Hatcher Pass Water Quality Sampling Report

(May 2010 through April 2011)

Prepared for the Matanuska-Susitna Borough

by

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Summary

Seasonal water chemistry and biological sampling was conducted at five Little Susitna River sampling locations from the Goldmint Trailhead to Edgerton Park Road in Hatcher Pass. This study provided the fifth year of water quality data. Water samples collected in June, August, September, and March were analyzed for total fecal coliform bacteria, ammonia nitrogen, nitrate plus nitrite nitrogen, pH, specific conductivity, and turbidity. August samples were analyzed for aromatic hydrocarbons. Stream macroinvertebrates were sampled in the spring at three locations in early June and analyzed using the ASCI methods as a biotic measure of water quality. Data loggers were used to measure and record water temperatures.

Stream water nutrient concentrations were generally consistent with previous years. Ammonia nitrogen concentrations were high downstream from the sampling location at Mile Post 12 to the Edgerton Park Road Bridge. Average annual concentrations are higher at the downstream locations. Nitrate nitrogen concentrations are lowest during the growing season as has been observed previously. Decreasing summer nitrate concentrations are most likely related to uptake by terrestrial vegetation. Like ammonia, nitrate-N tends to be higher at the downstream sites, but there are no obvious annual trends. Conductivity remained within the range of previously measured values and like nitrate+nitrite-N, was lowest during the summer months. Discharge recorded by the U.S.G.S gauging station showed rising flow during the spring and early summer related to glacial melting but no large fall increases due to storms as seen in previous years. Concentrations of hydrocarbons remained below detection limits in August samples. The macroinvertebrate community showed an improvement in water quality at the Goldmint site compared to the low values recorded in 2009.

Annual water quality monitoring of the Little Susitna River in Hatcher Pass provides a standard against which the effects of future development can be evaluated. Waters remain free of fecal coliform bacteria, hydrocarbons are absent, and nutrient concentrations remain low. Turbidity increases during the summer months up to 6 NTU due to glacial runoff; however, generally does not increase following rainfall events. Water quality based on the macroinvertebrate community has generally been within the "good to "excellent" range.

Introduction

The Little Susitna River is within the Cook Inlet Ecoregion (Gallant et al. 1995). The Cook Inlet Ecoregion includes portions of the Kenai Peninsula, the Knik and Matanuska River drainages, and the Susitna River drainage up to 500 m elevation. The Cook Inlet Ecoregion extends north of Talkeetna, east to the Talkeetna Mountains and west to the Alaska Range. Average annual precipitation ranges from 280 to 680 mm. Winter temperatures range from lows of -15°C to highs of -5°C and summer highs of about 5 to 8°C. May through September is generally frost free (Gallant et al. 1995). The Little Susitna River flows an estimated 113 miles from the Talkeetna Mountains to Cook Inlet, with an elevation change of over 4,000 feet.

The Little Susitna River is an important recreational area in Southcentral Alaska. The river supports a popular Chinook and coho sport fisheries. The river is road accessible upstream from the Parks Highway. Access downstream of the Parks Highway and the Miller's Reach subdivision (river mile 62) is limited to the Public Use Facility (river mile 25) located at the end of Ayrshire Road. The Little Susitna River is one of the rivers managed under the Susitna Area Recreational Rivers Management Plan. The lower river is located within the Susitna Flats State Game Refuge, and a small portion of the river downstream from the Parks Highway flows through the Nancy Lake State Recreation Area. The river is within the Hatcher Pass State Management Area upstream of the Edgerton Park Road Bridge. Residential and commercial development is restricted to the road accessible areas near the cities of Wasilla and Houston.

The Little Susitna River's headwaters begin at the Mint Glacier in the Talkeetna Mountains in Hatcher Pass within the Matanuska-Susitna Borough (MSB). Hatcher Pass is a historic gold mining district and there are still active mines within the area. The Independence Mine State Historical Park is managed by Alaska Department of Natural Resources (ADNR), Division of Parks and Outdoor Recreation. Most of the gold mining on the Little Susitna side of Hatcher Pass is historic, with the most recent mining occurring in the 1970's. There has been recent interest in reactivating some of the hard rock mines located outside of the 20-acre Independence Mine State Historical Site located on upper Fishhook Creek. The area geology is mostly diorite and granite. Most of the gold in the area is associated with granite seams. There is some pyrite (which is associated with sulphides and acid mine or rock drainage) but it is not high. Most of the gold mining on the Little Susitna side of Hatcher Pass was done with tunnels. ADNR, Division of Mining Land and Water, does not know if any of the old tunnels are leaking or if they connect to groundwater and/or tributaries to the Little Susitna River.

The population within the Matanuska-Susitna Borough has been increasing rapidly over the past few years. This has resulted in an increase in development and recreational use along the Little Susitna River. Residential development and recreational use have the potential to negatively affect the aquatic ecosystem. Residential development and associated road construction can result in the direct loss of fish habitat and indirect effects to water quality. Riparian vegetation often is removed for home construction or to provide unimpeded river views. The removal of bank vegetation can cause accelerated bank erosion rates. Increases in bank sediments in excess of the stream transport capacity can cause areas of sediment deposition. Fine sediment deposition can affect the transport of water and oxygen through the substrate, reducing the quality of fish spawning habitat and the living space for aquatic insects. Road construction can be a source of sediment, concentrating surface flows along ditch lines, and delivering sediment to streams at road crossings. The delivery of toxic hydrocarbons can increase at road crossings. The construction and use or failure of residential septic systems can result in an increase in concentrations of fecal coliform bacteria in adjacent waters causing increased risk to human health through direct or indirect contact with contaminated waters. Increases in stream water nutrient concentrations resulting in blooms of nuisance algae also have been associated with residential development.

Water quality monitoring in the upper portion of the Little Susitna watershed was initiated in the spring of 2005. Intensive sampling was conducted throughout the summer of 2005 with monthly water samples collected June through October and in January, February and March of 2006 (Davis et al. 2006). Water quality sampling was continued through 2006, 2007, 2008 and 2009 with spring, summer, fall, and winter water chemistry measures and spring and fall biotic measures of water quality (Davis and Davis 2006, 2008, 2009, 2010) There is an active USGS gauging station (15290000) with 58 years of record downstream of the bridge on Palmer Fishhook Road as the river exits the Hatcher Pass area.

The objectives of this project were to continue the evaluation of water quality within the upper Little Susitna River by obtaining chemical and biotic measures of water quality through the summer of 2010 and winter of 2011. These data will be used to support the overall goal of obtaining long-term measures of base-line water quality that can be used to assess potential future changes due to development, mining, or increased recreational use.

Methods

Water sampling in 2010 was conducted at five sampling sites on the Little Susitna River within Hatcher Pass. Sampling sites were located at the Goldmint Trailhead, Mile 12 (just upstream from Fishhook Creek), Mile 10.2, the USGS gauging station (below the Palmer Fishhook Road bridge), and upstream from the Edgerton Park Road bridge. Sites were labeled HP-1 through HP-5 from upstream to downstream (Figure 1).

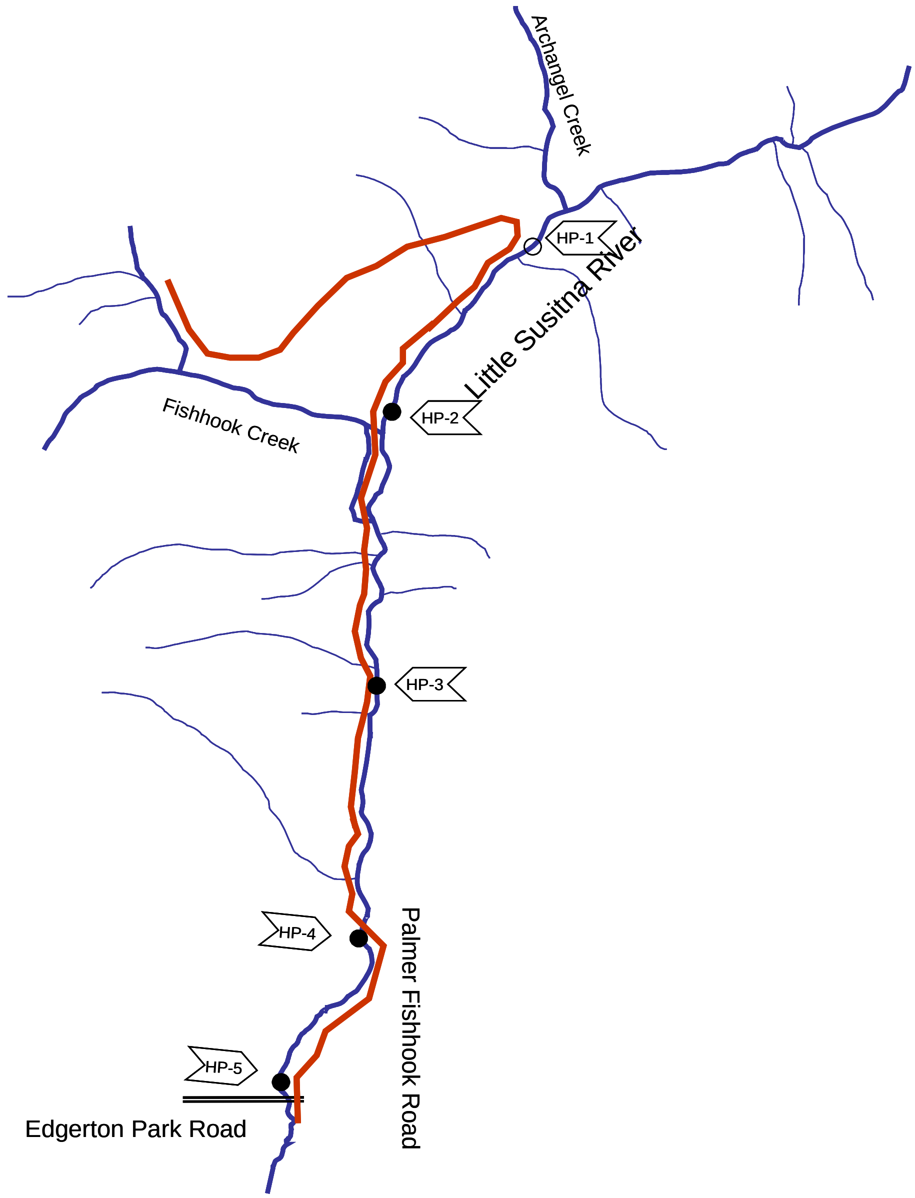


Figure 1. Map showing the location of the Hatcher Pass sampling sites.

Water samples were collected from all sites for chemical analyses on June 2, August 11, September 15, 2010; and March 7, 2011. Samples were submitted to SGS laboratory in Anchorage for total fecal coliform bacteria analyses, and to AM Test Inc. in Redmond, WA to be analyzed for nitrate plus nitrite nitrogen and ammonia nitrogen. Water samples collected in August were also analyzed for the BTEX aromatic hydrocarbons (benzene, toluene, ethyl benzene, and total xylene) components of gasoline. Stream water turbidity, pH, and specific conductivity were measured *in situ* on all sampling dates. Ice cover prevented sample collection at HP-3 and HP-4 in March.

Stream water temperature was measured at HP-2 (Mile 12) and at the Edgerton Park Road Bridge using ONSET Water Temp ProV2 loggers. Temperature was recorded every hour from May through September. The temperature logger at Mile 12 was damaged during the field season and we were unable to retrieve site data.

Macroinvertebrates were collected from sites at the Goldmint Trailhead, Mile 10.2, and Edgerton Park Road Bridge on May 17, 2009. Samples were collected and analyzed using the Alaska Stream Condition Index (ASCI) methods (Major and Barbour 2001).

Results and Discussion

Stream water discharge and summer sampling dates are shown in Figure 2. May water sampling occurred during the initial rise in hydrograph. August and October samples were collected as steam flows diminished following summer peak flows. Similar to 2008, there were no large increases in flows due to fall storms as have been recorded previously (Figure 3).

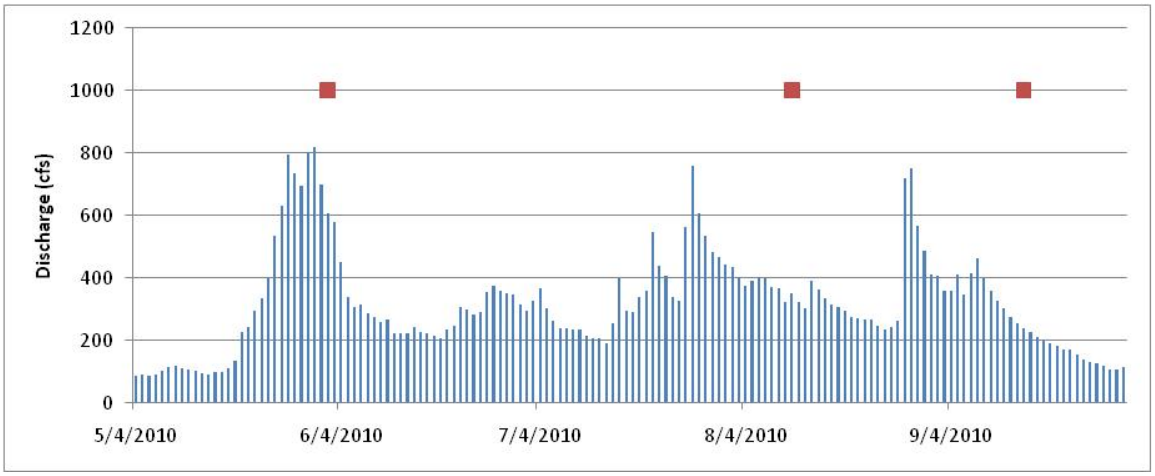


Figure 2. Little Susitna River discharge from the U.S.G.S. gauging station in Hatcher Pass. Red diamonds indicate water sampling dates.

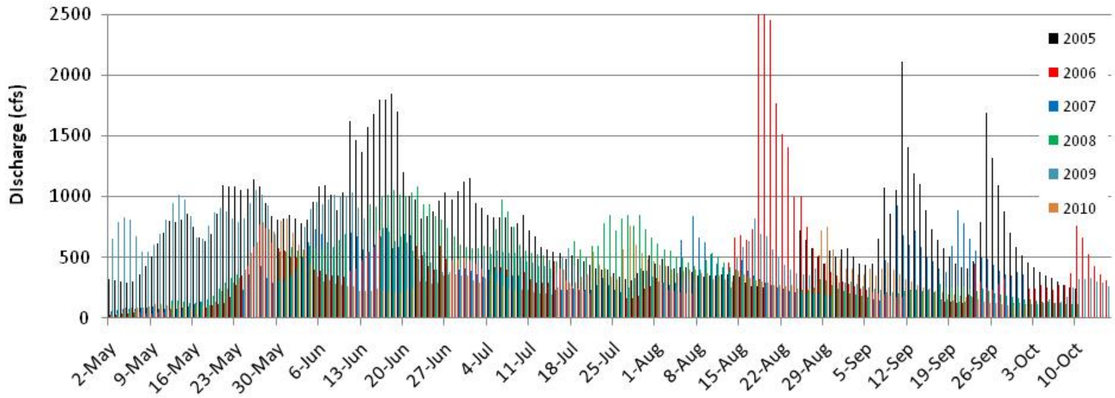


Figure 3. Little Susitna River discharge (2005 – 2010) by date showing annual variability.

The analytical results for each sampling date are shown in Table 1 (also see Appendix A). Ammonia-N concentrations ranged from below detection limits to 0.05 mg/L. These values were considerably were within the range of those measured previously. The highest values at most sites occurred in March of 2011 except for Fishhook and Edgerton Park, where highest values were in early June (Figure 4). There have been no consistent annual trends (Figure 5). Highest annual average ammonia concentrations occurred in 2009 at Goldmint, Mile 12, and the Edgerton Park Bridge, and in 2008 at Mile 10.2 and Fishook Road Bridge. Annual average concentrations at Edgerton Park have increased consistently from 2006 to 2009, but declined in 2010. There is little seasonal variation in ammonia-N concentrations at Goldmint and Mile 12, but concentrations from Mile 10.2 downstream are highest during spring or summer (Figure 6).

Nitrate plus Nitrite-N concentrations ranged from 0.06 to 0.45 mg/L for samples collected in 2010 and March of 2011 (Table 1 and Figure 7). The lowest annual average concentrations were in 2006 at most sites and highest annual average concentrations in 2007 (Figure 8). Average concentrations from 2006 through March 2011 are lowest during the summer, highest during the winter and tend to increase downstream (Figure 9).

Table 1. Water chemistry data for the 2009 Hatcher Pass sampling sites.

Date	*Site*	*Location*	*Ammonia N (mg/L)*	*Nitrate+Nitrite-N (mg/L)*	*pH*	*Specific Conductivity*	*Turbidity*	*Total Fecal Coliforms*	*Width (m)*
6/2/2010	HP-1	Goldmint	0	0.064	7.55	46.7	4.0	0	22.9
6/2/2010	HP-2	MP12	0	0.09	7.59	52.2	5.0	0	17.4
6/2/2010	HP-3	MP10.2	0	0.14	7.59	59.8	2.5	0	19.2
6/2/2010	HP-4	Fishook Road Bridge	0.027	0.11	7.61	60.4	3.3	0	24.1
6/2/2010	HP-5	Edgerton Road Bridge	0.053	0.11	7.53	58.1	3.3	10	26.8
8/11/2010	HP-1	Goldmint	0	0.12	7.62	55.5	4.2	4	16.5
8/11/2010	HP-2	MP12	0	0.14	7.59	60.6	4.3	3	14.9
8/11/2010	HP-3	MP10.2	0	0.16	7.65	69.3	3.3	2	14.9
8/11/2010	HP-4	Fishook Road Bridge	0	0.16	7.75	71.4	3.6	5	22.6
8/11/2010	HP-5	Edgerton Road Bridge	0.005	0.16	7.72	72.1	3.7	2	28.7
9/17/2010	HP-1	Goldmint			5.68	25.1	2.7	0	17.1
9/17/2010	HP-2	MP12	0	0.14	6.3	71.4	2.6	0	13.5
9/17/2010	HP-3	MP10.2	0	0.17	7.02	83.8	1.6	1	21.4
9/17/2010	HP-4	Fishook Road Bridge	0	0.19	7.17	83.9	1.6	0	17.1
9/17/2010	HP-5	Edgerton Road Bridge	0	0.20	7.49	84.1	1.6	7	27.5
3/7/2011	HP-1	Goldmint	0.030	0.26	7.3	50.1	0.8	0	Ice
3/7/2011	HP-2	MP12	0.029	0.34	7.3	53.8	0.4	0	Ice
3/7/2011	HP-3	MP10.2	Ice	Ice	Ice	Ice	Ice	Ice	Ice
3/7/2011	HP-4	Fishook Road Bridge	Ice	Ice	Ice	Ice	Ice	Ice	Ice
3/7/2011	HP-5	Edgerton Road Bridge	0.041	0.45	7.29	81.7	1.0	0	Ice
Max			0.053	0.45	7.75	84.1	5.0	10	28.7
Min			0.000	0.06	5.68	25.1	0.4	0	13.5
Average			0.011	0.18	7.32	63.3	2.7	2	20.3

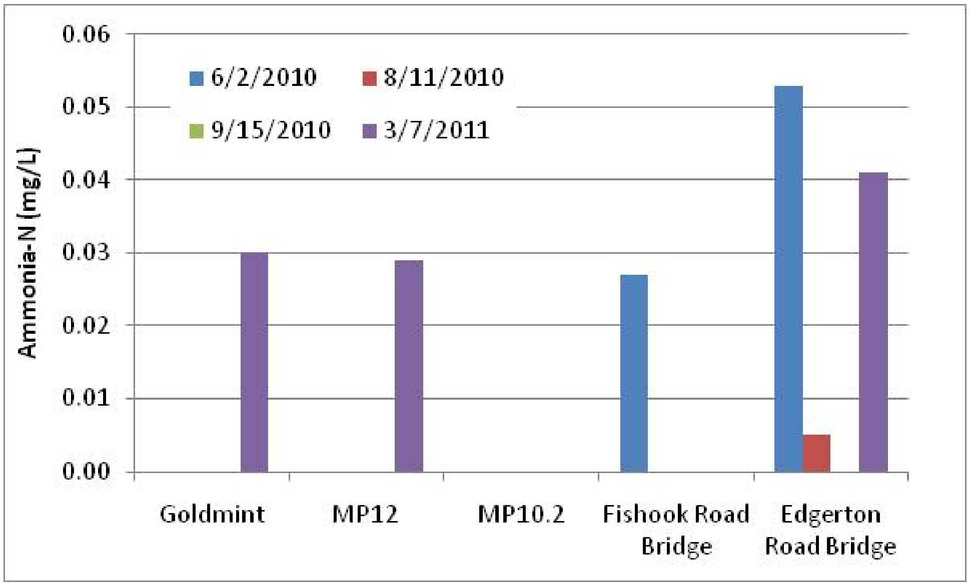


Figure 4. Ammonia nitrogen concentrations for each sampling date showing higher concentrations during the spring at most sites except for HP-1.

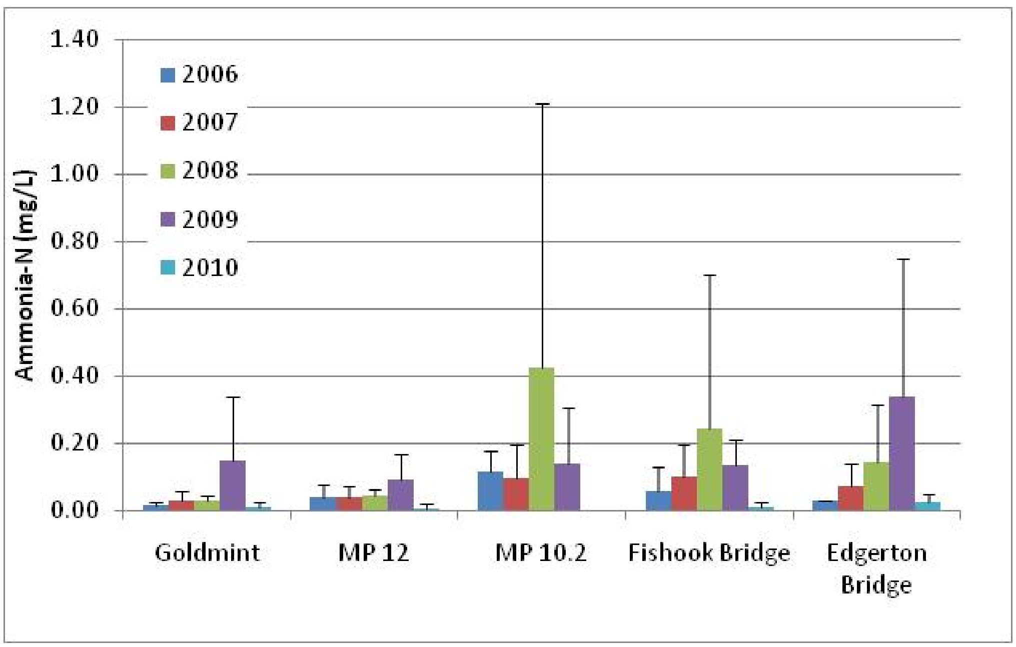


Figure 5. Average concentrations of Ammonia-N by site for 2006 through 2010. Error bars are one standard deviation.

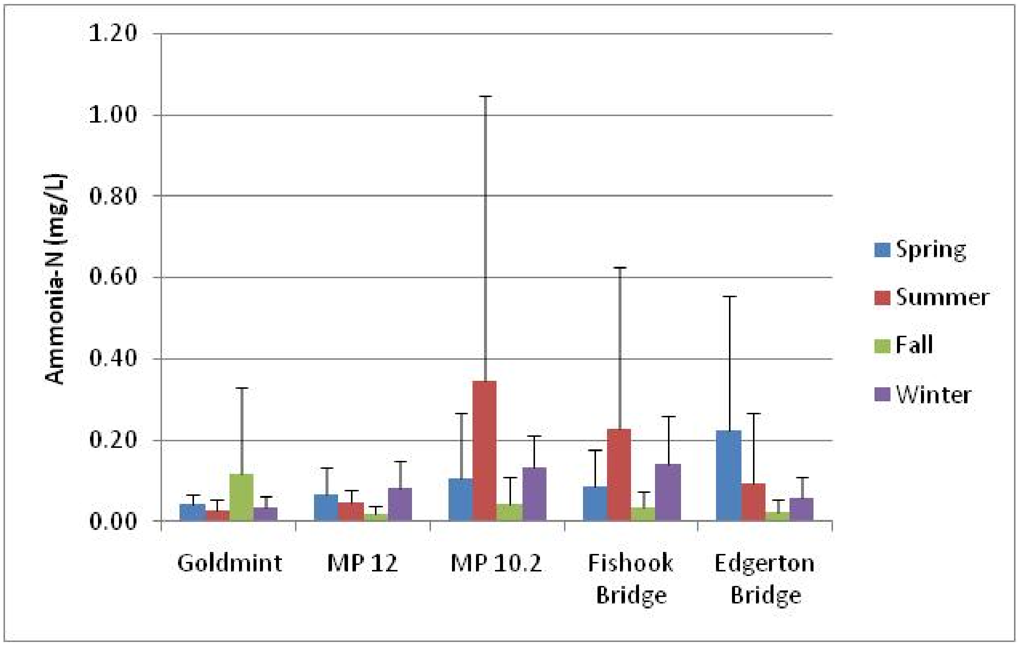


Figure 6. Average seasonal (2006 through 2010) ammonia concentrations.

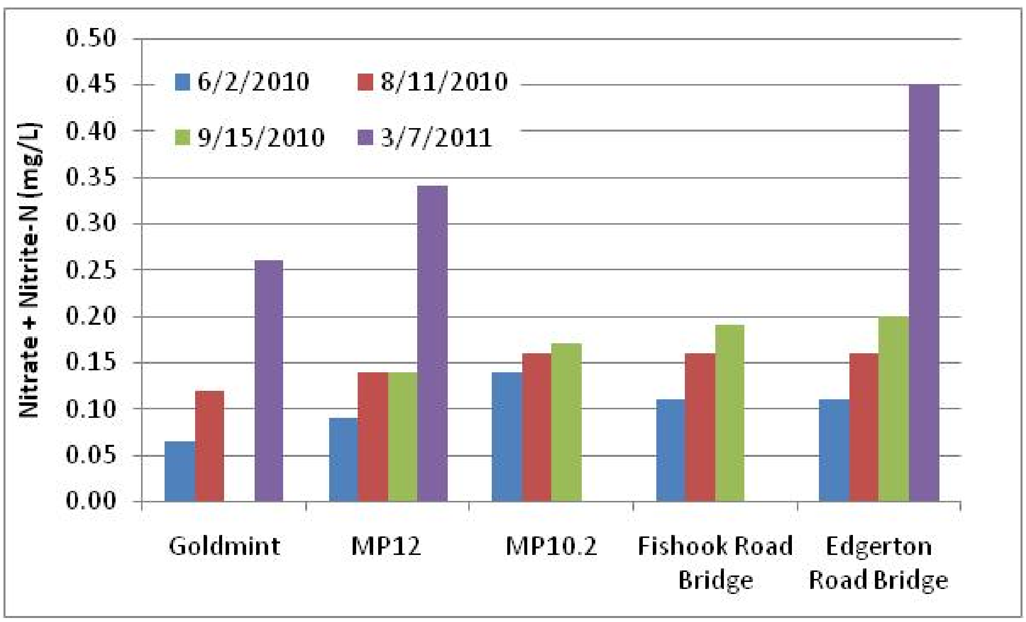


Figure 7. Nitrate+Nitrite-N concentrations for each sampling location and date.

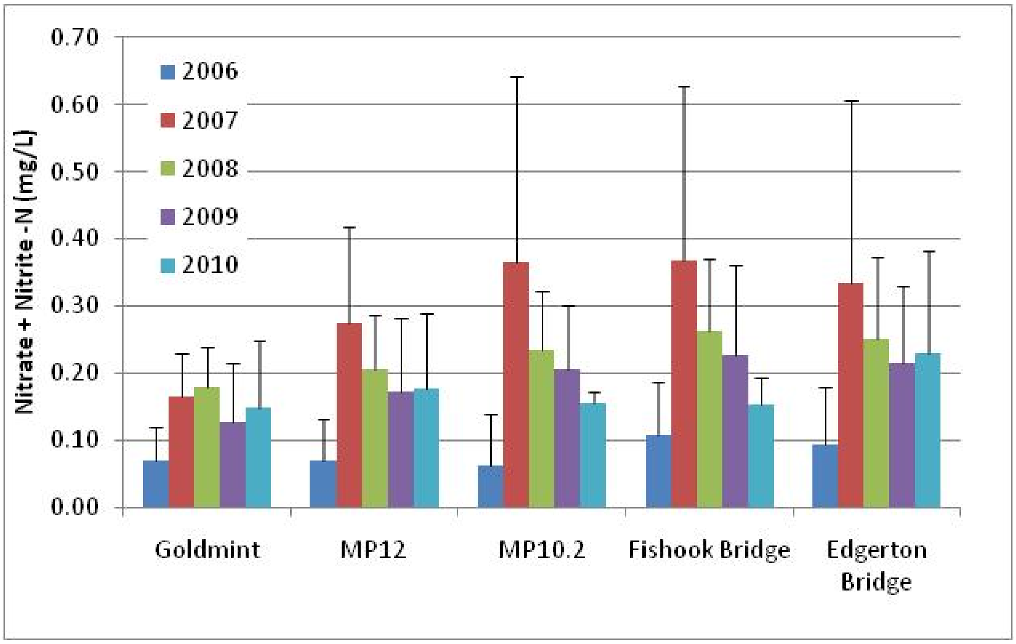


Figure 8. Average seasonal nitrate+nitrite-N concentrations for samples collected from May of 2006 through March of 2010. Error bars are one standard deviation.

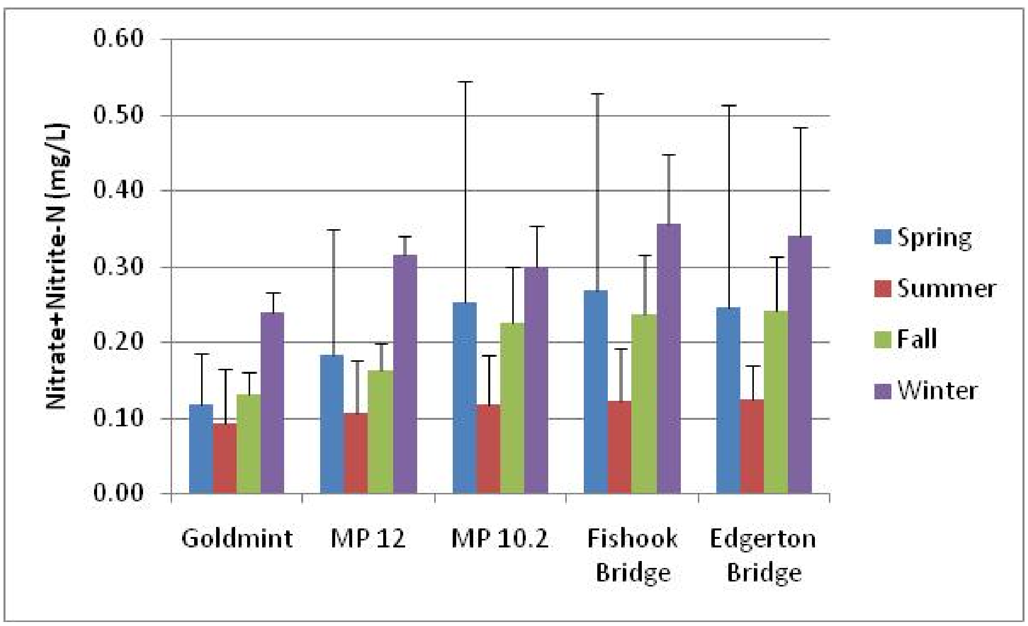


Figure 9. Seasonal average (2006 through 2010) nitrate+nitrite-N concentrations. Error bars are one standard deviation.

Stream water pH ranged from 5.7 to 7.7 in 2010 (Figure 10). Average pH has been between 6.95 and 7.70 from 2006 through March of 2011 (Figure 11). Stream water pH tends to increase downstream from Goldmint to Mile 10.2. There are no obvious seasonal differences in pH; however, lowest seasonal average values were during the fall (Figure 12). Stream water pH has been shown to decrease during storm events which may explain lower fall values. Stream pH values also are more variable at the upstream sampling locations.

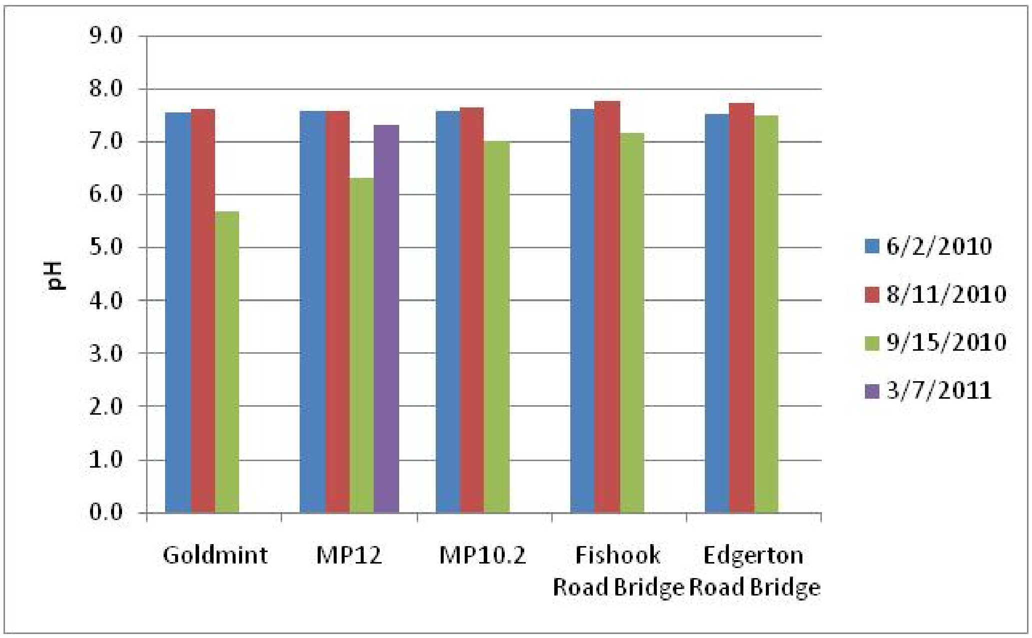


Figure 10. Stream water pH for each sampling site.

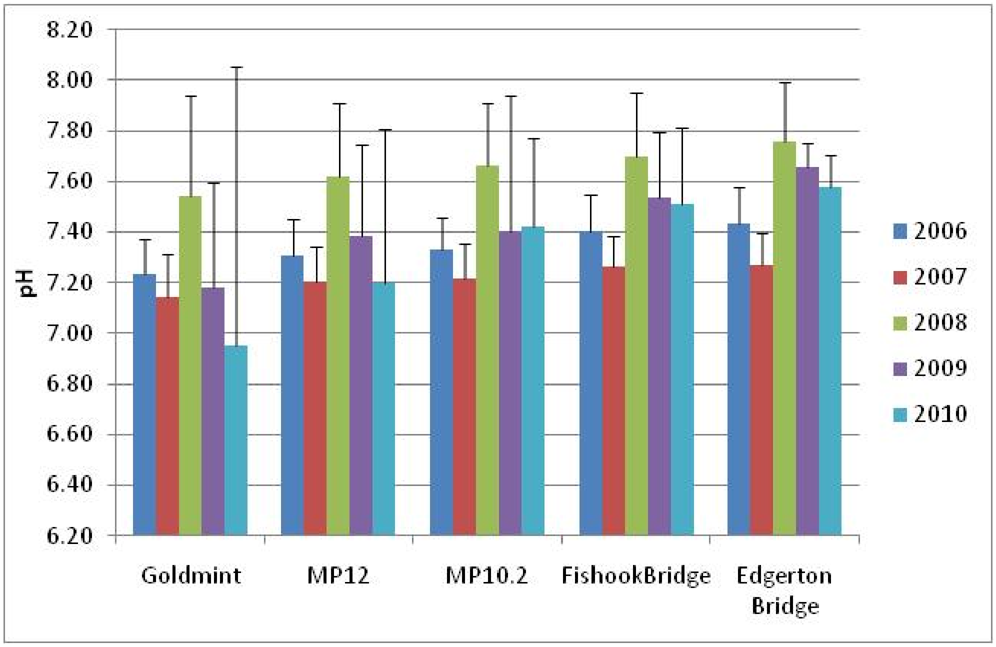


Figure 11. Average annual (May 2006 – March 2011) pH.

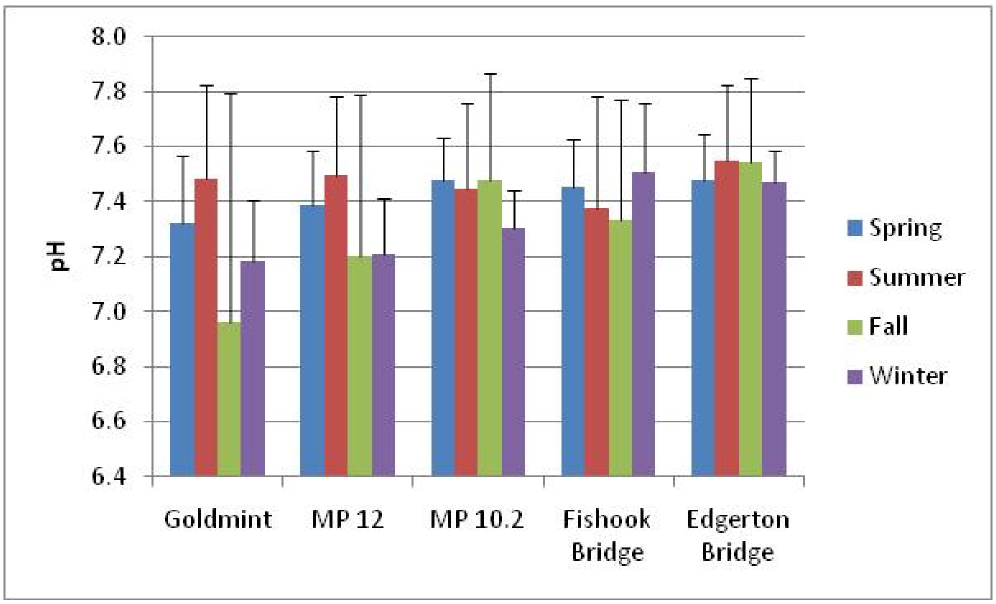


Figure 12. Average seasonal (May 2006 to March 2011) pH at each Hatcher Pass sampling location.

Specific conductivity was consistent with previous measures. Values ranged from near 40 to over 80 µS/cm (Figure 13). Specific conductivity increased to Mile 10.2 and then remained constant downstream. There has been no consistent annual trend, but average annual values were highest in 2007 (Figure 14), similar to concentrations of nitrate+nitrite N. Specific conductivity is generally lowest during the summer (Figure 15). This is consistent with the more intensive measures in 2005, which showed a pattern of the lowest specific conductance during the relatively higher summer flows. Specific conductivity in 2010 was within the range of average seasonal values (Figure 11).

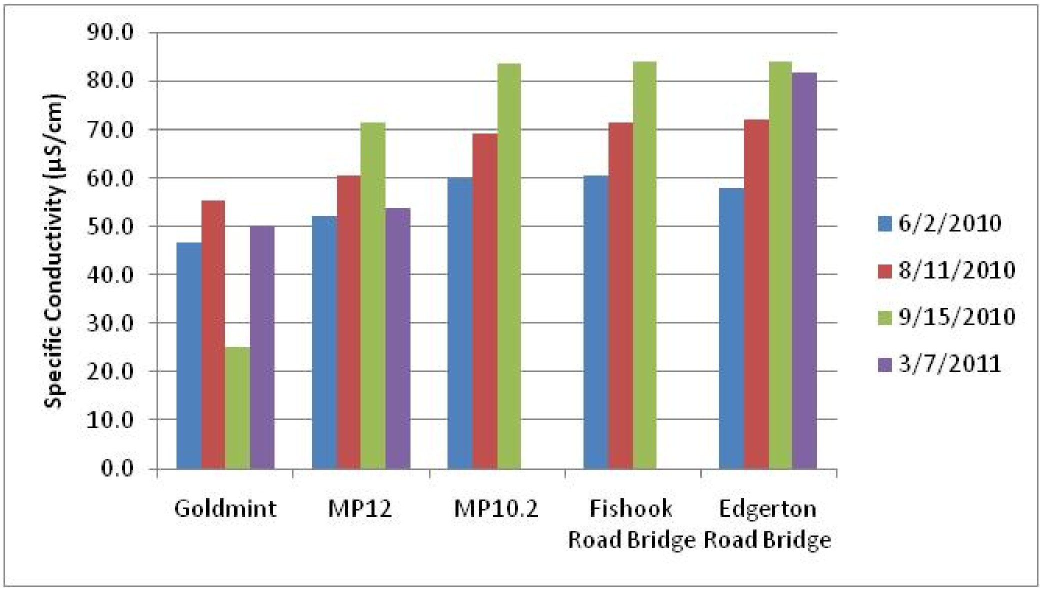


Figure 13. Specific conductivity at the Little Susitna sampling stations.

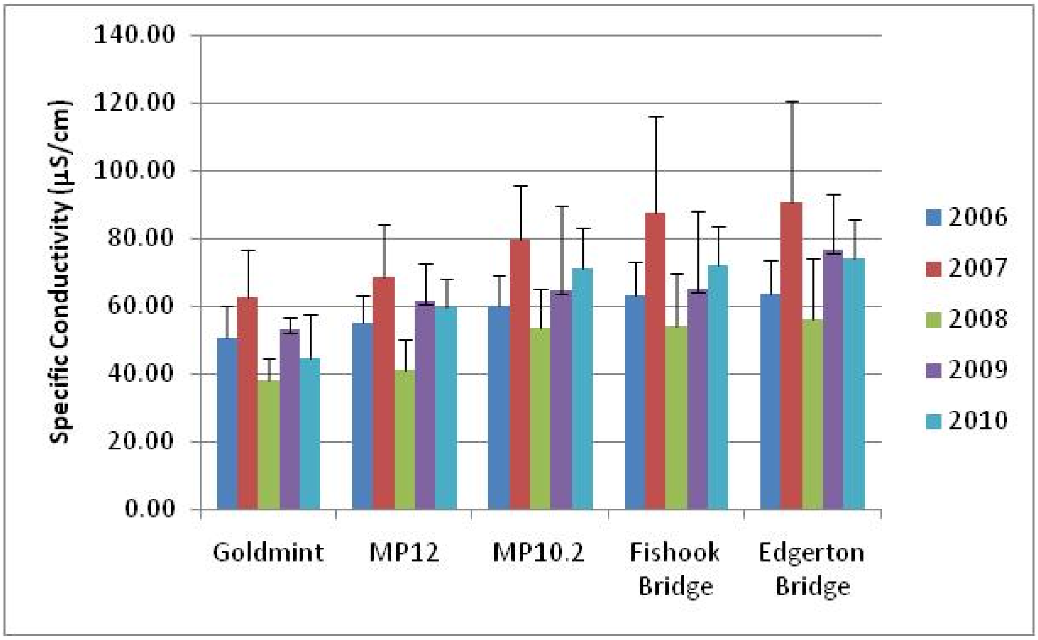
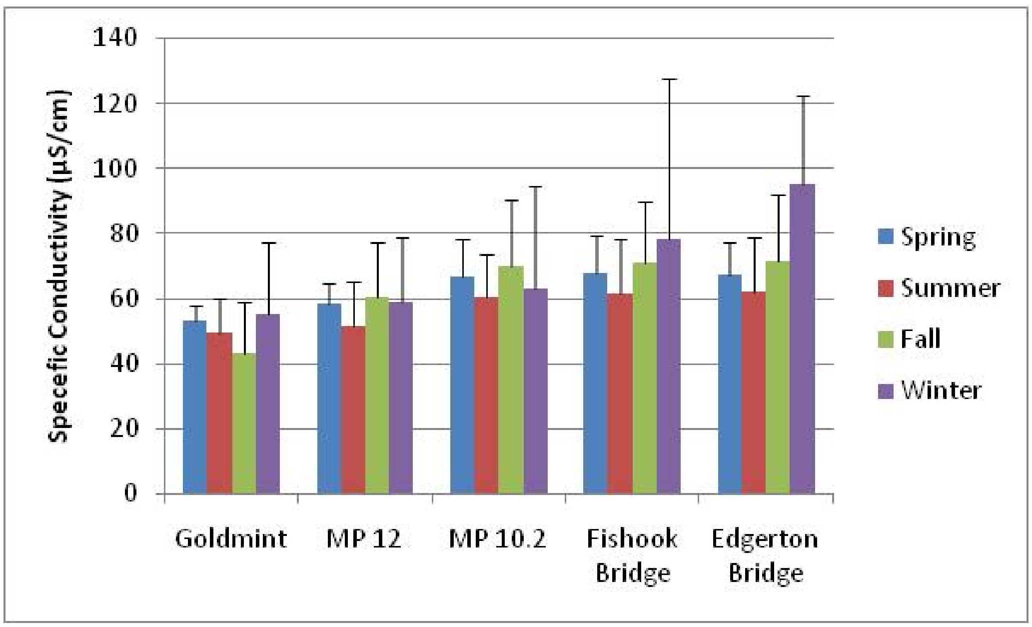


Figure 14. Annual (May 2006-March 2011) average specific conductivity for the 5 sampling locations. Error bars are one standard deviation.



Stream water turbidity ranged from 0 to 5 NTU in 2010 (Figure 15) compared to 0 to 13 NTU in 2009. Turbidity in 2010 was highest on the June and August sampling dates and at the upstream sampling locations. Average seasonal turbidity is highest during the summer (Figure 16). This is consistent with previous summer increases associated with glacial runoff. The previous maximum value was near 30 following storm events in 2007 and near11 NTU during 2005 breakup. Prior to 2007, turbidity had not been recorded to increase during storms. The high storm turbidity values may be due to possible erosion and exposed soil caused by the extreme flood during August 2006.

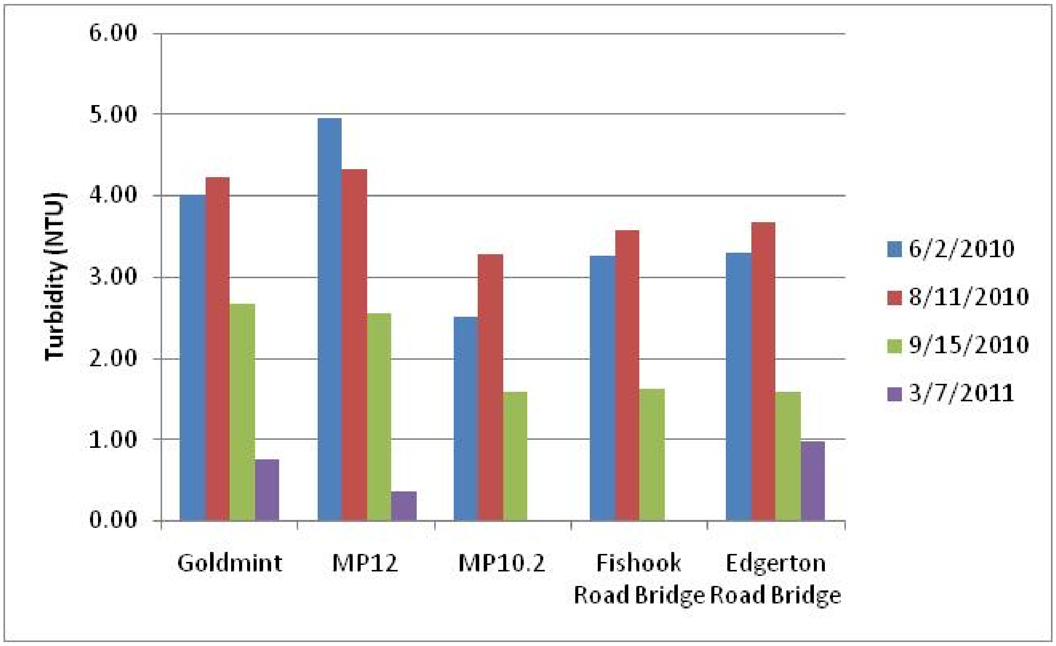


Figure 15. Stream water turbidity in 2010.

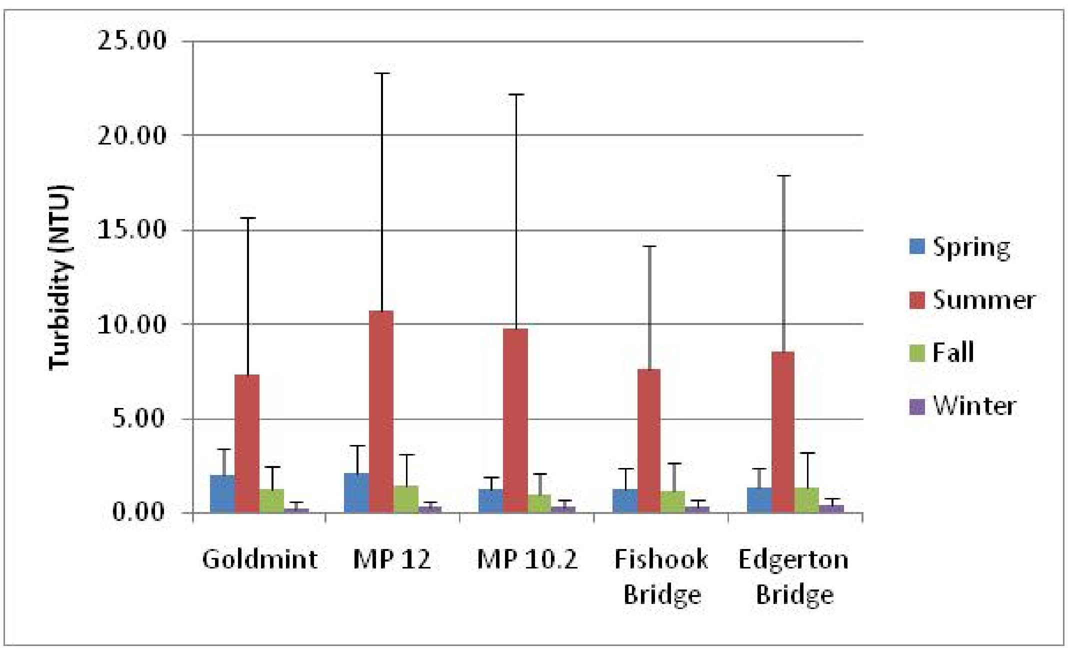


Figure 16. Seasonal average (2006 through 2010) turbidity for the 5 sampling locations in Hatcher Pass.

Hydrocarbons were not found in water samples collected from the Edgerton Park Road Bridge site in August of 2007, 2008, 2009, or 2010. BETX values were all below detection limits.

Total fecal coliform bacteria up to 10 cfu/100 ml were measured in August 2010 at the Edgerton Park Road Bridge. These values are well below State Water Quality Standards. The high concentrations observed during storm flows of 2007 (near 20 in early August and over 1000 at the Fishook Road Bridge in October) were not repeated. Total fecal coliform measures were within the range observed previously.

Stream water temperature data are shown in Table 2 and Figure 14. Stream water temperatures are cool and remain below State Water Quality Standards. Maximum water temperatures occurred during late July and early August.

Table 2. Stream water temperature values for measure during 2007 and 2008 at Mile 12 of Hatcher Pass Road. Cumulative degree days are the sum of daily average temperature values.

Little Susitna at Edgerton	2009	2010
Start Date	5/19/2009	6/2/2010
End Date	9/28/2009	9/15/2010
Season Maximum	15.01	14.48
Max Daily Range	6.49	4.91
Total Days	133	105
Days Max>13	13	3
Percent of Total	9.8%	2.9%
Days Max>15	1	0
Percent of Total	0.8%	0
Days Max>20	0	0
June Cumulative Degree Days	205	195
July Cumulative Degree Days	319	252
August Cumulative Degree Days	265	259
Sept Cumulative Degree Days	186	106

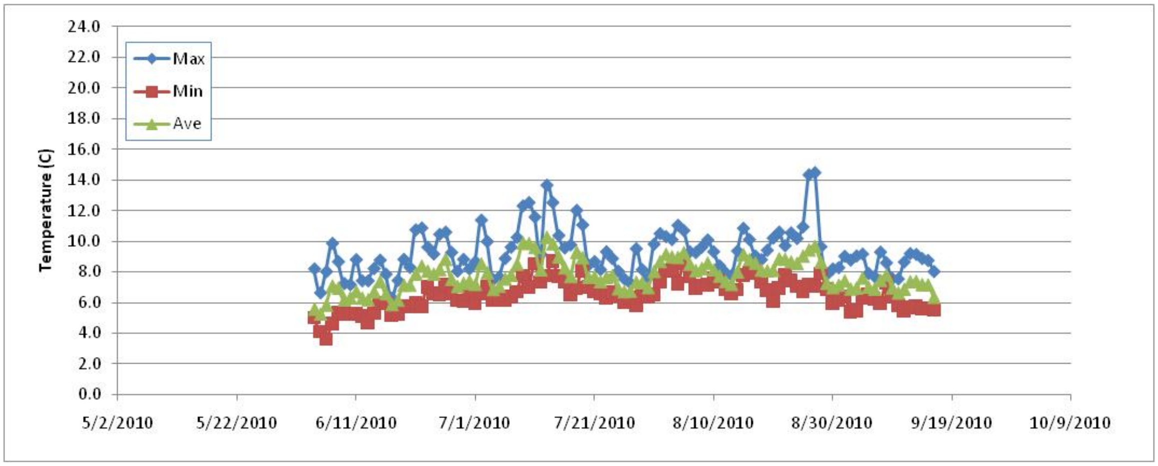


Figure 17. Daily stream water temperatures for the Little Susitna River at the Edgerton Road Bridge.

Water quality based on the macroinvertebrate community was excellent at all sites (Table 3). ASCI scores at Goldmint increased from a low of 34 in 2009 to over 80 in 2010. This change was largely due to the recovery of non-baetid Ephemeroptera (Mayflies) and Plecoptera (Stonefly) species. Macroinvertebrate ASCI scores, otherwise, have remained fairly consistent from 2005 through 2010 (Table 4).

Table 3. Macroinvertebrate metric data from June 2010 samples.

Metrics	***Goldmint Trailhead***	***MP 10.2***	***Edgerton Rd. Bridge***
Total Organisms	325	335	338
Ephemeroptera	268	213	175
Plecoptera	25	18	41
Trichoptera	5	15	7
Diptera	27	87	111
Richness	14	14	15
Ephemeroptera Taxa	6	4	3
Trichoptera Taxa	2	3	2
% Plectopera	7.69	5.37	12.13
% Ephemptera (no Baetidae)	34.77	23.88	19.82
% Diptera	8.31	25.97	32.84
Baetidae/Ephemeroptera	0.56	0.62	0.62
% Non-insects	0.00	0.60	0.89
HBI	3.16	4.16	4.32
%Scrapers	20.31	23.58	19.82
% Collectors	53.85	62.09	57.40
% EPT no Baetids or Zapada	40.62	28.66	23.37
ASCI Scores		***Low Gradient Coarse***	
Ephemeroptera taxa 100 * X / 5.5	100.00	72.73	54.55
% Ephemeroptera (no Baetidae) 100 * X / 20	100.00	100.00	100.00
% Plecoptera 100 * X / 14	54.95	38.38	86.64
Baetidae / Ephemeroptera 100 * (100 - X) / 100	44.40	37.56	38.29
% non-insects 100 * (30 - X) / 30	100.00	98.01	97.04
O/E (family 75%) 2 100 * X	70	70	90
% scrapers 100 * X / 15	100.00	100.00	100.00
HBI 100 * (6.5 - X) / 2	100.00	100.00	100.00
Average	84.80	77.08	83.31
Ranking	**Excellent**	**Excellent**	**Excellent**

Table 4. Summary of annual macroinvertebrate ASCI scores.

	Fall 2005	***Spring 2006***	***Fall 2006***	***Spring 2007***	***Spring 2008***	***Spring 2009***	***Spring 2010***
Goldmint Trailhead	80.8	80.1	75.5	62.5	72.7	34.0	84.80
Mile 10.2		80.3	81.0	64.0	81.2	59.1	77.08
Edgerton Park Bridge	62.2	69.1	60.3	55.9	59.4	75.1	83.31

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Appendix A—Laboratory Reports