Ketchikan Area Watersheds Plan:

Bacteria Management Strategy

September 2021

Southeast Alaska Watershed Coalition
Funded by the Alaska Department of Environmental Conservation, Alaska Clean Water Actions Grant

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Acronyms

ADEC	Alaska Department of Environmental Conservation
AMHS	Alaska Marine Highway System
AWTS	Advanced wastewater treatment system
BMP	Best Management Practices
ECHO	Enforcement and Compliance History Online
MSD	Marine sanitation device
MST	Molecular Source Tracking
OWTS	Onsite wastewater treatment system
PAH	Polycyclic aromatic hydrocarbon
PEL	Probable effects level
STH	South Tongass Highway
TEL	Threshold effects level
US EPA	United States Environmental Protection Agency
WWTF	Wastewater treatment facility

Units of Measurement

CFU	Colony forming units
km	Kilometer
ml	milliliter
MPN	Most probable number

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I. Introduction

Background

The Alaska Department of Environmental Conservation (ADEC) began funding the development of a watershed plan for the Ketchikan area in 2019 through the Alaska Clean Water Actions grant program. The Southeast Alaska Watershed Coalition led this effort and reached out to representatives of relevant departments of the City of Ketchikan, Ketchikan Gateway Borough, City of Saxman, Ketchikan Indian Community, and Alaska Department of Natural Resources to provide input on the plan. Ultimately, staff at the City's Public Works and Port and Harbors Departments, the Borough's Public Works Department, and Ketchikan Indian Community's Cultural Resources Department offered the most insights and input to this plan during in-person meetings, phone calls and over email; however, this plan has not been officially approved or endorsed by any organization. The Southeast Alaska Watershed Coalition compiled and released the final draft of this plan. Importantly, this is a living, working document that is meant to be updated *at least annually* as additional information becomes available and more stakeholders engage with the process of improving water quality in the Ketchikan area.

Location

Ketchikan Gateway Borough is the second-most populous borough in southeast Alaska, with most of the residents (13,918) living in southwest Revillagigedo Island (Figure 1). The urbanized area is largely confined to the coast along the Tongass Narrows and includes the cities of Ketchikan (population 8,289) and Saxman (population 384). This area includes many small coastal watersheds and a few larger drainage basins, including Ketchikan Creek watershed (37 km^2), the lower portion of which includes part of the city of Ketchikan (Figure 1). Residents of the community of Ketchikan, including the cities of Ketchikan and Saxman and outlying borough areas, are intimately connected to the area's fresh- and marine waters. People depend on healthy waters for harvesting fish and other seafood, recreating, and attracting hundreds of thousands of tourists a year.

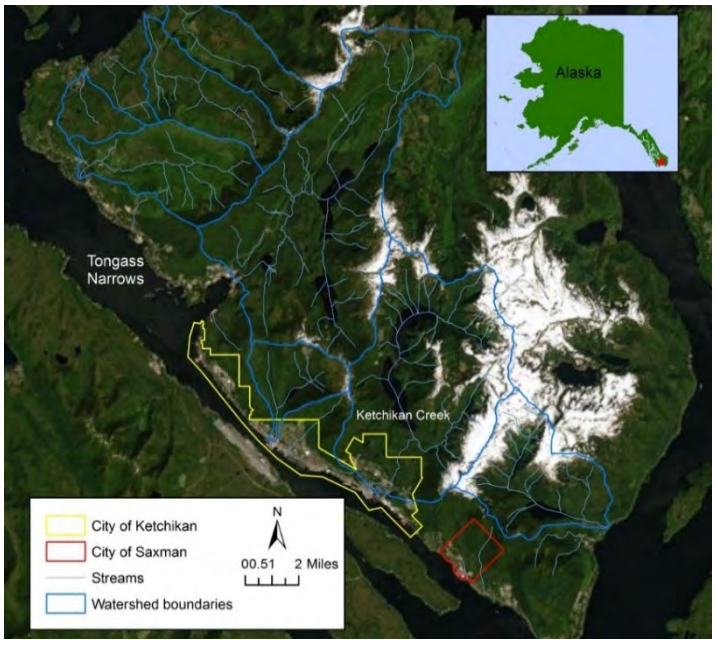

Figure 1. Ketchikan area map, including streams and some of the coastal watershed boundaries. The location is shown in red in the inset map of Alaska.

Goals

Various water quality data, including bacteria, metals, nutrients, and other physical and biological data have been collected in Ketchikan, Hoadley and Carlanna Creeks, and 13 recreational beaches in the Ketchikan area. Multiple years of high-quality fecal bacteria data exist for the beaches. Many of these locations experience elevated concentrations of fecal bacteria that are indicative of an increased health risk with exposure to the water. In contrast to the extensive fecal bacteria data, other water quality data, such as metals, nutrients, and pH are more limited and are still being collected and screened to understand the extent to which water quality (particularly in urban streams) might be polluted with respect to these constituents.

Based on the data that currently exists and community concerns about bacteria concentrations at many beaches, the participating stakeholders agreed that this iteration of the watersheds plan should focus primarily on fecal bacteria. As more information about urban pollutants or other water quality issues becomes available and indicates a need for action, future iterations of this plan (or a new plan) can address those issues. A summary of the creeks sampling is provided starting on page 13 of this report. While there are many potential sources of fecal bacteria, including wildlife, analyses have shown that human waste contributes to bacteria loads at every beach location that was sampled, and dog waste contributes at nearly every location. This information suggests that proactive management of human and pet waste can lead to improved water quality in the Ketchikan area.

The goal of this area-wide watersheds management plan is to identify and prioritize strategies and set a timeline for reducing bacteria concentrations in Ketchikan's waters. Ultimately, this plan is meant to provide a roadmap for the community to pursue cost-effective bacteria management strategies that will have measurable impacts on water quality. It is recognized that the strategies and timelines presented here are subject to change along with relevant information, finances, regulations, etc. This document includes the U.S. Environmental Protection Agency's (US EPA) 9 steps that are crucial for watershed management plans. Briefly, these include:

1. Addressing the causes and sources of pollution
2. Calculating needed load reductions to achieve water quality standards
3. Identifying management measure to achieve load reduction measures
4. Implementation schedule
5. Milestones
6. Criteria to assess progress
7. Monitoring plan
8. Education and outreach plan
9. Technical and financial resources needed

Water Quality Standards

Fecal coliform and enterococci are two groups of bacteria that are associated with the guts of warm-blooded animals – humans, other mammals, and birds. Most bacteria in these groups are not harmful themselves; however, they are commonly used to indicate when water has been contaminated by fecal material, which can contain other pathogens that are more difficult to test for. Higher concentrations of

fecal coliform and enterococci indicate a greater likelihood that pathogens that present a health risk may also be present.

In marine waters, to protect the health of those harvesting shellfish and other organisms for raw consumption, not more than 10% of samples may have fecal coliform concentrations that exceed 31 colony forming units (CFU) per 100 ml, and the geometric mean of samples may not exceed 14 CFU/100 ml. Additionally, to protect the health of those who come into direct contact with the water (contact recreation), not more than 10% of samples may have enterococci concentrations greater than 130 CFU/100 ml within a 30-day period, and the geometric mean of samples within a 30-day period may not be greater than 35 CFU/100 ml (18 AAC 70 (14), Appendix A. Alaska Water Quality Standards).

In freshwater, to protect water for drinking, not more than 10% of samples may have fecal coliform concentrations exceeding 40 CFU/100 ml over a 30-day period, and the geometric mean of concentrations in samples may not exceed 20 CFU/100 ml over a 30-day period. To protect the health of people who come into direct contact with water (contact recreation), not more than 10% of samples may have E. coli concentrations greater than 410 CFU/100 ml in a 30-day period, and the geometric mean of samples may not exceed 126 CFU/100 ml in a 30 day period (18 AAC 70 (2), Appendix A. Alaska Water Quality Standards).

Current Conditions

Beaches

Ketchikan's beaches were sampled for fecal bacteria during the recreational seasons of 2017 through 2020 (Jul-Sep 2017; May-Sep 2018 through 2020), and during the non-recreational season in 2020-2021 (March, April, May, October, November, December 2020, and January 2021), and data indicate that all beaches exceeded one or more of Alaska's relevant water quality criteria at some point (Figure 2); many experienced chronic exceedances during the summer and across years (See Section III. Load Reductions: Beaches and Appendix B. Beach water quality data summary). The non-recreational season data showed slightly lower bacteria levels but 8 of the 12 beaches sampled failed to meet both the recreation and harvest standards (Appendix B. Beach water quality data summary).

Genetic analyses (Molecular Source Tracking (MST)) of bacteria samples indicated that human and gull waste were a source of bacteria at all locations, while dog waste was detected at all but Mountain Point Surprise Beach (Figure 3). More detailed information about sampling results can be found in Section III. Load Reductions: Beaches, Appendix B. Beach water quality data summary, and the 2017-2020 Ketchikan Beach Monitoring Comprehensive Report (Ketchikan Beaches (alaska.gov).

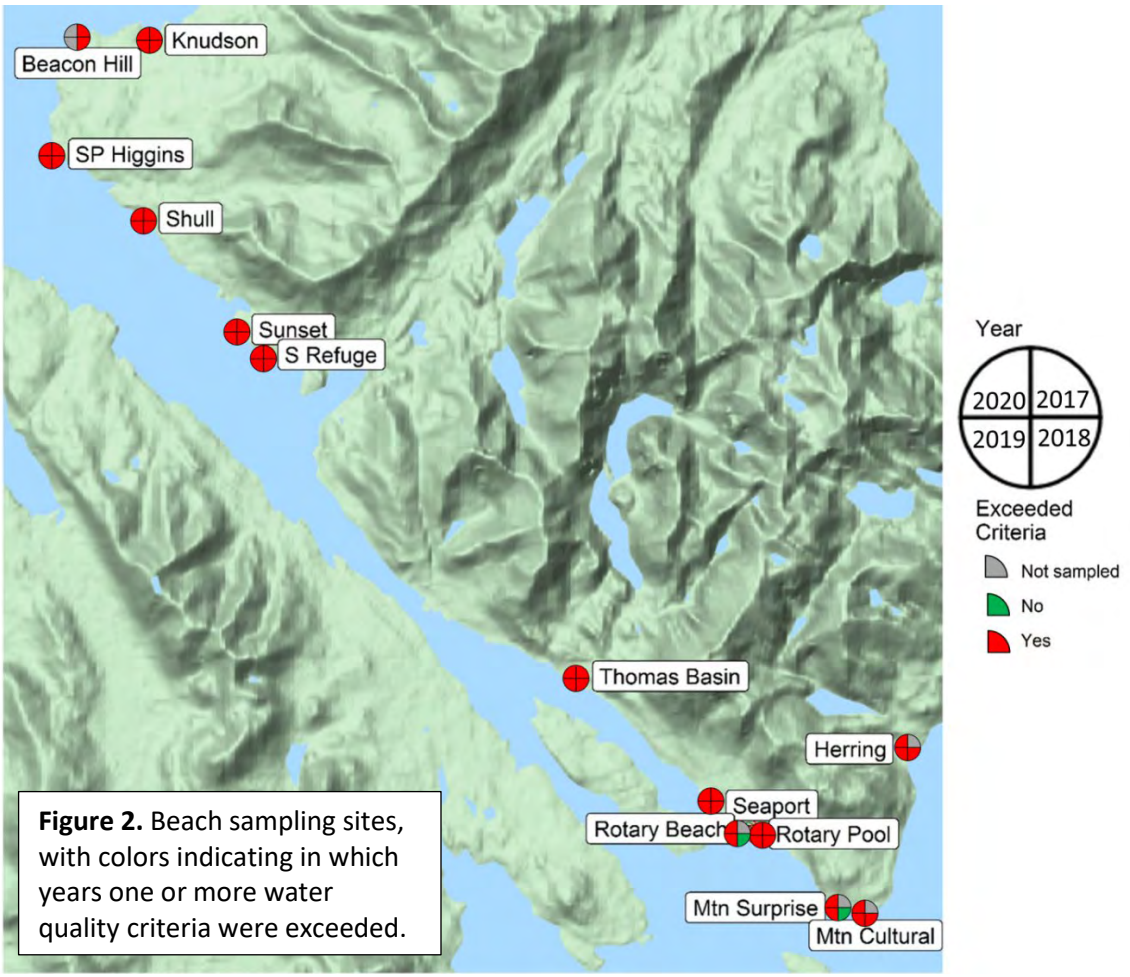

Figure 2. Beach sampling sites, with colors indicating in which years one or more water quality criteria were exceeded.

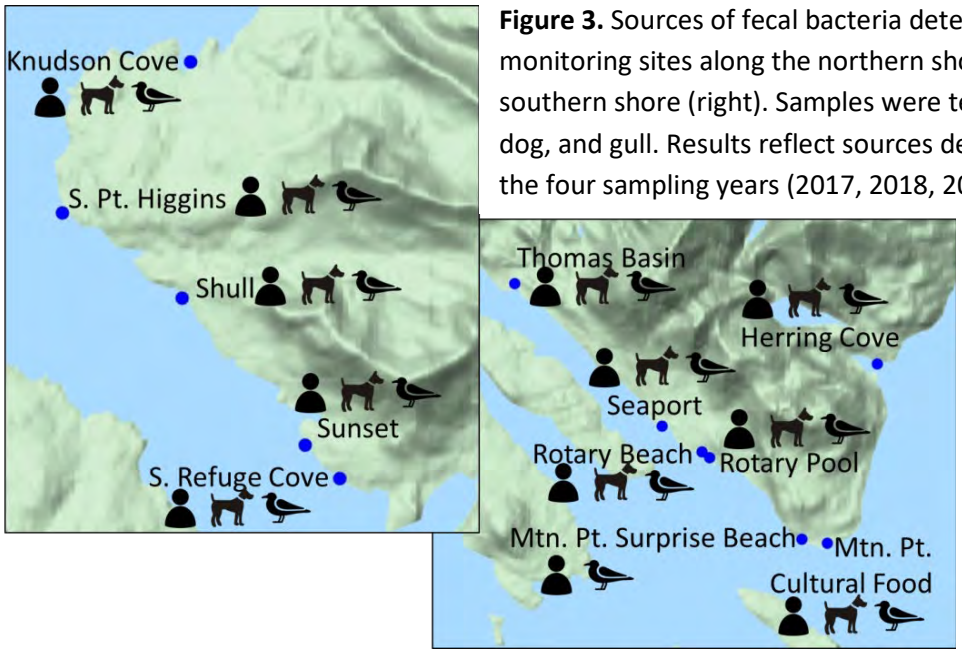

Figure 3. Sources of fecal bacteria detected at the beach monitoring sites along the northern shore (left) and southern shore (right). Samples were tested for human, dog, and gull. Results reflect sources detected in any of the four sampling years (2017, 2018, 2019, 2020).

Marine waters

ADEC has monitored ambient water quality in the Tongass Narrows from 2018-2020, including at sites near the cruise ship berth, ferry dock, city outfall, and Thomas Basin (Figure 4, Figure 5). Because the sampling was targeting "ambient" conditions, times when cruise ships with discharge permits were in port were avoided. In 2018, samples were collected on 4 dates – once each in April, June, August, and October. In 2019, samples were collected once in June. In 2020, samples were collected five times in July, in the absence of a cruise ship season. In 2018, the highest concentrations of fecal coliform were observed near Thomas Basin and the Alaska Marine Highway System (AMHS) dock (Table 1). In 2020, the locations with the highest concentrations were Thomas Basin and one sampling location (KE04) near the cruise ship berth area.

Table 1. Fecal coliform concentrations in marine locations near Ketchikan. Values for the Tongass Narrows in 2018 and 2019 represent the average of multiple samples taken within that area (n = 3 for 2018, n = 7 for 2019), individual sample results are reported for Thomas Basin, AMHS Dock, and City Outfall area in 2018 and 2019. The geomean of five samples taken over 30 days is reported for each sampling location in 2020 (ARRI 2020a, ARRI 2020b).

	Location			
Date	Tongass Narrows (cruise ship berth area)	Thomas Basin	AMHS Dock	City Outfall (KT AIR)
4/9/2018	6	11	6	
6/5/2018	18	19	22	
8/9/2018	76	315	166	
10/17/2018	7	58	28	
6/25/2019	11	5	6	11

	Cruise Ship Berth area			Thomas Basin	South Channel	Mid-channel			North Channel (near City Outfall)
	(KE04)	(KE05)	(KE08)	(KE01)	(KE07)	(KE02)	(KE03)	(KE06)	(KE09)
July 9, 13, 16, 20, 23, 2020	16.6	8.2	10.9	44.1	7.7	10.2	12.0	10.8	3.6

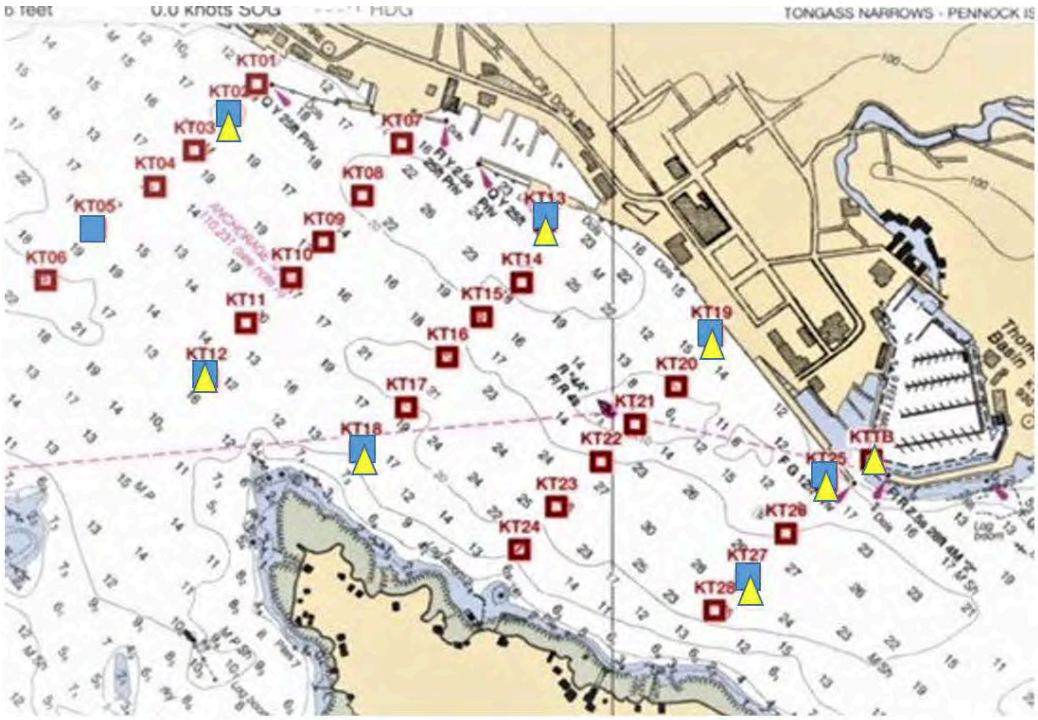

Figure 1. Potential sampling locations in Tongass Narrows near Ketchikan and at the mouth of Thomas Basin (KTTB). Blue squares indicate 2019 sampling sites. Yellow triangles indicate biological sampling sites. The AMHS Dock and City outfall sites are not shown but are located to the northwest.

Figure 2. Aerial view of Tongass Narrows showing the location of the sampling site near the Ketchikan Airport (KT AIR) and the Alaska Marine Highway Service (AMHS) relative to the main sampling area (KT 01 – KT 28) near the cruise ship docks and Thomas Basin (TB).

Figure 4. Ambient marine water quality sampling locations for 2018 and 2019 (Figures 1 and 2 in ARRI, 2020a).

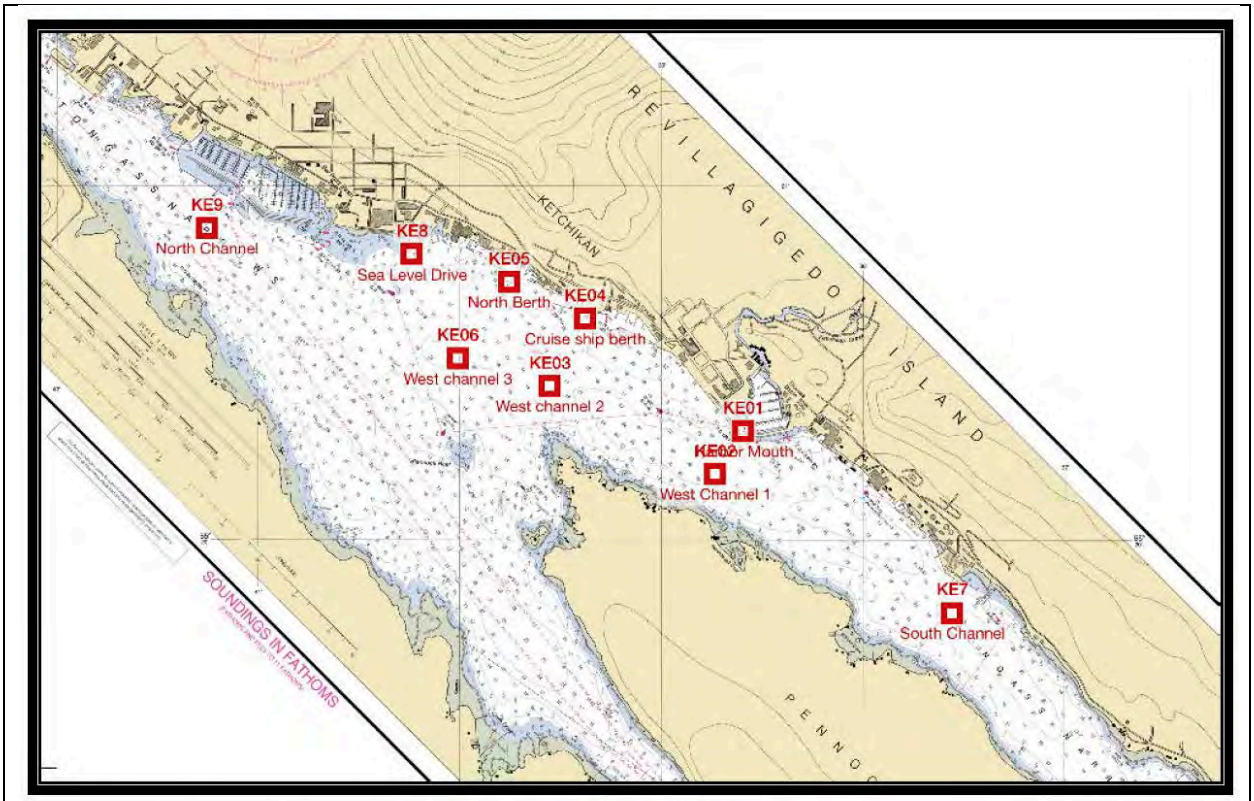

Figure 35. Locations of the nine sampling sites near Ketchikan.

Figure 5. Ambient marine water quality sampling locations for 2020 (Figure 35 in ARRI, 2020b).

Ketchikan Creek

Baseline sampling for physical, chemical, and biotic community characteristics occurred in three urban streams – Carlanna, Hoadley, and Ketchikan Creeks – in 2013 and 2014 to assess the potential impacts of urban development and stormwater runoff (Jensen et al., 2014).

Water samples were taken across a range of flow conditions, including summer base flow and one fall storm event in 2013, and 2014 spring runoff. Samples were collected at upstream reference sites and downstream urban locations during all sampling events, and samples also were collected from one storm drain outfall in each watershed during spring 2014. Water samples were analyzed for alkalinity, hardness, ammonia, nitrate + nitrite, total and total dissolved phosphorus, dissolved organic carbon, settleable solids, and dissolved copper, lead, and zinc. Additionally, water samples for total fecal coliform bacteria were collected during August through September and in May as screening data. Field water quality measurements were taken at each sampling site/location and included turbidity, specific conductivity, temperature, dissolved oxygen, and pH. Stream discharge was measured on each water quality sampling date (except bacteria) and at each wadable sampling site.

Stream sediment samples were collected at each sampling site during base flow and spring flow, and sediment samples at outfall sites were collected during the spring flow sampling event. All sediments were analyzed for metals, and the most downstream sediment sample in each stream was analyzed once for polycyclic aromatic hydrocarbons (PAHs).

Qualitative habitat assessments and substrate size measurements were conducted once at each sampling site. Juvenile salmonids and resident fish were sampled from one location in each stream in September 2013 and benthic macroinvertebrates were collected at each site in May 2014.

Findings

Alkalinity and hardness were generally low at all sampling sites, increasing the toxicity of metals in these streams. Dissolved metal concentrations were generally highest during summer base flow conditions. Copper concentrations exceeded acute and chronic toxicity levels in both the reference and urban Carlanna Creek sites during baseflow, and at most of the downstream urban Ketchikan Creek sites during all sampling periods. Dissolved lead concentrations exceeded acute and/or chronic toxicities during base flow at the reference site in Carlanna Creek and all Ketchikan Creek sites. No dissolved metals that were measured were above acute or chronic toxicity levels during any sampling event in Hoadley Creek.

Specific conductivity increased downstream in Carlanna and Hoadley Creeks, with highest values observed during base flow, but specific conductivity in Ketchikan Creek was always highest at the most upstream sampling location, with the highest values observed during the storm event. Water clarity was high during all sampling events, with turbidities less than 5 NTU and no detectable settleable solids at any sampling site. Dissolved oxygen was near saturation during all sampling events in Carlanna and Hoadley Creeks (>90%) but slightly lower on average in Ketchikan Creek (85.6%). Concentrations of ammonia and nitrate + nitrite tended to be higher in Ketchikan Creek as compared to Carlanna and Hoadley Creeks, with daily flux greatest during the storm event. Some unexpected longitudinal water chemistry trends in Ketchikan Creek may be related to the large diversion of stream water near the outlet of Ketchikan Lake, which is re-introduced below the most upstream sampling site.

Water samples collected from the stormwater outfalls had lower dissolved oxygen saturation, higher conductivity, turbidity, nutrients, and metals than stream samples. Both dissolved copper and dissolved zinc concentrations were much higher in the outfall samples than in their corresponding stream samples.

Water samples were collected in August and September 2013 and May 2014 as screening data to evaluate total fecal coliform concentrations. In 2013, between 50-67% of the individual samples from each site were greater than 40 CFU/100 ml. However, during the spring flow sampling period, all the sites were within the allowable limits.

Concentrations of metals in streambed sediments were generally below values that might result in adverse effects on biota, with a few notable exceptions. The most downstream Ketchikan Creek site had copper and arsenic concentrations above threshold effects levels (TEL)[1]. Additionally, all stream sites except upper Hoadley had cadmium concentrations above the TEL. Copper and zinc concentrations increased in the downstream direction in all streams, consistent with urban inputs; concentrations of both metals were much higher in outfall sediment samples than most stream sediment samples, with

[1] Threshold Effects Level (TEL) refers to an empirically derived concentration below which adverse effects on biota are thought to be unlikely to occur.

copper concentrations exceeding the TEL. Outfall samples also had arsenic concentrations above the TEL and sometimes above the Probable Effect Level (PEL)[2]. Finally, sediment PAHs were above the TEL in the Carlanna and Ketchikan Creek outfalls but were below the TEL or not detected in all the stream sediment samples and the Hoadley Creek outfall.

Biotic sampling indicated decreasing stream health between the upstream and downstream sampling locations in Hoadley and Ketchikan creeks. Macroinvertebrate abundance and richness was generally highest at the upstream sites, except for Carlanna Creek, where the upstream site had a lower biotic index score than the downstream site. Minnow trapping could not be completed at all sites due to high water velocities, so only one site on each stream was sampled for fish. Atypical morphology was observed for several juvenile Coho salmon in both Ketchikan and Carlanna Creeks, with irregular parr marks and increased height to length ratios.

Additional Sampling

Both Ketchikan Indian Community (in conjunction with ADEC) and the City of Ketchikan performed additional screening sampling for metals and bacteria in Ketchikan, Carlanna and Hoadley Creeks and their tributaries and stormwater outfalls during 2018. Their findings largely correspond to earlier results. Bacteria were not a persistent or acute issue in Carlanna Creek, although higher concentrations were observed in samples from the outfall and downstream site. Cadmium in sediment was elevated above TEL in a few samples, including the reference site, and copper and zinc concentrations in stream water exceeded acute criteria once in both the reference and downstream sites. In Hoadley Creek, E. coli was not elevated, but there were a few high fecal coliform concentrations in the downstream site. One sediment sample at the downstream site had a cadmium concentration above the TEL. In contrast to Carlanna and Hoadley Creeks, Ketchikan Creek exhibited more water and sediment quality issues. Fecal coliform concentrations were elevated in all urban stream samples, including the sampling site above the Powerhouse, before any significant urban inputs, although extensive outfall and tributary sampling in the Ketchikan Creek watershed found high fecal coliform concentrations in many outfalls, indicating important urban contributions. E. coli concentrations were occasionally elevated across the stream sampling sites, with outfall samples indicating urban inputs.

More sampling details and results can be found in Jensen et al. (2014), Section II. Causes and Sources of Pollution: Stormwater runoff in Ketchikan, and in Appendix C: Ketchikan Creek Bacteria Data.

II. Causes and Sources of Pollution

Bacteria in freshwater and marine waters can come from many sources. In the Ketchikan area, there are potential point and nonpoint sources that originate on land and in water. These include public and private sewer treatment system outfalls; waste from private boats at launches, in harbors and at sea; deficient onsite wastewater treatment systems (OWTS); sewer line deficiencies; wildlife, pet, and human

[2] Probable Effects Level (PEL) refers to an empirically derived concentration above which adverse effects on biota are thought to be likely to occur. TELs and PELs referred to here are from NOAA Screening Quick Reference Tables (SQuiRTs).

feces deposited on land or in the water; and cruise ships and ferries. Figure 6 shows the spatial distribution of some of these potential sources, and Table 2 shows potential sources at each of the water quality monitoring locations. These bacteria sources and the areas where they are potentially important are discussed in more detail in the following sections.

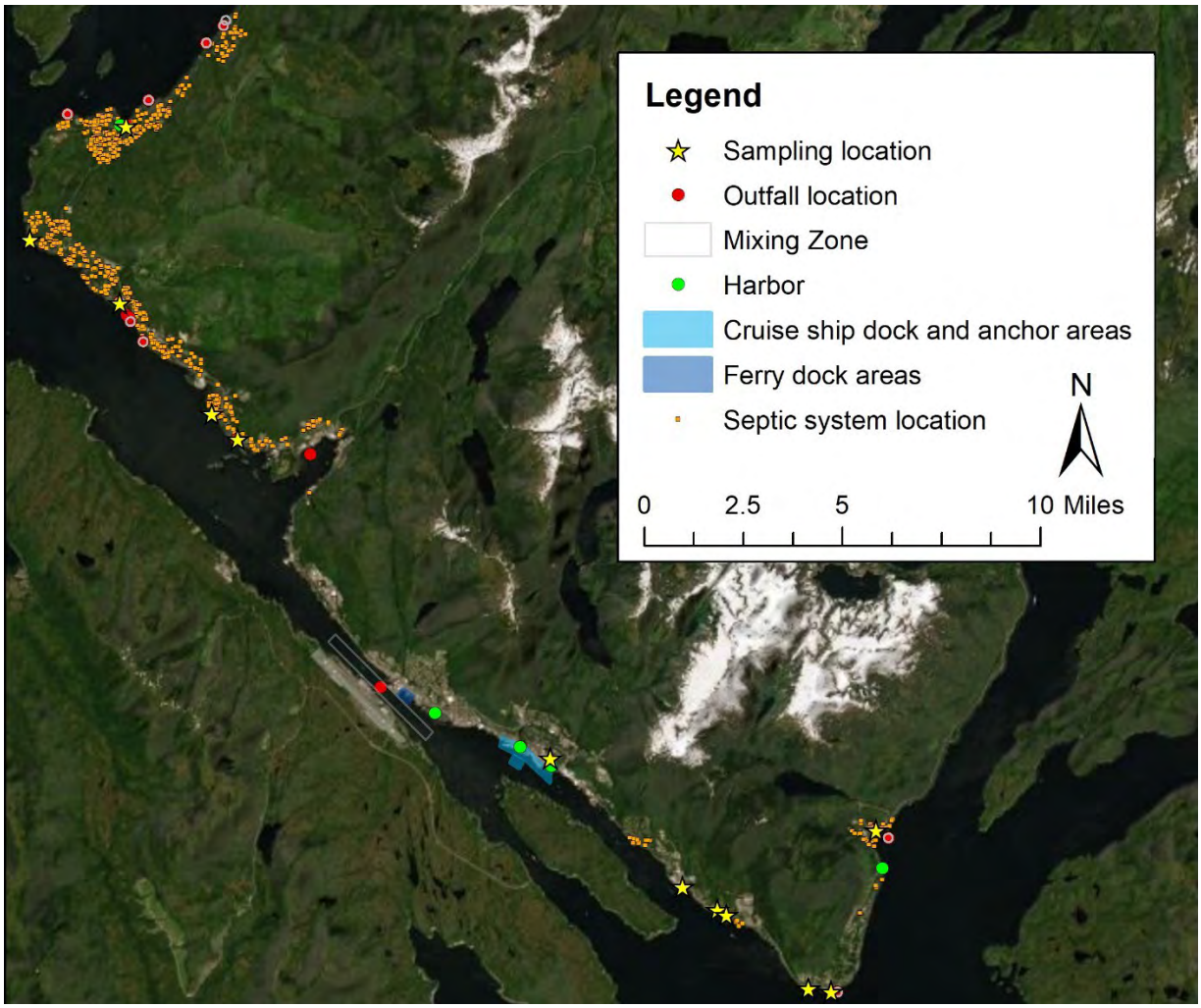

Figure 6. Distribution of some potential sources in the Ketchikan area. Note that the septic system layer was developed in 2014, and likely does not reflect the most up-to-date data, but provides a good overview of where septic systems are generally used.

Table 2. Potential point and nonpoint sources of bacteria present in waters near each monitoring location

Site ID	Individual septic tanks	Private sewer treatment system outfall(s)	Wildlife Pet feces	Private watercraft	Cruise ships, Ferries	Mountain Point sewer treatment system outfall(s)	Sewer collection system deficiencies	Charcoal Point sewer treatment system emergency bypass discharge	Boats at boat launches & in harbor areas
Knudson Cove	✓	✓	✓	✓					✓
Beacon Hill	✓	✓	✓	✓					
South Point Higgins	✓	✓	✓	✓	✓				
Shull	✓	✓	✓	✓	✓				
Sunset	✓	✓	✓	✓	✓				
South Refuge Cove	✓	✓	✓	✓	✓				
Thomas Basin			✓	✓			✓	✓	✓
Seaport			✓	✓	✓		✓	✓	✓
Rotary Beach			✓	✓	✓		✓	✓	
Rotary Pool			✓	✓	✓		✓		
Mt Point Surprise Beach*			✓	✓	✓	✓	✓	✓	✓
Mt Point Cultural Food*			✓	✓	✓	✓	✓	✓	✓
Herring Cove	✓	✓	✓	✓					
Ketchikan Creek			✓				✓		

*Private sewer treatment systems in this area were connected to the Mountain Point Wastewater Treatment Plant in 2018.

Wastewater Treatment Facility (WWTF) outfalls

Public sewer treatment outfalls include the City's Charcoal Point WWTF and the Borough's Mountain Point, Point Higgins, Waterfall South and Waterfall North WWTFs. There are many other private sewer treatment outfalls along the coast. Permitted facilities' outfalls are generally geolocated, but private outfalls from individual homes and common collectors that serve groups of homes, which are not currently required to have permits, have not been exhaustively mapped.

Charcoal Point WWTF

The Charcoal Point WWTF (Permit No. AK0021440) serves the residents (~8,300) of the City of Ketchikan and can also accept waste from ferries and cruise ships. Under the Clean Water Act, municipal WWTFs are required to implement primary treatment (separate solids from liquids) and secondary treatment (biologically remove organic material) before wastewater is discharged. However, Charcoal Point, like many other WWTFs that discharge to marine waters, has received a waiver under the US EPA 301(h) program and is currently only required to have primary treatment. The US EPA, not ADEC, is responsible for enforcement and compliance in this case. Currently Charcoal Point WWTF is permitted to discharge effluent with up to 1.5 million CFU/100 ml, with a monthly average of 1 million CFU/100 ml. The discharge point is offshore 110 feet below the surface (Figure 7). The permit allows for a mixing zone (Figure 7), where effluent mixes with ambient water; outside of the mixing zone, water quality standards must be met.

There has been only one reported fecal coliform exceedance in effluent in the past four years (Table 3). Edge of mixing zone data from 2017, 2018, and 2020 were obtained from ADEC. The median and mean fecal coliform concentrations were 1 and 4.2 CFU/100 ml, respectively, with maximum concentration of 76 CFU/100 ml (n = 138); only 6 samples exceeded 14 CFU/100 ml (Appendix D. Edge of Mixing Zone Data).

Ambient marine water sampling by ADEC in 2019 and 2020 near the outfall showed low fecal coliform concentrations at the surface (See Section 1. Current Conditions: Marine waters).

No direct evidence ties effluent from the Charcoal Point WWTF to beach bacteria, and edge of mixing zone samples have generally shown low fecal coliform concentrations. However, effluent mixing dynamics are not well understood, although tidal flow patterns suggest that most of the effluent would be carried south rather than north (Figure 8), and it is possible that poorly mixed effluent could reach the shoreline and contribute to bacteria at beaches. Current bacteria sampling techniques can neither confirm nor rule out any contribution from Charcoal WWTF.

Table 3. Instances of numeric exceedances reported for effluent from the Charcoal Point WWTF from 2016 to present.

Monitoring Period	Parameter	Permit Limit	Value
8/3/2018	Fecal coliform, weekly geometric mean (CFU/100 ml)	1.25 million	1.4 million

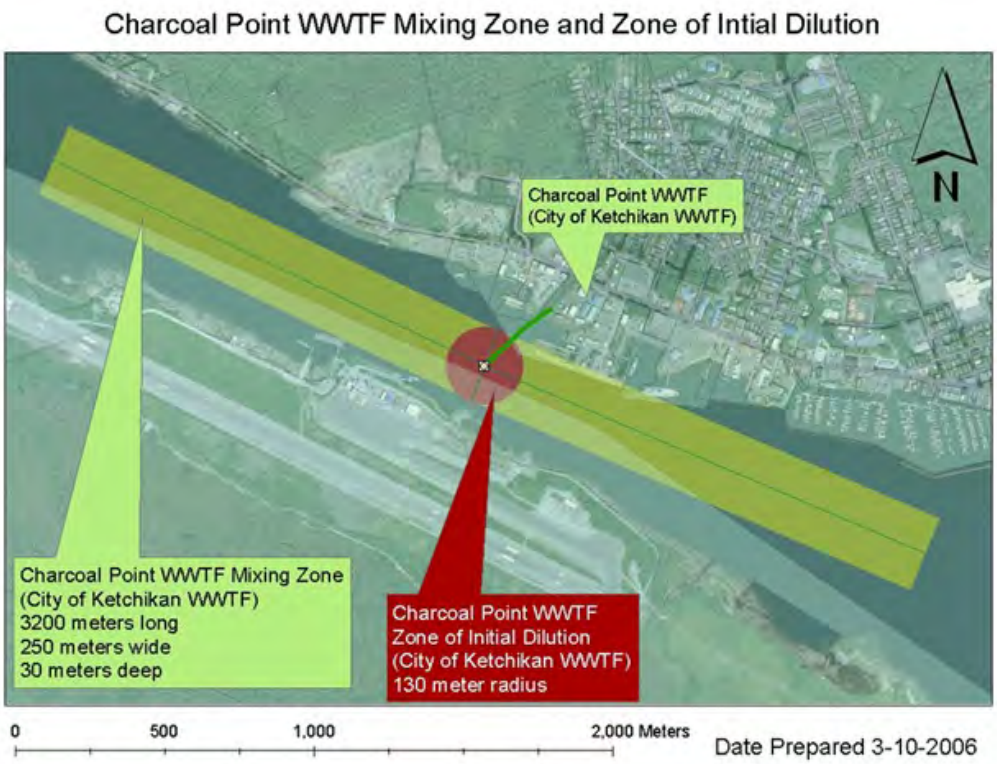

Figure 7. Charcoal Point WWTF discharge point (star), zone of initial dilution (red circle) and permitted mixing zone (yellow rectangle).

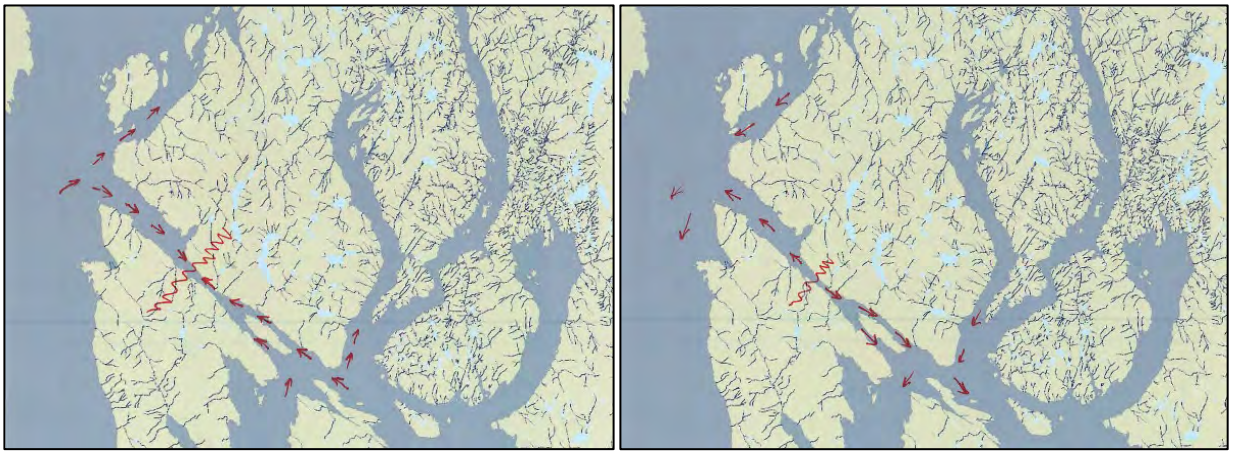

Figure 8. General direction of currents during Tongass Narrows flood (left) and ebb (right) tides. (Schematic courtesy of Steven Corporon, former Director of the Harbormaster's Office in Ketchikan, Alaska.)

Sites Potentially Affected: Thomas Basin, Seaport Beach, Rotary Beach, Mountain Point Surprise Beach and Cultural Food

Mountain Point WWTF

The Mountain Point WWTF serves Borough residents from the 2100 block of South Tongass Highway (STH) to Mile 7 of the STH (Permit No. AKG572028). This includes all the Forest Park Subdivision (formerly served by the Forest Park WWTF), the City of Saxman, and all points in between (Figure 9). It is a secondary treatment facility with disinfection of wastewater prior to discharge from a pipe approximately 100 m from shore (Figure 10). Currently, the facility is permitted to discharge effluent with up to 800 CFU/100 ml per day, with a 30-day average of 200 CFU/100 ml. The permit allows for a 100 m radius mixing zone (Figure 10), where effluent is allowed to mix with ambient water; beyond the permitted mixing zone, water quality standards must be met. Monthly monitoring of effluent over the past four years identified nine instances of bacteria concentrations exceeding permit limits (Table 4).

Table 4. Instances of numeric exceedances reported for effluent from the Mountain Point WWTF from 2016 to March 2021 (ECHO database).

Monitoring Period	Parameter	Permit Limit	Value
8/31/2017	Fecal coliform, monthly geometric mean (CFU/100 ml)	200	396
5/31/2019	Fecal coliform, monthly geometric mean (CFU/100 ml)	200	880
5/31/2019	Fecal coliform, daily maximum (CFU/100 ml)	800	2,600
12/31/2019	Fecal coliform, monthly geometric mean (CFU/100 ml)	200	1,355
12/31/2019	Fecal coliform, daily maximum (CFU/100 ml)	800	2,700
7/31/2020	Fecal coliform, monthly geometric mean (CFU/100 ml)	200	10,180
7/31/2020	Fecal coliform, daily maximum (CFU/100 ml)	800	20,000
11/30/2020	Fecal coliform, monthly geometric mean (CFU/100 ml)	200	30,005
11/30/2020	Fecal coliform, daily maximum (CFU/100 ml)	800	60,000

The permit stipulates twice per year sampling of the edge of the mixing zone and the shoreline in the mixing zone. ADEC provided these data from two sampling events in 2016 and one sampling event in 2017, 2018 and 2020 (Appendix D. Edge of Mixing Zone Data). No water quality exceedances were reported (mixing zone edge fecal coliform concentration (CFU/100 ml) minimum = 1, max = 11, mean = 6; shoreline in mixing zone minimum = 1, max = 17, mean = 5.8).

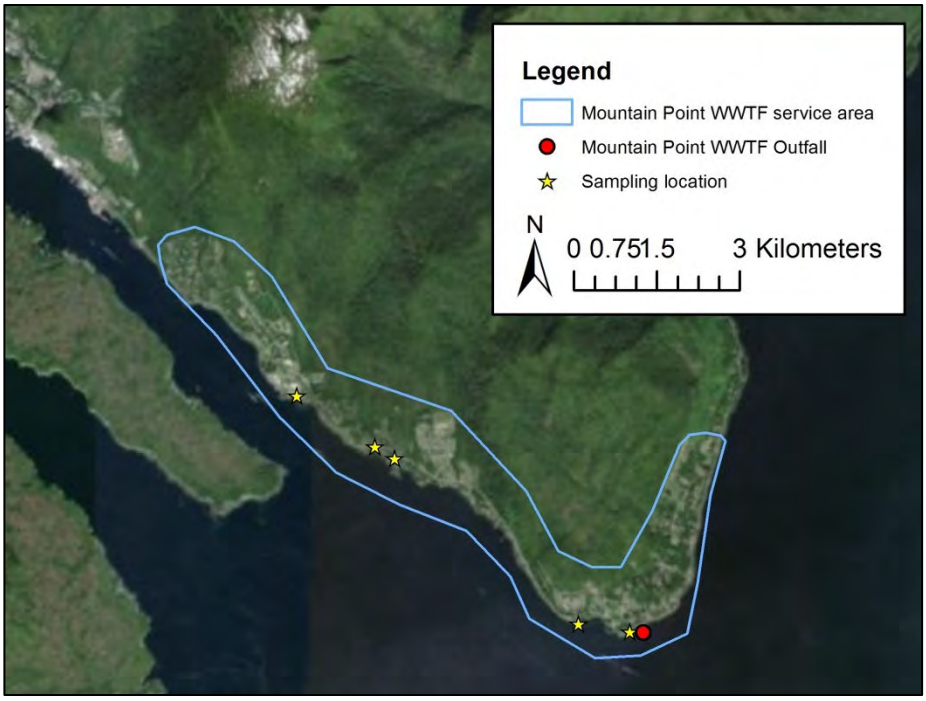

Figure 9. Mountain Point WWTF Service Area

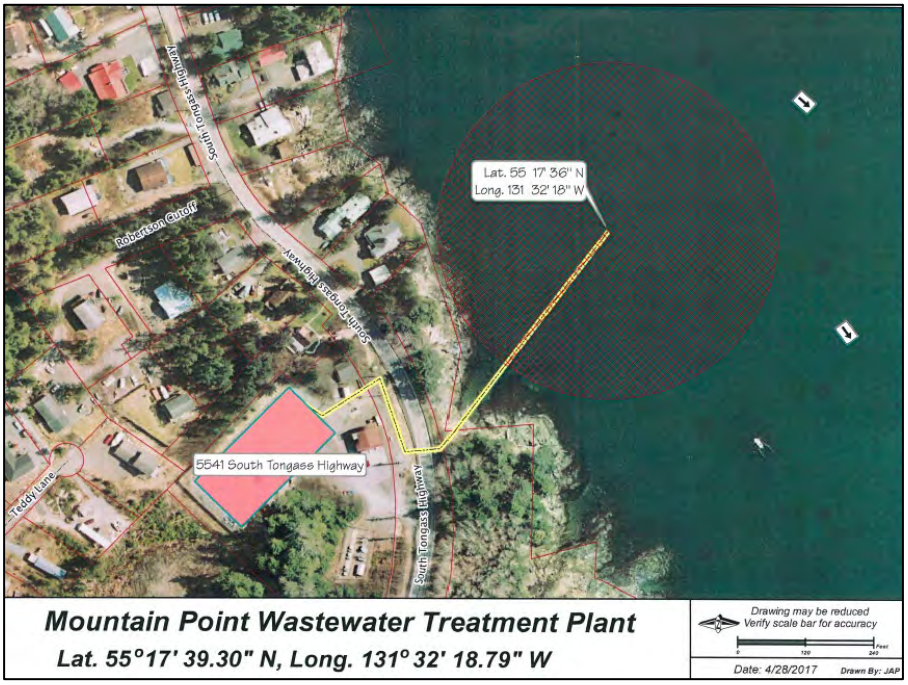

Figure 10. Mountain Point WWTF discharge point and permitted mixing zone.

Sites Potentially Affected: Mountain Point Surprise Beach and Cultural Food

Onsite wastewater treatment systems

Residences and businesses (~2,000) outside of areas served by City and Borough WWTFs have OWTSs. In some cases, wastewater from multiple OWTSs is combined into a single "common collector" pipe and marine outfall. In the Ketchikan area, soil and water conditions are not conducive to soil absorption systems from either septic tanks or secondary treatment units. Advanced treatment units with either an onsite soil absorption system or marine outfall are the most common types of wastewater systems installed. Advance treatment systems generally employ aeration systems to achieve higher quality effluent prior to discharge to a soil absorption system or to an outfall. Current construction standards require disinfection (usually UV) of the wastewater prior to discharge to a marine outfall. Inspections have found that failed aerators are not uncommon, greatly increasing fecal coliform concentrations.

Systems connected to marine outfalls

Many residences and business outside of the areas served by the City's and Borough's WWTFs have an OWTS that is connected to a marine outfall. No private residential marine outfalls (serving single- or two-family residences on one lot) and few common collectors (serving multiple lots or residences with different ownership) are eligible for discharge permit coverage, and these have not been thoroughly spatially inventoried. Although these systems are required to meet performance standards of secondary treatment with disinfection to achieve mean fecal coliform concentrations of less than 400 CFU/100 ml in seven days, and 200 CFU/100 ml in 30 days, no monitoring is required so it is unclear the extent to which these outfalls may be contributing to bacteria loading at beaches. Legacy systems without disinfection likely still exist and are of particular concern, but these are not easily identified from existing records.

Outfalls from small publicly owned treatment works and outfalls and privately owned treatment plants used at businesses like lodges are permitted and monitored (Table 5, ECHO database). From 2016 through March 2021, over one third of the reported samples resulted in numeric exceedances of end-of-pipe permitted effluent limits for fecal coliform, with overall median and average concentrations of 30,000 and 398,157 CFU/100 ml, respectively. No information was available in the Enforcement and Compliance History Online (ECHO) database on whether edge-of-mixing zone limits were met. If effluent quality in permitted systems is representative of all marine outfalls, which are pervasive along the coast outside of City and Borough sewer service areas, these systems may be an important source of fecal bacteria contamination at many beach sites.

Table 5. Permitted common collectors and private WWTFs, and summaries of fecal coliform concentrations in effluent from monitoring events from 2016 through March 2021 (data obtained from the ECHO database March 2021).

Permitted Outfall (Permit No.)	Fecal coliform concentration (CFU/100 ml)		Number of samples	Data Date range	Permit Information		
	Median	Mean			Max daily fecal coliform (CFU/100 ml)	Max daily discharge (gal per day)	Sampling Frequency
Clover Pass Resort (AKG572010)	2,000,000	3,824,375	16	May 2017 - Sep 2020	800	6,000	Monthly
Clover Subdivision (AKG571025)	17,723	91,844	57	Jan 2016 - Jan 2021	150,000	11,000	Monthly
Edgewater Inn (AKG572030)	50,000	50,000	1	Dec 2016 - Dec 2016	800	5,000	Quarterly
Eichner Subdivision (AKG571003)	50,000	215,480	15	Mar 2016 - Nov 2017	150,000	15,000	Monthly
Gena Road Subdivision (AKG571047)	60,000	164,876	19	Apr 2016 - Dec 2020	150,000	5,000	Quarterly
Herring Bay (common collector) (AKG571043)	90,000	218,237	12	Jan 2018 - Sep 2020	150,000	5,000	Quarterly
Salmon Falls Resort (AKG572038)	20	20	1	Jun 2018 - Jun 2018	800	7,400	Monthly
Vallenar View (AKG572047)	45	222,660	52	Jul 2016 - Jan 2021	800	20,000	Monthly
Victorson Court (AKG571026)	130,000	464,470	22	Jan 2016 - Jan 2021	150,000	5,000	Quarterly
Ward Cove Industrial Site WWTF (AK0053384)	10	41	28	Apr 2016 - Feb 2021	43	Report	Monthly
Waterfall Creek North Outfall #1 (AKG571038)	110,000	396,985	59	Jan 2016 - Feb 2021	150,000*	17,000	Monthly
Waterfall Creek South Outfall #2 (AKG571038)	30,000	247,308	59	Jan 2016 - Feb 2021	150,000*	22,000	Monthly

*The Waterfall Creek permit requires monitoring at the edge of the mixing zone twice per year, with a daily limit of 43 FC/100 ml. No mixing zone data was available in the ECHO database.

The Borough currently provides the following services for various marine outfalls authorized to discharge under general permits through the APDES program:

- Mountain Point WWTF (AKG572028): The Borough owns and operates this community secondary wastewater treatment plant. This system is a sequencing batch reactor that provides service to nearly all residents of Miles 2 – 7 S. Tongass Highway, including all residents of the City of Saxman.
- Clover Island View Subdivision WW Treatment Facility (AKG571025): Sampling services for this privately owned community collector outfall. All connected residents utilize onsite wastewater treatment systems (OWTS) for secondary treatment prior to their effluent being discharged through the collective outfall.
- Victorson Court Sewer Outfall (AKG 571026): Sampling services for this privately owned community collector outfall. All connected residents utilize onsite wastewater treatment systems (OWTS) for secondary treatment prior to their effluent being discharged through the collective outfall.
- Point Higgins (2003DB0092-1027): Sampling services for this Borough-owned community collector outfall. All connected residents and Point Higgins Elementary School utilize onsite wastewater treatment systems (OWTS) for secondary treatment prior to their effluent being discharged through the collective outfall.
- Waterfall Creek Subdivision Sewer Outfalls – South & North (AKG571038): Sampling services and operations for these two Borough-owned community collector outfall. All connected residents utilize onsite wastewater treatment systems (OWTS) for secondary treatment prior to their effluent being discharged through the collective outfall.

In general, those properties for which the Borough provides sampling services that remain under General Permit AKG571000 are common collector outfalls accumulating secondary treated effluent from onsite wastewater treatment systems. General Permit AKG572000 generally covers single plants which treat a community of properties (e.g., Mountain Point, Clover Island View) or lodges or other commercial endeavors.

Sites potentially affected: Knudson Cove, Beacon Hill, South Point Higgins, Shull Beach, Sunset Beach, South Refuge Cove, Herring Cove. Sites especially close to marine outfalls are likely to be the most severely affected by wastewater discharge.

Septic systems with soil absorption systems

Many residences outside of the City and Borough utility service areas have wastewater systems with onsite disposal to a soil absorption system, especially those farther from the coast. When properly installed and maintained, septic systems with soil absorption systems can be effective at removing bacteria. However, there is no known data that provides information about the efficacy of these systems at removing bacteria in the Ketchikan area. Bacteria removal can be less effective when soils are coarser, wetter, or cooler, when preferential water flowpaths develop and “short-circuit” treatment (Wang et al., 2021), as well as when the distance from the soil absorption system to groundwater and surface water is shorter. The Borough has identified only three systems that required maintenance during the past three years, including two on the waterfront; however, the detrimental conditions described above can be present without obvious symptoms of septic system failure. Additionally,

watershed-scale studies from other regions have found that the density of septic systems is correlated with fecal bacteria contamination of surface water (Verhougstraete et al., 2015; Sowah et al., 2018).

In the Ketchikan area, disposal to a conventional soil absorption system is not common due to the soils and terrain; special design considerations, such as sand liner, blasting of bedrock, above ground mound, etc. are nearly always required. Waivers are occasionally requested to build wastewater systems with soil absorption systems within 100 feet of surface water. Additional disinfection treatment, such as ultraviolet light, can be installed in these instances, but ADEC does not have information about the frequency that these waivers are granted or how often additional treatment is required.

Sites Potentially Affected: Sites outside the municipal WWTF service areas; notably Knudson Cove, Beacon Hill, South Point Higgins, Shull Beach, Sunset Beach, South Refuge Cove, and Herring Cove.

Private boats

Human waste that is dumped from private boats in harbors or at sea can contribute to elevated bacteria concentrations at beaches. Live-aboard boats are required to have US Coast Guard-approved marine sanitation devices (MSD) (Type I, II, or III) and pump out their waste at pump-out stations to prevent direct discharges of untreated waste into the water. However, anecdotally, the pump-out station at Thomas Basin gets limited use, and harbor residents have been observed dumping “honey buckets” of raw human waste directly into the water. Reports of direct dumping are investigated, and violators can and have been evicted from the harbor.

Sites potentially affected: All beach sites. Sites at/near harbors, especially those with many live-aboard vessels (Thomas Basin), are likely to be the most severely affected by waste from private boats.

Cruise ships

Large cruise ships discharging into Alaskan waters must have an installed and operational Advanced Wastewater Treatment System (AWTS), or a system that achieves a quality of effluent that is comparable to that achieved by vessels employing an AWTS (AS 46.03.462). These systems are capable of treating water so that it meets stringent water quality standards before it leaves the ship. Not all cruise ships that operate in Alaska discharge while in State waters.

Cruise ships must sample their wastewater discharges according to ADEC-approved sampling plans and submit results to ADEC. Large cruise ships must meet General Permit requirements at the end of pipe; no mixing zone is provided for bacteria. Permit limits for fecal coliform are a monthly geometric mean of 14 FC/100 ml and a daily maximum of 40 FC/100 ml with a frequency of twice per month.

Fecal coliform concentrations were below detection limits in most samples from 2016 through 2019; there were only 18 instances (of 876 samples total) when ships exceeded their permit limits for fecal coliform across all samples taken in Alaskan waters (Table 6). No compliance samples were taken in Ketchikan in 2017 or 2018, and only three samples were taken in 2019. However, if the ships’ treatment systems are consistently functional, they are unlikely to be a dominant source of bacteria in Ketchikan’s waters.

Monitoring results:

Table 6. Large cruise ship compliance sampling results for fecal coliform, both underway and stationary (https://dec.alaska.gov/water/cruise-ships/cruise-reports/). For 2016-2018, the summary statistics reflect samples of both mixed wastewater and graywater. One sample was taken in Ketchikan 2016; no samples were taken in Ketchikan in 2017 or 2018; 3 samples were taken in Ketchikan in 2019. No cruise ships visited Southeast Alaska in 2020 due to COVID-19 pandemic restrictions, so there is no wastewater data from that year. All values are in units of CFU/100 ml.

				2019	
	2016	2017	2018	Mixed wastewater	Graywater
Number of exceedances of daily max	4	1	4	9	0
Average	9.97	1.26	2.68	16	0.31
Median	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect
Min	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect
Max	840	48	130	>600	15
Number of samples	196	194	230	202	54

Sites potentially affected: South Point Higgins, Shull Beach, Sunset Beach, South Refuge Cove, Seaport Beach, Rotary Park Beach and Pool, Mountain Point Surprise Beach and Cultural Food.

Ferries and small cruise ships

Small cruise ships and ferries (between 50 and 250 overnight passengers) must have an ADEC-approved Best Management Practices plan (BMP) to discharge in State waters. The BMP must include efforts to minimize impacts to the environment and human health. Blackwater must be treated through a MSD II system, and ADEC generally requires that discharges are minimized in port. Most vessels discharge only while the vessel is underway at speeds of greater than 6 knots and 1 nautical mile from shore. Vessels that discharge within 1 nautical mile or at speeds less than 6 knots must take measures to protect the environment to the maximum extent feasible (18 AAC 69.046(c)(5)(B)). Discharge in protected spawning areas and within areas designated under AS 16.20 as refuges, sanctuaries and critical habitat areas is prohibited. Vessels operating in Alaska are subject to seasonal sampling to demonstrate that their wastewater treatment system is operating correctly, ideally at the beginning of the cruise season. If treated wastewater has elevated bacteria concentrations, actions must be taken to improve treatment system performance, and re-sampling is required to confirm improvement. Vessels that operate in the Ketchikan area may opt to voluntarily hold or minimize wastewater discharges. Notably, some smaller cruise vessels do not have graywater treatment systems installed on board.

Sampling results from small cruise ships and ferries across Alaska during the past three years indicate that, despite the implementation of BMPs, effluent from on board treatment systems is not consistently meeting water quality standards (Table 7), suggesting some of these ships could contribute to local elevated bacterial levels.

Monitoring Results:

Table 7. Small cruise ship and ferry compliance sampling results for fecal coliform for all of Alaska. No small cruise ships were sampled in Ketchikan during 2016-2019. Only 1 small cruise ship operated a partial itinerary in Southeast Alaska in 2020, and no samples were collected that year. All values are in units of CFU/100 ml.

	2016 (mixed wastewater and blackwater)	2017 (mixed wastewater and graywater)	2018 (mixed wastewater and graywater)	2019	
				(mixed wastewater)	(graywater)
Number of instances results exceeded AK water quality standards for Type II MSDs	6	5	7	10	4
Average	137,185	1,574,701	1,376,634	321,805	80,801
Median	10	129	81	18	310
Min	Non-detect	Non-detect	Non-detect	<2.0	Non-detect
Max	2,100,000	16,000,000	19,000,000	3,500,000	520,000
Number of samples	17	12	18	25	7

Sites potentially affected: South Point Higgins, Shull Beach, Sunset Beach, South Refuge Cove, Seaport Beach, Rotary Park Beach and Pool, Mountain Point Surprise Beach and Cultural Food.

Pets and wildlife

Figure 11. Dog feces on the bridge at Thomas Basin

Feces from pets and wildlife that are deposited onto the landscape can be washed into streams and the marine environment in rainwater and snowmelt runoff. A study found that a single average sized dog "fecal event" can contain enough bacteria to contaminate an Olympic-sized swimming pool, and that bacteria were much more concentrated in dog feces than bird feces (Wright et al., 2009). Although pet waste bags and receptacles are supplied at Borough parks, City docks and harbors, and along the downtown promenade, dog feces are regularly observed on beaches, city sidewalks and docks (Figure 11). Dogs have been observed defecating directly into the water off docks. Additionally, pet waste in private yards, especially those directly adjacent to creeks can contribute to bacteria loads.

During at least one sampling year, each of the beaches that have been tested except one have been found to have bacteria from dog hosts, and all beaches tested were found to have bacteria from gull hosts (Figure 3). While it is not possible to quantitatively partition the relative contributions of dog and wildlife to bacteria loads, the existing data, and visual observations of feces on the landscape (e.g., Figure 11) indicate that these

sources may be important contributors to elevated bacteria concentrations at many locations around Ketchikan.

More detailed data can be found in the 2017-2020 Ketchikan Beach Comprehensive Monitoring Report Ketchikan Beaches (alaska.gov).

Sites potentially affected: All

Human waste on land

A lack (or underutilization) of public toilet facilities in some areas results in people defecating directly onto the landscape. This has been identified as an issue associated with camping around lower Ketchikan Creek and occasionally with tourists in the downtown area. Illicit camping has also been known to occur near the Mountain Point Cultural Food site. Additionally, several beach sites (South Point Higgins, Shull Beach, Sunset Beach, Seaport Beach, and Herring Cove) currently lack public restrooms, and human feces have been observed near some of these beaches.

Sites potentially affected: South Point Higgins, Shull Beach, Sunset Beach, Thomas Basin, Ketchikan Creek, Seaport Beach, Mountain Point Cultural Food, and Herring Cove. This is probably a more serious issue in high use areas like South Point Higgins, Ketchikan Creek, and Thomas Basin.

Sewer system deficiencies

Much of the sewer infrastructure in the City of Ketchikan was constructed in the mid 1900's using asbestos cement, corrugated metal, and ductile iron pipes. The City's Public Works Department is currently working to replace the aging pipes, particularly the corrugated metal sections. Acute sewer system deficiencies, such as improper connections, and breaks or leaks in the sewer service are dealt with rapidly once they are identified.

In addition to improving aging city sewer system, the City has a program to identify and repair private connections that are failed, leaking, or incorrectly hooked up to the sewer system, which can lead to raw sewage being released into the environment, in some cases directly to Ketchikan Creek and near/in Thomas Basin. Exposed private sewer lines are regularly inspected, and the city funds a grant program to reimburse private landowners for sewer repairs.

Sites potentially affected: Ketchikan Creek, Thomas Basin, Seaport beach, Rotary Park Beach and Pool, Mountain Point Surprise Beach and Cultural Foods site. Ketchikan Creek and Thomas Basin are likely to be the most severely affected because of the density and age of the sewer system in the area.

Stormwater runoff in Ketchikan

Sampling results from tributaries and piped stormwater runoff in Ketchikan provide some indication about areas that may be contributing disproportionately to fecal coliform and E. coli loads in Ketchikan Creek (Figure 12, Figure 13). Elevated bacteria concentrations were measured in samples from the Revetment Way outfall and the outfall just above Harris bridge (KC-OUT) (Figure 12). Schoenbar Creek at the confluence (culvert) with Ketchikan Creek, and at the Recreation Center also exhibited elevated concentrations relative to most of the other sites that were sampled (Figure 12).

Sites potentially affected: Ketchikan Creek, Thomas Basin.

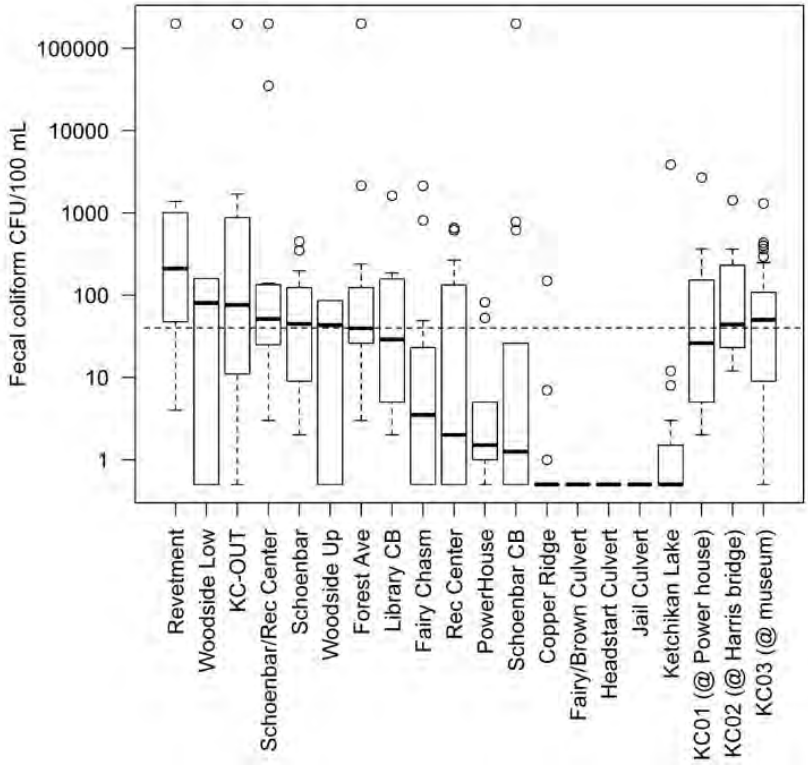

Figure 12. Distribution of fecal coliform concentrations in stormwater outfalls, catch basins, and tributaries to Ketchikan Creek (collected by the City of Ketchikan in 2018). The dotted line indicates 40 CFU/100 ml, which not more than 10% of samples may exceed in 30 days to meet the drinking water quality standard. The thick line in the middle of the box represents the median value, the upper and lower ends of the box represent the middle 50% of the data, whiskers extend either the minimum and maximum or 1.5 times the interquartile range. Points plotted individually fall outside of 1.5 times the interquartile range. Note that Ketchikan Lake, KC01, KC02, and KC03 are all lake/creek sites (Figure 13).

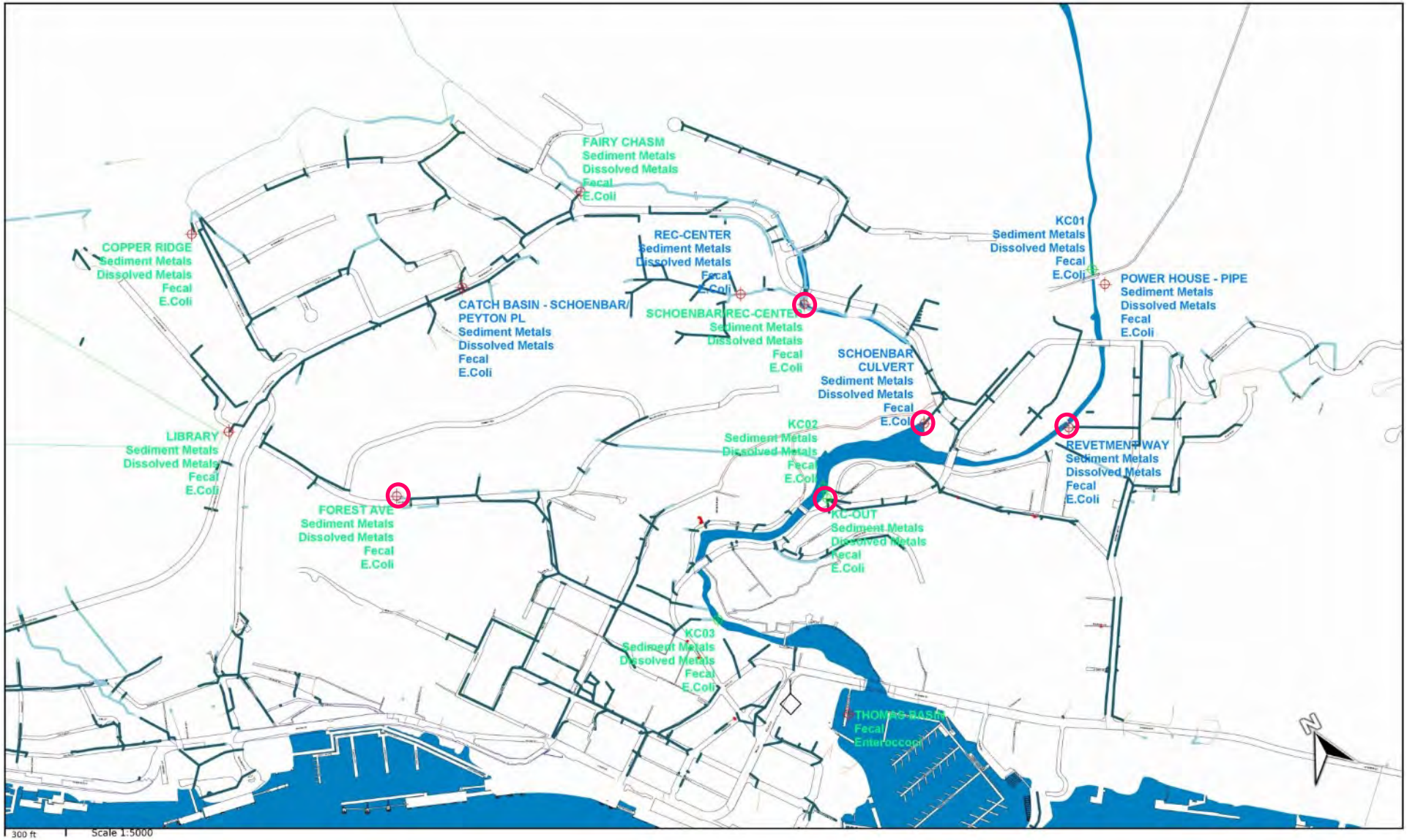

Figure 13. Locations of stormwater monitoring in Ketchikan Creek (City of Ketchikan Public Works Department). Some of the locations with the highest fecal coliform concentrations are highlighted with pink circles.

III. Load Reductions

The overall goal of this plan is to reduce bacteria loads (mass inputs) to meet water quality standards to protect public health. In the case of Ketchikan's beaches, bacteria loads contributing to water quality criteria exceedances cannot be estimated quantitatively from existing information. Highly detailed information, including freshwater inputs, concentrations in marine waters, and mixing patterns, would need to be collected to quantitatively address loading to the beaches. Unfortunately, that work is beyond the scope of this plan. Additionally, no stream discharge measurements were taken simultaneously with stream bacteria sampling, precluding load calculations for the stream sites. Despite this, bacteria concentrations point to the need for large improvements in water quality, and correspondingly large decreases in inputs of untreated human and pet waste to the lands draining to Ketchikan Creek and the coast, and to marine waters.

Beaches

Fecal coliform concentrations at beaches need to be reduced by 53-94% from the maximum concentration observed to meet the water quality standard for shellfish harvesting for raw consumption; seasonal geometric means need to be reduced by 13-80% from the maximum observed (except for Beacon Hill, which met this standard both years it was sampled) (Table 8). Enterococci concentrations would need to be reduced by 48-96% from the maximum observed to meet the water quality standard for contact recreation; the 30-day geometric mean would need to be reduced by 20-92% from the maximum observed (except for Mountain Point Surprise, Seaport, and South Refuge Cove beaches, which met this standard each year they were sampled) (Table 8).

Table 8. Maximum observed concentrations of fecal coliform and enterococci, and max seasonal geometric means of fecal coliform and 30-day geometric means of enterococci at each of the beach locations across 2017-2020 sampling seasons, and corresponding % reduction needed to meet water quality standards.

Monitoring Location	Fecal coliform				Enterococci			
	Max concentration[1] (CFU/100 ml)	% reduction needed	Max seasonal geomean (CFU/100 ml)	% reduction needed	Max concentration (MPN/100ml)	% reduction needed	Max 30-day geomean (MPN/100 ml)	% reduction needed
Knudson Cove	456	93	22	36	2603	95	54	35
Beacon Hill	66	53	12	0	579	78	45	22
South Point Higgins	437	93	35	60	2235	94	90	61
Shull	276	89	34	59	754	83	49	29
Sunset	300	90	22	36	410	68	70	50
South Refuge Cove	184	83	17	18	3448	96	33	0
Thomas Basin	431	93	58	76	2755	95	451	92
Seaport	163	81	16	13	250	48	27	0
Rotary Beach	272	89	25	44	269	52	44	20
Rotary Pool	390	92	62	77	3448	96	300	88
Mt Point Surprise Beach	133	77	20	30	384	66	22	0
Mt Point Cultural Food	526	94	64	78	934	86	177	80
Herring Cove	464	93	69	80	2595	95	167	79

[1]Excluding confluent growth

Ketchikan Creek

Additional water quality sampling in Ketchikan Creek and other urban creeks is needed to have a better spatial and temporal understanding of pollutants. Future data and analyses may indicate that bacteria and other water quality parameters need to be addressed in an updated watershed plan.

IV. Management Measures

Bacteria from humans, dogs, and waterfowl are transported from land to Ketchikan's fresh and marine waters through a variety of mechanisms. Decreasing bacteria loads from land to waterways can include: 1. Increasing sewage treatment effectiveness in wastewater treatment facilities and onsite wastewater treatment systems; 2. Decreasing the amount of bacteria (feces) that are deposited on the landscape and can be washed into waterways; 3. Implementing stormwater control measures to reduce bacteria loads in runoff before it enters waterways. In addition to land-based sources of bacteria, boats and ships are also a direct source of bacteria to marine waters, and decreasing bacteria loads from these sources will be important for reducing bacteria loads at beaches.

The following section outlines specific management measures that can be taken to reduce bacteria concentrations at area beaches and in Ketchikan Creek. Most of the following potential management measures are voluntary. ***Non-voluntary measures (those required by permit, regulations, etc.) are italicized.***

Additional education and outreach efforts will be important for reaching load reduction goals and are described in Section IX. Education and Outreach.

Increase sewage treatment effectiveness

Charcoal Point sewer system and WWTF

- Continue to identify properties within city limits that are not connected to the sewer system or have faulty connections and upgrade infrastructure.
- Continue the city's private cost recovery grant program to support landowners.
- Continue to identify deficiencies in the sewer system and repair.
- Continue to explore options to chemically disinfect wastewater that are compatible with the current infrastructure and permit limits.
- Continue to work with the Alaska Marine Highway and cruise ships to manage the timing of emergency pump-outs into the wastewater treatment system and avoid upsets.
- Purchase mobile generators as backup power for pumps.
- Eliminate all bypasses that allow raw wastewater to be discharged to surface waters.
- Conduct a feasibility study to identify options and costs for upgrading the treatment plant to secondary/tertiary treatment.
- Upgrade the WWTF to secondary/tertiary treatment system.

Mountain Point sewer system and WWTF

- Maintain new infrastructure and manage increased inputs from the recent connection to Forest Park and Saxman areas.
- Consider connecting the Herring Cove area.

Other Onsite Wastewater Treatment Systems with marine outfalls

- *Underperforming permitted WWTF operators should conduct needed maintenance and operate facilities according to best management practices to increase treatment and comply with existing permit effluent limits. (non-voluntary)*
- ADEC should continue to engage underperforming permittees to offer processes and objectives for WWTF system upgrades.
- Add disinfection component to Waterfall WWTF outfall.
- Develop implementation strategy for ADEC's General Permit AKG575000 for common collector systems. This general permit is to ensure that all common collector systems, those currently permitted and those that have gone unpermitted for many years, be held to equal standards and meet long-standing regulations aimed at protecting human health and the environment.
- Develop municipal code that requires treatment at common collector systems, which includes disinfection at a minimum.
- Conduct a feasibility study to evaluate WWTF capacities with the goal of extending municipal sewer service lines to unserved communities.

Onsite wastewater treatment systems with soil absorption systems

- Continue the Borough pump-out program.
- Update 18 AAC 72 to require at Time of Title Transfer adequacy inspection of OWTSs to collect information on system efficacy and catch systems that may have been installed without approval or do not meet standards.

Decrease direct inputs of untreated bacteria to the landscape

Pet Waste

- Continue to provide doggie bag dispensers and garbage cans at docks, parks, and areas with high pedestrian traffic in the city, in conjunction with an education campaign.

Human Waste

- Increase the availability of public restrooms, especially in the downtown area for use by tourists and those experiencing homelessness. Several options have been outlined by the Ketchikan Tourism Coalition (Appendix E. Downtown Public Restrooms Proposal).
- Maintain/construct restrooms at high-use parks. Keep restrooms clean and useable. South Point Higgins is a priority site for new restrooms.
- Feasibility study for homeless shelter.
- Construct and operate homeless shelter.

Implement stormwater control measures

Long sedimentation/retention times are needed to effectively remove bacteria, which is primarily associated with fine particles (Tilman et al., 2011), so implementing stormwater control measures that are size-appropriate will be difficult in the densely developed and relatively steep lower Ketchikan Creek watershed. Additionally, research has shown that many traditional stormwater control measures such as retention basins and bioswales that are designed to reduce sediment, metals and nutrients can be highly (and unpredictably) variable in their effectiveness at removing bacteria, and in some cases may lead to increases in bacteria by attracting wildlife (Clary et al., 2008). Given these challenges (and the cost of installing and maintaining stormwater BMPs), it is not currently recommended to pursue stormwater BMPs for bacteria load reduction in lower Ketchikan Creek as a high priority management action. Future iterations of this plan that address additional stormwater pollutants may indicate a strong need for stormwater control measures. In the meantime, the following recommendations are offered to help assess and protect the riparian corridor:

- Ketchikan Creek riparian condition assessment to characterize development and natural land within e.g., 25 and 50 feet of the stream to identify potential locations for stormwater measures.
- Consider a stream side set-back ordinance designed to retain the natural vegetation that would apply to future (re)development.

Reduce bacteria from boats and ships

Smaller boats and ferries in harbors and at sea

- *Boat owners and AMSH to ensure Type II MSDs are installed and properly functioning under existing regulations and requirements. (non-voluntary)*
- Maintain/install pump-outs at harbors/marinas.
- Continue to evict boats caught dumping in harbors.
- Develop a program requiring proof of frequent pump-outs for live aboard vessels to remain in the harbor. Under city code 14.20.100(a): "…The harbormaster shall have the right to require owners of live aboard vessels to demonstrate and/or document regular, legal off-loading of waste."
- Pledge and seek certification from the Alaska Clean Harbors Program.
- AMSH to continue implementing a 'No Discharge Zone' from the south boundary of Gravina Point/Mountain Point to the north boundary of South of Guard Island, including while in port.

Large cruise ships

- *Large cruise ships to maintain functioning advanced wastewater treatment systems. (non-voluntary)*
- Continue to ensure wastewater treatment systems are functioning before ships enter Alaskan waters.
- Conduct compliance monitoring in Ketchikan (not just Juneau).

- Work with cruise ships to voluntarily limit or eliminate discharge in the Tongass Narrows.
- Introduce a no discharge zone that includes the Tongass Narrows into a future Commercial Passenger Vessel General Permit.

Increase flushing and dilution

Increase the tidal flushing frequency in Rotary Park Pool. Currently, the pool is flushed only at very high tides. Repair and open tidal gates more frequently, especially during extended warm periods, which are conducive to in situ bacterial growth, or following heavy rains that flush bacteria from the landscape to the beach.

Information gaps/needs to help prioritize management strategies:

- VirtualBeach modeling will help identify environmental conditions and other variables associated with high bacteria concentrations at the various beaches. This information may provide more insights into likely sources and could help predict when concentrations will be high (and thus when the public should take more precautions).
- Edge of mixing zone compliance monitoring data for WWTFs is important for understanding the potential for outfalls to be sources of bacteria to surrounding beaches. Permitting agencies (US EPA, ADEC) were only able to provide data for Charcoal Point and Mountain Point WWTFs. No mixing zone data was available for any other WWTF with a permitted mixing zone. Ultimately the permittees themselves may become a go-to source for this data.
- Although it would be logistically and politically difficult to obtain, locations of and effluent bacteria concentration data from non-permitted outfalls would provide insights into how important it will be for ADEC to pursue permitting (and compliance) for all common collectors, and/or how aggressive the Borough/ADEC might need to be in requiring treatment system upgrades.
- Information about the efficacy of onsite septic soil absorption systems in the Ketchikan area would provide insights into how important these systems might be as nonpoint source of bacteria to beaches, and how aggressive the Borough may need to be in working with property owners to address issues.
- Information about the physical mixing and transport of Charcoal Point effluent is needed to understand the potential for the WWTF to contribute to elevated bacteria concentrations at beaches.
- Monitoring of effluent from large cruise ships and smaller vessels with wastewater treatment BMPs should occur more regularly in Ketchikan (most compliance monitoring has been in Juneau). R&M Engineering is a local laboratory that could analyze bacteria samples.
- Investigate any effluent monitoring data from commercial non-cruise vessels – US Coast Guard vessels, fish processors, barges, contractor activities, docked vessels in the Ketchikan shipyard, etc.
- Additional water quality monitoring in urban creeks for bacteria and other stormwater pollutants.

Management Strategies by Site

Table 9. Management strategies most important to water quality improvement at each site

Site	Relevant Management Measures[1]
Knudson Cove	Better pet waste management; improve effectiveness of nearby OWTSs, especially those with marine outfalls; limit dumping in the harbor
Beacon Hill	Improve effectiveness of nearby OWTSs, especially those with marine outfalls
South Point Higgins	Install public restroom; better pet waste management, improve effectiveness of nearby OWTSs, especially those with marine outfalls
Shull	Better pet waste management; improve effectiveness of nearby OWTSs, especially those with marine outfalls
Sunset	Install public restroom; better pet waste management, improve effectiveness of nearby OWTSs, especially those with marine outfalls
South Refuge Cove	Better pet waste management; improve effectiveness of nearby OWTSs, especially those with marine outfalls
Thomas Basin	Increase use of pump out; better pet waste management; improve on-site and downtown restroom access/usability; address any sewer system deficiencies in Ketchikan Creek watershed, but especially along lower Ketchikan Creek and in the intertidal area.
Seaport	Address any sewer system deficiencies; better pet waste management; reduce dumping in the harbor; increase effectiveness of Charcoal Point WWTF
Rotary Beach	Address any sewer system deficiencies; better pet waste management; increase effectiveness of Charcoal Point WWTF
Rotary Pool	Repair tide gate and increase tidal flushing frequency; address any sewer system deficiencies; better pet waste management
Mt Point Surprise Beach	Address any sewer system deficiencies; increase effectiveness of Mountain Point WWTF
Mt Point Cultural Food	Reduce illicit camping; address any sewer system deficiencies; increase effectiveness of Mountain Point WWTF; better pet waste management
Herring Cove	Improve effectiveness of nearby OWTSs, especially those with marine outfalls; better pet waste management
Ketchikan Creek	Reduce pet waste inputs; reduce direct human waste inputs; address any sewer system deficiencies

[1] Limiting discharge by cruise ships and ferries in the Tongass Narrows and improving small cruise ship/ferry/private boat treatment system effectiveness/compliance applies to all sites except for Ketchikan Creek.

V. Implementation Schedule

Table 10 outlines a schedule for management and outreach and education actions over the next 10 years. Currently, the stakeholders agreed that the highest priority sites are Thomas Basin, Rotary Park Beach and Pool and South Point Higgins based on a combination of high use and/or chronically elevated bacteria concentrations. In addition to actions specific to those sites, relatively inexpensive actions with the potential to benefit many sites are also prioritized, and other actions that are already planned (e.g., in the Borough Capital Plan) are included on schedule. Importantly, this is a "working" schedule and implementation timing is subject to change with new information, funding, regulations, etc.

Table 10. Implementation Schedule. Some management options are one-time actions (although there may be continuing maintenance); others are ongoing programs or activities, which is noted in the "Type of Action" column.

Year	Management and Education Actions	Type of Action
2021	Develop a stakeholder working group to pursue the implementation of education and management actions	Initiate
	Install pump-out at Bar Harbor South (currently funded by ADFG)	One time
	Off-season sampling	Potentially continuing
	Repair tidal gates and increase flushing frequency in Rotary Park Pool	Initiate
	Community-wide education campaign about risk associated with high fecal bacteria concentrations, and steps that can be taken to mitigate it	Continuing
	Explore implementing a proof-of-pump-out program for the harbors	Initiate
	Ensure large and small cruise ships' and ferries' wastewater treatment systems are functioning prior to entering AK waters	Continuing
	Virtual Beach modeling	Continuing
	Signage at all beaches about advisories during recreation season	Continuing
	City and Borough sewer line maintenance	Continuing
	Private sewer infrastructure improvement with city's grant program	Continuing
	Borough OWTS pump-out program	Continuing
	Work with AMHS and cruise ships to limit discharge in Tongass Narrows	Continuing
	Educate/Fine/Evict boats from harbors caught dumping instead of pumping	Continuing
	Permit compliance for OWTSs – develop and implement improvement plans where needed	Continuing
2022	Evaluate effectiveness of 2014 OWTS maintenance education campaign and ordinance update. Decide if another round is needed, and how it could be improved	One time
	Outhouse construction at S. Point Higgins beach (in Capital Plan for 2022)	One-time
	Update 18 AAC 72 to require at Time of Title Transfer adequacy inspection of onsite systems to collect information on system efficacy and catch systems that may have been installed without approval or do not meet standards	One time

Year	Management and Education Actions	Type of Action
2022 cont.	Consider/approve a stream-side setback ordinance that would apply to future (re)development	One time
	Introduce a no discharge zone that includes the Tongass Narrows into a future Commercial Passenger Vessel General Permit	One time
	Develop implementation strategy for ADEC's General Permit AKG575000 for common collector systems.	Continuing
	Develop municipal code that requires treatment at common collector systems, which includes disinfection at a minimum.	One time
	Conduct a feasibility study to evaluate WWTF capacities with the goal of extending municipal sewer service lines to unserved communities.	One time
	Education campaign at Thomas Basin (and other harbors) to encourage use of pump-outs	Continuing
	Community-wide education campaign about pet waste	Continuing
	Conduct cruise ship compliance monitoring in Ketchikan (not just Juneau)	Initiate
	Implement downtown public restroom access strategies	Initiate
	Include a no-dumping recommendation for the Tongass Narrows in the Tongass Narrows Waterway Guide	Initiate
	Implement proof-of-pump-out program at harbors	Initiate
	Install and maintain doggy doo bag stations at strategic locations	Initiate
	Continuing actions	Continuing
2023	Develop implementation strategy for ADEC's General Permit AKG575000 for common collector systems.	Continuing
	Ketchikan Creek riparian condition assessment and recommendations for stormwater control measures	One-time
	Add disinfection component to Waterfall WWTF outfall	One-time
	Borough-wide OWTS maintenance education campaign	Continuing
	Continuing actions	Continuing
2024-25	Install educational kiosks at pump-out stations and ferry terminal	One-time
	Purchase mobile generators as backup power for pumps	One-time
	Conduct feasibility study for Charcoal Point WWTF upgrade	One-time
	Explore options for homeless shelter/transitional housing with City Assembly, relevant NGOs, etc.	Initiate
	Pledge and seek certification from the Alaska Clean Harbors Program	Continuing
	Continuing actions	Continuing
2026-30	Construct homeless shelter	One-time (with ongoing services)
	Eliminate all bypasses in municipal sewer systems that allow raw wastewater to be discharged to surface waters	Initiate
	Continuing actions	Continuing
2031+	Upgrade Charcoal Point WWTF	One-time

VI. Milestones

Table 11. Milestones provide a timeline for measurable progress on management strategies and water quality goals.

Indicator	Year 2025 Interim Target	Year 2030 Interim Target	Year 2035 Target
Percent of enterococci samples from each beach that exceed water quality criteria related to primary contact recreation (130 CFU/100 ml)	< 20%,	< 10%	< 10%
Percent of fecal coliform samples from each beach that exceed water quality criteria related to raw shellfish harvest (31 CFU/100 ml)	< 40%	< 25%	< 10%
Participation in Borough septic pump out program by eligible landowners	80%	90%	95%
Percent of permitted marine outfalls' compliance samples meeting permit limits for fecal coliform	70%	80%	90%
Community education campaigns completed	5	5	5

VII. Criteria to assess Progress

Table 12. Criteria to assess progress towards milestones.

Indicator	Criteria for assessing progress
Percent of enterococci samples from each beach that exceed water quality criteria related to primary contact recreation (130 /100 ml)	Concentration of enterococci in grab samples from 12 beaches (see Figure 2; all beaches except for Beacon Hill).
Percent of fecal coliform samples from each beach that exceed water quality criteria related to raw shellfish harvest (31 CFU/100 ml)	Concentration of fecal coliform in grab samples from 12 beaches (see Figure 2; all beaches except for Beacon Hill).
Participation in Borough septic pump out program by eligible landowners	Fraction of known landowners with a septic system participating in the pump out program over a 3-year period.
Percent of permitted marine outfalls' compliance samples meeting permit limits for fecal coliform	Percent of compliance samples for fecal coliform from locations in Table 5 that meet permit limits.
Community education campaigns completed	Number of funded and completed (including publicly released report about number of people reached, lessons learned, etc.) education campaigns.

VIII. Monitoring

Table 13. Monitoring for milestones.

Indicator	Monitoring Approach
Percent of enterococci samples from each beach that exceed water quality criteria related to primary contact recreation (130 CFU/100 ml)	Limited beach monitoring during recreation seasons: Analyze at least 1 sample for enterococci and one for fecal coliform from each beach in Figure 2 (except Beacon Hill) per month to assess whether beaches are meeting water quality criteria and to validate the VirtualBeach model.
Percent of fecal coliform samples from each beach that exceed water quality criteria related to raw shellfish harvest (31 CFU/100 ml)	
Participation in Borough septic pump out program by eligible landowners	Track participation in the pump out program and calculate percent participation over the past three years (the recommended maximum time between pump outs) each year.
Percent of permitted marine outfalls' compliance samples meeting permit limits for fecal coliform	Download compliance data from the ECHO database for the locations in Table 5 at the end of each year and assess the percent of samples from each outfall that meet permit requirements.
Community education campaigns completed	Track the number of community education campaigns completed.
Develop more comprehensive monitoring program, as needed.	Develop more comprehensive monitoring program to evaluate whether the load reduction milestones are being met.

Additional monitoring to improve understanding of the problem:

- Monitor beaches for fecal coliform and enterococci (and possibly MST) outside of the recreation season to help identify bacteria sources.
- Use previously collected bacteria monitoring data, weather data and tide data to develop a model (VirtualBeach) that can be used to predict when bacteria concentrations would be elevated.
- Monitor large and small cruise ship effluent for enterococci in Ketchikan.
- Continue monitoring creeks to better characterize any stormwater pollution issues in freshwater.

IX. Education and Outreach

To increase awareness and understanding of the bacteria issues at beaches:

- Educate the community on how to mitigate risk when coming into contact with water that may be contaminated (e.g., avoid getting it in mouth, wash afterwards, clean and thoroughly cook fish, etc.) through newspaper stories, public service announcements on the radio, and/or permanent signs.
- Educate the community on the possible sources of bacteria through newspaper and radio stories, public meetings, etc.
- Consider reporting cruise ship compliance monitoring data as it is received, possibly along with beach monitoring data.
- Improve communication around beach data and advisories:
    - Provide signage at beaches for advisories – possibly with QR code that directs to ADEC Ketchikan Beaches webpage and Facebook page for current results.
    - Utilize non-internet methods to share results – radio public service announcements, weekly community billboard postings, etc.
- Improve signage and education about where marine outfalls are and what kinds of activities should be avoided there (e.g., Mountain Point Cultural Food, Herring Cove).

To enhance sewage treatment effectiveness:

- Develop and carry out a communication and engagement strategy for the community to educate the population about how upgrades to existing private treatment systems (which do not require permits) can reduce bacteria impacts to local waters.
- Increase awareness of resources that are available to address private infrastructure issues – e.g., the city's cost recovery grant program.
- Evaluate the effectiveness of the 2014 education campaign and updated ordinance and identify potential ways to improve. Past education materials are available online.
- Conduct a follow-up septic system maintenance education campaign.
- Engage underperforming permittees to offer processes and objectives for WWTF system upgrades.
- Explain to property owners the impacts that AKG575000 for common collector systems would have on existing systems. This general permit is to ensure that all common collector systems, those currently permitted and those that have gone unpermitted for many years, be held to equal standards and meet long-standing regulations aimed at protecting human health and the environment. Appendix F. General Permit AKG575000 FAQ includes an FAQ page.
- Conduct another public education campaign on proper OWTS maintenance.

To decrease direct inputs of untreated waste to the landscape:

- Conduct a public education campaign to increase awareness of the impacts of not properly disposing of pet waste.

To reduce bacteria released from boats and ships:

- Conduct a public education campaign about pumping out untreated wastewater from boats.

- Add attractive, educational kiosks to pump out stations encouraging use and at ferry terminal with the theme of “keeping Ketchikan’s waters clean.”
- ADEC to continue sending out annual reminders to boaters that dumping untreated sewage within three nautical miles of land is prohibited.
- Include a section in the Tongass Narrows Waterway Guide (produced by the Tongass Narrows Working Group and distributed by Southeast Alaska Pilot’s Association) that discourages wastewater dumping/discharges in the Tongass Narrows.

X. Technical and Financial Resources Needed

Table 14. Management measures and associated lead organization, cost estimate, and technical and financial resources. Estimated cost categories:
$ = < $5,000
$$ = $5,000 - $25,000
$$$ = $25,000 - $100,000
$$$$ = >$100,000

Management Measure	Potential Lead Organization	Estimated Cost/Funding Sources	Technical Resources Needed	Other social, political, etc. obstacles or opportunities
Private sewer infrastructure improvements	City Public Works	$$$ City budget (including Cost Recovery Grant Program), State Revolving Fund (beginning 2022)	City Public Works internal expertise	The City has been able to leverage the Alaska Alcohol and Marijuana Control Office to help with enforcement in some cases.
Public sewer line improvements – sewer main and manhole repair/ replacement, upgrade sewer laterals	City Public Works	$105K/year Currently included in annual capital improvement program	City Public Works internal expertise	
Chemical disinfection at Charcoal WWTF	City Public Works	$$$$	City Public Works and outside expertise	
Purchase mobile generators as backup power for pumps	City Public Works	$150K City budget, climate resilience grant		
Feasibility study for upgrading Charcoal WWTF	City Public Works or City Assembly	$$$ State Revolving Fund (Alaska Clean Water Fund)	Outside engineering and design- e.g., DOWL HKM	
Upgrade Charcoal Point WWTF	City Public Works	$$$$ State Revolving Fund (Alaska Clean Water Fund), federal infrastructure dollars, bonds	Outside engineering and design, construction	

Management Measure	Potential Lead Organization	Estimated Cost/Funding Sources	Technical Resources Needed	Other social, political, etc. obstacles or opportunities
Install pump-out at Bar Harbor South	City Port and Harbors	$50K Alaska Dept of Fish and Game		
Develop implementation strategy for General Permit AKG575000 for common collector systems.	ADEC	$$ (50-100 staff hours) State budget		Public comments and engagement expected
Evaluate effectiveness of 2014 OWTS maintenance education campaign	Borough Public Works, NGO	$		
Conduct follow-up OWTS maintenance education campaign	Borough Public Works, NGO	$$		
Continue borough pump-out program	Borough Public Works	~$80K/year User-fee funded		This is a well-functioning program
Public education campaign on pet waste	NGO	$$		
Install and maintain doggie bag dispensers and garbage cans	City properties, Borough Parks Department	$$ Existing funding in Borough budget for Borough parks and playgrounds		Increased public engagement recommended
Increase availability of public restrooms in downtown area	City Assembly	$1.6M over 10 years Commercial passenger vessel head tax, city budget		The Ketchikan Tourism Coalition has proposed a series of options (Appendix E)
Construct restroom at South Point Higgins	Borough Parks Department	$200,000 Recreation Capital Improvement Project funds		
Feasibility study for homeless shelter	City Assembly	$$$$ Grants, city budget	Outside expertise (e.g., Juneau Housing First Collaborative)	

Management Measure	Potential Lead Organization	Estimated Cost/Funding Sources	Technical Resources Needed	Other social, political, etc. obstacles or opportunities
Construct homeless shelter	City, NGO	$$$$ Grants, bonds, city budget	Outside expertise (e.g., Juneau Housing First Collaborative)	
Educational kiosks at pump-out stations	City Port and Harbors	$ ADEC, Alaska Clean Waters Actions		
Public education campaign about pumping out at harbors	NGO	~$7,000 Alaska Clean Harbors Grant (ADEC, Alaska Clean Waters Actions)		Public comments and engagement expected
Evict boats caught dumping	City Port and Harbors	Existing part of City Port and Harbors staff duties		
Require proof of frequent pump-outs for live-aboards to remain in the harbor	City Port and Harbors	$$ City budget		Increased public engagement recommended
Pledge and seek certification from Alaska Clean Harbors Program	City Port and Harbors	$$		Most items on the Clean Harbors checklist are already being met, but some are still being considered on how to implement e.g., limiting discharge from hull maintenance/ sanding
Conduct cruise ship compliance monitoring in Ketchikan	ADEC Cruise Ship Program	Costs should not increase significantly over current compliance monitoring	R&M Engineering can analyze samples in Ketchikan	
Work with cruise ships to limit or eliminate discharge in the Tongass Narrows	ADEC Cruise Ship Program	$ ADEC staff time/state budget		
Increase tidal flushing frequency in Rotary Park Pool	Borough Parks Department	$$$		

Management Measure	Potential Lead Organization	Estimated Cost/Funding Sources	Technical Resources Needed	Other social, political, etc. obstacles or opportunities
Community education campaign on risk mitigation related to bacteria exposure	NGO	$		
Improve communication about beach data and advisories, including signage	ADEC, City, Borough, DNR	$		

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Appendix A. Alaska Water Quality Standards

Water Quality Standards for Designated Uses	
POLLUTANT & WATER USE	**CRITERIA**
(2) BACTERIA, FOR FRESH WATER USES (See note 1)	
(A) Water Supply (i) drinking, culinary, and food processing	In a 30-day period, the geometric mean may not exceed 20 fecal coliform/100 ml, and not more than 10% of the samples may exceed 40 fecal coliform/100 ml. For groundwater, the fecal coliform concentration must be less than 1 fecal coliform/100 ml, using the fecal coliform Membrane Filter Technique, or less than 3 fecal coliform/100 ml, using the fecal coliform most probable number (MPN) technique.
(A) Water Supply (ii) agriculture, including irrigation and stock watering	In a 30-day period, the geometric mean of samples may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply, (2)(A)(i), apply.
(A) Water Supply (iii) aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml. For products not normally cooked, the criteria for drinking water supply, (2)(A)(i), apply.
(A) Water Supply (iv) industrial	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml.
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 126 *Escherichia coli (E. coli)* colony forming units (CFU)/ 100ml, and not more than 10% of the samples may exceed a statistical threshold value (STV) of 410 *E. coli* CFU/100 ml.
(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 fecal coliform/100 ml, and not more than 10% of the total samples may exceed 400 fecal coliform/100 ml.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.

Water Quality Standards for Designated Uses	
POLLUTANT & WATER USE	**CRITERIA**
(14) BACTERIA, FOR MARINE WATER USES, (see note 1)	
(A) Water Supply (i) aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml. For products not normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 20 fecal coliform/100 ml, and not more than 10% of the samples may exceed 40 fecal coliform/100 ml.
(A) Water Supply (ii) seafood processing	In a 30-day period, the geometric mean of samples may not exceed 20 fecal coliform/100 ml, and not more than 10% of the samples may exceed 40 fecal coliform/100 ml.
(A) Water Supply (iii) industrial	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml.
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 35 enterococci CFU/100 ml, and not more than 10% of the samples may exceed a statistical threshold value (STV) of 130 enterococci CFU/100 ml.
(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 fecal coliform/100ml, and not more than 10% of the samples may exceed 400 fecal coliform/100ml.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.
(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life	The geometric mean of samples may not exceed 14 fecal coliform/100 ml; and not more than 10% of the samples may exceed; - 43 MPN per 100 ml for a five-tube decimal dilution test; - 49 MPN per 100 ml for a three-tube decimal dilution test; - 28 MPN per 100 ml for a twelve-tube single dilution test; - 31 CFU per 100 ml for a membrane filtration test (see note 14).

Appendix B. Beach water quality data summary

Table B1. Summary of fecal coliform bacteria results for 2017 through 2020.

Monitoring Locations	Total Samples	Maximum				% Exceedances				Geometric Mean			
		2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
Knudson Cove	63	**200**	**144**	**456**	**202**	**33**	**22**	**44**	**33**	**20**	13	**22**	**22**
Beacon Hill	27	**58**	**66**	--[3]	--	**11**	**17**	--	--	10	12	--	--
South Point Higgins Beach	63	**161**	**236**	**187**	**437**	**22**	**39**	**50**	**61**	7	**21**	**35**	**34**
Beach at Shull Road	63	**167**	**132**	**276**	**2001**	**22**	**28**	**39**	**50**	**15**	**20**	**19**	**34**
Beach at Sunset Drive	63	**142**	**93**	**196**	**300**	**33**	**33**	**28**	**28**	**15**	**20**	**21**	**22**
South Refuge Cove	63	**69**	**88**	**184**	**44**	**11**	**33**	**22**	**17**	12	**17**	**15**	10
Thomas Basin Harbor	63	**CG**[2] (>250)	**CG** (>250)	**431**	**324**	**33**	**44**	**61**	**56**	**14**	**28**	**38**	**58**
Seaport Beach	63	**CG** (>250)	**63**	**163**	**152**	**33**	**17**	**22**	**17**	**16**	7	11	11
Rotary Park Beach	43	--	26	**272**	**60**	--	0	**39**	**17**	--	9	**25**	**15**
Rotary Park Pool	56	**200**	**169**	**390**	**CG** (2001)	**33**	**45**	**33**	**61**	**24**	**20**	**20**	**62**
Mountain Point Surprise Beach	43	--	23	**133**	**106**	--	0	**33**	**22**	--	7	**20**	**17**
Mountain Point Cultural Food	47	--	**118**	**526**	**406**	--	**45**	**67**	**39**	--	**17**	**64**	**29**
Herring Cove	54	--	**318**	**386**	**464**	--	**72**	**61**	**78**	--	**47**	**44**	**69**

[1] Bold red font indicates exceedance of criteria 18AAC70 (14) (D) Harvesting – – maximum result, over 10% of samples exceedance, and seasonal geometric mean for each recreation year monitored.

[2] CG – confluent growth. The 2017/2018 data used 250 CFU/100 ml as a proxy value for confluent growth. Based on updated guidance, 2001 CFU/100 ml was used for 2019/2020 data (Julianne Ruffner, WA State Dept. of Ecology, personal communication, Nov 5, 2018).

[3] '--' not tested, not part of sampling plan that year

Table B2. Summary of enterococci bacteria results for 2017 through 2020

Monitoring Locations	Total Samples	Maximum				% Exceedances				Max Geometric Mean			
		2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
Knudson Cove	63	**1986**[1]	**2603**	**369**	97	**22**	**17**	**11**	0	**50**	**54**	**39**	19
Beacon Hill	27	**579**	**183**	--[2]	--	**11**	6	--	--	**45**	21	--	--
South Point Higgins Beach	63	**161**	**410**	130	**2235**	**11**	**33**	0	**17**	**41**	**70**	23	**90**
Beach at Shull Road	63	125	**754**	**727**	**160**	0	**17**	**17**	6	**44**	**49**	**37**	20
Beach at Sunset Drive	63	**248**	**410**	130	**231**	**11**	**33**	0	6	32	**70**	23	**56**
South Refuge Cove	63	**1300**	97	**3448**	41	**11**	0	6	0	33	27	27	13
Thomas Basin Harbor	63	**2420**	**2755**	**1024**	**620**	**33**	**28**	**33**	**11**	**62**	**451**	**133**	**83**
Seaport Beach	63	**250**	52	**173**	**152**	**33**	0	6	6	27	12	9	19
Rotary Park Beach	43	--	10	**269**	**192**	--	0	**11**	6	--	8	**44**	18
Rotary Park Pool	56	**1120**	**1454**	**2851**	**3448**	**44**	**27**	**17**	**28**	**300**	**71**	**71**	**161**
Mountain Point Surprise Beach	43	--	51	**384**	41	--	7	6	0	--	8	22	13
Mountain Point Cultural Food	47	**--**	**414**	**934**	**144**	--	**18**	**28**	6	--	**43**	**177**	**67**
Herring Cove	53	**--**	**457**	**2595**	**706**	--	**22**	**33**	**28**	--	**70**	**23**	**167**

[1] Bold red font indicates exceedance of criteria 18AAC70 (14) (B) (i) Contact Recreation – maximum result, over 10% of samples exceedance, and maximum of rolling geometric mean for each recreation year monitored.

[2]'--' not tested, not part of sampling plan that year

Table B3: Non-recreational season beach sampling bacteria results

	2020-21 Ketchikan Off-Season Bacteria Monitoring - Analytical Data Results																							
	Knudson Cove		S Pt Higgins		Shull		Sunset		S Refuge Cove		Thomas Basin		Seaport		Rotary Pool		Rotary Beach		Point Cultural		Point Surprise Beach		Herring Cove	
Sample Date	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter	FC	Enter
3/16/2020	1	<10	2	<10	3	<10	<1	<10	<1	<10	3	<10	3	<10	-	-	5	<10	**147**	**299**	21	20	<1	<10
4/29/2020	18	<10	20	20	**38**	<10	**32**	<10	7	<10	**74**	20	26	20	27	<10	5	<10	23	<10	**62**	<10	12	<10
5/7/2020	8	**134**	9	<10	**69**	**305**	**>200**	10	4	10	31	10	6	10	25	<10	15	<10	18	<10	**38**	10	**122**	<10
10/19/2020	18	<10	22	10	18	10	15	<10	18	52	26	10	3	41	**32**	52	5	<10	**84**	**142**	27	31	9	<10
11/4/2020	18	<10	20	<10	10	20	**38**	20	21	31	**42**	10	6	20	**95**	20	20	<10	15	31	14	<10	17	31
12/7/2020	3	<10	12	10	6	10	22	63	11	41	11	73	7	40	**73**	20	25	20	24	<10	15	10	6	<10
1/20/2021	**96**	<10	3	<10	6	<10	8	<10	10	10	11	10	9	<10	13	31	5	<10	**35**	74	6	<10	2	<10

18 AAC 70 Alaska Water Quality Standards (amended as of March 5, 2020) - (14) Bacteria, For Marine Water Uses		
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 35 enterococci CFU/100 ml, and not more than 10% of the samples may exceed a STV of 130 enterococci CFU/100 ml.	
(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml.	
(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life (most stringent)	The geometric mean of samples may not exceed 14 fecal coliform/100 ml; and not more than 10% of the samples may exceed; 31 CFU per 100 ml for a membrane filtration test.	
FC = fecal coliform bacteria	Tides focus is on either side of low tide, using ebb and flow stages	
Entero = enterococci	STV - statistical threshold value	MPN - most probable number

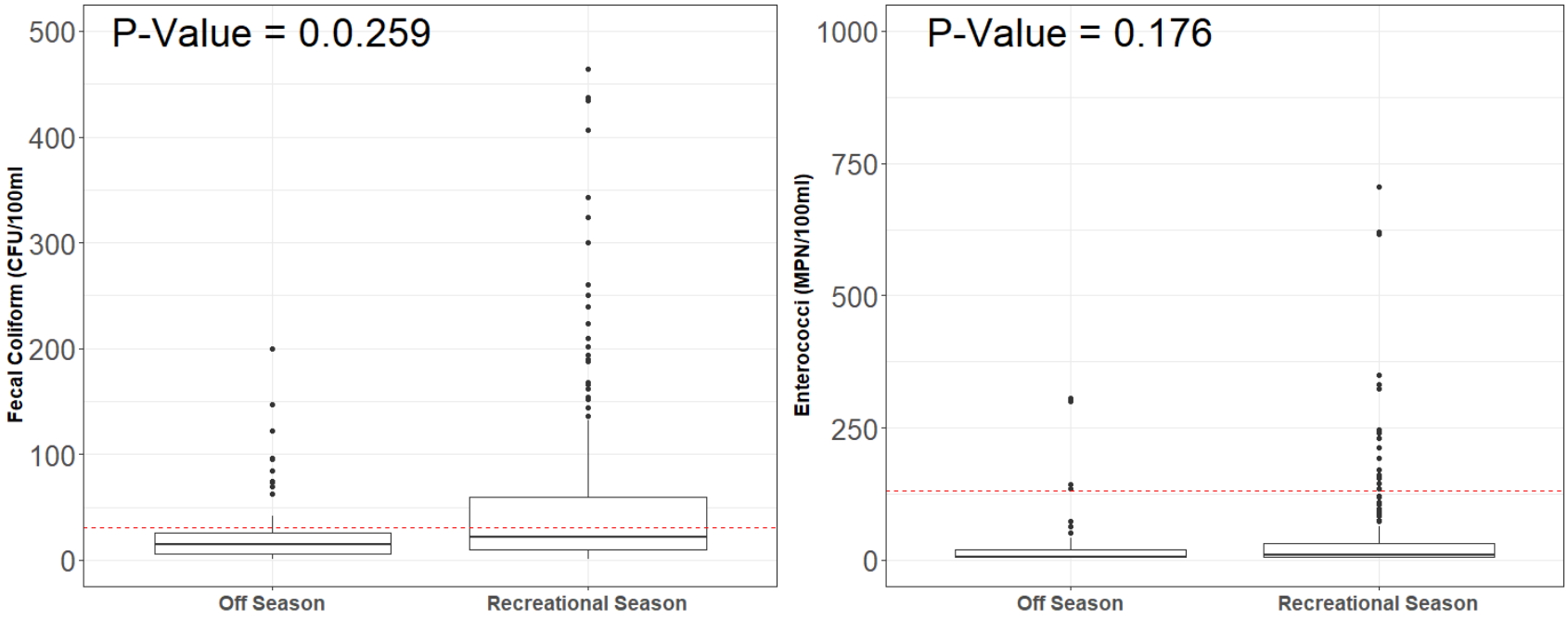


Figure B1: Comparison of off-season and recreational season bacteria levels. Fecal coliform y-axis was limited to 500 for graphing, excluding one point at 2,000 CFU/100 ml (representing confluent growth). Enterococci y-axis was limited to 1,000 for graphing, excluding one point at 2,235 and one at 3,448 MPN/100 ml. Dashed red lines indicate the ADEC standard that not more than 10% of the samples may exceed.

Appendix C: Ketchikan Creek Bacteria Data

Fecal coliform:

Table C1. Fecal coliform concentration and water quality criteria exceedance summaries for Ketchikan Lake and Creek sites. Data for screening purposes only, not regulatory.

						Proportion of sample dates exceeding drinking water standards	
Sampling Site	**mean**	**median**	**min**	**max**	**n**	Not more than 10% > 40 CFU/100 ml in 30 days	30-day geomean may not exceed 20 CFU/100 ml
Ketchikan Lake	205.1	0.5	0.5	3864	19	0.05	0
Power House	262.0	26	2	2700	14	0.43	0.80
Harris Bridge	202.7	44	12	1428	15	0.60	1.00
Museum	131.6	50	0.5	1300	38	0.55	0.90

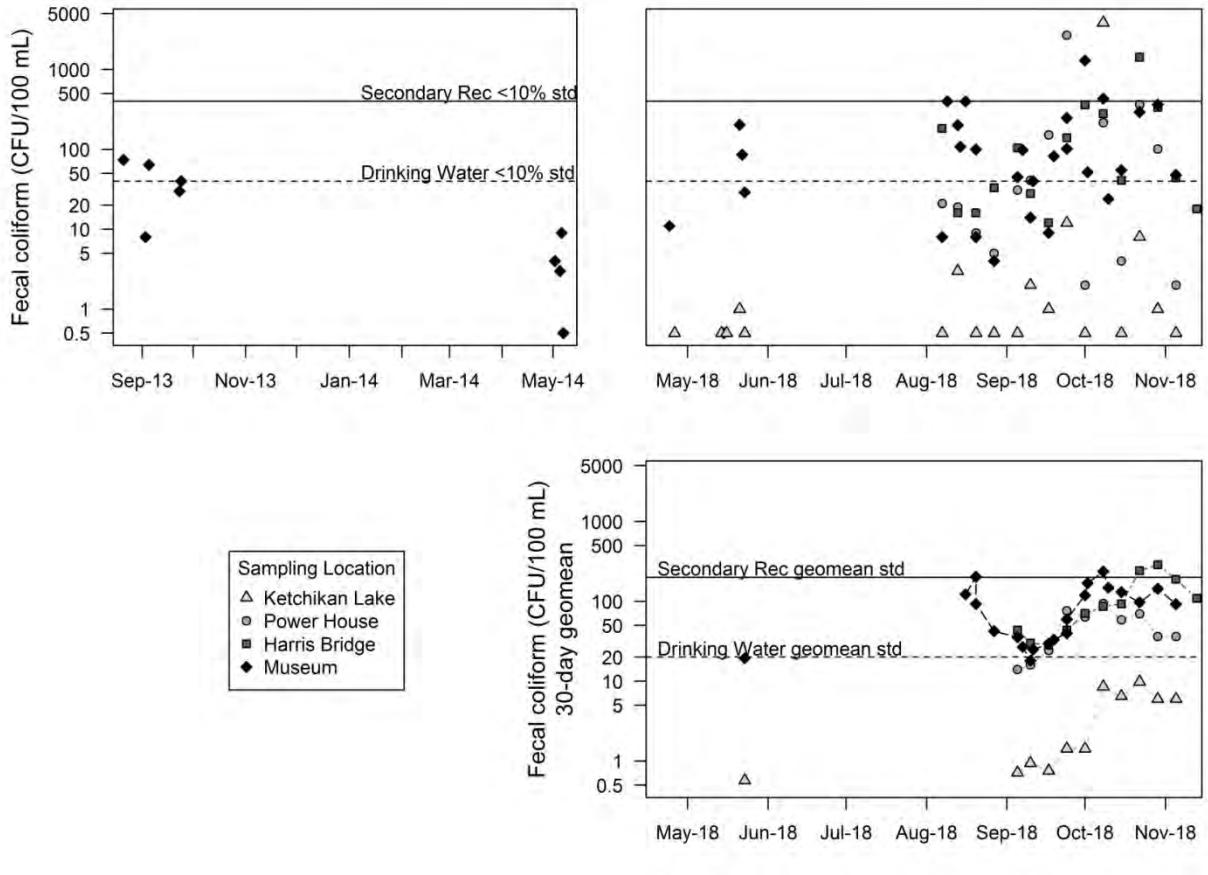


Figure C1. Fecal coliform concentrations in Ketchikan Creek from 2013-2018 (top panels) and 30-day rolling geometric means (with at least 5 samples per 30-day period) in 2018 (bottom panel). The horizontal lines indicate relevant water quality criteria.

E. coli

Table C2. E. coli concentration and water quality criteria exceedance summaries for Ketchikan Lake and Creek sites.

Sampling Site	mean	median	min	max	n	Proportion of sample dates exceeding contact recreation standards: Not more than 10% may exceed 410 CFU/100 ml in 30 days	Proportion of sample dates exceeding contact recreation standards: 30-day geometric mean may not exceed 126 CFU/100 ml
Ketchikan Lake	27.5	0.5	0.5	504	19	0.05	0.00
Power House	93.9	28.5	0.5	700	14	0.07	0.00
Harris Bridge	13512.8	50	4	>200000	15	0.13	0.36
Museum	149.3	112	0.5	532	29	0.03	0.19

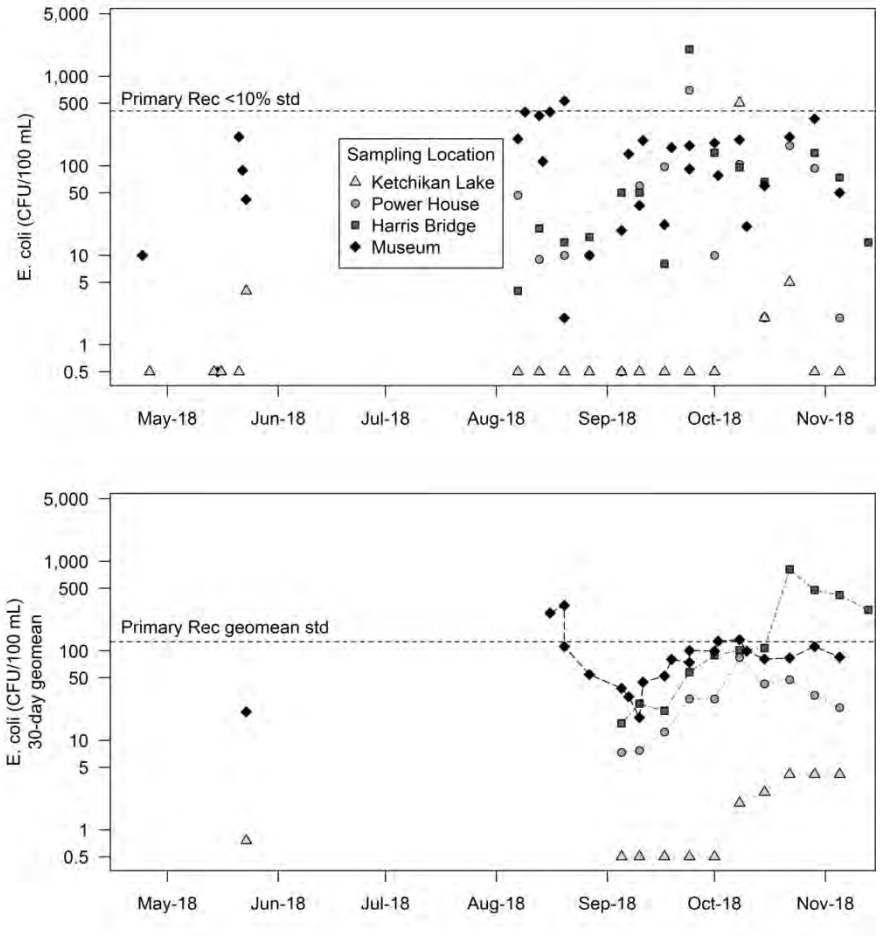


Figure C2. E. coli concentrations in Ketchikan Creek in 2018 (top panel) and 30-day rolling geometric means (with at least 5 samples per 30-day period) (bottom panel). The dotted lines indicate relevant water quality criteria.

Appendix D. Edge of Mixing Zone Data

Table D1. Charcoal Point Edge of Mixing Zone Data. Fecal coliform concentrations in CFU/100 ml.

	Location					
Date	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**
2/7/2017	0	0	1	1	2	0
5/24/2017	5	0	8	12	1	0
6/13/2017	0	0	1	0	0	0
7/25/2017	2	0	2	0	1	1
8/9/2017	1	2	2	2	1	3
10/6/2017	1	2	5	8	3	3
12/13/2017	3	1	2	6	6	0
2/12/2018	**49**	1	0	1	0	**76**
2/13/2018	4	NA	NA	NA	NA	3
2/14/2018	2	NA	NA	NA	NA	1
5/22/2018	**41**	**70**	**35**	7	13	**24**
5/23/2018	2	10	8	NA	6	2
5/24/2018	NA	0	1	NA	NA	NA
6/6/2018	3	2	1	1	0	2
7/2/2018	3	2	0	0	0	0
8/29/2018	2	2	1	2	0	**15**
8/30/2018	NA	NA	NA	NA	NA	0
9/12/2018	0	0	3	1	2	0
12/5/2018	3	5	4	8	5	4
3-14-2019	0	3	5	7	1	8
5-15-2019	0	**43**	0	5	2	0
5-16-2019	NA	10	NA	NA	NA	NA
6-6-2019	0	3	0	1	1	0
7-23-2019	0	**19**	0	1	0	0
7-24/2019	NA	**82**	NA	NA	NA	NA
7-25-2019	NA	6	NA	NA	NA	NA
8-29-2019	4	9	5	5	5	7
9-9-2019	1	1	0	2	0	0
12-5-2019	4	1	1	6	4	1
2/5/2020	1	10	7	6	4	2
5/13/2020	0	0	2	0	0	0
6/17/2020	0	1	0	0	0	0
7/21/2020	1	3	3	3	0	2
8/12/2020	3	4	0	0	0	1
9/15/2020	2	5	2	1	1	0
11/30/2020	0	2	0	0	0	0
3-2-2021	0	1	0	0	0	0

5-5-2021	0	0	0	0	0	0
6-8-2021	0	0	0	1	0	0

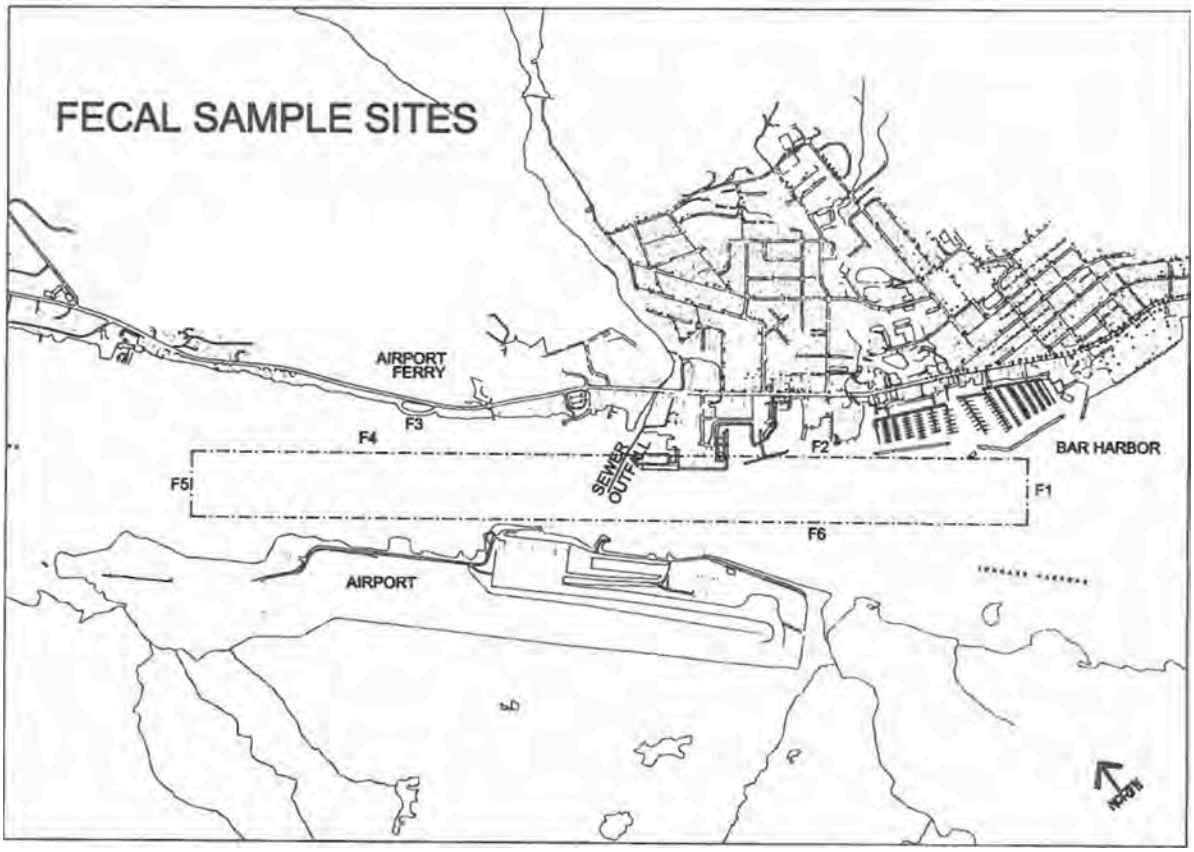


Figure D1. Charcoal Point WWTF edge of mixing zone sample sites for fecal coliform.

Table D2. Fecal coliform concentrations (CFU/100 ml) at the edge of the mixing zone (MZ) and at the shoreline within the mixing zone. The date refers to the end of the monitoring period (30 days), not the sample date, which are not reported in the quarterly/annual reports.

	Location	
Date	**3 - outside edge of MZ**	**4 - shoreline in MZ**
4/30/2016	9	3
10/31/2016	1	1
9/30/2017	11	1
6/30/2018	4	17
8/31/2020	5	7

Appendix E. Downtown Public Restrooms Proposal

The following proposal was developed by the Ketchikan Tourism Coalition:

Ketchikan Tourism Coalition

Find balance with preservation, conservation, education, recreation, tourism economic development and interpretation for the betterment of the lifestyle and natural resources of Ketchikan Gateway Borough.

Emission rise from 4 stacks clouding downtown corridor KGBAK website photo

Responsible Tourism

October 16, 2019

Cooperative Relations Committee
City of Ketchikan & Gateway Borough
Council and Assembly Members
Residents of Gateway Borough

Mary L. Stephenson Cell 907.254.2121
email: mlstephenson2017@gmail.com

SUBJECT: Public Restrooms – Seasonal and Permanent

One cannot dwell on economic development or strategy plans without including health and safety amenities in the same discussion. One cannot have a conversation about Responsible Tourism without addressing the physical needs of residents of Southeast Alaska and the floating cities that arrive each day at our docks i.e. 1.2 million visitors plus 30,550 crew members who poop and litter while exploring our island. Diverse in their social and cultural norms (behavior, values, taboos and laws); agilities and frailties, not to mention their intent to abide by or do harm to self or environment, Ketchikan has a universal challenge.

City provides 6 public restrooms: visitor center, 2 berths, 2 museums, 1 harbor master office, and City/Borough joint effort: Stedman-Thomas Basin Loo. City Hall no longer permits the public to use their restrooms. A Creek Street visitor asked for a restroom and I directed her to Stedman's LOO; when she got there it was locked and dire need no other option soiled herself; now humiliated, the family returned to the ship to clean up.

Once the tourists exit dock, private property owners are expected to carry the burden of being the good or bad host; merchants, attractions, restaurants are not always set up (due to year built and waste water system) to handle their own staff or minimal patrons. Salmon Landing 2nd floor restrooms is the closest facility to Berth 1 visitors, Spruce Mill customers and area employees; Tongass Trading Company offer customers restrooms, won't deny anyone access, however won't advertise public restrooms either. Feeling it was his obligation to offer his one and only bathroom for staff and visitors, the owner of Soaring Eagles on Main Street makes it work. Accepting his obligation, owner pays over $800 to KPU and cleaning supplies; when guests, in appreciation of his 'service to mankind', offered money he installed a donation box and all proceeds go to KIC.

Private property owners stepped up to provide tour bus parking and portable toilets for a monthly fee when the Borough fell short of public parking and restrooms while promoting economic development for Herring Cove neighborhood.

Taxpayers are paying for janitorial services and KPU bill for city-operated buildings. Humbug...Mr. Mayor you can't close City Hall restroom and then deny the business owners, who are battling a messy dilemma alone, nothing in return.

City declared $1.6 million budget for ONE restroom to be installed Federal Building lot adjacent to waterfront boardwalk. With that kind of money, City could offer willing participants a stipend toward KPU bill and cleaning service; install a couple of permanent restrooms and offer seasonal portable toilets with eclectic 'authentic charm' outhouse structure. Obviously bears get stressed out waiting thus their signature; keep for the rustic patina affect.

<u>Finding what best serves the Alaskan Elements</u>: seasonal, yet permanent, high volume and daily service

- Stedman-Thomas Basin Loo – permanent
- Standard & ADA Portable toilet – seasonal, customize architectural features to neighborhood
- Merchant Participation–Least expensive, immediate coverage throughout downtown
- Mobile restroom trailer unit – seasonal and versatile for community events

Stedman Thomas Basin Loo (STBL)	**Tyler Rental Maxium 3000**	**Merchant Participation**
$150,000 – 2020 prices Permanent installation Janitorial service paid by City **Must question Seasonal Hours** as it is not meeting the needs when told it's the only public restroom Creek Street/harbor area.	Seasonal installation less than $2,000/month 2 styles: Standard vs. Deluxe Stanitizer vs. Sink w/H^2O ADA compliant available. Daily service; supplies: sanitizer, soap, paper towels, tissue **Tyler prices are estimate only**	$950 x 5 mo. = $4,750 per season Seasonal; store hours Establish stipend for KPU utilities or cleaning service; credit appears on KPU October bill. Qualify willing participants: restaurants, merchants, attractions;

Budget $1,600,000	**Locations**	**Specification Design**
150,000	Creek Street – behind Star House	Permanent restroom custom built
150,000	Plaza Mall – next to BUS stop in parking lot	Permanent restroom (STBL)
150,000	419/421 Dock Street former Knickerbocker Hotel*	Permanent restroom (STBL)
0	*<u>$375,000</u> Acquisition of Ellis-Oliver vacate lot from $5 million designated for property budget	
<u>50,000</u>	*Capture historic, native culture in design, interpretive signage, landscape, canopies (description page 6)	
<u>$ 500,000</u>	→One time expenditure will have seasonal maintenance/repair expenses hereafter (see below)	

$27,000	Permanent 3 restrooms maintenance & repairs an estimate; depending on seasonal/permanent	
27,000	Stedman St. adjacent promenade Federal Building	Seasonal portable restrooms
27,000	Fire Station #1 Mill at Bawden – access to Mill visitors	Seasonal portable restrooms
	→Recommend 3 units per location: M-F/ADA, $1,800 x 3 = $5,400 x 5 months $27,000/season	
<u>$81,000</u>	Price includes daily cleaning service; entirely sanitized for public health and safety. **Tyler prices are estimate only**	

	10 Business Owners participating in Public Use Program	
	Stipend: $950/month x 5 months = $4,750 season; credit given on KPU bill in November	
$ 4,750	Soaring Eagle 319 Mill Street	Chad Aysheh, Owner
4,750	Northern Investment: 208 Main Street	Jacob Mensurian, Owner
4,750	Northern Investment: Downtown Plaza Bawden/Mission	Jacob Mensurian, Owner
33,250	Locating 7 more merchants to respond @ $4,750/season	
<u>$47,500</u>	**Calculation: $47,500 : 10 Owners : 153 days = $31 per day!!!**	

<u>Initial Investment: $500,000</u> **<u>Sustainability Seasonally: $128,500+ annually – estimates</u>**

Crunch the Numbers: $1.6 million minus $500,000 leaves balance of $1.1 million divided by $128,500 maintenance = provides stipend to serve public for 8.5 years!

Merchant Participation Civic responsibilities can be financed through Port Enterprise Fund..... Community Enterprise Fund if established as soon as possible or Excise Tax on Tobacco Products whichever becomes 1) likely by the will of the city council and, 2) long term expenses meets the demand of 1.9 million visitors. Meeting the requirement: whenever a cigarette butt is found in the wastewater from toilet's bowel, the Restroom Project qualifies from the Excise Tax on Tobacco Products and should be on the To Do Ordinance List by the City in 2020. With voters' confidence (October ballot) to continue the ETOTP, Borough transferred account to Local Education Fund within the School District budget to help fray their costs; this was not the intent of voters and never implemented properly. Anytime topics of health, safety, users, victims of second hand smoke and litter needs revenue stream to resolve – Borough should be spending it on voters' intent, in my opinion, otherwise deceitful.

Business owners must qualify a Merchant participation criterion (TBD) and remain in the program for entire season with payment (now in a form of a credit) on KPU November invoice. KPU has a similar program with Division of Public Assistance to credit the electricity bill a years' assistance. Merchant Participation also agrees to post signage and be listed on directory (TBD) of said location.

City, along with Public Works, would work with the business owner to assure building, wastewater lines meet code and can facilitate an increase usage. In the case of Mr. Mensurian property at 208 Main/Mission, his restroom has a macerator pump for his pipe that ties into Coliseum Theater sewer line. To handle the volume required, DPW needs to increase the size of pipe and connect to Dock Street line; a request, according to Mr. Mensurian, has been on the DPW books for years to no resolve.

Health and Safety Amenities for all mankind

Ketchikan has a drug problem and society does not assist those with diabetes with a receptacle for safe disposal. Trashcans, cigarette receptacles and public restrooms: said litter, needles and tobacco products show up in toilets waste water and sewer system.

Ketchikan needs to make a better effort to make restroom safe for everyone: those who use restroom, agents cleaning unit and sewer system.

Needle drop boxes should be installed in all City and Borough public restrooms and program to safely discard needles.

Let's assess doggy bag litter program and make the containers/bags more assessable. Here are 2 designs ranging from $115 to $230 each.

Attach portable cigarette receptacle on established directional street sign posts; San Francisco installed receptacle at every Pit Stop mobile trailer for easy disposal of cigarette butt BEFORE going into the restroom. Eliminates butts in waste water.

Creek Street is an example of individuals enjoying tobacco product and litters butt into street, nearby sidewalk, beneath the bench or into Centennial parking lot.

SAN FRANCISCO PIT STOP Mobile Restroom Trailer

- 2 Non-gender restrooms provided; OPTION: sanitizer or water with paper towel – outside unit. (eliminates stuff going down toilet into holding tank)
- Needle Drop box and doggy poop bags are also provided in some neighborhoods.
- Cleaned after every use by staff, which are paid $17 an hour; program for recently released inmates.
- Pit Stop Mobile trailer removed nightly to sanitation center for cleaning; returned early morning next day.

Popular to WRAP vehicles with graphics...
Sign Pro of Ketchikan would gladly help camouflage this toilet!

San Francisco Pit Stop mobile restroom unit
Purchase price $79,000 + daily service

Flexibility to season; hours; after every use, cleaned by staff; taken offsite in evening to dump and clean; paid by City of SF.

Everyone uses 1 door entrance with hallway to 2 restrooms, one being ADA compliant.

Tyler Rental assessment of trailer unit: TB verified:

- Generator will be loud and nuisance to merchants nearby
- Metal frame is good, however, wear-tear of unit is quicker (a lot of moving parts) than plastic single units.
- Ketchikan seasonal use and stored indoor during winter
- Several competitors offer units; Tyler would still have to be local company to service and store.
- Tyler keeping open to idea, however logistics need better clarification by manufacture, freight costs, daily service.

Rachel Gordon Director of Policy and Communications
San Francisco Public Works | City and County of San Francisco
City Hall Room 348, No. 1 Carlton B. Goodlett Place | San Francisco, CA 94102 | (415) 554-6045
sfpublicworks.org | twitter.com/sfpublicworks | Join the Team. Keep SF Clean. Giant Sweep

Alamo Square. San Francisco

It is worth the mention for creativity. Residents embraced the Pit Stop mobile unit and customized the architecture to suit their neighborhood.

Rachel stated marble vanities were installed; fresh flowers and art work make the experience...unique.

Note the stain glass on the (traditional feature) bay window to catch the limited sunlight on a foggy day. Nice touch.

Note signage; dog poop bags on post, free standing toilet, and out of photo range is waste bin. Hand sanitizer used where water lines are not available.

Alamo Square in San Francisco is a beautiful and centrally located neighborhood that is home to the famous "Painted Ladies" or "Seven Sisters." They are a group of seven similar, colorfully painted Victorians that sit right along this district's popular park. You will also hear this row of houses called "Postcard Row."

This district lies just to the west of Hayes Valley and centerpiece of this SF neighborhood is the park, which is bordered by Fulton, Steiner, Scott, and Hayes Streets.

The most famous Victorian Painted Ladies in San Francisco are across from the park on Steiner Street. The addresses for them are 710–720 Steiner Street. These seven beauties line up side-by-side for a picture-perfect scene. They are known as the "Seven Sisters.

#1 Most Popular Destination – Creek Street Historic District

Worth exploring the architectural design for the permanent restrooms suggested to be installed on the backside of #5 Star House.

Land Acquisition for City of Ketchikan consideration

Brigette Ellis and her late husband, Marvin Oliver owns the property at 419/421 Dock Street next to Subway restaurant. Now vacant, it was the former site of Knickerbocker Hotel; land is 2 parcels a total of 2,360 square feet.

It is not often the 'heart of downtown' gets the opportunity to preserve open space and let the parcel serve many purposes for the community and visitors. With economic growth, this parcel has the potential of a 2-3 story property development; it would be settling to know we saved the open space while the community had this opportunity to preserve our legacy.

Landscape the park with flora, plants and trees; provide canopies to shelter in seasonal weather, and benches to welcome community activities and picnic from nearby restaurants.

With the parcel nestled up against the rock and nearby Edmonds steps, design could display historic photos to reflect the neighborhood's connection with the historic Knickerbocker Hotel, downtown and Creek Street.

Brigette is open to negotiate the sale of said lot with the City of Ketchikan if interested in preserving the green space and installing a permanent restroom similar to Stedman-Thomas Loo serving mid-town visitors and residents. The property has the necessary plumbing for a restroom, running water and nighttime lanterns.

Please contact Brigette Ellis to discuss an opportunity for the community and visitors wanting respite.

In summary, Ketchikan Tourism Coalition has provided several suggestions on how best to handle litter, restrooms, and revenue stream to support City and Borough's effort in sustainable health and safety issues.

We look forward to working with City and Borough leadership and community through a series of public vetting's to discuss seasonal, permanent and mobile restroom facilities; cost to support merchants participation program will increase the inventory of restrooms at fraction of the costs to purchase inventory. 2020 season is only 6 months away; let us not wait any further – thanks!

Respectfully submitted,

Mary L. Stephenson
Ketchikan Alaska
(907) 254-2121 mlstephenson2017@gmail.com

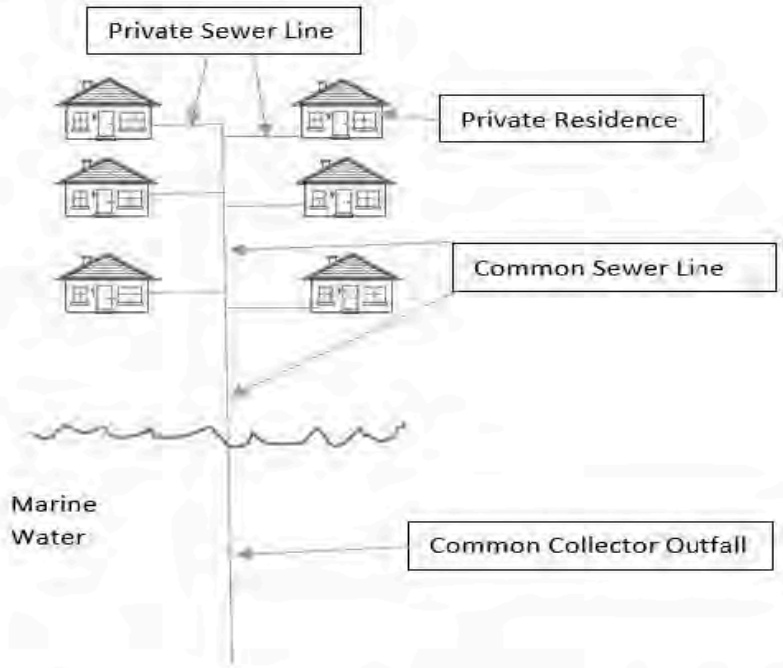
Appendix F. General Permit AKG575000 FAQ

COMMON COLLECTOR SYSTEMS
FREQUENTLY ASKED QUESTIONS

What is a common collector system?

A common collector system is a wastewater system that collects and discharges treated domestic wastewater through a common sewer line and outfall pipe, and serves two or more individual treatment plants located on separate tax lots or parcels.

Common Collector System



Why must a common collector system be permitted?

The Clean Water Act prohibits the discharge of pollutants from a point source into a water of the United States unless the discharging facility has a wastewater discharge permit. The Clean Water Act required the United States Environmental Protection Agency (EPA) to develop specific regulations to carry out the congressional mandate. EPA developed the National Pollutant Elimination Discharge System (NPDES) Program with regulations primarily found in Title 40 of the Code of Federal Regulations (CFR) Part 122. EPA administered the program in Alaska until permitting authority was transferred to the State as the Department of Environmental Conservation (DEC or Department) Alaska Pollutant Elimination Discharge System (APDES) Program in October 2008. State regulations to implement and administer the APDES

program can be found in Title 18 Alaska Administrative Code (AAC) Section 83. APDES regulations also require that any point source that discharges pollutants into waters of the United States is required to obtain a discharge permit.

What type of common collector systems may be eligible for coverage under the Alaska Pollutant Elimination Discharge System (APDES) General Permit AKG575000?

General Permit AKG575000 covers common collector systems that discharge equal to or less than 25,000 gallons of secondary treated domestic wastewater to marine waters within Southeast Alaska.

Why is permit coverage limited to Southeast Alaska?

In coastal areas, particularly in Southeast Alaska, site conditions such as poor soil and/or high groundwater tables do not support the installation and operation of most conventional on-site disposal systems. Due to the logistics and cost of installing a marine outfall line, groups of homeowners combine their individual waste streams to discharge via a singular outfall pipe.

Why is DEC requiring common collector systems to be permitted at this time?

This action does not represent new State of Alaska regulations. As previously stated, the Clean Water Act and subsequent federal and state regulations require a permit for a point source discharge to waters of the state (such as discharges from common collector systems). EPA developed a general permit in 2004 that covered a variety of domestic wastewater discharge facilities; small publicly owned treatment works, privately owned lodges, small lagoon treatment systems, and common collector systems. When the general permit expired in 2009, facilities that had applied for permit reissuance were issued administrative extensions until the general permit could be reissued. As such, several facilities that will be affected by DEC's permitting action have long been permitted. DEC assumed regulatory authority in 2008 and determined it appropriate to revise the 2004 general permit into three separate general permits to more accurately address the unique characteristics and issues of the different types of discharge facilities.

To replace the broad EPA permit issued in 2004, a first general permit, AKG572000, went into effect November 2012 to cover the small publicly owned treatment works and privately owned treatment plants used at businesses like lodges. The second general permit, AKG573000, went into effect September 2013 to cover lagoon treatment systems. The third general permit, AKG575000, is being developed for common collector systems.

Eight common collector systems are currently permitted, under administrative extensions of the expired 2004 general permit. Some of these common collector systems have been permitted for 13 or more years. DEC estimates that there are at least 30 other common collector systems in Southeast Alaska that have never been permitted. DEC's goal in developing the common collector general permit is to ensure that all common collector systems, those currently permitted and those that have gone unpermitted for many years, be held to equal standards and meet long standing regulations aimed at protecting human health and the environment.

Why does the new general permit contain fecal coliform bacteria effluent limits and more stringent limits than those applied in the 2004 general permit?

All discharge permits issued in Alaska must contain conditions that ensure compliance with Alaska Water Quality Standards (WQS) regulations found in 18 AAC 70. These regulations protect human health, aquatic life and wildlife. Fecal coliform bacteria have water quality criteria established in the regulations. Effluent limits for fecal coliform bacteria in the general permit are calculated based upon these regulatory water quality criteria. The general permit contains three options a common collector system may utilize to comply with the general permit effluent limits; 1) meet the "end-of-pipe" limits prior to discharge to the receiving water, 2) meet the effluent limits associated with the standard sized mixing zone specified in the general permit, or 3) provide information to the department for review to determine if a site specific mixing zone and effluent limits are warranted.

It is anticipated that some common collector systems may not be able to meet the applicable water quality criterion for fecal coliform bacteria at that point when the discharge leaves the outfall pipe. In such cases, the applicant may request a mixing zone under the general permit. A mixing zone is a limited area within the marine receiving water, around the point of discharge, where water quality criteria can be exceeded as long as toxic conditions are prevented and the water body as a whole is not impaired.

There is a set of fecal coliform bacteria permit effluent limits in the new common collector general permit that are based on a calculated dilution available within a mixing zone size that was designed to fit most common collection outfall characteristics. This standard mixing zone is offered to spare the homeowners the expense of conducting their own mixing zone modeling. However, homeowners have the option to model a site-specific mixing zone and submit evidence necessary for DEC to base an informed decision as to whether a different sized mixing zone will meet all regulatory requirements.

The eight currently permitted common collector systems will have more stringent fecal coliform bacteria permit limits than are required in their current general permit authorizations issued under the 2004 permit. Again, the more stringent proposed fecal coliform bacteria limits are calculated based on the current regulatory water quality criteria under 18 AAC 70. To meet these fecal coliform bacteria permit limits, the common collector systems may be required to incorporate disinfection of the wastewater prior to discharging.

How often will a common collector system be required to be sampled?

The general permit requires that samples be taken to demonstrate that the permit limits are being met. Monitoring is required by regulation. Sampling frequency depends on the volume of discharge which is based on the sum of the design flow rates for all contributors to the common collector systems.

- Common collector systems that discharge less than 1,500 gallons per day (gpd) will only be required to sample twice per year;
- Common collector systems that discharge greater than 1,501 gpd and less than or equal to 15,000 gpd will only be required to take samples quarterly, four times per year; and
- Common collector systems that discharge greater than 15,001 gpd and less than 25,000 gpd will be required to sample monthly, 12 times per year.

As an example: A common collector systems that services 20 homes that all have treatment plants with a design flow rate of 600 gpd (which can serve a four bedroom home) would have a sum of 12,000 gpd and would be required to sample only quarterly.

Why are marine outfalls from single family homes not required to have wastewater discharge permits?

An APDES general permit for discharges to marine water from single family homes has not yet been developed. Currently, the Division of Water (DOW) evaluates single family home septic systems under 18 AAC 72 Wastewater Disposal regulations. Additional information is located on the DOW website at: http://dec.alaska.gov/water/wwdp/onsite/index.htm

What are the fees for coverage under the General Permit?

The appropriate fee is based on the sum of the design flow rates of all contributors to the common collector system which corresponds to the flow classes defined in the permit.

Annual fee for a domestic wastewater system covered under a general permit, with a daily maximum permitted flow, in gallons per day, of	Fee (in dollars) on or before December 31, 2017	Fee (in dollars) not earlier than January 1, 2018 and not later than December 31, 2018	Fee (in dollars) on or after January 1, 2019
(A) 0 – 1,500	405	535	665
(B) 1,501 – 15,000	765	765	765
(C) 15,001 and over	1,280	1,280	1,280

Permit fees can also be found either in regulations at 18 AAC 72.956(a) Table D(1) or on DEC's web site at http://dec.alaska.gov/water/wwdp/online_permitting/fees.htm under "General Permit Fees (18 AAC 72.956) – Table D." Invoices are mailed out annually, usually at the beginning of the calendar year, and payment is due within 30 days.

Who will be held responsible for the discharge from the common collector system and for the annual permit fee?

The responsible entity, as identified on the Notice of Intent (NOI), will be the permittee and will be legally responsible for the total discharge from the common collector system, and thus is ultimately responsible for the permit compliance, including violations, fines, enforcements, compliance orders, and annual permit fees.

The responsible entity can be any of the examples described in 18 AAC 72.205(a)(6):
a local governments organization, a homeowner's association, a private utility, a commercial entity, or other entity.