Annual Industrial Stormwater Monitoring Report

Seattle-Tacoma International Airport

For the Period July 1, 2017 through June 30, 2018

September 28, 2018

Prepared by

Aviation Environmental Programs

Port of Seattle

TABLE OF CONTENTS

Table of Contents i
List of Tables ii
List of Figures ii
1.0 Introduction 1
2.0 Background 2
2.1 Seattle-Tacoma International Airport Drainage 2
2.2 STIA Storm Drainage Subbasins, Activities, and Outfall Descriptions 2
3.0 Sampling Results and Discussion 7
3.1 Monitoring of Industrial Stormwater Discharges 7
3.1.1 Sampling Objectives and Procedures 7
3.1.2 Field Quality Control Samples 8
3.1.3 Storm Events Sampled 8
3.1.4 Data Presentation Methods 9
3.1.5 Grab Sample Results and Discussion 10
3.1.6 Composite Sample Results and Discussion 14
3.2 Toxicity Monitoring 17
3.2.1 In Situ Toxicity Monitoring 17
3.3 Priority Pollutant Monitoring 18
4.0 BMP Implementation 19
5.0 Summary and Conclusions 20
6.0 References 21

Appendix A: Tabular NPDES Sample Data Summaries
Appendix B: Other Sample Data

LIST OF TABLES

Table 1 STIA Subbasins and Associated Activity 4,5
Table 2 Constituents, Methods and Detection Limits 8

LIST OF FIGURES

Figure 1 NPDES Drainage Subbasins and Outfalls……6
Figure 2 Rainfall Summary 9
Figure 3 pH Results 11
Figure 4 TPH Results..... 12
Figure 5 Turbidity Results 13
Figure 6 Copper Results 15
Figure 7 Zinc Results 16

EXECUTIVE SUMMARY

This Annual Industrial Stormwater Monitoring Report provides a summary of industrial monitoring results conducted pursuant to Part 2, Condition 2S1 of the National Pollutant Discharge Elimination System (NPDES) permit for the Port of Seattle's Seattle-Tacoma International Airport (STIA) NPDES Permit WA0024651. Industrial stormwater discharges authorized under Part 2 of the permit include runoff associated with roads, runways, taxiways, airfield, rooftops, cargo operations, flight kitchens, and other areas associated with airport industrial activities, and excludes construction runoff and industrial wastewater discharges associated with ramp operations .

This report summarizes the results of stormwater sampling at outfalls listed in permit Condition 2S1 between July 1, 2017 and June 30, 2018 and satisfies the annual reporting requirement detailed in Part 2 Condition 2S2.G. Monitoring of construction activities, sanitary sewer discharges and the Industrial Wastewater System (IWS) are subject to other reporting requirements. Annual summaries of Part 1 IWS, Part 1 sanitary sewer monitoring results and Part 3 construction monitoring results are provided separately.

The STIA met all required sampling and reporting requirements in the NPDES permit for the 2017-2018 data collection period. A total of 40 grab and 40 composite stormwater samples from 9 storm events were collected in the past year with results reported on quarterly Discharge Monitoring Reports (DMRs).

There were six instances of permit limit exceedances associated with 240 individual constituent analyses. In addition to routine NPDES monitoring required by Condition 2S1, the STIA continued monitoring activities pursuant to other NPDES Part 2 permit conditions. This activity included *in situ* toxicity sampling (Condition 2S9), and the start of priority pollutant monitoring for the permit renewal cycle as required by Condition 2S2.A.

This page left intentionally blank.

1.0 INTRODUCTION

This Annual Report summarizes industrial stormwater monitoring results from the Seattle-Tacoma International Airport (STIA) as required by Part 2, Condition 2S2.G. of the Airport's NPDES permit. The Permit authorizes discharges from airport industrial activities. Airport industrial activity areas include roads, runways, taxiways, airfield, rooftops, cargo operations, flight kitchens, and other areas associated with airport industrial activities. The purpose of this Annual Report is to present the monitoring results from discharges to the Airport's stormwater drainage system (SDS) outfalls identified in Part 2 of the NPDES permit. This Annual Report does not address discharges to the Airport's Industrial Wastewater System (IWS) or construction-related stormwater discharges.

The report covers samples collected in the 12-month period of July 2017 through June 2018. Outfall sampling results summarized in this report include data previously submitted to Ecology in the NPDES permit Part 2 Discharge Monitoring Reports (DMRs), plus additional stormwater sample data such as that from quality assurance sampling and samples that were analyzed for additional parameters not required by the Permit. These additional monitoring data are presented in Appendix B of this report. Toxicity monitoring and priority pollutant sampling as required by Part 2 of the NPDES permit also are summarized in this report.

This report is organized into four sections following the introduction. Section 2 describes background conditions at the Airport including descriptions of each drainage subbasin and outfall sampling location. Section 3 presents all of the discharge monitoring report (DMR) related grab sample and composite sample analytical data collected during the reporting period and the rainfall totals for the period. Section 4 provides a summary of the effluent limit compliance and BMP implementation during the monitoring period. A summary and conclusion are provided in Section 5.

2.0 BACKGROUND

2.1 Seattle-Tacoma International Airport Drainage

Located mid-way between the cities of Seattle and Tacoma, Washington, STIA was built in the 1940s and is owned and operated by the Port. According to the Port's 2017 Airport Activity Report, STIA handled 416,136 aircraft operations, 425,856 metric tons of air cargo, and 46.9 million passengers. In 2017, the Airports Council International ranked STIA the nineth busiest United States passenger airport and the Federal Aviation Administration ranked STIA the thirteenth busiest airport in the U.S. for aircraft operations.

Stormwater drainage at STIA is separated into two different collection systems, the Industrial Wastewater System (IWS) and the Storm Drainage System (SDS). The IWS receives stormwater runoff from the ramp and other areas involved with aircraft servicing and maintenance, providing treatment before discharge to Puget Sound through a separate outfall. A total of 375 acres are diverted to the IWS.

The SDS drains over 1,200 acres. Half of this area is impervious and primarily associated with airport runways, taxiways, parking lots, roads and roof tops. The remainder is pervious which consists of landscaped or fallow open spaces and areas assocated with stormwater treatment best management practices (BMPs) such as runway filterstrips. About 25 percent of the area drained by the SDS flows to Miller Creek. This drainage area represents about 7 percent of Miller Creek's watershed. Approximately 71 percent of the total SDS area drains to the Northwest Ponds and Des Moines Creek, which represents about 21 percent of the creek's watershed.

2.2 STIA Storm Drainage Subbasins, Activities, and Outfall Descriptions

The Airport's SDS is segregated into separate stormwater subbasins that each drain to individual outfall locations. The NPDES permit lists a total of 13 outfalls in two categories: Existing & Proposed Outfalls Locations and Outfalls and Subbasins, and Future Outfalls to be activated during future development. As of June 30, 2018, 11 of the 13 outfalls are active and discharge stormwater related to industrial activity.

STIA stormwater subbasins are categorized according to their dominant activities: landside or airfield. These categories group subbasins together by similar land use and other characteristics. In general, passenger vehicle operations are absent from the airfield drainage subbasins while aircraft operations are absent from the landside subbasins. SDE4/S1 subbasin is an exception in that it includes both airfield and landside activities. Previous reports found that concentrations of TPH, TSS and other constituent concentrations were different for the landside and airfield categories (POS 1996a, 1997a.) Table 1, *STIA Subbasin Characteristics*, describes each active subbasin, receiving water, activities within each subbasin, stormwater

management BMPs, and total pervious and impervious surface areas. The physical location of the outfalls listed in Table 1 are shown on Figure 1 along with additional receiving water monitoring locations used for sublethal toxicity and *in situ* toxicity testing.

Table 1. STIA Subbasins Characteristics

Outfall Name	Receiving Water	General Category	Industrial Activity	Non-Industrial Activity	Pervious Area[b] (acres)	Impervious Area[b] (acres)	Total Area[b, c] (acres)
SDE4/S1	Des Moines Creek (East Branch)	Landside	Limited portions of the airfield taxiways.	Public roads, vehicle parking areas, rooftops (terminal, hangar, cargo) and landscaped areas.	41.71	130.47	172.18
SDD-06A	Des Moines Creek (East Branch)	Landside	Loading docks, vehicle maintenance, vehicle washing, equipment parking and maintenance.	Public roads, vehicle parking areas, rooftops (terminal, hangar, cargo) and landscaped areas.	17.08	28.35	45.4
SDN1	Miller Creek via Lake Reba	Landside	Flight service kitchen.	Public roads, building rooftops and vehicle parking.	3.8	16.0	19.8
SDS3/5	NW Ponds and Des Moines Creek West	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, open areas and building rooftops.	212.44	244.98	457.42
SDS4	NW Ponds and Des Moines Creek West	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Runway infield and open areas.	41.6	24.8	66.4
SDS6/7	NW Ponds and Des Moines Creek West	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Access roads, runway infield and open areas.	63.94	45.94	109.88

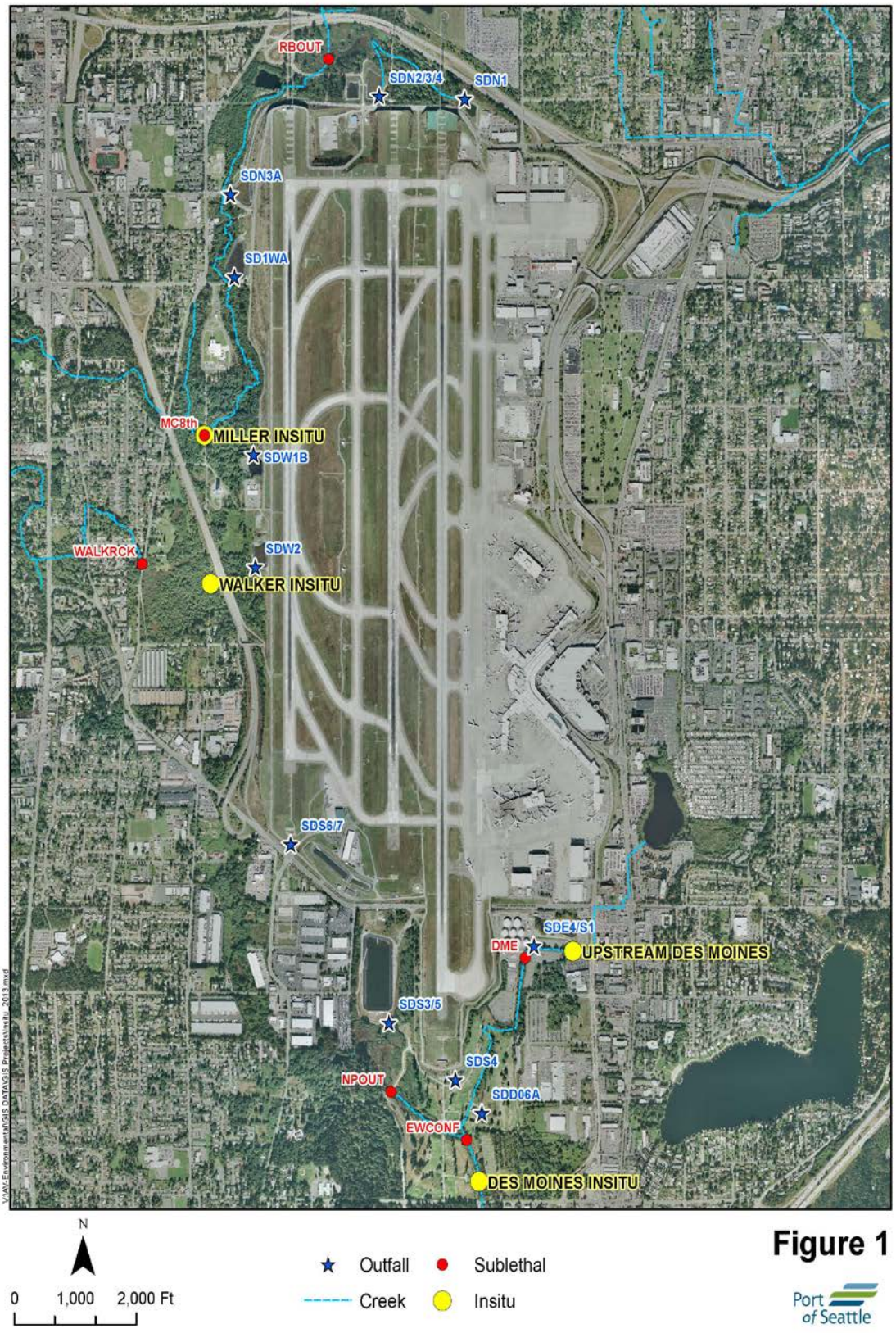
Table 1. STIA Subbasins Characteristics

Outfall Name	Receiving Water	General Category	Industrial Activity	Non-Industrial Activity	Pervious Area[b] (acres)	Impervious Area[b] (acres)	Total Area[b, c] (acres)
SDN2/3/4[a]	Miller Creek via Lake Reba	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, access road, taxiway infield and open areas.	71.83	41.04	112.87
SDN3A	Miller Creek	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, runway infield and open areas.	22.9	8.62	31.5
SDW1A	Miller Creek	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, runway infield and open areas.	44.35	25.78	70.1
SDW1B	Miller Creek	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, runway infield and open areas.	59.7	25.0	84.7
SDW2	Walker Creek	Airfield	Ground surface deicing/anti-icing, aircraft taxi, takeoff and landings.	Perimeter road, runway infield and open areas.	27.04	10.5	37.51
Note:				**Total Area**	**606.39**	**601.48**	**1207.76**

a) The SDN2 runoff is pumped to IWS for all flows up to the 6 month /24-hour event. The SDN2 subbasin comprises approximately 46.5 acres, 36.6 of which are impervious. This area is included in acreages reported to the IWS.
b) Subbasin areas as described in the NPDES permit and updated annually in the STIAs Stormwater Pollution Prevention Plan.
c) Stormwater pond areas were not included in total acres. It is anticipated that ongoing changes resulting from planned construction will alter subbasin totals in the future.

Note: Land use numbers represent current conditions for completed projects as of September 2018 reporting.

Figure 1. Sampling Locations



3.0 SAMPLING RESULTS AND DISCUSSION

This section of the Annual Report summarizes the results of SDS outfall monitoring. All data summarized in this section has been reported to Ecology on quarterly DMRs and is included in Appendix A. Data generated from grab and composite samples are presented and discussed. These types of samples employ different protocols that represent different temporal periods of the particular stormwater discharge event and are therefore evaluated separately. Grab samples represent an instantaneous or short duration sampling period, while composites are collected over the storm event hydrograph to provide an event mean concentration (EMC).

In addition to the DMR data, this report summarizes other data collected at the outfalls listed in Part 2, 2S1 of the NPDES permit. These other data consist of field equipment blank samples, field duplicate samples, and other parameters collected during the monitoring period. These other data are presented in Appendix B. Section 3.2 of this report summarizes *in situ* toxicity testing at receiving water sites downstream of STIA outfalls

3.1 Monitoring of Industrial Stormwater Discharges

3.1.1 Sampling Objectives and Procedures

Sampling protocols and locations have been selected to provide data consistent with the requirements of the NPDES permit and the representativeness criteria set forth in the *Quality Assurance Program Plan for Non-Construction Stormwater Runoff Monitoring* (QAPP) (Cardno TEC, Inc. 2013). The monitoring locations were selected to represent stormwater downstream of the last best management practice (BMP) within each subbasin.

The QAPP describes the criteria for sampling storm events and describes all relevant sampling, programming, and handling necessary to satisfy the monitoring requirements of the permit. Table 2 lists the current constituents measured or analyzed, methods used, and detection limits. The STIA reports results on DMRs from storms and samples that were considered representative according to criteria specified in the QAPP.

The STIA uses telemetry-based automatic samplers to collect a grab sample then a flow-weighted composite sample during rainstorms of 0.10 inches or greater that are preceded by less than 0.10 inch of rainfall in the previous 24 hours. These rainfall and antecedent sampling conditions are specified in the NPDES permit, Part 2, 2S2.B. Each grab or composite sample is analyzed for the constituents listed in Table 2 depending on sample type as specified in the NPDES permit.

Table 2. Constituents, Methods and Detection Limits

Constituent	Method	Detection limit (MDL)	Sample Type	Effluent Limits
pH	150.1[(1)]	0.01 S.U.	Grab	6.5 – 8.5 S.U[3].
Oil & Grease - TPH (by GC)	NWTPH-Dx[(2)]	0.75 mg/l	Grab	15 mg/L – no sheen
Turbidity	180.1[(1)]	0.05 NTU	Grab	25 NTUs
Total Recoverable Copper	200.8[(1)]	0.5 µg/l	flow-wt comp.	25.6 to 59.2 µg/l
Total Recoverable Zinc	200.8[(1)]	4.0 µg/l	flow-wt comp.	71.4 to 117 µg/l

1. Method refers to EPA-600/4-79-020 (U.S. EPA 1983).
2. Method reports both a motor oil fraction and diesel fraction. TPH-Dx is the sum of these two fractions.
3. Approved limits for pH at stations SDN3A, SDW1A, SDW1B, SDW2 are 6.3 to 9.0 S.U.

3.1.2 Field Quality Control Samples

STIA routinely collects field duplicate and equipment blank samples during NPDES sampling events in accordance with the QAPP. Appendix B summarizes these results. The results reflect on the efficacy of the STIA's "clean" sampling methods developed for stormwater monitoring relative to metals (POS 1999).

Eighteen Field Quality Control samples were collected in the 2017 – 2018 reporting period. There were no anomalies associated with samples collected during these same storm events.

Permit Effluent Limits

The NPDES permit specifies effluent limits for turbidity, pH, oil and grease, total copper, and total zinc at all outfalls (see Table 2). Effluent limits for industrial stormwater first became effective during the previous permit on December 31, 2007. The site-specific study and subsequent derivation of site-specific water quality based effluent limits for copper and zinc are described in the 2009 NPDES Permit fact sheet. A 25 NTU effluent limit for turbidity was added in the April 1, 2009 permit as a replacement for an earlier TSS benchmark. The permit also specifies effluent limits for ammonia and nitrates/nitrites, however monitoring for these parameters is only required if urea is applied as a ground surface deicing and anti-icing agent. Urea was not used in the reporting year and has not been used at the Airport since 1996.

3.1.3 Storm Events Sampled

During the permit's annual reporting schedule, 38.42 inches of rain fell at STIA, 0.39 inches less than the historical normal of 38.81 inches and 9.83 inches less than the past monitoring year (48.25 inches). Monthly rainfall totals were well below average in July, August, December, February, March, May and June. September, October,November,January and April all had monthly rainfall above normal with April having over two times the monthly normal rainfall (Figure 2).

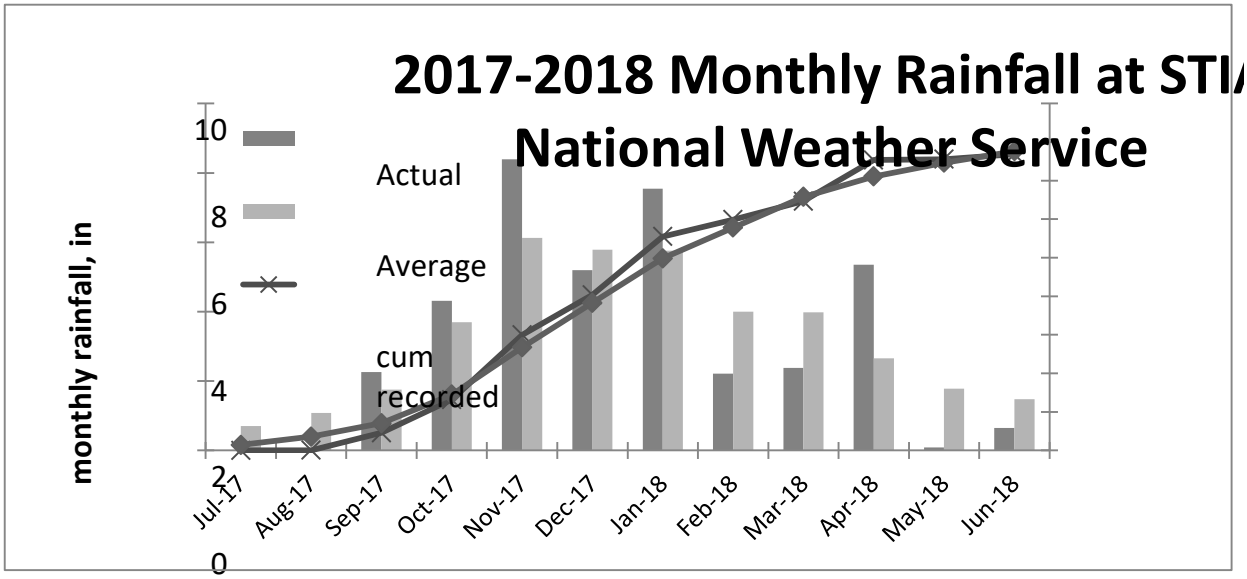


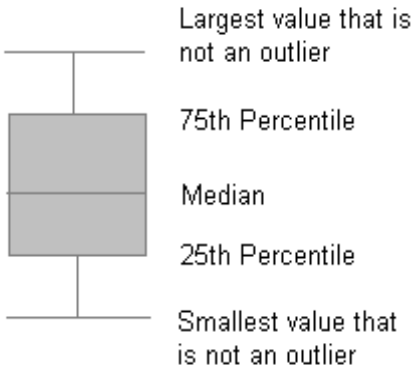
Figure 2. Rainfall Summary

In the 12 months ending June 30, 2018, the STIA sampled 9 rainfall events with rainfall ranging from 0.15 to 1.1 inches. Dry weather preceding these events ranged from 19 hours (November 2, 2017) to 35.5 days (September 17, 2017). The tabular sample data in Appendix A includes storm event data such as rainfall depth, antecedent rainfall, and length of antecedent dry period[1].

3.1.4 Data Presentation Methods

Outfall sampling results for the reporting period are summarized graphically in box plots that illustrate the central tendency, spread, and skew of the stormwater data (Figures 3 through 7). For low-censored data (i.e. non-detected values), a value of one half the detection limit was assumed for any calculation purposes (i.e. median, percentiles, etc.).

[1] The length of the dry antecedent period (the "dryant" data field in Appendix A) is the time, in hours, to the previous measurable (0.01") rainfall, which may or may not have actually produced runoff at a particular outfall.



The data set may include outliers and extreme values that represent unusual conditions or anomalies. Outliers are displayed on the box plots as circles and extreme values are shown as asterisks. With the exception of pH, permit effluent limits (where applicable) are indicated in a note below each graph, solid reference lines are used to indicate the upper and lower pH effluent limit. A flat horizontal line indicates the analyte was not detected during the reporting period.

Appendix A tabulates and summarizes analytical results for each outfall for parameters required by the current permit, for the current annual reporting period July 1, 2017 through June 30, 2018. All data included in Appendix A has previously been provided to Ecology in quarterly DMRs and represents samples collected from those storms and sampling routines that met the criteria of the QAPP.

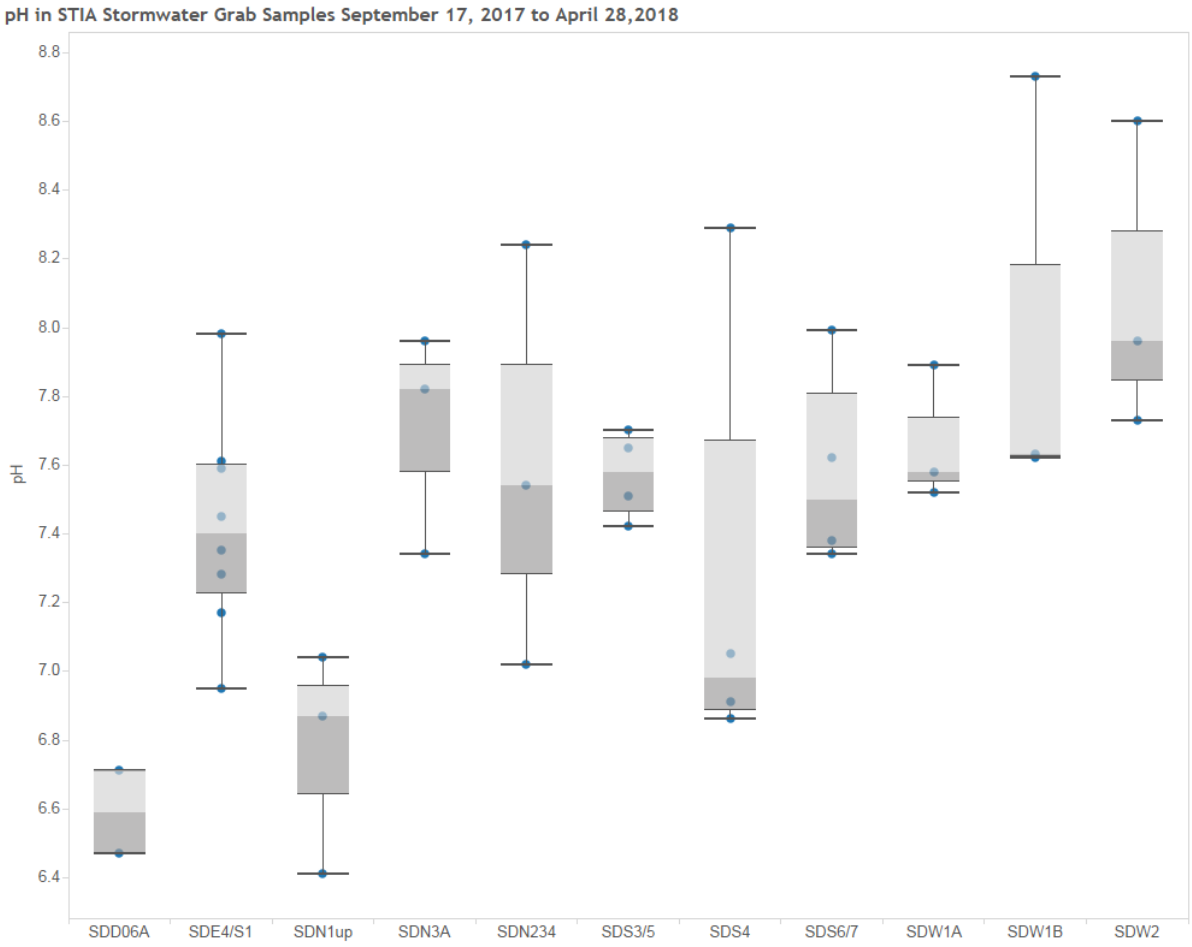
3.1.5 Grab Sample Results and Discussion

The following discussion includes results from 40 grab samples collected in the past year. Grab samples are analyzed for pH, TPH, and turbidity per current permit requirements, with tabular results and summary statistics contained in Appendix A.

3.1.5.1 pH

Figure 3 shows pH data for the current year. The median pH value from all outfalls was 7.5. Standard Units (S.U.) Sample results fell consistently within the effluent limit range of 6.5 to 8.5 (6.3-9.0 at SDN3A, SDW1A, SDW1B and SDW2) with the exception of four samples. The February 28, 2018 samples for SDW1B and SDW2 were both above the permit effluent limit, 8.73 and 8.60 respectfully. The November 2, 2017 SDN1 sample and the SDD06A sample from April 28, 2018 were below the

lower permit effluent limit at 6.41 and 6.47.

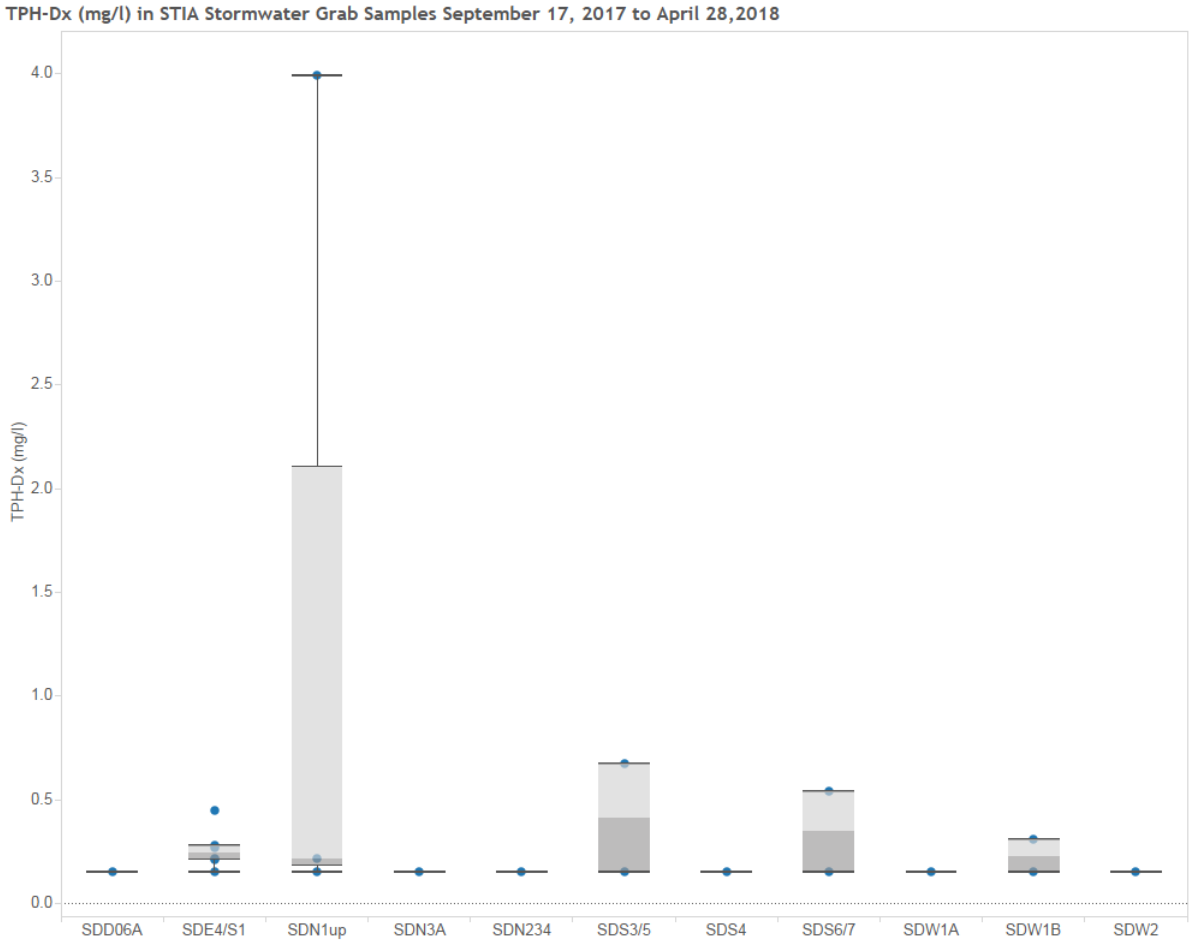


pH effluent limits: Stations SDE4/S1, SDD06A, SDN1, SDN2/3/4, SDS3/5, SDS6/7, SDS4 6.5 to 8.5. Stations SDN3A, SDW1A, SDW1B, SDW2 6.3 to 9.0

Figure 3. pH Results

3.1.5.2 Total Petroleum Hydrocarbons (TPH)

Figure 4 shows TPH data for the current reporting year. TPH ranged from less than 0.15 mg/L to 3.99 mg/L. The estimated median TPH concentration at all outfalls was 0.15 mg/L. However, the actual median TPH concentration may have been lower since TPH was only detected in 10 of the 40 samples. All sample results were well below the TPH effluent limit of 15 mg/L.

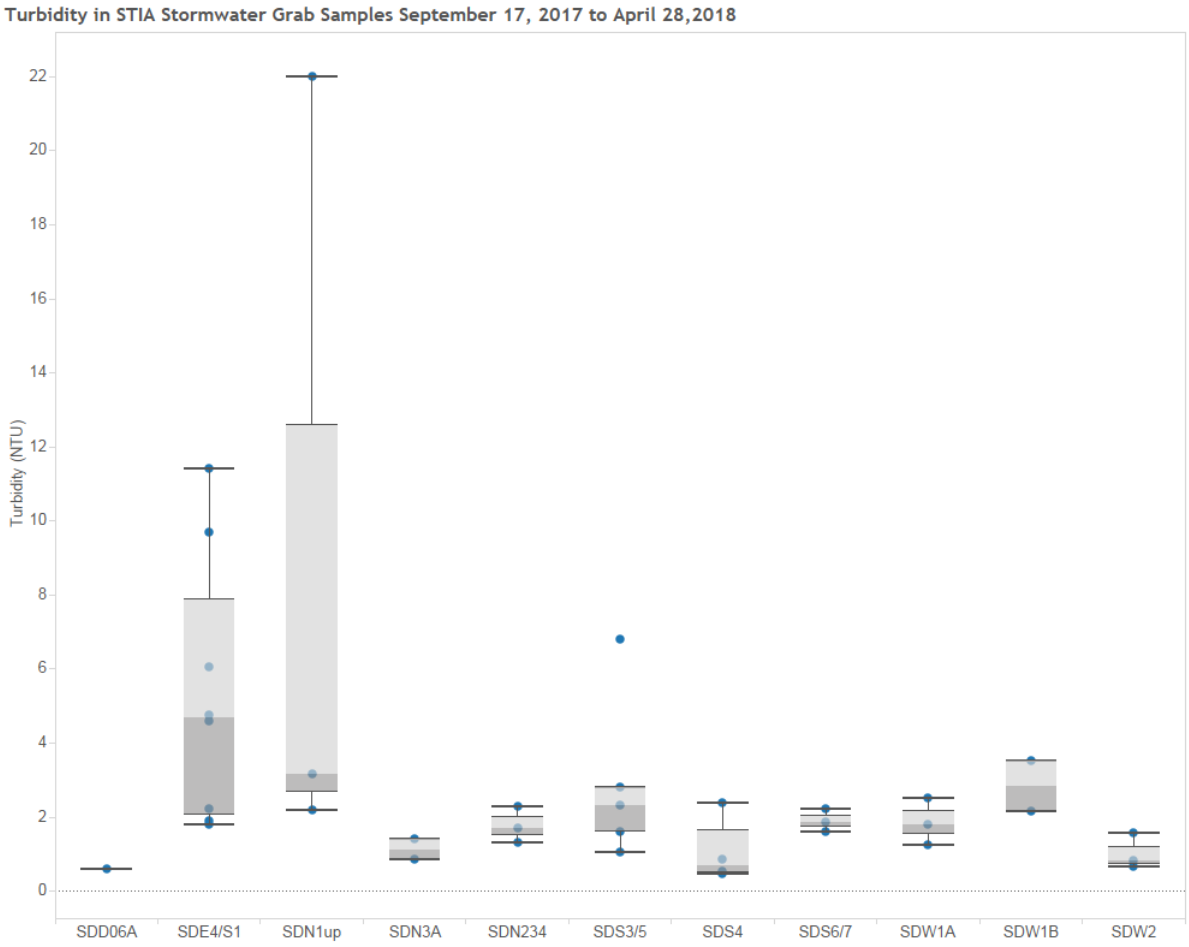


TPH Effluent Limit = 15 mg/L

Figure 4. TPH Results

3.1.5.3 Turbidity

Turbidity results for the current year are shown in Figure 5. The median turbidity for all outfalls was 1.8 NTU with a range from 0.46 NTU to 22 NTU. There were no permit limit exceedances for turbidity at any outfall during the monitoring period.



Turbidity Effluent Limit = 25 NTU

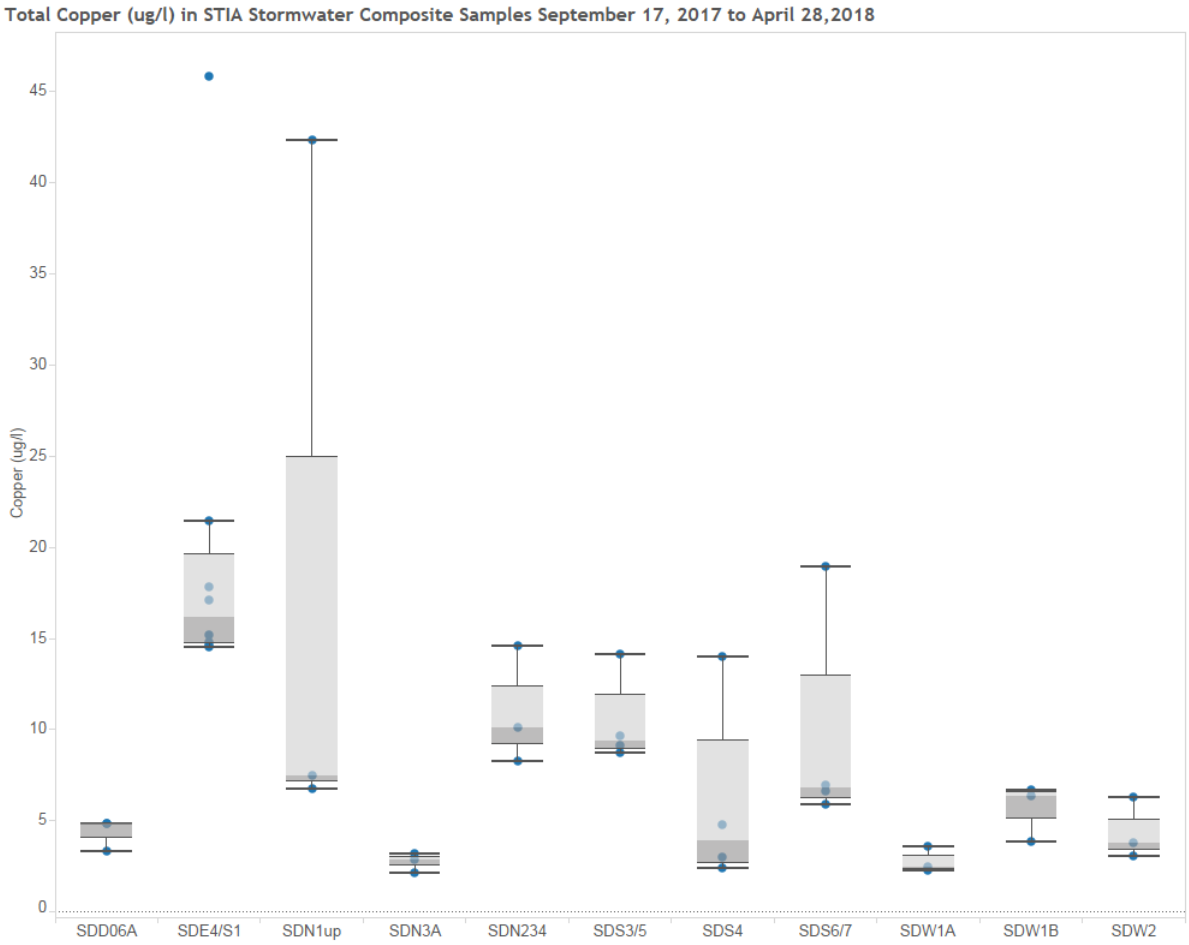
Figure 5. Turbidity Results

3.1.6 Composite Sample Results and Discussion

For the 2017-2018 sampling period, the STIA collected a total of 40 flow-weighted composite samples. Composite sample results are described separately from grab samples because grab samples represent an isolated segment of the storm event runoff. Composite sample results represent a flow-weighted average value over a longer time period. All composite sample data contained within this report and on the DMRs met the representativeness criteria of the STIA's QAPP, which provides samples comparable with EPA methods (U.S. EPA 1992).

3.1.6.1 Copper

All data reported below are for total recoverable copper. The median copper concentration for all outfalls was 7.0 µg/L, with individual storm sample concentrations ranging from 2.0 µg/L to 46 µg/L (Figure 6). The permit effluent limit for copper at each outfall is variable based on a site-specific study and ranges from 26 µg/L to 59 µg/L depending on receiving water location. There were two permit limit exceedances for copper at during the monitoring year. The September 18, 2017 SDE4/S1 sample was 45.8 ug/L (limit 25.6 ug/L) and the 11/2/2017 SDN1 sample was 42.3 ug/L (limit 28.5 ug/L).

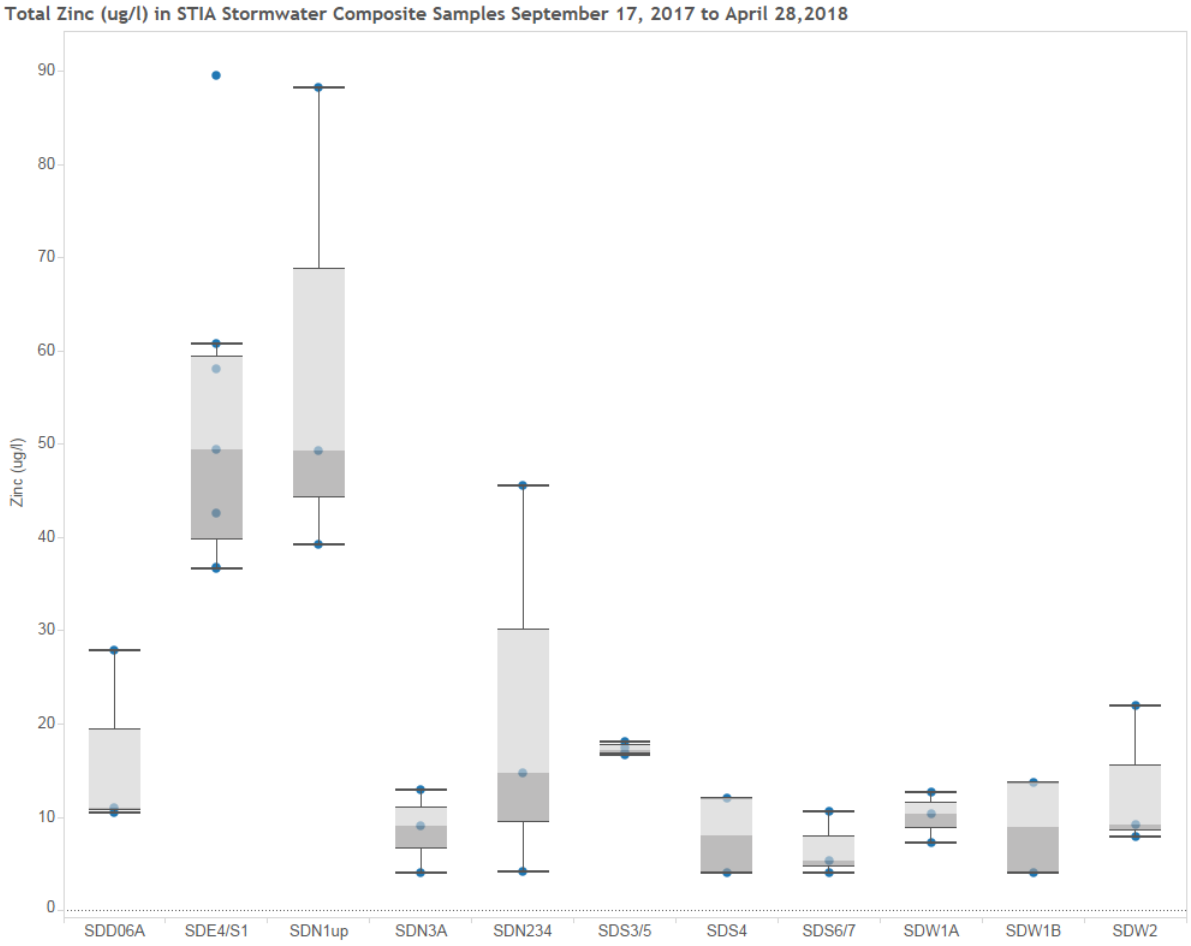


Effluent limits by outfall: 32.2 ug/l (SDS3/5, SDS4, SDS6/7), 28.5 ug/l (SDN1, SDN2/3/4), 25.6 ug/l (SDE4/S1, SDD06A), 59.2 ug/l (SDN3A, SDW1A, SDW1B), 47.9 ug/l (SDW2)

Figure 6. Copper Results

3.1.6.2 Zinc

All data reported are for total recoverable zinc. The median zinc concentration at all outfalls was 13 µg/L (Figure 7). Zinc concentrations ranged from 2 µg/L to 90 µg/L. There were no permit limit exceedances for zinc at any outfall during the monitoring period.



SDS4 effluent limit = 71.4 ug/l, all other outfalls 117 ug/l

Figure 7. Zinc Results

3.2 Toxicity Monitoring

The following section discusses stormwater monitoring data related to the *in situ* monitoring program that was completed during fall season 2017 and spring season 2018.

3.2.1 In Situ Toxicity Monitoring

The in situ monitoring approach utilizes the early life stage (ELS) salmonid bioassay testing procedure using rainbow trout that can be applied in a laboratory or field (i.e., in situ) context. The test encompasses a number of developmental milestones (e.g., hatching, yolk-sac absorption, etc.), and provides a variety of biological endpoints, such as survival and growth, that can be used to assess water quality.

Results from the in situ bioassays and supporting analytical data are intended to provide an indication of attainment of receiving water quality standards and associated beneficial uses related to salmonid spawning and rearing. Initial Phase 1 testing conducted previously demonstrated that the RBT in situ ELS bioassay is an effective instream biological monitoring tool for assessing the potential effects of stormwater discharges on the receiving environment.

The sampling events conducted during this reporting period were completed under the Port's Permit, WA0024651, Part 2. 2S9, and are required to be conducted biannually in the fall and spring, corresponding to the spawning regimes of local salmonid species. Sampling was performed using the revised *Quality Assurance Program Plan: Seattle-Tacoma International Airport Receiving Water Sublethal Toxicity Testing* (Port of Seattle 2016).

In the Fall 2017 event, adverse effects were observed on post-hatch and cumulative survival at all sites in comparison to the control; hatch rate was also significantly decreased at Des Moines Creek at S 200th and Des Moines Creek Upstream. Weekly measurements of physical parameters (temperature, dissolved oxygen, pH and specific conductivity) did not record results outside of the healthy range for salmonids. There were several large rain events of over .5 inches/day which may account for the widespread adverse effects.

Specific to Des Moines Creek, significant adverse effects were observed at Des Moines Creek at S 200th and Des Moines Creek Upstream sites, with reduced survival and hatching rates in Fall 2017. With the exception of the Spring 2015 and 2018 testing events (Nautilus Environmental 2015, 2018), Des Moines Creek Upstream has consistently exhibited evidence of adverse effects, suggesting an ongoing pattern of impaired water quality upstream of STIA inputs. This pattern continues to suggest that any downstream effects observed at Des Moines Creek at S 200th could be related to inputs originating upstream of STIA.

No significant impacts on hatch rates or cumulative survival were observed in the Spring event at any of the sites. Finally, no adverse effects were observed on either lengths or weights in both Fall and Spring events.

A full discussion of results of the sampling is contained in *Rainbow Trout Early Life Stages In Situ Monitoring Testing, Fall 2017 and Spring 2018 Testing Events* (Nautilus report in final preparation).

3.3 Priority Pollutant Monitoring

The Port began required priority pollutant monitoring as required under Part 2 2S2.A, which specifies collecting a wet and dry season sample during year three of the permit cycle.Sampling began during the dry season (April-October). Two of the required outfalls, SDN1 and SDW2, were successfully sampled during this period, with the remaining stations to be targeted during the remaining dry season and the subsequent wet season. A summary of the priority pollutant sampling results will be presented upon completion of the sampling effort, in both the 2018-2019 annual report and during the submittal of permit renewal documentation.

Although there is not a complete data package for the priority pollutant monitoring, results from the initial sampling have led to ongoing basin investigations (Winter 2018 sampling) for potential sources of Copper and Zinc in SDN1. Based on findings from this investigation the Port will evaluate BMP’s and tenant space operations as necessary to ensure continued compiance with permit conditions.

4.0 BMP IMPLEMENTATION

The STIA has designed and constructed stormwater peak runoff rate and flow control BMPS to retrofit the entire airport. In addition to flow control BMPs, treatment BMPs are implemented to achieve stormwater effluent limits. Redeveloped areas are assessed for BMP requirements and implemented as necessary to meet NPDES permit requirements During the design process, opportunities to implement LID technologies are explored.

During the 2017-2018 year, two BMPs were added as part of the installation of the Alternate Utility Facility: a Filterra bioretention vault and an oil/water separator with secondary containment. The Fire Station pump station was improved with the addition of a downturned elbow to enhance its ability to separate oil and water. BMPs are maintained on a scheduled frequency to ensure effluent limits are being met.

5.0 SUMMARY AND CONCLUSIONS

During the reporting period from July 2017 to June 2018 the STIA fulfilled requirements for outfall monitoring under the current NPDES permit by collecting a total of 40 grab samples and 40 composite stormwater samples during 9 storm events. Outfalls were sampled quarterly when discharges occurred from rain events that met the minimum rainfall criteria of 0.1 inch. There were only six instances of effluent limit exceedance associated with the 80 samples and 240 constituents that were tested to meet the monitoring requirements of the NPDES permit. This high level of compliance is an indication that the stormwater BMPS and the overall stormwater management program are effective at mitigating impacts from Airport operations on the adjacent receiving waters.

6.0 REFERENCES

Cardno TEC, Inc. 2013. Quality Assurance Program Plan for Non-Construction Stormwater Runoff Monitoring, Conducted Under Part 2 of the National Pollutant Discharge Elimination System Waste Discharge Permit, Port of Seattle, Seattle Tacoma International Airport, November 2013

Nautilus Environmental Inc. 2015. NPDES Sublethal Toxicity Testing: Seattle-Tacoma International Airport, Spring Event (April/May) 2015, June 5, 2015.

Nautilus Environmental Inc. 2015b. Port of Seattle, Seattle-Tacoma International Airport, Rainbow Trout Early Life Stages In Situ Monitoring Testing, Phase I: Development and Demonstration – Fall 2014 and Spring 2015 Testing Events, August 2015.

POS 1999. Adapting Clean Sampling Techniques for POS NPDES Stormwater and other Stormwater Monitoring Project Needs. Scott Tobiason, Port of Seattle, Aviation Environmental Programs. Draft 6/5/99.

POS 2016. Quality Assurance Program Plan: Seattle-Tacoma International Airport Receiving Water Sublethal Toxicity Testing, Port of Seattle, February 2016

U.S. EPA 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

U.S. EPA 1992. NPDES Storm Water Sampling Guidance Document. U.S. EPA Office of Water. EPA 833-B-92-001. July 1992.

WDOE 2016. National Pollutant Discharge Elimination System permit No. WA0024651, effective January 1, 2016 by Washington Department of Ecology, Olympia, WA.

WDOE 2012. Agreed Order Docket No. 8755.

APPENDIX A

TABULAR NPDES SAMPLE DATA SUMMARIES and STATISTICS

This page left intentionally blank

Port of Seattle

EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
All Outfalls	Count							40		40
	Max							0.046		0.090
	95th							0.022		0.062
	75th							0.014		0.037
	Median							0.007		0.013
	25th							0.004		0.007
	Min							0.002		0.002
	SD							0.013		0.024
	CV%							81%		51%
	#NonDetects							0		8
	%NonDetects							0%		20%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDE4/SDS1 (002)	Count							7		7
	Max							0.046		0.090
	95th							0.038		0.081
	75th							0.020		0.059
	Median							0.017		0.057
	25th							0.015		0.046
	Min							0.014		0.037
	SD							0.011		0.017
	CV%							54%		30%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle

EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
SDS3/5 (005)	Count							4		4
	Max							0.014		0.018
	95th							0.013		0.018
	75th							0.011		0.018
	Median							0.009		0.017
	25th							0.009		0.017
	Min							0.009		0.017
	SD							0.003		0.001
	CV%							24%		3%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDS4 (009)	Count							4		4
	Max							0.014		0.012
	95th							0.013		0.010
	75th							0.007		0.004
	Median							0.004		0.002
	25th							0.003		0.002
	Min							0.002		0.002
	SD							0.005		0.005
	CV%							90%		111%
	#NonDetects							0		3
	%NonDetects							0%		75%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle
EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
SDS6/7 (014)	Count							4		4
	Max							0.019		0.011
	95th							0.017		0.010
	75th							0.010		0.007
	Median							0.007		0.004
	25th							0.006		0.002
	Min							0.006		0.002
	SD							0.006		0.004
	CV%							65%		82%
	#NonDetects							0		2
	%NonDetects							0%		50%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDN1 (006)	Count							3		3
	Max							0.042		0.088
	95th							0.039		0.084
	75th							0.025		0.069
	Median							0.007		0.049
	25th							0.007		0.044
	Min							0.007		0.039
	SD							0.020		0.026
	CV%							108%		44%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle
EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
SDW2 (016)	Count							3		3
	Max							0.006		0.022
	95th							0.006		0.021
	75th							0.005		0.016
	Median							0.004		0.009
	25th							0.003		0.009
	Min							0.003		0.008
	SD							0.002		0.008
	CV%							39%		60%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDW1B (017)	Count							3		3
	Max							0.007		0.014
	95th							0.007		0.013
	75th							0.007		0.008
	Median							0.006		0.002
	25th							0.005		0.002
	Min							0.004		0.002
	SD							0.002		0.007
	CV%							28%		114%
	#NonDetects							0		2
	%NonDetects							0%		67%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle
EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
SDW1A (018)	Count							3		3
	Max							0.004		0.013
	95th							0.003		0.012
	75th							0.003		0.012
	Median							0.002		0.010
	25th							0.002		0.009
	Min							0.002		0.007
	SD							0.001		0.003
	CV%							26%		27%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDN3A (019)	Count							3		3
	Max							0.003		0.013
	95th							0.003		0.013
	75th							0.003		0.011
	Median							0.003		0.009
	25th							0.002		0.006
	Min							0.002		0.002
	SD							0.001		0.006
	CV%							20%		69%
	#NonDetects							0		1
	%NonDetects							0%		33%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle
EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
SDN2/3/4 (007)	Count							3		3
	Max							0.015		0.045
	95th							0.014		0.042
	75th							0.012		0.030
	Median							0.010		0.015
	25th							0.009		0.009
	Min							0.008		0.004
	SD							0.003		0.022
	CV%							30%		100%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%
SDD06A (020)	Count							3		3
	Max							0.005		0.028
	95th							0.005		0.026
	75th							0.005		0.019
	Median							0.005		0.011
	25th							0.004		0.011
	Min							0.003		0.010
	SD							0.001		0.010
	CV%							21%		60%
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle

EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		TSS	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn
Landside (SDE4/SDS1, SDN1, SDD06A)	Count							13		13
	Max							0.046		0.090
	95th							0.044		0.089
	75th							0.018		0.058
	Median							0.015		0.049
	25th							0.007		0.037
	Min							0.003		0.010
	#NonDetects							0		0
	%NonDetects							0%		0%
	#Trimmed							0		0
	%Trimmed							0%		0%
Airfield (SDS3/5, SDS4, SDS6/7, SDW2, SDW1B, SDW1A, SDN3A, SDN2/3/4)	Count							27		27
	Max							0.019		0.045
	95th							0.014		0.021
	75th							0.009		0.014
	Median							0.006		0.009
	25th							0.003		0.002
	Min							0.002		0.002
	SD							0.004		0.009
	CV%							66%		89%
	#NonDetects							0		8
	%NonDetects							0%		30%
	#Trimmed							0		0
	%Trimmed							0%		0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle

EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

SAMPLE DATA			STORM CHARACTERISTICS									CONCENTRATION, mg/L									
Seq	Outfall	Sample ID	Storm Date	Dpth in	Dur hr	MaxInt in/hr	24hrant in	48hrant in	Dryant hr	Type	Ground Deice?	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn		
1	SDE4/SDS1	SDE4/S1091817COMP	9/17/2017	0.35	43	0.07	0	0	852	SMC	No						0.046		0.09		
2	SDE4/SDS1	SDE4/S1110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.015		0.037		
3	SDE4/SDS1	SDE4/S1110917COMP	11/8/2017	0.53	33	0.12	0.01	0.01	13	SMC	No						0.014		0.043		
4	SDE4/SDS1	SDE4/S1030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.015		0.049		
5	SDE4/SDS1	SDE4/S1030918COMP	3/7/2018	0.38	25	0.14	0	0	78	EMC	No						0.017		0.058		
6	SDE4/SDS1	SDE4/S1040518COMP	4/4/2018	0.31	20	0.07	0	0	178	EMC	No						0.018		0.061		
7	SDE4/SDS1	SDE4/S1042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.021		0.057		
8	SDS3/5	SDS3/5092017COMP	9/20/2017	0.15	5	0.09	0.03	0	21	EMC	No						0.014		0.017		
9	SDS3/5	SDS3/5110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.009		0.017		
10	SDS3/5	SDS3/5030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.009		0.018		
11	SDS3/5	SDS3/5042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.01		0.017		
12	SDS4	SDS4091917COMP	9/17/2017	0.35	43	0.07	0	0	852	EMC	No						0.014		< 0.004		
13	SDS4	SDS4110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.005		< 0.004		
14	SDS4	SDS4030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.003		< 0.004		
15	SDS4	SDS4040518COMP	4/4/2018	0.31	20	0.07	0	0	178	SMC	No						0.002		0.012		
16	SDS6/7	SDS6/7091817COMP	9/17/2017	0.35	43	0.07	0	0	852	SMC	No						0.019		0.005		
17	SDS6/7	SDS6/7110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.006		< 0.004		
18	SDS6/7	SDS6/7030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.007		< 0.004		
19	SDS6/7	SDS6/7040418COMP	4/4/2018	0.31	20	0.07	0	0	178	EMC	No						0.007		0.011		
20	SDN1	SDN1110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.042		0.088		
21	SDN1	SDN1030818COMP	3/7/2018	0.38	25	0.14	0	0	78	SMC	No						0.007		0.049		
22	SDN1	SDN1042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.007		0.039		
23	SDW2	SDW2112017COMP	11/19/2017	1.1	25	0.19	0	0	72	SMC	No						0.006		0.009		
24	SDW2	SDW2030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.003		0.008		
25	SDW2	SDW2042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.004		0.022		
26	SDW1B	SDW1B110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.007		< 0.004		
27	SDW1B	SDW1B030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.006		0.014		
28	SDW1B	SDW1B042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.004		< 0.004		
29	SDW1A	SDW1A110317COMP	11/2/2017	0.66	31	0.09	0.01	0.01	19	SMC	No						0.004		0.013		
30	SDW1A	SDW1A030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.002		0.007		
31	SDW1A	SDW1A040518COMP	4/4/2018	0.31	20	0.07	0	0	178	EMC	No						0.002		0.01		
32	SDN3A	SDN3A112017COMP	11/19/2017	1.1	25	0.19	0	0	72	SMC	No						0.003		0.013		

R=Rejected Non-Representative Data - Refer to line comment for detail

L:\EMIS_SQL\SQLFrontEndInstall\SurfaceWater_SQL.mdb/rptSWNPDESComposites

Port of Seattle

EMIS

NPDES Composite Statistics 7/1/2017 - 6/30/2018

SAMPLE DATA			STORM CHARACTERISTICS										CONCENTRATION, mg/L									
Seq	Outfall	Sample ID	Storm Date	Dpth in	Dur hr	MaxInt in/hr	24hrant in	48hrant in	Dryant hr	Type	Ground Deice?	Turb, NTU		E-Glycol	P-Glycol	Total Glycol	Cu	Pb	Zn			
33	SDN3A	SDN3A030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.002		< 0.004			
34	SDN3A	SDN3A040518COMP	4/4/2018	0.31	20	0.07	0	0	178	EMC	No						0.003		0.009			
35	SDN2/3/4	SDN2/3/4110917COMP	11/8/2017	0.53	33	0.12	0.01	0.01	13	SMC	No						0.015		0.046			
36	SDN2/3/4	SDN2/3/4030118COMP	2/28/2018	0.19	17	0.04	0	0.01	29	EMC	No						0.008		0.015			
37	SDN2/3/4	SDN2/3/4042918COMP	4/28/2018	0.37	18	0.11	0	0	142	EMC	No						0.01		0.004			
38	SDD06A	SDD06A111017COMP	11/8/2017	0.53	33	0.12	0.01	0.01	13	EMC	No						0.005		0.01			
39	SDD06A	SDD06A030918COMP	3/7/2018	0.38	25	0.14	0	0	78	EMC	No						0.005		0.028			
40	SDD06A	SDD06A042918COMP	4/28/2018	0.37	18	0.11	0	0	142	SMC	No						0.003		0.011			

R=Rejected Non-Representative Data - Refer to line comment for detail

Port of Seattle
EMIS

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
All Outfalls	Count	40	40	40	4	40	40
	Max	8.7		3.99	0.42	2.35	22
	95th	8.3		0.55	0.40	0.26	10
	75th	7.8		0.21	0.34	0.10	3
	Median	7.5		0.15	0.24	0.10	1.8
	25th	7.0		0.15	0.14	0.10	1
	Min	6.4		0.15	0.07	0.10	0.457
	SD	0.5		1.05	0.00	0.62	6
	CV%	6%		65%	0%	203%	111%
	#NonDetects	0	0	30	1	35	0
	%NonDetects	0%	0%	75%	25%	88%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%
SDE4/SDS1 (002)	Count	7	7	7	1	7	7
	Max	8.0		0.45	0.16	0.26	11.4
	95th	7.9		0.42	0.16	0.25	11
	75th	7.5		0.32	0.16	0.21	8
	Median	7.3		0.27	0.16	0.12	4.74
	25th	7.2		0.18	0.16	0.10	3
	Min	6.9		0.15	0.16	0.10	1.8
	SD	0.3		0.11	0.00	0.07	4
	CV%	4%		41%	0%	43%	62%
	#NonDetects	0	0	2	0	4	0
	%NonDetects	0%	0%	29%	0%	57%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
SDS3/5 (005)	Count	4	4	4	1	4	4
	Max	7.7		0.67	0.32	0.35	6.8
	95th	7.7		0.59	0.32	0.31	6
	75th	7.7		0.28	0.32	0.16	4
	Median	7.6		0.15	0.32	0.10	2.55
	25th	7.5		0.15	0.32	0.10	2
	Min	7.4		0.15	0.32	0.10	1.03
	SD	0.1		0.26	0.00	0.13	2
	CV%	2%		93%	0%	77%	77%
	#NonDetects	0	0	3	0	3	0
	%NonDetects	0%	0%	75%	0%	75%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%
SDS4 (009)	Count	4	4	4	1	4	4
	Max	8.3		0.20	0.07	0.14	2.39
	95th	8.1		0.19	0.07	0.13	2
	75th	7.4		0.16	0.07	0.11	1
	Median	7.0		0.15	0.07	0.10	0.685
	25th	6.9		0.15	0.07	0.10	0
	Min	6.9		0.15	0.07	0.10	0.457
	SD	0.7		0.03	0.00	0.02	1
	CV%	9%		16%	0%	16%	86%
	#NonDetects	0	0	4	1	4	0
	%NonDetects	0%	0%	100%	100%	100%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
SDS6/7 (014)	Count	4	4	4	1	4	4
	Max	8.0		0.54	0.42	0.12	2.2
	95th	7.9		0.48	0.42	0.12	2
	75th	7.7		0.25	0.42	0.11	2
	Median	7.5		0.15	0.42	0.10	1.725
	25th	7.4		0.15	0.42	0.10	1
	Min	7.3		0.15	0.42	0.10	0.918
	SD	0.3		0.19	0.00	0.01	1
	CV%	4%		79%	0%	11%	33%
	#NonDetects	0	0	3	0	4	0
	%NonDetects	0%	0%	75%	0%	100%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%
SDN1 (006)	Count	3	3	3		3	3
	Max	7.0		3.99		2.35	22
	95th	7.0		3.61		2.13	20
	75th	7.0		2.10		1.23	13
	Median	6.9		0.21		0.10	3.15
	25th	6.6		0.18		0.10	3
	Min	6.4		0.15		0.10	2.19
	SD	0.3		2.20		1.30	11
	CV%	5%		152%		153%	123%
	#NonDetects	0	0	1		2	0
	%NonDetects	0%	0%	33%		67%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
SDW2 (016)	Count	3	3	3		3	3
	Max	8.6		0.15		0.10	1.56
	95th	8.5		0.15		0.10	1
	75th	8.3		0.15		0.10	1
	Median	8.0		0.15		0.10	0.81
	25th	7.8		0.15		0.10	1
	Min	7.7		0.15		0.10	0.64
	SD	0.5		0.00		0.00	0
	CV%	6%		0%		0%	49%
	#NonDetects	0	0	3		3	0
	%NonDetects	0%	0%	100%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%
SDW1B (017)	Count	3	3	3		3	3
	Max	8.7		0.31		0.10	3.5
	95th	8.6		0.29		0.10	3
	75th	8.2		0.23		0.10	3
	Median	7.6		0.15		0.10	2.15
	25th	7.6		0.15		0.10	2
	Min	7.6		0.15		0.10	0.95
	SD	0.6		0.09		0.00	1
	CV%	8%		45%		0%	58%
	#NonDetects	0	0	2		3	0
	%NonDetects	0%	0%	67%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
SDW1A (018)	Count	3	3	3		3	3
	Max	7.9		0.15		0.10	2.5
	95th	7.9		0.15		0.10	2
	75th	7.7		0.15		0.10	2
	Median	7.6		0.15		0.10	1.8
	25th	7.6		0.15		0.10	2
	Min	7.5		0.15		0.10	1.25
	SD	0.2		0.00		0.00	1
	CV%	3%		0%		0%	34%
	#NonDetects	0	0	3		3	0
	%NonDetects	0%	0%	100%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%
SDN3A (019)	Count	3	3	3		3	3
	Max	8.0		0.15		0.10	1.4
	95th	7.9		0.15		0.10	1
	75th	7.9		0.15		0.10	1
	Median	7.8		0.15		0.10	0.841
	25th	7.6		0.15		0.10	1
	Min	7.3		0.15		0.10	0.538
	SD	0.3		0.00		0.00	0
	CV%	4%		0%		0%	47%
	#NonDetects	0	0	3		3	0
	%NonDetects	0%	0%	100%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
SDN2/3/4 (007)	Count	3	3	3		3	3
	Max	8.2		0.15		0.10	2.27
	95th	8.2		0.15		0.10	2
	75th	7.9		0.15		0.10	2
	Median	7.5		0.15		0.10	1.7
	25th	7.3		0.15		0.10	2
	Min	7.0		0.15		0.10	1.3
	SD	0.6		0.00		0.00	0
	CV%	8%		0%		0%	28%
	#NonDetects	0	0	3		3	0
	%NonDetects	0%	0%	100%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%
SDD06A (020)	Count	3	3	3		3	3
	Max	6.7		0.15		0.10	0.958
	95th	6.7		0.15		0.10	1
	75th	6.7		0.15		0.10	1
	Median	6.7		0.15		0.10	0.945
	25th	6.6		0.15		0.10	1
	Min	6.5		0.15		0.10	0.6
	SD	0.1		0.00		0.00	0
	CV%	2%		0%		0%	24%
	#NonDetects	0	0	3		3	0
	%NonDetects	0%	0%	100%		100%	0%
	#Trimmed	0	0	0		0	0
	%Trimmed	0%	0%	0%		0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

NPDES Grab Statistics 7/1/2017 - 6/30/2018

CONCENTRATION, mg/L

		pH	Sheen	TPH-Dx	TPH-D	TPH-MO	Turb
Landside (SDE4/SDS1, SDN1, SDD06A)	Count	13	13	13	1	13	13
	Max	8.0		3.99	0.16	2.35	22
	95th	7.7		1.86	0.14	1.09	16
	75th	7.3		0.28	0.14	0.20	6
	Median	7.0		0.21	0.16	0.10	3.15
	25th	6.7		0.15	0.14	0.10	2
	Min	6.4		0.15	0.16	0.10	0.6
	#NonDetects	0	0	6	0	9	0
	%NonDetects	0%	0%	46%	0%	69%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%
Airfield (SDS3/5, SDS4, SDS6/7, SDW2, SDW1B, SDW1A, SDN3A, SDN2/3/4)	Count	27	27	27	3	27	27
	Max	8.7		0.67	0.42	0.35	6.8
	95th	8.5		0.47	0.41	0.13	3
	75th	7.9		0.15	0.37	0.10	2
	Median	7.6		0.15	0.32	0.10	1.56
	25th	7.4		0.15	0.19	0.10	1
	Min	6.9		0.15	0.07	0.10	0.457
	SD	0.5		0.12	0.18	0.05	1
	CV%	6%		65%	67%	44%	74%
	#NonDetects	0	0	24	1	26	0
	%NonDetects	0%	0%	89%	33%	96%	0%
	#Trimmed	0	0	0	0	0	0
	%Trimmed	0%	0%	0%	0%	0%	0%

Values qualified as non-detect (<) calculated at 1/2 the reported detection limit.

Port of Seattle
EMIS

NPDES Grab Sample Data 7/1/2017 - 6/30/2018

SAMPLE DATA			STORM CHARACTERISTICS							CONCENTRATION, mg/L							
Seq	Out fall	Sample ID	Storm Date	Dpth in	Dur hr	MaxInt in/hr	24hrant in	48hrant in	Dryant hr	Ground Deice?	pH	Sheen	TPH-Dx	TPH - D	TPH - MO	Turb	
1	SDE4/SDS1	SDE4/S1091717GRAB	9/17/2017	0.35	43	0.07	0	0	852	No	H 7.98	No Sheen	0.277	0.158	< 0.238	4.6	
2	SDE4/SDS1	SDE4/S1110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 7.45	No Sheen	0.216		< 0.200	1.8	
3	SDE4/SDS1	SDE4/S1110817GRAB	11/8/2017	0.53	33	0.12	0.01	0.01	13	No	H 7.59	No Sheen	0.269		0.219	2.2	
4	SDE4/SDS1	SDE4/S1022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 7.17	No Sheen	0.448		0.258	9.70	
5	SDE4/SDS1	SDE4/S1030818GRAB	3/7/2018	0.38	25	0.14	0	0	78	No	H 7.35	No Sheen	< 0.3		< 0.200	4.74	
6	SDE4/SDS1	SDE4/S1040418GRAB	4/4/2018	0.31	20	0.07	0	0	178	No	H 7.28	No Sheen	< 0.3		< 0.200	6.06	
7	SDE4/SDS1	SDE4/S1042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 6.95	No Sheen	0.368		0.202	11.4	
8	SDS3/5	SDS3/5092017GRAB	9/20/2017	0.15	5	0.09	0.03	0	21	No	H 7.51	No Sheen	0.67	0.319	0.351	6.8	
9	SDS3/5	SDS3/5110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 7.42	No Sheen	< 0.3		< 0.200	2.3	
10	SDS3/5	SDS3/5022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 7.70	No Sheen	< 0.3		< 0.200	2.80	
11	SDS3/5	SDS3/5042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 7.65	No Sheen	< 0.3		< 0.200	1.03	
12	SDS4	SDS4091817GRAB	9/17/2017	0.35	43	0.07	0	0	852	No	H 8.29	No Sheen	< 0.405	< 0.135	< 0.270	0.86	
13	SDS4	SDS4110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 6.86	No Sheen	< 0.3		< 0.200	0.51	
14	SDS4	SDS4022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 6.91	No Sheen	< 0.3		< 0.200	2.39	
15	SDS4	SDS4040418GRAB	4/4/2018	0.31	20	0.07	0	0	178	No	H 7.05	No Sheen	< 0.3		< 0.200	0.457	
16	SDS6/7	SDS6/7091717GRAB	9/17/2017	0.35	43	0.07	0	0	852	No	H 7.99	No Sheen	0.5395	0.416	< 0.247	2.2	
17	SDS6/7	SDS6/7110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 7.34	No Sheen	< 0.3		< 0.200	1.6	
18	SDS6/7	SDS6/7022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 7.62	No Sheen	< 0.3		< 0.200	1.85	
19	SDS6/7	SDS6/7040418GRAB	4/4/2018	0.31	20	0.07	0	0	178	No	H 7.38	No Sheen	< 0.3		< 0.200	0.918	
20	SDN1	SDN1110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 6.41	No Sheen	3.99		2.35	22	
21	SDN1	SDN1030718GRAB	3/7/2018	0.38	25	0.14	0	0	78	No	H 6.87	No Sheen	0.213		< 0.200	3.15	
22	SDN1	SDN1042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 7.04	No Sheen	< 0.3		< 0.200	2.19	
23	SDW2	SDW2111917GRAB	11/19/2017	1.1	25	0.19	0	0	72	No	H 7.73	No Sheen	< 0.3		< 0.200	0.81	
24	SDW2	SDW2022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 8.60	No Sheen	< 0.3		< 0.200	0.640	
25	SDW2	SDW2042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 7.96	No Sheen	< 0.3		< 0.200	1.56	
26	SDW1B	SDW1B110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 7.63	No Sheen	0.307		< 0.200	3.5	
27	SDW1B	SDW1B022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 8.73	No Sheen	< 0.3		< 0.200	0.950	
28	SDW1B	SDW1B042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 7.62	No Sheen	< 0.3		< 0.200	2.15	
29	SDW1A	SDW1A110217GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	No	H 7.52	No Sheen	< 0.3		< 0.200	2.5	
30	SDW1A	SDW1A022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 7.89	No Sheen	< 0.3		< 0.200	1.25	
31	SDW1A	SDW1A040418GRAB	4/4/2018	0.31	20	0.07	0	0	178	No	H 7.58	No Sheen	< 0.3		< 0.200	1.80	
32	SDN3A	SDN3A111917GRAB	11/19/2017	1.1	25	0.19	0	0	72	No	H 7.34	No Sheen	< 0.3		< 0.200	1.4	

R=Rejected Non-Representative Data - Refer to line comment for detail
L:\EMIS_SQL\SQLFrontEndInstall\SurfaceWater_SQL.mdb/rptSWNPDESGrabOnly

Port of Seattle

EMIS

NPDES Grab Sample Data 7/1/2017 - 6/30/2018

SAMPLE DATA			STORM CHARACTERISTICS							CONCENTRATION, mg/L							
Seq	Out fall	Sample ID	Storm Date	Dpth in	Dur hr	MaxInt in/hr	24hrant in	48hrant in	Dryant hr	Ground Deice?	pH	Sheen	TPH-Dx	TPH - D	TPH - MO	Turb	
33	SDN3A	SDN3A022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 7.96	No Sheen	< 0.3		< 0.200	0.538	
34	SDN3A	SDN3A040418GRAB	4/4/2018	0.31	20	0.07	0	0	178	No	H 7.82	No Sheen	< 0.3		< 0.200	0.841	
35	SDN2/3/4	SDN2/3/4110817GRAB	11/8/2017	0.53	33	0.12	0.01	0.01	13	No	H 7.02	No Sheen	< 0.3		< 0.200	1.7	
36	SDN2/3/4	SDN2/3/4022818GRAB	2/28/2018	0.19	17	0.04	0	0.01	29	No	H 8.24	No Sheen	< 0.3		< 0.200	1.30	
37	SDN2/3/4	SDN2/3/4042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 7.54	No Sheen	< 0.3		< 0.200	2.27	
38	SDD06A	SDD06A111917GRAB	11/19/2017	1.1	25	0.19	0	0	72	No	H 6.71	No Sheen	< 0.3		< 0.200	0.60	
39	SDD06A	SDD06A030818GRAB	3/7/2018	0.38	25	0.14	0	0	78	No	H 6.71	No Sheen	< 0.3		< 0.200	0.945	
40	SDD06A	SDD06A042818GRAB	4/28/2018	0.37	18	0.11	0	0	142	No	H 6.47	No Sheen	< 0.3		< 0.200	0.958	

R=Rejected Non-Representative Data - Refer to line comment for detail

APPENDIX B

OTHER SAMPLE DATA

This page left intentionally blank.

QC Samples Dups - 7/1/2017-6/30/2018

																Conventionals		Metals		TPH		
Outfall	Sample	Storm	depth	dur	maxint	ant24	ant48	dryant	Event Type	Sub Type	Comp Type	Type	Purpose	Grnd Deice	Comment	ph pH Units	Turb NTU	Cu Total mg/l	Zn Total mg/l	Sheen N/A	TPH-Dx mg/l	TPH-MO mg/l
SDE4/SDS	SDSE4/S1110217DUPG	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	first flush grab		N	FldQC	No		H 7.61	1.9				0.208	< 0.1
SDE4/SDS	SDSE4/S1110217DUPG	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	first flush grab		N	FldQC	No	verify with field sampling team					No Sheen		
SDE4/SDS	SDE4/S1110317DUPC	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	flow-wt comp	SMC	N	FldQC	No				0.0146	0.0366			
SDS3/5	SDS3/5092017DUPC	9/20/2017	0.15	5	0.09	0.03	0	21	NPDES-Part II	flow-wt comp	EMC	FD	FldQC	No				0.0136	0.0132			
SDS3/5	SDS3/5110217DUPG	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	first flush grab		N	FldQC	No		H 7.51	1.6				< 0.15	< 0.1
SDS3/5	SDS3/5110217DUPG	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	first flush grab		N	FldQC	No	verify with field sampling team					No Sheen		
SDS3/5	SDS3/5110317DUPC	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	flow-wt comp	SMC	FD	FldQC	No				0.00912	0.0103			
SDS4	SDS4022818DUPG	2/28/2018	0.19	17	0.04	0	0.01	29	NPDES-Part II	first flush grab		FD	FldQC	No		H 6.9	2.43			No Sheen		< 0.1
SDS4	SDS4030118DUPC	2/28/2018	0.19	17	0.04	0	0.01	29	NPDES-Part II	flow-wt comp	EMC	FD	FldQC	No				0.00309	< 0.002			
SDD06A	SDD06A111017DUPC	11/8/2017	0.53	33	0.12	0.01	0.01	13	NPDES-Part II	flow-wt comp	EMC	FD	FldQC	No				0.00474	0.0197			
SDD06A	SDD06A111917DUPG	11/19/2017	1.1	25	0.19	0	0	72	NPDES-Part II	first flush grab		FD	FldQC	No		H 7.34	0.6					< 0.1
SDD06A	SDD06A111917DUPG	11/19/2017	1.1	25	0.19	0	0	72	NPDES-Part II	first flush grab		FD	FldQC	No	verify with field sampling team					No Sheen		

Selected Date Range; 7/1/2017-6/30/2018; Values Qualified as (<) are included as 1/2 the reported Detection Limit; Rejected Values not included.

QC Samples Blanks - 7/1/2017-6/30/2018

															Metals		TPH	
Outfall	Sample	Storm	depth	dur	maxint	ant24	ant48	dryant	Event Type	Sub Type	Type	Comp Type	Purpose	Grnd Deice	Comment	Cu Total mg/l	Zn Total mg/l	Sheen N/A	TPH-MO mg/l
SDN8	SDN8110617GRAB	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	discreet series	EB		FldQC	No		< 0.00025	< 0.002		
SDN8	SDN8111017GRAB	11/8/2017	0.53	33	0.12	0.01	0.01	13	NPDES-Part II	discreet series	EB		FldQC	No		< 0.00025	< 0.002		
SDN8	SDN8030918GRAB	3/7/2018	0.38	25	0.14	0	0	78	NPDES-Part II	first flush grab	EB		FldQC	No		< 0.00025	< 0.002	No Sheen	
SDE4/SDS	SDE4/S1110617BLNK	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	discreet series	FB		FldQC	No		< 0.00025	< 0.002		< 0.1
SDS3/5	SDS3/5110617BLNK	11/2/2017	0.66	31	0.09	0.01	0.01	19	NPDES-Part II	discreet series	FB		FldQC	No		< 0.00025	0.00426		< 0.1
SDD06A	SDD06A111017BLNK	11/8/2017	0.53	33	0.12	0.01	0.01	13	NPDES-Part II	discreet series	FB		FldQC	No		< 0.00025	< 0.002		

Selected Date Range; 7/1/2017-6/30/2018; Values Qualified as (<) are included as 1/2 the reported Detection Limit; Rejected Values not included.