

Anchorage MS4 Street Sweeping Report for 2021

WMS Document No. CPr22001

MUNICIPALITY OF ANCHORAGE
WATERSHED MANAGEMENT SERVICES SECTION

February 2022

Anchorage MS4 Street Sweeping Report for 2021

Document No. WMP CPr22001

WMS Project No. 95003

February 2022

Prepared for: Municipality of Anchorage

Prepared by: Watershed Management Services Section
Project Management & Engineering Division
Public Works Department

ANCHORAGE MS4 STREET SWEEPING REPORT FOR 2021

TABLE OF CONTENTS

1.	PURPOSE.....	1
2.	STREETS AND PARKING LOTS DESIGNATED FOR SWEEPING.....	2
2.1.	TECHNICAL FEASIBILITY FOR SWEEPING.....	2
2.2.	DESIGNATED STREETS FOR 2021 SWEEPING	3
2.3.	DESIGNATED LARGE PUBLIC PARKING LOTS	4
3.	2021 SWEEPING PERFORMANCE REPORTS.....	6
3.1.	STREET SWEEPING PERFORMANCE REPORTS FOR 2021.....	6
3.2.	PARKING LOT SWEEPING PERFORMANCE REPORT FOR 2021.....	9
3.3.	PARTICLE SIZE DISTRIBUTIONS FOR SWEPT MATERIALS.....	10
4.	2021 SWEEPING PERFORMANCE ASSESSMENT	11
4.1.	UNIT LOAD COMPARISON 2019-2021	12
4.2.	SWEEPING EFFECTIVENESS ASSESSMENT FOR 2021	13
5.	2021 MAPS AND DATA TABLES.....	17
5.1.	DESIGNATED STREETS AND GENERAL LOCATION MAPS	17
5.2.	ANCHORAGE MS4 DETAILED SWEEPING RECORDS FOR 2021	27
5.2.1.	<i>CBERRRSA 2021 Detailed Sweeping Reports*</i>	28
5.2.2.	<i>ASD 2021 Detailed Sweeping Reports</i>	29
5.2.3.	<i>2021 Changes to Sweeping and Basis for Changes</i>	31

Anchorage MS4 Street Sweeping Report for 2021

1. Purpose

Alaska Pollutant Discharge Elimination System (APDES) Permit No. AKS-052558, Part 3.4.4.4 requires the permittees, the Municipality of Anchorage (MOA) and the State of Alaska Department of Transportation and Public Facilities (ADOT&PF, submitted in a separate report) to inventory and designate arterial and residential streets and large public parking lots within the Anchorage Municipal Separate Storm Sewer System (MS4) for sweeping maintenance; to record and report sweeping performed along these systems on an annual basis; and to annually assess these sweeping practices relative to minimization of pollutant discharges from these systems into receiving waters. Specifically, permittees are required to submit:

- **Sweeping maps**: Each year permittees must submit maps of the streets and parking lots that have been designated for sweeping that year and their proposed sweeping frequency relative to the frequencies specified in this permit. Permittees must also designate those streets that they deem ‘technically infeasible’ for sweeping.
- **Sweeping records**: Permittees must submit annual records of the sweeping practices used, and the curb miles and volumes of materials swept, and other relevant qualitative information such as ‘visually clean’ evaluation, for streets and large public parking lots organized by sweeping event, and sweeping frequency class. Analyses of particle size distributions for samples representative of swept materials must also be submitted.
- **Sweeping assessment**: Permittees must annually prepare an assessment on the basis of submitted sweeping records of the effectiveness of MS4 sweeping completed that year in minimizing pollutant discharges to storm drains and receiving waters.

The permittees have completed and compiled these inventories, records and assessments and submit summaries of these data and findings in this report in compliance with this permit part. The report is organized into five major sections. Section 1.0 summarizes the purpose of this report. Section 2.0 identifies 2021 swept streets and large public parking lots as well as those streets designated infeasible for sweeping. Section 3.0 summarizes sweeping records for 2021. Section 4.0 summarizes an assessment of the permittees’ sweeping effectiveness for this year. Section 5.0 includes maps and additional summary tables described in Sections 2.0 through 4.0.

2. Streets and Parking Lots Designated for Sweeping

Permit Part 3.4.4.1 requires permittees to map all streets and large public parking lots to be swept in the coming year and designate their assigned sweeping frequency relative to permit requirements. Additionally, Part 3.4.4.3 requires that permittees designate streets that are technically infeasible for sweeping, specify why, and document other trash/litter control techniques to minimize pollutant discharges to the MS4 and receiving waters. Finally, Part 3.4.4.4.1 requires that permittees annually “identify any significant changes” in mapping of “residential, arterial, and public parking lots” subject to regular sweeping under the permit. The following section summarizes this information. Section 2.1 identifies types of streets deemed technically infeasible for sweeping by the permittees. Section 2.2 identifies streets designated for sweeping within each of the permittees’ jurisdictions. Section 2.3 identifies the public parking lots designated as large and swept by the permittees. Any changes in swept features and the basis for those changes are summarized in Sections 2.2 and 5.2.3.

2.1. *Technical Feasibility for Sweeping*

The permittees specify the technical infeasibility of regularly sweeping a street based on two factors: surface type and cases where the combined character of speed, access and drainage type make regular sweeping unnecessary, disruptive, and/or dangerous.

Unpaved road surfaces are not technically feasible for sweeping. Such surfaces include dirt and gravel roads and also roads that have been treated with applications of chemicals, asphaltic, or other mixtures to create a smooth, temporarily hardened surface. Treatment typically results in only a short-term hardening of the road surface with a primary intent of smoothing the road surface for traffic over the summer season. However, the treatment also serves to temporarily bind particles to reduce dust and erosion. Sweeping can speed deterioration of these surfaces and increase mobilization of fines during runoff. Therefore, these roads are not swept but may be periodically re-graded or re-treated to reduce erosion and dust generation.

High-speed, high-traffic roadways (freeways and expressways), where access is limited and drainage is provided by open channels on both sides of the road, are also not regularly swept. Regular sweeping along these street segments is considered both technically infeasible and unnecessary. Regular sweeping is technically infeasible along these roadway segments because of the speed and volume of the traffic. Regular sweeping activity along these segments would present unpredictable danger to traffic as a slow-speed obstruction. It would also limit, for prolonged periods of time, the utility of these roadways as high-speed throughways. From a more practical standpoint, regular sweeping along these segments is also generally unnecessary. Winter traction sand applications along these segments is less frequently done, significantly reducing sediment loading on the roadway. The sediment that does accumulate is rapidly removed by high-speed traffic along these segments. Wind and wheel energy generated by traffic very effectively move particulates off the paved surface and onto vegetated shoulder and median areas where these materials are collected on a seasonal or as-needed basis during shoulder maintenance.

Anchorage MS4 Street Sweeping Report for 2021

2.2. Designated Streets for 2021 Sweeping

Permittees are required to identify and map all streets designated for sweeping and provide maps of streets swept in an annual report of these activities (3.4.4.1). Any changes in swept features and the basis for those changes must also be summarized. Sweeping for different parts of the Anchorage MS4 is performed by different operators, based on the jurisdictions of the MS4 owners (ADOT&PF and MOA) and the maintenance authorities assigned to different operators by the owners. Initial maps of Anchorage MS4 streets and large public parking were compiled and submitted in the permittees' 'Street Sweeping Management Plan: Anchorage MS4', (hereinafter, MS4 Sweeping Plans or Sweeping Management Plans).

Through various means, MOA and ADOT&PF assign maintenance administrative authorities for the Anchorage MS4 to different agencies. Each maintenance administrative agency is assigned a specific geographic area covering different portions of the Anchorage MS4. ADOT&PF assigns maintenance authority for its entire Anchorage MS4 jurisdiction to its Maintenance & Operations Division, Central Region (ADOT&PF). MOA assigns maintenance authorities for various portions of its MS4 jurisdiction to different roads and drainage 'service areas', or to particular segments of streets and roads, through Municipal administrative and Assembly-codified authorizations. The primary maintenance administrative authorities (maintenance operators) for the Anchorage MS4 facilities regulated under 3.4.4 include:

- The MOA Public Works Maintenance & Operations Division (ARDSA)
- The MOA Chugiak Eagle River Rural Road Service Area (CBERRRSA)
- The MOA Public Works Administration Division (PWA)
- The MOA Anchorage School District (ASD)
- The MOA Parks and Recreation Department (Parks).

Individual maintenance administrative authorities may further divide their assigned regions into smaller operational areas. Each maintenance authority also designates streets within its region for sweeping (based on guidelines provided by the MS4 owners and as required by the MS4 storm water permit). Operational areas are shown in Figure 5-1 and streets that were designated for sweeping in 2021 are shown in Figures 5-2 through 5-9 in Section 5.1 for each of the primary maintenance administrative agencies for the Anchorage MS4.

Changes in mapping of streets designated for sweeping have been made during the 2021 reporting period reflecting changes in features swept. Changes in streets swept are tabulated in Table 5-5 in Section 5.2.3 and are summarized below.

In 2021 ARDSA reported no changes to their inventory of streets designated for sweeping from the 2020 reporting period.

In 2021 CBERRRSA reported no changes to their inventory of streets designated for sweeping from the 2020 reporting period.

Anchorage MS4 Street Sweeping Report for 2021

Any changes to ADOT&PF management practices or streets designated for sweeping for the 2021 reporting period will be addressed in a separate ADOT&PF sweeping report (Appendix E-2).

2.3. Designated Large Public Parking Lots

Section 3.4.4 specifies that permittees must identify and designate large parking lots for sweeping that serve schools, cultural facilities, plazas, sports and event venues and similar facilities. The permittees have interpreted a large public parking lot to be any such lot that has a total exposed parking footprint of 2 acres or larger within a single parcel or a complex of closely associated parcels (see the Anchorage MS4 Sweeping Plan).

MOA identified 62 large public lots meeting these criteria. Maps showing location of these lots are included as Appendix C in the MS4 Sweeping Plan. The designated MOA large public parking lots serve 51 schools, 9 parks, one cultural facility and one events venue. The median size of all 62 designated MOA large public parking lots is 2.5 acres. The largest lot is approximately 13.3 acres in size, with only four lots 10 acres or larger in size. Four of the designated lots are between 5 and 10 acres in size, 15 lots are 3 to 5 acres in size, and 39 lots are 2 to 3 acres in size. No changes were made to the large parking lot sweeping list for 2021. Table 2-1 below lists all large public parking lots currently identified by the permittees.

Table 2-1 Large Public Parking Lots (MOA)

Name	Type	Area, ft ²
Hilltop Ski Area	Park	88000
Ravenwood Elementary	School	89075
Girdwood K-8 School	School	89969
Davis Park	Park	90000
Muldoon Elementary	School	92049
Turnagain Elementary	School	93900
Susitna Elementary	School	94200
Harry J. McDonald Memorial Center	Park	95000
Mountain View Elementary	School	95101
Huffman Elementary	School	95228
Ruth Arcand Park	Park	96000
Rogers Park Elementary	School	96305
Polaris K-12 School	School	97293
Wonder Park Elementary	School	97567
Williwaw Elementary	School	97956
O'Malley Elementary	School	98189
Bear Valley Elementary	School	98474
Rabbit Creek Elementary	School	99865
Far North Bicentennial/ Hillside Park	Park	100500
Mears Middle School	School	102000
Alpenglow Elementary	School	102825
Trailside Elementary	School	103834
Campbell Elementary	School	104000
Eagle River Lion's Club	Park	104000
Gladys Wood Elementary	School	104344

Anchorage MS4 Street Sweeping Report for 2021

Name	Type	Area, ft ²
Bowman Elementary	School	106000
Spring Hill Elementary	School	106000
Lake Otis Elementary	School	106173
North Star Elementary	School	106780
Bayshore Elementary	School	106792
Northern Lights ABC School	School	108974
Albrecht Field	Park	113300
Lake Hood Elementary	School	114600
Central Middle School/Chugach Optional Elementary	School	116792
Northwood ABC Elementary	School	118491
Birchwood ABC Elementary	School	119236
Kasuun Elementary	School	119441
Tyson Elementary	School	120690
Willow Crest Elementary	School	124285
Russian Jack Elementary	School	128685
South Anchorage Sports Park	Park	140000
Chugiak Elementary	School	140875
Loussac Library	Cultural	141000
King Career Center	School	144663
Kincaid Park	Park	145000
Gruening Middle School	School	150000
Kincaid Elementary	School	152789
Clark Middle School	School	168224
Hanshew Middle School	School	169175
Romig Middle/ West High Schools	School	176826
Begich Middle School	School	177442
Wendler Middle School	School	193293
Goldenview Middle School	School	201993
Mirror Lake Middle School	School	203260
Eagle River High School	School	275595
Chugiak High School	School	325000
South High School	School	340669
Bartlett High School	School	412961
Sullivan/Boeke Arenas	Events	457000
East High School	School	459000
Service High School	School	473795
Dimond High School/Chinook Elementary	School	580883

3. 2021 Sweeping Performance Reports

Permit Part 3.4.4.4 requires permittees to report sweeping performance annually in terms of specific factors and to assess sweeping effectiveness in minimizing discharge of pollutants to storm drains and creeks based on those factors. Sweeping performance reports must at minimum identify and map the actual streets that were swept in the reporting year. In addition, permittees must compile and report specific sweeping performance factors including:

- Sweeping practices used,
- Dates of sweep,
- Volume or weight of swept materials, and
- Particle size distributions of representative swept materials.

The permit specifies that sweeping performance information is to be organized and reported, in some respect, by date and sweeping ‘frequency category’ (defined in the permit as Arterial or Residential streets, and Parking). However, whatever the exact organizational structure elected by the permittees for the performance report information, all these factors are specifically to be used in assessing the effectiveness of MS4 sweeping on limiting discharge of pollutants to the MS4 and receiving waters. This section summarizes sweeping performance records sorted by maintenance agency for both streets (Subsection 3.1) and parking (Subsection 3.2). Subsection 3.3 describes particle size distributions for swept street materials and residuals collected during and after the 2021 and previous sweep periods. In Section 4, we use these performance records, along with other information, to assess effectiveness of the 2021 MS4 sweeping program.

3.1. *Street Sweeping Performance Reports for 2021*

The permittees have organized their sweeping performance data to reflect both significant differences in drainage types across the MS4 and variations in street sediment loading between those drainage types to the extent practicable. As described in their MS4 Sweeping Plan, the permittees may use different sweeping practices for streets having curb and gutter (CG) drainage as opposed to those having open channel (OC) or ditch drainage. For streets with curb and gutter drainages, sediments are concentrated along the gutter pan and readily available for mobilization in wash-off events. For these streets, swept materials are always collected during sweeping, and the removed volumes can be readily inventoried. Conversely, sediments from streets with open channel drainages tend to become concentrated onto the adjacent vegetated shoulders where runoff events are much less likely to mobilize them. Along these streets common sweeping practices are ones that ‘kick’ the sediments left on the street pavement onto the same vegetated shoulder (to be removed later during shoulder maintenance and ditch ‘dressing’). As a result, inventories of the volumes of sediment swept from a portion of open channel street segments are usually not available, at least not as part of sweeping performance records.

Given these practices, reporting sweeping information for curb miles alone, is problematic. Reporting only those streets having ‘curb miles’ (i.e., curb and gutter type streets) as specified in the permit would obviously bias measurement of total Anchorage MS4 sweeping performance. Similarly, using total street miles when assessing the total

Anchorage MS4 Street Sweeping Report for 2021

volume of swept materials will bias loading and efficiency estimates when the only swept sediment volumes recorded are for curb and gutter streets but open channel street miles are included in the analysis. Finally, potential for biasing analysis is even further compounded considering differences in sediment loading between drainage types (and sweeping frequency categories).

To control for these sweeping practices and characteristics, sweeping performance information for Anchorage MS4 streets is collected and sorted by a number of factors. These include sweeping frequency type, the MS4 maintenance operator, and the sweeping event (determined by the sweeping completion date range; spring, summer, fall). Sweeping frequency types include ‘arterial’ and ‘residential’ categories as already described in the permittees’ MS4 Sweeping Plans.

Sweeping performance information reported for the Anchorage MS4 includes total swept volumes (in cubic yards) referenced to “Street Miles”, “Curb Miles”, and/or “Pick Up Miles”. “Street Miles” for all designated swept streets are included in this performance report and are calculated as the total centerline lengths of swept street segments. Where a “kick” type of sweeping practice is used along open channel roads (i.e., swept sediments are not collected), total swept volume will not be known and Street Miles is the only sweeping information reported. Any estimate of swept volumes for these streets must be calculated using the swept mileage and an estimate of street sediment loading present at the time of the sweeping event for the particular sweeping frequency category (arterial or residential). Because sweep practices that collect swept material (i.e., swept volumes are inventoried) are used on both curb and gutter and open channel drainage type roads, the term “Pick Up Miles” is more appropriate and used in place “Curb Miles” for this report. Pick Up Miles optimally represent the total actual length of road shoulder swept, for the case of open channel road segments, and the actual length of curbed drainage swept, for curb and gutter road segments. Where this is not known, Pick Up Miles are estimated as twice the length of the swept streets centerline along which the sediments are collected. Where possible, the Anchorage MS4 sweeping performance report also includes an estimate of the unit swept volume (cubic yards per Pick Up Mile) for each combination of frequency type and drainage type.

2021 sweeping performance records for the principle Anchorage MS4 street maintenance operators (ARDSA and CBERRRSA) are summarized for all three sweeping events in Table 3-1 below. Note that the two tandem sweeps required for arterial frequency category streets are summarized under the single spring event shown. Operational areas for these maintenance operators are as described in Section 2.2 and shown in Figure 5-1. More detailed sweeping summary tables are included in Section 5.2. Note: details specific to ADOT&PF sweeping and performance can be found in Appendix E-2 of the 2021 APDES report.

In general in 2021 all Anchorage MS4 operators completed sweeping of designated streets in accordance with permit requirements using the various practices as described in the previously published MS4 Sweeping Management Plan. (more information included

Anchorage MS4 Street Sweeping Report for 2021

below Table 3-1 and detailed records for each operator in Section 5.2 or in Appendix E-2 of the 2021 APDES report for ADOT&PF).

Table 3-1 Anchorage MS4 Sweeping Summary, 2021

Spring 2021						
	EPA Category	Drainage Type	Street Miles	PickUp Miles	Total Volume* (cyds)	Unit Volume* (cyds/mile)
ARDSA	Arterial	Mixed	45.8	91.6	1410.0	15.4
	Residential	Mixed	580.6	1161.3	2050.0	1.8
CBERRRSA	Residential	Mixed	196.0	392.4	992.0	2.5
Summer 2021						
	EPA Category	Drainage Type	Street Miles	PickUp Miles	Total Volume* (cyds)	Unit Volume* (cyds/mile)
ARDSA	Arterial	Mixed	45.8	91.6	50.0	0.5
	Residential	Mixed	580.6	*	No data reported	*
CBERRRSA	Residential	Mixed	196.0	392.4	No data reported	
*ARDSA and CBERRRSA Residential roads were swept on an "as-needed" basis to maintain a "visually clean" standard during the summer sweep period						
Fall 2021						
	EPA Category	Drainage Type	Street Miles	PickUp Miles	Total Volume* (cyds)	Unit Volume* (cyds/mile)
ARDSA	Arterial	Mixed	45.8	91.6	244.0	2.7
	Residential	Mixed	580.6	1161.3	1147.0	1.0
CBERRRSA	Residential	Mixed	196.0	392.4	84.0	0.2

* Volumes represent only swept materials collected along reported/estimated Curb/PickUp Miles
 OC = Open Channel Drainage
 CG = Curb and Gutter Drainage

For 2021, CBERRRSA reported 100% completeness for all sweep periods according to the procedures described in the MS4 Sweeping Management Plan, with no reported road segments or operational areas falling below permit requirements. For the 2021 summer sweep period, CBERRRSA reported that roads were swept "as needed" to maintain a "visually clean standard" (as prescribed in the MS4 Sweeping Management Plan) but did not report a total volume collected for the summer. CBERRRSA reported their roads

Anchorage MS4 Street Sweeping Report for 2021

typically required 6 passes for those roads swept with kick brooms, and 5 to 6 passes with a tandem sweeper configuration for roads where swept material is collected. All roads were swept until they were deemed ‘visually clean’ by a CBERRRSA supervisor, including additional passes with the sweeper train, if necessary to meet the standard. CBERRRSA also reported conducting additional spot sweeps as necessary after the fall sweep period to deal with fallen leaves and other organics.

ARDSA reported a sweeping completeness of 100% for designated streets within its administrative authority for all 2021 sweep periods. All ARDSA roads swept in 2021 were swept according to the procedures described in the MS4 Sweeping Management Plan and were inspected by ARDSA supervisors to ensure they were deemed “visually clean” before being marked off as “swept” for each sweep period. ARDSA reported an average of 4 passes with two tandem trains for arterial type roads for the spring sweep period and an average of two passes for residential roads in the spring and all roads types for the summer and fall sweep periods. Additional passes were performed as necessary to maintain the “visually clean” standard and were usually focused on hills and heavily trafficked intersections where sediment was more heavily applied in the winter. ARDSA also reported doing additional spot sweeps (beyond what is described in the MS4 Sweeping Management Plan) for excess leaves and organics, as necessary, during the fall sweep period. These additional spot sweep efforts were identified in the report “Anchorage Street Sweeping and Storm Water Controls: 2013 Performance Evaluation” (Appendix E-2 of the 2013 APDES report) as a suggested means to accomplish the post-sweep sediment load goals identified in the report, and were incorporated into the permittees most recent MS4 Sweeping Management Plan version.

In 2021, operators for the Girdwood Service Area (GSA) reported a total of 94 cubic yards of sediment collected for all sweeping operations in 2021. 59 cubic yards of sediment were collected during the spring sweep period, 35 cubic yards during the summer sweep period, and GSA reported that they were not able sweep during the fall sweep period due to heavy rains and early snowfall that caused local flooding and lots of damage to GSA operated roads. GSA sweeps 2.3 miles of curb and gutter drainage type streets and 1.6 miles of open channel drainage streets using a tandem pick up broom configuration consisting of at least one mechanical sweeper and one vacuum sweeper. GSA also sweeps 3 miles of open channel drainage streets and 3.5 miles of bike trails using kick brooms. GSA’s sweeping contract requires at least 4 passes per sweep, with additional passes as needed until the road surface is clean. All roads within GSA jurisdiction are of the residential category.

3.2. *Parking Lot Sweeping Performance Report for 2021*

Sweeping performance was reported by the Anchorage School District for all 51 public schools on the large public parking lot list as designated in Section 2.3, for a completion of 100%. No changes in number of swept school parking lots was submitted. Reported total swept volumes for individual parking lots ranged from 4 to 42 cubic yards per lot, for a total of 742 cubic yards collected during 2021 sweeping efforts (roughly 3.9 cubic yards per acre of parking lot area for the year). Detailed sweeping reports for the large

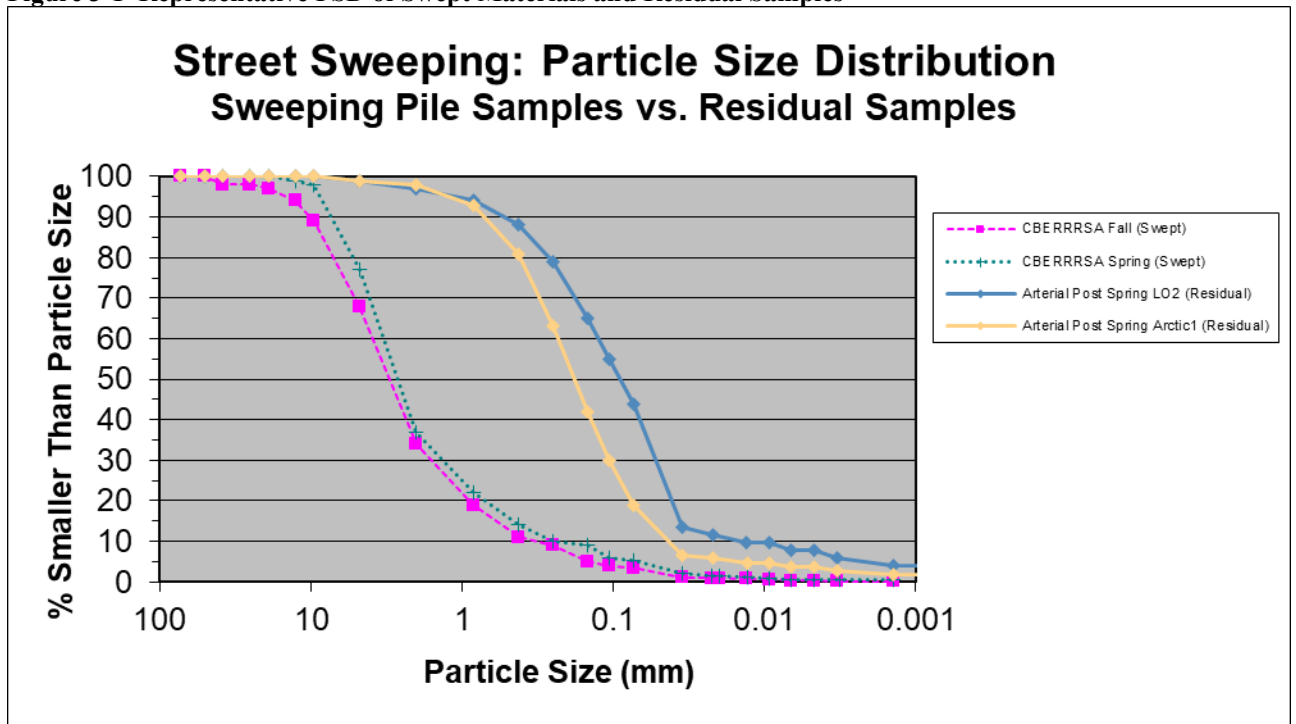
Anchorage MS4 Street Sweeping Report for 2021

school parking lots are included in Section 5.2. No other reports were submitted for sweeping performed in 2021 for the other large public parking lots as listed in Table 2-1.

3.3. Particle Size Distributions for Swept Materials

Representative samples of swept street materials (no samples were available from parking lots) were collected by subsampling temporary sweeping storage piles built up by MS4 operators and the samples were then submitted to a certified laboratory for analysis. Residual samples, collected after sweeping has been completed, are also submitted to the lab for analysis. Particle size distributions representative of samples collected during 2021 and previous sweeping events are included in Figure 3-1 below.

Figure 3-1 Representative PSD of Swept Materials and Residual Samples



In 2010 and 2011, samples were collected from street surfaces before and after each sweeping event, in order to compare pre- and post-sweep street conditions. In 2013, samples were collected from street surfaces after spring and summer sweeps in order to further analyze and quantify post-sweep residual loading. Analysis of data suggests reduced sweeping practices efficiency in removing the mid-range fine particles—from about 75 to 1000 microns. Available data for estimation of sweeping efficiencies for very fine particles (finer than 75 micron) does suggest that current sweeping practices may have limited competency at removing particles smaller than 75 microns. In 2021, a select number of roads were sampled after they were deemed ‘visually clean’ for the fall sweep period, in order to help assess residual dirt amounts and overall sweeping practice efficiency. The results and conclusions of these sampling efforts are contained in Section 4-2.

Anchorage MS4 Street Sweeping Report for 2021

Figure 3-1 includes particle size distributions (PSDs) of samples collected from temporary storage piles generated from street sweeping in 2019 (curves labeled as “Swept”, no pile samples were submitted to WMS in 2021) as well as PSDs for post-sweep samples collected from street surfaces in 2021 (curves labeled as “Residual”). Particle size distributions for swept materials, collected from street sweeping temporary storage piles, show similar data ranges as previously tested samples. Dirt collected from CBERRRSA piles showed a very similar particle size distribution, with dirt from the fall sweep pile containing a slightly higher proportion of coarse grained materials. Dirt from CBERRRSA’s spring pile had less coarse to very coarse (particle size 1-10mm) content than in previous years, but both samples showed a very similar particle size distribution of medium to fine grained material.

In 2021 post-sweep samples were taken after the spring sweep period. Post sweep sampling showed a similar particle size distribution to past sampling, and again suggests that sweeping is very efficient at removing coarse grained (<10% total sample) and very fine grained materials, but not as efficient in removing the mid-range fine particles— from about 75 to 1000 microns.

4. 2021 Sweeping Performance Assessment

Sweeping effectiveness and performance were analyzed in the 2013 report “Anchorage Street Sweeping and Storm Water Controls: 2013 Performance Evaluation”, and recommendations to increase effectiveness and performance from the report were incorporated into the permittee’s MS4 Sweeping Management Plan. APDES permit part 3.4.4.4 requires the permittees to “perform annual assessments of street sweeping effectiveness to minimize pollutant discharges to storm drains and creeks” on the basis of the performance factors required to be reported under the permit. To help in this assessment, the permittees completed additional sampling of street sweeping activities in 2010, 2011, 2013, 2016, 2017, 2018, 2019, 2020, and 2021, and reviewed sampling efforts and studies performed under earlier Anchorage MS4 permit terms and in other areas nationwide. Section 4.1 provides a comparison of unit loads (cubic yards per pick up mile and pounds per pick up mile) for swept dirt for the past three years (2019-2021). Based on both this additional information and current performance reports, Section 4.2 summarizes the effectiveness of the permittees’ 2021 sweeping program as required under Part 3.4.4.4.

Anchorage MS4 Street Sweeping Report for 2021

4.1. Unit Load Comparison 2019-2021

Swept volume data, collected over the past three years, have been analyzed and, where possible, have been converted to unit load values (cubic yards/pick up mile), to give a measure of what volume of dirt is being swept up per pick up mile for each different operator and sweep frequency category. Table 4-1 shows unit loads in cubic yards per pick up mile for the spring, summer, and fall sweep periods for 2019, 2020, and 2021.

Table 4-1 2019-2021 Unit Load Comparison

Unit Load Comparison 2019-2021 (cubic yards/pickup mile)					
Spring			Spring 2021	Spring 2020	Spring 2019
Operator	EPA Category	Drainage Type	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)
ARDSA	Arterial	Mixed	15.4	14.6	15.1
	Residential	Mixed	1.8	1.8	1.6
CBERRRSA	Residential	Mixed	2.5	5.4	6.5
Summer			Summer 2021	Summer 2020	Summer 2019
Operator	EPA Category	Drainage Type	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)
ARDSA	Arterial	Mixed	0.5	0.4	0.4
	Residential	Mixed	-	-	-
CBERRRSA	Residential	Mixed	-	-	1.2
Fall			Fall 2021	Fall 2020	Fall 2019
Operator	EPA Category	Drainage Type	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)	Unit Volume (cyds/mile)
ARDSA	Arterial	Mixed	2.7	1.8	0.6
	Residential	Mixed	1	0.9	0.6
CBERRRSA	Residential	Mixed	0.2	0.9	1

For the 2021 spring sweep period ARDSA reported a slightly higher unit load for arterial type road segments than in 2020 (15.4 cubic yards per mile, up from 14.6 cubic yards in 2020 and 15.1 cubic yards in 2019), while they reported the same 1.8 cubic yards per mile as in 2020 for residential type road segments. For the 2021 summer sweep period ARDSA reported a slightly higher unit load of 0.5 cubic yards per mile than in 2020 (up from 0.4 cubic yards per mile). Likewise, for the fall sweep period ARDSA reported unit loads that were higher than in 2020 for both arterial and residential road types (2.7 cubic yards per mile, up from 1.8 for arterials, and 1.0 cubic yards per mile, up from 0.9 for residential). This is likely due to ARDSA continuing to sweep well into October to pick up as much organics as possible before freeze up. Fall 2021 in Anchorage saw an extension of summerlike temperatures and fewer wind storms than normal, keeping leaves on the trees much later into the fall than is typically experienced. Also whereas in the 2020 fall sweep was not completed due to an early snowfall in mid October, ARDSA reported 100% completeness for the 2021 fall sweep period, indicating that they were able to sweep later in the fall and thus collect more material.

In 2021 CBERRRSA reported much lower unit loads for both the spring and fall sweep periods than in 2020 (no loads were reported for the summer period in either 2020 or 2021). CBERRRSA staff suggested several possible explanations for this. The winter of 2020-2021 was overall milder than in 2019-2020, with fewer mid-winter warm-ups and freeze/thaw cycles requiring less road sanding than normal. CBERRRSA also reported having issues with the record keeping of one of their sweeping contractors, making it so

Anchorage MS4 Street Sweeping Report for 2021

they were unable to compile the detailed sweeping volume records for individual street segments that they normally submit. Because the normal record keeping was unavailable, CBERRRSA decided that measuring the volumes of their piles of collected sweeping material for each sweep period was the most accurate way to report their total volume of swept material (this is the same volume measurement practice used by ARDSA). Due to the record keeping issues, the contractors sweeping contract was terminated for the fall sweep period and another contractor took over.

Overall variability from year to year and between the different operators and sweep categories is highest for the spring sweep period each year. This is likely due to differences in winter weather from year to year (amount of snow and number of mid-winter freeze/thaw cycles), as well as the different sand and gravel application procedures and products between the different operators. See Appendix E-2 for information regarding DOT sweeping operations and results.

4.2. Sweeping Effectiveness Assessment for 2021

Sweeping effectiveness can be related to potential for receiving water impact by a number of relationships illustrated by this data and other data presented in this report. The spatial relationship of street drainage to receiving waters and to the total sediment load present on those streets is an important factor. Performance records summarized in Section 3.1 along with operation maps included in Section 5 provide insight to the potential for street sediment loads to wash off into Anchorage storm drains and receiving waters based on these spatial relationships. Of the three reporting MS4 operators, ARDSA sweeps the most street miles at approximately 626 miles (~580 miles of residential streets and 46 miles of arterial streets), with CBERRRSA second at 204 street miles (all residential), and ADOT&PF third with about 187 street miles (~100 miles arterial and 86 miles residential). Distribution of these contributing surfaces varies even more significantly between the operators. ADOT&PF and CBERRRSA streets are spread across large geographic areas. For ADOT&PF jurisdiction, streets extend across the entire Municipality and most of its watersheds. Despite its relatively small street inventory, CBERRRSA's operational areas also cross a large number of watersheds. ARDSA's operational area, although including the largest street inventory, is significantly more compact, with the result that ARDSA streets drain across a much smaller number of watersheds than either of the other two primary Anchorage MS4 operators.

Street sweeping operators have instituted new tools and modified existing procedures in order to increase the overall effectiveness of street sweeping operations. Street maintenance supervisors visually inspect the streets after sweeping and certify them as "visually clean" before marking them as done for that sweep period. In some instances, before and after sweeping photos were collected to further qualify the "visually clean" assessment (see Figures 4-1 and 4-2). Both CBERRRSA and ARDSA reported increased "spot" sweeps above and beyond procedures described in the MS4 Sweeping Management Plan in order to meet the "visually clean" standard. These extra sweeps were typically focused on the gutter where the majority of sediment accumulates, and were typically more frequent in the summer and fall sweep periods in order to deal with

Anchorage MS4 Street Sweeping Report for 2021

accumulated organic material. Additional spot sweeps and emphasizing sweeping along the gutter and first 4 feet of street adjacent to the gutter, where the majority of sediment is present, represent changes to sweeping procedures that were recommended in the report, “Anchorage Street Sweeping and Storm Water Controls: 2013 Performance Evaluation”.

Operators also increased public outreach to inform the public of the status of sweeping operations and encourage people to move vehicles parked on the street and other obstructions, in order to maximize the street surfaces available for sweeping. In neighborhoods with less off street parking available, ARDSA increased their use of temporary no parking signs, sweeping east-west oriented streets and north-south oriented streets on different days, which benefitted both sweeping operations and residents. Similarly, both ARDSA and CBERRRSA schedule sweeping operations around trash pickup days to minimize street obstructions. CBERRRSA uses the Eagle River Right of Way department to give notice to residents when sweeping operations are imminent, encouraging on street parkers to move their vehicles prior to sweeping. ARDSA continues to use and update online mapping to inform residents of day-to-day sweeping operations and track progress, and is continuing to use a service called Nixle to inform residents of sweeping schedules via text message alerts. ARDSA has also started including the ‘visually clean’ standard into its dealings with construction contractors, requiring that a newly constructed road meet the standard before accepting the road into their inventory. DOT efforts to increase street sweeping effectiveness are detailed in Appendix E-2.

Figure 4-1 2021 ‘Visually Clean’ Photo Example (Post Spring Sweep ARDSA Lake Otis2)



Anchorage MS4 Street Sweeping Report for 2021

Figure 4-2 2021 'Visually Clean' Photo Example (Post Spring Sweep ARDSA Arctic1)



Overall, sweeping efficiencies are high for the spring sweep period. These high efficiencies are believed to be due to the high sediment loadings on the street surfaces, representing traction sanding loads accumulated over the entire winter. As a result, spring sweeping efficiencies historically exceed 90 percent. The results of 2013 residual sampling reflected a removal rate of approximately 95% for arterial streets and 70% for residential streets for the 2013 spring sweep period. Results from the 2016 residual sampling reflect a removal rate of approximately 99% for ARDSA arterial roads and 86% for ARDSA residential roads. Results from the 2017 residual sampling reflect a removal rate of approximately 99% for ARDSA arterial roads and 93% for ARDSA residential roads. Results from the 2018 residual sampling reflect a removal rate of approximately 99% for ARDSA arterial roads and 96% for ARDSA residential roads. Results from the 2019 residual sampling reflect a removal rate of 99.5% for ARDSA arterial roads and 90% for ARDSA residential roads. Results from 2021 residual sampling reflect a removal rate of 99.2% for ARDSA arterial roads. These higher removal rates suggest that changes to sweep practices, including those suggested in the report “Anchorage Street Sweeping and Storm Water Controls: 2013 Performance Evaluation” have increased the overall efficiency of sweeping operations. Residuals loading rates for 2019 and 2021 were overall much smaller than when they were sampled in 2013, and in one ARDSA category (post spring arterial) was below the goal standards proposed in the “Anchorage Street Sweeping and Storm Water Controls: 2013 Performance Evaluation”.

Anchorage MS4 Street Sweeping Report for 2021

Sweeping efficiencies for later events are somewhat reduced but include sweeping removal rates that still reflect relatively large sediment loads varying from approximately 0.5 to 2.7 cubic yards per pick up mile for arterial streets and 0.2 to 1.0 cubic yards per pick up mile for residential/collector streets for the 2021 summer and fall sweeps. This shows a similar range of variability in late season sediment loads to those in 2020. In fall 2021 ARDSA and CBERRSA residential streets tended to have the lightest concentration sediment on them, producing unit load numbers lower than those of ARDSA arterial streets. Unit loads for both ARDSA residential and arterial streets for the fall were higher than in 2020 (arterial up from 1.8 cubic yards per pick up mile in 2020 to 2.7 in 2021, residential up from 0.9 cubic yards per pick up mile in 2020 to 1.0 in 2021). This increase in ARDSA fall unit loads is likely due to the late fall Anchorage experienced in 2021, with leaves remaining on trees much later into the season than is typical, causing ARDSA to continue sweeping well into October to deal with organics as they accumulated on the street surfaces, reporting 100% completeness for the fall sweep. Previous data showing CBERRSA to consistently have lowest fall concentrations may be due to differences in the street patterns of the areas maintained by these street maintenance groups. The primary residential area served by CBERRSA lies in a relatively flat, newer subdivision areas served by lollipop and looped streets linked by a single collector, with adjacent yards having few trees. As a result, fewer intersections are present and the need for winter sanding may be significantly reduced. On the other hand, ARDSA and ADOT&PF serve much older and highly urbanized Anchorage areas where streets are laid out on a grid block basis, requiring many more collectors and a larger number of controlled intersections where more sanding may be needed to maintain safe winter trafficking. These older neighborhoods are also well-treed, which may lead to the higher street particulate load typically observed in the fall. Though overall sweeping efficiencies for summer and fall sweep periods are less than those of the spring sweep period, in 2019 residual sampling showed a removal rate of approximately 89% for ARDSA arterial streets for the 2019 summer sweep period (residual samples for the summer and fall sweep periods were not analyzed for weight and volume in 2021).

5. 2021 Maps and Data Tables

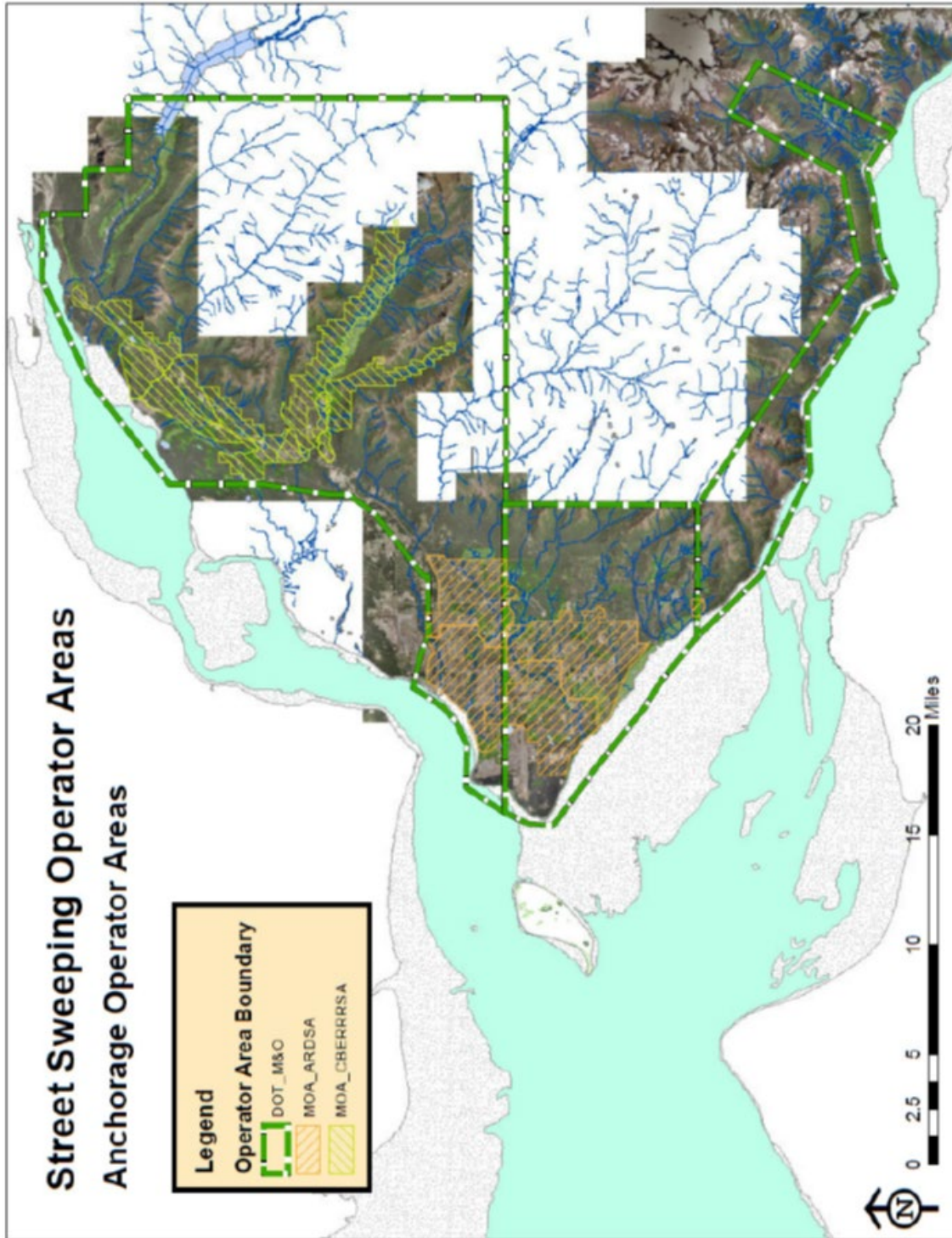
Section 5 contains maps and detailed data tables supporting summary information and the sweeping assessment presented in Section 2 through 4 above. Section 5.1 contains maps of swept streets and operational areas. Section 5.2 contains detailed sweeping performance records for Anchorage MS4 operators.

5.1. *Designated Streets and General Location Maps*

This section contains maps of Anchorage MS4 streets designated for sweeping by each of the principle street maintenance operators listed in Section 2.0. The first map in this section, Figure 5-1, provides an overview of all operational areas for all operators. More detailed maps of individual operator's areas and designated streets are presented in the following figures.

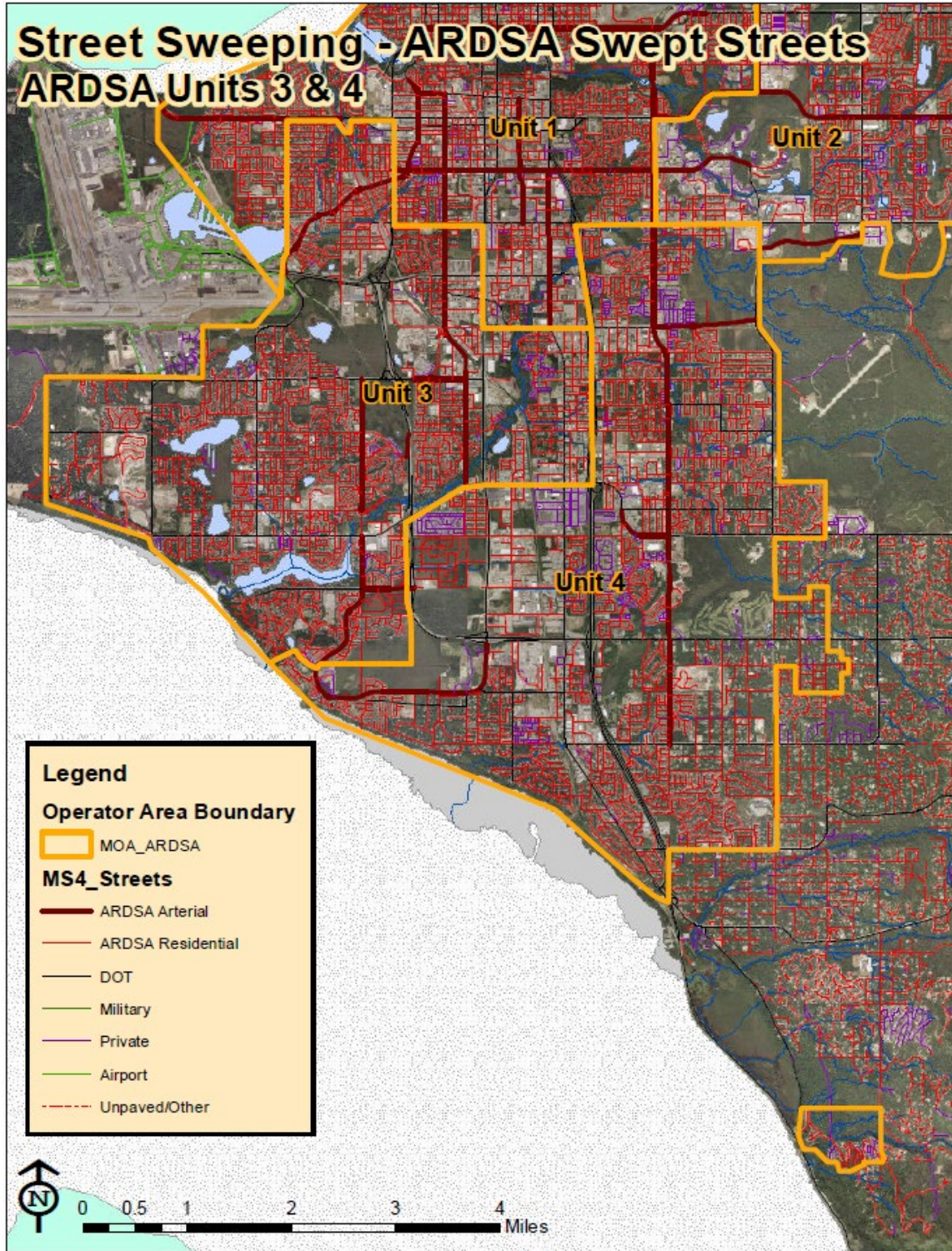
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-1 Anchorage MS4 Sweeping 'General Locations' 2021



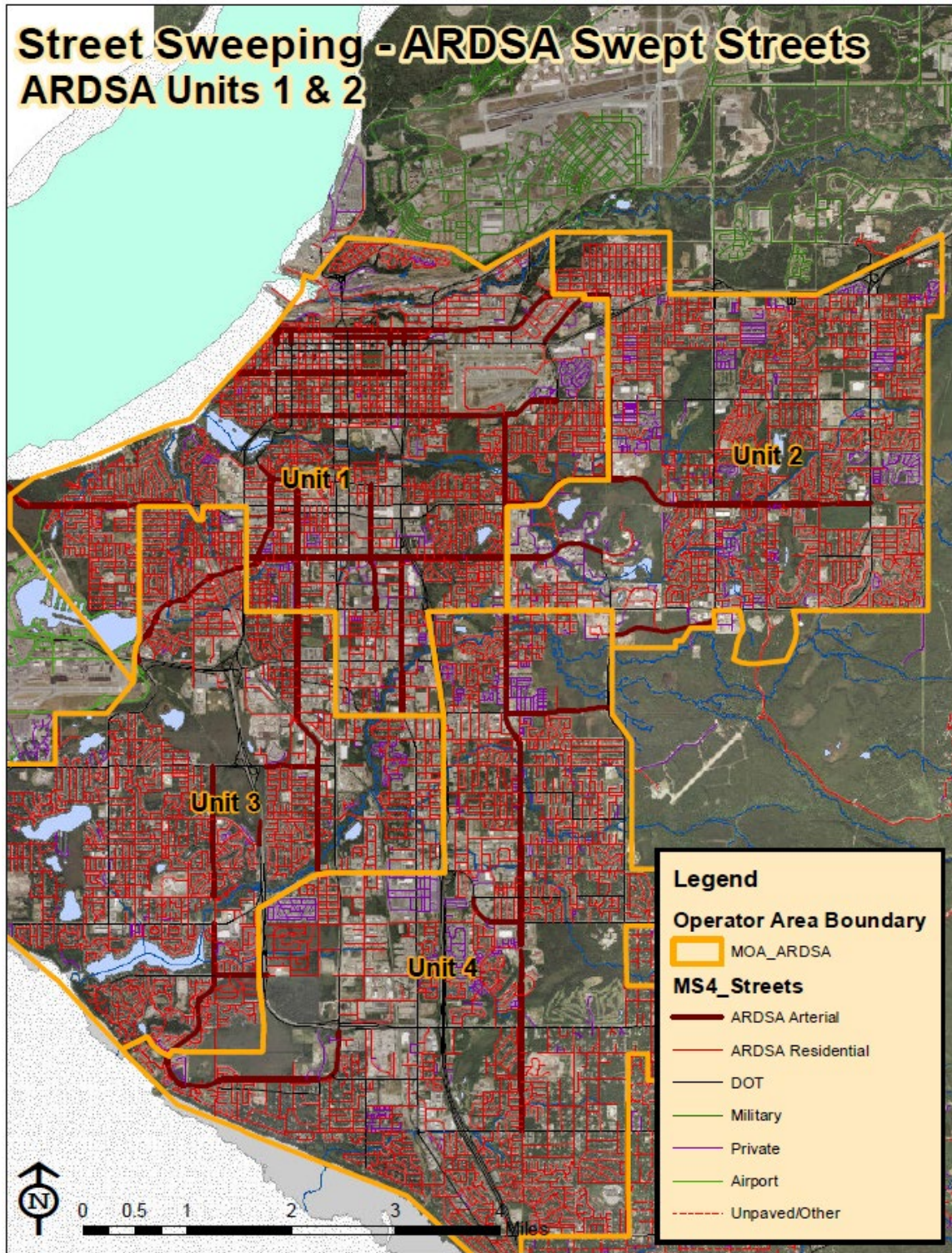
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-2 MOA_ARDSA, Units 3 & 4 (South)—2021 Designated Swept Streets



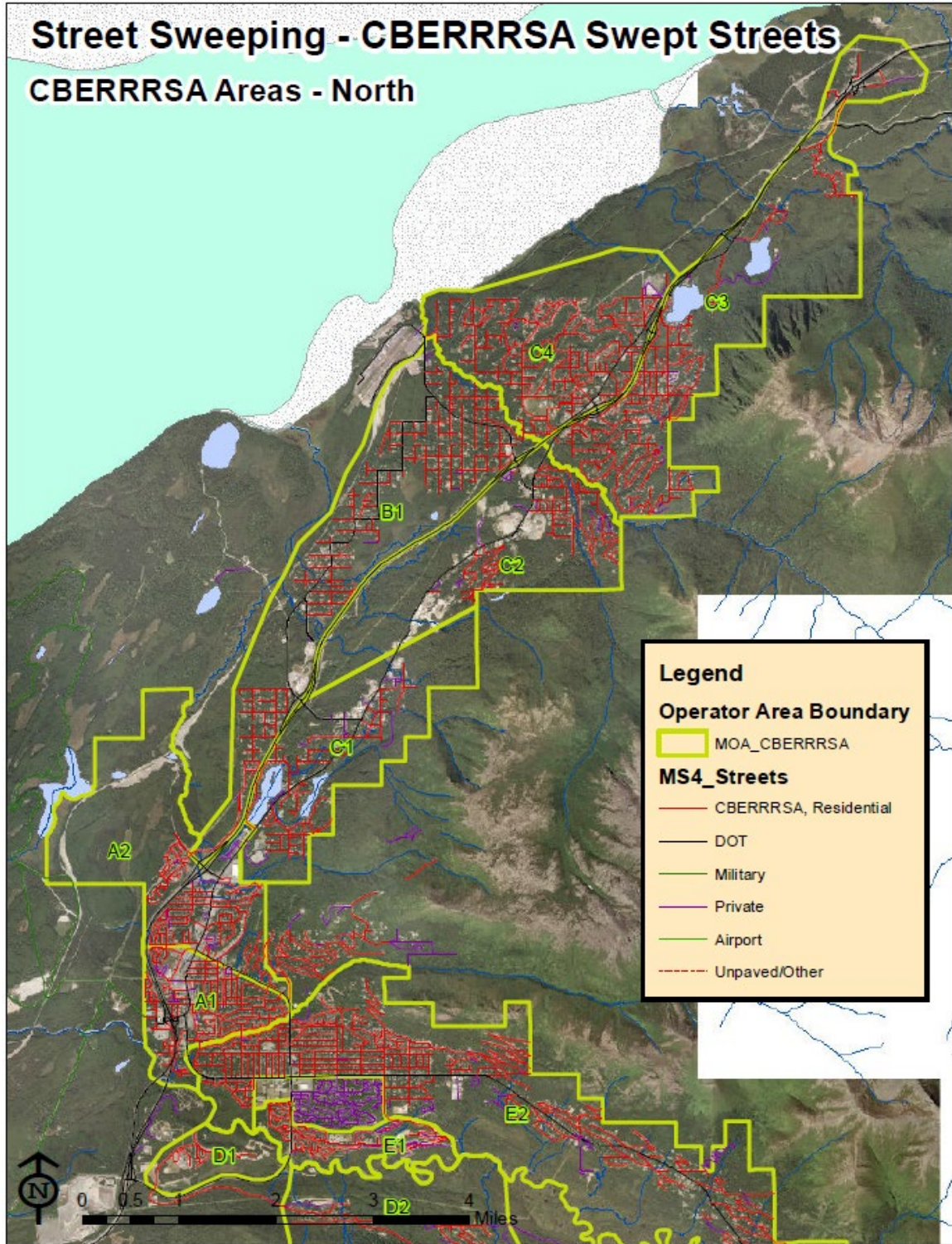
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-3 MOA_ARDSA, Units 1 & 2 (North)—2021 Designated Swept Streets



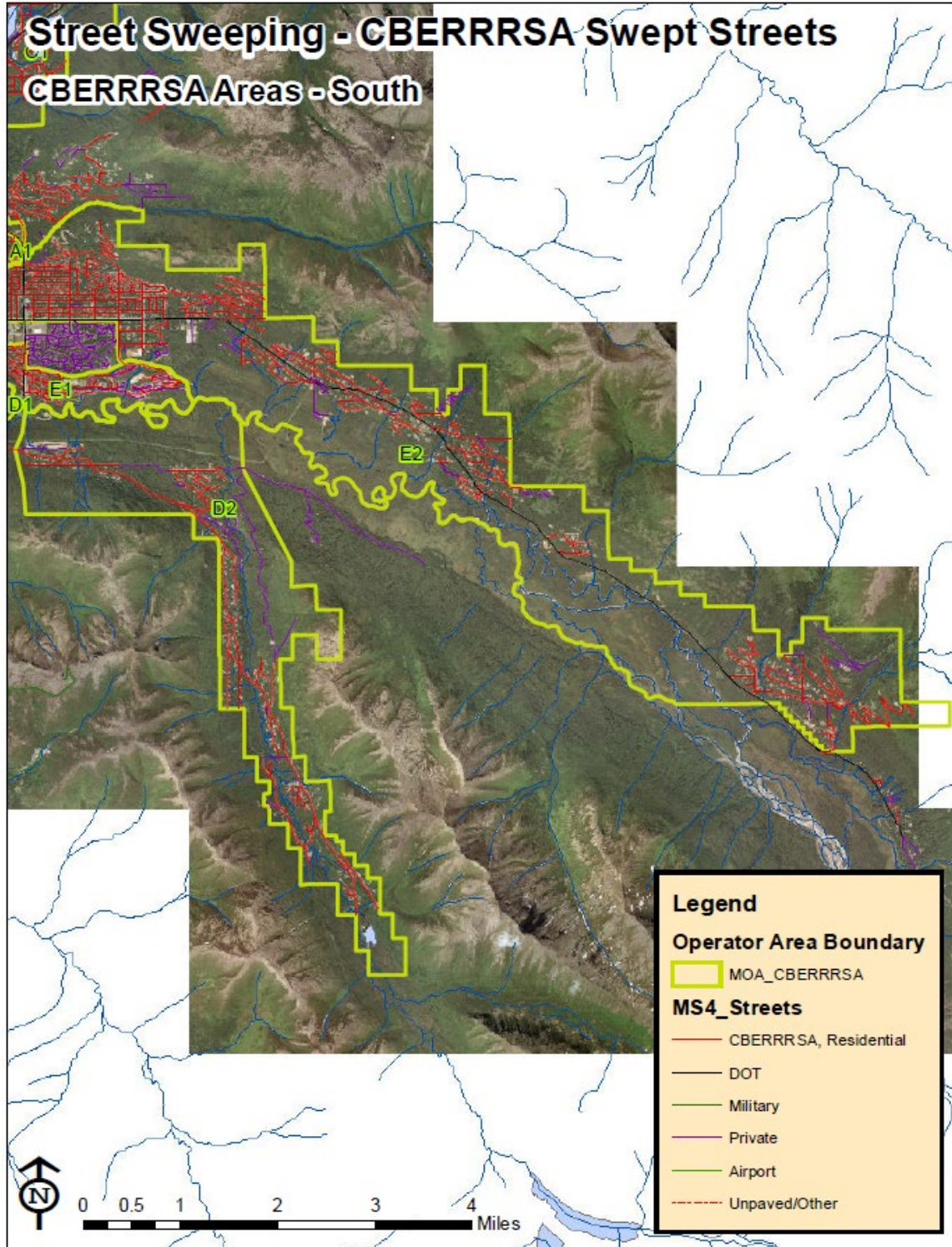
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-4 CBERRRSA, North—2021 Designated Swept Streets



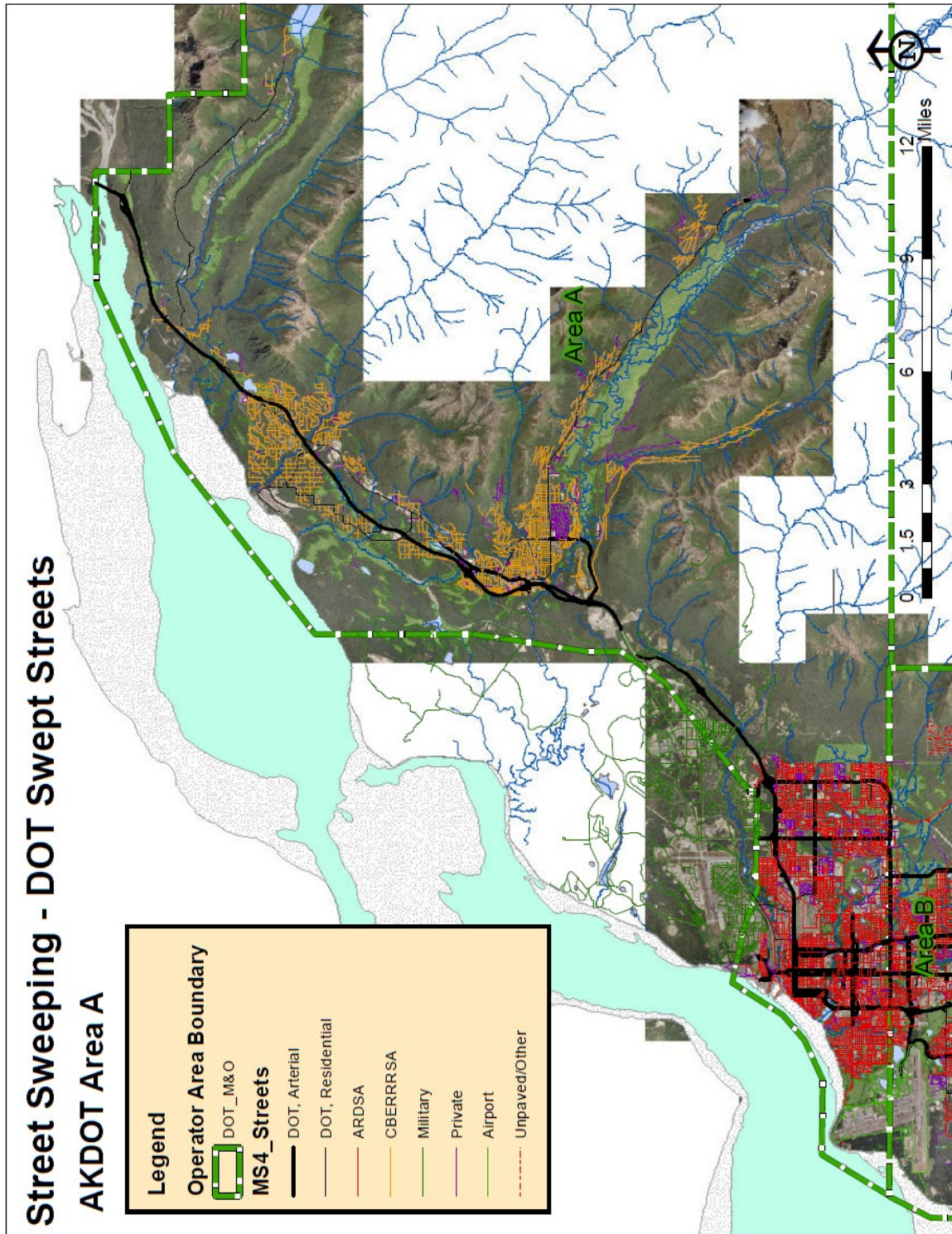
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-5 CBERRRSA South—2021 Designated Swept Streets



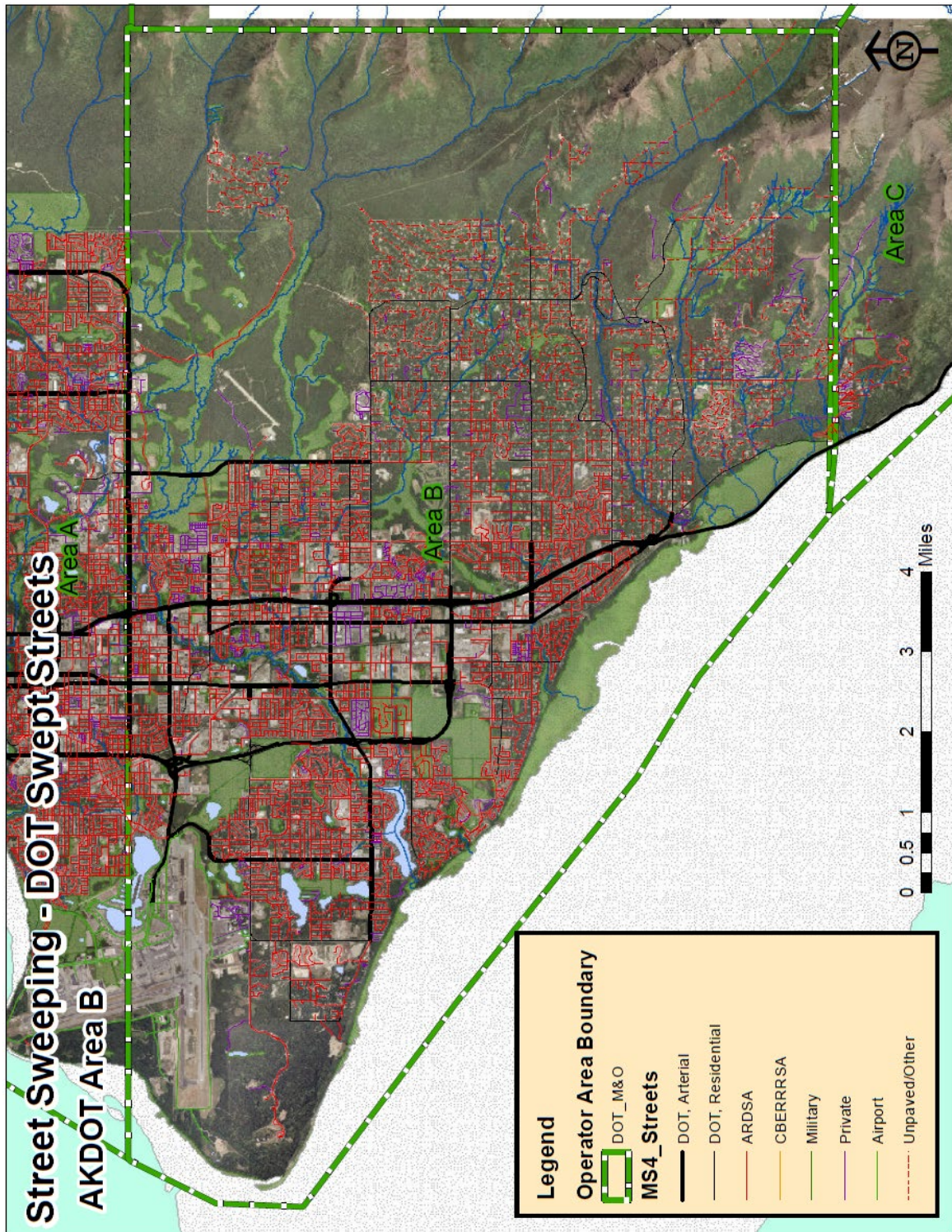
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-6 ADOT&PF Area A—2021 Designated Swept Streets



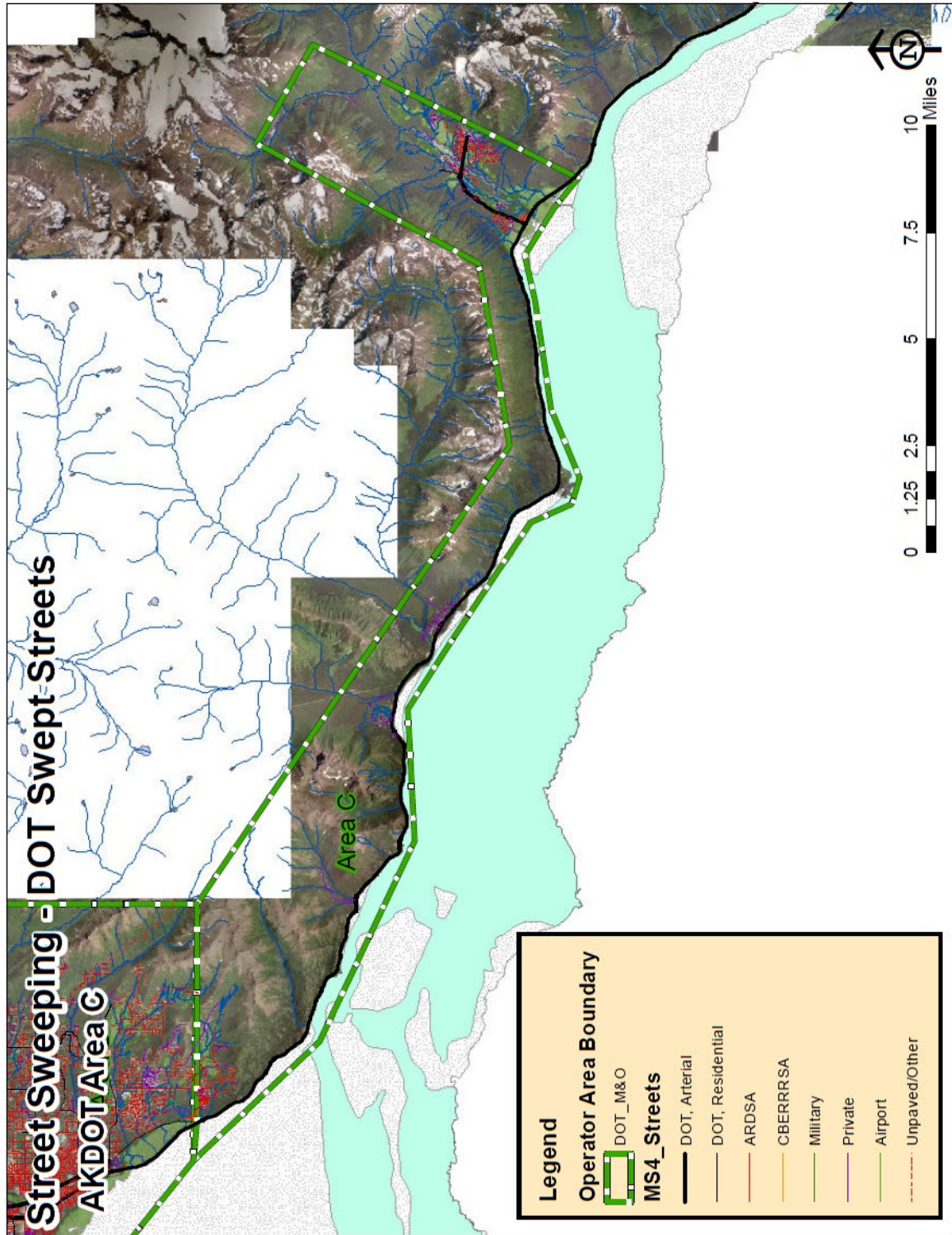
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-7 ADOT&PF Area B—2021 Designated Swept Streets



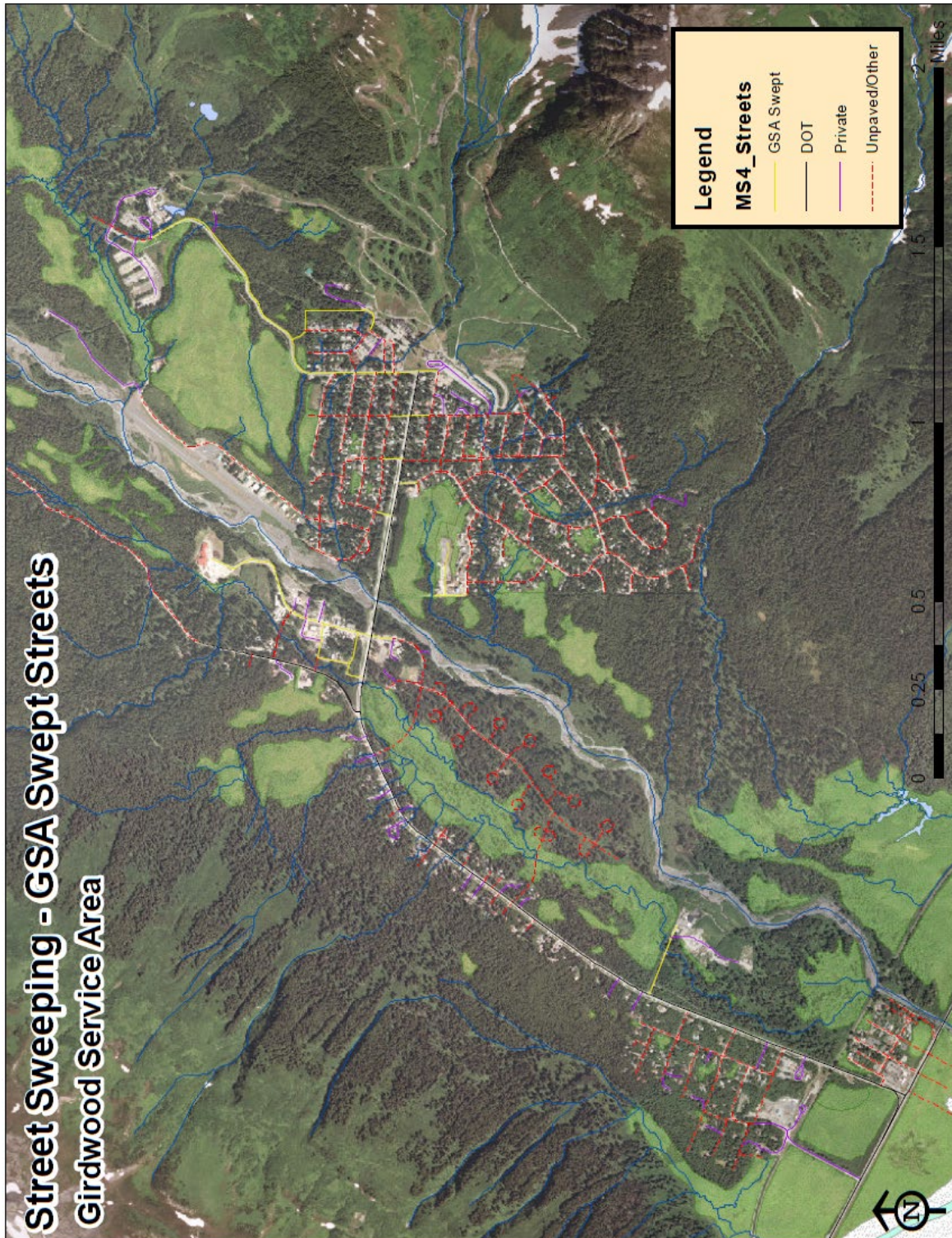
Anchorage MS4 Street Sweeping Report for 2021

Figure 5-8 ADOT&PF Area C—2021 Designated Swept Streets



Anchorage MS4 Street Sweeping Report for 2021

Figure 5-9 Girdwood Service Area (GSA) —2021 Designated Swept Streets



Anchorage MS4 Street Sweeping Report for 2021

5.2. Anchorage MS4 Detailed Sweeping Records for 2021

Section 5.2 contains detailed sweeping records for 2021 for Anchorage MS4 maintenance agencies. Records for each agency are summarized in a separate subsection. *For more information regarding DOT sweep records for 2021 refer to Appendix E-2.

Anchorage MS4 Street Sweeping Report for 2021

5.2.1. CBERRRSA 2021 Detailed Sweeping Reports

Table 5-1 CBERRRSA Spring 2021 Sweeping Report

*Due to issues with record keeping from one of CBERRRSA sweep contractors, swept material volumes for 2021 were reported from sweep pile measurements rather than detailed sweeping records. The contractor's sweep contract was subsequently terminated.

Table 5-2 CBERRRSA Summer 2021 Sweeping Report

*For the 2021 summer sweep period CBERRRSA reported that roads were swept 'as needed' to maintain a visually clean standard (as per the Street Sweeping Management Plan).

Table 5-3 CBERRRSA Fall 2021 Sweeping Report

*Due to issues with record keeping from one of CBERRRSA sweep contractors, swept material volumes for 2021 were reported from sweep pile measurements rather than detailed sweeping records. The contractor's sweep contract was subsequently terminated.

Anchorage MS4 Street Sweeping Report for 2021

5.2.2. ASD 2021 Detailed Sweeping Reports

Table 5-4 ASD 2021 Sweeping Report

ASD Parking Lot Sweep Summary 2021			
ASD SiteCode	Site	Area (sqft)	Swept Total Qty (cyds)
335	Ravenwood Elementary School	89,075	10
220	Girdwood K-8 School	89,969	16
270	Muldoon Elementary School	92,049	4
380	Turnagain Elementary School	93,900	6
364	Susitna Elementary School	94,200	10
260	Mountain View Elementary School	95,101	8
237	Huffman Elementary School	95,228	12
340	Rogers Park Elementary School	96,305	6
450	Polaris K-12 School	97,293	12
410	Wonder Park Elementary School	97,567	8
390	Williwaw Elementary School	97,956	12
320	O'Malley Elementary School	98,189	7
118	Bear Valley Elementary School	98,474	14
330	Rabbit Creek Elementary School	99,865	9
112	Alpenglow Elementary School	102,825	4
363	Trailside Elementary School	103,834	10
130	Campbell Elementary School	104,000	14
418	Gladys Wood Elementary School	104,344	20
125	Bowman Elementary School	106,000	12
362	Spring Hill Elementary School	106,000	8
250	Lake Otis Elementary School	106,173	10
280	North Star Elementary School	106,780	12
116	Bayshore Elementary School	106,792	10
290	Northern Lights ABC School	108,974	10
248	Lake Hood Elementary School	114,600	12
300	Northwood ABC Elementary School	118,491	10
120	Birchwood ABC Elementary School	119,236	12
242	Kasuun Elementary School	119,441	6
384	William Tyson Elementary School	120,690	12
400	Willow Crest Elementary School	124,285	12
345	Russian Jack Elementary School	128,685	9
170	Chugiak Elementary School	140,875	10
760, 850	West High/ Romig Middle School	176,826	42

Anchorage MS4 Street Sweeping Report for 2021

ASD Parking Lot Sweep Summary 2021			
ASD SiteCode	Site	Area (sqft)	Swept Total Qty (cyds)
700, 160	Central Middle/ Chugach Elementary	116,792	14
805	King Tech High	144,663	18
730	Gruening Middle School	150,000	8
246	Kincaid Elementary School	152,789	16
750	Mears Middle School	156,806	18
710	Clark Middle School	168,224	16
740	Hanshew Middle School	169,175	16
785	Begich Middle School	177,442	16
770	Wendler Middle School	193,293	19
780	Goldenview Middle School	201,993	18
755	Mirror Lake Middle School	203,260	16
865	Eagle River High School	275,595	20
810	Chugiak High School	325,000	24
860	South High School	340,669	30
800	Bartlett High School	412,961	36
830	East High School	459,000	28
840	Service High School	473,795	18
820, 150	Dimond High/ Chinook Elementary	580,883	42
	Total	8,256,362	742
	Unit Pick Up (cyds/acre)		3.9

Anchorage MS4 Street Sweeping Report for 2021

5.2.3. 2021 Changes to Sweeping and Basis for Changes

Table 5-5 CBERRRSA 2021 Changes to Swept Streets

CBERRRSA reported no changes to their list of swept streets for the 2021 sweeping periods.

ARDSA reported no changes to their list of swept streets for the 2021 sweeping periods.

For changes to DOT swept streets in 2021 see Appendix E-2.