

Holden Mine Site Fact Sheet

Sediment

ROD REQUIREMENTS FOR SEDIMENTS AND PHASE 1 REMEDIATION ACTIVITIES

- Remedial Action Objective (RAO) 2 is stated as, “Reduce exposure to contaminants of concern in sediment (including the adverse effects of ferricrete on aquatic life in Railroad Creek) to protect aquatic life and comply with ARARs.” (USFS 2012)
- The selected remedy for sediments in the Record of Decision (ROD) included relocating a portion of Railroad Creek, eliminating the adverse effects of ferricrete on the aquatic habitat in those relocated sections (USFS 2012, Page 1-6).
 - During Phase 1, a section of Railroad Creek near Tailings Pile 2 that was impacted by ferricrete was permanently relocated.
 - Additionally, in the non-relocated portions of Railroad Creek where ferricrete was identified (in the vicinity of Tailings Piles 1 and 2), it was broken up and removed from the creek bed and shoreline during Phase 1.
- The selected remedy for sediment in the ROD also required that the Wetlands East of Tailings Pile 3 area be remediated (refer to the Holden Mine Site Fact Sheet for Wetlands East of Tailings Pile 3 for further details).
- The ROD stated that “The Agencies have determined that other active measures to clean up sediment are not warranted at this time” and that “Rather, the remedy will include source controls and relocation of a portion of Railroad Creek to prevent ongoing release of hazardous substances into Railroad Creek” (USFS 2012, Page 1-6).
- The ROD also stated that long-term monitoring would determine if the remedy is protective of sediment quality (USFS 2012, Page 1-6).
 - Sediment sampling and biological testing have been performed following the implementation of Phase 1 in accordance with the Performance Standard Verification Plan (PSVP; Floyd|Snider 2020a).
 - Sediment sampling and biological testing have also been performed within Railroad Creek by the Washington State Department of Ecology (Ecology) and Rio Tinto prior to and following implementation of the Phase 1 remedial action. This sampling and testing is summarized later in this fact sheet.
 - In September 2020, sediment sampling was conducted at six locations in Railroad Creek (including two background sample locations and four locations adjacent to or downstream of the Holden Mine Site) and two locations in Lucerne Bar in accordance with the Agency-approved PSVP (Floyd|Snider 2020a). Sediment sampling locations are shown on Figure 3.2 (of Floyd|Snider 2021a), provided in Attachment 1.
 - At each location, sediment samples were collected as composites of multiple grab samples taken from pockets of fines deposited among the gravel and cobble substrate of Railroad Creek. Grab samples were collected to a target depth of 30 centimeters where possible.
 - Sediment in Railroad Creek can be characterized as sandy gravel or gravely sand.

Sediment Chemistry Analyses and Results

- **Analyses:** Sediment samples were analyzed for the metals contaminants of concern (COCs) listed in the ROD (aluminum, beryllium, cadmium, chromium, copper, iron, silver, and zinc), total solids, total organic carbon (TOC), acid volatile sulfide/simultaneously extracted metals (AVS/SEM), and grain size.
- **Criteria:** Sediment results were compared to the current Washington State Sediment Management Standards (SMS) criteria for freshwater sediment, or the Sediment Quality Values (SQVs) that were proposed in the 2010 Proposed Plan if an SMS criterion was not available (WAC 173-204-563, USFS 2010a).
- **Results:**
 - None of the 2020 sediment samples had COC concentrations that exceeded the SMS criteria or SQVs.
 - Sediment COC concentrations in the two Lucerne Bar samples were less than or similar to concentrations in samples from upstream site locations, indicating that COCs are not accumulating to levels of concern in sediments at the mouth of Railroad Creek.
 - COC results for metals in sediment are summarized in Table 3.2 and shown on Figure 3.2 (from Floyd|Snider 2021a), both provided in Attachment 1. Sediment concentration charts (Appendix I from Floyd|Snider 2021a) are included in Attachment 2.
 - AVS/SEM results are indicators of metals bioavailability (primarily for anoxic sediments). AVS was only detected at one location at Lucerne Bar (LB-1). The Σ SEM/AVS ratio calculated for LB-1 was 23, indicating that the SEM metals are likely bioavailable. Although the AVS/SEM model predicts that the metals are bioavailable in sediments at LB-1, the metals concentrations are much less than the sediment chemistry criteria (Floyd|Snider 2021a).

Sediment Bioassay Testing and Results

- **Testing:**
 - Bioassay testing in accordance with SMS Sediment Cleanup User's Manual (SCUM) guidance was performed on the sediment samples and included the following tests (Ecology 2019):
 - *Chironomus tentans*, 10-day mortality, ASTM E1706-19 (2019)/USEPA Method 100.5 (USEPA 2000)
 - *Hyalella azteca*, 28-day growth and mortality, USEPA Method 100.4 (USEPA 2000)
 - Two of the sediment samples tested were background sample locations (RC-6 and RC-1) that represent the effects of natural variability on the bioassay organisms. The bioassay tests also included a laboratory control sample.
- **Criteria:**
 - Test performance was evaluated using the SMS freshwater biological criteria (the sediment cleanup objective [SCO], cleanup screening level [CSL], and performance standards).
 - As allowed under SMS (WAC 173-204-563), the bioassay results for the four samples adjacent to and downstream of the Holden Mine Site and the two Lucerne Bar samples were compared to the background sample results, rather than to the laboratory control sample results.
 - An exceedance of the SCO or CSL requires that the result be greater than the criteria, and that there be a statistically significant difference between the test result and background result at $p \leq 0.05$. A

test result was considered statistically significant, if there was a statistically significant difference between the test result and both background samples (RC-6 or RC-1). Additionally, an exceedance of the SCO for any two bioassay metrics equates to a CSL exceedance at the sample location.

- **Results:**

- None of the sample locations exceeded the *C. tentans* mortality SCO or CSL.
- Based on the *H. azteca* test metrics, sample locations RC-4, LB-1, and LB-2 exceeded the SMS biological CSL.
 - The *H. azteca* mortality metric exceeded the SCO and the CSL at three sample locations (RC-4, LB-1, and LB-2).
 - The *H. azteca* growth metric exceeded the SCO at three sample locations (RC-4, RC-10(SG-20), and LB-1), and the CSL at one sample location (RC-4).
- Bioassay results are shown on Figure 3.2 of the 2020 ACAR (from Floyd|Snider 2021a), provided in Attachment 1. The bioassay replicate results (Appendix J from Floyd|Snider 2021a) are included in Attachment 3.
- The results suggest that the poor performance observed at RC-4, LB-1, and LB-2 were likely related to the natural conditions in Railroad Creek and the natural sediment matrix, particularly since these stations are upgradient of the tailings piles or the farthest downgradient stations from the tailings piles and the Holden Mine Site. Indications that poor performance was not related to COCs in sediment include the following:
 - The results from the 28-day *Hyalella* growth test did not meet the SMS performance standard for the background samples.
 - *H. azteca* growth measured at all test locations was significantly less than growth measured in the laboratory control (refer to Figure J.3 in Attachment 3).
 - *H. azteca* growth and survival performance was variable across the sample locations and no spatial trends were apparent based on a graphical analysis.
 - The results of the benthic macroinvertebrate (BMI) community evaluation indicate an improvement compared to the baseline conditions.

ADDITIONAL SEDIMENT CHEMISTRY AND BIOSSAY TESTING

- In addition to the 2020 PSVP sediment sampling activities, sediment sampling was conducted in Railroad Creek in 1994, 1996, 2015, 2018, and 2019, and in Lucerne Bar in 1998, 1999, 2001, 2002, and 2018.

Pre-Phase 1 Remedial Action Sediment Sampling and Results

Railroad Creek

- In 1994, 10 sediment samples were collected by USGS, and 2 samples were collected by the U.S. Bureau of Mines (USGS 1994, USBM 1995). Metals were analyzed using a graphite furnace technique. One or more of the results from the sediment samples collected in 1994 exceeded the SMS criteria or SQVs for aluminum, chromium, iron, and silver.
- In 1996, four sediment samples were collected by Ecology and analyzed for aluminum, cadmium, copper, iron, and zinc using low detection limit methods (Ecology 1997). None of the results exceeded the SMS criteria or SQVs (WAC 173-204-563, USFS 2010a).

- The 1996 Ecology investigation (Ecology 1997) also included sediment bioassay testing (H. azteca survival and Microtox). The results of the H. azteca survival test and the Microtox bacteria luminescence test indicated that metals concentrations in Railroad Creek were not present at concentrations that would cause adverse effects to aquatic life (Ecology 1997). Ecology noted that H. azteca survival was somewhat reduced in sediment upgradient of the Holden Mine Site and at the mouth of Railroad Creek, while the highest survival was reported at the sample location at the downstream end of Tailings Pile 3 (RC-2).
- In 2015, six sediment samples were collected by Ecology in Railroad Creek. None of the results exceeded the SMS criteria or SQVs.

Lucerne Bar

- Between 1998 and 2002, 23 sediment samples were collected in Lucerne Bar to support the 1999 Remedial Investigation and the Draft Final Feasibility Study for the Holden Mine Site (Dames & Moore 1999, URS 2004). Of the 23 samples, 13 exceeded the SMS SCO but not the CSL for cadmium, and one sample exceeded the SQV for iron.
- Bioassays were performed on a subset of the sediment samples collected in 2001 and 2002. In 2001, the tests included a 21-day Hyalella growth and toxicity test, a 10-day Chironomus toxicity test, and a Microtox 100% sediment porewater toxicity test. The bioassay tests performed in 2002 consisted of Hyalella and Chironomus tests. Evaluations of the results from both the 2001 and 2002 bioassay tests indicated that metals concentrations in sediments from the Lucerne Bar were either not present at concentrations that would cause adverse effects to aquatic life (URS 2004) or were present at concentrations that would cause only minor adverse effects to aquatic life (USFS 2010b). The Agencies did not consider these aquatic life “effects to be severe enough nor widely distributed enough to require an active sediment cleanup” on the Lucerne Bar (USFS 2010b).

Post-Phase 1 Remedial Action Sediment Sampling and Results

Railroad Creek

- Between 2018 and 2019, 17 sediment samples were collected from 10 locations by Ecology in Railroad Creek.¹ One sample collected in 2019 exceeded the SQV for iron. There were no other exceedances.

Lucerne Bar

- In 2018, 13 samples were collected from seven locations in Lucerne Bar by Ecology.² Sediment samples were collected from 0 to 2 centimeters (cm) at all locations and from 10 to 12 cm at all but one location.
- None of the samples collected from recently deposited sediment (0 to 2 cm) exceeded the SMS criteria or SQVs. In the deeper interval (10 to 12 cm), cadmium exceeded the SMS SCO but not the CSL at three locations, and copper slightly exceeded the SMS SCO but not the CSL at one location.

FERRICRETE MONITORING

- Ferricrete visual monitoring surveys are performed in Railroad Creek every 3 years to assess the presence of ferricrete or iron oxide precipitate in the creek in accordance with the Agency-approved PSVP (Floyd|Snider 2020a). If observed, ferricrete is documented and then broken up in place in accordance with the Phase 1 Operations and Maintenance Plan (Floyd|Snider 2021b).

¹ These data were not collected under the UAO-SOW and are considered a secondary data source.

² These sediment results are reported in Ecology’s Environmental Information Management system as provisional data and no associated data report has been provided by Ecology to date.

- The last ferricrete monitoring survey was performed during the fall 2019 monitoring event and covered a 2.3-mile stretch of Railroad Creek (Floyd|Snider 2020b). Observations were recorded at 30 monitoring points along this monitoring zone (F1 through F30).
- The fall 2019 survey found two isolated areas with limited extents of ferricrete on the south bank of Railroad Creek along Tailings Piles 1 and 2 (F19 and F30) and one location where iron oxide precipitate deposits are accumulating but have not formed ferricrete, near the toe of Tailings Pile 3 (F13). These monitoring point locations are shown on Figure 3.1 (from Floyd|Snider 2020b), provided in Attachment 1.
 - It is possible that some limited ferricrete remained on the south bank along Tailings Piles 1 and 2 following the Phase 1 Remedial Action activities that could explain the presence of the ferricrete observed at monitoring points F19 and F30.
 - Ferricrete at both locations where ferricrete was observed during the 2019 ferricrete monitoring survey was broken up and removed.

PHASE 1 REMEDIAL ACTION PERFORMANCE

- Based on the evaluation of the 2020 sediment data and bioassay test results, the low concentrations of COCs in sediment were determined to be protective of aquatic life and comply with Applicable or Relevant and Appropriate Requirements (ARARs).
- RAO 2 also includes reducing the adverse effects of ferricrete on aquatic life in Railroad Creek. At this time, the ferricrete observed to be present in Railroad Creek appears to be limited to potentially one location within the creek or along the creek bank. Therefore, adverse effects on aquatic life due to the presence of ferricrete would be expected to be very limited. However, consistent with the PSVP monitoring objectives, ferricrete monitoring will continue.

PHASE 2 REMEDIAL ACTIVITIES AND ONGOING MONITORING

- Based on the ROD statement that, “The Agencies have determined that other active measures to clean up sediment are not warranted at this time” and that “Rather, the remedy will include source controls and relocation of a portion of Railroad Creek to prevent ongoing release of hazardous substances into Railroad Creek” (USFS 2012, Page 1-6), sediment is not expected to require specific action(s) separate from groundwater remediation to protect surface water.
- The next ferricrete visual monitoring survey will occur in fall 2022. The ferricrete monitoring zone for the 2022 survey will be slightly reduced in extent, covering the stretch of Railroad Creek between the East Bypass Bridge to the western extent of the West Area Seeps survey zone (covering from F11 through F28 on Figure 3.1 in Attachment 1) (Floyd|Snider 2022).
- No additional sediment sampling for chemical analysis or bioassay testing is proposed for the 2022 PSVP monitoring program.

REFERENCES

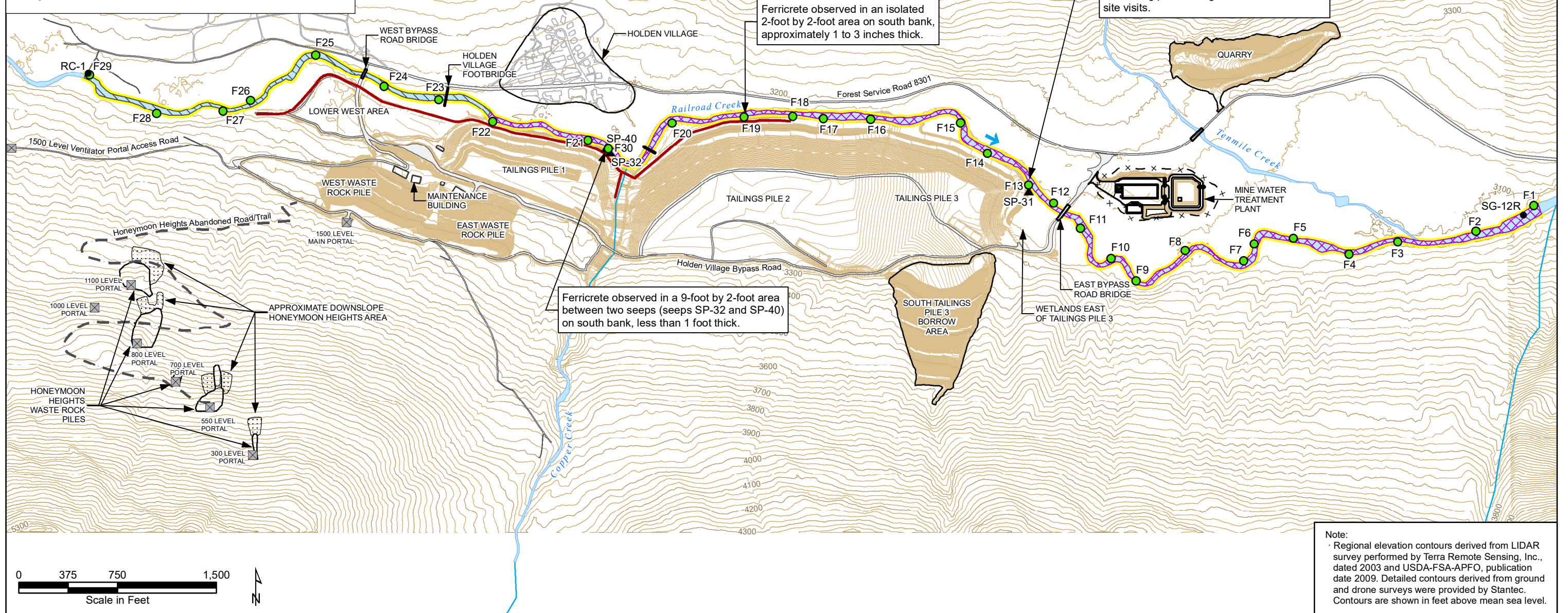
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Attachment 1

Legend

- Ferricrete and Iron Staining Survey Monitoring Point
- Select Railroad Creek Monitoring Station (included as reference point)
- ▲ Select Seep Location (included as reference point)
- Iron Staining Present
- No Iron Staining or Ferricrete Present
- Railroad Creek Ferricrete Monitoring Zone
- Current Railroad Creek Alignment
- Approximate Location of Subsurface Barrier Wall
- Portal
- ➔ Surface Water Flow Direction
- 100-foot Elevation Index Contour



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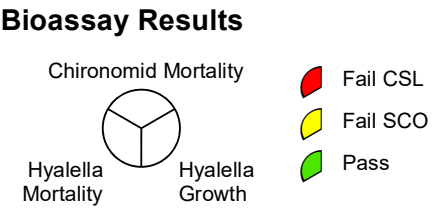
Performance Standards Verification 2019 Annual Compliance Assessment Report Holden Mine Site Chelan County, Washington

Figure 3.1
Railroad Creek Ferricrete and Iron Staining
Survey Observations (Fall 2019)

- Legend**
- Sediment Sample Location
 - Approximate Location of Subsurface Barrier Wall
 - Surface Water Flow Direction
 - 3400 100-foot Elevation Index Contour

Sample Key

Location ID → **RC-1** Result and Qualifier
Analyte → Ag: 0.0300 ←



Notes:

- All results presented in mg/kg dry weight.
- All sediment chemistry results are less than the SMS and SQV criteria for freshwater sediment (WAC 173-204-563 and USFS 2010).
- Elevation contours provided by Stantec. Contours are shown in feet above mean sea level.

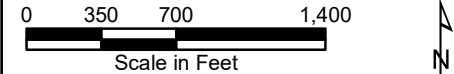
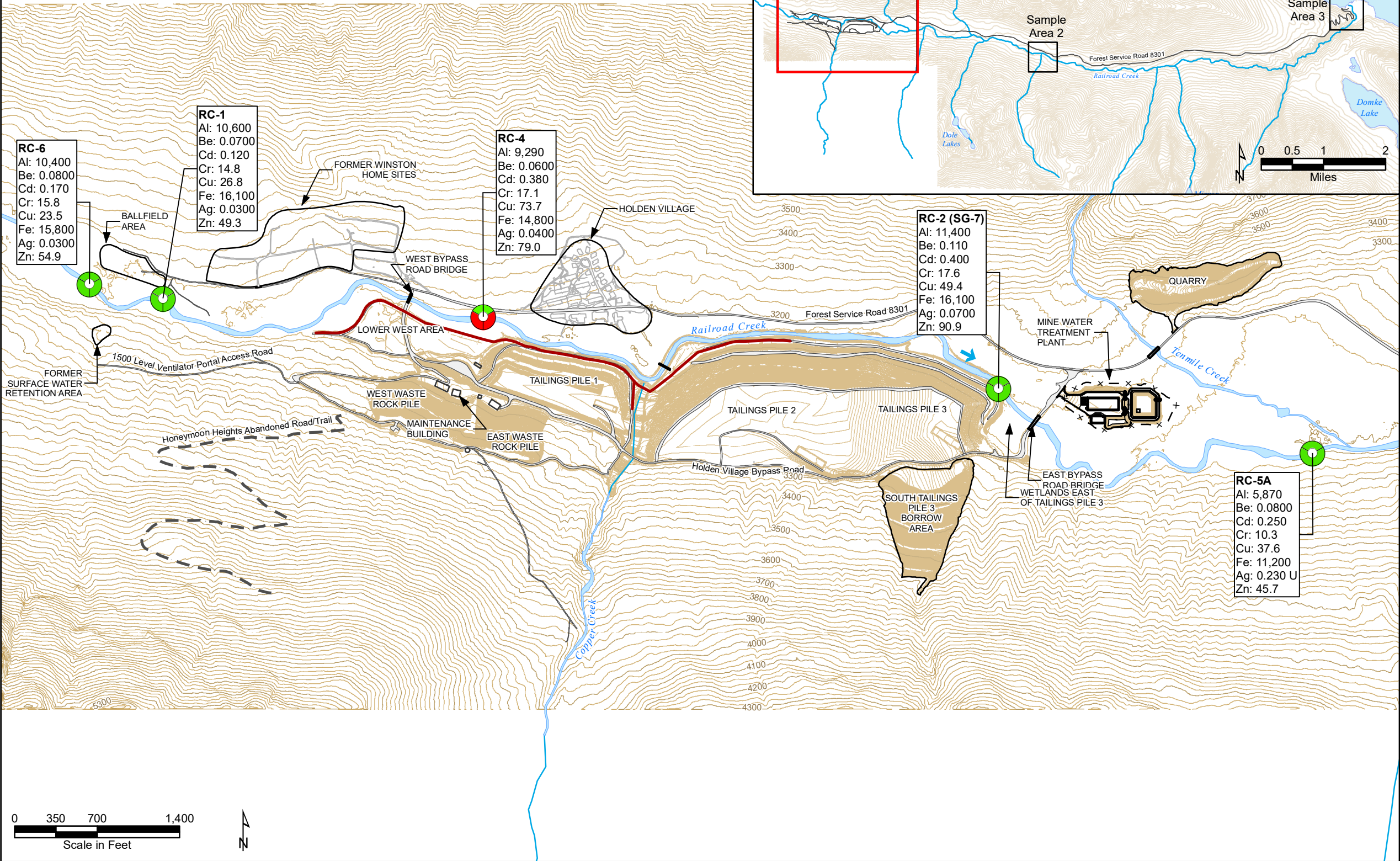
Abbreviations:

Ag = Silver
Al = Aluminum
Be = Beryllium
Cd = Cadmium
COC = Contaminant of concern
Cr = Chromium
CSL = Cleanup Screening Level
Cu = Copper
Fe = Iron
mg/kg = Milligrams per kilogram
SCO = Sediment Cleanup Objective
SMS = Sediment Management Standard
SQV = Sediment Quality Values
USFS = United States Forest Service
WAC = Washington Administrative Code
Zn = Zinc

Qualifier:

U Analyte was not detected at the given reporting limit.

Sample Area 1



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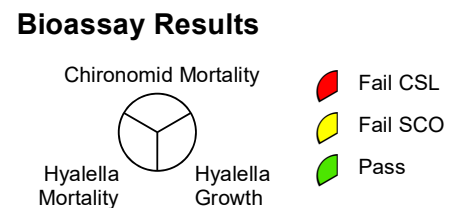
**Performance Standards Verification
2020 Annual Compliance Assessment Report
Holden Mine Site
Chelan County, Washington**

**Figure 3.2
COC and Bioassay Results from Sediment Sample Locations
(Fall 2020) (Sheet 1 of 2)**

- Legend**
- Sediment Sample Location
 - Approximate Location of Subsurface Barrier Wall
 - Surface Water Flow Direction
 - 100-foot Elevation Index Contour

Sample Key

Location ID → **RC-1** Result and
Analyte → Ag: 0.0300 ← Qualifier



Notes:

- All results presented in mg/kg dry weight.
- All sediment chemistry results are less than the SMS and SQV criteria for freshwater sediment (WAC 173-204-563 and USFS 2010).
- Elevation contours provided by Stantec. Contours are shown in feet above mean sea level.

Abbreviations:

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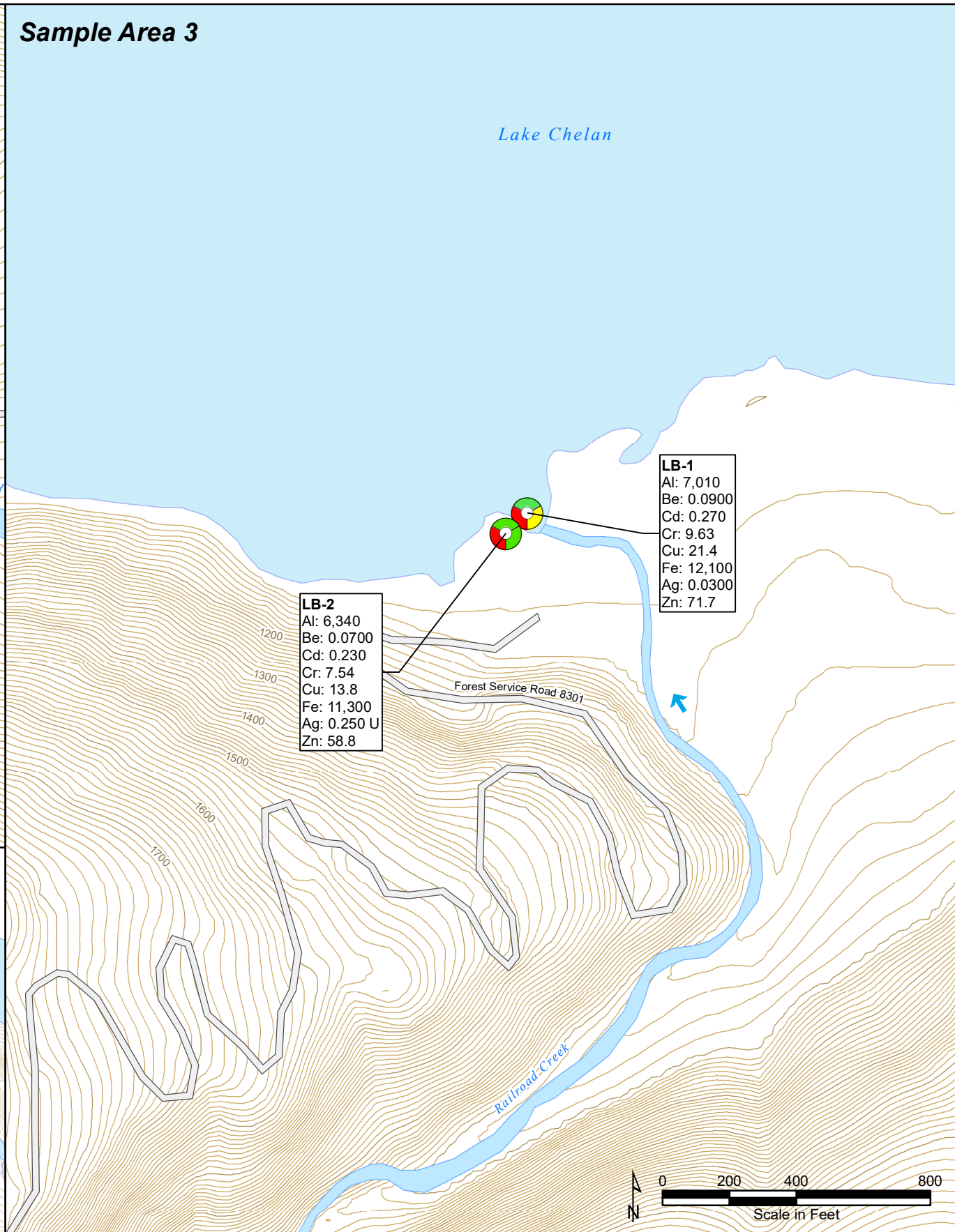
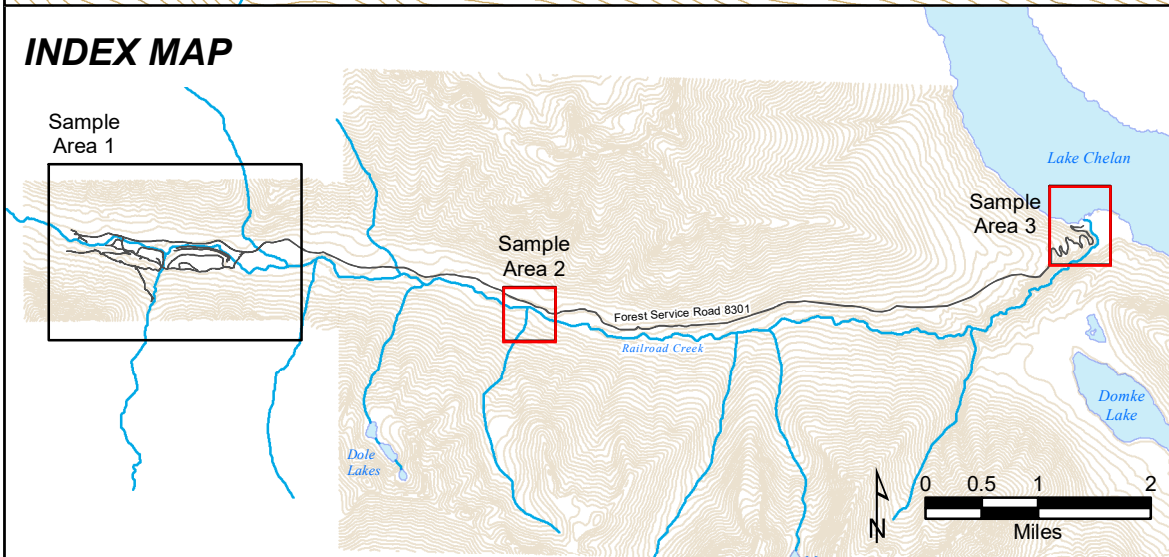
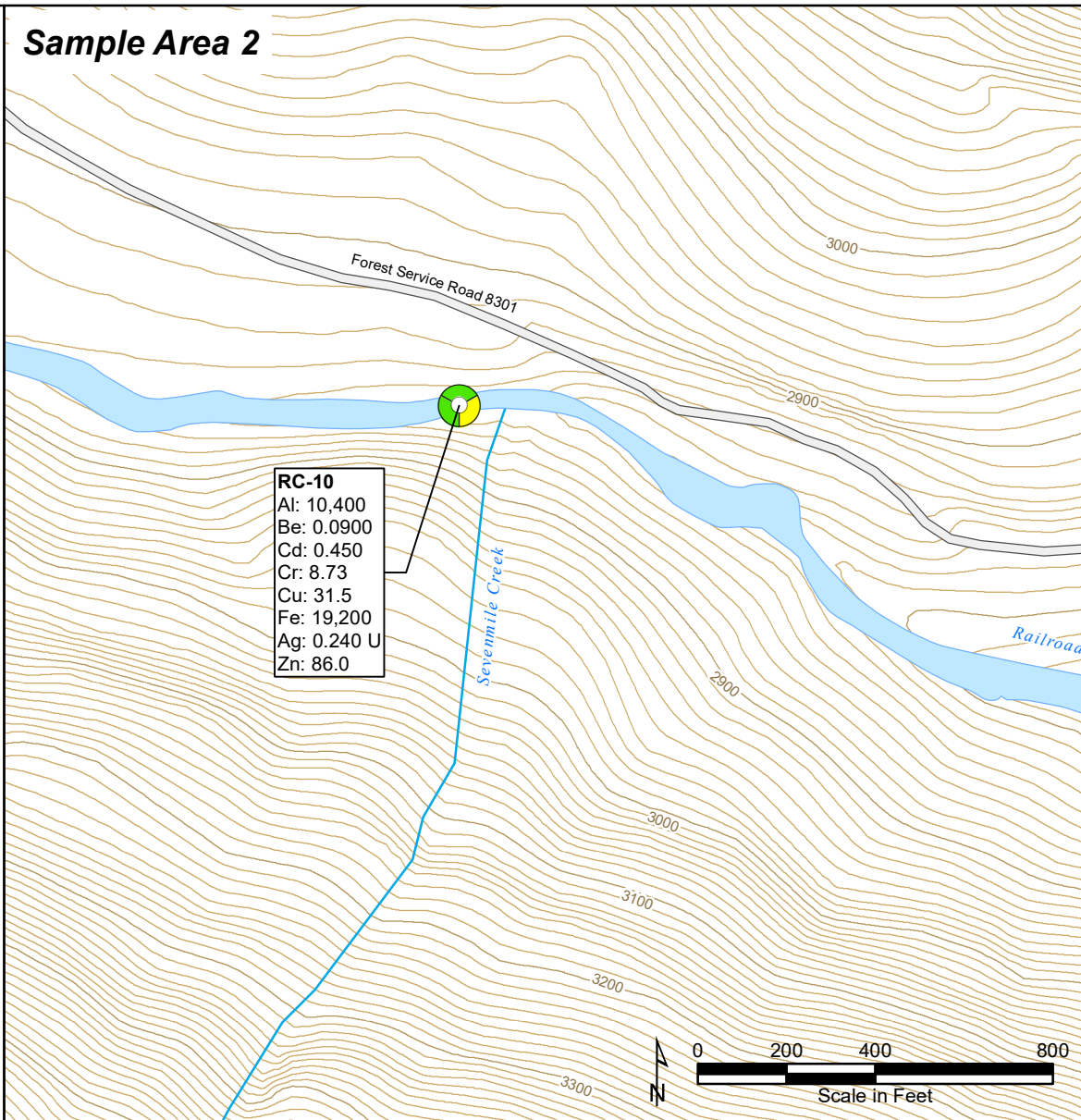


Table 3.2
Sediment Analytical Results

Location					RC-6	RC-1	RC-4	RC-2(SG-7)		RC-5A	RC-10(SG-20)	LB-1	LB-2
Sample ID					RC-6-SS-092920	RC-1-SS-092620	RC-4-SS-092620	RC-2(SG-7)-SS-092920	RC-102(SG-107)-SS-092920	RC-5A-SS-092620	RC-10-SS-092720	LB-1-SS-092720	LB-2-SS-092720
Sample Type					Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Sample Date					9/29/2020	9/26/2020	9/26/2020	9/29/2020	9/29/2020	9/26/2020	9/27/2020	9/27/2020	9/27/2020
Depth					0–12 cm	0-20 cm	0-25 cm	0-15 cm	0-15 cm	0-23 cm	0-30 cm	0-30 cm	0-20 cm
Analytes	Units	SMS SCO ⁽¹⁾	SMS CSL ⁽¹⁾	Literature SQVs ⁽²⁾									
Conventionals													
Total Organic Carbon	%	--	--	--	0.52	0.24	0.07	0.3	0.3	0.11	0.18	0.96	0.07
Total Solids	%	--	--	--	72.3	71.9	83.4	75.2	70.9	87.8	74.4	67.5	73.5
Metals													
Aluminum	mg/kg	--	--	58,000	10,400	10,600	9,290	11,400	9,700	5,870	10,400	7,010	6,340
Beryllium	mg/kg	--	--	--	0.08 JQ	0.07 JQ	0.06 JQ	0.11 JQ	0.08 JQ	0.08 JQ	0.09 JQ	0.09 JQ	0.07 JQ
Cadmium	mg/kg	2.1	5.4	--	0.17	0.12 JQ	0.38	0.4 JQ	0.24	0.25	0.45	0.27	0.23
Chromium	mg/kg	72	88	--	15.8	14.8	17.1	17.6	15.4	10.3	8.73	9.63	7.54
Copper	mg/kg	400	1,200	--	23.5	26.8	73.7	49.4	36.6	37.6	31.5	21.4	13.8
Iron	mg/kg	--	--	40,000	15,800	16,100	14,800	16,100	13,600	11,200	19,200	12,100	11,300
Silver	mg/kg	0.57	1.7	--	0.03 JQ	0.03 JQ	0.04 JQ	0.07 JQ	0.04 JQ	0.23 U	0.24 U	0.03 JQ	0.25 U
Zinc	mg/kg	3,200	4,200	--	54.9	49.3	79	90.9 JQ	73.4	45.7	86	71.7	58.8
Grain Size													
Gravel (<-1 Phi)	%	--	--	--	56.2	43.4	79.1	23.1	15.8	64.6	43.7	0	16.5
Sand (very coarse, -1 to 0 Phi)	%	--	--	--	7.5	14.5	11.1	7.1	6.7	16.7	23.1	1.8	22.7
Sand (coarse, 0 to 1 Phi)	%	--	--	--	11.2	18.5	4.7	22.6	26.6	9.1	16.6	9.3	32
Sand (medium, 1 to 2 Phi)	%	--	--	--	11.4	14.5	3.5	27.6	29.7	6	11.6	30.7	22.3
Sand (fine, 2 to 3 Phi)	%	--	--	--	7.9	4.3	1.3	11.5	12.4	1.2	3.2	31.4	5
Sand (very fine, 3 to 4 Phi)	%	--	--	--	2.9	1.1	0.4	4.4	5	0.3	0.5	18.2	0.6
Sand (total)	%	--	--	--	40.9	52.9	21.0	73.2	80.4	33.3	55.0	91.4	82.6
Silt (coarse, 4 to 5 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Silt (medium, 5 to 6 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Silt (fine, 6 to 7 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Silt (very fine, 7 to 8 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Clay (8 to 9 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Clay (9 to 10 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Clay (>10 Phi)	%	--	--	--	0	0	0	0	0	0	0	0	0
Total Fines	%	--	--	--	3.0	3.7	0	3.6	3.7	2.2	1.4	8.6	0.9

Notes:

- 1 Freshwater SCOs and CSLs Chemical Criteria (WAC 173-204-563).
- 2 SQVs proposed by USFS in the Proposed Plan (USFS 2010).

Abbreviations:

- CSL Cleanup Screening Level
- mg/kg Milligram per kilogram
- SCO Sediment Cleanup Objective
- SMS Sediment Management Standards
- SQV Sediment Quality Value
- USFS U.S. Department of Agriculture, Forest Service

Qualifiers:

- JQ Analyte was detected between the method detection limit and reporting limit and is considered to be an estimate.
- U Analyte was not detected at the given reporting limit.

Table 3.4
Summary of Bioassay Results

Location					Lab Control	RC-6	RC-1	RC-4	RC-2(SG-7)	RC-5A	RC-10(SG-20)	LB-1	LB-2
Sample ID						RC-6-SS-092920	RC-1-SS-092620	RC-4-SS-092620	RC-2(SG-7)-SS-092920	RC-5A-SS-092620	RC-10-SS-092720	LB-1-SS-092720	LB-2-SS-092720
Sample Date						9/29/2020	9/26/2020	9/26/2020	9/29/2020	9/26/2020	9/27/2020	9/27/2020	9/27/2020
Depth						0–12 cm	0–20 cm	0–25 cm	0–15 cm	0–23 cm	0–30 cm	0–30 cm	0–20 cm
Bioassay Tests and Metrics ⁽¹⁾	Units	Performance Standard ⁽²⁾ (Control and Background)	SMS Biological SCO ^(2,3)	SMS Biological CSL ^(2,3)									
10-day Chironomid Mortality Test													
Percent Mortality	%	≤30 and ≤30	--	--	5.0	13.7	17.5 a	15.0 a	5.0	31.2 a, c	18.7 a	8.7	15.0 a
M _T - M _B	%	--	> 20	> 30	--	--	--	-0.6	-10.6	15.6	3.1	-6.9	-0.6
28-day Hyalella Mortality Test													
Percent Mortality	%	≤20 and ≤30	--	--	8.7	10.0	25.0 a, c	70.0 a, b, c	16.2	22.5 a, c	31.2 a, c	48.7 a, b, c	48.7 a, b, c
M _T - M _B	%	--	> 10	> 25	--	--	--	52.5	-1.3	5.0	13.7 ⁽⁴⁾	31.2	31.2
28-day Hyalella Growth Test													
Mean Dry Weight Per Surviving Organism	mg	≥0.15 and ≥0.15	--	--	0.696	0.128 a	0.103 a, c	0.037 a, b, c	0.125 a	0.096 a, c	0.076 a, b, c	0.070 a, b, c	0.084 a, c
(MIG _B - MIG _T)/MIG _B	mg	--	> 0.25	> 0.40	--	--	--	0.680	-0.0823	0.169	0.342	0.394	0.273 ⁽⁴⁾

Notes:

- Not applicable.
- BOLD** Result exceeds the performance standard for control or reference samples.
- BOLD** Result exceeds the SCO. An exceedance of the SCO for any two bioassay test metrics equated to a CSL exceedance at the sample location.
- BOLD** Result exceeds the SCO and CSL. An exceedance of the SCO for any two bioassay test metrics equated to a CSL exceedance at the sample location.
- 1 As allowed under SMS (WAC 173-204-563), the Site and Lucerne Bar bioassay results are proposed to be compared to the background sample results, rather than the laboratory control results, as the background samples are representative of natural sediment conditions and the natural sediment matrix. Background results were calculated as the average of the results from RC-6 and RC-1.
- 2 Freshwater SCOs and CSLs Biological Criteria (WAC 173-204-563).
- 3 An exceedance of the SCO or CSL requires that the result is greater than the criteria, and that there is a statistically significant difference between the test result and reference result at p ≤ 0.05. A test result was considered statistically significant, if there was a statistically significant difference between the test result and both background samples (RC-6 and RC-1).
- 4 The result is greater than the SCO, but there is not a statistically significant difference between the result and both background samples results.
- a Indicates a statistically significant difference from the laboratory control at alpha = 0.05.
- b Indicates a statistically significant difference from RC-1 background site at alpha = 0.05.
- c Indicates a statistically significant difference from RC-6 background site at alpha = 0.05.

Abbreviations:

- B Background
- CSL Cleanup Screening Level
- M Mortality
- mg milligrams
- MIG Mean individual growth at time final
- SCO Sediment Cleanup Objective
- SMS Sediment Management Standards
- T Test

Attachment 2

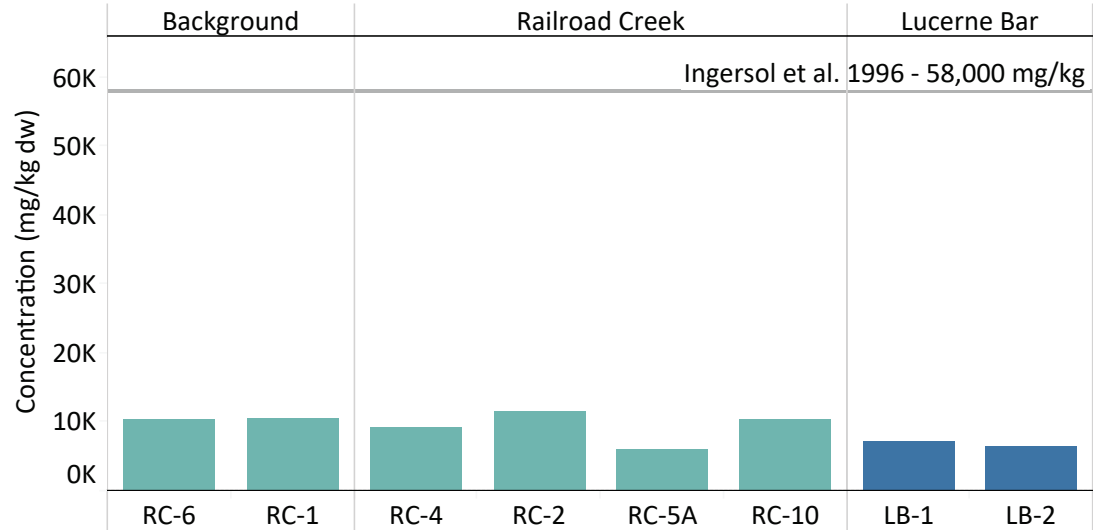
Holden Mine Site

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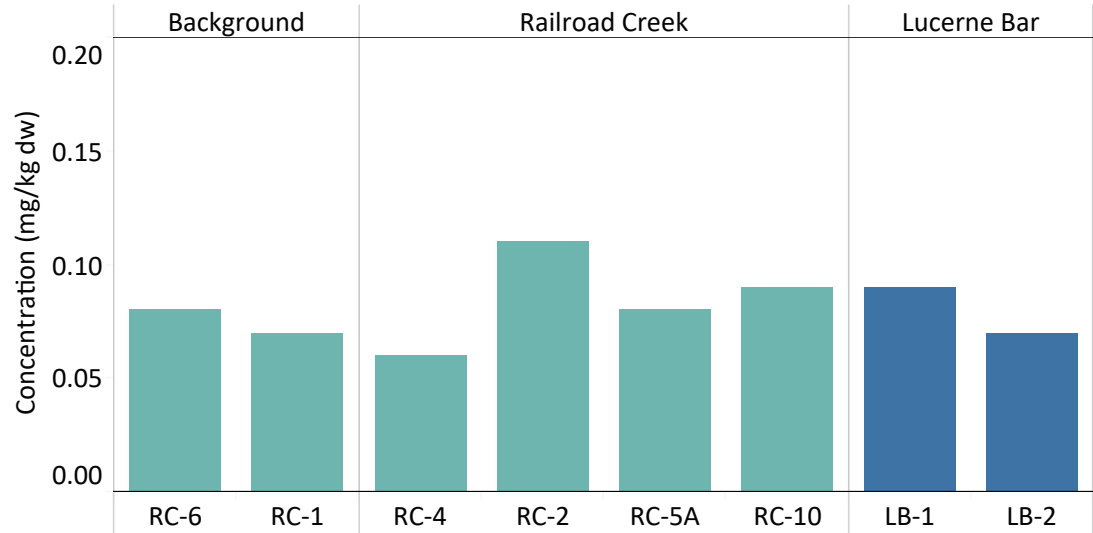
**Appendix I
Sediment Concentration Charts**

DRAFT

Aluminum in Sediment



Beryllium in Sediment



Legend

— Sediment criteria

Note:

1. A sediment criterion is not available for beryllium.

Abbreviations:

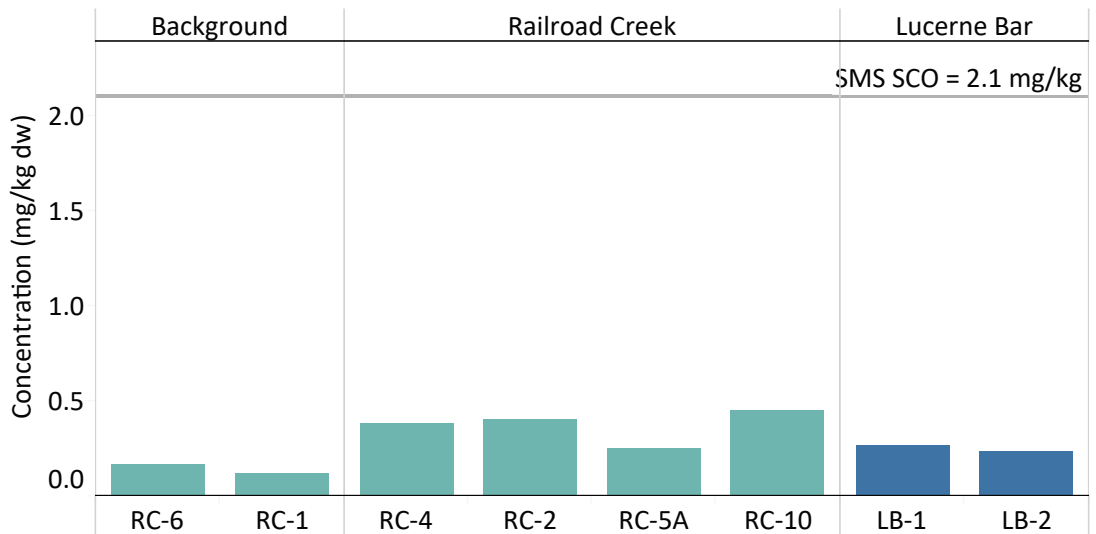
dw = dry weight

mg/kg = Milligrams per kilogram

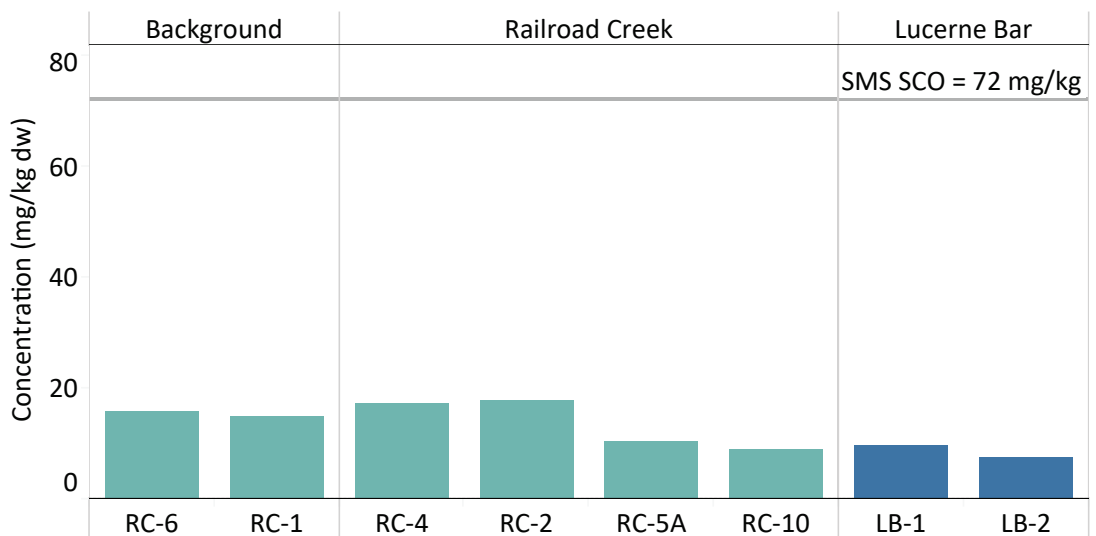
Figure I.1

Metals Concentrations in Sediment in Railroad Creek and Lucerne Bar (Sheet 1 of 4)

Cadmium in Sediment



Chromium in Sediment



Legend

— Sediment criteria

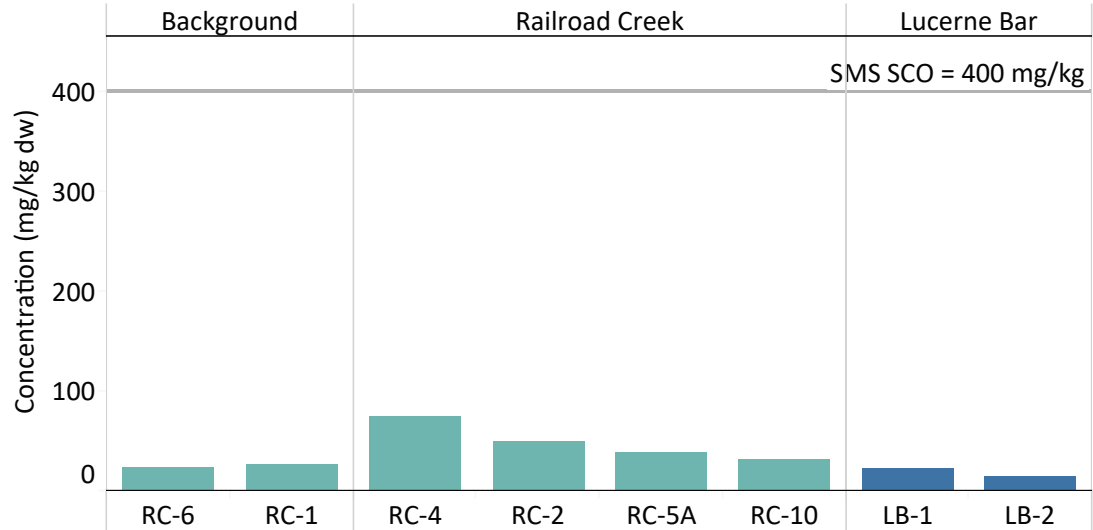
Abbreviations:

dw = dry weight

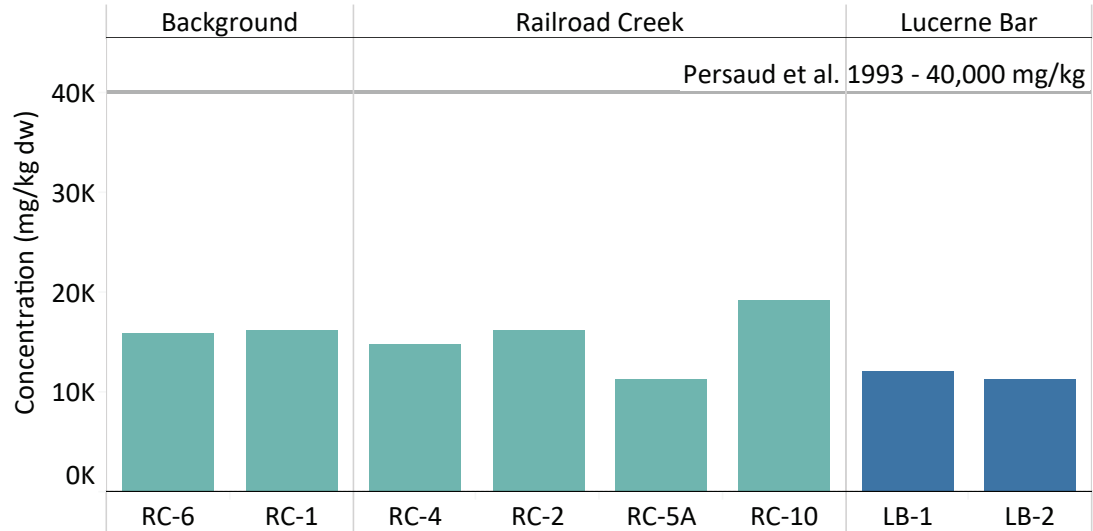
mg/kg = Milligrams per kilogram

Figure I.1
Metals Concentrations in Sediment in Railroad Creek and Lucerne Bar (Sheet 2 of 4)

Copper in Sediment



Iron in Sediment



Legend

— Sediment criteria

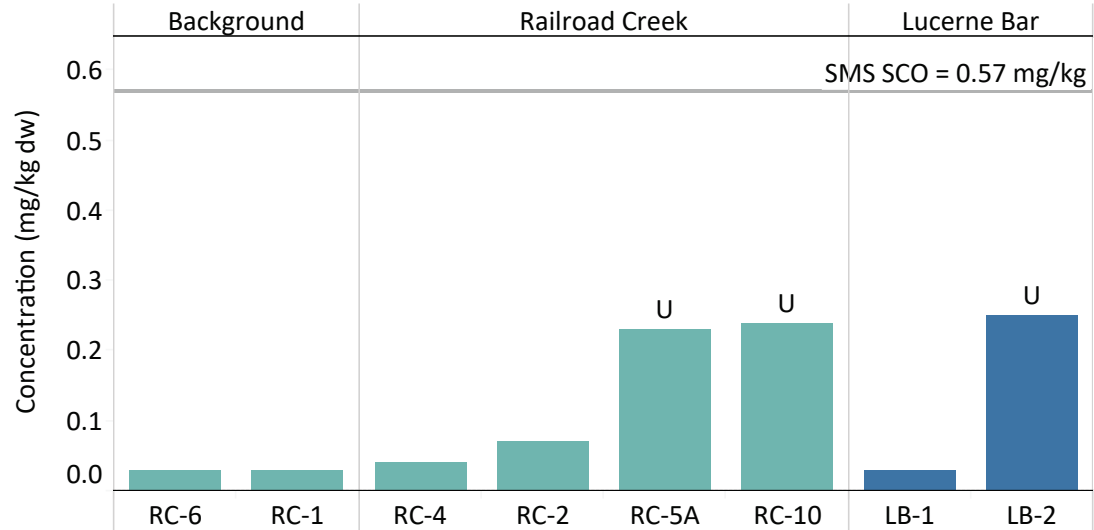
Abbreviations:

dw = dry weight

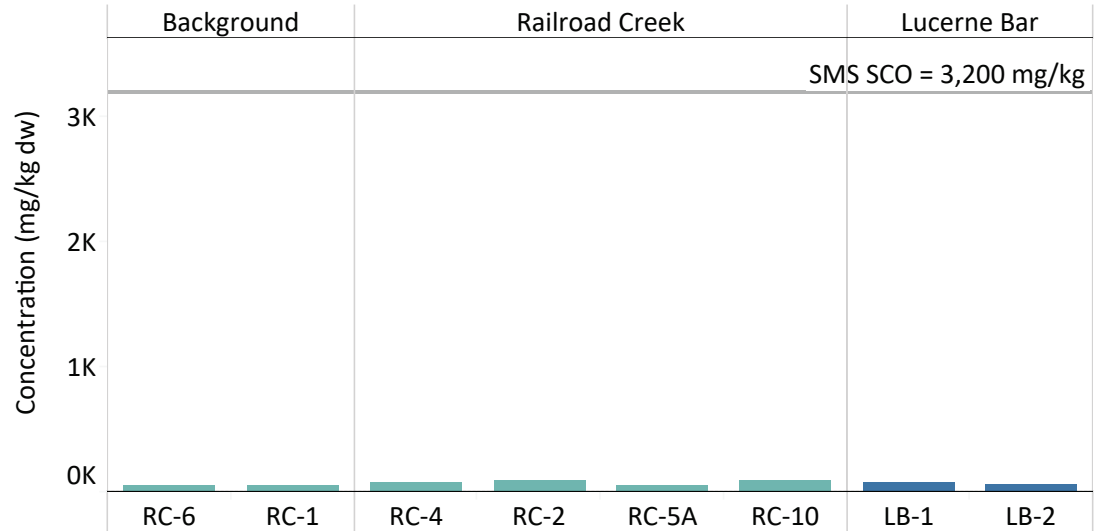
mg/kg = Milligrams per kilogram

Figure I.1
Metals Concentrations in Sediment in Railroad Creek and Lucerne Bar (Sheet 3 of 4)

Silver in Sediment



Zinc in Sediment



Legend

— Sediment criteria

Abbreviations:
dw = dry weight

mg/kg = Milligrams per kilogram
U = Non-detect result

Figure I.1
Metals Concentrations in Sediment in Railroad Creek and Lucerne Bar (Sheet 4 of 4)

Attachment 3

Holden Mine Site

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**Appendix J
Bioassay Replicate Results**

DRAFT

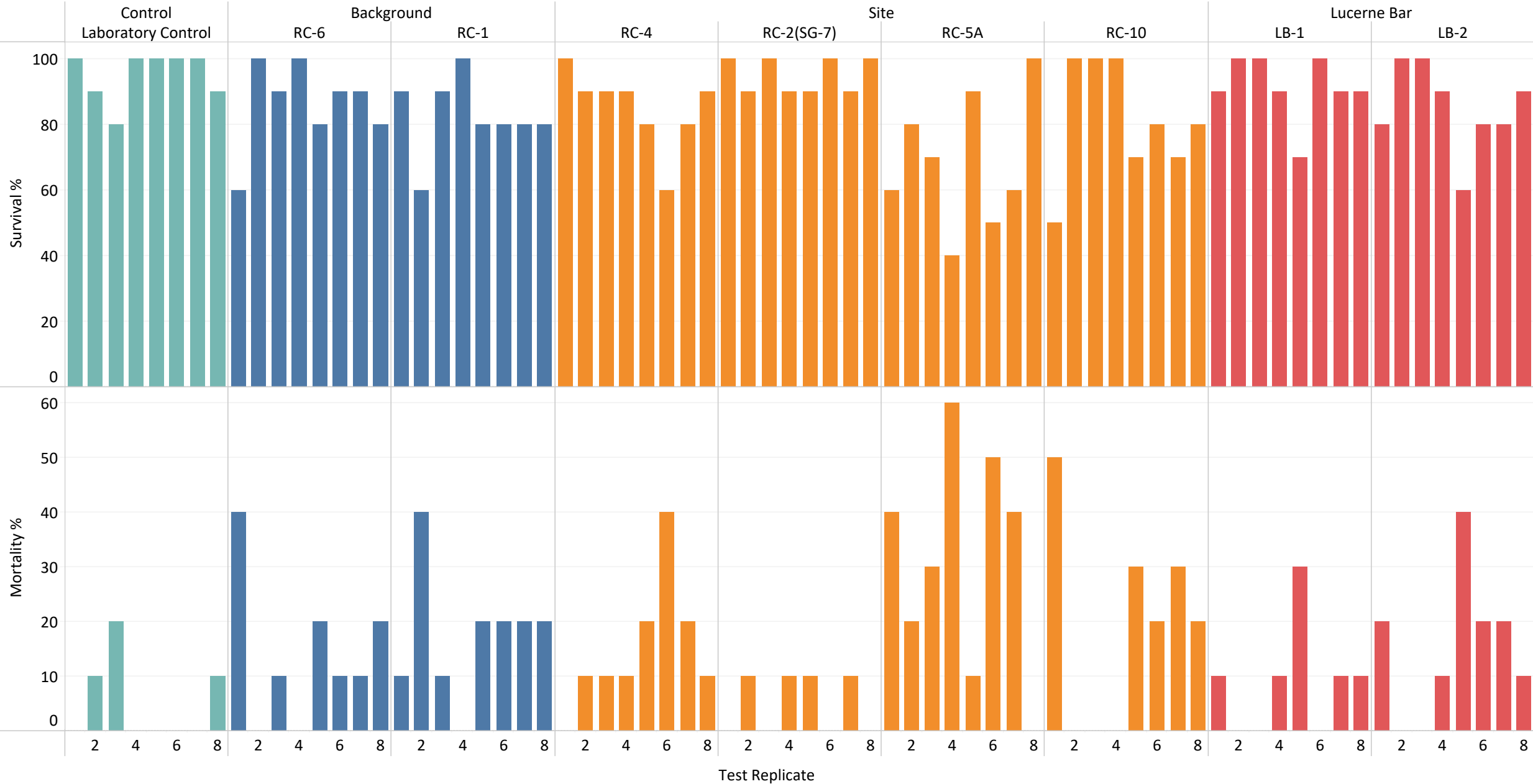


Figure J.1
Chironomid 10-Day Survival Test Results

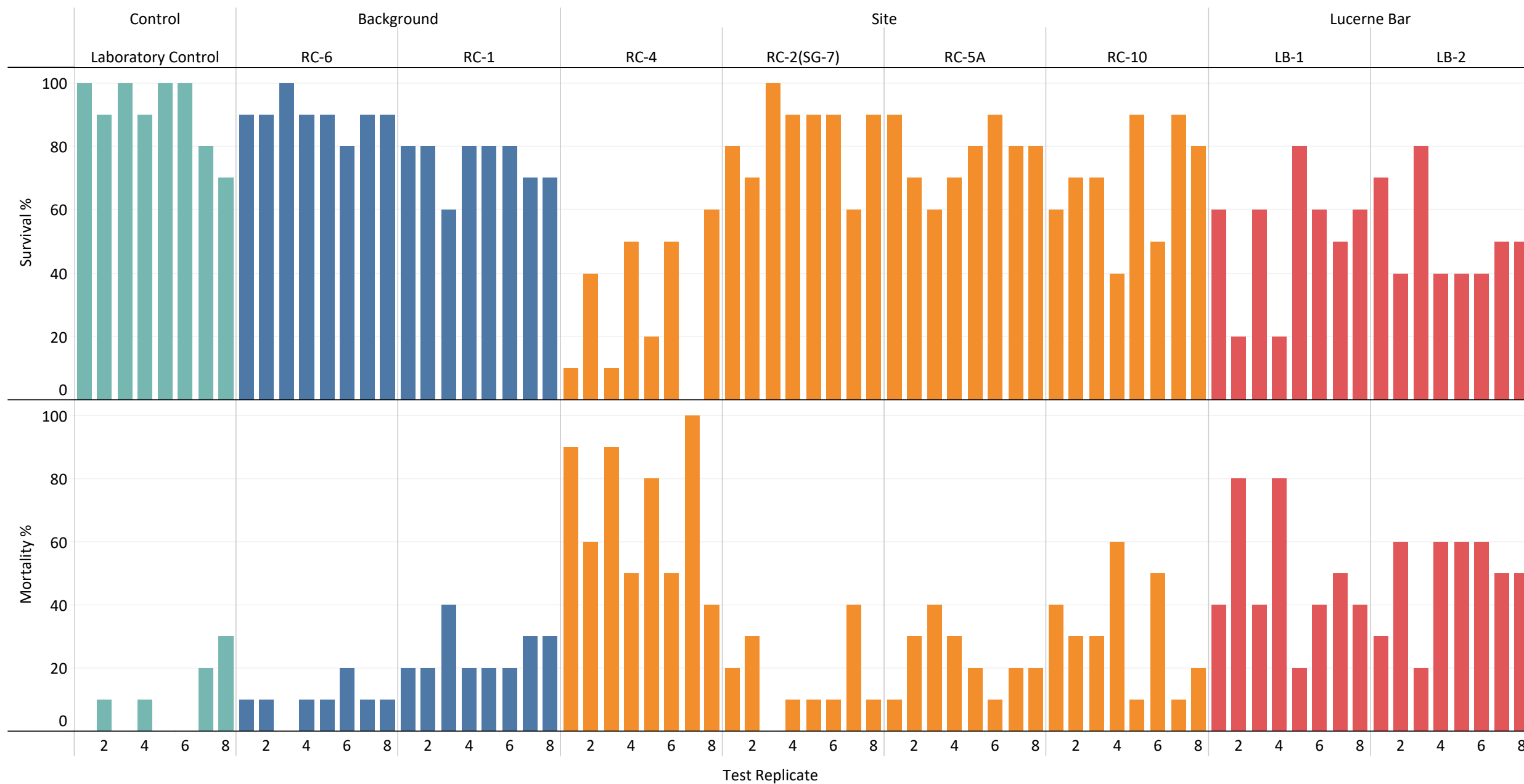


Figure J.2
Hyalella 28-Day Survival Test Results

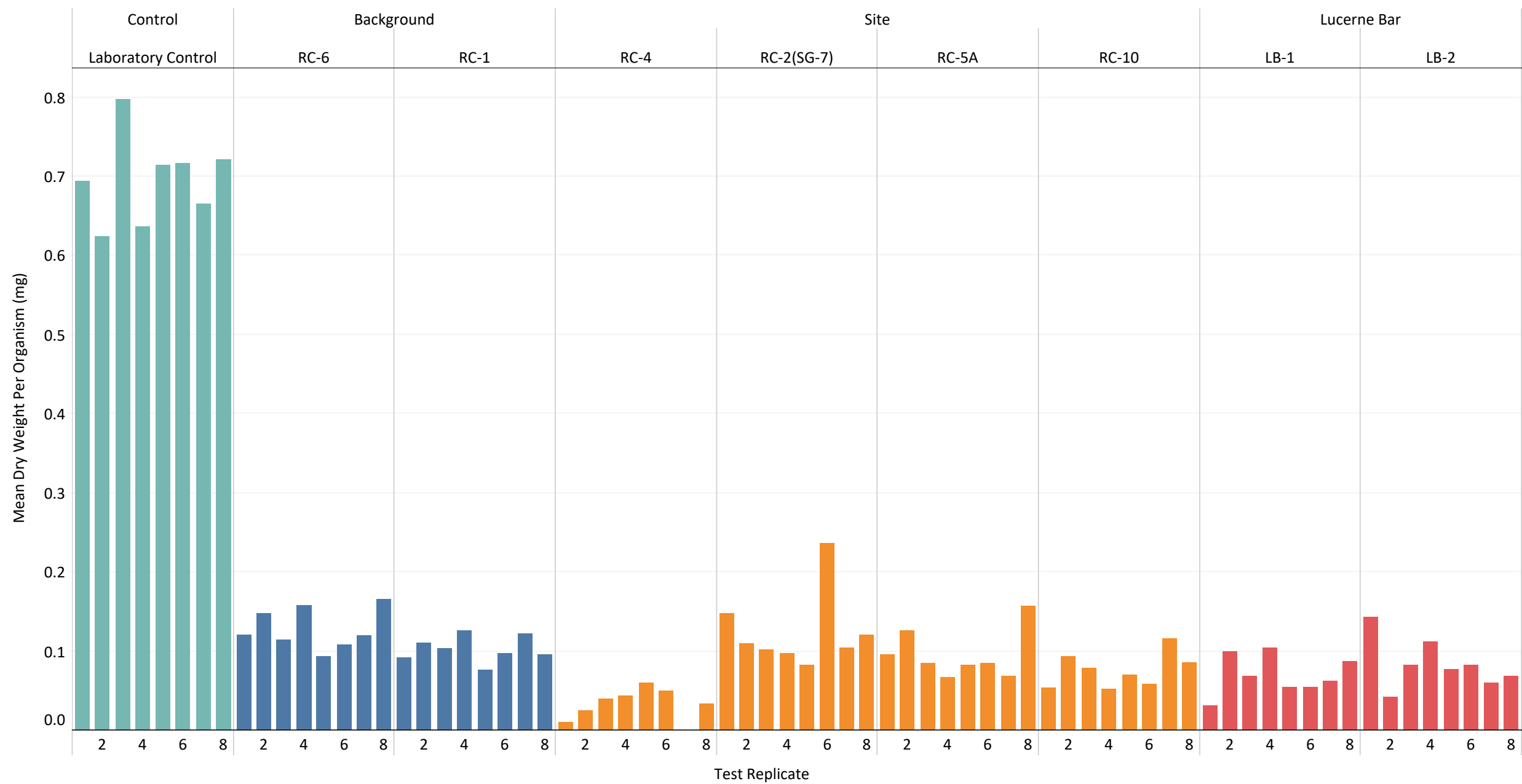


Figure J.3
Hyalella 28-Day Growth Test Results