Holgate Creek Assessment and Monitoring Project

Final Report

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Tim Shields

Takshanuk Watershed Council

This report covers the grant requirements for a
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Holgate Creek Assessment and Monitoring Project
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The cover photograph was taken on Don and Betty Holgate's reach of the stream. The Holgate family has been long time stewards of the Creek since they moved to Haines in 1973.
Photo by Tim Shields

Abstract

In July 2005, US Fish & Wildlife Service awarded a grant to Takshanuk Watershed Council to complete a baseline assessment and monitoring project on Holgate Creek in Haines, Alaska. TWC used juvenile fish trapping and benthic macroinvertebrate field sampling as well as water quality monitoring and chemistry to develop a baseline understanding of the watershed. A second major component of the project was to delineate the watershed boundary using Global Positioning Systems and Geographic Information Systems (GPS and GIS). This watershed boundary would help TWC, the Haines Borough, and agencies guide management decisions within the watershed.

Introduction

The Holgate Creek drainage, a sub-basin of the Battery Point Watershed, is two kilometers south of Haines near the northern end of the Chilkat Peninsula. Holgate Creek is also known as One-mile Creek (ADF&G stream #115-32-094). Residential and light industrial development of the Holgate Creek basin has been occurring for the last 40 years. Until the expansion of the Haines City limits in 1999, the area was part of the Haines Third Class Borough and lacked planning and zoning services. There was no limit on lot size and no local regulation of sewage disposal. The majority of the households in the area are served by septic tanks.

In 2001, during the course of Small Tracts Road expansion, road workers noticed pipe ends terminating in the roadside ditch in several locations and sampled the gray-colored, smelly discharges. Staff concluded these pipes were most likely drain field pipes accidentally installed within the Small Tracts Road right-of-way and then clipped off when DOT widened ditches. The City of Haines conducted water quality tests in the settled portions of the Holgate Creek sub-basin and discovered high levels of fecal coliform contamination. Four systems were identified as causing contamination in the watershed and either repaired or closed off, by order of the City of Haines. Another separate property was investigated at the owners' request and changed to a DEC-approved design after the investigation showed a malfunctioning system. At that time, the City of Haines recognized the need to expand utilities to the area and conducted a feasibility study to determine the possibility. Local resistance to the idea surfaced and no official action has taken place. No further open sewage discharge has been reported to the Haines Borough; however, no more follow-up testing has been done by the Borough. At this time, no Borough efforts concerning handling failed systems or pollution in Holgate Creek are known.

Betty Holgate, resident in the area since 1973 and a keen observer of the creek which bears her name, considers sedimentation of the creek to be a significant problem. She ascribes much of the current sedimentation to road work on Small Tracts Road in the early 1990's. Better culverts and ditches may have facilitated the transport of sediment into the creek. She asserts that following the Small Tracts upgrade the sedimentation of the creek passing through her land increased dramatically and that it continues to this day. In 2000 an artificial pond on her property was dredged to a depth of one to two meters. It has since filled in entirely and the creek now crosses her property as a small, shallow stream.

This report covers the work of a baseline watershed assessment done in 2005 and 2006. It is divided into four sections: Basic Watershed Geography Findings, Findings on Discrete Impacts, Habitat Quality Assessment, Future Management, Restoration and Monitoring Needs.

Watershed Geography Findings

The Holgate Creek sub-basin boundary was defined using an ArcView GIS with ground-truthing field work to validate the mapping. This consisted of physically visiting boundary points of the sub-basin and recording their GPS coordinates and subsequently plotting them on the watershed imagery in ArcView GIS. Adjustments based on this field work were made to the boundary base map.

Figure 1: Base Map, Holgate Creek Sub-basin

The main stem of Holgate Creek was defined by recording frequent GPS points during field work (BMI sampling, fish trapping and stream surveys). Photographs were taken at many of these points to record the character of the stream at defined points. An intensive stream survey was performed to define the different stream reaches. Reaches were classified using the Alaska Department of Fish and Game stream survey protocol (an adaptation of a US Forest Service protocol). Human impacts were noted, photographed and mapped using GPS.

Tributaries were noted and their points of entry into the mainstem were recorded with GPS. Subsequently the significant tributaries were walked and points taken along their definable course with GPS. For the most part these flow only seasonally, drying out in the summer

months. Land ownership patterns were obtained from Haines Borough records and plotted on the base map. Developed lots and buildings were mapped from GIS photo imagery as a subset of the overall land ownership presentation. Figure 1 shows the above information and will serve as the base map for this report.

The area of the Holgate Creek sub-basin is approximately 2.9 square kilometers. The creek flows from the ridge of the Chilkat peninsula west to the Chilkat River with several small tributaries draining in from the northern part of the drainage. Its total length is 3.11 kilometers. It empties into the Chilkat River one kilometer northwest of Pyramid Island.

The forested portions of the sub-basin are covered by mixed Sitka spruce-western hemlock forest at maturity. Previously cleared areas are re-vegetated with Sitka alder, white birch, black cottonwood and other deciduous species.

The lower third of the Holgate Creek drainage, between Small Tracts and Mud Bay Roads, is a residential area with approximately one hundred twenty at least partially cleared lots averaging two acres in size (range= 0.4 to 5.2 acres). Small businesses, such as an independent car maintenance business, a carpenter's furniture making shop, an animal shelter, and a youth hostel, occur in the area immediately adjacent to or very near the creek. The principal landfill serving the community of Haines is located near the northeast corner of the basin. Approximately 0.95 km of the main stem of the waterbody flows through residential property. Several tributaries also drain the residential area from the north and south, including roadside ditches on Small Tracts and Mud Bay Roads.

Findings of Discrete Impacts from the Mapping Effort

Human impacts are primarily associated with housing development in the lower watershed. Figure 2 presents the cumulative human impacts in a single map: paved and dirt roads, driveways, cleared land and structures. Approximately 123 of a total of 185 lots in the sub-basin have been partially or entirely cleared and about eighty of these parcels have buildings. Note that this development is concentrated in the lower reaches of the basin and that ditches along the paved roads empty into the creek. These ditches are, in essence, tributaries of the creek.

Water Quality Considerations

Septic Contamination: The history of failure of septic systems and resultant very high coliform counts in 2001 indicates that Holgate Creek is vulnerable to this type of pollution and is dependent on the maintenance of those systems by homeowners. Problems can go unnoticed leading to undetected leakage of fecal material with its attendant negative aquatic effects. Elevated fecal coliform counts indicate that the water in question has had contact with human or animal feces. It is used as an indicator of the possible presence of a suite of pathogenic bacteria. Aerobic decomposition of fecal material can reduce dissolved oxygen levels if discharged into streams. Elevation of nutrient levels can be problematic in that it can alter the balance of stream microbiota. In extreme cases this may reduce the oxygen level enough to kill fish and other aquatic life. The probable main source of fecal contamination in the drainage is faulty septic systems. The area has no hookup to city sewer facilities and disposal of sewage is left to individual landowners. The four systems traced as the source of that problem were either repaired or replaced. TWC's 2005-6 testing was the first conducted since 2001.

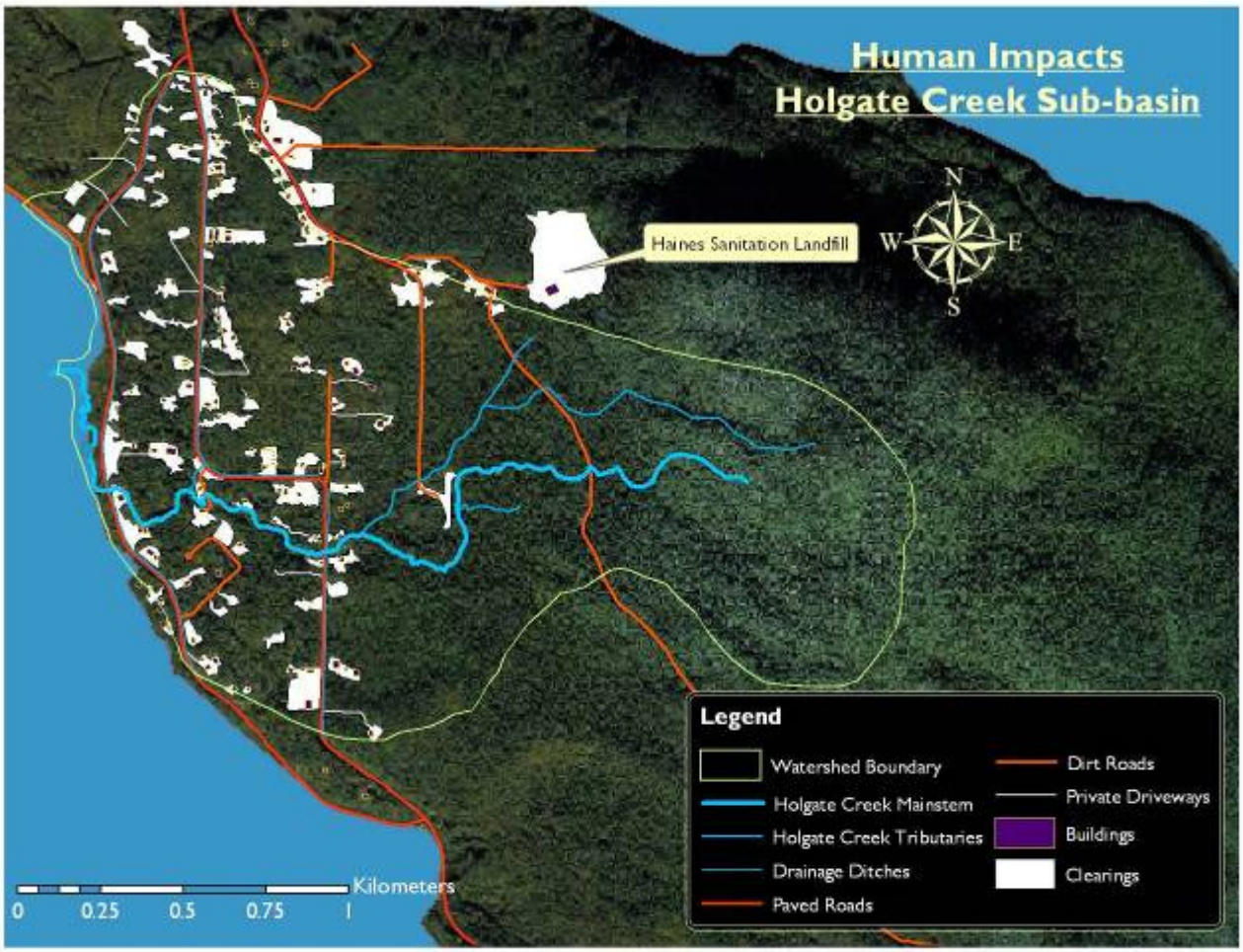

Figure 2: Human Impacts, Holgate Creek Sub-basin

A horse corral is located immediately above the west bank of the creek 150 m downstream of Small Tracts Road. Formerly, this was the site of a dog breeder's kennel housing dozens of very large malamutes. This is doubtless a source of fecal material entering the creek as it lacks any dedicated composting facilities or structures to control runoff from the yard.

Road Runoff: Small Tracts Road, Mud Bay Road and the network of driveways and private roads are sources of run-off of automotive fluids, sediment and trash. Within the Holgate Creek sub-basin there are 4.27 km of paved road. Small Tracts and Mud Bay Roads are the two main arteries and only paved roads. Average traffic counts per day in 2004 were 605 for Small Tracts and 578 for Mud Bay Road. There are 2.79 km of dirt roads. Lily Lake Road crosses the upper portion of the basin. This road is used principally by the Haines Borough water plant managers as access to Lily Lake, the primary source of domestic water for Haines townsite. It is very lightly traveled as is the unpaved portion of FAA road- an access road to a pair of navigation towers maintained by the FAA. Other unpaved roads intersect the two paved roads and provide access to low density residential areas.

Landfill contaminants: Haines Sanitation Inc. has a landfill located in the northeast corner of the watershed, apparently just beyond the watershed boundary. DEC has documented the leaching of toxins into groundwater in the area. However, DEC personnel state that the drainage from the dump is toward Portage Cove, on the Chilkoot side of the peninsula, not into the Holgate watershed that drains into the Chilkat River. Figure 2 shows the distribution of these discrete points of water quality concern including cleared lots, buildings and Haines Sanitation Landfill.

Refuse in creek: As part of a separate contract TWC organized a creek cleanup and carried it out with about 25 volunteers in April 2006. The results are indicative of the interaction between humans and the creek. In four hours of work the equivalent of 50 large trash bags of garbage of various kinds were removed from the creek. Items included a large piece of carpeting, numerous snow sleds, basketballs, various toys, etc. as well as large numbers of plastic bags, quart containers of automotive oil, plastic milk jugs and other packaging (see Photo above). Plastics are known to have deleterious effects on aquatic organisms via toxicity and physical impairment.

Several items were too large to remove. 30 meters downstream of Small Tracts Road we found several large diameter creosoted pilings at the base of a steep section of bank. In the same location were eight discarded tires, undoubtedly from the Small Tracts Tire shop nearby. Another 50 meters downstream were several very old rusted drums (see Photo at left). It is unknown what these barrels contained.

Water Quality

Four sites were chosen for water quality sampling. They represent the geographic range and habitat quality spectrum of the creek. Sampling Point 1 is downstream of Mud Bay Road and shows the cumulative water quality impacts on the entire stream system. Sampling Point 2 is downstream of Small Tracts Road and just above the entrance of the tributary draining the ditch alongside Small Tracts. This sample shows the influence of the upstream portion of the developed land. Sampling Point 3 is located at the same point in the roadside ditch that was sampled by the Borough in 2001. Sampling Point 4 is located at the intersection of the main stem with Lily Lake Road upstream of the area of human settlement. Point 4 serves as a control.

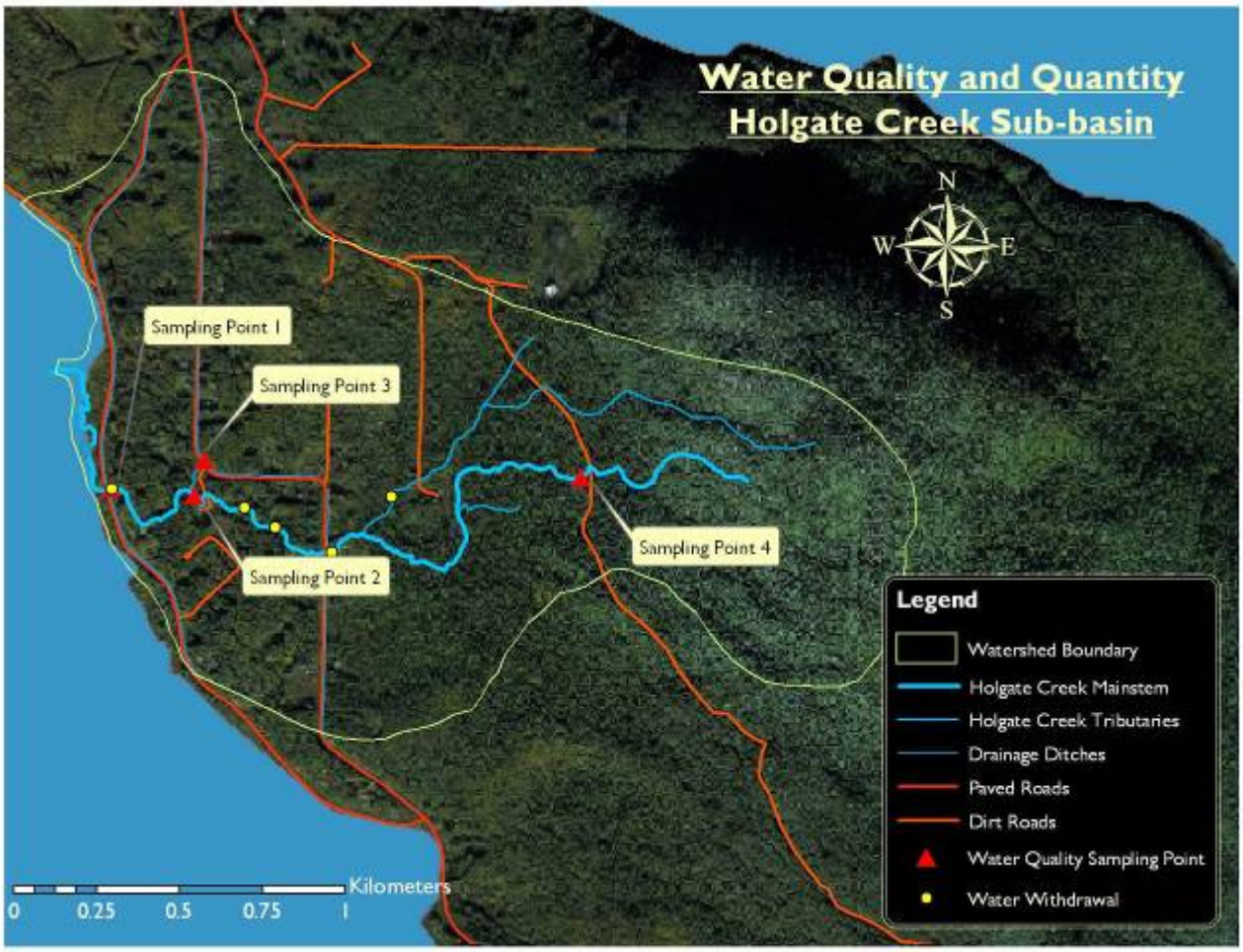

Figure 3: Water quality sampling points and Water Withdrawal Sites

The following water quality parameters were sampled on 31 August 2006:

- temperature,
- conductivity,
- pH,
- dissolved oxygen,
- oxidation-reduction potential,
- nitrates,
- phosphates,
- fecal coliform,
- petroleum products (oil and grease).

An YSI 556 handheld multi meter, two colormetric testing kits and Analytica Labs in Juneau Alaska were used to determine the following results. The following table shows the parameters sampled and the method used for each parameter. TWC attempted to replicate, as nearly as possible, the sampling done by the Haines Borough in 2001 and testing by DEC personnel in 2005.

Cumulative water quality test results are presented in Table 2, below. They reveal low but measurable levels of fecal contamination. These results are significantly lower than the "Too Numerous to Count" results of earlier testing and may indicate that the fecal coliform problem has abated. Analytica lab personnel characterize the fecal coliform levels seen in the Holgate samples as relatively low. The comparison between sites is probably more important than the absolute values. Note that the reading for Sampling Point 4, from high in the drainage, is near zero and is much lower than the other three sampling points. The difference between the upstream and downstream sites is probably related to proximity to human dwellings and activity. Levels of petroleum products were below the sensitivity threshold of the analytical equipment used by the contracted lab and can be assumed to be very low. Colorimetric testing for phosphates and nitrates likewise revealed insignificant levels of these pollutants. Temperature was highest in the roadside ditch and DO lowest. pH was significantly higher at this site as well. These results show that water flowing in roadside ditches may be of relatively low quality. This, of course, was a single sampling day and reveals little about the dynamics of the system. A much broader program of testing over a larger span of time would be required to adequately characterize the water quality of Holgate Creek.

Parameter	Method	Units	Point 1	Point 2	Point 3	Point 4
Temperature	Multi meter	Celsius	10.85	10.82	12.85	10.81
DO saturation	Multi meter	percentage	131.5	131.3	111.3	135.4
Relative DO saturation*	Multi meter	ratio	0.97	0.97	0.82	1
pH	Multi meter	neg log H+ conc	7.95	8.01	9.18	8.18
ORP	Multi meter	standard units	-25.6	26	-29.2	-1.6
Conductivity	Multi meter	uS/liter	82	148	53	85
Nitrates	colorimetric		negligible	negligible	negligible	negligible
Phosphates	colorimetric		negligible	negligible	negligible	negligible
Petroleum Products	Analytica	mg/liter	<5.3	<5.3	<5.3	<5.3
Fecal Coliform	Analytica	CFU/100 ml	39	90	28	2
*relative DO=site specific value/highest recorded value (x/135.4)						

Table 1: Water Quality Test Methods and Results

Water Quantity Considerations

Water Withdrawals: There are several water pumping systems in place on the creek between Mud Bay and Small Tracts Rd. These are apparently used as garden water sources. The volume of withdrawal is unknown as is its effect on the creek, especially in dry years. In an interview with one landowner we were told that he had turned his pump on only two times in the summer of 2006 which was a very wet season. We will continue to talk to landowners adjacent

to the creek to assess water use. Figure 3 shows the location of the water withdrawal systems on the creek. Some of these appeared to be inactive this year.

TWC and ADFG placed a stream level data logger in the creek just upstream of the Mud Bay Road culvert in October of 2005. The logger is adjacent to the most downstream house on the creek. The data logger reporting period covered mid-May to late August. Storm events are clear as spikes set against the steady decline in creek level over the course of the summer. The zigzag character of the readout is curious and the interpretation is pending. This is likely to be an equipment malfunction. We are working with Jarrod Sowa of ADF&G to determine the source of the observed pattern. TWC will continue to collect flow data from Holgate Creek in cooperation with ADF&G.

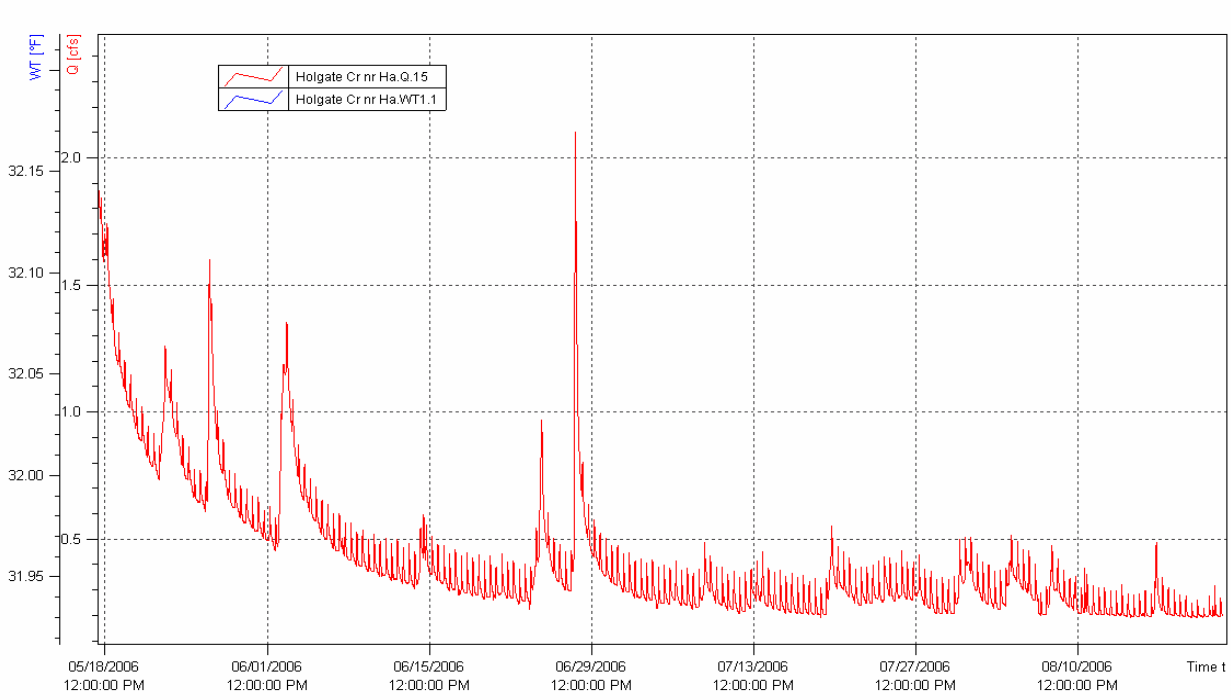

Figure 4: Holgate Creek flow data chart

Fish Passage

Some potential fish passage barriers were discovered during our creek research. These may be of particular concern during dry years. Of course the most dramatic form of fish passage barrier is the drying of the creek. The lower 200 meters of Holgate Creek were dry in the summer of 2004 and even more extensive drying occurred in 2005. For at least two months there was a complete break in surface water access between the end of the creek and the Chilkat River. Other specific problem spots are discussed below.

The fish ladder was installed to compensate for the sub-optimal design of the culvert. Historically, it has been stocked with cobbles and small boulders. These create a series of pools within the culvert thus facilitating passage. Unfortunately these are regularly flushed out by high flows during wintertime rendering the fish ladder less effective (see photos).

Photos of the Mud Bay Road fish ladder

There may be problems associated with a dual culvert set-up beneath a driveway that crosses the creek midway between Small Tracts and Mud Bay Roads. This is the only other roadway crossing the creek in the residential portion of the watershed. These culverts are small (24") and at low water only the lower of the two is available for fish passage.

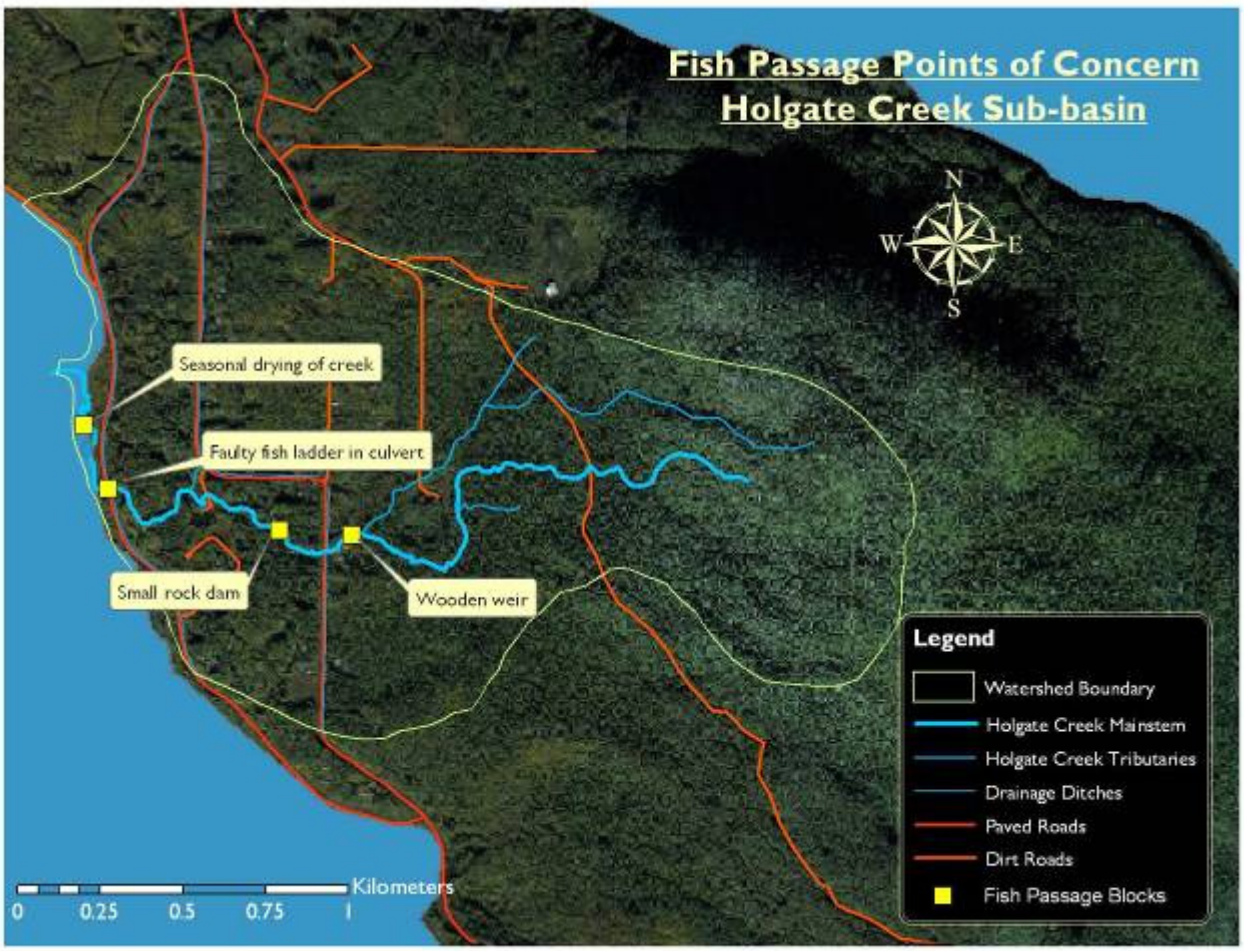

Figure 5: Fish Passage Points of Concern, Holgate Creek Sub-basin

Crude rock dams have been built in the creek near Small Tracts Rd. These were probably put in by kids and create a 25 cm fall. Such obstacles could be problematic in low flow periods. Debris jams in stretch along just downstream of Small Tracts Road could be a partial passage barrier if allowed to grow. The large storm of November 2005 cleared much of small material but left the larger wood in place and these pieces of key wood will collect smaller branches and other debris over time. Overall woody debris concentrations like this are advantageous but in association with human refuse (clogging by plastic sheeting or bags for instance) such jams could impede passage by larger fish.

A wooden weir has been built across the creek 150 m upstream of Small tracts Road. It appears to have been in place for several years and has created a 10 m pool upstream. This structure may impede fish passage but in early October of 2006 an adult coho salmon was seen well upstream of the site.

Habitat Quality Assessment

To characterize the habitat quality of Holgate Creek we used the ADF&G draft stream survey protocol, fish trapping and benthic macroinvertebrate (BMI) sampling, and BMI habitat assessment classification.

Stream Survey Methods: The ADFG stream survey protocol was used to characterize the main stem of the creek. The work includes identifying the channel type for each reach, tallying pools and woody debris, mapping tributary entry points, recording human impacts and frequent GPS and photo documentation of features and from map points. Observations of fish are recorded as well. At channel type verification points, performed once in each reach, detailed classification of streamside vegetation, substrate and channel characteristics is performed. This work accomplishes a thorough documentation of the physical character and some of the biological attributes of a creek.
Results of the survey indicate that Holgate Creek maintains much of its native character and function. Even in that portion of the creek within the developed part of the watershed the creek retains the character of a natural creek with frequent pools, woody debris accumulations and channel sinuosity. Forest cover remains along most of the creek. In a few spots buildings, fences and parking areas have been placed quite near the creek. Channel alterations and rerouting of the creek have occurred near the FAA towers, on the Holgate property in the form of the creation of a pond and just downstream of the pond where the creek has been confined between a steep bank and the yard of a residence created by fill. The remains of an historic dam are just upstream of the Holgate's pond site. The pond impounded by this dam supplied a nearby cannery.

Sedimentation is a concern. In 2000, an 8 x 15 meter pond was excavated by the Holgates to a depth of one to two meters. This pond is now almost completely filled in by fine sediment. The speed of the filling in of this pond shows the high level of sediment being transported by the creek. The relative contributions to this process from natural and human sources is unknown but Betty Holgate asserts that road work on Small Tracts Road in the mid-90's greatly exacerbated the problem (Betty Holgate, personal communication).

The upper reaches of the creek are almost pristine. From a point 200 m upstream of Small Tracts Road the forest changes from mixed coniferous-deciduous with young spruce and hemlock and numerous large stumps to one dominated by mature conifers. This is the edge of a past logging operation. Numerous stumps are immediately adjacent to the creek and indicate that no stream buffers were observed during logging of the site. A pair of FAA navigation towers (and associated clearing) is located half a kilometer upstream of Small Tracts Road. Filling of the site restricted the creek and adjacent to this site it flows in a linear bed. Lily Lake Road is the only significant human impact upstream of this point. It traverses the upper portion of the basin but is used only infrequently by Haines Borough water department. A locked gate prevents its use by the motorized public.

Fish Trapping

Fish trapping was performed on the creek in 2005 and 2006. The reaches below Small Tracts Road were sampled on 5 April and 21 September 2005 and 9 June and 10 August 2006.

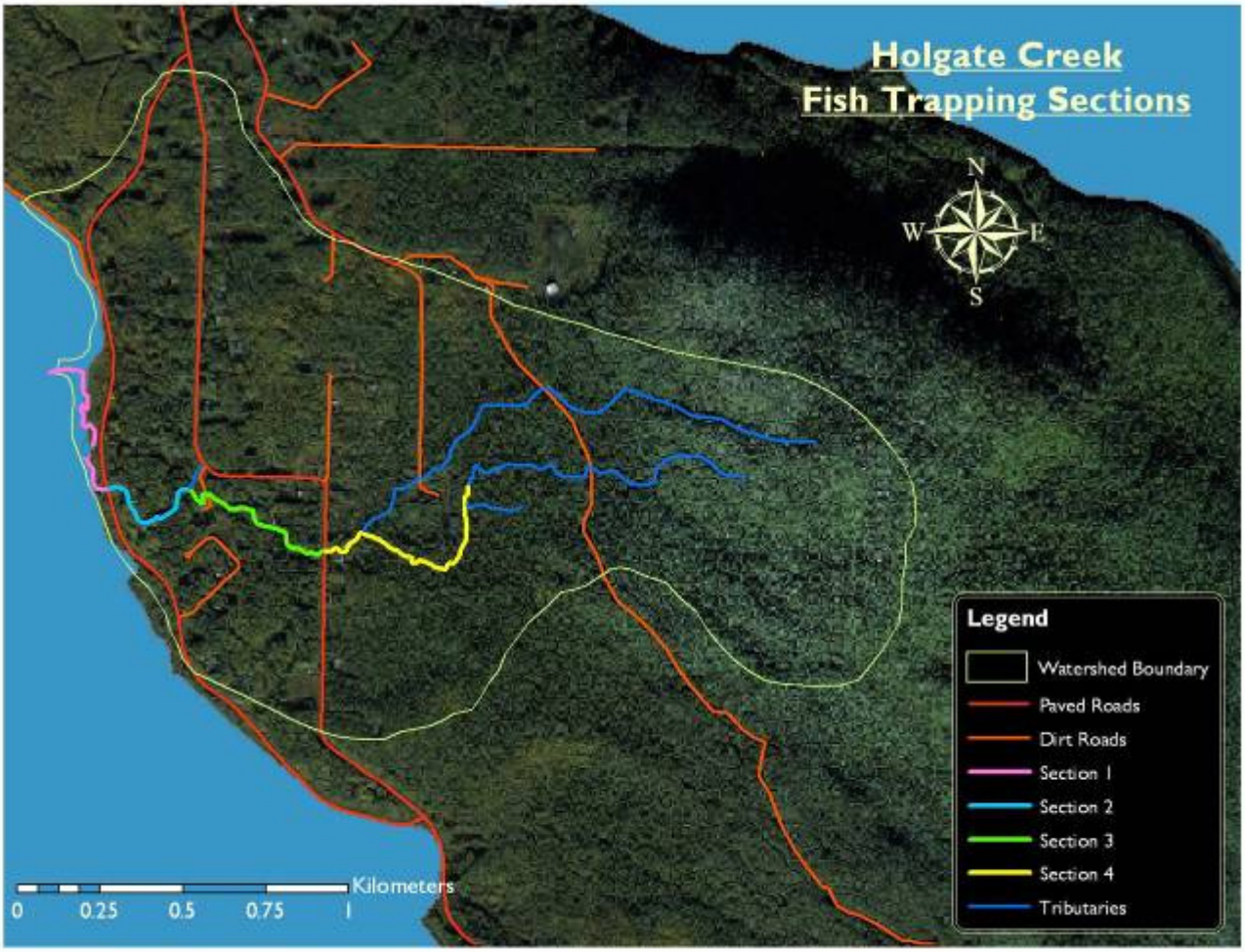

Figure 6: Fish Trapping Sections, Holgate Creel

Twenty-five sample sites were selected and were located from the tidally influenced lower reach up through the middle reach of the creek. In addition, six sites above Small Tracts were sampled on the 2006 sample dates. The trap site farthest upstream was within 0.5 km of the probable upper limit of fish habitat.

Standard gee-style minnow traps baited with commercial cat food were used. Soak time averaged four hours for all trappings. Fish were identified to species and measured to the nearest 5mm of length before release. Trap sites were recorded using GPS and aluminum tags were placed on prominent landmarks to facilitate repeated samplings. Trapping was timed to avoid sensitive times such as the cutthroat spawning period. ADF&G Biologist Randy Erickson was consulted on trap timing. Results are shown in Table 4.

Holgate Creek Fish Trapping Results				
		Average Number of Fish per Trap		
Date	Section	Cutthroat	Dolly Varden	Coho
5-Apr-05	1[1]	0	0.5	2.5
	2	0	0.71	2.86
	3	0.25	0	0
	4	NS[2]	NS	NS
21-Sep-05	1	0	0	**31**
	2	0.22	0	7.7
	3	0.08	0	2.2
	4	NS	NS	NS
9-Jun-06	1	0	0	2.5
	2	1.25	0.5	0.63
	3	0.88	0	0.71
	4	1	0.33	0.33
10-Aug-06	1	0	1.25	3.75
	2	1	0.63	2.5
	3	0.4	0.3	0.8
	4	1.17	0.17	0.17

Table 2: Holgate Creek Fish Trapping Results

The distribution of fish indicates that the lower portions of the creek are especially important for rearing coho salmon. In the fall the numbers of juvenile coho are particularly high, as shown by fish trapping results. The numbers of cutthroat are low in the lower-gradient portion of the creek downstream of Mud Bay Road, but are higher in the middle and upper reaches of the creek, those areas with gravel and cobble streambed. Spawning cutthroat trout are observed in the spring by residents in these areas.

[1] Stream Sections are as follows:
1- Holgate estuary to Mud Bay Road crossing, 2- Mud Bay Road crossing to Small Tracts Tributary, 3- Small Tracts Tributary to Small Tracts Road crossing, 4- Upstream of Small Tracts Road crossing
[2] NS: Not Sampled

Results indicate that Holgate Creek is consistently occupied throughout by juvenile coho salmon and cutthroat trout. Dolly Varden char were present at lower numbers and less consistently. Three-spined sticklebacks were caught on one occasion in the most downstream trap. Coast Range sculpin and juvenile flounder have been observed in the estuarine areas of the creek. Coho dominate in the lower reaches of the creek and cutthroat in the reaches above Small Tracts Road but both species occupy the entire length sampled. Table 4 presents a digest of trapping results

Incidental fish observations indicate that fish habitat extends up to near Lily Lake Road in areas of relatively steep topography. On 29 August 2006 a 50 mm fish, most likely a cutthroat trout, was observed 50 m downstream of Lily Lake Road.

Note the very high number of coho in the lowest reach in the September 2005 sample. This makes sense in light of the need of juvenile coho to find suitable over wintering habitat. Also note that numbers of coho decline from downstream to upstream while cutthroat numbers increase in that direction. Habitat needs of the two species may account for this distributional difference.

Benthic Macroinvertebrate Sampling

Three sites were chosen for sampling to help characterize the habitat quality adjacent to human habitation in the watershed. We chose sites based on proximity to the road system and habitat variety. The sites were sampled in the spring and fall of 2005 and 2006. In August 2006 one additional sample was taken upstream of Small Tracts Road and the area of human habitation to serve as a baseline for future study. The Alaska Environmental and Natural Resources Institute (ENRI) volunteer protocol was followed. Benthic macroinvertebrates were sorted to Order level and counted discretely at the species level (but not identified) for purposes of this analysis.

BMI Habitat Quality Assessment Digest				
Habitat Factor	Point 1	Point 2	Point 3	Point 4
BMI Attachment Places	3.5	9	6	9
Embeddedness	4	9	8	10
Flow and Depth Combos	3	6	5.5	5
Sediment Deposition	3.5	7	4	7
Channel Flow Status	5.5	7	5	9
Channel Alteration	5	8.5	6	9
Channel Sinuosity	3.5	9	8	8
Bank Stability	6.5	9	6	10
Vegetative Protection	9.5	10	9	9
Riparian Zone Width	7.5	9.5	7	9
Total	56	84	64.5	85

Table 3. Benthic Macroinvertebrate Habitat Quality Assessment Results

Habitat quality at BMI sites was characterized on the initial visit to each site using ENRI's format. A follow up set of habitat quality assessments was done at the end of the study.

The BMI table in the Appendix presents the digest of BMI sampling results. These results were intriguing. Site Two has a high habitat quality score and during the site visits, appeared to be the best of the four locations for BMI in terms of the physical environment. Site Two has gravel riffles and pools with stable banks typical of high quality habitat. Site Two, however, consistently scored not much higher than the other two sites, both of which had much higher levels of sedimentation, a higher level of embeddedness and, in the case of Site One, much lower habitat diversity. Overall Holgate Creek has a diverse and apparently healthy BMI biota with a high representation of pollution-sensitive Ephemeroperta, Plecoptera, and Trichoptera species.

Bird observations

Observations by Tim Shields and ADF&G Biologists prior to this project indicated that the mouth of Holgate Creek and the pond in the lower reach were important stopovers for migrating birds. Two observation points overlooking the tidal flats and the main pond along Mud Bay Road were chosen and visited 25 times between 23 March and 22 May. From these locations a visual sweep with binoculars was made of the tidal flat area near the creek mouth and out onto the adjacent flats of the Chilkat River. Birds seen were identified to species and an estimate made of the number of each species. Given the high numbers and intermixture of dabbling ducks these were recorded as "mixed dabblers". The species included in the mix were recorded. The extent of the sweep was limited to avoid double counting.

Results are presented in the Appendix. Thirty-one bird species were tallied and thousands of individuals use the Holgate Creek-Chilkat River junction. From personal observations in the area over the last twenty years the Holgate Creek Estuary is one of the three most important stopover points for avian migrants in the Haines area. Shorebirds tended to use the mud flats whereas dabblers use the shallow stretches of the Chilkat River and the pond on Holgate Creek. Prominent among the species seen were five species of dabblers: American wigeon, green-winged teal, shoveler, mallard and pintail. These species were usually lumped as "dabblers" in the observation table. Six species of shorebirds were seen. The most common were the western sandpiper, dunlin, black-bellied plover and short-billed dowitcher. Many thousands of gulls milled around in the area during herring and eulachon runs in the area.

Such stopovers provide fueling stations for birds preparing to fly up to their interior nesting grounds. The richness of the interface of the creek and the Chilkat River is the obvious draw for the migrants observed every spring. Dabblers work just offshore at the mouth of the creek, shorebirds feed in the tidally exposed mudflats and raptors such as harriers, falcons and eagles prey on the smaller migrants.

Amphibian observations

The largest pond on Holgate Creek is located 0.25 km upstream of the mouth of the creek. It has been monitored by Shields for five years for its use by western toads (*Bufo boreas*), a species endangered in the southern portion of its range and one that is declining locally. In four of those

five years toads bred in the pond and in at least two of the five years significant numbers of young toads successfully emerged. In addition, numerous observations were made of immature and adult toads in the area.

The 2005 breeding season was moderately successful with around 10,000 tadpoles hatching and an estimated 3000 emerging metamorphs. A majority of these metamorphs traveled downstream along Holgate Creek and sheltered beneath rocks in the creek bed and in the mud banks on the sides of the creek before further dispersing. It is likely that this stretch of creek side coastal habitat is an important over wintering area for young toads. Numerous metamorphs were found in both years moving through the area adjacent to the creek in August and early September. Observations in 2006 showed the pond on Holgate Creek and downstream reaches of the creek had only a small number of tadpoles. A pond 0.3 km upstream on the Chilkat River had attracted a large breeding congregation in 2006.

It should be noted that reports by residents indicate that the current number of toads in the area is greatly reduced from historic levels. Lyle Huff reports that until the late 1980's his garden would be "full of baby toads" in the fall. The Holgate Creek pond is one of only four breeding sites found in the immediate vicinity of Haines townsite.

Future Management, Restoration and Monitoring Needs

This baseline assessment has demonstrated the high value of Holgate Creek as fish and wildlife habitat. A wide variety of aquatic and terrestrial organisms use the creek and its environs. Holgate Creek is home to a spawning run of cutthroat trout (*Salmo clarkii*). These fish have been observed by residents for decades. Residents Don and Betty Holgate have been observing the spawning run of cutthroat trout since moving to the area in 1970. Randy Erickson, Alaska Department of Fish & Game Sportfish Biologist in Haines has known of Holgate Creek hosting spawning runs of cutthroat since the mid-1980s. He reports that spawning coho salmon (*Oncorhyncus kisutch*) have been seen in the creek on occasion in that time. In addition the creek hosts rearing coho salmon and smaller numbers of Dolly Varden char (*Salvelinus malma*). The lower stretches of the creek are also occupied by three-spined stickleback (*Gasterosetus aculeatus*), juvenile flatfish (probably starry flounder *Platichthys stellatus*) and Coast Range sculpin (*Cottus aleuticus)*).

Conditions conducive to cutthroat spawning are rare in the Haines area and Holgate Creek is an important stream for the species in the Chilkat River system. The two major landowners in the lower creek are very proud and defensive of the creek during cutthroat spawning time, a great sign of local watershed protection. Fish trapping indicates that the creek is a significant cutthroat trout spawning and rearing stream, and a valuable coho salmon rearing stream. The lower reaches are significant for migrating birds, the western toad, and for other fish such as juvenile starry flounder, Coast Range sculpin and three-spined stickleback (all observed in the lowest portion of the creek).

Human use of the area has somewhat degraded the creek's habitat value. Trash removal in April of 2006 showed the high volumes of refuse that enter the creek and accumulate over time. Although petroleum product testing results were below the threshold of the equipment used by

the contractor it is a certainty that runoff from roads and driveways washes automotive fluids into the stream. Water withdrawal is a seasonal concern and may have contributed to the drying of the lower portions of the creek in the summers of 2004 and 2005. Fish passage barriers, particularly in low water situations may restrict the movement of fish. The rapid sedimentation of the pond excavated by the Holgates in 2000 shows that sediment deposition is rapid in the downstream reaches of the creek and that these levels may be elevated above what would be seen in an undisturbed drainage. Given the lack of sufficient baseline data it is impossible to draw quantitative conclusions about problems caused by human use of the area but this work has established a benchmark and points to qualitative concerns which whould be addressed through time.

Water quality testing in 2001 revealed a significant fecal coliform problem from improperly monitored and maintained septic systems, but the 2005-6 sampling shows marked improvements. Home septic systems continue to be the dominant method of disposing of human fecal waste in the area. It is unknown how many homes are served by DEC-approved septic systems in the area versus how many septic systems are old, faulty or failing. A community education program on the proper maintenance of septic systems would be highly beneficial to both residents and fish and wildlife habitat.

Overall, our assessment highlighted the following issues and opportunities:

1. The fact that TWC's stream clean-up in April 2006 netted the equivalent of 50 large bags of trash from the portions downstream of Small Tracts Road shows the prevalence of improper refuse disposal and its consequences. The trash recovered included many plastic bags, empty automotive oil containers, and car tires as well as the typical plastic drink bottles, aluminum cans and food wrappers. Recommendation: Make annual event of cleanup. Inform landowners

2. Run-off from Mud Bay and Small Tracts Roads and the network of driveways and small gravel access roads undoubtedly contributes to water pollution in the form of leaked automotive fluids. Several old, rusted 55 gallon drums now rest in the creek sediment, pointing to the possibility of significant past pollution events. In association with this, the most obvious human impact on the creek is the sedimentation of the lower reaches. Long-time resident Betty Holgate, a keen observer of the creek, asserts that sedimentation increased greatly in the early 1990's following road work on Small Tracts Road and contemporaneous with the development of many lots in the sub-basin. Recommendation: install permeable ditch blocks to capture sediment before it enters creek and monitor sediment levels in the creek, especially during large storm events. A set of sample locations should be selected which will allow the tracking of sediment contributions of different branches of the creek.

3. Water removal by residents presents another potential problem, particularly in dry summers when the human demand for water increases as the supply shrinks. Flow measurement on the creek is documenting its range over time. At least five systems have been active in the past. Recommendation: Investigation of the water rights and contact with landowners operating these systems is needed. The data logger and flow

monitoring of Holgate Creek should continue for the five years necessary to provide the needed flow data to establish a State instream flow reservation.

4. Ten of fifteen of the lots immediately adjacent to Holgate Creek are developed. Over time these remaining parcels will be occupied. Considering the entire sub-basin, two thirds of the lots of five acres or less have been developed. The manner in which these are developed will determine the future health of the creek. Recommendation: Appropriate set-backs from the creek, maintenance of adequate vegetative cover and grading which avoids direct drainage from construction and house sites into the creek will reduce negative impacts such as sedimentation. Well-maintained septic systems are less likely to load the creek with excess nutrients and fecal contaminants. The character of development is probably the most important monitoring activity to be done to ensure Holgate Creek's well-being.

5. Extension of city sewer systems would reduce fecal pollution of the creek as human population density increases. A recent initiative by the Haines Borough proposing such an extension was strongly opposed by residents, largely on the grounds of the expense those people would incur. After a hearing before the Borough Assembly the proposal for extending the service was not pursued. TWC

6. **Fish passage may be a concern, particularly in times of low flow in the creek. The culvert under Mud Bay Road is considered to be undersized by Fish and Game personnel (Ben Kirkpatrick pers comm.). The current fish ladder was installed as partial compensation for this but the tendency of the cobbles within it to wash out calls into question its effectiveness. Recommendation: Survey these sites and use passage models to determine if they are indeed problems. Approach ADOT and landowners with solutions**.

In spite of the above impacts, the creek retains the essential character of a wild stream with channel alteration confined to a few short segments. Even as it flows past the houses of the lower basin it is sinuous and structurally complex, with frequent pools and abundant woody debris. This condition indicates that, with appropriate behavior on the part of its human neighbors the creek can continue to provide high value habitat to its fish and other wildlife.

We propose below a schedule for monitoring the creek's condition over time. The schedule presented is based on the findings of the CCP grant work just completed. It balances the expense of various tests and field work with the generation of important information on Holgate Creek's health.

Periodic fish trapping and BMI sampling will afford a look at the creek's health over time. Use of the four established BMI sites as fish trapping and BMI monitoring sites would be convenient and would provide continuity with the work done previously. Continued monitoring of toad breeding in the pond and use by birds of the estuarine areas can be easily done as well. Testing of water quality should be continued to track changes in these variables. Multi-meter sampling is simple and cost effective and could be conducted in association with BMI sampling and fish trapping. More expensive tests should be done when there is specific evidence of the presence

of pollutants such as petroleum. A downstream site should be monitored for fecal coliform counts. Such a site would be a "catch-all" and a high reading here would indicate the need for more testing. The relatively low cost of fecal coliform tests ($60 per test) makes quarterly testing a reasonable frequency.

Establishing systematic monitoring of Holgate Creek would build on the work just completed by TWC. The familiarity we have gained with the creek and its human neighbors should be the beginning of long-term, low cost caretaking of this valuable creek.

Holgate Sub-basin Monitoring Plan	
Monitoring Item	**Frequency**
Water Quality Testing	
Multi-meter Testing	Quarterly at four sites
Fecal Coliform Sampling	Quarterly at two downstream sites
Petroleum	Following evidence of spill
Phosphates	Annually at two downstream sites
Nitrates	Annually at two downstream sites
Creek Walk	
Assess Trash build-up	Annually
Monitor Construction	Annually
Monitor Water Pumping	Annually, monthly in dry summers
Monitor Sedimentation	Annually
Creek Flow Monitoring	
Check Staff Gauge	Weekly when flowing
Download Data Logger	Quarterly
Discharge Measurement	Monthly and after storm events
Fish Trapping	Quarterly at four sites
BMI Sampling	Annually at four sites
Amphibian Observation	Mid-May and early August
Bird Observation	April and May

Table 4: Proposed Monitoring Schedule

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Appendix: Bird Observations and Benthic Macroinvertebrate Sampling Results

Date	Point 1	Point 2
23-Mar-06		trumpeter swans-5
12-Apr-06	Common raven-1	
14-Apr-06	harrier-1, belted kingfisher-1	r.c. kinglet, pine siskins singing
17-Apr-06		dabblers- 70 in delta
18-Apr-06		dabblers- 250 near shore
19-Apr-06	dabblers- 60, bald eagles-2	western sandpipers- 40, dunlin- 5, b.b. plovers-2, dabblers-300+
20-Apr-06	northwestern crow- 12, mallard- 2	w. sandpipers- 15, dunlin- 5, b.b. plover- 4, s.b. dowitchers- 5, dabblers- 250, snow goose-1, gulls- 1000 in river flats
21-Apr-06	n. crow- 18, mallard- 2	
22-Apr-06		dabblers- 100, bald eagle- 1, mew gulls- 200
24-Apr-06	n. crow- 2	dabblers- 60, mew gulls- 50 (note herring run in Mud Bay may be attracting gulls)
25-Apr-06		b.b. plover- 3, s.b. dowitcher-2, mew gull- 2, great blue heron- 1
2-May-06	harrier- 1, mew gulls- several thousand, Bonaparte's gull- 100 on near shore flats	w. sandpiper-25, dunlin- 10, semi-palmated plover- 2, s.b. dowitcher- 1, teal (unidentified)- 5, snow goose- 8
3-May-06	dabblers- 30, mew and Bonaparte's gulls- 2000, swallow (unidentified)- 1	w. sandpipers- 120, b.b.plovers- 15, s.b. dowitcher- 5, dabblers-20, marbled godwit- 2
4-May-06		white fronted goose- 12
5-May-06		dunlin- 8, s.b. dowitcher- 15, m. godwit- 5, dabblers-30, harrier- 2, bald eagle- 1, small gull- several thousand in river flats
6-May-06		dunlin- 1, dabblers- 100, white fronted goose- 12, snow goose- 18, Canada goose- 1, gulls- 15,000- 20,000
8-May-06	snow goose- 12, lesser scaup- 25, widgeon- 20, red-breasted merganser- 2, harrier- 1, n. crow- 15	w. sandpiper- 25, m.godwit- 4, green-winged teal- 15, dabblers- 100 (mostly widgeon), harriers- 4, bald eagle- 1
9-May-06	lesser yelowlegs- 1, snow goose- 8 flying	gulls- 30,000 on river flats
12-May-06		w. sandpipers- 25, gulls (mostly mew)- 10,000
13-May-06		w. sandpiper- 40, b.b. plover- 1, dabblers- 200, r.b. merganser- 50, w.f. goose- 23, Canada goose- 1, n. crows- 20, gulls- several hundred flying by
14-May-06	r.b. merganser- 80	w. sandpiper- 420, s.b. dowitcher- 8, g.w. teal- 5, r.b. merganser- 5, dabblers- 500, w.f. goose- 15, Ross goose- 22, blad eagle- 2, gulls- 400 near river bank, 5000 on river flats
18-May-06		mixed ducks- 300 (g.w. teal, widgeon, shovelers, mallards, w.f. goose)
19-May-06	shovelers- 12	dabblers- 300
21-May-06		w. sandpiper- 50, b.b. plover- 3, S.b. dowitcher- 6, dabblers20, b. kingfisher- 1, mew gull- 100
22-May-06		w. sandpiper- 1, b.b. plover- 3, b. eagle- 1, Arctic tern- 10, gulls- 200

(Appendix Continued)

Benthic Macroinvertebrate Sampling Results Digest			
16 and 17-Jun-05	Point 1	Point 2	Point 3
EPT Richness	7	5	5
Non-EPT Richness	3	7	7
Total Organisms	3179	787	272
Total Taxa	10	12	12
Group 1. Sensitive	15.9	16.2	16.2
Group 2. Somewhat Sensitive	3	6.8	6.6
Group 3. Somewhat Tolerant	2.1	3.2	3.2
Water Quality Rating	21	26.2	26
21 and 23-Sep-05	Point 1	Point 2	Point 3
EPT Richness	6	7	7
Non-EPT Richness	7	7	5
Total Organisms	509	871	287
Total Taxa	13	14	12
Group 1. Sensitive	16.5	16.5	16.5
Group 2. Somewhat Sensitive	6.2	3	6.6
Group 3. Somewhat Tolerant	2.1	3.2	3.3
Water Quality Rating	24.8	22.7	26.4
10-Aug-06	Point 4		
EPT Richness	6		
Non-EPT Richness	6		
Total Organisms	555		
Total Taxa	12		
Group 1. Sensitive	15.9		
Group 2. Somewhat Sensitive	3.4		
Group 3. Somewhat Tolerant	3.4		
Water Quality Rating	22.7		