

Pre/Post Canyon Lake Alum Treatment Monitoring Memo - DRAFT



Prepared for:

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Canyon Lake

Monitoring Dates

September 19, 2016 (Pre Alum) and October 5, 2016 (Post Alum)

Locations

Analytical chemistry samples were collected at four locations in Canyon Lake: Sites CL07, CL08, CL09, and CL10. These sites are depicted in Figure 1. In addition, a single water quality profile was performed just north of Vacation Drive in the North Ski Area.

Water Quality Monitoring Activities

Pre and Post alum monitoring included the following activities at each location:

- Vertical water column profile measurements of each site at 1-m increments for temperature, conductivity, pH, and dissolved oxygen;
- Analytical chemistry sample collection at Sites CL07, CL08, CL09 and CL10 analyzed for Total Dissolved Solids, Total Suspended Solids, Nitrate as N, Nitrite as N, Kjeldahl Nitrogen, Total Nitrogen, Ammonia-Nitrogen, Ortho Phosphate Phosphorus, Total Phosphorus, Total and Dissolved Aluminum, Chlorophyll-a;
- Each site had a depth integrated sample collected for water chemistry. When thermal stratification (i.e. a thermocline) was noted during the water column profile, discrete samples were collected within the epilimnion and hypolimnion and tested for the full suite of analytical constituents listed above;
- Secchi disk measurements;
- Visual observations of lake conditions

A summary of water quality profile measurements are presented in Tables 1 and 2. Results of the water chemistry analyses are presented in Tables 3 and 4. Weather conditions were sunny to partly cloudy on both sampling days with no abnormal observations noted. As an analytical quality assurance measure, a field blank sample was prepared on October 5, 2016 with a non-detect result for all analytes of interest. Copies of field datasheets are presented in Appendix A. Analytical lab reports are contained in Appendix B.

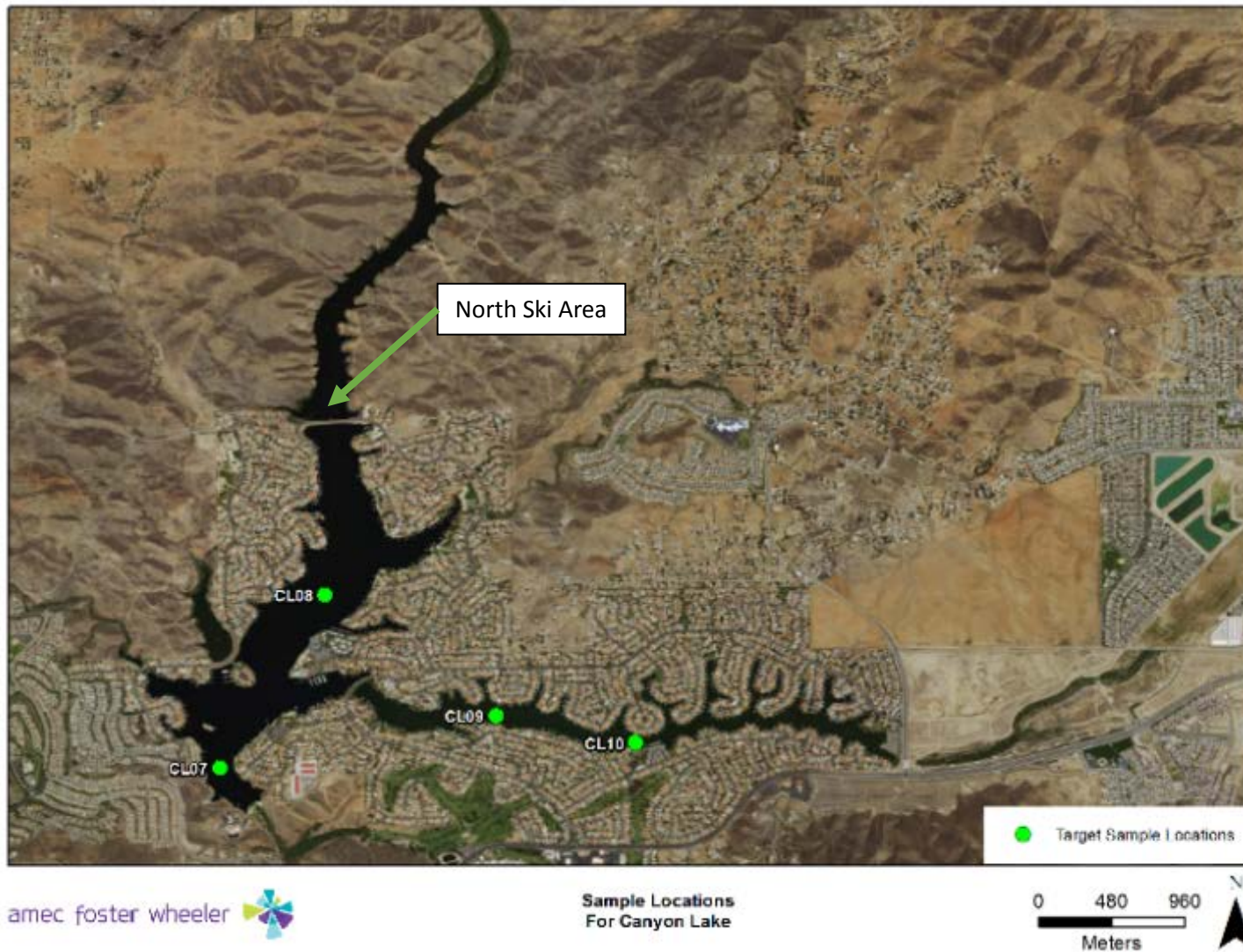


Figure 1. Canyon Lake Sampling Locations

Table 1. Canyon Lake Alum Pre-Treatment Water Column Profile – September 19, 2016

| Site | Time | Measure | Surface | 1 m | 2 m | 3 m | 4 m | 5 m | 6 m | 7 m | 8 m | 9 m | 10 m | 11 m | 12 m | 13 m | 14 m | 15 m | 16 m | Water Column Mean - All | Water Column Mean - Epilimnion | Water Column Mean - Hypolimnion | |
|----------------|------|--------------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------------------------|--------------------------------|---------------------------------|------|
| CL07 | 1420 | Temp (°C) | 26.8 | 25.8 | 25.2 | 25.1 | 25.1 | 24.8 | 24.6 | 23.9 | 20.0 | 16.5 | 15.4 | 14.7 | 14.1 | 13.9 | 13.7 | -- | -- | 20.6 | 25.3 | 13.9 | |
| | | Cond (µS/cm) | 1266 | 1275 | 1272 | 1270 | 1271 | 1270 | 1271 | 1271 | 1264 | 1201 | 1198 | 1200 | 1200 | 1212 | 1210 | 1215 | -- | -- | 1240 | 1271 | 1212 |
| | | pH | 8.25 | 8.27 | 8.26 | 8.22 | 8.15 | 8.06 | 7.98 | 7.74 | 7.11 | 6.99 | 6.94 | 6.87 | 6.83 | 6.84 | 6.83 | -- | -- | 7.56 | 8.17 | 6.83 | |
| | | DO (mg/L) | 7.8 | 7.9 | 7.5 | 7.3 | 6.8 | 6.1 | 5.5 | 0.8 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | -- | -- | 3.4 | 7.0 | 0.2 | |
| CL08 | 1340 | Temp (°C) | 26.5 | 25.9 | 25.4 | 25.2 | 24.9 | 24.7 | 24.6 | 23.6 | 20.7 | -- | -- | -- | -- | -- | -- | -- | -- | 24.6 | 25.3 | 20.7 | |
| | | Cond (µS/cm) | 1261 | 1269 | 1267 | 1268 | 1271 | 1274 | 1261 | 1261 | 1207 | -- | -- | -- | -- | -- | -- | -- | -- | 1260 | 1267 | 1207 | |
| | | pH | 8.21 | 8.21 | 8.19 | 8.15 | 7.93 | 7.84 | 7.66 | 7.32 | 6.91 | -- | -- | -- | -- | -- | -- | -- | -- | 7.82 | 8.03 | 6.91 | |
| | | DO (mg/L) | 7.9 | 7.9 | 7.6 | 7.4 | 6.1 | 5.4 | 3.6 | 0.3 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | 5.2 | 6.6 | 0.3 | |
| CL09 | 1230 | Temp (°C) | 26.6 | 25.2 | 24.8 | 24.4 | 24.2 | 24.0 | 21.0 | 19.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 23.7 | 24.9 | 19.1 | |
| | | Cond (µS/cm) | 1354 | 1345 | 1341 | 1341 | 1349 | 1354 | 1366 | 1382 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1354 | 1347 | 1382 | |
| | | pH | 8.54 | 8.65 | 8.58 | 8.31 | 8.00 | 7.70 | 6.71 | 6.70 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.90 | 8.30 | 6.70 | |
| | | DO (mg/L) | 9.8 | 10.6 | 9.8 | 6.8 | 3.9 | 1.4 | 0.3 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.4 | 7.1 | 0.3 | |
| CL10 | 1155 | Temp (°C) | 26.7 | 25.5 | 24.8 | 24.5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 25.4 | -- | -- | |
| | | Cond (µS/cm) | 1375 | 1361 | 1362 | 1370 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1367 | -- | -- | |
| | | pH | 8.41 | 8.41 | 8.40 | 7.82 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 8.26 | -- | -- | |
| | | DO (mg/L) | 10.1 | 10.5 | 8.7 | 5.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 8.7 | -- | -- | |
| North Ski Area | 1630 | Temp (°C) | 24.9 | 24.5 | 24.3 | 24.3 | 24.2 | 24.0 | 24.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 24.3 | -- | -- | |
| | | Cond (µS/cm) | 1028 | 1025 | 1027 | 1030 | 1032 | 1034 | 1036 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1030 | -- | -- | |
| | | pH | 8.25 | 8.17 | 8.07 | 7.98 | 7.91 | 7.81 | 7.73 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.99 | -- | -- | |
| | | DO (mg/L) | 7.7 | 6.8 | 5.8 | 5.6 | 5.2 | 3.5 | 3.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.4 | -- | -- | |

Hypolimnion
 Epilimnion
 Thermocline
 No Shading - Indicates that there is no stratification

Table 2. Canyon Lake Alum Post-Treatment Water Column Profile – October 5, 2016

| Site | Time | Measure | Surface | 1 m | 2 m | 3 m | 4 m | 5 m | 6 m | 7 m | 8 m | 9 m | 10 m | 11 m | 12 m | 13 m | 14 m | 15 m | 16 m | Water Column Mean - All | Water Column Mean - Epilimnion | Water Column Mean - Hypolimnion | |
|-------------------|-----------|--------------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------------------------|--------------------------------|---------------------------------|------|
| CL07 | 1044 | Temp (°C) | 23.6 | 23.4 | 23.2 | 23.1 | 23.1 | 23.1 | 23.0 | 23.0 | 22.9 | 17.5 | 15.3 | 14.6 | 14.2 | 14.1 | 13.9 | -- | -- | 19.9 | 23.2 | 14.1 | |
| | | Cond (µS/cm) | 1286 | 1285 | 1285 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1207 | 1210 | 1205 | 1217 | 1217 | 1219 | -- | -- | 1256 | 1284 | 1218 |
| | | pH | 7.59 | 7.56 | 7.51 | 7.47 | 7.43 | 7.41 | 7.41 | 7.41 | 7.41 | 7.41 | 6.94 | 6.91 | 6.90 | 6.87 | 6.88 | 6.87 | -- | -- | 7.24 | 7.47 | 6.87 |
| | DO (mg/L) | 7.1 | 7.1 | 7.1 | 6.8 | 6.6 | 6.8 | 6.8 | 6.6 | 6.4 | 6.4 | 2.6 | 1.9 | 1.7 | 1.6 | 1.4 | 1.3 | -- | -- | 4.8 | 6.8 | 1.4 | |
| | 1450 | Temp (°C) | 24.8 | 24.6 | 23.9 | 23.4 | 23.2 | 23.1 | 23.1 | 23.0 | 22.3 | 17.0 | 15.4 | 14.7 | 14.3 | 14.1 | 13.9 | -- | -- | 20.1 | 23.5 | 14.3 | |
| | | Cond (µS/cm) | 1288 | 1288 | 1288 | 1283 | 1283 | 1284 | 1284 | 1284 | 1277 | 1202 | 1205 | 1216 | 1216 | 1219 | 1216 | -- | -- | 1256 | 1284 | 1217 | |
| pH | | 7.70 | 7.69 | 7.69 | 7.67 | 7.59 | 7.53 | 7.50 | 7.46 | 7.29 | 6.92 | 6.94 | 6.90 | 6.91 | 6.91 | 6.92 | -- | -- | 7.31 | 7.57 | 6.91 | | |
| DO (mg/L) | 7.1 | 7.2 | 7.6 | 7.3 | 6.6 | 6.8 | 6.9 | 6.8 | 4.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | -- | -- | 4.1 | 6.7 | 0.2 | | | |
| CL08 | 0950 | Temp (°C) | 23.5 | 23.5 | 23.4 | 23.3 | 23.2 | 23.2 | 23.2 | 23.1 | 21.2 | -- | -- | -- | -- | -- | -- | -- | -- | 23.1 | 23.3 | 21.2 | |
| | | Cond (µS/cm) | 1263 | 1264 | 1281 | 1281 | 1281 | 1281 | 1281 | 1280 | 1243 | -- | -- | -- | -- | -- | -- | -- | -- | 1273 | 1277 | 1243 | |
| | | pH | 7.83 | 7.82 | 7.79 | 7.78 | 7.76 | 7.75 | 7.72 | 7.69 | 7.27 | -- | -- | -- | -- | -- | -- | -- | -- | 7.71 | 7.77 | 7.27 | |
| | DO (mg/L) | 7.4 | 7.4 | 7.2 | 7.0 | 6.7 | 6.5 | 6.4 | 6.0 | 0.31 | -- | -- | -- | -- | -- | -- | -- | -- | 6.1 | 6.8 | 0.3 | | |
| | 1435 | Temp (°C) | 25.2 | 24.2 | 23.6 | 23.4 | 23.3 | 23.2 | 23.1 | 23.1 | 21.4 | -- | -- | -- | -- | -- | -- | -- | -- | 23.4 | 23.6 | 21.4 | |
| | | Cond (µS/cm) | 1285 | 1282 | 1281 | 1280 | 1280 | 1280 | 1281 | 1283 | 1247 | -- | -- | -- | -- | -- | -- | -- | -- | 1278 | 1282 | 1247 | |
| pH | | 7.82 | 7.85 | 7.83 | 7.76 | 7.70 | 7.63 | 7.56 | 7.50 | 7.14 | -- | -- | -- | -- | -- | -- | -- | -- | 7.64 | 7.71 | 7.14 | | |
| DO (mg/L) | 7.9 | 8.2 | 7.8 | 7.0 | 6.8 | 6.4 | 6.2 | 5.6 | 0.4 | -- | -- | -- | -- | -- | -- | -- | -- | 6.3 | 7.0 | 0.4 | | | |
| CL09 ^a | 0849 | Temp (°C) | 22.9 | 22.9 | 22.9 | 22.9 | 22.8 | 22.8 | 21.4 | 19.6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.3 | 22.9 | 19.6 | |
| | | Cond (µS/cm) | 1374 | 1374 | 1374 | 1374 | 1374 | 1374 | 1381 | 1384 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1376 | 1374 | 1384 | |
| | | pH | 7.83 | 7.85 | 7.86 | 7.87 | 7.86 | 7.85 | 7.12 | 7.01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.66 | 7.85 | 7.01 | |
| | DO (mg/L) | 7.4 | 7.3 | 7.2 | 7.1 | 7.0 | 6.7 | 0.2 | 0.2 | -- | -- | 7.2 | 7.1 | -- | -- | 0.2 | -- | -- | 5.4 | 7.1 | 0.2 | | |
| | 1415 | Temp (°C) | 24.8 | 23.4 | 22.9 | 22.7 | 22.6 | 22.1 | 22.2 | 19.5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.5 | 23.0 | 19.5 | |
| | | Cond (µS/cm) | 1363 | 1367 | 1372 | 1374 | 1376 | 1379 | 1380 | 1377 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1374 | 1373 | 1377 | |
| pH | | 7.90 | 7.94 | 7.85 | 7.73 | 7.64 | 7.63 | 7.31 | 6.81 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.60 | 7.71 | 6.81 | | |
| DO (mg/L) | 8.3 | 8.7 | 7.3 | 6.6 | 6.3 | 6.1 | 0.8 | 0.3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.5 | 6.3 | 0.3 | | | |
| CL10 | 0805 | Temp (°C) | 22.4 | 22.4 | 22.5 | 22.4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 22.4 | -- | -- | |
| | | Cond (µS/cm) | 1399 | 1400 | 1400 | 1400 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1400 | -- | -- | |
| | | pH | 7.46 | 7.51 | 7.56 | 7.58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.53 | -- | -- | |
| | DO (mg/L) | 6.4 | 6.4 | 6.4 | 6.32 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6.4 | -- | -- | | |
| | 1400 | Temp (°C) | 25.0 | 23.6 | 22.8 | 22.5 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 23.5 | 25.0 | 22.5 | |
| | | Cond (µS/cm) | 1372 | 1392 | 1396 | 1398 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1390 | 1372 | 1398 | |
| pH | | 7.86 | 7.93 | 7.94 | 7.71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.86 | 7.86 | 7.71 | | |
| DO (mg/L) | 7.9 | 8.6 | 8.5 | 6.6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 7.9 | 7.9 | 6.6 | | | |

^a Bottom measurement taken at 6.5m

Hypolimnion
 Epilimnion
 Thermocline

No Shading - Indicates that there is no stratification

Table 3. Canyon Lake Water Chemistry – Pre/Post Alum Treatment (Main Basin)

| | | | | | | | CL07 | | CL08 | |
|--------------|-----------------------------|-------|-----------|---------|---------------------------|------------------|------|------|------|------|
| Method | Compound | Units | MDL | RL | Basin Plan or TMDL Target | Sample Type | PRE | POST | PRE | POST |
| SM 2540C | Total Dissolved Solids | mg/L | 12 | 20 | 700 | Depth Integrated | 780 | 800 | 840 | 800 |
| | | | | | NA | Epilimnion | 760 | 800 | 820 | 800 |
| | | | | | NA | Hypolimnion | 760 | 810 | 840 | 820 |
| SM 2540D | Total Suspended Solids | mg/L | 2-5 | 2-5 | NA | Depth Integrated | 3 | 4 | 3 | 2 |
| | | | | | | Epilimnion | 3 | 2 | 4 | 2 |
| | | | | | | Hypolimnion | 2 | 5 | 6 | 3 |
| EPA 300.0 | Nitrate as N | mg/L | 0.11 | 0.2 | 10 | Depth Integrated | ND | ND | ND | ND |
| | | | | | NA | Epilimnion | 0.35 | ND | ND | ND |
| | | | | | NA | Hypolimnion | ND | ND | ND | ND |
| SM 4500NO2 B | Nitrite as N | mg/L | 0.046 | 0.1 | NA | Depth Integrated | ND | ND | ND | ND |
| | | | | | | Epilimnion | ND | ND | ND | ND |
| | | | | | | Hypolimnion | ND | ND | ND | ND |
| EPA 351.2 | Kjeldahl Nitrogen | mg/L | 0.13-0.25 | 0.2-0.4 | NA | Depth Integrated | 1.4 | 2.1 | 0.90 | 0.73 |
| | | | | | | Epilimnion | 0.60 | 1.0 | 2.7 | 0.81 |
| | | | | | | Hypolimnion | 4.3 | 5.5 | 2.4 | 1.0 |
| | Total Nitrogen ^a | mg/L | -- | -- | 0.75 ^{b1} | Depth Integrated | 1.4 | 2.1 | 0.90 | 0.73 |
| | | | | | NA | Epilimnion | 0.95 | 1.0 | 2.7 | 0.81 |
| | | | | | NA | Hypolimnion | 4.3 | 5.5 | 2.4 | 1.0 |

Notes:

^a - Total Nitrogen = TKN+NO2+NO3

^b - Annual average

¹ - 2020 TMDL Target, based on Table 5-9n of 2004 TMDL

NA – Not applicable/available

ND – Not detected

Table 3 (cont.). Canyon Lake Water Chemistry – Pre/Post Alum Treatment (Main Basin)

| | | | | | | | CL07 | | CL08 | |
|--------------|--------------------|-------|---------------|----------|--|------------------|------|------|------|------|
| Method | Compound | Units | MDL | RL | TMDL Target | Sample Type | PRE | POST | PRE | POST |
| SM4500NH3H | Ammonia-Nitrogen | mg/L | 0.048-0.48 | 0.1-1.0 | CMC: 5.1-17.6 ^{b1} CCC: 0.81-2.7 ^{b1} | Depth Integrated | 1.5 | 1.4 | ND | ND |
| | | | | | | Epilimnion | ND | ND | ND | ND |
| | | | | | | Hypolimnion | 3.1 | 4.9 | ND | 0.14 |
| SM 4500P E | Ortho Phosphate | mg/L | 0.0028-0.0056 | 0.05-0.1 | NA | Depth Integrated | 0.20 | ND | ND | ND |
| | | | | | | Epilimnion | ND | ND | ND | ND |
| | | | | | | Hypolimnion | 0.23 | 0.22 | ND | ND |
| SM 4500P B E | Total Phosphorus | mg/L | 0.02-0.04 | 0.05 | 0.1 ^{a1} | Depth Integrated | 0.10 | ND | ND | ND |
| | | | | | | Epilimnion | ND | ND | ND | ND |
| | | | | | | Hypolimnion | 0.28 | 0.24 | ND | ND |
| EPA 200.7 | Total Aluminum | µg/L | 37 | 100 | NA | Depth Integrated | ND | 130 | ND | 180 |
| | | | | | | Epilimnion | ND | 190 | ND | 290 |
| | | | | | | Hypolimnion | ND | ND | ND | 130 |
| EPA 200.7 | Dissolved Aluminum | µg/L | 37 | 100 | NA | Depth Integrated | ND | ND | ND | 110 |
| | | | | | | Epilimnion | ND | 100 | ND | 120 |
| | | | | | | Hypolimnion | ND | ND | ND | ND |
| EPA 10200 H | Chlorophyll-a | µg/L | 0.5 | 1.0 | 25 ¹ , 40 ² | Depth Integrated | 31 | 24 | 14 | 12 |
| | | | | | | Epilimnion | 10 | 12 | 12 | 10 |
| | | | | | | Hypolimnion | 24 | 57 | 11 | 14 |

Notes:

^a - Annual average

^b - Values are site specific dependent upon pH and temperature recorded at each location

¹ – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL

² – 2015 TMDL Target, based on Table 5-9n of 2004 TMDL

NA – Not applicable/available

ND – Not detected

Table 4. Canyon Lake Water Chemistry – Pre/Post Alum Treatment (East Basin)

| | | | | | | | CL09 | | CL10 | |
|--------------|-----------------------------|-------|-----------|---------|---------------------------|------------------|------|------|------|------|
| Method | Compound | Units | MDL | RL | Basin Plan or TMDL Target | Sample Type | PRE | POST | PRE | POST |
| SM 2540C | Total Dissolved Solids | mg/L | 12 | 20 | 700 | Depth Integrated | 870 | 880 | 860 | 900 |
| | | | | | NA | Epilimnion | 880 | 900 | NS | NS |
| | | | | | NA | Hypolimnion | 860 | 850 | NS | NS |
| SM 2540D | Total Suspended Solids | mg/L | 2 | 2 | NA | Depth Integrated | 7 | 6 | 12 | 8 |
| | | | | | | Epilimnion | 8 | 4 | NS | NS |
| | | | | | | Hypolimnion | 16 | 6 | NS | NS |
| EPA 300.0 | Nitrate as N | mg/L | 0.11 | 0.2 | 10 | Depth Integrated | ND | ND | ND | ND |
| | | | | | NA | Epilimnion | ND | ND | NS | NS |
| | | | | | NA | Hypolimnion | ND | ND | NS | NS |
| SM 4500NO2 B | Nitrite as N | mg/L | 0.046 | 0.1 | NA | Depth Integrated | ND | ND | ND | ND |
| | | | | | | Epilimnion | ND | ND | NS | NS |
| | | | | | | Hypolimnion | ND | ND | NS | NS |
| EPA 351.2 | Kjeldahl Nitrogen | mg/L | 0.13-0.25 | 0.2-0.4 | NA | Depth Integrated | 1.3 | 1.1 | 1.7 | 2.3 |
| | | | | | | Epilimnion | 1.4 | 1.7 | NS | NS |
| | | | | | | Hypolimnion | 6.5 | 1.4 | NS | NS |
| | Total Nitrogen ^a | mg/L | -- | -- | 0.75 ^{b1} | Depth Integrated | 1.3 | 1.1 | 1.7 | 2.3 |
| | | | | | NA | Epilimnion | 1.4 | 1.7 | NS | NS |
| | | | | | NA | Hypolimnion | 6.5 | 1.4 | NS | NS |

Notes:

^a - Total Nitrogen = TKN+NO2+NO3

^b - Annual average

¹ - 2020 TMDL Target, based on Table 5-9n of 2004 TMDL

NA – Not applicable/available

ND – Not detected

NS – Not Sampled

Table 4 (cont.). Canyon Lake Water Chemistry – Pre/Post Alum Treatment (East Basin)

| | | | | | | | CL09 | | CL10 | |
|--------------|--------------------|-------|------------|---------|--|------------------|------|------|------|------|
| Method | Compound | Units | MDL | RL | TMDL Target | Sample Type | PRE | POST | PRE | POST |
| SM4500NH3H | Ammonia-Nitrogen | mg/L | 0.048-0.48 | 0.1-1.0 | CMC: 5.1-17.6 ^{b1} CCC: 0.81-2.7 ^{b1} | Depth Integrated | ND | ND | ND | ND |
| | | | | | CMC: 4.7-6.1 ^{b1} CCC: 0.78-1.2 ^{b1} | Epilimnion | ND | ND | NS | NS |
| | | | | | CMC: 38.9-44.6 ^{b1} CCC: 4.1-6.2 ^{b1} | Hypolimnion | 4.9 | ND | NS | NS |
| SM 4500P E | Ortho Phosphate | mg/L | 0.0028 | 0.05 | NA | Depth Integrated | ND | ND | ND | ND |
| | | | | | | Epilimnion | ND | ND | NS | NS |
| | | | | | | Hypolimnion | ND | ND | NS | NS |
| SM 4500P B E | Total Phosphorus | mg/L | 0.02-0.04 | 0.05 | 0.1 ^{a1} | Depth Integrated | 0.05 | ND | 0.05 | ND |
| | | | | | NA | Epilimnion | ND | ND | NS | NS |
| | | | | | NA | Hypolimnion | 0.08 | ND | NS | NS |
| EPA 200.7 | Total Aluminum | µg/L | 37 | 100 | NA | Depth Integrated | ND | 200 | 120 | 240 |
| | | | | | NA | Epilimnion | ND | 200 | NS | NS |
| | | | | | NA | Hypolimnion | ND | 270 | NS | NS |
| EPA 200.7 | Dissolved Aluminum | µg/L | 37 | 100 | NA | Depth Integrated | ND | 110 | ND | 110 |
| | | | | | NA | Epilimnion | ND | 120 | NS | NS |
| | | | | | NA | Hypolimnion | ND | 120 | NS | NS |
| EPA 10200 H | Chlorophyll-a | µg/L | 0.5 | 1.0 | 25 ¹ , 40 ² | Depth Integrated | 29 | 36 | 43 | 38 |
| | | | | | NA | Epilimnion | 31 | 33 | NS | NS |
| | | | | | NA | Hypolimnion | 147 | 55 | NS | NS |

Notes:

^a - Annual average

^b - Values are site specific dependent upon pH and temperature recorded at each location

¹ – 2020 TMDL Target, based on Table 5-9n of 2004 TMDL

² – 2015 TMDL Target, based on Table 5-9n of 2004 TMDL

NA – Not applicable/available

ND – Not detected

NS – Not Sampled

Appendix A
Field Datasheets

Appendix B
Analytical Lab Reports

9/19/16 Pre-Alum Report

10/5/16 Post-Alum Report