for TPH as Diesel, starting with Winter Storm 2005 to present. Further analysis and investigation is recommended.
- **TPH as Gasoline**
  - Not detectable in any sample.
- **Total Boron**
  - Spatial: Capay Bridge and Gordon Slough average concentrations are similar and less than Upstream of Gordon Slough, Stevens Bridge and I-5 Bridge which also have similar average concentrations. However, no discernable trend was evident.

- Seasonal: First Flush and Summer have the same approximate concentrations, with Winter Storm being the lowest likely due to dilution.
- Temporal: All sampling events were above the 600 µg/L water quality objective except for First Flush 2002, Winter Storm 2005, Winter Storm 2006, and First Flush 2008. No trends were observed.

- **Dissolved Mercury**
  - Dissolved Mercury was only detected during the Summer 2004 sampling event. No trends were observed.
- **Total Mercury**
  - Spatial: Total Mercury was only detected during the First Flush 2000, 2002, 2006, 2010 and Summer 2004 sampling events. No trends were observed with this reduced data set.
  - Seasonal: The extremely elevated concentrations observed during the Summer 2004 sampling appears to be an anomaly at this point in time, although further investigation may be warranted. However, detectable concentrations of Mercury in half of the First Flush samples do indicate a seasonal flushing trend.
  - Temporal: Total Mercury was only detected during the First Flush 2000, 2002, 2006, 2010 and Summer 2004 sampling events. The four First Flush events had average concentrations that were similar to each other, but the Summer 2004 concentration is almost 6 times greater.
- **Fecal Coliform**
  - Spatial: An increasing trend between sites on the creek was observed. Gordon Slough had a significantly higher concentration than all of the creek sites. This may be due to local land use practices. Further analysis and investigation is recommended.
  - Seasonal: A flushing trend with the highest concentrations during First Flush, decreasing during Winter Storm, and the lowest in Summer was observed.
  - Temporal: The increasing trend was observed.
- **Total Coliform**
  - Spatial: Stevens Bridge was a factor of 10 less than the other sites. Furthermore, Total Coliform concentrations for Gordon Slough are significantly higher than all the creek sites. This is likely due to land practices in the upstream watershed.
  - Seasonal: A flushing trend may be present with the highest concentrations during First Flush, decreasing during Winter Storm, and the lowest in Summer.
  - Temporal: A possible increasing trend was observed. Further analysis and investigation is recommended.
- **Chlorinated Herbicides**
  - Only detected during the Winter Storm 2005 and First Flush 2006 sampling. 2,4-D was detected at Upstream of Gordon Slough during First Flush 2006 with a concentration of 8.9 µg/L. MCPP was detected at Gordon Slough and I-5 Bridge with concentrations of 8 and 8 µg/L.

- **Orthophosphate Pesticides**
  - Only detected during the Winter Storm 2005 sampling at Gordon Slough and I-5 Bridge. Ronnel and Mevinphos were detected at both sites with concentrations of 0.3 and 0.3 µg/L.

Should you have any questions concerning the contents of this letter or any of the provided data and graphs, please contact me at (916) 435-1202 or email scott.perrou@foothill.com to discuss.

Sincerely,

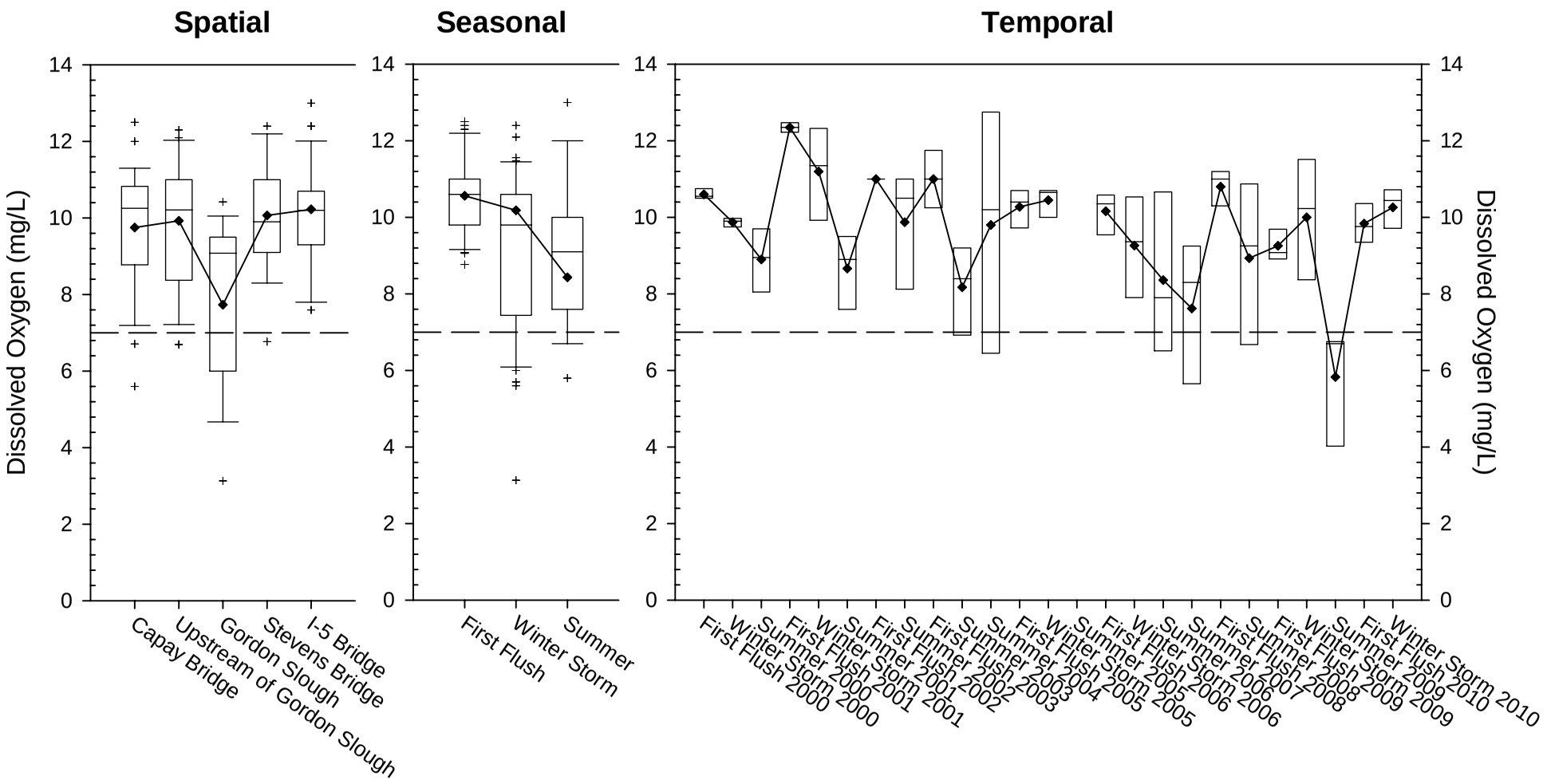
Scott Perrou, CPESC, CPSWQ

cc: Cindy Tuttle, Yolo County Natural Resources Coordinator
cindy.tuttle@yolocounty.org

Enclosures

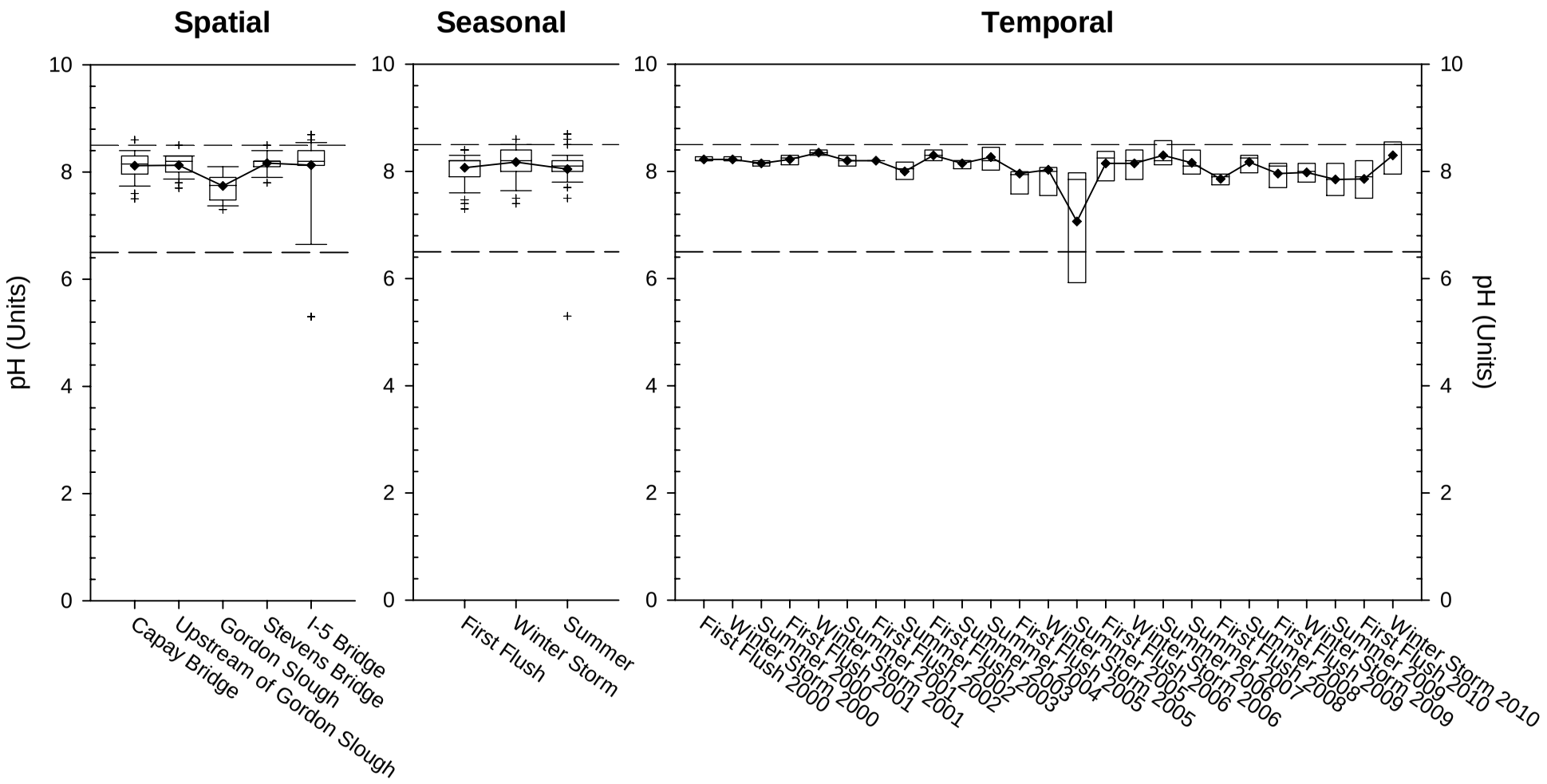
Lower Cache Creek

Dissolved Oxygen Analysis



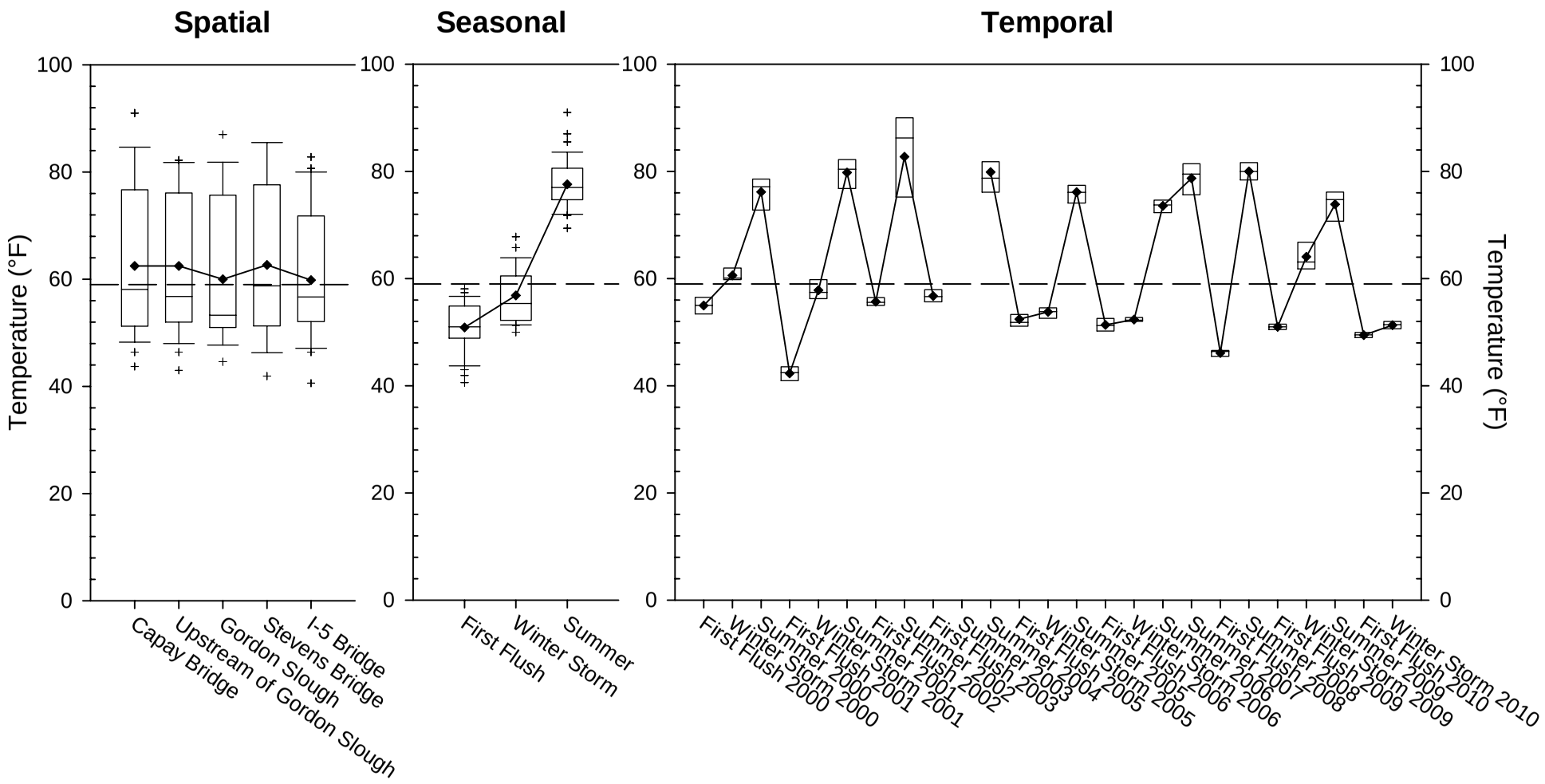
Lower Cache Creek

pH Analysis



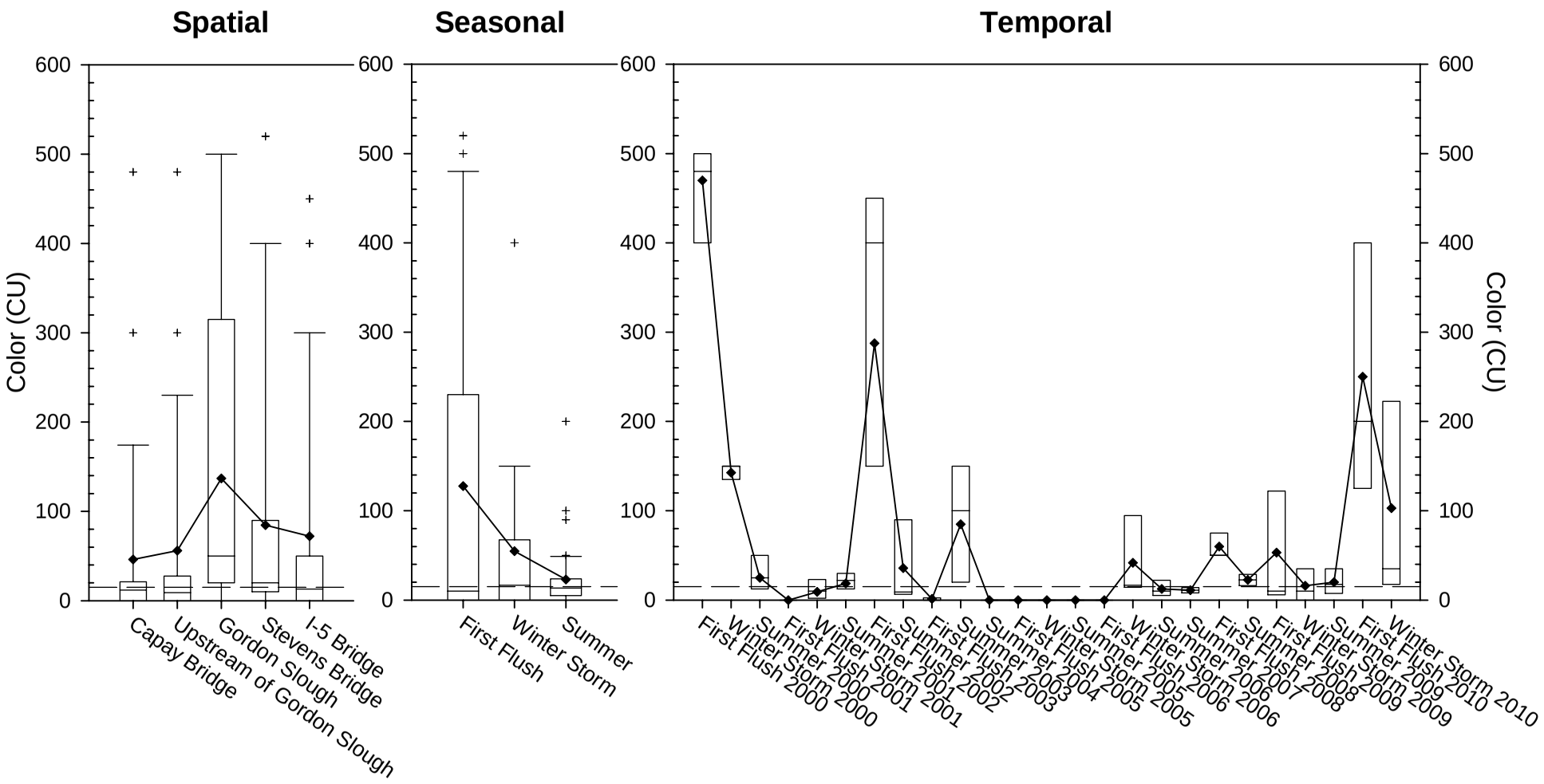
Lower Cache Creek

Temperature Analysis



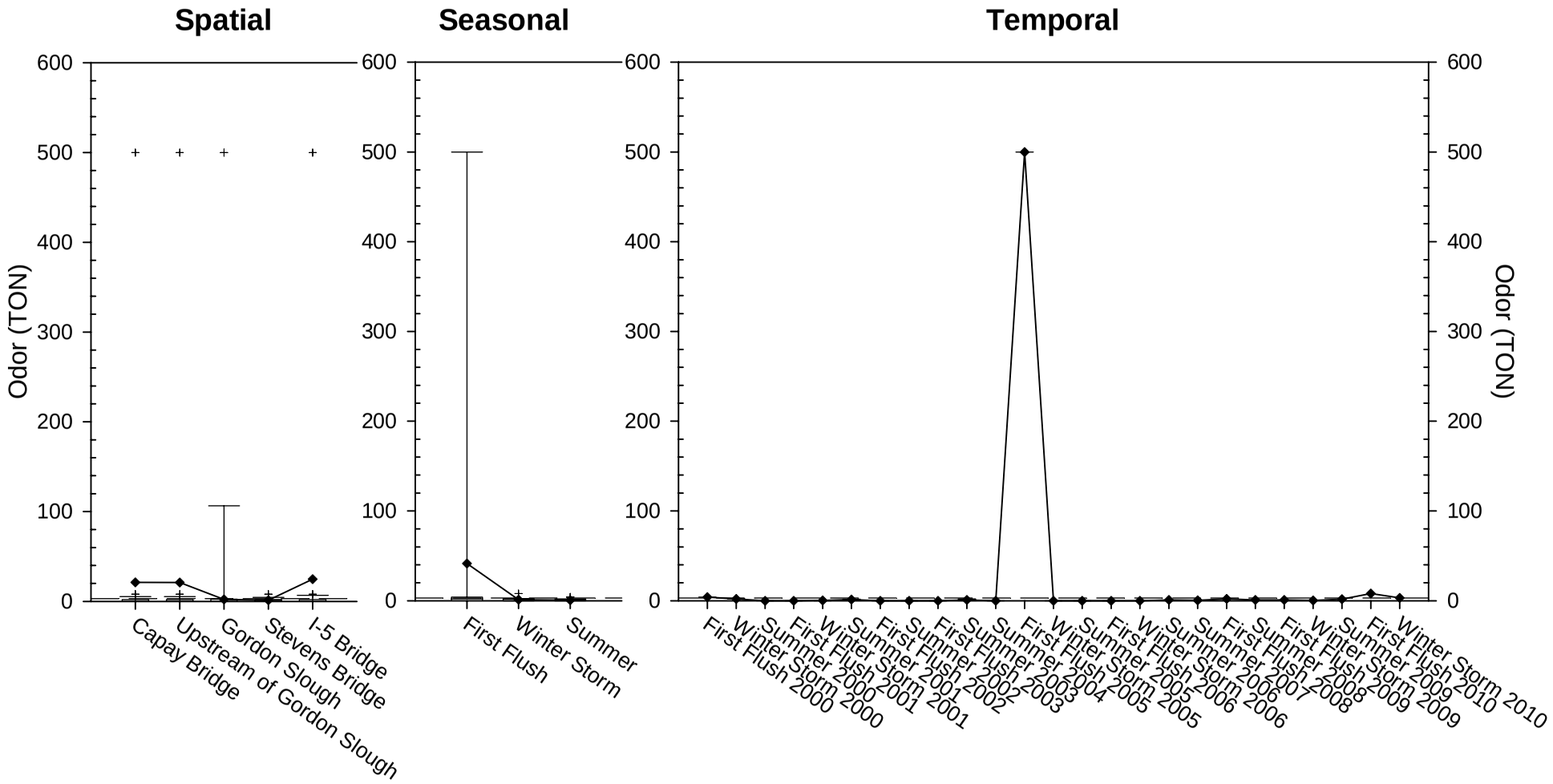
Lower Cache Creek

Color Analysis



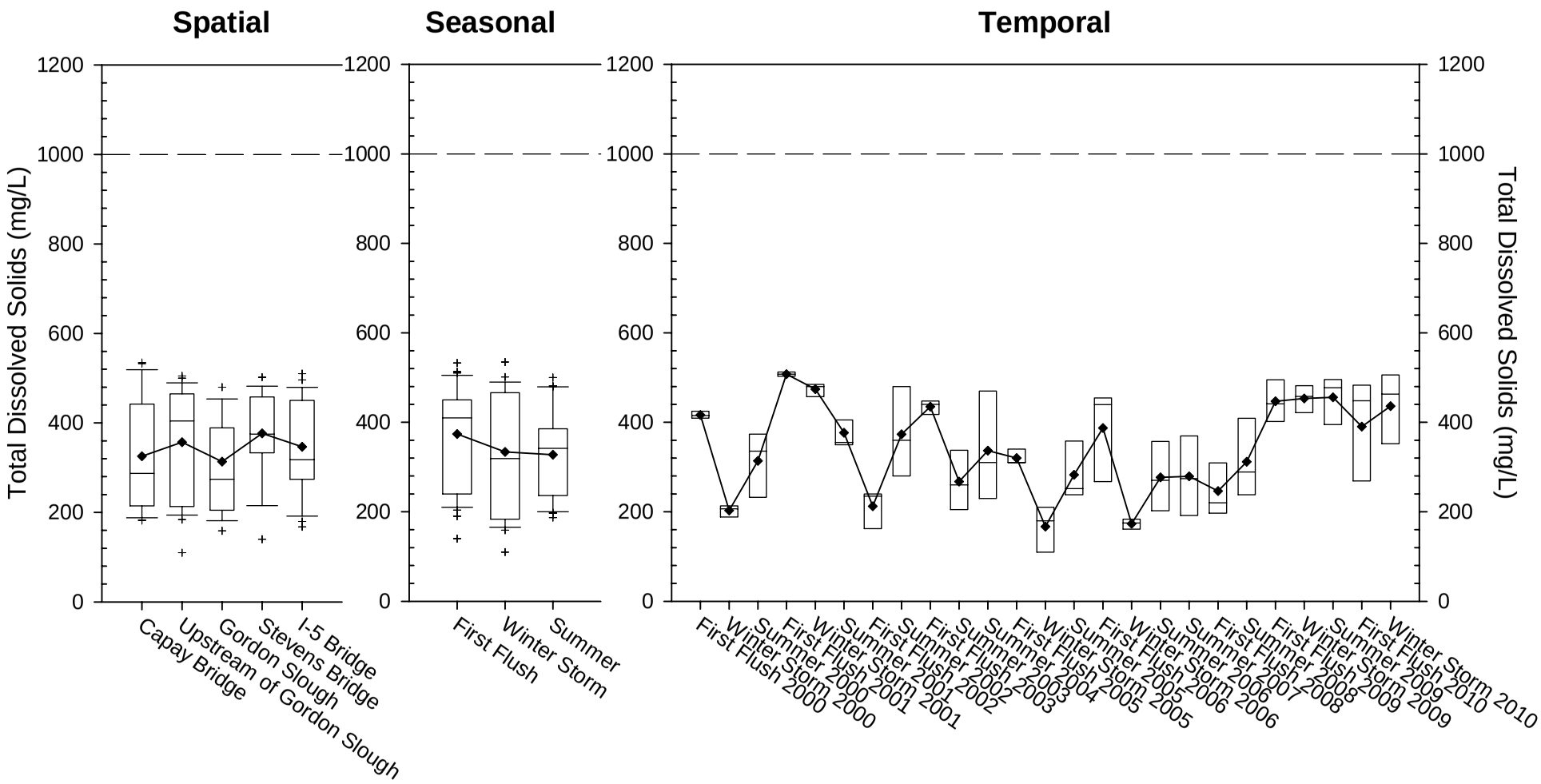
Lower Cache Creek

Odor Analysis



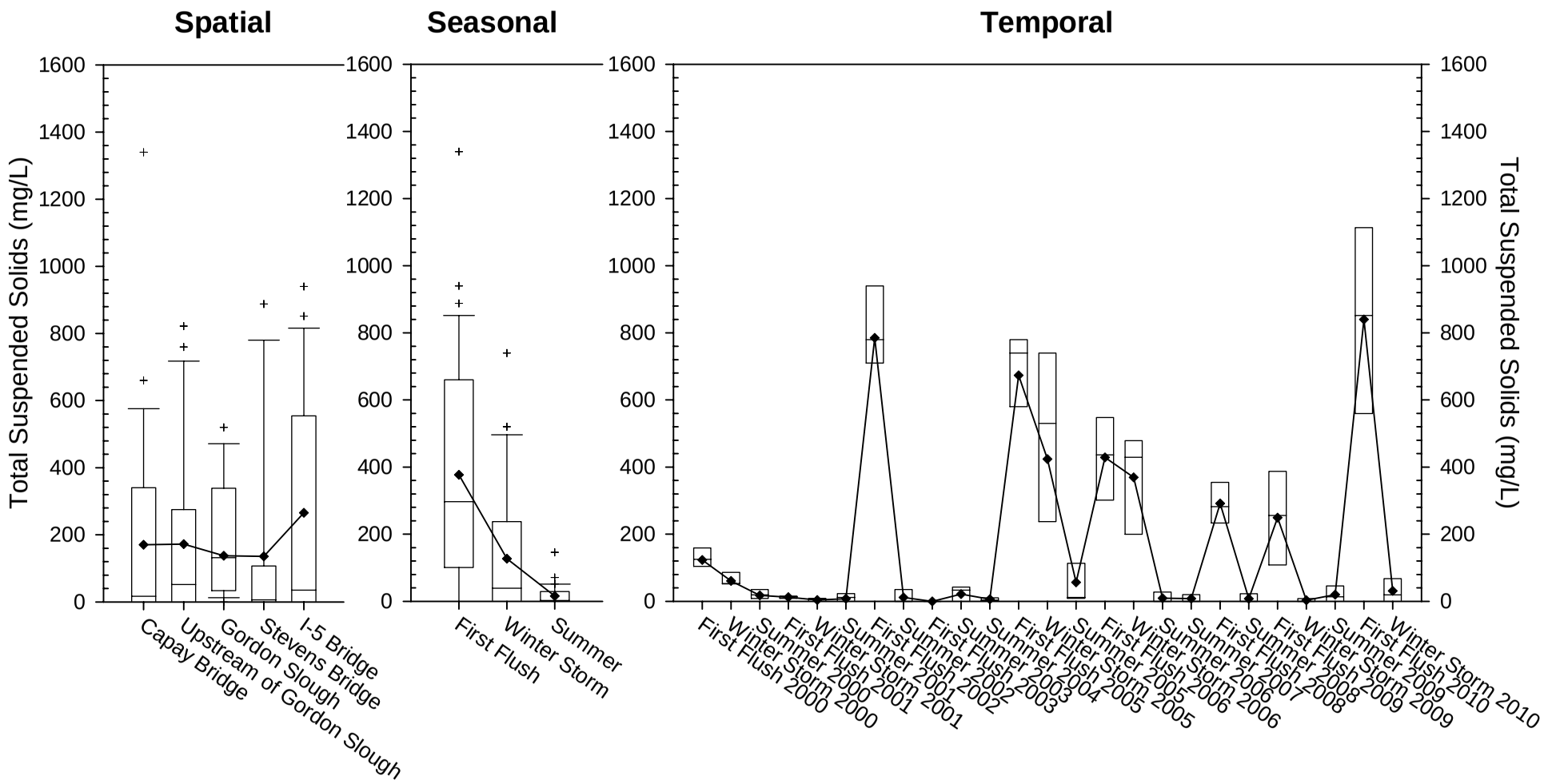
Lower Cache Creek

Total Dissolved Solids (TDS) Analysis



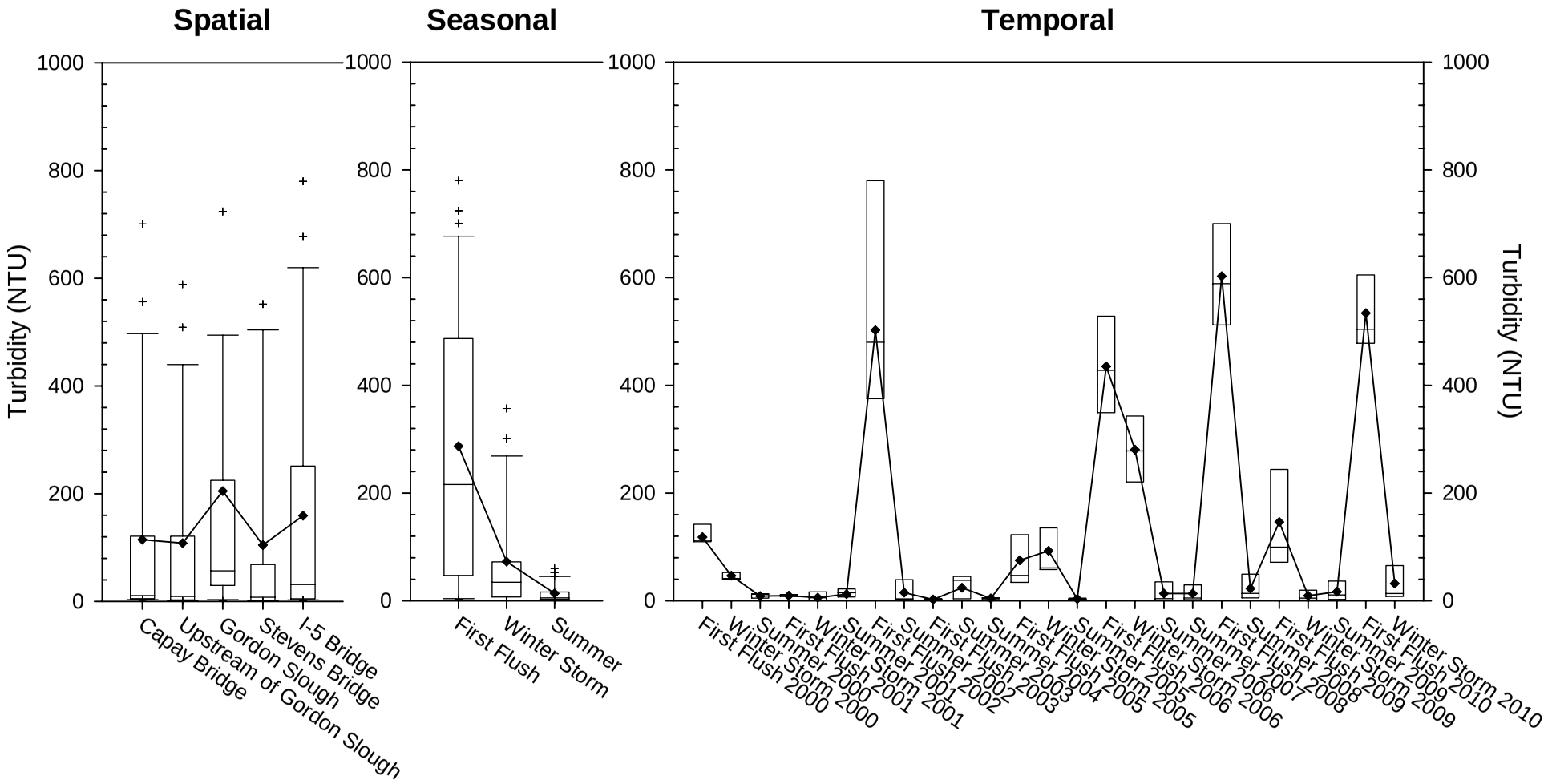
Lower Cache Creek

Total Suspended Solids (TSS) Analysis



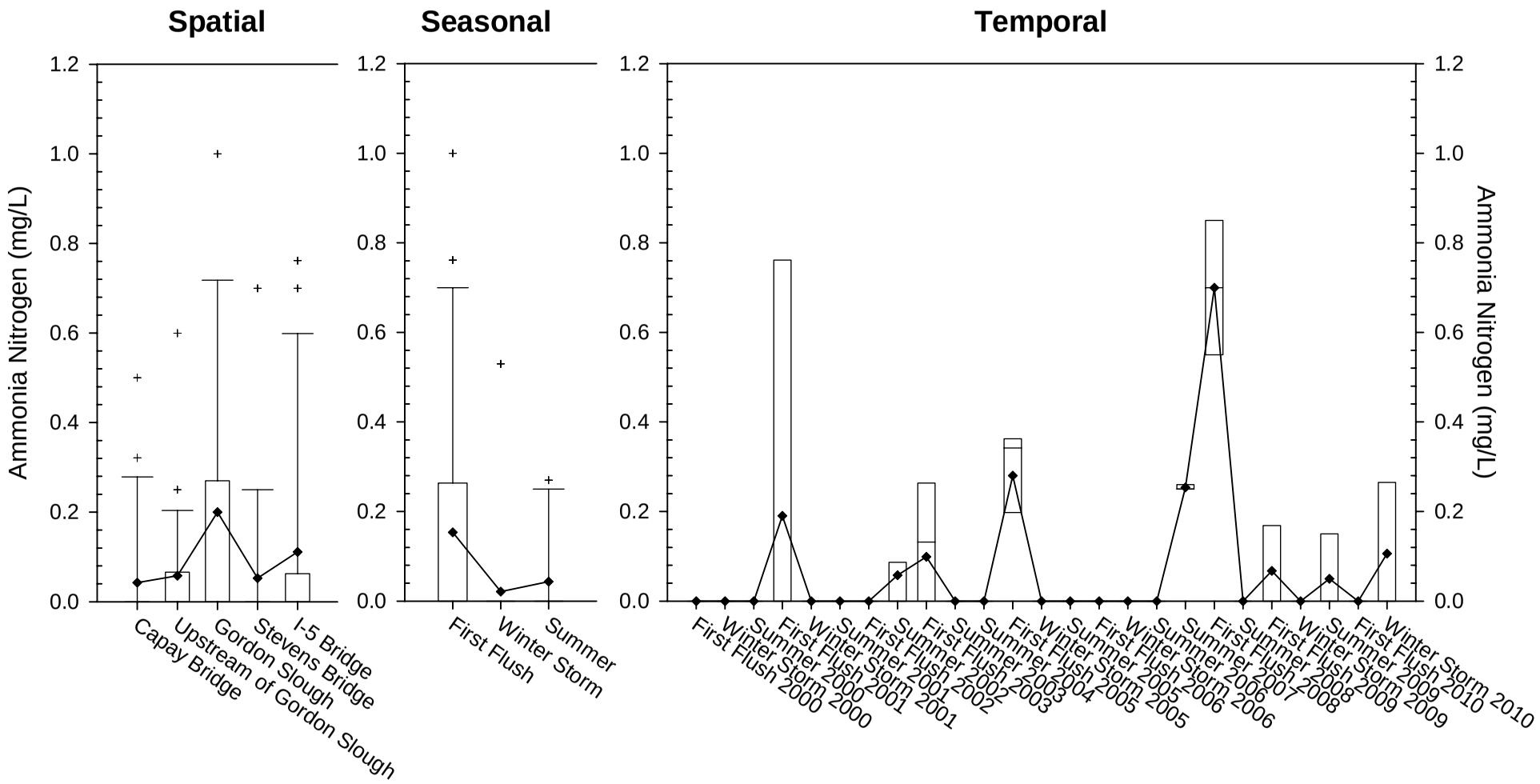
Lower Cache Creek

Turbidity Analysis



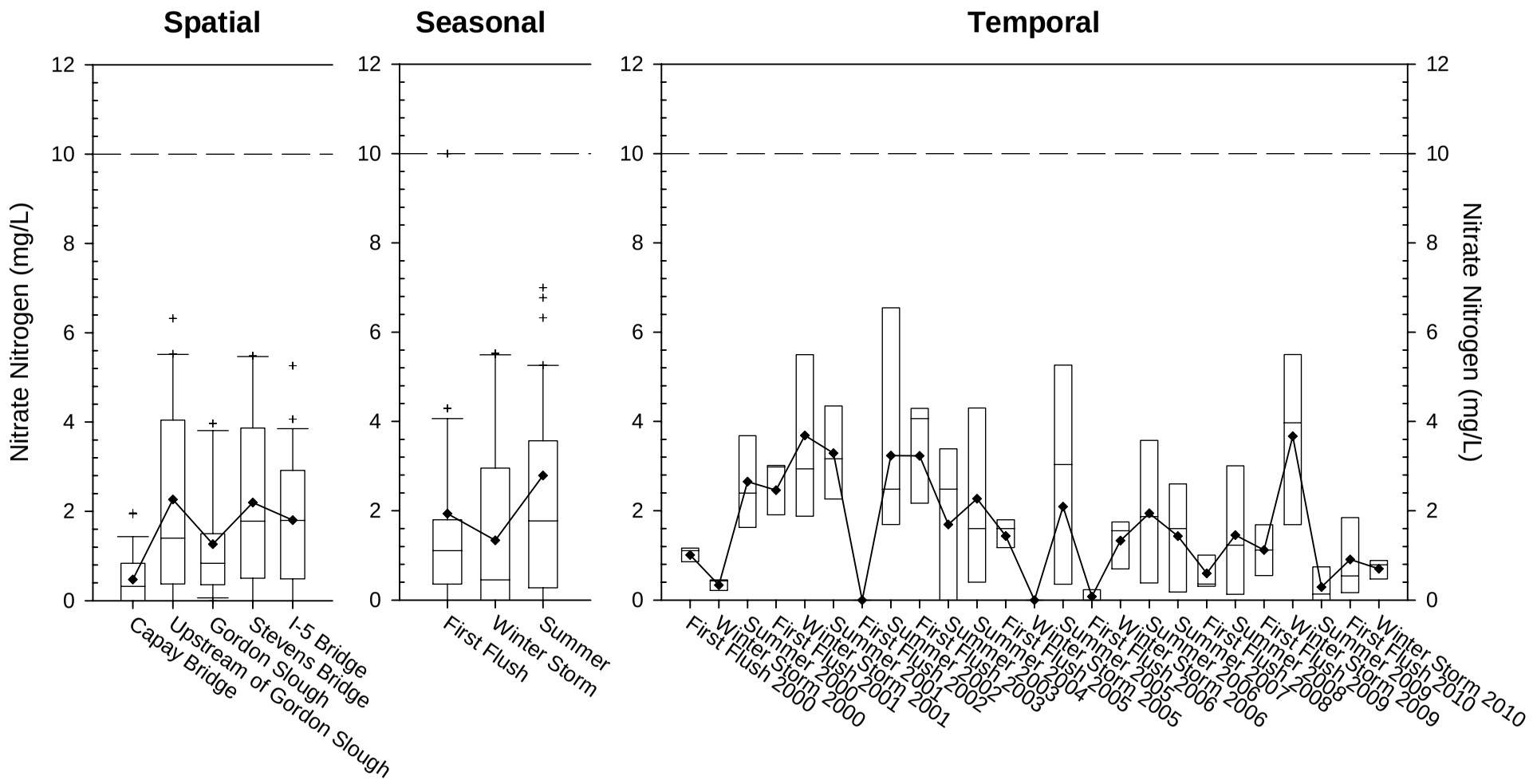
Lower Cache Creek

Ammonia Nitrogen (NH_3-N) Analysis



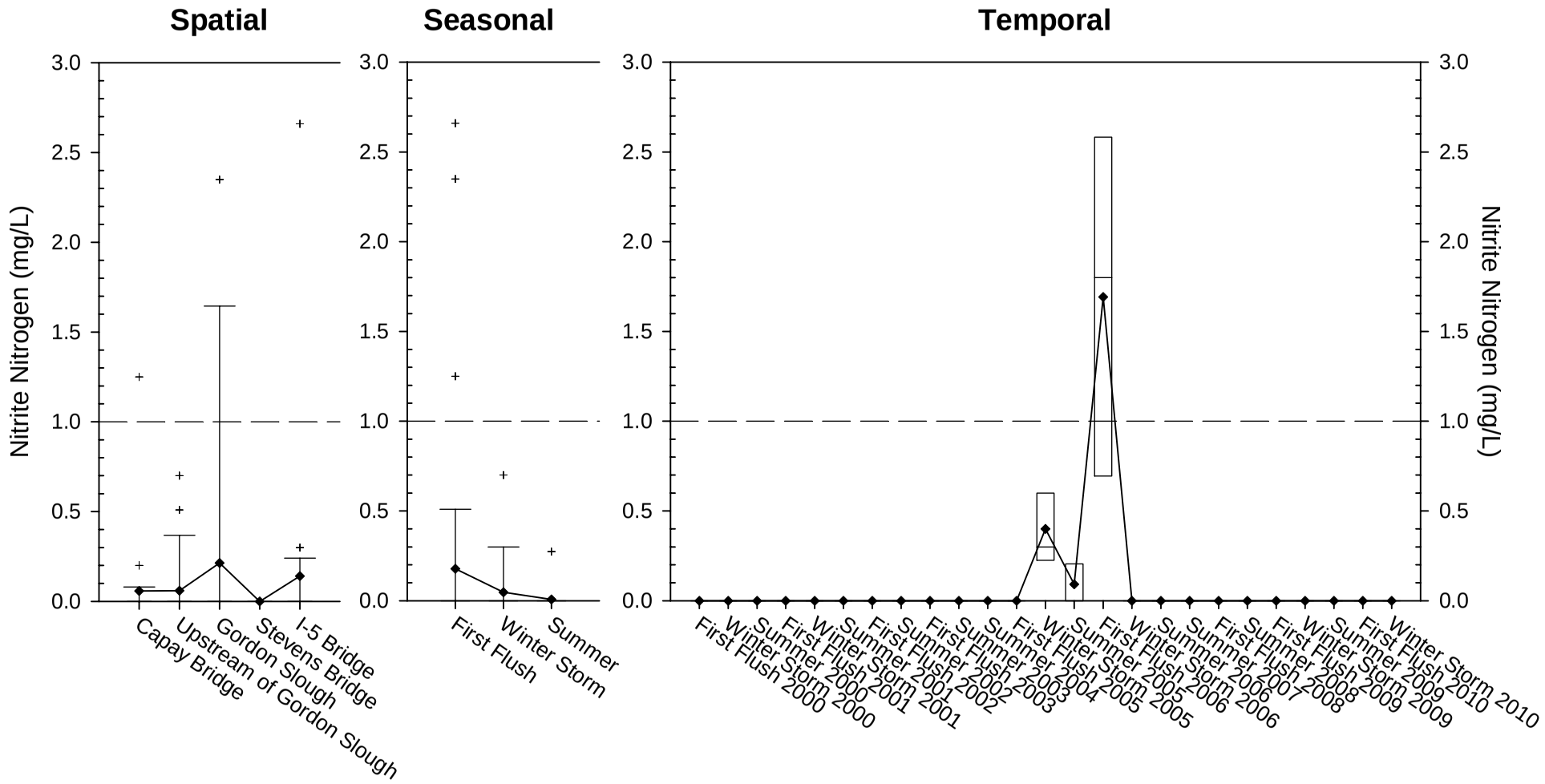
Lower Cache Creek

Nitrate Nitrogen (NO_3-N) Analysis



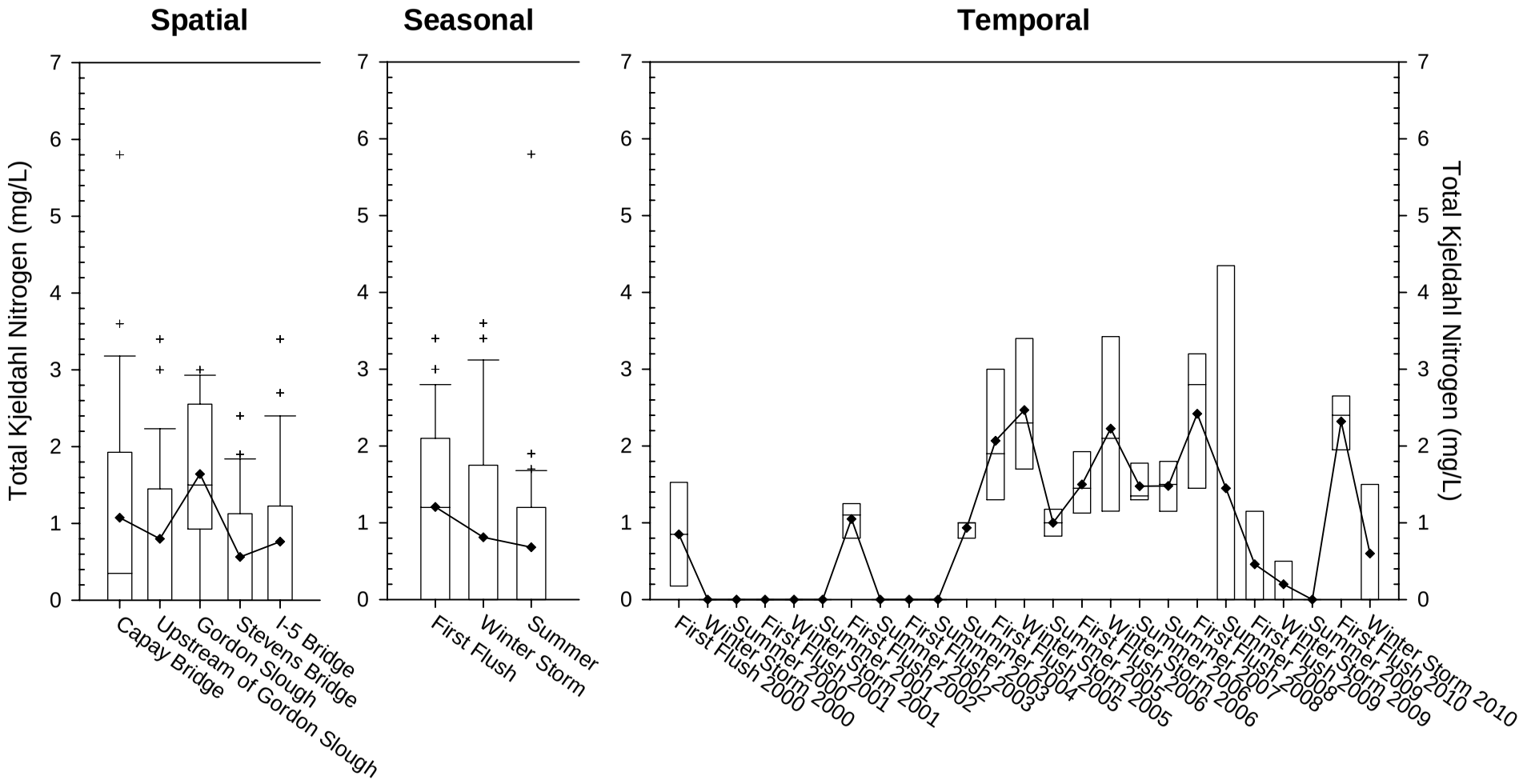
Lower Cache Creek

Nitrite Nitrogen (NO_2-N) Analysis



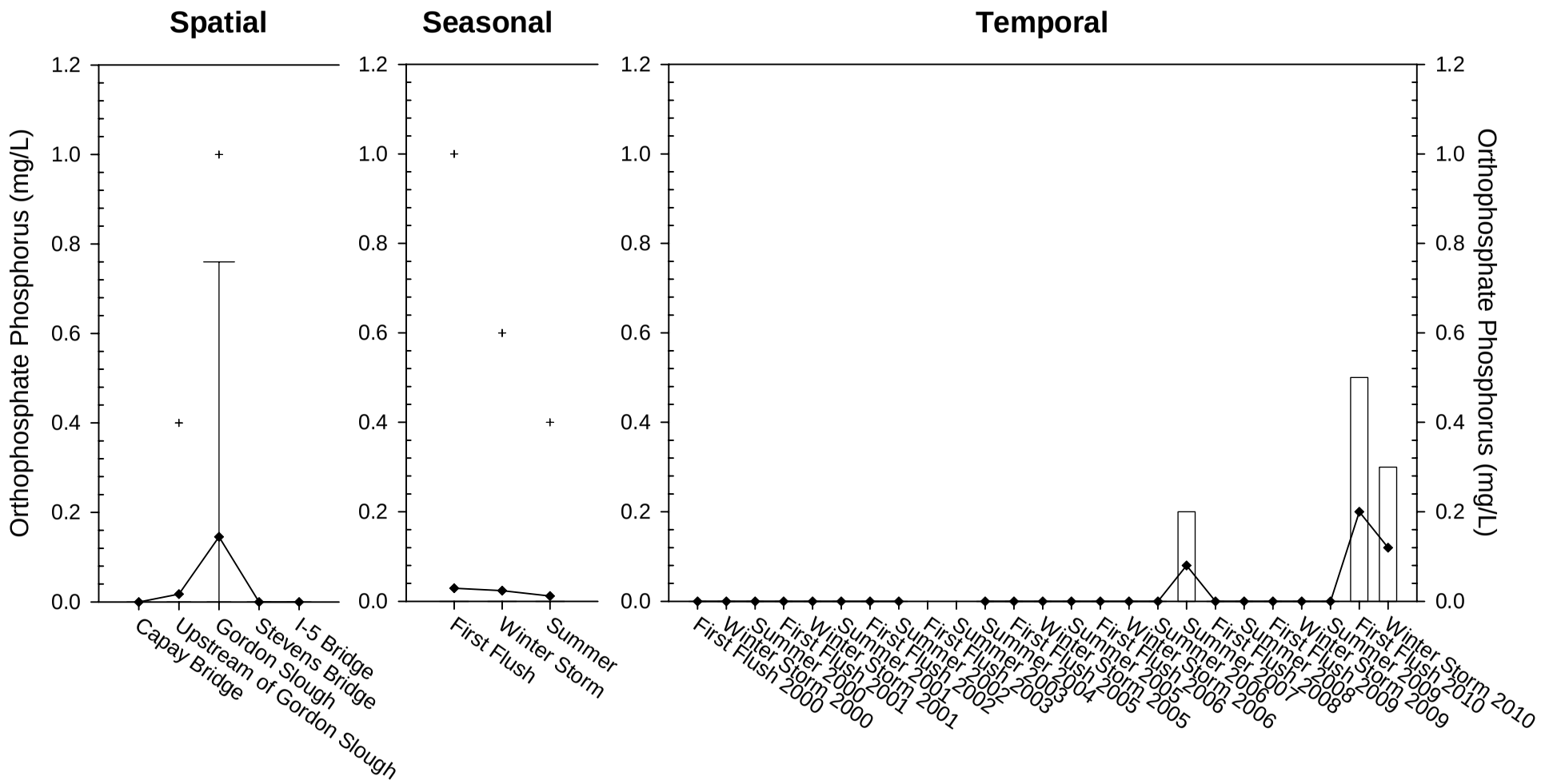
Lower Cache Creek

Total Kjeldahl Nitrogen (TKN) Analysis



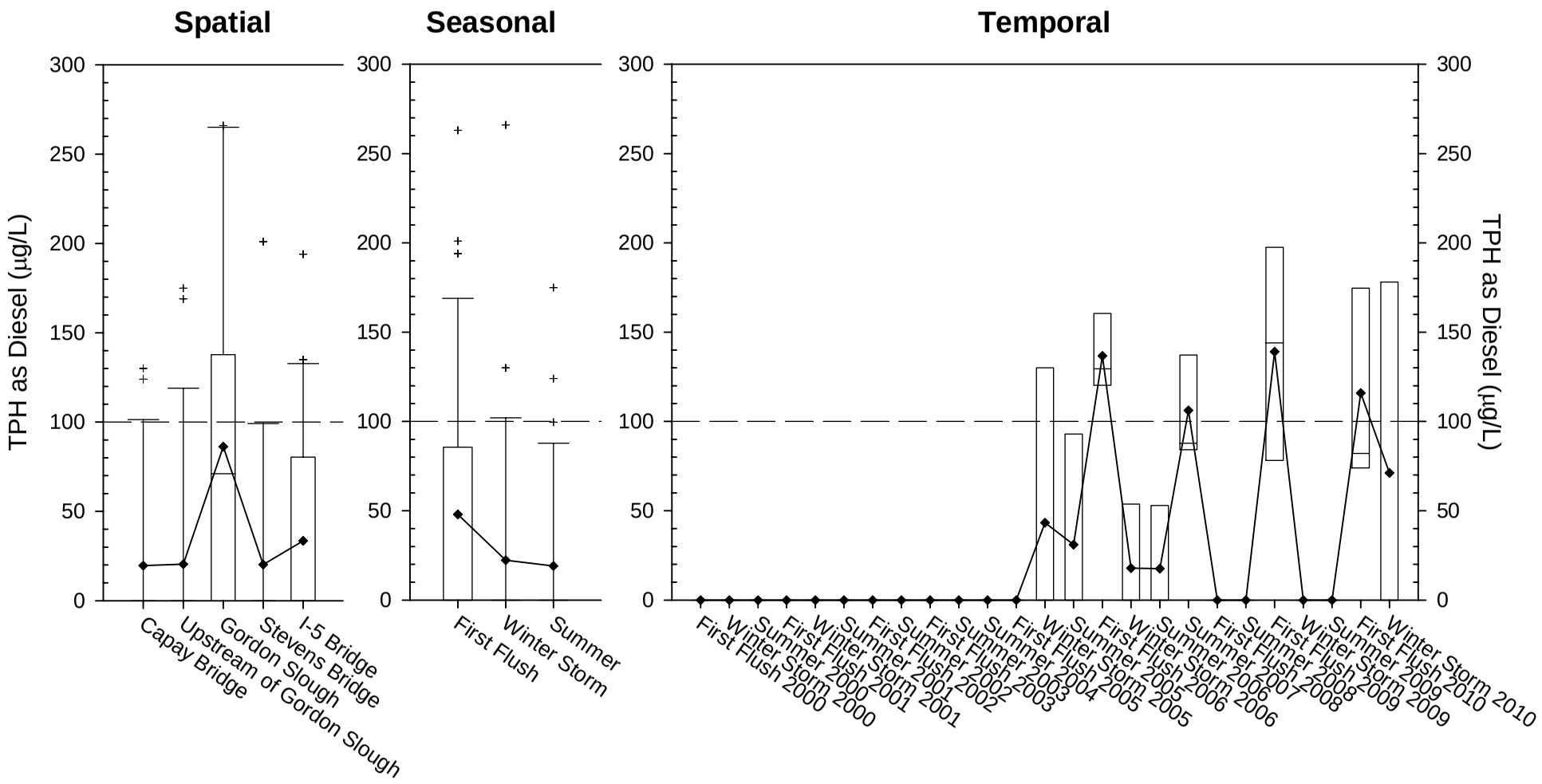
Lower Cache Creek

Orthophosphate Phosphorus (PO_4-P) Analysis



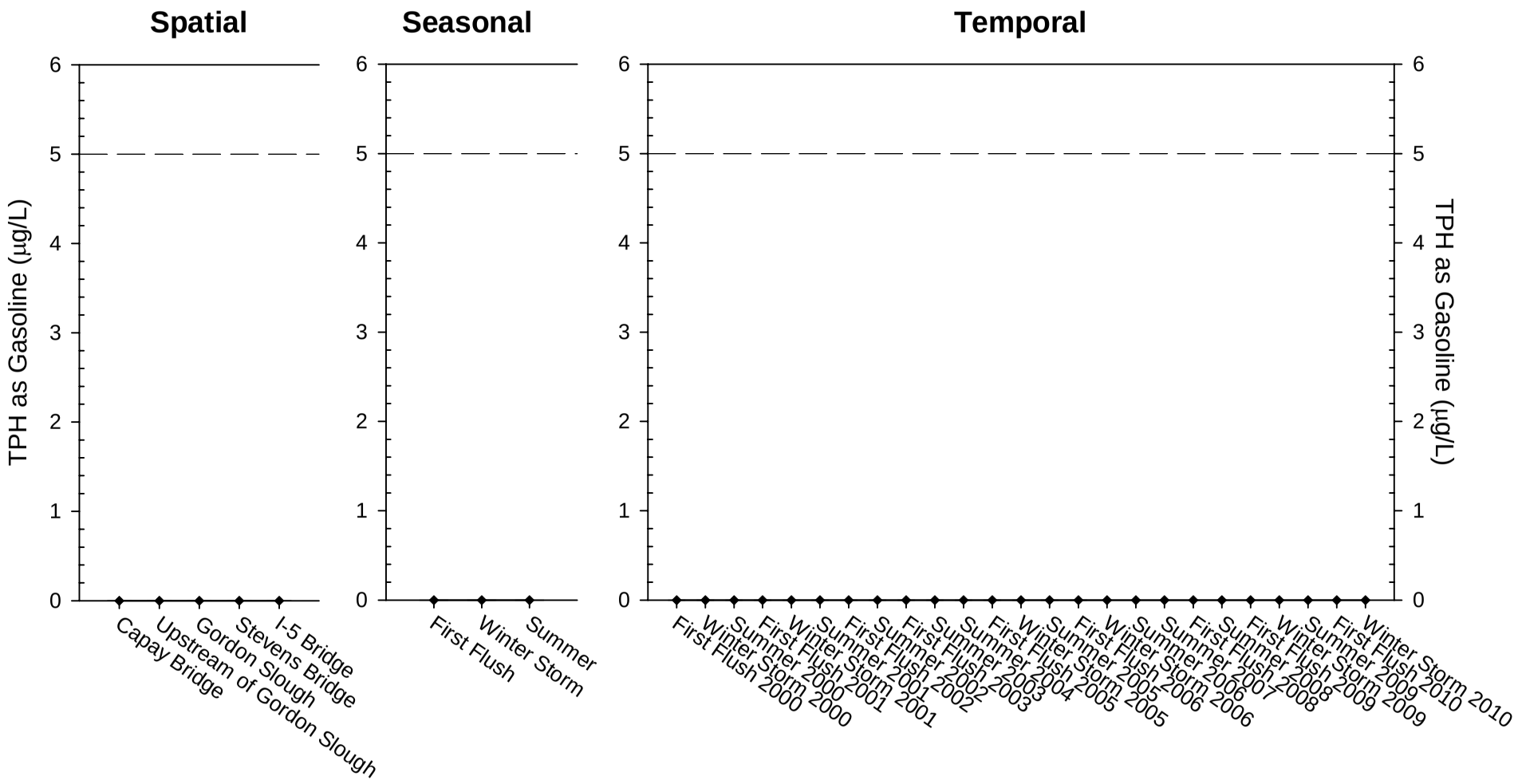
Lower Cache Creek

TPH as Diesel Analysis



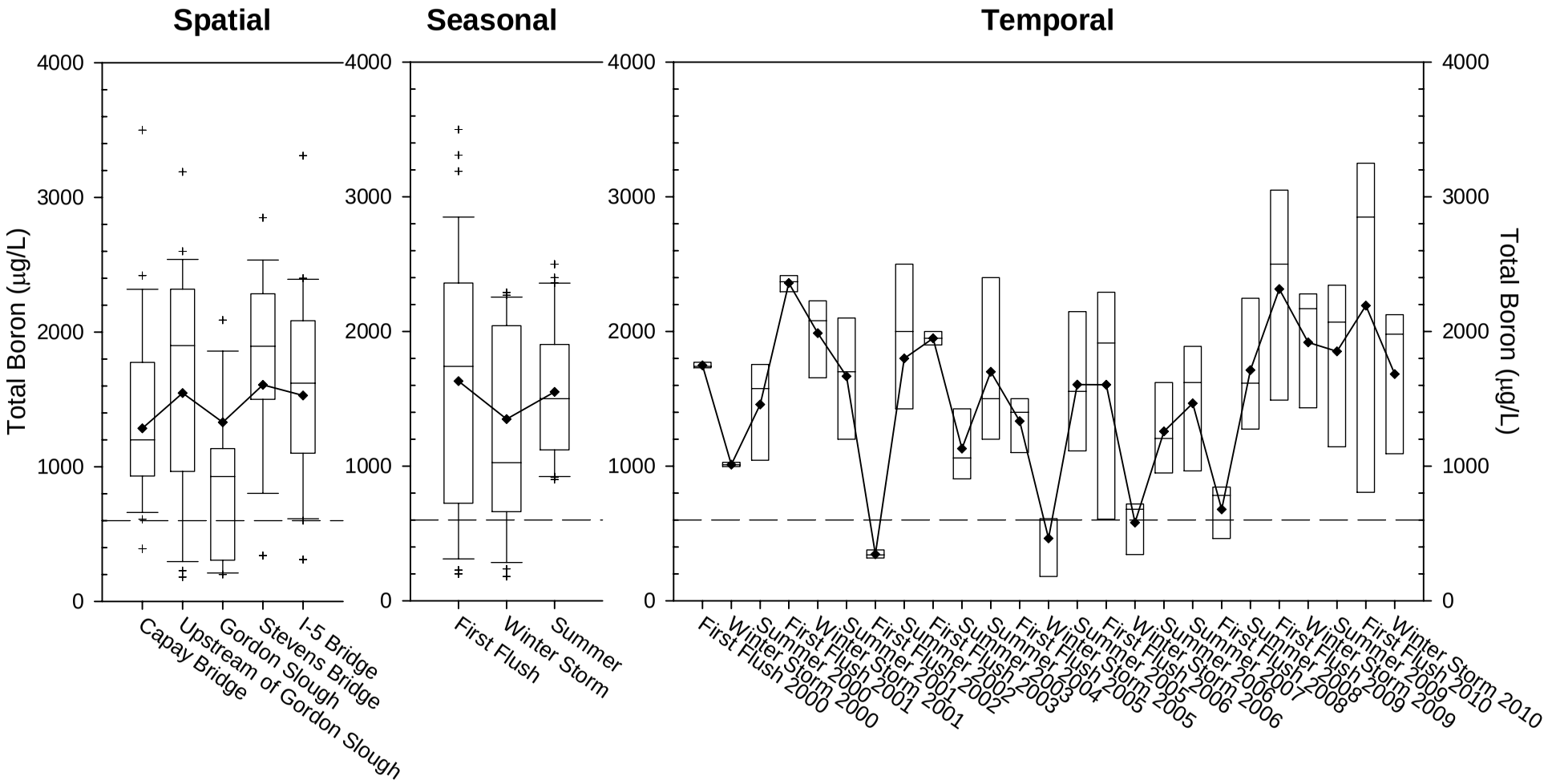
Lower Cache Creek

TPH as Gasoline Analysis



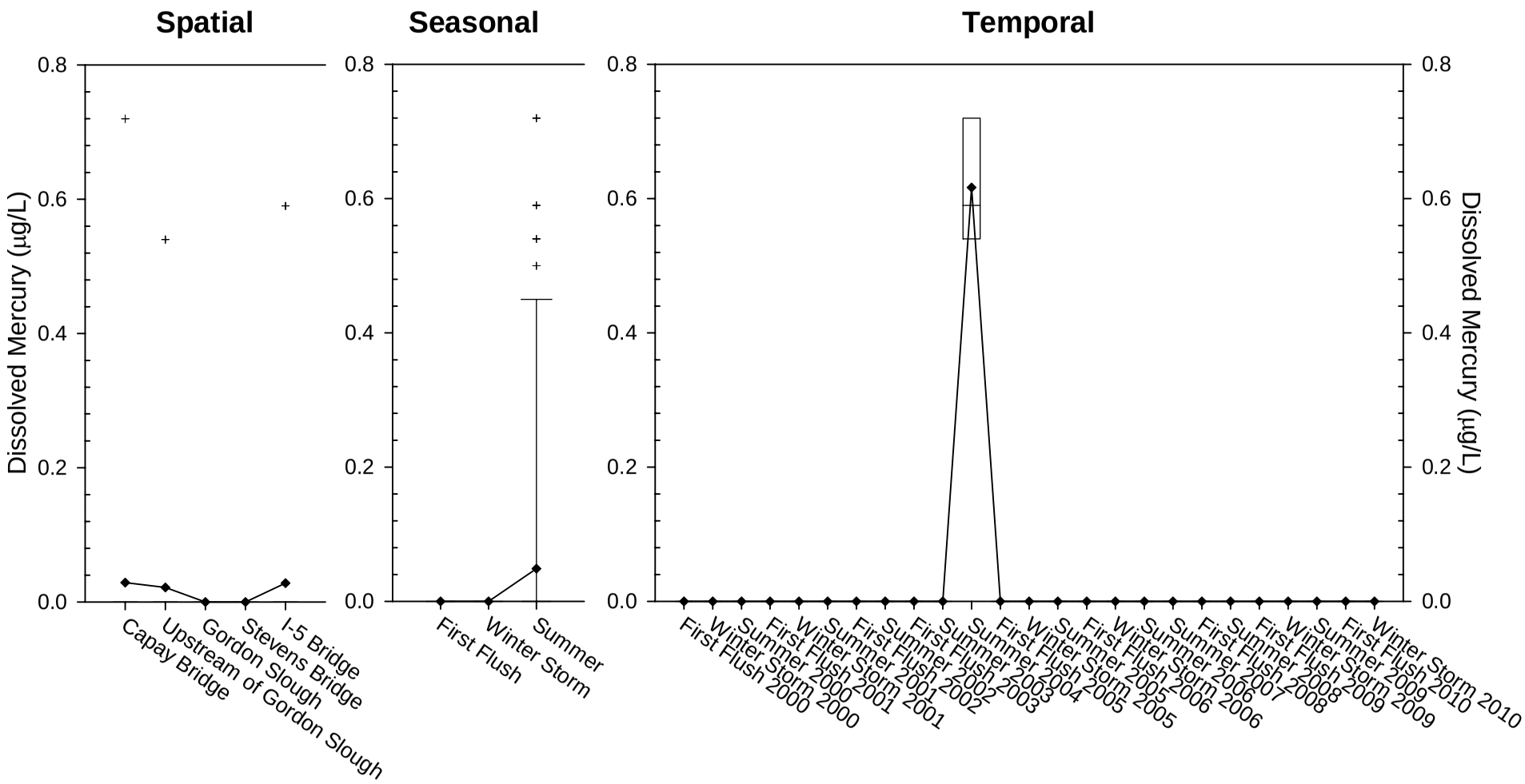
Lower Cache Creek

Total Boron Analysis



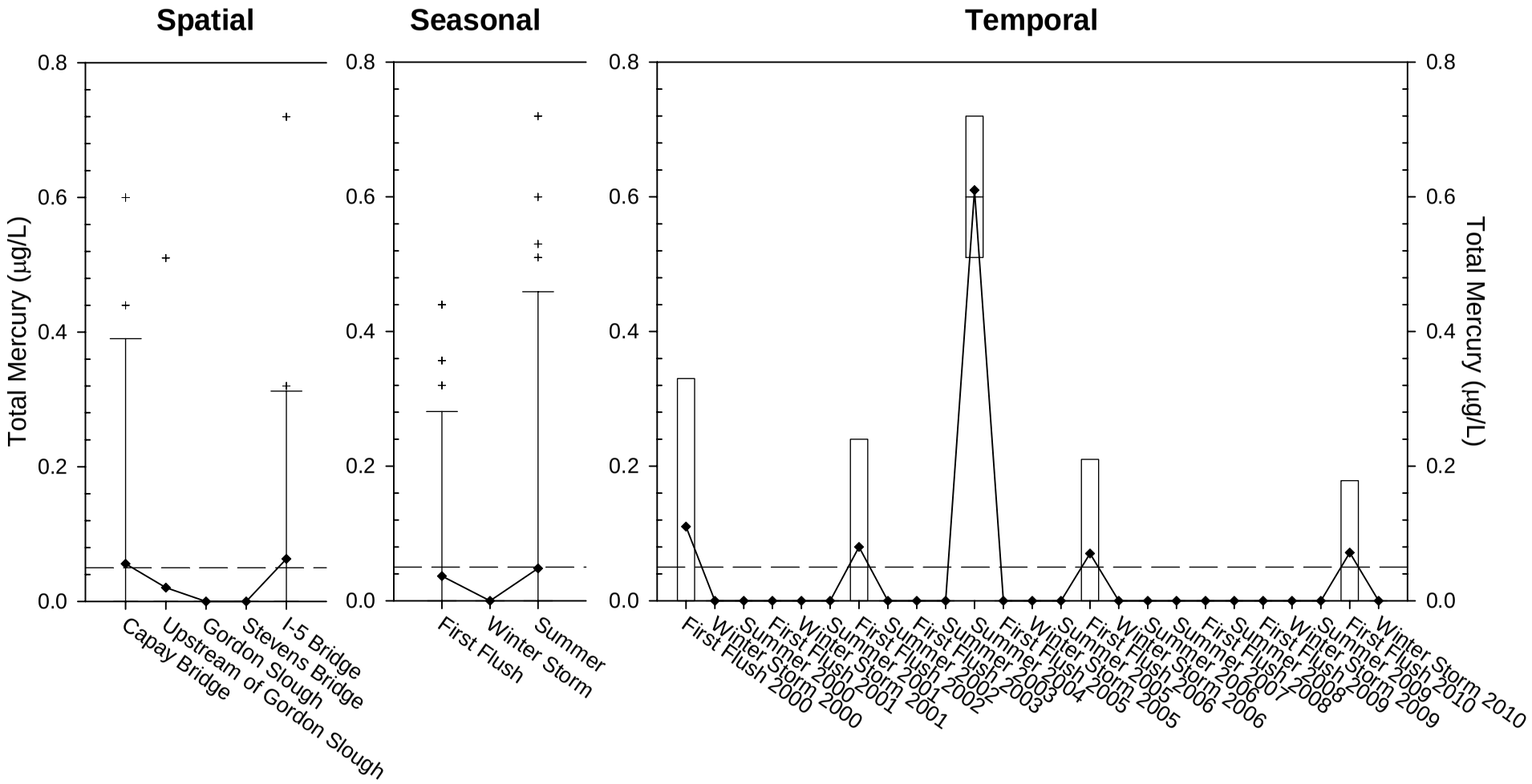
Lower Cache Creek

Dissolved Mercury Analysis



Lower Cache Creek

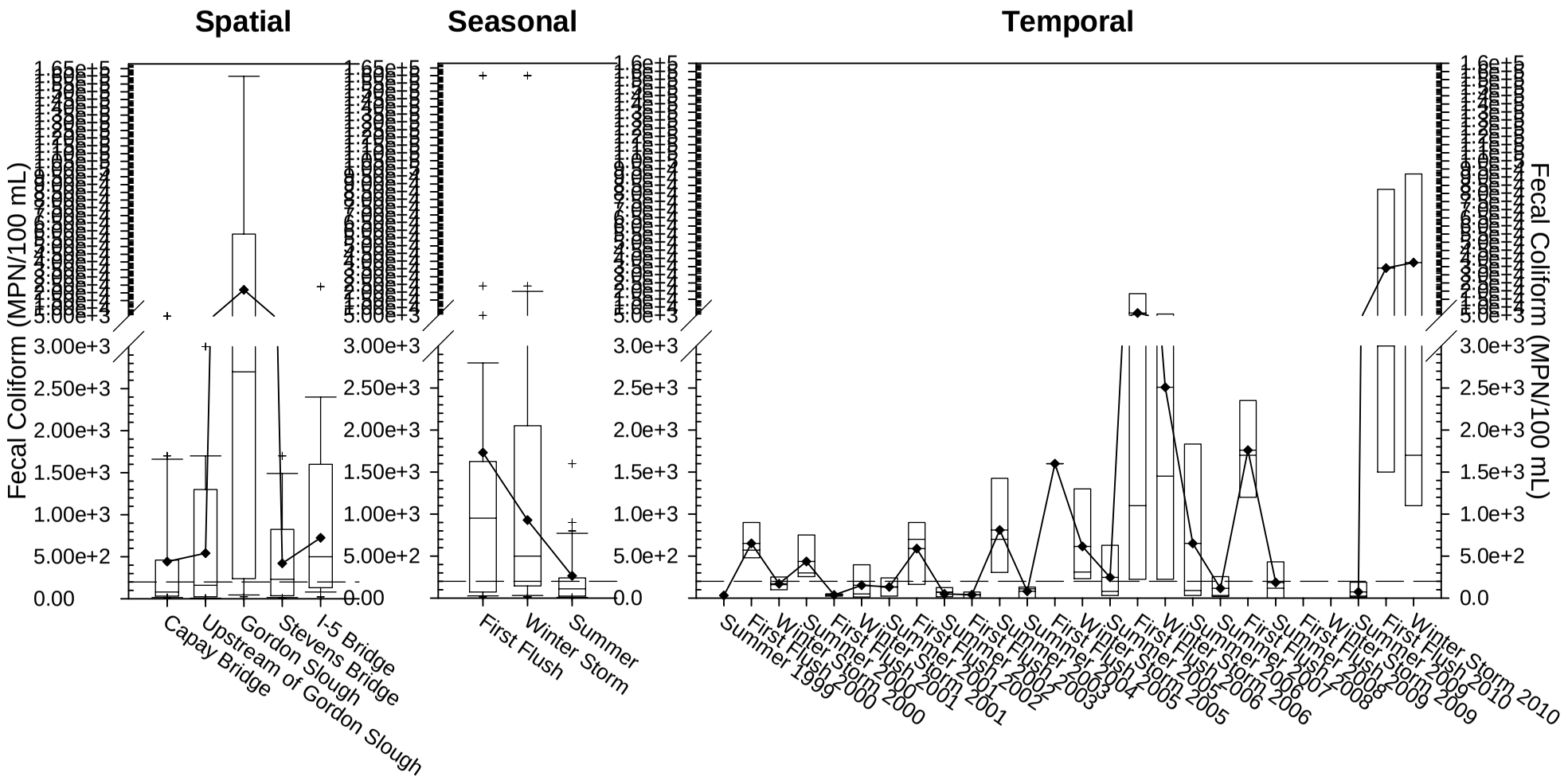
Total Mercury Analysis



Lower Cache Creek

Fecal Coliform Analysis

Note:
(1) Scale changes after break in Y-axis
(2) Upper Reporting Limit of 1600 through Winter Storm 2010



Lower Cache Creek

Total Coliform Analysis

Note:
(1) Scale changes after break in Y-axis
(2) Upper Reporting Limit of 1600 through Winter Storm 2010