

2022 Small Commercial Passenger Vessel and Ferry Wastewater Report

COMMERCIAL PASSENGER VESSEL ENVIRONMENTAL COMPLIANCE (CPVEC) PROGRAM



January 2023



Cover photo: Matanuska State Ferry Vessel docked in Juneau, Alaska. September 10th, 2022

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INTRODUCTION

This report summarizes the 2022 wastewater sampling results for small commercial passenger vessels (CPVs)¹ and Alaska Marine Highway Ferry System (AMHS) vessels discharging in Alaska waters². Appendix A provides vessel information and Appendix B provides wastewater sampling results.

This year, 20 small CPVs (18 small cruise ship vessels and 2 AMHS ferries) registered with the Alaska Department of Environmental Conservation (ADEC), and 14 of those CPVs intended to discharge to AK waters. Small discharging CPVs are required to sample according to the [2021 sampling regime schedule](#) and AMHS vessels sample every 3 months of operation (4 samples total, assuming year-round operation). Sampling is a requirement to:

- Verify that marine sanitation devices (MSD) onboard are achieving good effluent quality in accordance with their Best Management Practices (BMP) Plans;
- Document treatment system performance for future BMP plan development; and
- Gather information on potential environmental impacts from small CPVs operating in AK waters.

Alaska Statute (AS) 46.03.463 establishes discharge limits on fecal coliform (FC) and total suspended solids (TSS). If an exceedance of FC or TSS occurs the vessels BMP Plan directs them to take corrective action, report the exceedance to ADEC, and resample to confirm compliance. To ensure quality data is obtained, each vessel must have a Vessel Specific Sampling Plan (VSSP) and Quality Assurance Project Plan (QAPP), approved by ADEC. The QAPP plan can be based on the current year Cruise Lines International Association (CLIA) QAPP, or dedicated vessels can have their own individual sampling QAPP.

Reports and summaries for prior years can be found on the cruise program's report webpage (<https://dec.alaska.gov/water/cruise-ships/cruise-reports/>)

¹ Small CPVs have overnight accommodations (lower berths) for 50 to 249 passengers.

² Alaska water extends 3 miles from the coastline and includes the Alexander Archipelago.

BACKGROUND

CPVs produce two types of wastewater: blackwater and graywater. Blackwater is wastewater from ship's toilets and medical facilities. Graywater is wastewater from accommodations (showers/sinks), galley areas, and laundry. Any combination of blackwater and graywater will be referred to as mixed wastewater in this report, but technically it is considered blackwater.

All wastewater, whether blackwater or graywater, must be treated, prior to discharge. Large CPVs typically utilize advanced wastewater treatment systems (AWTS) for treatment, while the small CPVs process and treat wastewater through their MSD. The onboard MSD systems on a small CPV must be properly operated and maintained (AS 46.03.463)³ and must meet performance requirements⁴ for US Coast Guard approval of Type II MSD systems for vessels operating in US waters (33 CFR 159).

To better manage the distinct issues associated with classes of vessels, a unique permit was issued for large CPVs (>250 lower berths) while an alternative plan and BMP Plan was implemented for small CPVs (<250 lower berths). Small CPVs and ferries are required to meet standard terms and conditions, or seek alternative terms and conditions with BMP plans, in order to discharge wastewater in Alaska marine waters. Standard terms and conditions for treated blackwater, graywater, and other wastewater (AS 46.03.463, Prohibited discharges; limitations on discharges) align with the USCG limits for approved Type II MSDs, 33 CFR 159.53(b). Wastewater effluent must contain no more than 200 FC per 100 milliliters and no more than 150 milligrams per liter of TSS. Traditionally, blackwater has had the high median fecal coliform results, and very high results have also been found in graywater. Ships with separate graywater discharges are required to sample graywater for conventional parameters in accordance with the sampling regime schedule and VSSP.

Regulations require the BMP Plans to include certain elements, such as inclusion of no discharge areas, (18 AAC 69.046 (c)). The National Park Service prohibits discharge in several federally managed areas of concern, such as Glacier Bay Park and Preserve.

³ Determination of a properly maintained MSD is described 18 AAC 69.080.

⁴ Performance is measured under controlled test conditions.

METHODS

Wastewater sampling consists of grab samples taken from the MSD overboard discharge pipe (described in the VSSP) while the vessel is discharging. The VSSP also described appropriate sampling event times, and sample port and location, to ensure samples are representative of wastewater discharges into Alaska waters. Sampling follows the requirements in the vessels approved QAPP. In 2022, 5 cruise lines and the AMHS (14 vessels total) used their own Department approved QAPP, while 1 cruise line (1 vessel) used the 2022 Cruise Line International Association (CLIA) Alaska Wastewater QAPP, developed for large cruise ships (Table A3). The QAPP specifies minimum quality requirements for sample collection, field test handling, and analysis of wastewater samples in the laboratory. It includes a list of approved methods, data quality objectives, and responsibilities of the parties that approve the document.

Sampling may occur while the vessel underway or while docked (stationary). Typically, sampling was conducted while in port or while underway in route to Juneau for vessel conducting their own wastewater sampling. All samples in this report were taken in Southeast Alaska in 2022, with most samples obtained in or near Juneau to meet sample holding times requirements.

Most laboratory analysis was conducted locally, with some samples being shipped to the lower 48 for analysis by a subcontractor. Some vessels receive training at the beginning of the season and take their grab samples themselves, while others opt to have their samples collected for them. CPVEC reviews results submitted by the cruise ship operators for compliance with the QAPPs and VSSPs.

RESULTS

Table 1 and 2 provide summary data for effluent parameters measured. 2022 wastewater sampling results are listed in Appendix B and are broken down based on the type of wastewater sampled. Non-detect (ND) values are entered as a dash in Table 1 and Table 2, but the parameter may still be present in the sample, just not at a detectable level. Sampling for priority parameters (volatile organic compounds (VOCs) and base neutral acids (BNAs)), and nutrients are not required with every sample. Priority/nutrients sampling results are not provided in this report but are available upon request. Table B4 provides metals sampling results.

Table 1. 2022 Small Cruise Ship & Ferry Summary Data, Mixed Wastewater Effluent

Analyte	Coun	Average	Media	Minimu	Maximum
Temp (C)	27	16	16	12	20
pH (S.U.)	27	7.42	7.64	4.96	8.34
Free Cl (mg/L)	27	2.18	0.44	-	19.00
TR Cl (mg/L)	27	4.97	1.14	-	34.00
Fecal Coliform (FC/100mL)	27	3,063,76	200	-	80,000,000
BOD (mg/L)	19	210	92	-	810
TSS (mg/L)	27	116	81	8	540
Spec. Conductance (umhos/cm)	13	31,194	37,900	1,910	47,500
Alkalinity (Total)	12	189	115	-	600
Settleable Solids (mg/L)	12	2	-	-	16
COD (mg/L)	12	805	600	440	1,900
Total Organic Carbon	9	2.6	-	-	12.3
Hardness (mg/L)	12	3,580	4,400	24	6,400
Ammonia (as N) (mg/L)	12	26	16	-	81
Total Kjeldahl Nitrogen (mg/L)	11	3	-	-	29
Nitrogen, Nitrate-Nitrite (as N)	11	0	-	-	0
Total Phosphorus (as P) (µg/L)	11	1	-	-	11
E.coli (MPN/ 100mL)	5	-	-	-	-
Oil & Grease (mg/L)	12	16	-	-	107

Table 2. 2022 Small Cruise Ship & Ferry Summary Data, Graywater Effluent

Analyte	Count (n)	Average	Median	Minimum	Maximum
Temp (C)	17	17	16	13	23
pH (S.U.)	17	7.39	7.45	5.68	9.24
Free Cl (mg/L)	17	29.39	0.03	-	480.00
TR Cl (mg/L)	17	35.22	0.04	-	540.00
Fecal Coliform (FC/100mL)	17	36,553	10	-	490,000
BOD (mg/L)	11	192	120	-	690
TSS (mg/L)	17	52	29	-	143
Spec. Conductance (umhos/cm)	10	8,784	585	162	37,900
Alkalinity (Total)	10	79	72	21	200
Settleable Solids (mg/L)	10	0	-	-	3
COD (mg/L)	10	566	370	-	2,400
Total Organic Carbon	4	3.1	-	-	12.3
Hardness (mg/L)	10	990	46	-	4,400
Ammonia (as N) (mg/L)	10	4	0	-	24
Total Kjeldahl Nitrogen (mg/L)	7	3	-	-	10
Nitrogen, Nitrate-Nitrite (as N) (mg/L)	6	0	-	-	0
Total Phosphorus (as P) (µg/L)	7	1	-	-	2
E.coli (MPN/ 100mL)	4	-	-	-	-
Oil & Grease	10	26	22	-	72

Analysis of Table 1 & 2 Results

Tables 1 & 2 show the analyte summary data for both mixed wastewater effluent (Table 1) and graywater effluent (Table 2). Some analytes such as FC and BOD have a very wide range of values because one vessel resulted in a very high value due to a potential issue with the system. There were also results with a high oil and grease value. This is of concern for because high amounts of oil and grease should not be entering these wastewater treatment systems because they are not made to process and/or reduce oil and grease. Better operational practices such as oil and grease traps or other removal systems are helpful in preventing oil and grease from entering the system.

Table 3. 2022 Exceedance Summary by Vessels

Vessel Name	WW Type	Samples Taken (total)	Fecal Coliform (>200FC/100ml)	Total Suspended Solids (>150mg/L)	Total Residual Chlorine (>1mg/L)	Vessel Resample (Y=yes,N=no, NR=not required)	Comments Following Resample
American Constellation	MIX	2	2	0	0	Y	Notice of Enforcement Issued.
Kennicott	MIX	2	0	0	2	NR	
Matanuska	MIX	3	1	0	1	Y	
NG Quest	MIX	3	0	0	0	Y	
NG Venture	MIX	2	0	0	0	NR	
Wilderness Adventurer	MIX	2	2	1	1	Y	
Wilderness Discoverer	MIX	1	0	1	1	N	Did Not Resample
Wilderness (SS) Legacy	MIX	4	3	2	3	Y	Notice of Violation Issued
Admiralty Dream	BW	3	2	1	2	Y	Notice of Violation Issued
Chichagof Dream	BW	1	1	1	1	Y	
Safari Endeavor	BW	3	3	0	2	Y	Notice of Violation Issued
NG Sea Lion	BW	1	0	0	0	NR	
NG Sea Bird	BW	2	0	0	0	NR	
Wilderness Explorer	BW	1	0	0	1	NR	
Admiralty Dream	GW	6	3	0	2	Y	Notice of Violation Issued
Chichagof Dream	GW	2	0	0	1	NR	
Ocean Victory	GW	9	8	1	0	Y	Notice of Violation Issued
Safari Endeavor	GW	2	2	0	0	Y	Notice of Violation Issued
NG Sea Bird	GW	2	0	0	0	NR	
NG Sea Lion	GW	2	1	0	0	Y	
Totals		53	28	7	17		
Percent of Samples			53%	13%	32%		

Analysis of Table 3 Results

Table 3 provides a summary of effluent exceedance for discharging vessels during 2022. The majority of MSD systems on small vessels incorporate chlorination into the treatment process as an add-on, by injecting additional chlorine into the system to improve the effluent quality. A resample may be requested if over chlorination of the system is suspected and the Department needs to determine that the MSD is working without overcompensating with chlorine to get the FC level down.

Notices of Violation were issued for exceedances based on two criteria from the sampling results: 1) there was an exceedance of FC and/or TSS and, 2) the exceedance was repeated in at least one resample event, in many cases, repeated multiple times. A Notice of Enforcement was determined warranted if the sample exceedance was found to be reoccurring for multiple years while operating in Alaskan waters.

SUMMARY

The CPVEC program will continue to work with small CPVs and AMHS to improve overall wastewater effluent quality. Small CPVs and state ferries continue to balance bacterial digestion processes with chlorine disinfection. Chlorine is used to sterilize effluent, but it is toxic to marine organisms and high residuals must be avoided. Several vessels have installed equipment to dechlorinate the treated wastewater.

Since the beginning of the CPVEC program and implementation of the small CPV's BMPs several vessels have shown improvements and more consistent performance of their MSD units. Unfortunately, some ships continue to exceed standards for fecal coliform, chlorine, and BOD. In 2022, four major issues were identified that warrant greater oversight in 2023:

- 1) Chlorine levels: Multiple small CPVs had FC exceedances that were corrected by increasing the chlorine dosage in the system, however 72% of mixed water samples contained elevated chlorine levels; TRC ranging between 0 and 34 mg/L (see Table B3 in Appendix B).
Raising the chlorine dosage is a short-term fix and vessels will need to work within their ADEC approved BMP plans to diagnose and conduct corrective actions in order to improve overall effluent quality entering Alaska waters. This will include planning responsible chlorine injection into the system, and inclusion of neutralization of the effluent post-chlorine injection.
- 2) Oil and grease: The rise in oil and grease levels from sample results is something that the Department will continue to monitor as the Type II MSDs that are approved for these vessels rely on biological and aerobic digestion to process waste. Oil and grease being introduced into through these systems could potentially result in a breakdown of the system. An effort should also be made on part of the vessels to identify and mitigate the cause of the high oil and grease results.

- 3) Shore pump-outs: one small CPV continuously had high FC exceedances and decided mid-way through the season to rely on shore pump-outs instead of fixing the MSD to be within limits to discharge. This is not a solution that the Department is in favor of, and if an MSD is not working properly, it is expected to be fixed.
- 4) “Hoteling” of vessels: one CPV had pre-season sample results come back with very high FC and TSS levels. Although the vessel brought a technician aboard to remedy the MSD, they ultimately decided to suspend the operations of the vessel for the 2022 season and use it to house transient crew members. The Department required an additional resample from this vessel as the MSD system would still need to be working, even with reduced passenger capacity onboard. Suspending voyages due to a nonworking MSD is something the Department would like to avoid if possible and is why it is encouraged to conduct maintenance on these vessels during the off season.

If there are any questions or concerns regarding this report, please contact the Cruise Ship Program Manager, Kaitlyn Raffier, at Kaitlyn.raffier@alaska.gov or 907-465-5138.

ONLINE RESOURCES

Alaska Department of Environmental Conservation (ADEC) Cruise Ship Program

<http://dec.alaska.gov/water/cruise-ships/>

Small Cruise Ship Discharge Options

<http://dec.alaska.gov/water/cruise-ships/cruise-smallship/>

Alaska Cruise Ship Laws and Regulations

<http://dec.alaska.gov/water/cruise-ships/laws-regs/>

2019 CLIA Wastewater Sampling Quality Assurance Project Plan

<http://dec.alaska.gov/water/cruise-ships/cruise-operator/>

Sample reports and summaries from other years

<http://dec.alaska.gov/water/cruise-ships/cruise-reports/>

Sampling regime report

<https://dec.alaska.gov/media/23126/2021-small-vessel-sampling-regimes-r1.pdf>

APPENDIX A: 2022 SMALL CPV INFORMATION

Table A1: 2022 Small CPV Vessel discharge status, wastewater treatment system and capacities presented. [1 Page]

Table A2: 2022 Requirements and Deadlines for Small CPVs presented [1 Page]

Table A3: 2022 ADEC Approved QAPPs for Small CPVs presented [1 Page]

APPENDIX B: 2022 SMALL CPV WASTEWATER RESULTS

Table B1: Blackwater sampling results presented [1 Page]

Table B2: Greywater sampling results presented [1 Page]

Table B3: Mixed wastewater sampling results presented [1 Page]

Table B4: Metal results presented [1 Page]

APPENDIX A: 2022 SMALL COMMERCIAL PASSENGER VESSEL INFORMATION

Table A1: 2022 Wastewater Treatment and Discharges from Small CPVs¹ in AK Waters

2022 Season Overview: Small ¹ Commercial Passenger Vessels									
	Vessel Operator	Vessel Name	Wastewater Treatment System ²	Passenger Capacity ³	Crew Capacity	Voyages	Annual Passenger capacity ⁴	Discharging In Alaska ⁵	
								BW	GW
AMHS1	AMHS, State of Alaska	<i>Kennicott</i>	Orca II 500 (x3)	748	42			Yes - Mixed	
AMHS2	AMHS, State of Alaska	<i>Matanuska</i>	Omnipure 15MX (x3)	498	50			Yes - Mixed	
1	Alaska Dream Cruises	<i>Admiralty Dream</i>	Omnipure 12M (x1)	56	19	19	1064	Yes	Yes
2	Alaska Dream Cruises	<i>Chichagof Dream</i>	Orca II A-500 (x1)	76	27	17	1292	Yes	Yes
4	Lindblad/Nat. Geographic	<i>NG Endurance</i>	ND	126	112	1	126	No	No
5	Lindblad/Nat. Geographic	<i>NG Resolution</i>	ND	126	112	3	378	No	No
6	Lindblad/Nat. Geographic	<i>NG Orion</i>	ND	102	49	6	612	No	No
7	Lindblad/Nat. Geographic	<i>NG Quest</i>	G&O Bioreactor BR-37000 BG-V (x1)	100	49	18	1800	Yes - Mixed	
8	Lindblad/Nat. Geographic	<i>NG Sea Bird</i>	Omnipure 12MX (x1)	62	35	24	1488	Yes	Yes
9	Lindblad/Nat. Geographic	<i>NG Sea Lion</i>	Omnipure 12M (x1)	62	35	23	1426	Yes	Yes
10	Lindblad/Nat. Geographic	<i>NG Venture</i>	G&O Bioreactor BR-37000 BG-V (x1)	100	49	20	2000	Yes - Mixed	
11	Scenic (Vships)	<i>Scenic Eclipse</i>	ND	218	176	2	436	No	No
13	UnCruise Adventures	<i>Safari Endeavour</i>	Omnipure 12M5508 (x2)	86	35	20	1720	Yes	Yes
14	UnCruise Adventures	<i>SS Legacy</i>	Red Fox RF-2000-FP (x1)	92	34	13	1196	Yes	Yes
15	UnCruise Adventures	<i>Wilderness Adventurer</i>	Omnipure 12MX (x1)	74	23	26	1924	Yes - Mixed	
16	UnCruise Adventures	<i>Wilderness Discoverer</i>	Headhunter TW-HMX-6004LP (x2)	78	24	22	1716	Yes - Mixed	
17	UnCruise Adventures	<i>Wilderness Explorer</i>	Headhunter TW-HMX-6004LP (x2)	76	26	20	1520	Yes	Yes
18	Victory Cruise Lines	<i>Ocean Victory</i>	JETS Ecomotive Model 16.65 (x1)	199	100	14	2786	Yes - Mixed	
					Totals	248	21,484		

¹ Small commercial passenger vessels have overnight accommodations for 50 to 249 passengers.

² Marine Sanitation Device: Model (# of units). Non-discharge (ND) vessels are not required to provide treatment system information.

³ Based on the number of lower berths for small cruise ships. Based on max passenger capacity for Alaska Marine Highway System (AMHS) vessels.

⁴ Assumes full passenger capacity on every voyage.

⁵ Alaska water extends 3 nautical miles from the coastline and includes the Alexander Archipelago

Vessels highlighted in gray (indicated by 'ND') have registered as non-discharge vessels. No effluent sampling is required.

Table A2: 2022 Requirements and Deadlines for Small CPVs

Document	Authority	Due Date (2022)
Registration Requirements:		
Registration with original notarized signature page submitted	AS 46.03.461, 18 AAC 69.010	March 1
Non-hazardous Solid Waste Offloading and Disposal Plan (vessel policies and procedures)	AS 46.03.475(e)(1), 18 AAC 69.035	March 1
Hazardous Waste and Substance Offloading Plan (vessel policies and procedures)	AS 46.03.475(e)(2), 18 AAC 69.040	March 1
Environmental Compliance Fee	AS 46.03.480, 18 AAC 69.015	June 1
Requirements if Discharging IN ALASKAN WATERS:		
Quality Assurance Project Plan (QAPP; for vessels with intent to discharge to marine waters of the state)	AS 46.03.465(b) 18 AAC 69.025	March 1 [a]
Best Management Practices Plan (BMP) (if vessel will discharge under alternative terms and conditions)	AS 46.03.462(k)	March 1 [b]
Vessel Specific Sampling Plan (VSSP), Approved by ADEC	18 AAC 69.030 AS46.03.465 (b)	A 2022 VSSP is required 21 days before sampling.
Discharge Sample Report	18 AAC 69.055	21 days after analytical testing is completed.
OTHER Requirements:		
Discharge or offloading of hazardous waste (copy of report or notice as required by US or Canadian laws)	AS 46.03.475(d)	21 days after providing report/notice to US/Canadian agency.
Voyage Report and Deviation Report to document any changes to the number of voyages or deviations from waste plans	18 AAC 69.015, 18 AAC 69.065	November 15
[a] Approved QAPP are valid for up to three years, this deadline is for new/revised QAPPs.		
[b] Deadline for new BMPs, approved plan is not already in place and remains active until the end of the season.		

Table A3: 2022 ADEC Approved QAPPs for Small CPVs

Vessel Operator	Vessel Name	Quality Assurance Project Plan (QAPP)	Field Parameters Measured By [1]
Alaska Marine Highway	Kennicott	AMHS DOT/PF Small Commercial Passenger Vessel QAPP for Sampling and Analysis of Treated Sewage and Graywater, dated: September 2022	Admiralty Environmental
	Matanuska		
Alaskan Dream Cruises	Admiralty Dream	Alaska Catamaran, LLC Generic Small Commercial Passenger Vessel QAPP for Sampling and Analysis of treated Sewage and Graywater dated: 29 April, 2019	Admiralty Environmental
	Chichagof Dream		
American Cruise Lines	American Constellation	CLIA Alaska Quality Assurance Project Plan (QAPP)for Sampling and Analysis of Treated Sewage and Graywater from Commercial Passenger Vessels rev. 12 dated: 1 April 2022	Admiralty Environmental
Lindblad/Nat. Geographic	National Geographic Quest	Lindblad Expeditions Tier II Quality Assurance Project Plan (QAPP) for Sampling and Analysis of Treated Sewage ad Graywater from Commercial Passenger Vessels (QA/QCP) dated: April 2022	Vessel Crew
	National Geographic Sea Bird		
	National Geographic Sea Lion		
	National Geographic Venture		
Un-Cruise Adventures	Safari Endeavor	Un-Cruise Adventures Small Commercial Passenger Vessel QAPP for Sampling and Analysis of Treated Seage and Graywater dated: 30 June 2021	Admiralty Environmental
	SS Legacy		
	Wilderness Adventure		
	Wilderness Discoverer		
	Wilderness Explorer		
Victory Cruise Lines	Ocean Victory	Cruise Management International INC. Small Commercial Passenger Quality assurance Project Plan (QAPP) for sampling and Analysis of Treated Sewage and Graywater Rev 2 dated: May 2021	Admiralty Environmental

[1] All Analytes other than field parameters were processed by Admiralty Environmental or one of their designated sub-contractor’s labs.

APPENDIX B: WASTEWATER RESULTS

Table B1. 2022 Blackwater Sampling: Small CPVs and AMHS Vessels

Analyte			Field				Convention I			Convention II							
			Temp	pH	Free chlorine	Total Chlorine	Fecal Coliform	Suspended Solids	Biochemical O2 Demand	Ammonia (as N)	Chemical Oxygen Demand	Specific Conductance	Oil and Grease	Alkalinity (Total)	Hardness (as CaCO3)	Total Settleable Solids	
Units		Sample IP/UW (in port or underway)	°C	SU	mg/L	mg/L	FC/100ml	mg/L	mg/L	mg/L	mg/L	umhos/cm	mg/L	mg/L	mg/L	mg/L	
Alaska Marine Water Quality Standards AS 46.03.463 or Secondary Treatment Standard.				N/A	6.5-8.5	N/A	0.0075	200	150	60	1	N/A	N/A	N/A	N/A	N/A	N/A
Vessel Name	Date	Sample #															
Admiralty Dream	6/11/2022	AE 29210	IP	17	7.57	0	0	80,000,000	540	460	0	0	0	0	0	0	0
Admiralty Dream	6/25/2022	AE 29478	IP	18.3	7.59	0	1.3	28,000	147	0	0	0	0	0	0	0	0
Admiralty Dream	7/7/2022	AE 29542	IP	20.4	7.71	10	28	200	108	0	0	0	0	0	0	0	0
Chichagof Dream	6/3/2022	AE 29209	IP	16.8	8.1	2.3	2.8	360	62	0	1.4	810	39300	8.5	110	4900	0
NG Sea Bird	5/15/2022	AE 28570	UW	13.77	8.34	0.16	0.2	0	81	49	4.5	620	47100	6.9	120	5300	2
NG Sea Bird	5/19/2022	AE 28965	UW	14.38	8.23	0.05	0.1	0	24	22	2.2	480	47500	0	110	6400	1
NG Sea Lion	5/14/2022	AE 28747	UW	15.7	8.09	0	0	0	68	92	12	660	43400	0	120	5100	0
Safari Endeavour	5/21/2022	AE 28787	IP	11.6	7.85	1.47	4.2	450	92	81	0	0	0	0	0	0	0
Safari Endeavour	7/2/2022	AE 29588	IP	16.6	7.31	0	0	21,000	56	0	0	0	0	0	0	0	0
Safari Endeavour	7/16/2022	AE 29638	IP	12.9	7.27	1.1	1.7	370	70	0	0	0	0	0	0	0	0
Wilderness Explorer	5/15/2022	AE 28786	IP	16.2	7.77	10.4	12.1	160	69	61	42	580	39400	0	250	4200	0

Table B2. 2022 Graywater Sampling: Small CPVs and AMHS Vessels

Analyte			Field				Convention I			Convention II						
			Temp	pH	Free chlorine	Total Chlorine	Fecal Coliform	Suspended Solids	Biochemical O2 Demand	Ammonia (as N)	Chemical Oxygen Demand	Specific Conductance	Oil and Grease	Alkalinity (Total)	Hardness (as CaCO3)	Total Settleable Solids
Units		Sample IP/UW (in port or underway)	°C	SU	mg/L	mg/L	FC/100ml	mg/L	mg/L	mg/L	mg/L	umhos/cm	mg/L	mg/L	mg/L	mg/L
Alaska Marine Water Quality Standards AS 46.03.463 or Secondary Treatment Standard.			N/A	6.5-8.5	N/A	0.0075	200	150	60	1	N/A	N/A	N/A	N/A	N/A	N/A
Vessel Name	Date	Sample #														
Admiralty Dream	6/25/2022	AE 29478	IP	16	5.68	0	0.02	540	29	0	0	0	0	0	0	0
Admiralty Dream	6/25/2022	AE 29478	IP	18.4	7.66	0.07	0.03	100,000	140	0	0	0	0	0	0	0
Admiralty Dream	7/7/2022	AE 29542	IP	20.8	9.24	480	540	0	140	0	0	0	0	0	0	0
Admiralty Dream	7/7/2022	AE 29542	IP	20.5	6.95	13	48	0	143	0	0	0	0	0	0	0
Chichagof Dream	6/3/2022	AE 29209	IP	17.7	7.49	2	5.2	63	24	99	0.47	160	9960	9.6	75	880
NG Sea Bird	5/15/2022	AE 28570	UW	14.61	7.94	0.15	0.15	0	22	230	0	380	525	53	26	20
NG Sea Bird	5/19/2022	AE 28965	UW	15.27	7.88	0.04	0.04	0	12	690	0	2400	1131	29.2	200	75
NG Sea Lion	5/14/2022	AE 28747	UW	14.2	6.51	0	0.04	2,200	43	120	0.74	260	208	40.9	21	0
NG Sea Lion	5/26/2022	AE 29102	UW	13.1	8.5	0.01	0	0	17	0	0	0	0	0	0	0
Safari Endeavour	5/21/2022	AE 28787	IP	22.9	7	0	0	6,400	29	220	0.5	360	226	28.3	31	22
Safari Endeavour	6/25/2022	AE 29476	IP	22.1	6.58	0	0	22,000	36	0	0	0	0	0	0	0

Table B3. 2022 Mixed Wastewater (Blackwater + Greywater) Sampling: Small CPVs and AMHS Vessels

Analyte			Field				Convention I			Convention II							Nutrients				
			Temp	pH	Free chlorine	Total Chlorine	Fecal Coliform	Suspended Solids	Biological O2 Demand	Ammonia (as N)	Chemical Oxygen Demand	Specific Conductance	Oil and Grease	Alkalinity (Total)	Hardness (as CaCO3)	Total Settleable Solids	Total Organic Carbon	Nitrate-Nitrite	Kjeldahl Nitrogen	Phosphorus	
Units			°C	SU	mg/L	mg/L	FC/100ml	mg/L	mg/L	mg/L	mg/L	mg/L	umhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Alaska Marine Water Quality Standards AS 46.03.463 or Secondary Treatment Standard.			N/A	6.5-8.5	N/A	0.0075	200	150	60	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vessel Name	Date	Sample #	IP/UW (in port or underway)	Temp	pH	Free chlorine	Total Chlorine	Fecal Coliform	Suspended Solids	Biological O2 Demand	Ammonia (as N)	Chemical Oxygen Demand	Specific Conductance	Oil and Grease	Alkalinity (Total)	Hardness (as CaCO3)	Total Settleable Solids	Total Organic Carbon	Nitrate-Nitrite	Kjeldahl Nitrogen	Phosphorus
Kennicott	6/7/2022	AE 28751	IP	17.7	7.99	3.5	3.8	0	7.6	0	0	440	37900	0	95	4400	0	0	0	0	0
Kennicott	7/27/2022	AE 29741	IP	16.3	8.07	0.8	1.14	10	14	4.3	0	0	0	0	0	0	0	0	0	0	0
Matanuska	5/29/2022	AE 29062	IP	15.6	6.52	0.03	0.34	10	59	100	8.9	575	36900	6.6	95	4400	0	12.3	0.11	0.51	2.01
Matanuska	7/24/2022	AE 29728	IP	17.3	7.73	0.03	0.3	450	45	91	0	0	0	0	0	0	0	0	0	0	0
Matanuska	8/27/2022	AE 30065	IP	17.4	7.01	0.44	1.4	36	58	0	0	0	0	0	0	0	0	0	0	0	0
NG Quest	5/12/2022	AE 28716	UW	14.3	7.76	0	0	0	84	73	76	500	1910	0	500	76	0	0	0	0	0
NG Quest	5/15/2022	AE 28898	UW	16.49	7.8	0	0	0	98	100	81	500	2020	0	600	56	0	0	0	0	0
NG Quest	7/31/2022	AE 29700	UW	17.2	7.22	0.77	0.48	100	132	380	0	0	0	0	0	0	0	0	0	0	0
NG Venture	5/14/2022	AE 28750	UW	17.4	6.8	0.47	23	0	93	810	20	1200	2190	107	170	24	0	0	0	0	0
NG Venture	7/30/2022	AE 29699	UW	16.36	7.11	0.06	0	0	108	580	0	0	0	0	0	0	0	0	0	0	0
Wilderness (SS) Legacy	5/14/2022	AE 28785	IP	18.5	4.96	5.2	12.9	2,000	320	230	26	1400	40200	0	0	4400	4.5	10.8	0.31	29	10.6
Wilderness (SS) Legacy	6/25/2022	AE 29477	IP	13.1	6.47	19	34	200	68	0	0	0	0	0	0	0	0	0	0	0	0
Wilderness (SS) Legacy	7/16/2022	AE 29637	IP	12.4	6.94	1.4	1.9	210	15	0	0	0	0	0	0	0	0	0	0	0	0
Wilderness (SS) Legacy	8/9/2022	AE 29911	IP	11.6	7.84	0	0	68,000	248	0	0	0	0	0	0	0	0	0	0	0	0
Wilderness Adventurer	4/15/2022	AE 28608	IP	15.3	6.63	0	0.76	2,600,000	307	480	42	1900	31300	58.8	96	3700	16	0	0	0	0
Wilderness Discoverer	5/1/2022	AE 28784 R	IP	13.8	7.64	1.75	3.7	200	167	370	0	0	36400	0	0	0	0	0	0	0	0

Table B4. 2022 Metals Results: Small CPVs and AMHS Vessels

			Dissolved [1]								Total [1]									
			Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Selenium	Zinc	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Selenium	Zinc
Units			µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg	µ/mg
Alaska Marine water Quality Standards (chronic for marine life)			N/A	36	9.3	50 (chromium)	3.1	8.1	8.2	71	81	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vessel Name	Date	WW Type																		
Admiralty Dream	6/11/2022	GW	ND	ND	1.2	1.4	110	1.7	3.7	ND	400	ND	ND	ND	1.2	110	2.1	6.1	ND	430
Admiralty Dream	6/11/2022	GW	ND	3.8	ND	ND	110	4.4	3.5	ND	600	ND	3.9	ND	ND	120	8.2	3.2	ND	550
American Constellation	6/13/2022	MIX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
American Constellation	8/2/2022	MIX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chichagof Dream	6/3/2022	BW	ND	ND	ND	ND	16	ND	ND	ND	70	ND	ND	ND	ND	49	ND	ND	ND	110
Chichagof Dream	6/3/2022	GW	ND	ND	ND	ND	37	ND	ND	ND	66	ND	ND	ND	11	390	5.5	13	ND	540
Chichagof Dream	6/3/2022	GW	ND	ND	ND	ND	62	ND	ND	ND	27	ND	ND	ND	ND	110	1.5	ND	ND	29
Kennicott	6/7/2022	MIX	ND	ND	ND	ND	69	ND	ND	ND	55	ND	ND	ND	ND	5900	ND	ND	ND	63
Matanuska	5/29/2022	MIX	ND	ND	ND	12	220	ND	16	ND	120	ND	ND	ND	ND	230	ND	ND	ND	160
NG Quest	5/12/2022	MIX	ND	1.1	ND	ND	63	ND	5.3	1.1	100	ND	ND	ND	ND	85	ND	5.7	ND	200
NG Quest	5/15/2022	MIX	ND	1.1	ND	1.3	50	ND	5.2	1.3	100	ND	1.1	ND	1.8	73	ND	5.8	1.4	160
NG Sea Bird	5/15/2022	BW	ND	ND	ND	ND	9.6	ND	ND	10	93	ND	ND	ND	ND	ND	ND	ND	ND	200
NG Sea Bird	5/15/2022	GW	ND	ND	ND	ND	140	2.5	3.6	ND	150	ND	ND	ND	ND	99	2.1	3.6	ND	150
NG Sea Bird	5/19/2022	BW	ND	ND	ND	ND	ND	ND	ND	ND	110	ND	ND	ND	ND	ND	13	ND	ND	160
NG Sea Bird	5/19/2022	GW	ND	ND	ND	ND	84	ND	ND	ND	120	ND	ND	ND	1.1	110	ND	ND	ND	130
NG Sea Lion	5/14/2022	GW	ND	ND	ND	ND	48	ND	8.3	ND	200	ND	ND	ND	ND	120	10	9.3	ND	220
NG Sea Lion	5/14/2022	BW	ND	ND	ND	ND	ND	ND	ND	6.6	130	ND	ND	ND	ND	42	ND	ND	ND	210
NG Venture	5/14/2022	MIX	ND	1.6	ND	ND	95	ND	7.2	ND	270	ND	ND	ND	ND	120	ND	7	ND	310
Safari Endeavour	5/21/2022	GW	ND	ND	ND	ND	72	ND	25	ND	620	ND	ND	ND	1	77	7.3	50	ND	590
Widerness (SS) Legacy	5/14/2022	MIX	ND	ND	ND	ND	370	ND	8.2	6	440	ND	ND	ND	ND	630	ND	ND	ND	620

[1] Non-detect **Note:** Lab analysis conducted for Beryllium, Mercury, Silver and Thallium. All results were non-detects so these metals were omitted from the table.

2022 Summary Data	n (count)	0	4	1	3	16		10		18		2	0	5	16	8	9	1	18
	Minimum	0	1.1	1.2	1.3	9.6		3.5		27		1.1	0	1	42	1.5	3.2	1.4	29
	Maximum	0	3.8	1.2	12	370		25		600		3.9	0	11	5900	8.2	13	1.4	620
	% Detection	0%	20%	5%	15%	80%		50%		90%		10%	0%	25%	80%	40%	45%	5%	90%