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Report No.: 0041/17/ED/0481A

Quarterly EM&A Report May 2019 - July 2019

Client : Drainage Services Department

Project : Contract No. CM 14/2016
Environmental Team for Operational
Environmental Monitoring and Audit for Siu
Ho Wan Sewage Treatment Works

Report No.: : 0041/17/ED/0481A

Prepared by: Andy K. H. Choi

Reviewed by: Cyrus C. Y. Lai

Certified by:

A handwritten signature in black ink, appearing to be "Colin K. L. Yung", written over a horizontal line.

Colin K. L. Yung
Environmental Team Leader
Fugro Technical Services Limited

Allied Environmental Consultants Limited
Acousticians & Environmental Engineers

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Our Ref: 1458/19-0024

27 August 2019

By Post and E-mail

Drainage Service Department
Projects and Development Branch
Consultants Management Division
42/F, Revenue Tower,
5 Gloucester Road
Wan Chai, Hong Kong

Attn: Mr. LAU Ka Kin, Marcus (E/CM16)

Dear Sir,

**RE: CONTRACT NO. CM 13/2016
INDEPENDENT ENVIRONMENTAL CHECKER FOR OPERATIONAL ENVIRONMENTAL
MONITORING AND AUDIT FOR SIU HO WAN SEWAGE TREATMENT WORKS (SHWSTW)
QUARTERLY ENVIRONMENTAL MONITORING AND AUDIT (EM&A) REPORT
(MAY 2019 TO JULY 2019)**

Reference is made to the submission of Quarterly Environmental Monitoring and Audit (EM&A) Report (May 2019 to July 2019) (Report No.: 0041/17/ED/0481A) received from the Environmental Team (ET), Fugro Technical Services Ltd., on 27 August 2019 via email.

We would like to inform you that we have no adverse comment on the captioned submission and hereby verify the same in accordance with Condition 4.3 of the Environmental Permit (EP) for the captioned Project (Permit No.: EP-076/2000).

Notwithstanding, please be reminded that the ET shall strictly follow Condition 4.3 of the EP to submit EM&A report within two weeks after the completion of each reporting period and the report shall be certified by the Independent Environmental Checker (IEC) before depositing with the Environmental Protection Department.

Should you have any queries, please feel free to contact the undersigned, or our Mr. Rodney IP at 2815 7028.

Yours faithfully,

For and on behalf of
Allied Environmental Consultants Ltd.

A handwritten signature in black ink, appearing to read 'Grace M. H. Kwok', written over a light blue horizontal line.

Grace M. H. KWOK
Independent Environmental Checker

GK/ri/ck/sc

c.c. Fugro Technical Service (ET Leader)
AECOM

Attn: Mr. Colin YUNG
Attn: Ms. Joanne TSOI

(By E-mail)
(By E-mail)

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**EXECUTIVE SUMMARY**

The Drainage Services Department (DSD) of Hong Kong Special Administrative Region has appointed Fugro Technical Services Limited (FTS) to undertake the Environmental Team services for the Project and implement the EM&A works.

This is the eighth Quarterly EM&A Report presents the environmental monitoring and audit works for the period between 1 May 2019 and 31 July 2019. As informed by the Contractor, major activities in the reporting period included:

May 2019 - July 2019

- Perform comprehensive operation and maintenance services for the electrical, mechanical and electronic systems/equipment at Siu Ho Wan Sewage Treatment Works (SHWSTW).
- Alleviate as far as practicable the impact that the facilities and sewage systems imposed on the environment of Hong Kong.

Breaches of Action and Limit Levels

Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporarily suspended and no monitoring was carried out in the reporting period. No exceedances of Action/Limit levels at Air Sensitive Receivers (ASRs) were recorded and no non-compliance of odour monitoring at ASRs were recorded in the reporting period.

Water quality monitoring, sediment quality monitoring and benthic survey were carried out on June 2019. No specific Action/Limit level has to be followed since the purpose of the monitoring is to collect data for future purpose.

Compliant Log

There was no complaint received in relation to the environmental impact during the report period.

Notifications of Summons and Successful Prosecutions

There were no notifications of summons or prosecutions received during the reporting period.

Summary of the Environmental Mitigations Measures

Mitigation measures specified in the EP and EIA Report such as aeration, chemical dosing system, covering or enclosing the pressing and sludge thickening facilities and ventilating air to a biological treatment unit prior to stack exhaust was implemented during the reporting period.

1. INTRODUCTION

1.1 Background

- 1.1.1 The Project “Upgrading of Siu Ho Wan Sewage Treatment Works” is to upgrade Siu Ho Wan Sewage Treatment Works (SHWSTW) from the preliminary treatment level to Chemically Enhanced Primary Treatment (CEPT) level with Ultraviolet (UV) disinfection facilities. The Project is required to comply with the Environmental Permit (EP) in respect of the construction and operation phases of the Plant.
- 1.1.2 Under the Environmental Impact Assessment Ordinance (EIAO), the Project was classified as “Designated Project”. The Environmental Impact Assessment (EIA) study was completed in September 1997 with the EIA Report of Register No. EIAR-124BC, Operational EM&A Plan and the EP of No. EP-076/2000 was issued in August 2000 to Drainage Services Department (DSD).
- 1.1.3 The CEPT part has been completed and was put into operation in March 2005. The UV disinfection works were substantially completed in December 2006. It is considered that the operation of the Project shall be deemed to start when the UV disinfection facilities have been completely installed and tested.
- 1.1.4 This Quarterly EM&A report is required under Section 8.5 of the OEM&A Plan. It is to report the results and findings of the EM&A programme required in the OEM&A Plan.
- 1.1.5 This is the eighth quarterly OEM&A Report which summaries the impact monitoring results and audit findings for the Project within the period between 1 May 2019 and 31 July 2019.

1.2 Project Description

- 1.2.1 The project proponent was DSD. AECOM was commissioned by DSD as the Engineer for the Project. Allied Environmental Consultants Limited (AEC) was commissioned by DSD as the Independent Environmental Checker (IEC) in the operation phase of the Project. FTS was appointed as the ET by DSD to implement the EM&A programme for the operation phase of the Project including air quality monitoring, water quality monitoring, sediment quality and benthic survey and Chinese white dolphin (CWD) monitoring.

1.3 Project Organization

- 1.3.1 The project organization for environmental works is shown in **Appendix A**. The contact person and telephone numbers of key personnel for the captioned project are shown in **Table 1.1**.

Table 1.1 Contact Persons and Telephone Numbers of Key Personnel

Organization	Role	Contact Person	Telephone No.	Fax No.
DSD	Project Proponent Representative	Mr. Marcus Lau	2594 7218	3104 6426
AECOM	Engineer Representative (ER)	Ms. Joanne Tsoi	3922 9423	3922 9797
AEC	Independent Environmental Checker (IEC)	Ms. Grace Kwok	2815 7028	2815 5399

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FTS	ET Leader (ETL)	Mr. Colin Yung	3565 4114	2450 8032
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1.4 Work Undertaken during the Report Period

1.4.1 During this reporting period, the principal work activities included:

May 2019 - July 2019
<ul style="list-style-type: none">▪ Perform comprehensive operation and maintenance services for the electrical, mechanical and electronic systems/equipment at SHWSTW.▪ Alleviate as far as practicable the impact that the facilities and sewage systems imposed on the environment of Hong Kong.

2. SUMMARY OF EM&A REQUIREMENTS AND MONITORING RESULTS

2.1 Monitoring Requirement

2.1.1 In accordance with the approved OEM&A Plan, air quality monitoring (odour patrol monitoring, H₂S measurement and olfactometry analysis), water quality monitoring (onsite measurement and laboratory analysis), sediment quality & benthic survey at the designated monitoring stations are required. Data interpretation for the distribution and abundance of Chinese white dolphin (CWD) from the survey undertaken by the Agriculture, Fisheries and Conservation Department (AFCD) is also required for CWD monitoring. Air quality monitoring (H₂S concentration monitoring and Odour patrol) should be conducted on a weekly basis for six months while the odour sampling for olfactometry analysis should be conducted on the first week of the odour patrol monitoring. For water quality monitoring, sediment quality & benthic survey and CWD monitoring should be carried out once per two months for a period of five years. The Action and Limit Levels of the air quality monitoring are given in **Appendix B**.

2.2 Monitoring Locations

2.2.1 According to the OEM&A Plan, one Air Sensitive Receiver (ASR) was identified and required to conduct air quality monitoring. The location (ASR) for air quality monitoring is shown in **Figure 1**.

2.2.2 In accordance with Section 5 of the EM&A Plan, water quality monitoring should be carried out at 8 designated monitoring locations (2 impact stations and 6 control stations). The monitoring locations shall be the same monitoring locations that were used for the baseline monitoring programme and have been approved by EPD. The coordinates of the monitoring location is shown in **Table 2.1**. The monitoring locations of water quality monitoring, Sediment Quality Monitoring and Benthic Survey are also shown in **Figure 2**.

Table 2.1 Location of Water Quality Monitoring, Sediment Quality Monitoring and Benthic Survey

Sampling Location		Easting	Northing
A	The Brothers, Control Station	816 100	822 500
B	The Brothers, Control Station	816 680	822 440
C	Siu Ho Wan Outfall, Impact Station	816 800	820 180
D	Siu Ho Wan Outfall, Impact Station	817 160	820 360
E	Cheung Sok, Control Station	819 817	821 655
F	Cheung Sok, Control Station	820 158	821 922
G	Tai Ching Chau, Control Station	822 214	822 692
H	Tai Ching Chau, Control Station	822 494	822 939

2.3 Monitoring Parameter

2.3.1 The durations and frequencies of H₂S concentration measurement, odour patrolling and odour sampling are summarized in **Table 2.2** below.

Table 2.2 Durations and Frequencies of Air Quality Monitoring Programme

	Duration	Frequency
H ₂ S concentration monitoring	15 minutes	¹ Weekly basis for 6 months during the initial operation stage
Odour patrol		
Odour sampling for olfactometry analysis	³ 15 minutes	² First week of the odour patrol monitoring

Remark:

- 1) In case excessive odour nuisance was detected during the odour patrol monitoring or the standard of the 5 odour units cannot be complied with during the odour panel monitoring, the odour patrol monitoring and H₂S concentration monitoring shall be extended for a period of three months to cater for the warm-up period of the functioning of the additional mitigation measures.
- 2) In case the relationship between H₂S concentration (ppb) with the odour unit (OU/m³) cannot conclude from the correlation study carried out at the first week of the odour patrol monitoring due to invalid data, additional odour sampling for olfactometry analysis shall be carried out for the correlation study.
- 3) Sufficient air samples (approximate 60L) may be collected in less than 15 minutes during odour sampling.

2.3.2 The monitoring parameters for water quality monitoring are summarized in **Table 2.3**.

Table 2.3 Parameters for Water Quality Monitoring

Monitoring Parameters	
In-situ Measurement	Laboratory Analysis
Dissolved oxygen (mg/L)	<i>E. coli</i> (cfu/100ml)
Temperature (degree Celsius)	5-day BOD (mg/l)
pH value	Suspended Solids (mg/l)
Water depth (m)	Ammonia as N (mg/l)
Salinity (ppt)	Nitrate as N (mg/l)
Turbidity (NTU)	Nitrite as N (mg/l)
Current Speed (m/s)	Total inorganic nitrogen (mg/l)
Current Direction (degree magnetic)	Total phosphorus (soluble and particulate) (mg/l)

2.3.3 The monitoring parameters for sediment quality monitoring and benthic survey are summarized in **Table 2.4**.

Table 2.4 Parameters for Sediment Quality Monitoring and Benthic Survey

Monitoring Parameters	
Sediment Quality Monitoring	Rinsate Blank for Benthic Survey
Grain size profile* (i.e. Particle Size Distribution) (%)	Cadmium (µg/L)
Total organic carbon* (%)	Chromium (µg/L)
pH value	Copper (µg/L)
Ammonia as N (mg-N/kg)	Lead (µg/L)
Total nitrogen (mg-N/kg)	Mercury ((µg/L)
Total phosphorus (mg-N/kg)	Nickel (µg/L)
Cadmium (mg/kg)	Zinc (µg/L)
Chromium (mg/kg)	Arsenic (µg/L)
Copper (mg/kg)	Silver (µg/L)



Monitoring Parameters	
Sediment Quality Monitoring	Rinsate Blank for Benthic Survey
Lead (mg/kg)	
Mercury (mg/kg)	
Nickel (mg/kg)	
Zinc (mg/kg)	
Arsenic (mg/kg)	
Silver (mg/kg)	

*Grain size profile and total organic carbon is determined from the sediment sampled collected for benthic survey.

2.3.4 Apart from the parameters listed in the **Table 2.3** and **Table 2.4**, other relevant supplementary information such as monitoring location, time, weather conditions and any special phenomena shall be also recorded.

2.3.5 The tidal data will be obtained from the tide gauge installed in Ma Wan Marine Traffic Station, managed by the Hydrographic Office of Marine Department. Location of the tide gauge is shown in **Figure 3**. Tidal data obtained from Ma Wan Marine Traffic Station is present in **Appendix D**.

2.4 Results and Observations

2.4.1 Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporary suspended and no monitoring was carried out in the reporting period.

2.4.2 No Action and Limit Level exceedance for air quality monitoring (odour patrol monitoring, H₂S measurement and olfactometry analysis) was recorded in the reporting period at ASR since no complaint on odour was received in the reporting period.

2.4.3 According to the approved EM&A plan, a correlation study has to be carried out to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). Due to non-ideal wind direction or domination of non-target smell during the measurements conducted between August 2017 and May 2018, inadequacy of representative data was result between August 2017 and May 2018. Current H₂S measurement and olfactometry analysis was considered as unlikely way to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASR, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASR is not appropriate for the correlation study as the change of both odour level and H₂S concentrations at ASR were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD’s approval. Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD’s memo dated 14 May 2018.

2.4.4 Due to adverse weather condition, the water quality monitoring, sediment quality monitoring and benthic survey were rescheduled from 13 June 2019 to 21 June 2019. Water quality monitoring, sediment quality monitoring and benthic survey were conducted to collect data for future reference in accordance with Section 5.5 and 6.5 of the Operational EM&A Plan. Heavy marine traffic and construction works from expansion of Hong Kong International Airport were observed nearby the Project site and its vicinity and may affect the water and sediment quality. The above conditions may affect monitoring results. The summaries of results collected of the monitoring



were presented in the below tables. The graphical presentation of water quality monitoring results, sediment quality monitoring and benthic survey results are given in **Appendix C** and **Appendix E** respectively.

Table 2.5 Summary of In-situ Monitoring Results on 21 June 2019 (Depth – Average)

Monitoring Station	pH	Salinity (ppt)	Temperature (degree Celsius)	Dissolved oxygen (mg/L)	Turbidity (NTU)	Current speed (m/s)	Current velocity (degree magnetic)
A	E	8.11	26.60	28.94	6.51	3.5	217.9
	F	7.83	25.81	28.47	6.17	3.1	201.0
B	E	8.17	27.30	28.90	6.24	4.7	252.4
	F	7.89	26.14	28.87	5.98	4.6	163.2
C	E	8.06	27.07	29.32	6.59	5.1	222.2
	F	7.79	26.18	28.90	6.36	2.5	201.5
D	E	8.06	27.55	28.84	6.12	4.4	209.0
	F	7.79	26.14	28.87	5.84	3.0	164.7
E	E	8.18	25.57	29.15	7.47	5.4	219.0
	F	7.90	26.99	28.91	7.13	3.2	183.8
F	E	8.18	26.76	29.04	7.39	3.6	237.0
	F	7.90	26.71	29.19	7.05	3.8	166.1
G	E	8.20	27.50	29.13	6.70	4.6	163.1
	F	7.92	26.56	29.28	6.39	4.4	187.9
H	E	8.25	27.74	29.12	7.78	5.0	153.5
	F	7.97	26.56	29.14	7.39	5.1	177.4

Table 2.6 Summary of Laboratory Analysis Results on 21 June 2019 (Depth – Average)

Monitoring Station	TSS (mg/L)	NH ₃ as N (mg/L)	NO ₂ ⁻ as N (mg/L)	NO ₃ ⁻ as N (mg/L)	TIN (mg/L)	E.coli (cfu/100mL)	Total P (mg/L)	BOD ₅ (mg/L)
A	E	6.8	<0.005	0.044	0.916	0.960	6.7	1.9
	F	5.0	<0.005	0.050	0.835	0.885	ND	2.0
B	E	10.0	<0.005	0.046	0.851	0.897	1.3	2.2
	F	5.7	<0.005	0.052	0.831	0.883	ND	1.8
C	E	10.2	<0.005	0.042	0.861	0.904	5.7	2.5
	F	5.3	<0.005	0.050	0.838	0.889	ND	2.0
D	E	6.4	<0.005	0.042	0.888	0.930	7.5	2.6
	F	5.5	<0.005	0.050	0.854	0.904	ND	2.0
E	E	9.4	<0.005	0.046	0.854	0.900	3.3	2.7
	F	5.5	<0.005	0.052	0.827	0.879	ND	1.8
F	E	9.3	<0.005	0.043	0.814	0.858	4.2	3.1
	F	6.2	<0.005	0.051	0.864	0.915	ND	1.6
G	E	10.9	<0.005	0.048	0.760	0.808	3.2	3.1
	F	5.1	<0.005	0.050	0.866	0.916	3.7	1.9
H	E	9.4	<0.005	0.047	0.770	0.816	9.2	2.6
	F	6.8	0.024	0.039	0.914	0.977	2.5	1.7

Table 2.7 Summary of laboratory analysis results for sediment monitoring on 21 June 2019

Monitoring Station	pH value	NH ₃ as N (mg/L)	Total N (mg-N/kg)	Total P (mg-P/kg)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Ni (mg/kg)	Zn (mg/kg)	As (mg/kg)	Ag (mg/kg)
A	8.6	4	745	428	<0.10	31.5	29.9	37.7	0.08	18.9	90.7	22.8	0.22
B	8.4	5	926	505	0.12	37.5	36.9	41.5	0.11	22.3	108	13.5	0.46
C	8.5	11	1260	566	0.11	43.9	38.5	47.5	0.24	26.6	124	12.8	0.32
D	8.3	35	1450	586	0.10	43.3	37.7	46.4	0.13	26.4	123	14.2	0.30
E	8.8	14	1410	580	0.10	43.0	40.3	46.7	0.15	26.2	128	11.6	0.34
F	8.3	25	1690	605	0.15	43.8	41.6	48.2	0.14	27.1	128	12.4	0.36
G	8.5	8	1120	481	0.12	45.0	51.7	48.0	0.12	26.7	138	12.5	0.71
H	8.4	9	1330	546	0.12	43.7	51.4	55.3	0.13	25.9	125	12.1	0.35

Table 2.8 Summary of laboratory analysis results for benthic survey

Monitoring Day	Monitoring Station	Total organic carbon (%)	Grain size profile (%)				Description
			Gravel	Sand	Silt	Clay	
21 June 2019	A	0.66	2	38	30	30	Dark grey, sandy SILT/CLAY with shell fragments
	B	0.73	2	24	45	29	Dark grey, slightly sandy SILT/CLAY with shell fragments
	C	0.92	0	3	56	41	Dark grey, slightly sandy SILT/CLAY with shell fragments
	D	0.70	1	14	49	36	Dark grey, slightly sandy SILT/CLAY with shell fragments
	E	1.02	0	8	53	39	Dark grey, slightly sandy SILT/CLAY with shell fragments
	F	1.08	0	3	56	41	Dark grey, slightly sandy SILT/CLAY with shell fragments
	G	0.88	2	12	50	36	Dark grey, slightly sandy SILT/CLAY with shell fragments
	H	1.22	16	16	42	26	Dark grey, slight gravelly, slightly sandy SILT/CLAY with shell fragments

2.4.5 The benthic survey results are analyzed and presented as below:

- I. June 2019
- II. Abundance

A total of 215 benthic organisms was recorded from the eight monitoring stations during the June 2019 monitoring period. Compared to both dry (March 2004) and wet (August 2004) seasons baseline data, the present total abundance remained relatively lower similar to the previous monitoring periods. It can be observed that decreasing abundances were recorded during wet season monitoring periods while increasing abundances during dry season monitoring periods. These variations in the abundances might be attributed to the natural response of benthic communities to seasonal changes. However, these observed seasonal differences are not statistically significant (F=1.34, F crit=2.02, P-value=0.23, α=0.05).



Similar to the previous monitoring periods, however, a more apparent variation ($F=3.01$, $F\text{-crit}=2.14$, $P\text{-value}=0.008$, $\alpha=0.050$) across monitoring stations was observed. The lowest abundance with 18 individuals (ind.) was recorded in Station C and H and the highest (44 ind.) was recorded in Station A. Abundance distribution showed that the impact stations, Stations C and D, showed relatively lower abundances compared to the reference stations, a similar trend observed in the baseline data. Previous report showed that benthic abundance showed evident correlation with particle size, wherein relatively higher abundances were recorded in stations with moderately sorted sediments and lower abundances in stations with well-sorted sediments. However, during the present monitoring, abundance-sediment size correlation is less apparent. Nonetheless, stations with moderately sorted sediments have generally higher abundances compared to the stations with well-sorted sediments.

III. Biomass

The total wet biomass recorded in the eight monitoring stations was 94.27g, which is lower compared to the previous monitoring period (119.27g) but remained higher compared to the baseline data. The highest total biomass was observed in Station F (22.09g) while Station H (0.10g) exhibited the lowest biomass. The relatively higher biomass in Station F is contributed by the heavier mass of the molluscan species, *Paphia undulata* and *Ruditapes philippinarum*. The average biomass (12.4g) at the impact stations was higher compared to the average biomass (11.58g) at the reference stations.

IV. Taxonomic Composition

A total of seven phyla comprised of 36 families and 51 genera was identified during the present monitoring period. The benthic assemblage remained to be dominated by the annelids (57.67%), followed by the molluscs (27.44%), and arthropods (7.91%). Based on the recorded abundance, the percentage of mollusca increased during the present monitoring period. The dominant species (abundance >10) were the bivalve, *Angulus* sp., with the abundance of 10 ind. at Station A and the polychaete, *Capitella capitata*, with the abundance of 13 ind. at Station G. Similar to the baseline data, the current benthic assemblage were dominated by the capitellids, which are typical of inhabitants of unbalanced and organically enriched habitats (Pearson and Rosenberg 1978; Borja et al. 2000).

Highest number of genera was recorded in Station A (19) and the lowest in Station C (9). Similar to abundance, relatively lower number of taxa was observed at impact stations compared to the reference stations.

V. Diversity

Benthic diversity index (H') and evenness index (J) in the impact stations ranged from 1.98 – 2.46 and 0.90 – 0.93, respectively. Diversity and evenness indices, on the other hand, in the reference stations ranged from 2.09 – 2.65 and 0.83 – 0.96, respectively. These suggest that benthic faunal diversity is relatively higher at reference stations than those at impact stations. However, overall diversity in the eight monitoring stations is within the range of typical values recorded in the previous monitoring periods. Compared with the baseline survey result, apparent increase in diversity index and evenness index was observed.

Table 2.9 Summary of Benthic Survey Data on 21 June 2019

Station	Abundance (ind.)	Total Biomass (g)	Number of Taxa	Diversity (H')	Evenness (J)
A	44	14.24	19	2.65	0.90

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B	22	8.07	10	2.09	0.91
C	18	7.46	9	1.98	0.90
D	28	17.33	14	2.46	0.93
E	31	19.71	18	2.61	0.90
F	19	22.09	12	2.23	0.90
G	35	5.27	18	2.40	0.83
H	18	0.10	12	2.40	0.96
TOTAL	215	94.27			

2.4.6 The latest AFCD's report dated 10 July 2018, "*Monitoring of Marine Mammals in Hong Kong Waters (2017-18)*" in terms of the distribution and abundance of CWDs was reviewed in the Monthly EM&A report in July 2018. According to the advice from AFCD, the data of distribution and abundance of CWDs would only be available in the annual reports for Monitoring of Marine Mammals In Hong Kong Waters which cover monitoring data from 1 April to 31 March (next year). The updated status of the distribution and abundance of CWDs will be provided once the annual report (2018-19) is uploaded to AFCD's webpage.

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3. ADVICE ON IMPLEMENTATION STATUS OF ENVIRONMENTAL MITIGATION MEASURES

3.1 Implementation Status

- 3.1.1 Although no site inspection is prescribed during the operation of the Plant in accordance with the approved EM&A Plan, SHWSTW is reminded to fully and properly implement mitigation measures specified in the EP and EIA Report. Mitigation measures such as aeration, chemical dosing system, covering or enclosing the pressing and sludge thickening facilities and ventilating air to a biological treatment prior to stack exhaust was implemented in the reporting period. A summary of mitigation measures implementation schedule is provided in **Appendix F**.



4. ADVICE ON THE SOLID AND LIQUID WASTE MANAGEMENT STATUS

4.1.1 SHWSTW is reminded to fully comply with EP conditions. All measures and recommendations in the EP, EIA Report and approved waste management plan shall be fully and properly implemented. During the reporting period, following measures in related to solid and liquid waste management was implemented:

- The influent of waste water shall be treated by CEPT with UV disinfection;
- Trip-ticket system shall be implemented for sludge and sediment;
- The acceptance criteria for Landfill disposal should be followed;
- Chemical waste should be properly handled and stored temporarily in designated chemical waste storage area on site in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

4.1.2 A summary of mitigation measures implementation schedule is provided in **Appendix F**.

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5. SUMMARY OF EXCEEDANCE OF THE ENVIRONMENTAL QUALITY PERFORMANCE LIMITS

- 5.1.1 Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporary suspended and no monitoring was carried out in the reporting period. No exceedances of Action/Limit levels at ASRs were recorded.
- 5.1.2 Water quality monitoring, sediment quality monitoring and benthic survey were carried out on 21 June 2019. No specific Action/Limit level has to be followed since the purpose of the monitoring is to collect data for future purpose.

6. SUMMARY OF ENVIRONMENTAL COMPLAINTS

6.1.1 No complaint (written or verbal), inspection notice, notification of summons or prosecution was received in relation to the environmental impact during the report period. Summaries of complaints, notification of summons and successful prosecutions are presented in **Table 6.1** and **Table 6.2**.

Table 6.1 Cumulative Statistics on Complaints

Environmental Parameters	Cumulative No. Brought Forward	No. of Complaints This Month	Cumulative Project-to-Date
Air	0	0	0
Noise	0	0	0
Water	0	0	0
Waste	0	0	0
Others	0	0	0
Total	0	0	0

Table 6.2 Cumulative Statistics on Notification of Summons and Successful Prosecutions

Environmental Parameters	Cumulative No. Brought Forward	No. of Notification of Summons and Prosecutions This Month	Cumulative Project-to-Date
Air	0	0	0
Noise	0	0	0
Water	0	0	0
Waste	0	0	0
Others	0	0	0
Total	0	0	0

7. CONCLUSION

- 7.1.1 Air quality monitoring i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis, was temporary suspended and no monitoring was carried out in the reporting period. No exceedances of Action/Limit levels at ASR were recorded as no complaint was received during the reporting period.
- 7.1.2 According to the approved EM&A plan, a correlation study has to be carried out to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). Due to non-ideal wind direction or domination of non-target smell during the measurements conducted between August 2017 and May 2018, inadequacy of representative data was result between August 2017 and May 2018. Current H₂S measurement and olfactometry analysis was considered as unlikely way to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASR, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASR is not appropriate for the correlation study as the change of both odour level and H₂S concentrations at ASR were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD's approval. Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.
- 7.1.3 Water quality monitoring, sediment quality monitoring and benthic survey were conducted on 21 June 2019 to collect data for future reference in accordance with Section 5.5 and 6.5 of the Operational EM&A Plan. The details of methodology and results collected of the monitoring were presented in Section 2. Heavy marine traffic and construction works from expansion of Hong Kong International Airport were observed nearby the Project site and its vicinity and may affect the water and sediment quality. The above conditions may affect monitoring results.
- 7.1.4 The latest AFCD's report dated 10 July 2018, "*Monitoring of Marine Mammals in Hong Kong Waters (2017-18)*" in terms of the distribution and abundance of CWDs was reviewed. Only one sighting of CWD was made in NEL in 2018. CWD occurrence in NEL has plummeted starting from 2013 to the lowest point in 2015-17 when no dolphin was sighted. Even the marine works of HZMB has been mostly completed in 2017, it is reported that there is still no sign of recovery. The potential impact of increased effluent discharged from SHWSTW on CWDs is not mentioned in this AFCD report. However, anthropogenic disturbances such as increasing level of vessel traffic, construction of HZMB and expansion of Hong Kong International Airport are perceived as causes of decline in local abundance of CWDs. Continued systematic dolphin surveying in Lantau Island is necessary to further study this issue.
- 7.1.5 SHWSTW is reminded to fully *comply with EP conditions*. All *environmental mitigation measures* and recommendations in the EP, EIA Report and approved waste management plan shall be fully and properly implemented.
- 7.1.6 No complaint (written or verbal), inspection notice, notification of summons or prosecution was received in relation to the environmental impact during the report period.

7.2 Comment and Recommendations



7.2.1 The recommended environmental mitigation measures, as proposed in the EIA reports and OEM&A Plan were effectively and efficiently minimize the potential environmental impacts from the Project. Therefore, no complaint or non-compliance of monitoring were recorded during the reporting period. As inadequacy of representative data was result between August 2017 and May 2018, current H₂S measurement and olfactometry analysis was considered as unlikely way to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). Alternative methods shall be proposed and submitted for EPD's approval to ensure that EM&A programme could effectively monitor the environmental impacts generated from the site and ensure the proper implementation of mitigation measure.

7.2.2 According to the environmental monitoring performed in the reporting period, the following recommendations were made:

Air Quality Monitoring

- In order to assess whether SHWSTW is the major H₂S source to ASR, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASR is not appropriate for the correlation study as the change of both odour level and H₂S concentrations at ASR were not sensitive to that at site boundary of SHWSTW. Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.

Water Quality Monitoring

- No specific observation was identified in the reporting period.

Sediment Quality Monitoring and Benthic Survey

- No specific observation was identified in the reporting period.

Chinese White Dolphin Monitoring

- No specific observation was identified in the reporting period.

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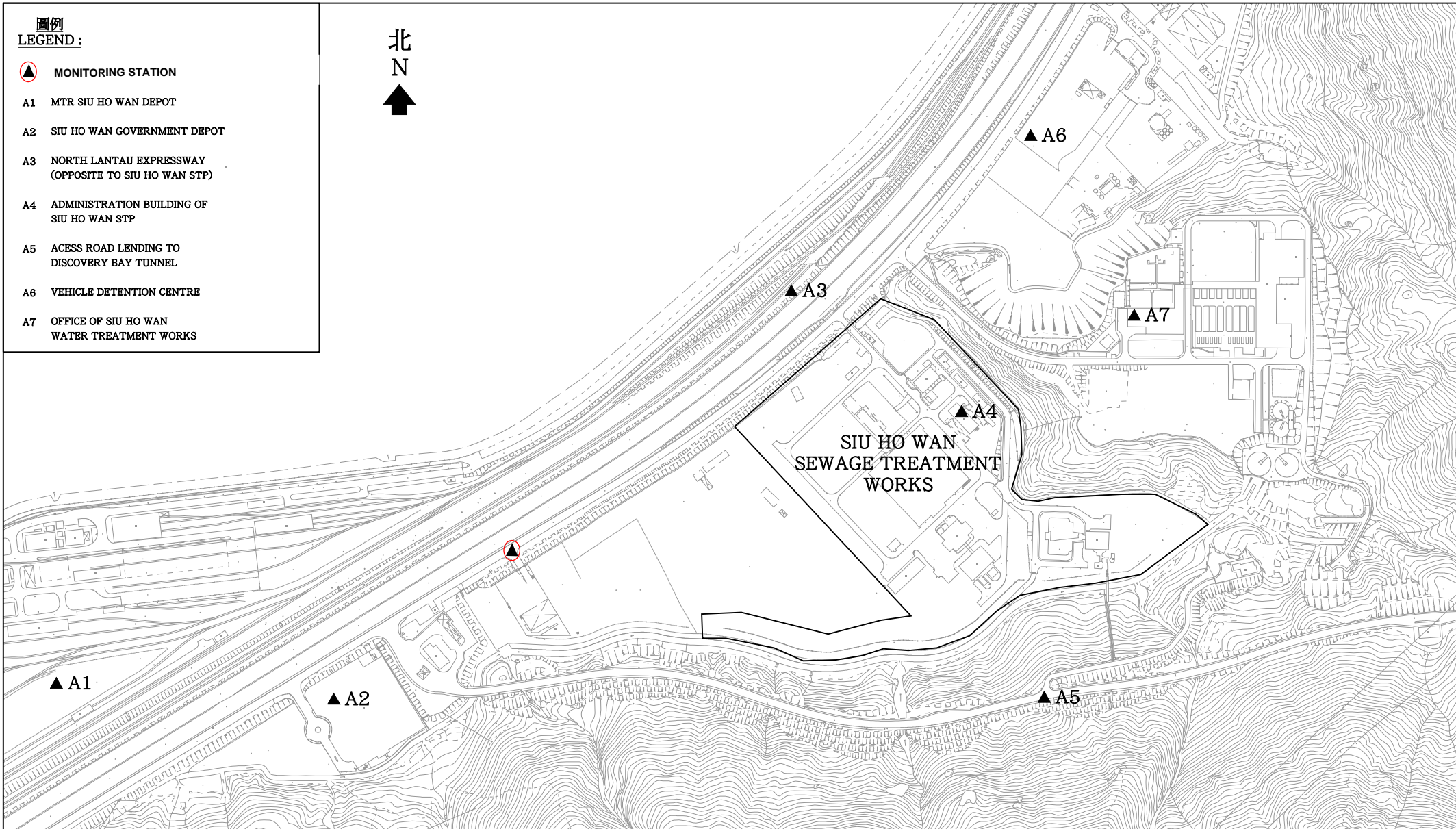
Report No.: 0041/17/ED/0481A


Figure 1

Monitoring Location of Air Sensitive Receiver

圖例
LEGEND :

-  **MONITORING STATION**
- A1** MTR SIU HO WAN DEPOT
- A2** SIU HO WAN GOVERNMENT DEPOT
- A3** NORTH LANTAU EXPRESSWAY
(OPPOSITE TO SIU HO WAN STP)
- A4** ADMINISTRATION BUILDING OF
SIU HO WAN STP
- A5** ACCESS ROAD LENDING TO
DISCOVERY BAY TUNNEL
- A6** VEHICLE DETENTION CENTRE
- A7** OFFICE OF SIU HO WAN
WATER TREATMENT WORKS



<p>圖則名稱 drawing title</p> <p>UPGRADING OF SIU HO WAN SEWAGE TREATMENT PLANT OPTIONAL ENVIRONMENTAL MONITORING AND AUDIT PLAN ODOUR PATROL MONITORING STATIONS</p>	繪畫 drawn	C.W. CHAN	日期 date 16-08-2006	圖則編號 drawing no. DCM/2006/063	比例 scale N.T.S.
	核對 checked	C.K. LAM	日期 date 16-08-2006	保留版權 COPYRIGHT RESERVED	
	批核 approved	S.K. WONG	日期 date 16-08-2006		
	部門 office	顧問工程管理部 CONSULTANTS MANAGEMENT DIVISION		 <p>香港特別行政區政府渠務署 DRAINAGE SERVICES DEPARTMENT GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION</p>	

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Figure 2

Monitoring Location of Water Quality Monitoring, Sediment Quality Monitoring and Benthic Survey



816000E

818000E

820000E

822000E

CO-ORDINATES OF CONTROL STATIONS :

CONTROL STATION No.	CO-ORDINATES	
	NORTHING	EASTING
A	822500	816100
B	822440	816680
E	821655	819817
F	821922	820158
G	822692	822214
H	822939	822494

CO-ORDINATES OF IMPACT STATIONS :

IMPACT STATION No.	CO-ORDINATES	
	NORTHING	EASTING
C	820180	816800
D	820360	817160

822000N

820000N

大小灣刀
BROTHERS

圖則名稱 drawing title

UPGRADING OF SIU HO WAN SEWAGE TREATMENT PLANT
BASELINE MONITORING - LOCATION OF MONITORING STATIONS

繪畫 drawn

H.K. LAI

日期 date

06-02-2004

核對 checked

C.K. LAM

日期 date

04-03-2004

批核 approved

S.K. WONG

日期 date

04-03-2004

部門 office

顧問工程管理部

CONSULTANTS MANAGEMENT DIVISION

圖例
LEGEND :

IMPACT STATION



CONTROL STATION



SUBMARINE OUTFALL

圖則編號 drawing no.

DCM/2004/002

比例 scale

N.T.S.

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Figure 3 Location of the Tide Gauge

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Figure 2 - Location of the Tide Gauge

Source: Google Maps

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Appendix A Project Organization Chart

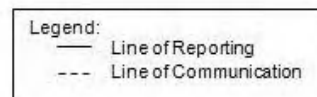
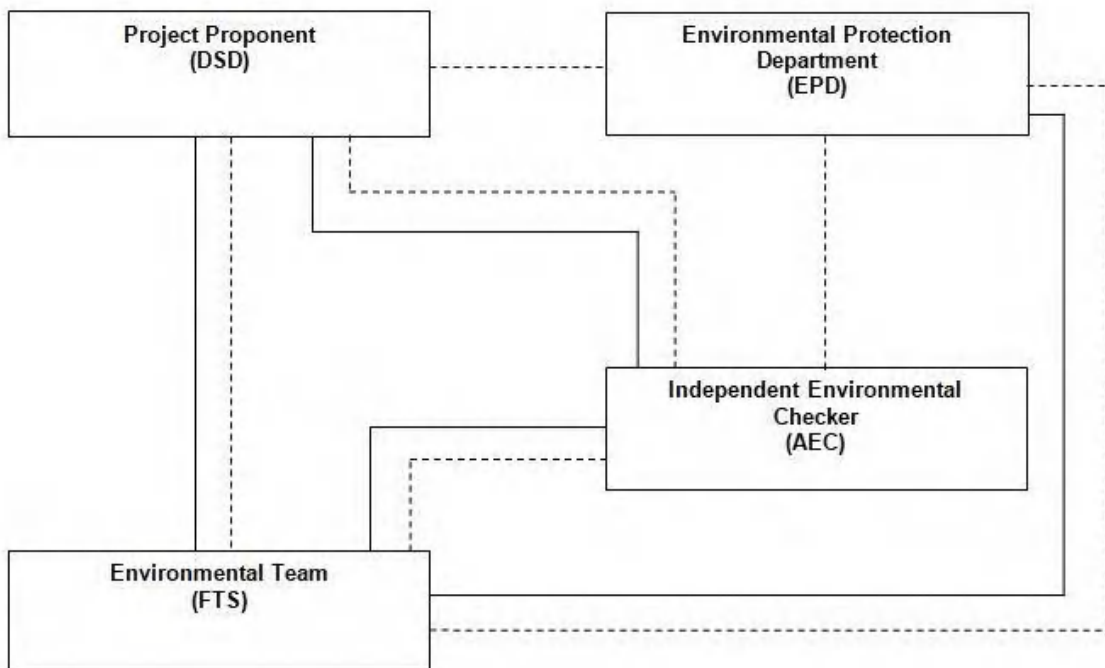
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Appendix B

Action and Limit Levels for Air Quality Monitoring

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Action and Limit Levels for Air Quality Monitoring

Parameter	Action	Limit
Odour	One complaint received for specific odour event	Two or more independent complaints receive for specific odour event

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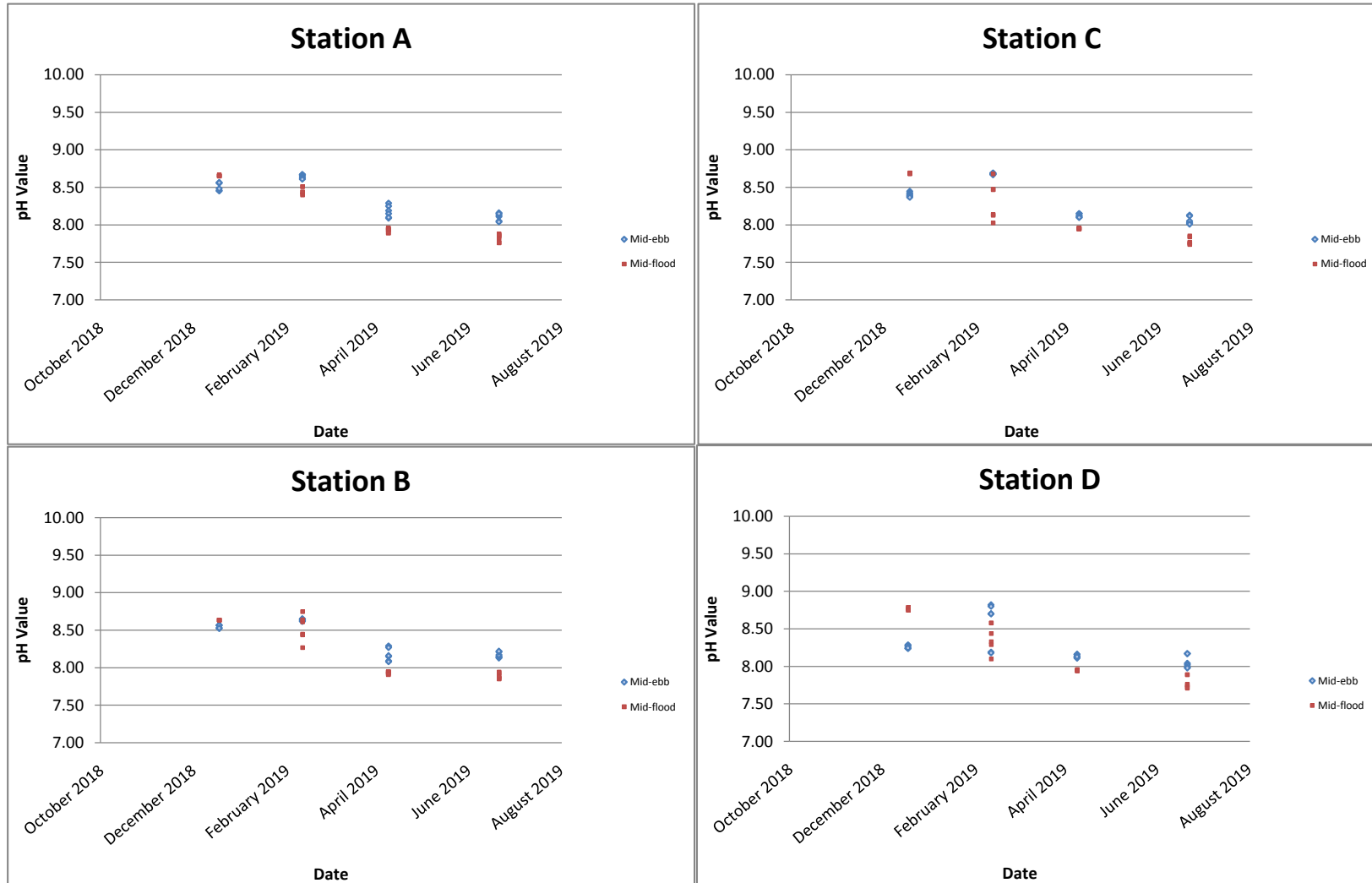


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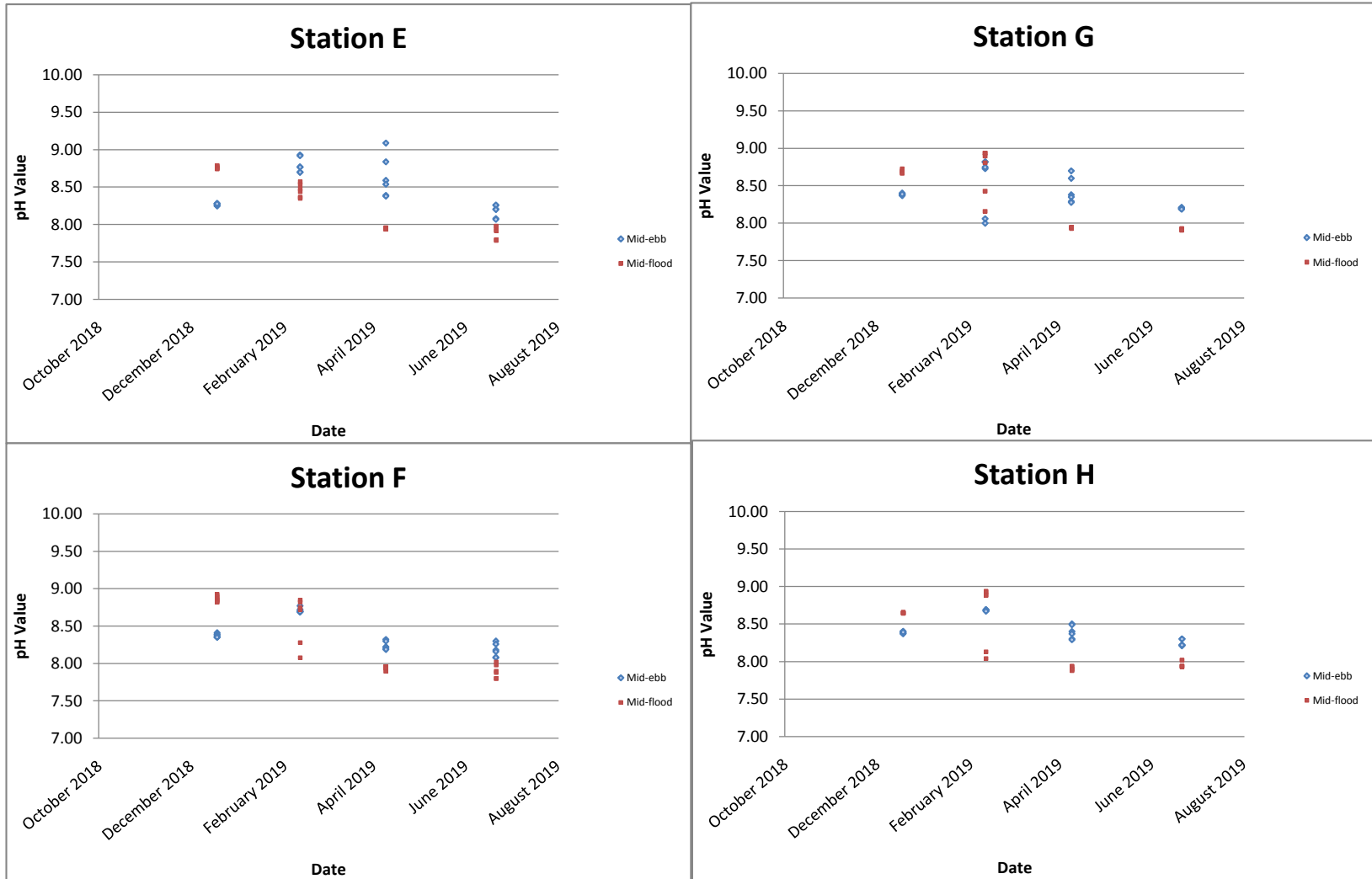
Appendix C

Graphical Presentation of Water Quality Monitoring

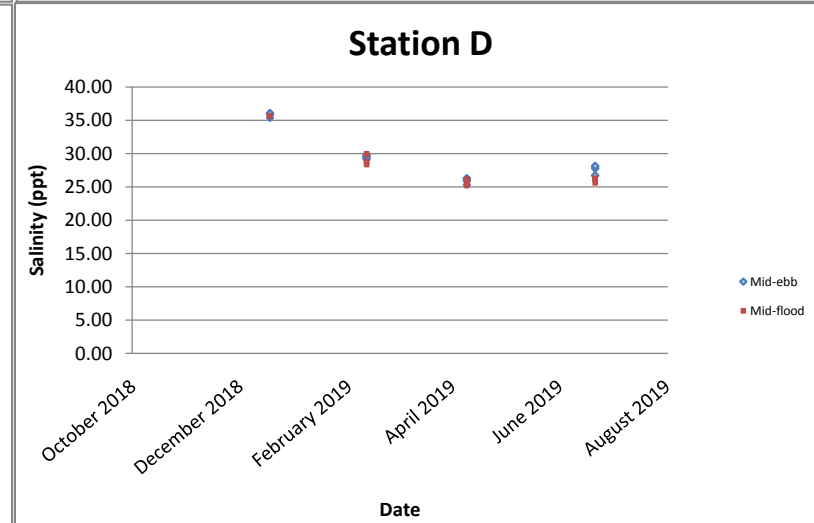
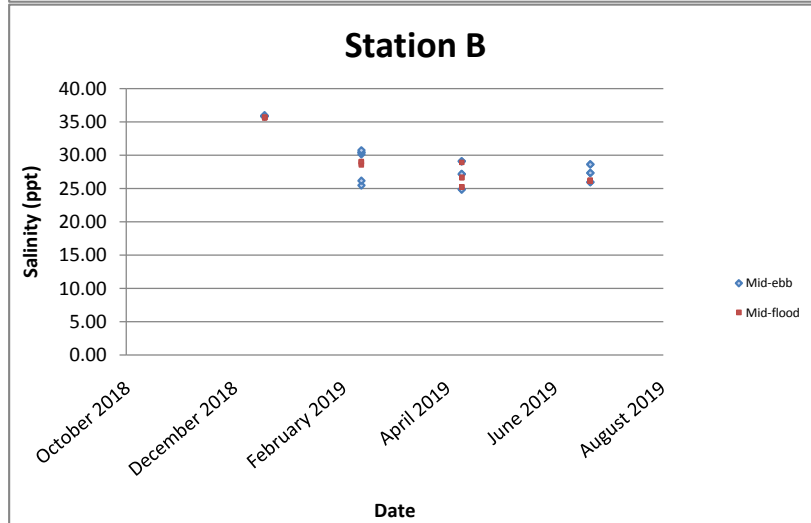
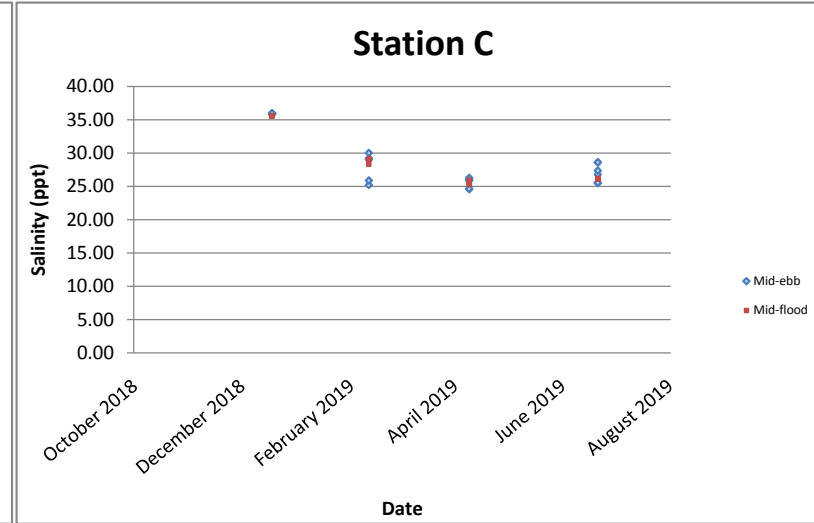
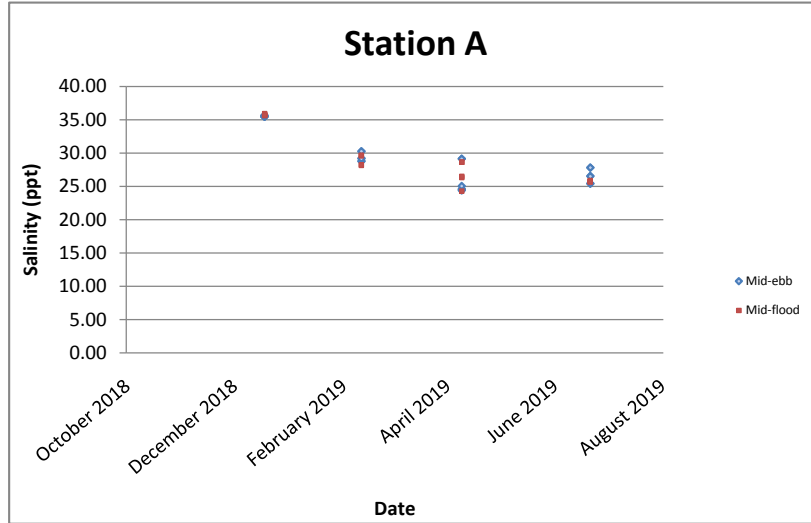
pH value



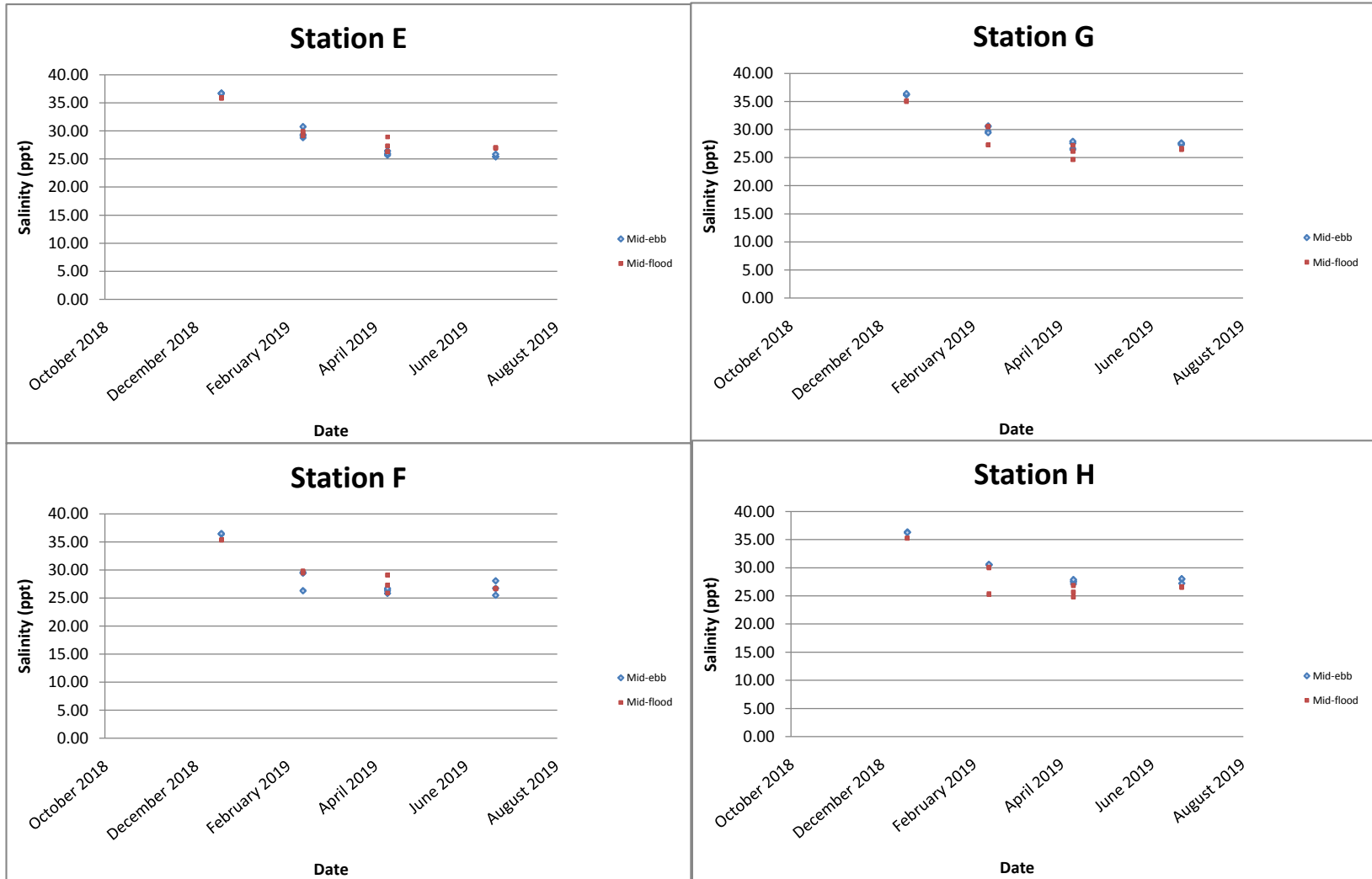
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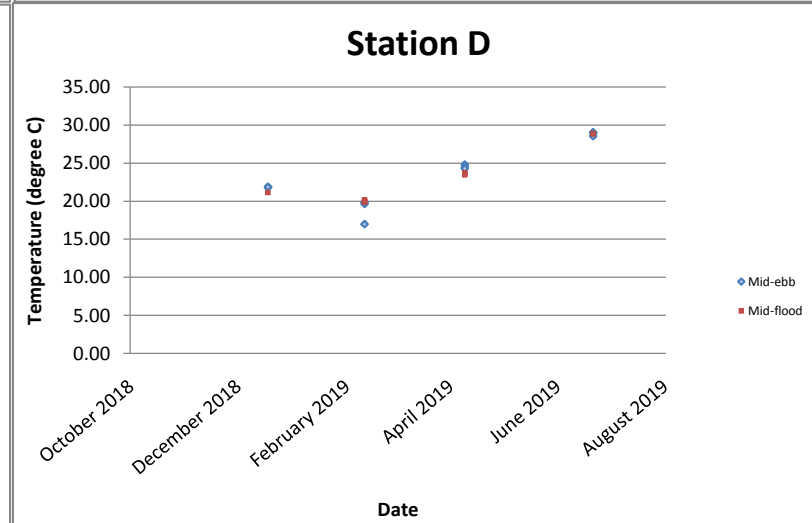
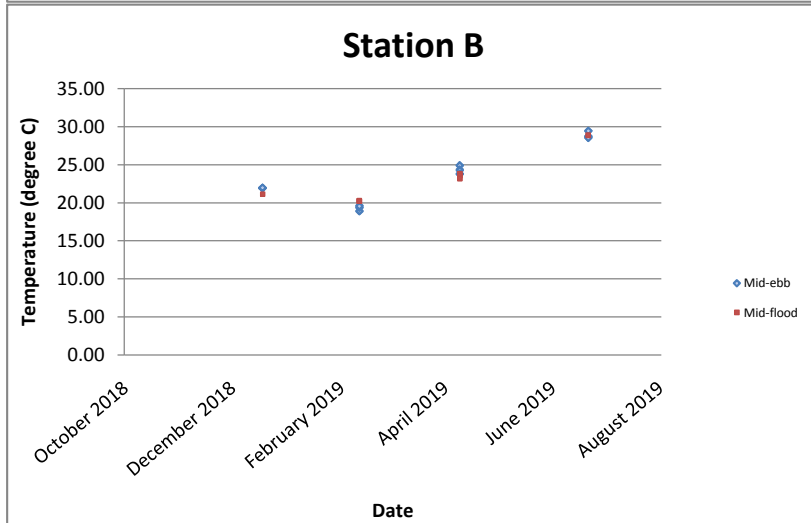
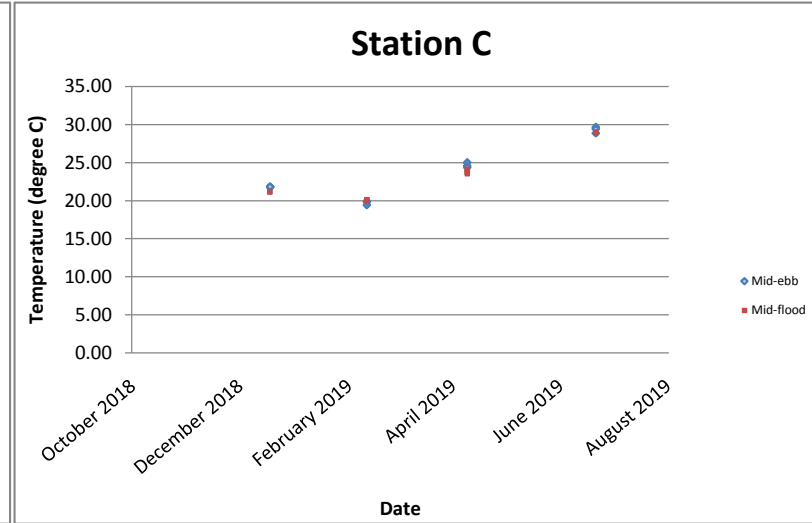
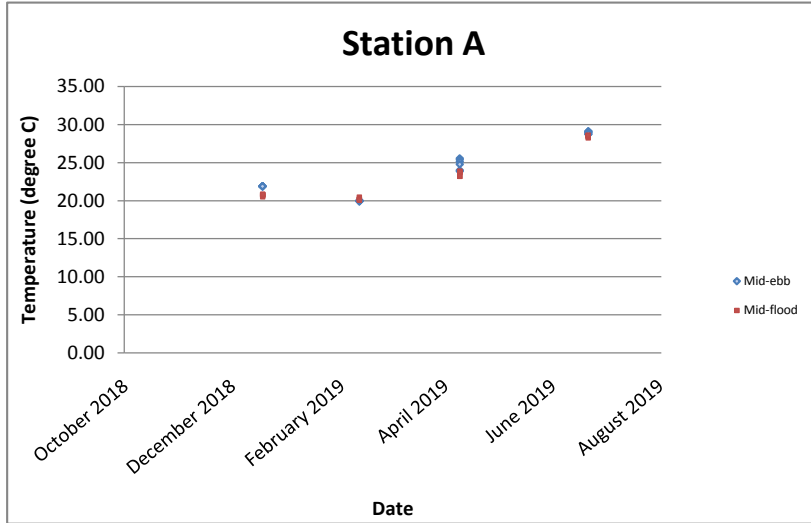
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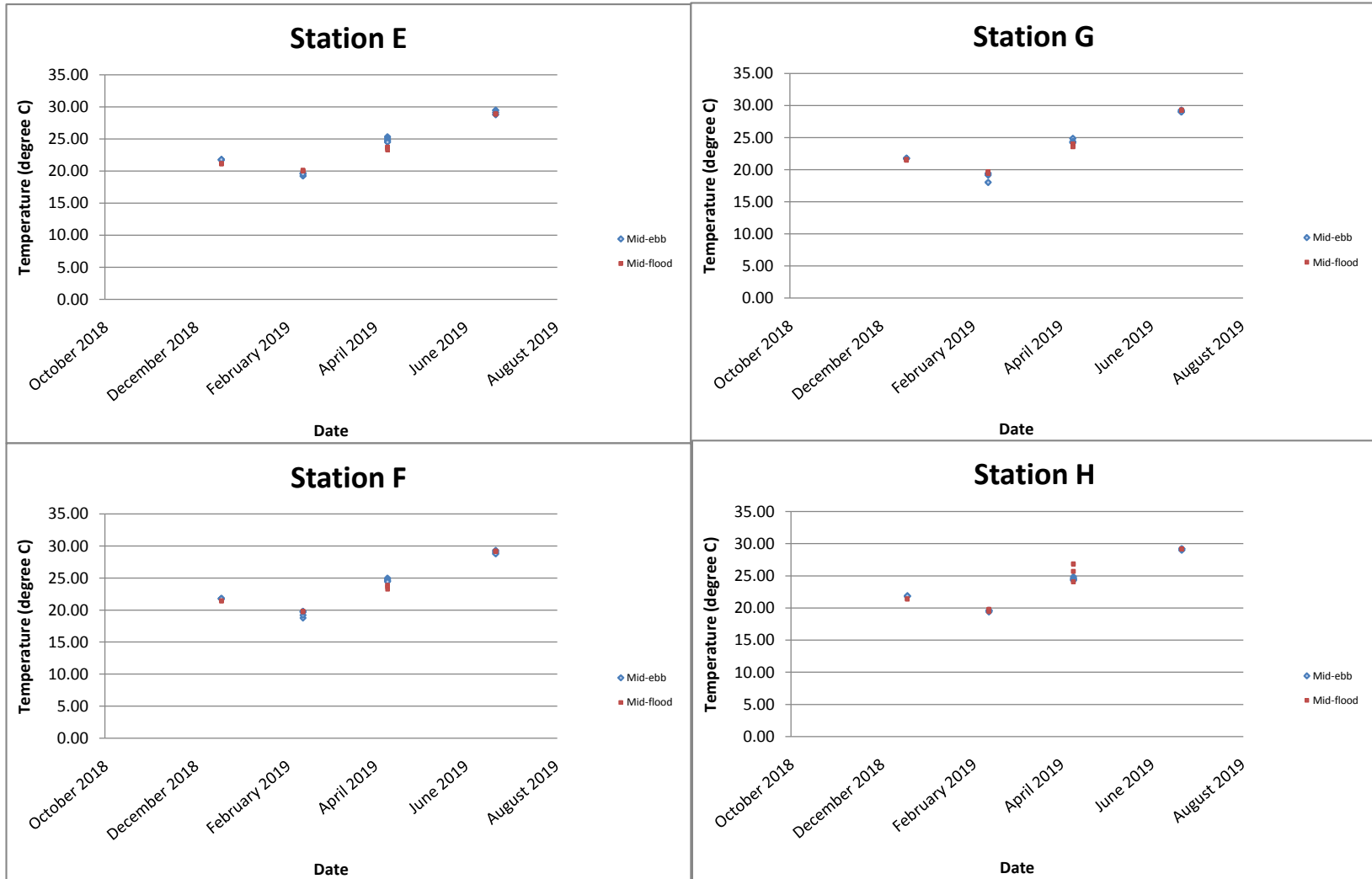
Salinity (ppt)



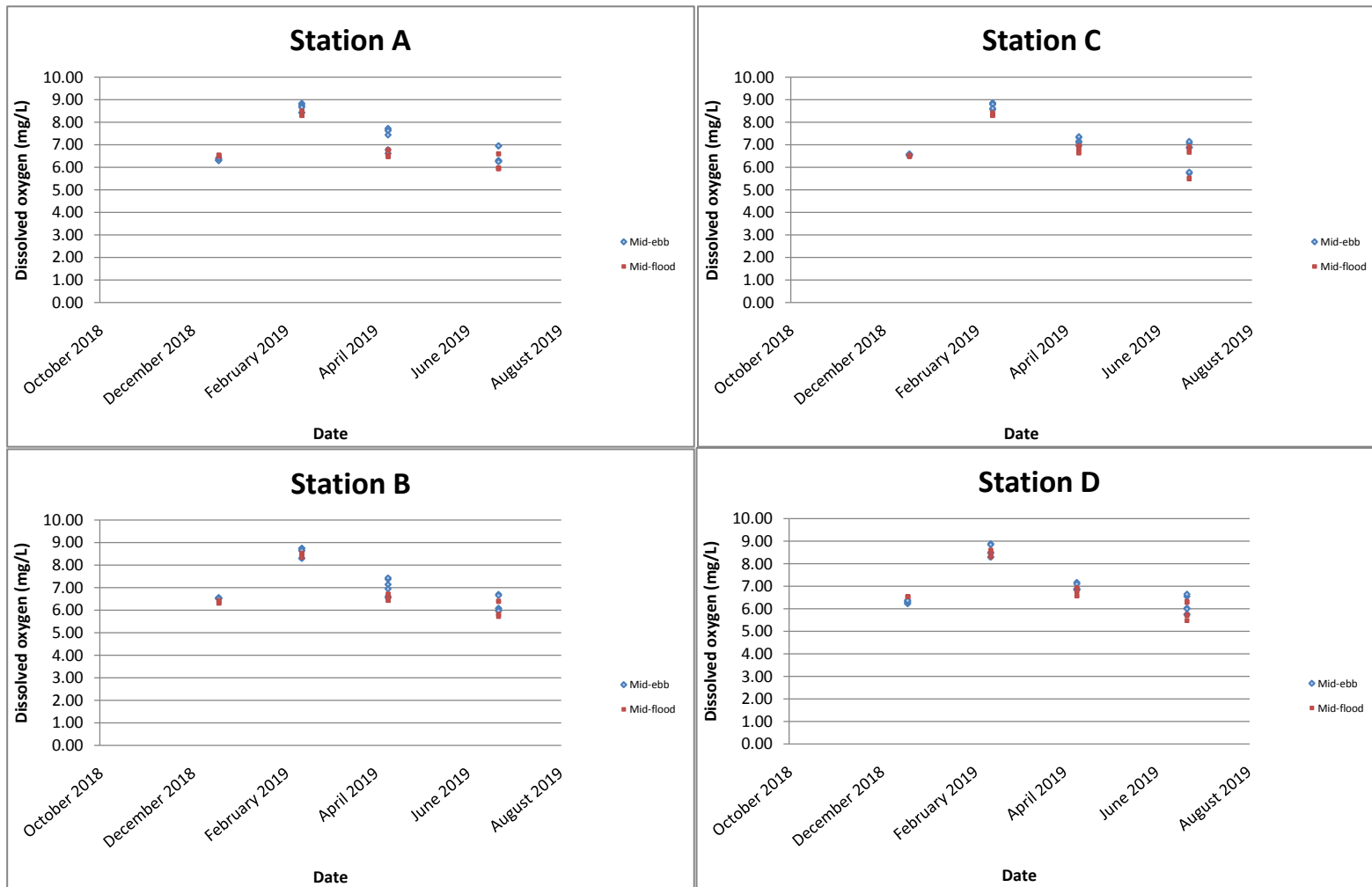
Temperature (degree C)



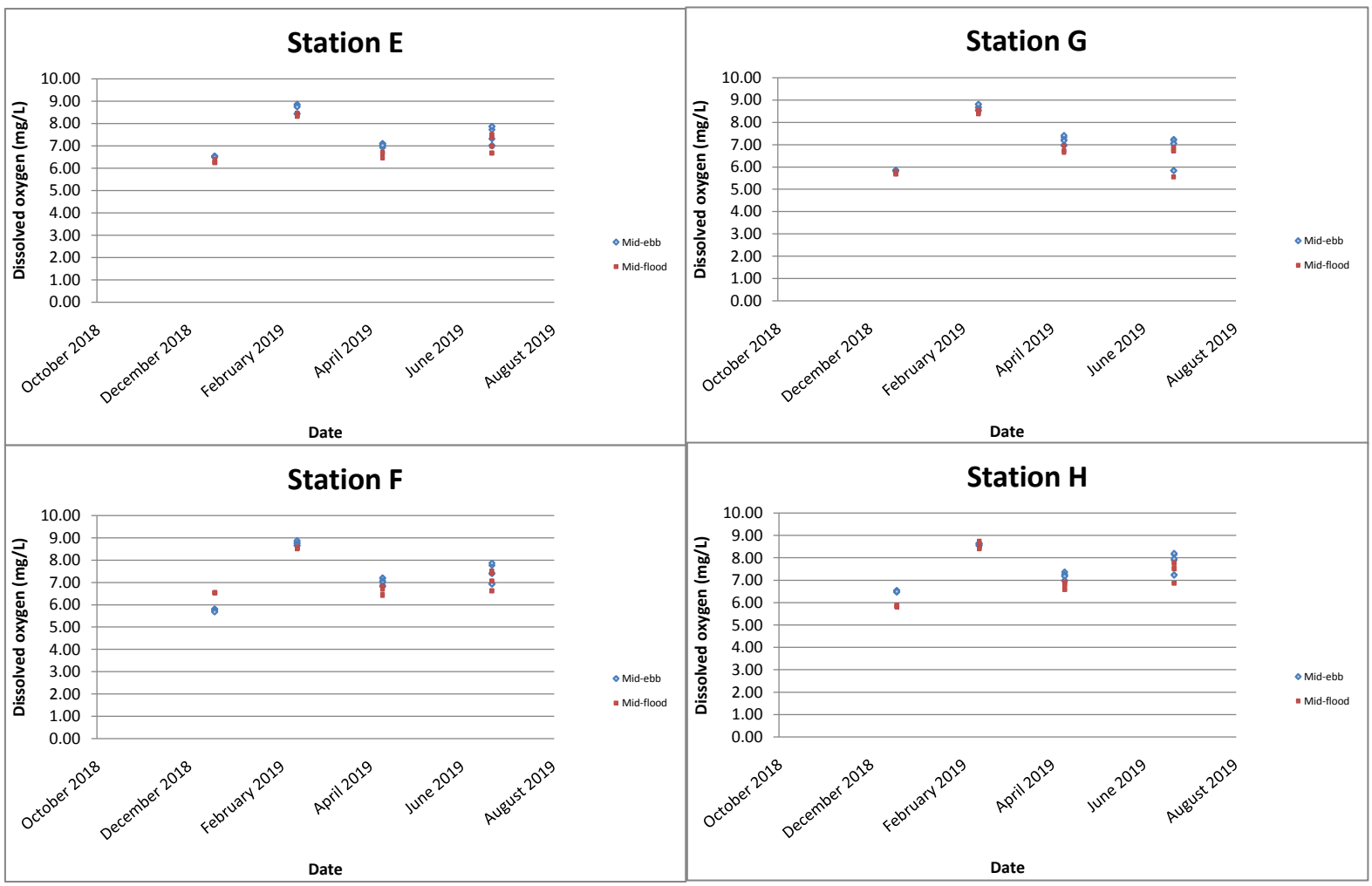
Temperature (degree C)



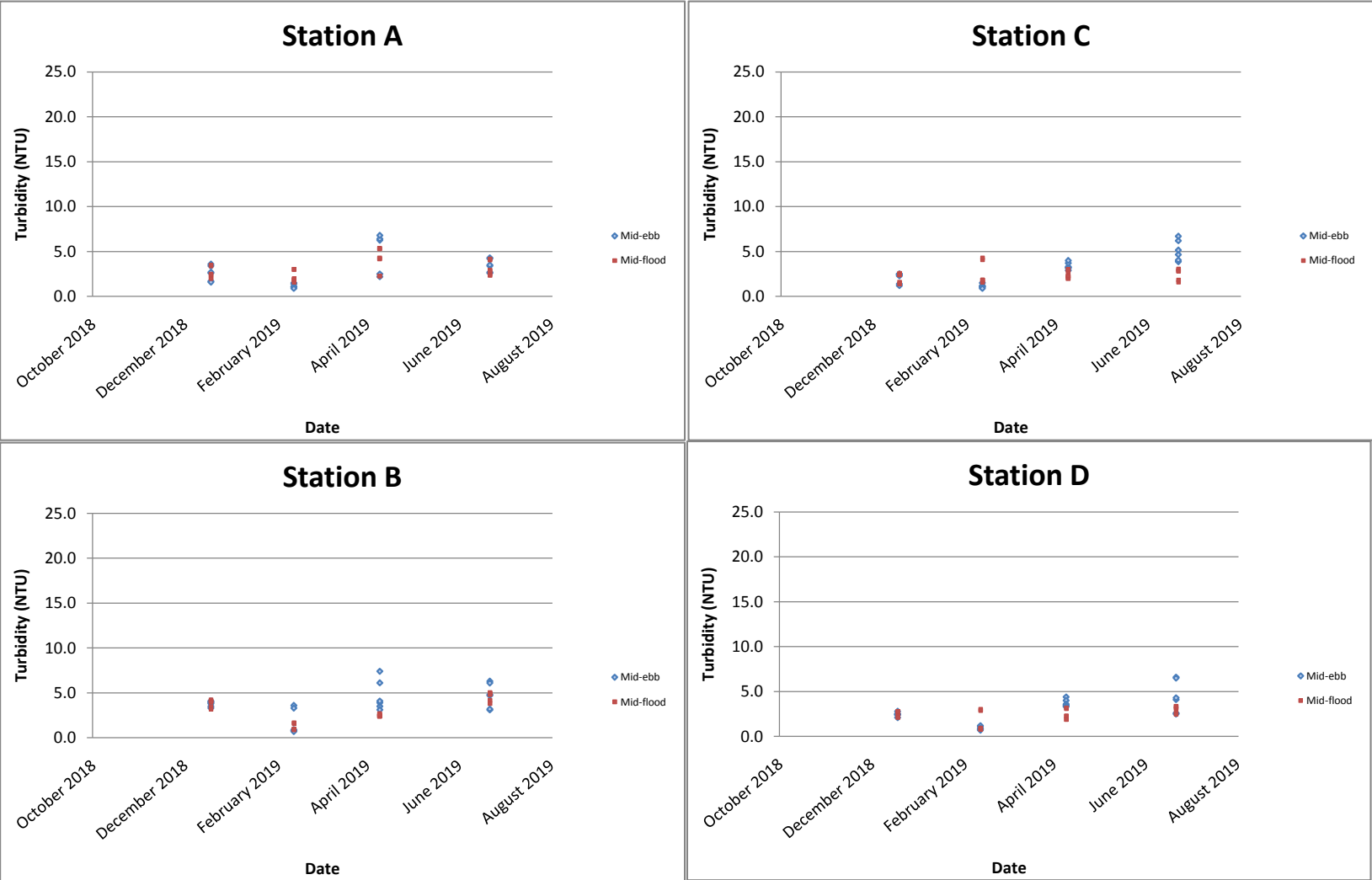
Dissolved oxygen (mg/L)



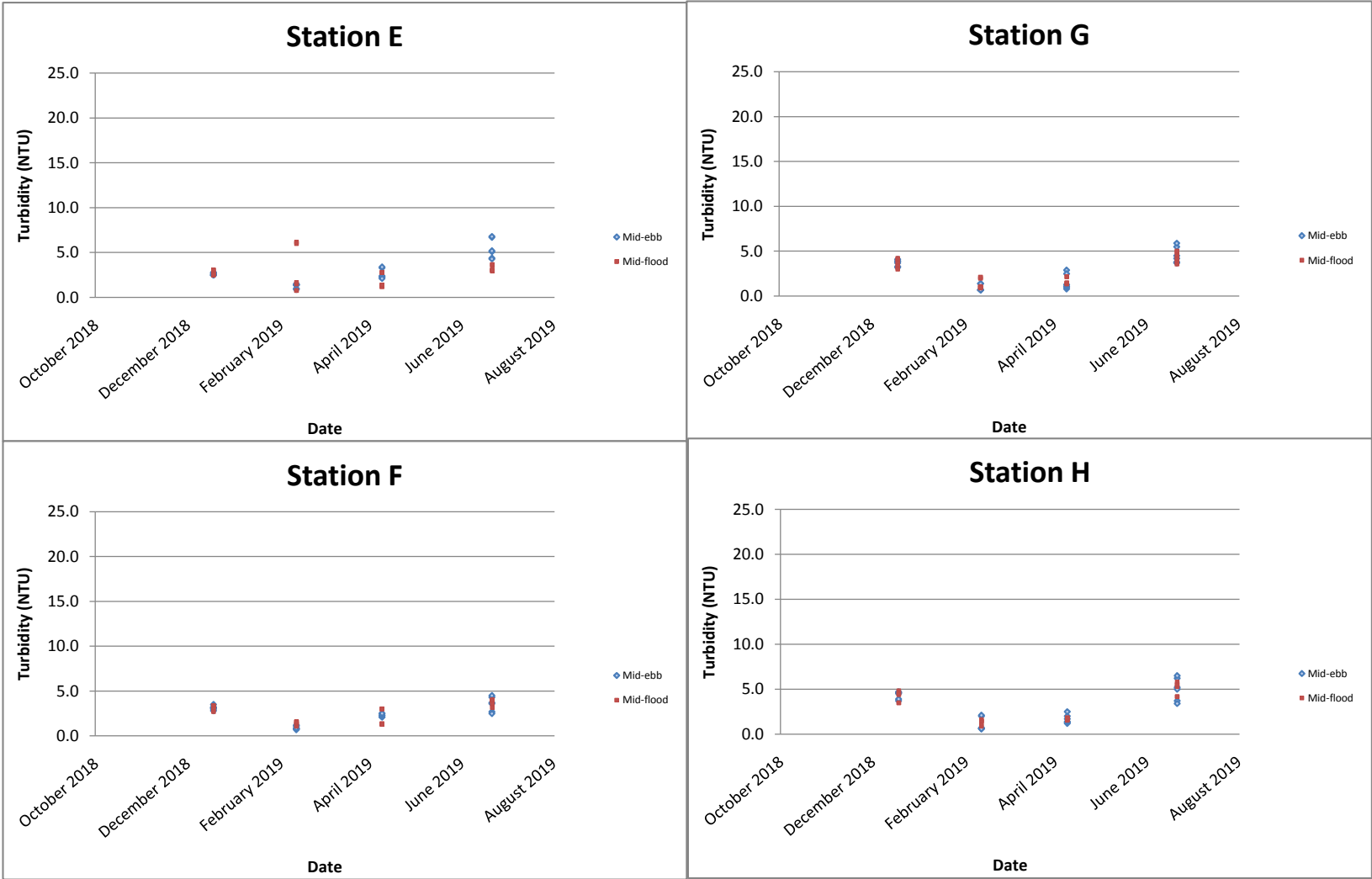
Dissolved oxygen (mg/L)



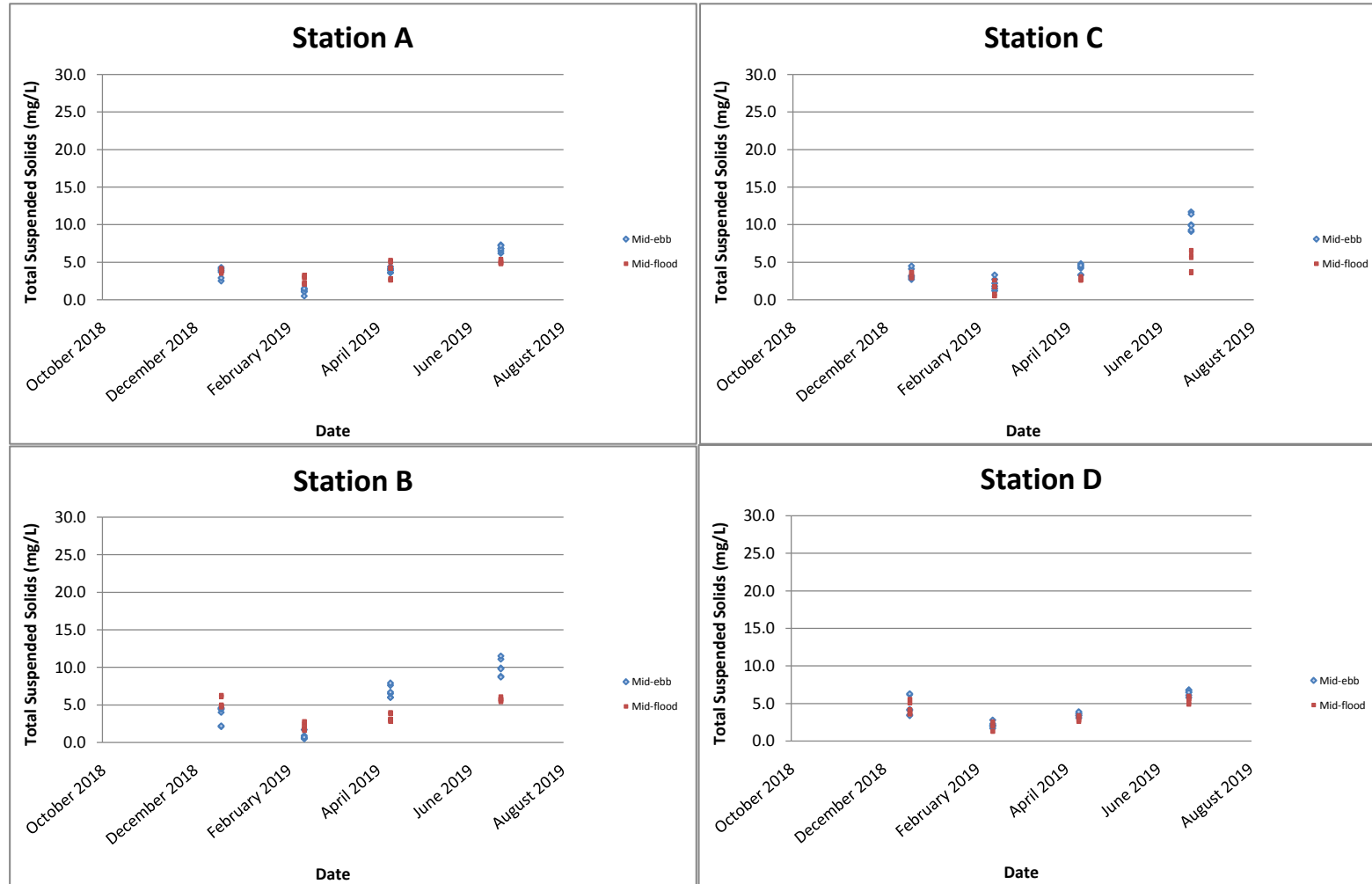
Turbidity (NTU)



Turbidity (NTU)

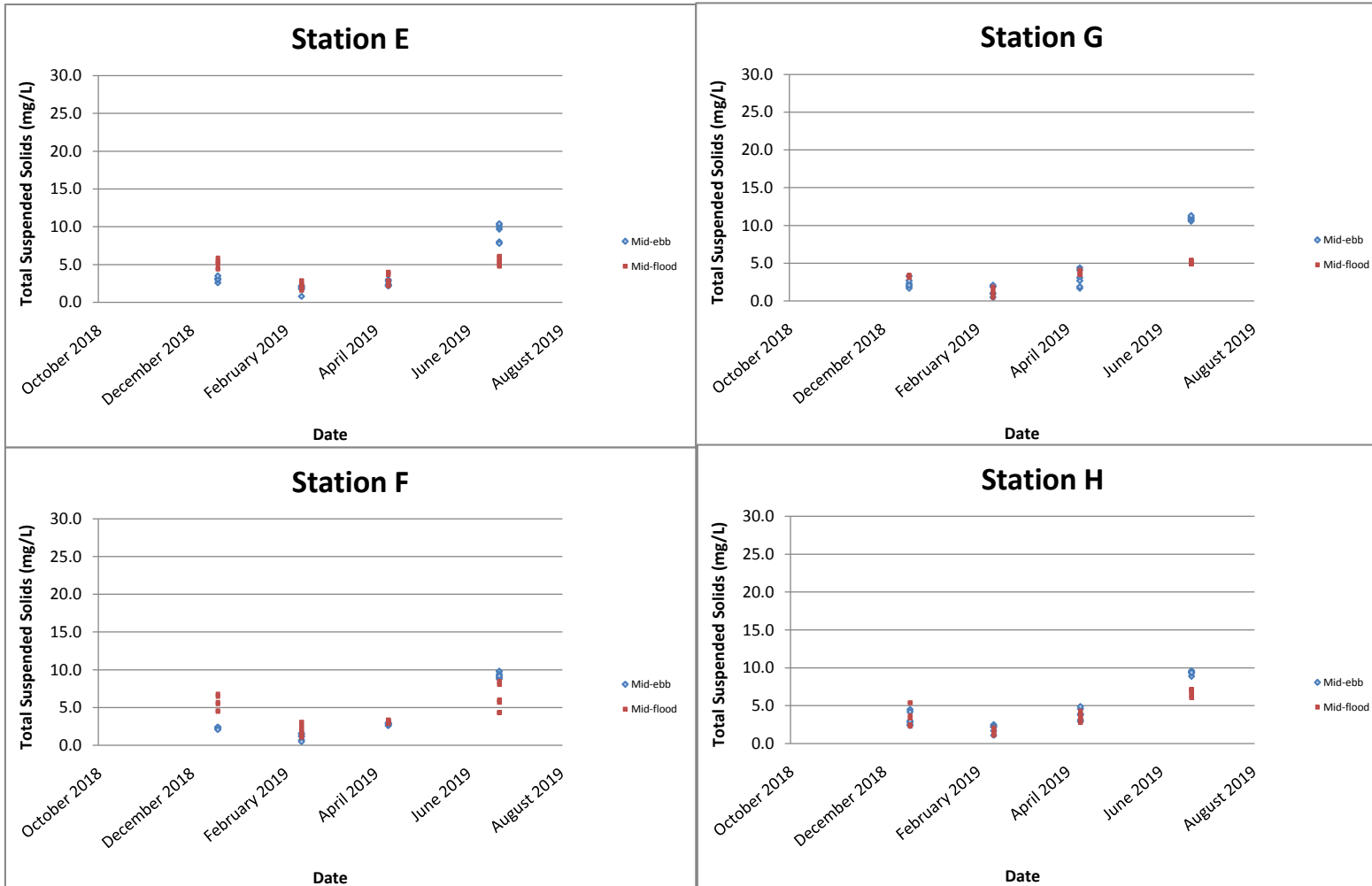


Total Suspended Solids (mg/L)



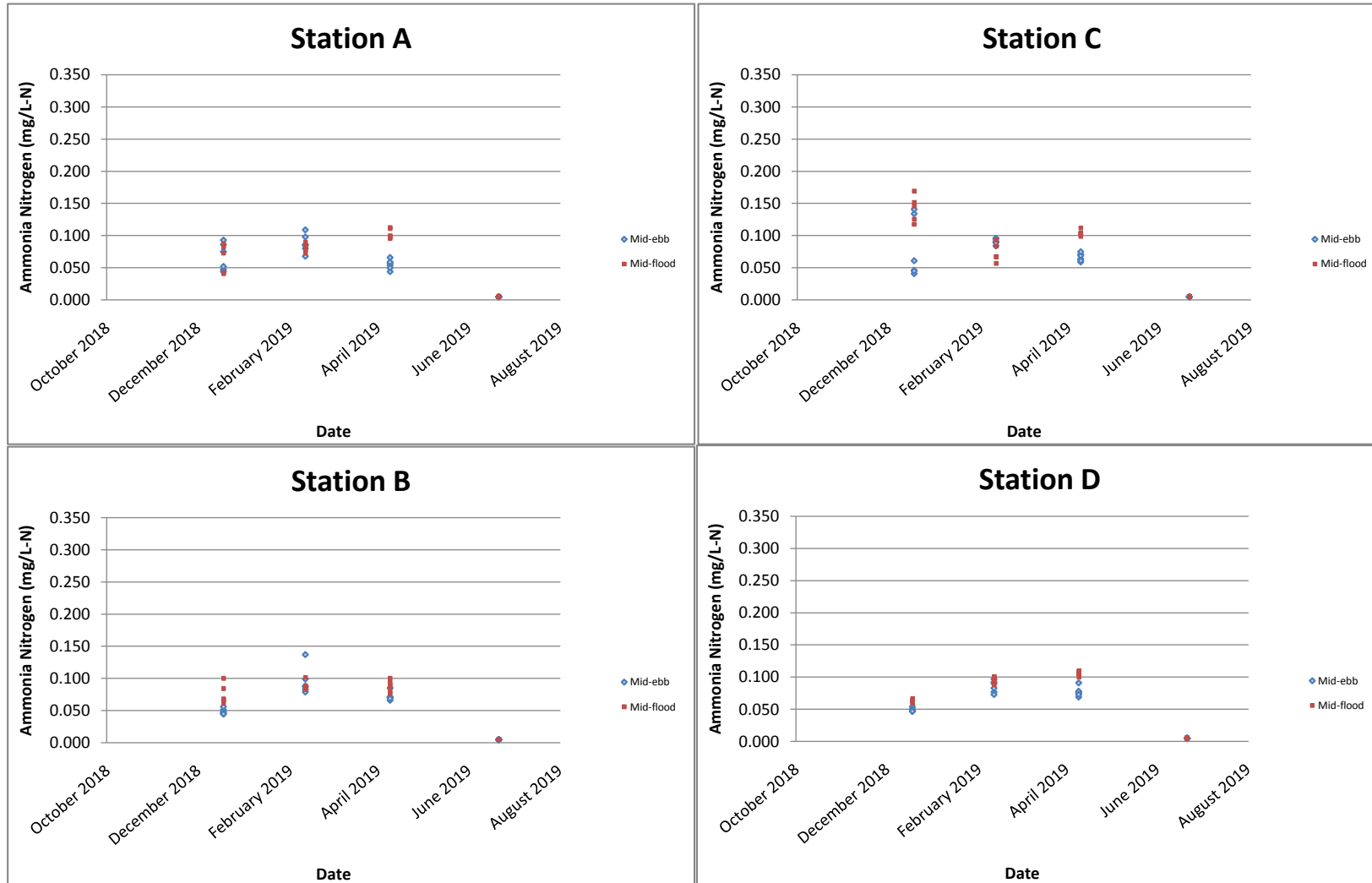
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Total Suspended Solids (mg/L)



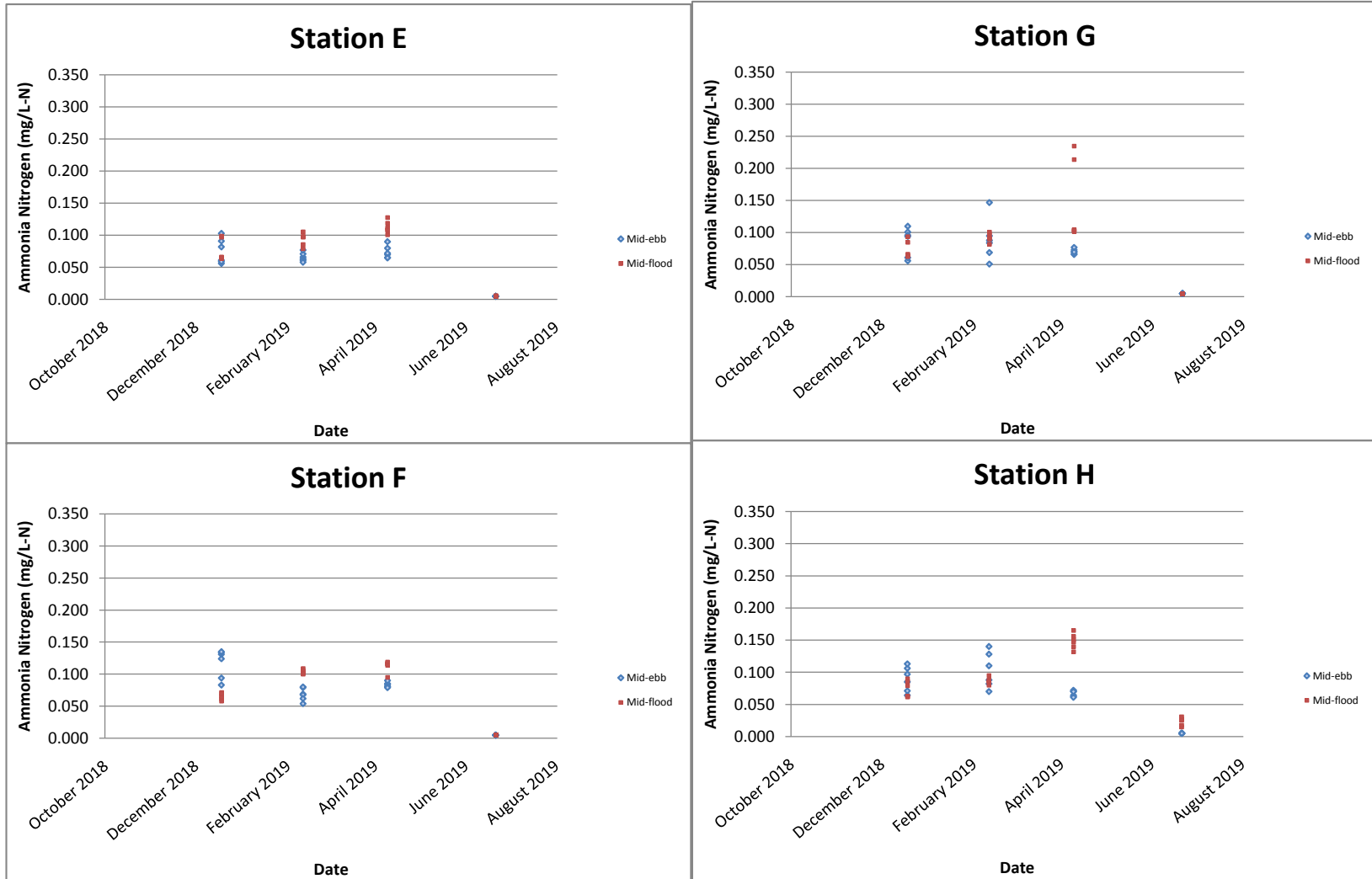
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Ammonia Nitrogen (mg/L-N)



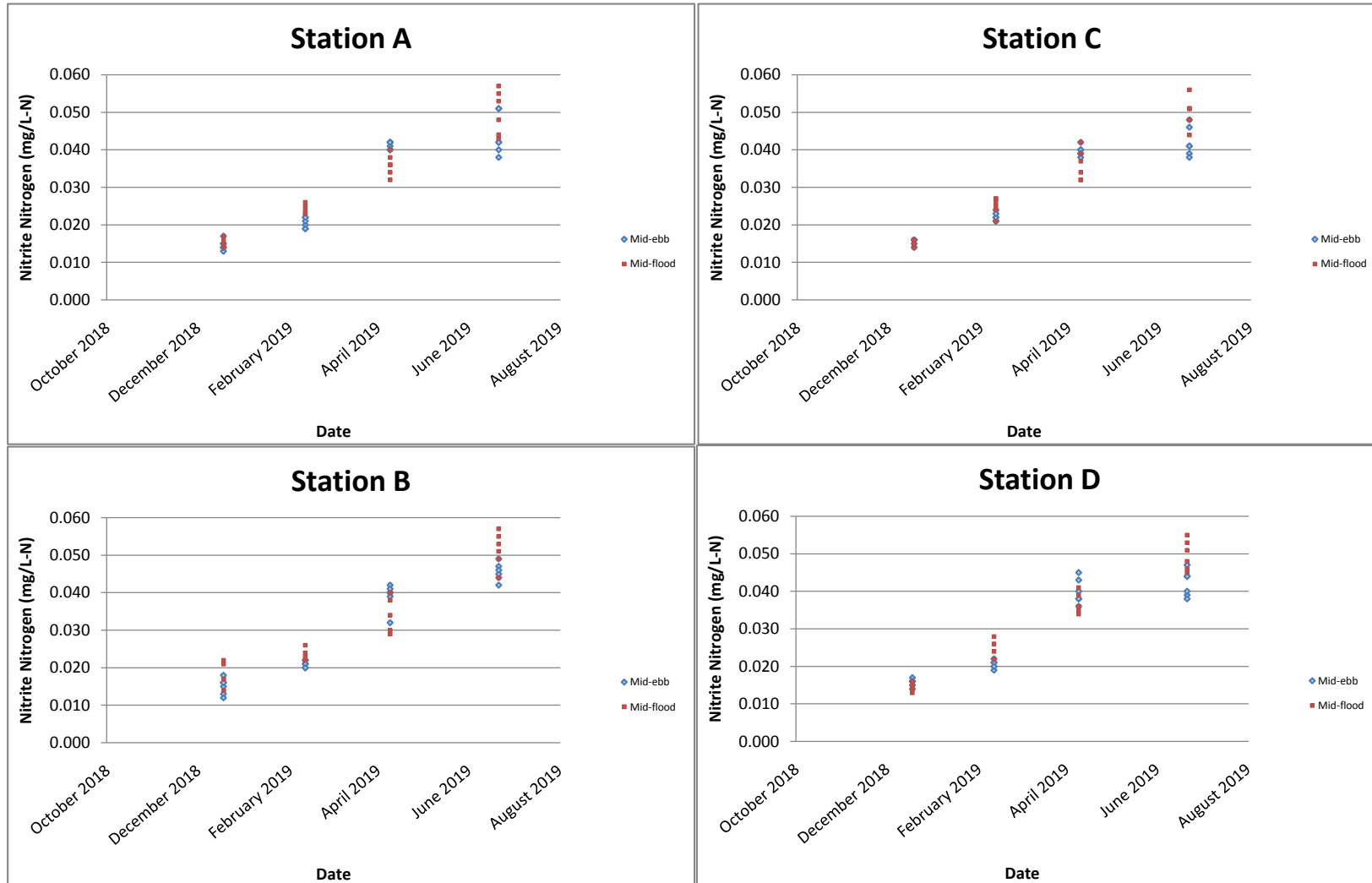
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Ammonia Nitrogen (mg/L-N)



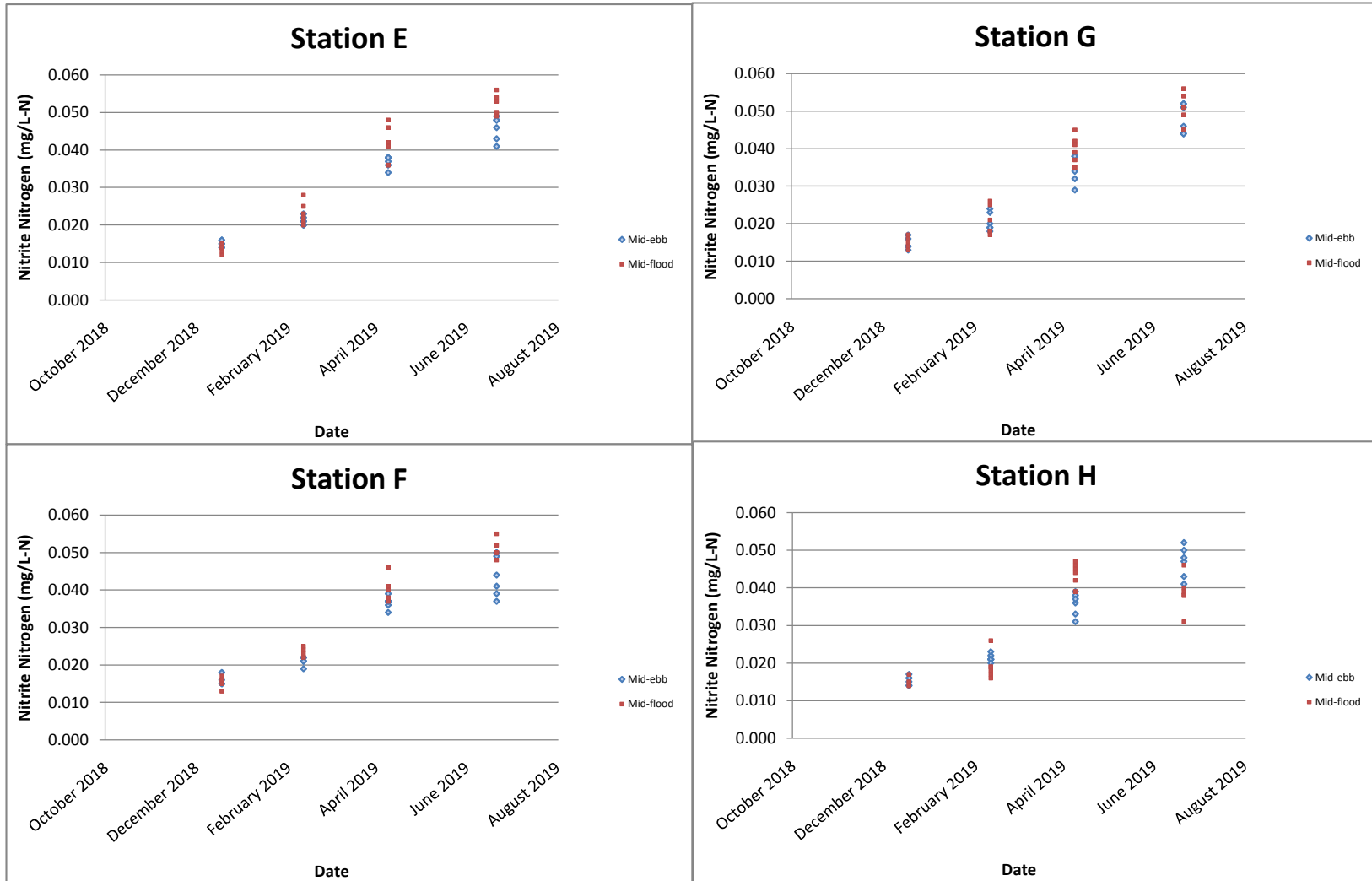
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Nitrite Nitrogen (mg/L-N)



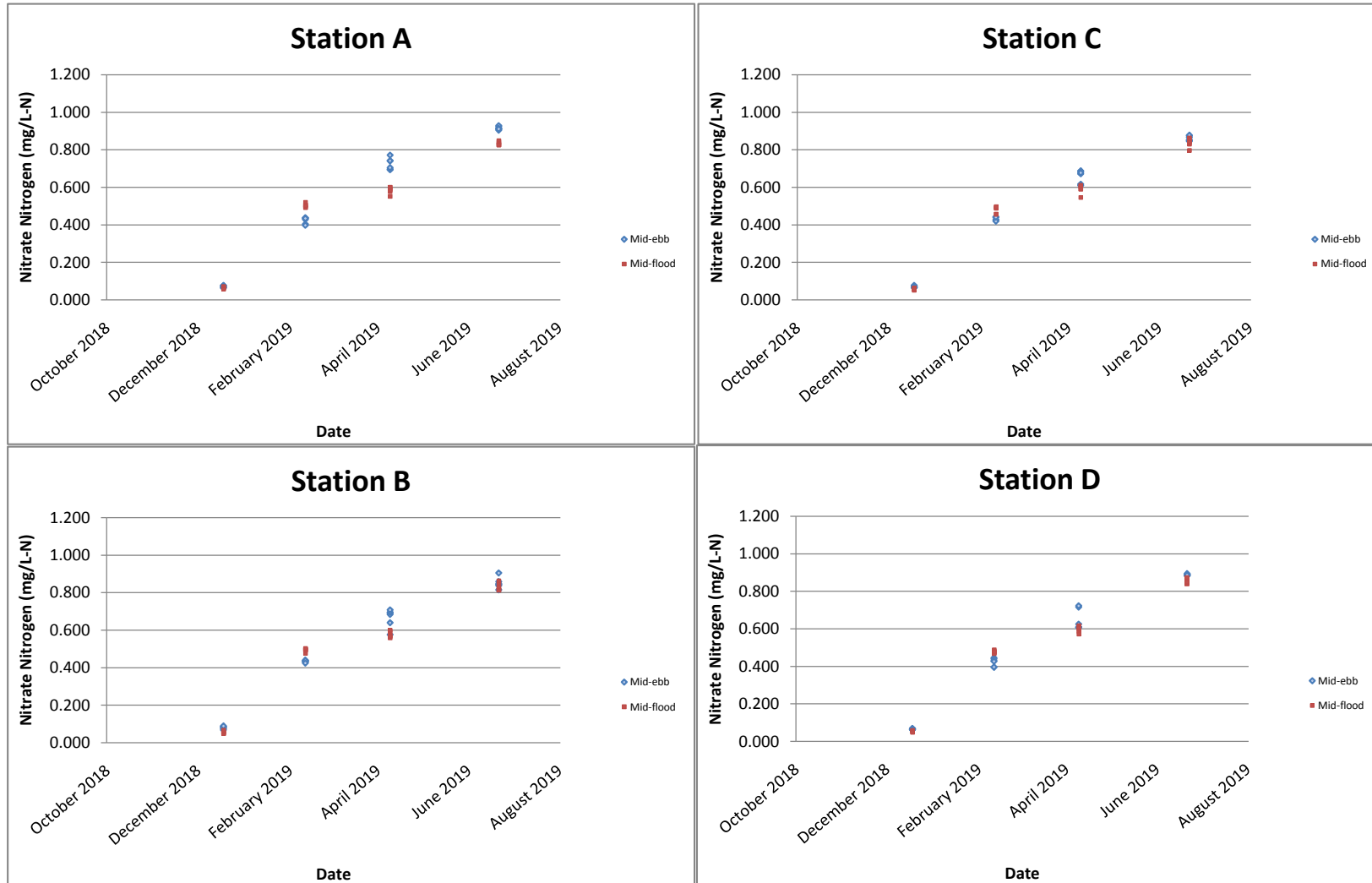
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Nitrite Nitrogen (mg/L-N)



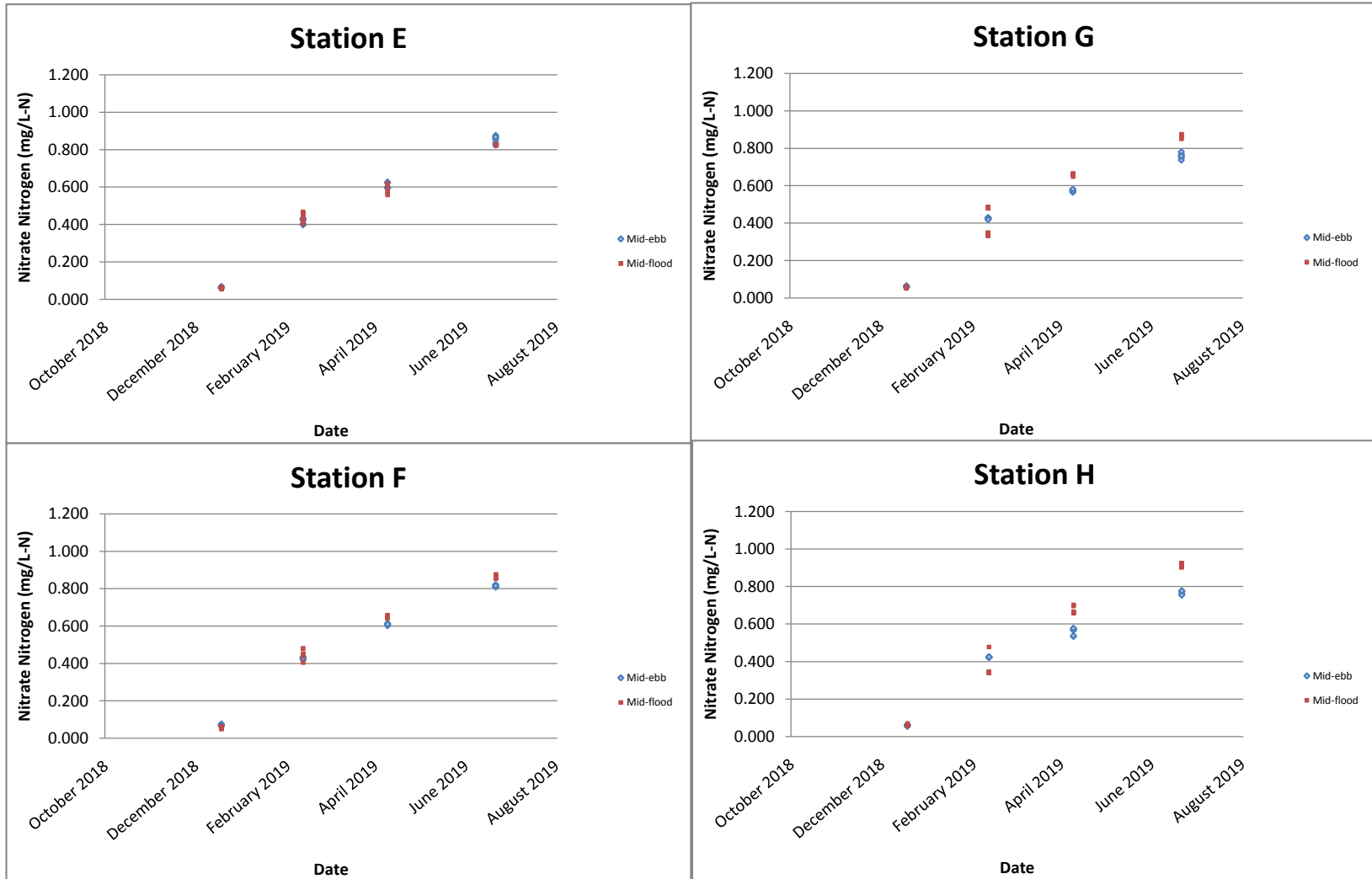
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Nitrate Nitrogen (mg/L-N)



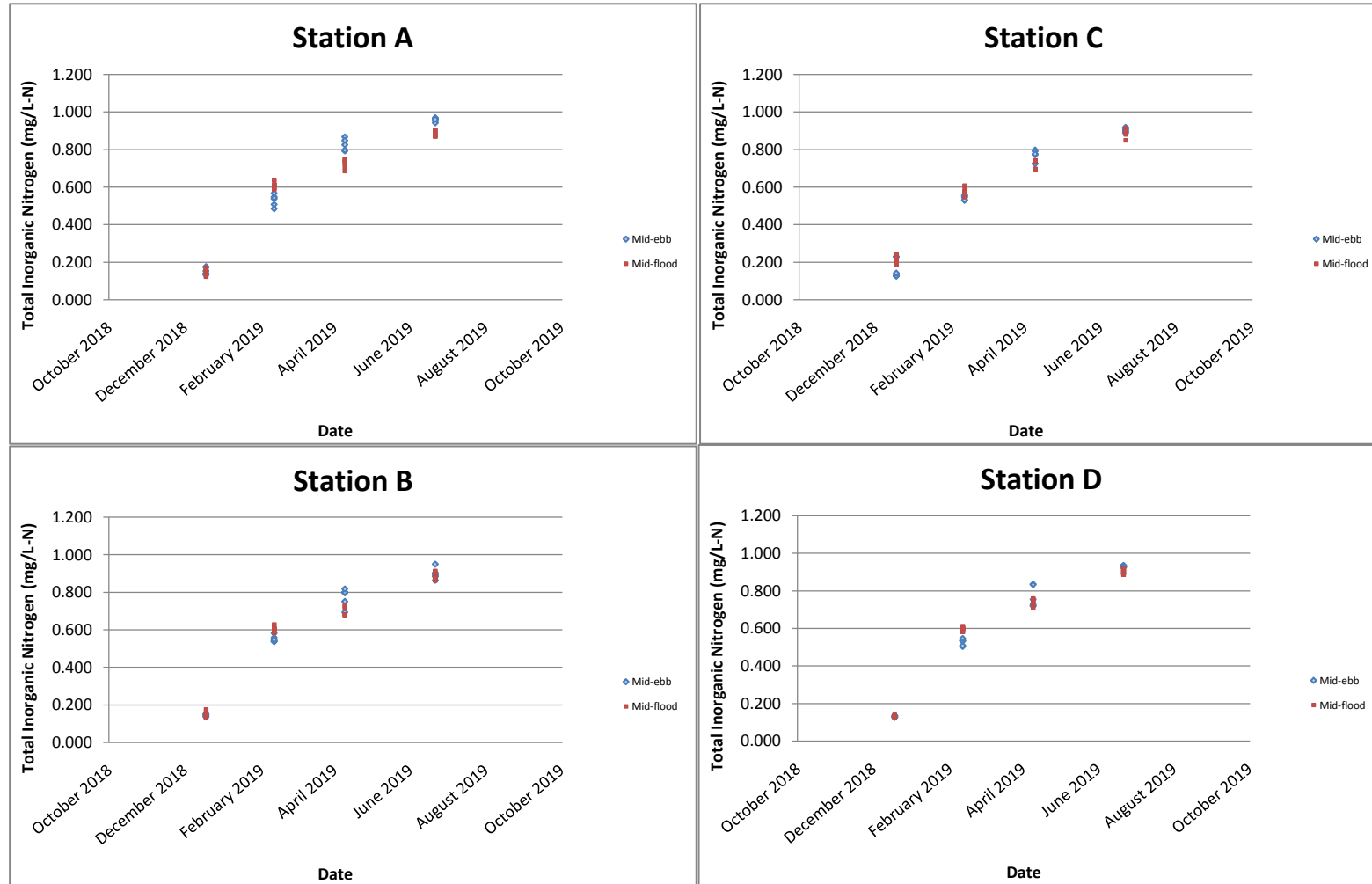
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Nitrate Nitrogen (mg/L-N)



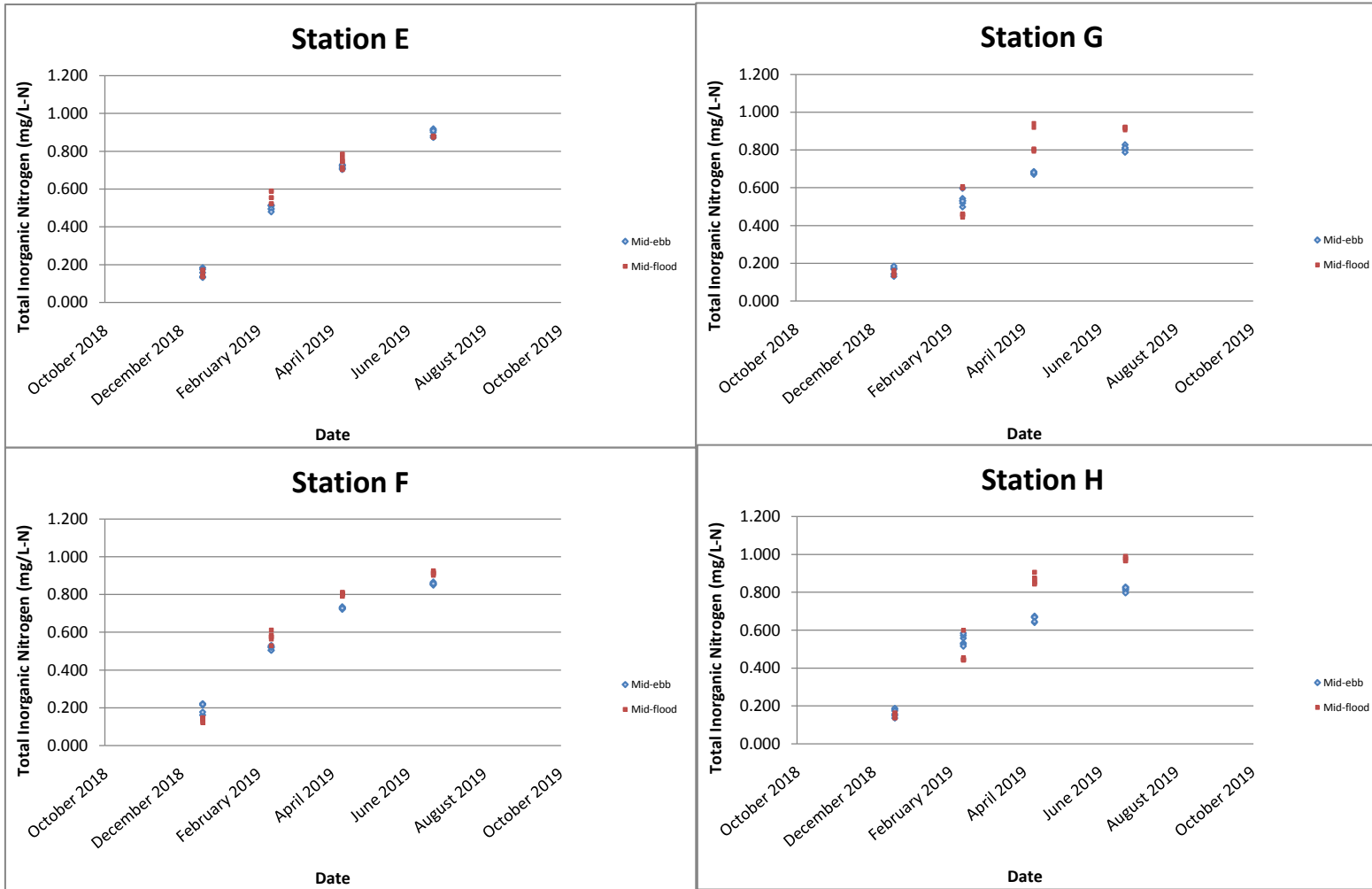
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Total Inorganic Nitrogen (mg/L-N)



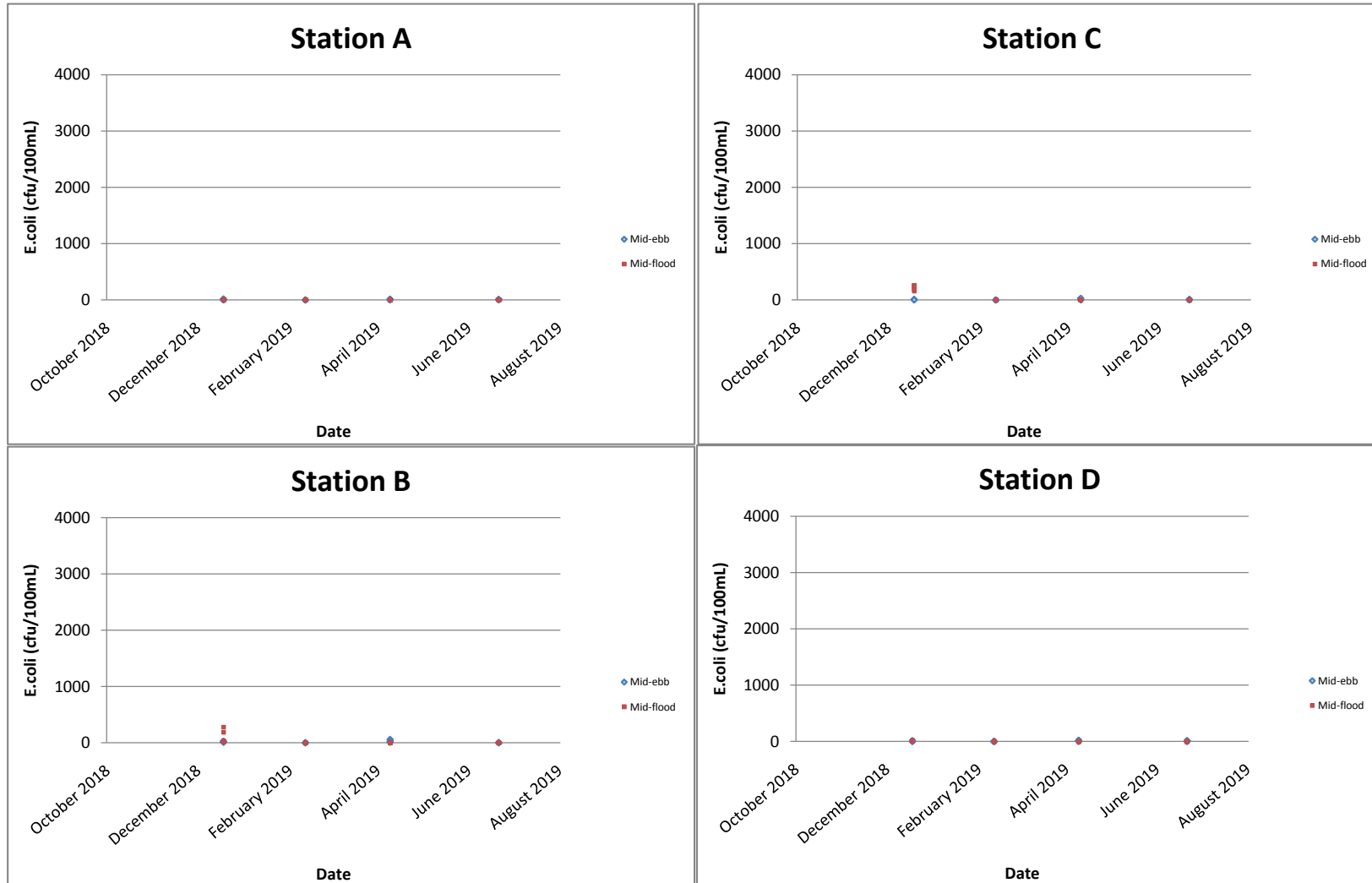
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Total Inorganic Nitrogen (mg/L-N)



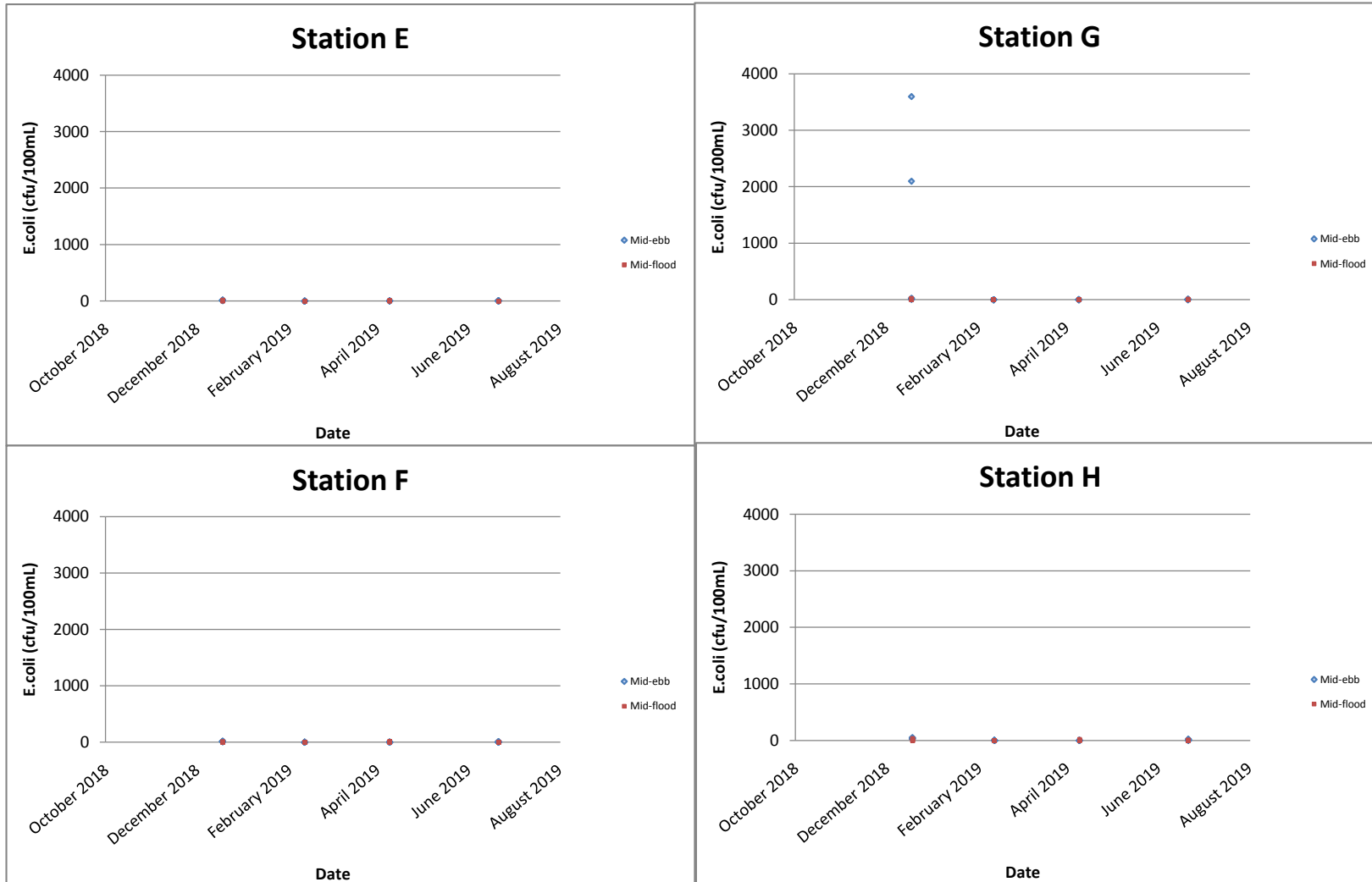
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E.coli (cfu/100mL)



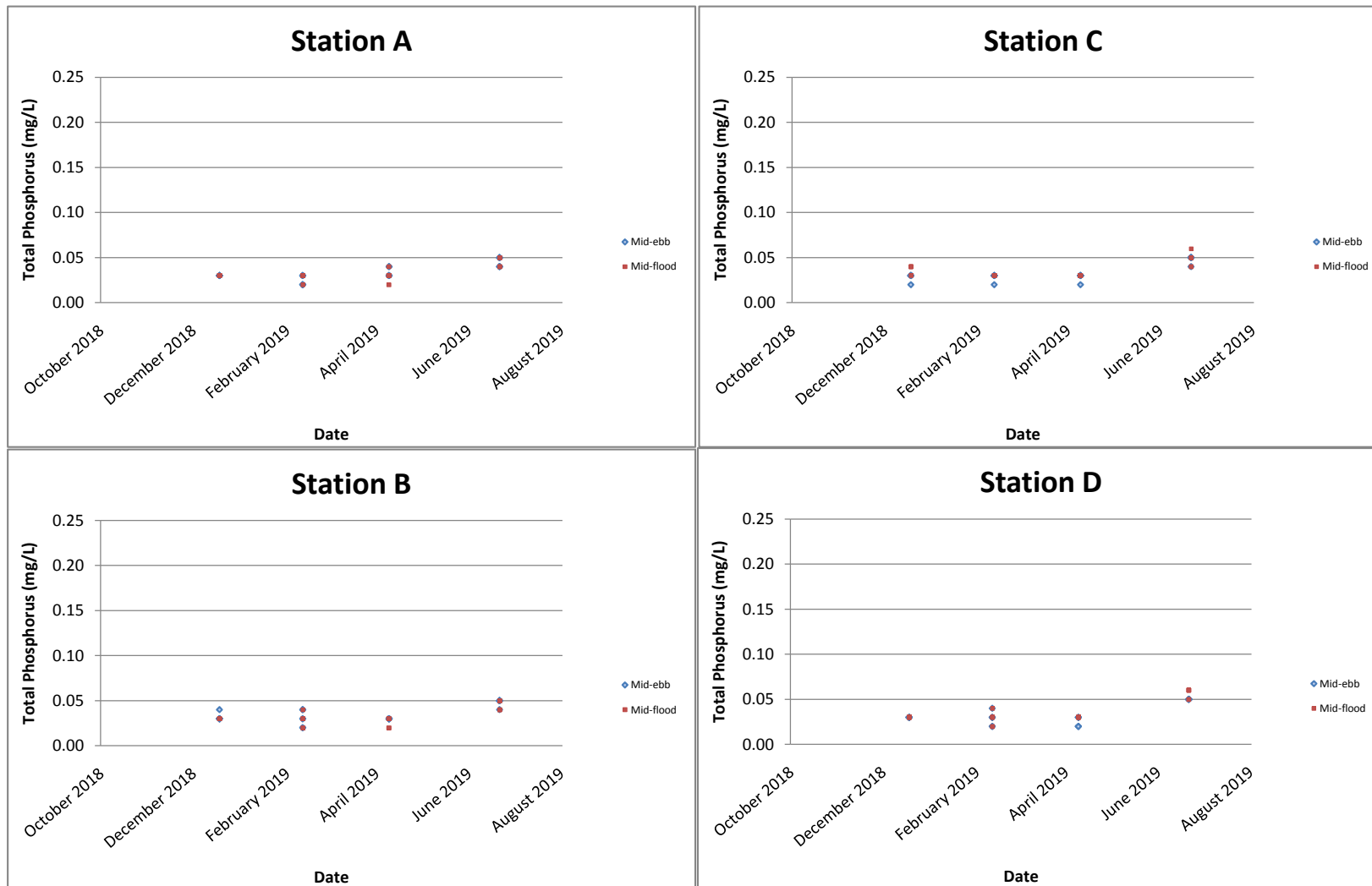
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E.coli (cfu/100mL)



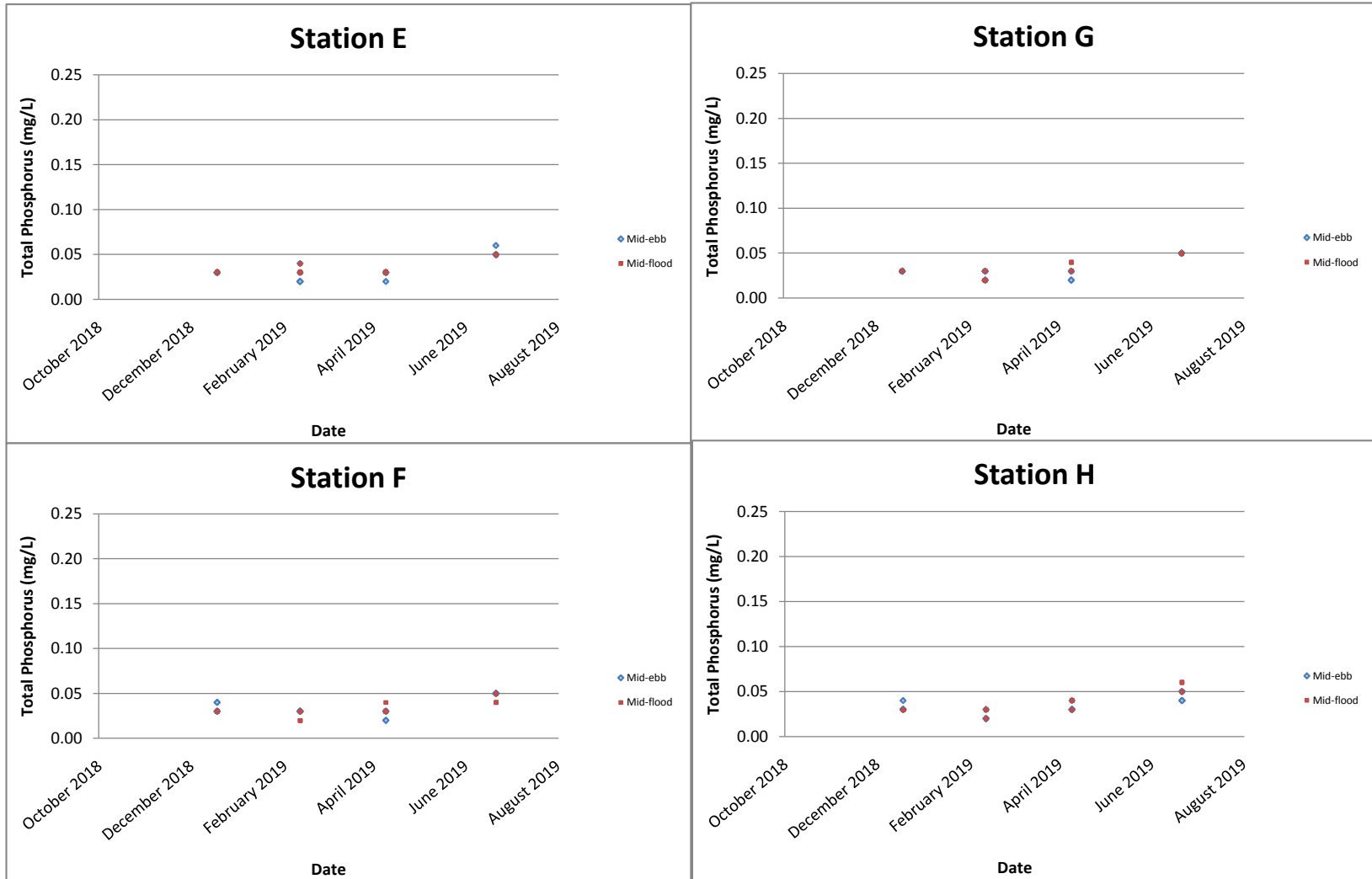
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Total Phosphorus (soluble and particulate) (mg/L)



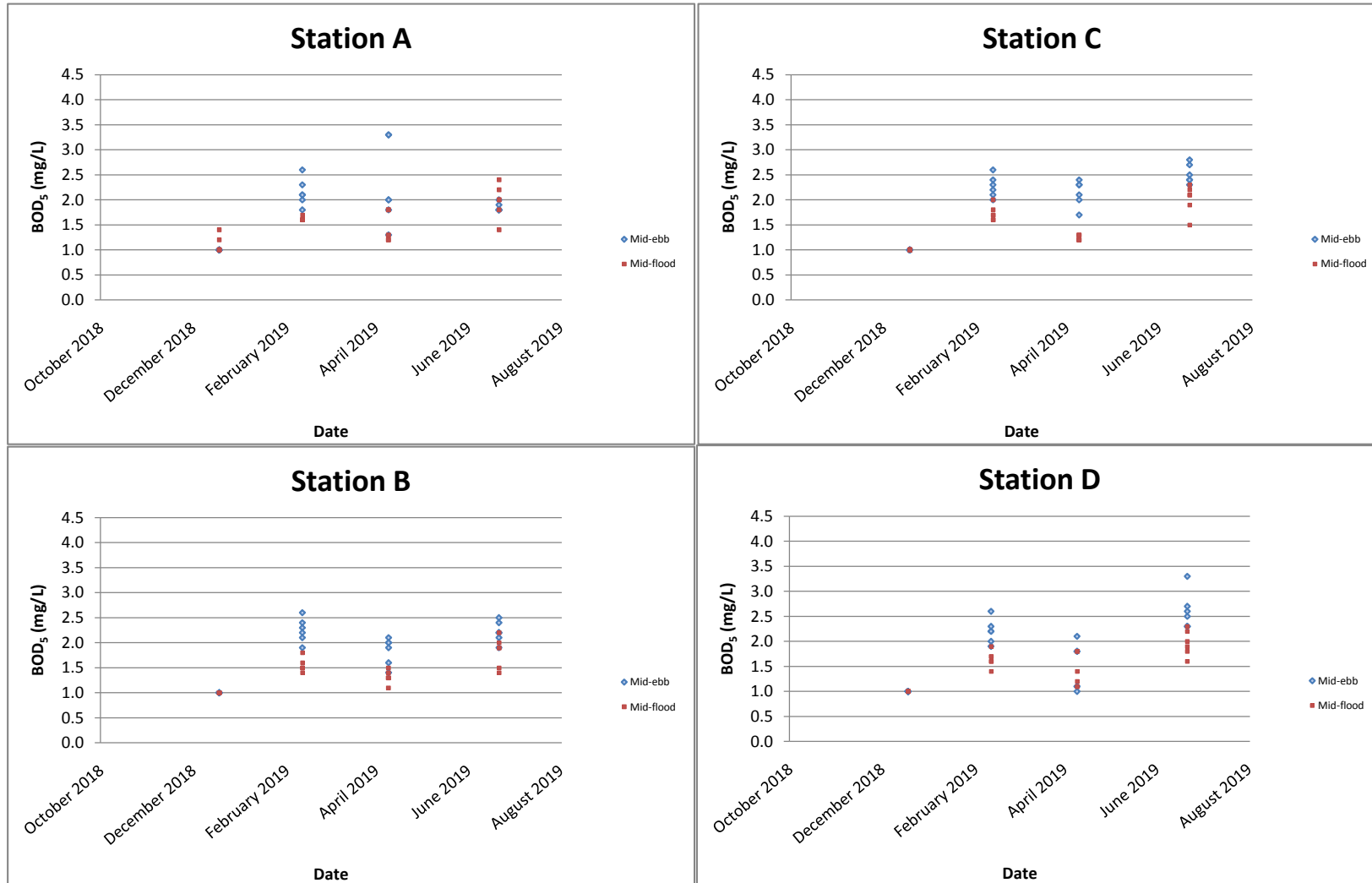
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Total Phosphorus (soluble and particulate) (mg/L)



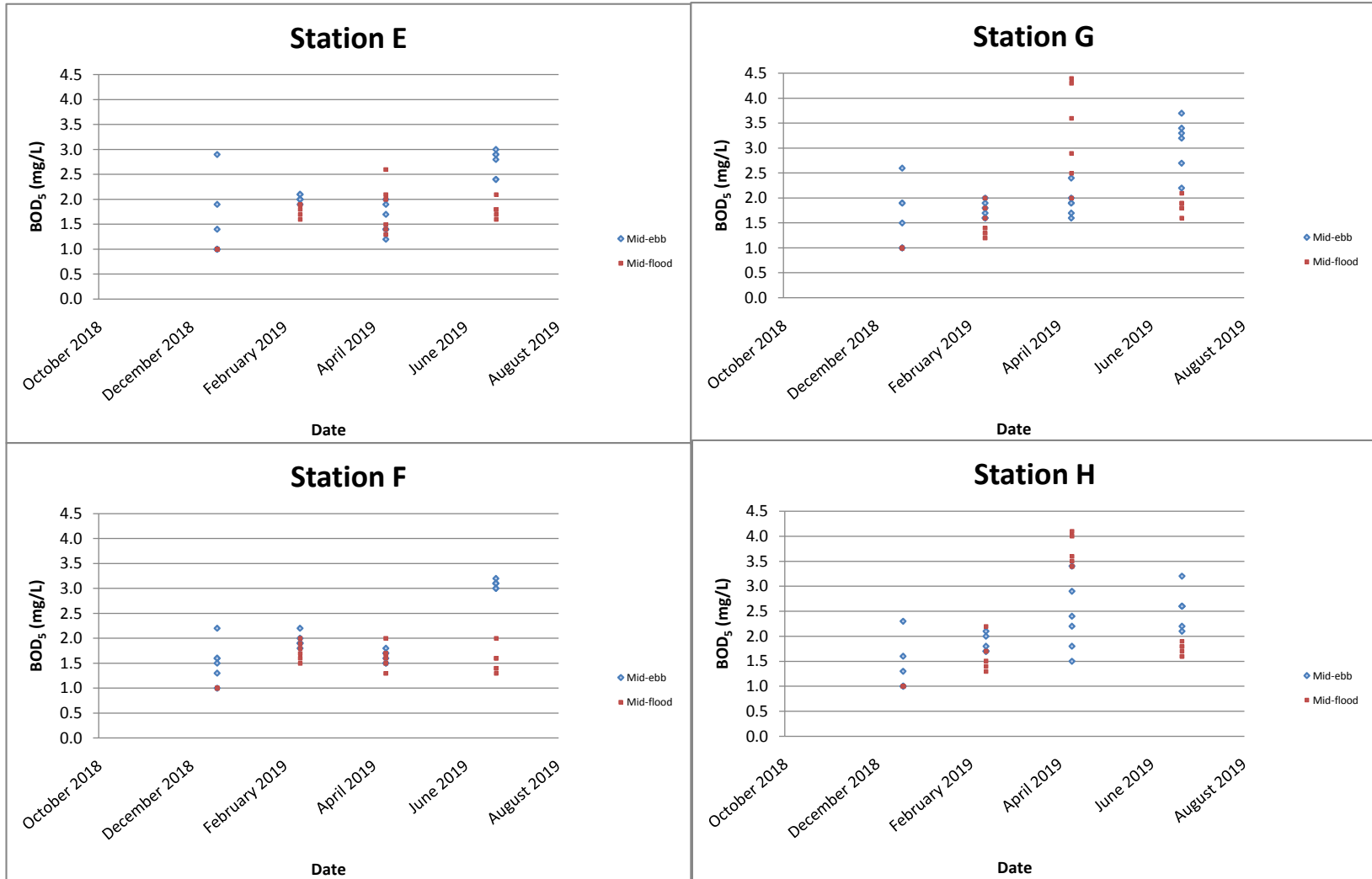
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BOD₅ (mg/L)



Remark: All below the Limit of Report sample results (<1.0 mg/L) for BOD₅ is regarded as 1.0 mg/L in graphical presentation.

BOD₅ (mg/L)



Remark: All below the Limit of Report sample results (<1.0 mg/L) for BOD₅ is regarded as 1.0 mg/L in graphical presentation.

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Appendix D

Tidal Data obtained from Ma Wan Marine Traffic Station

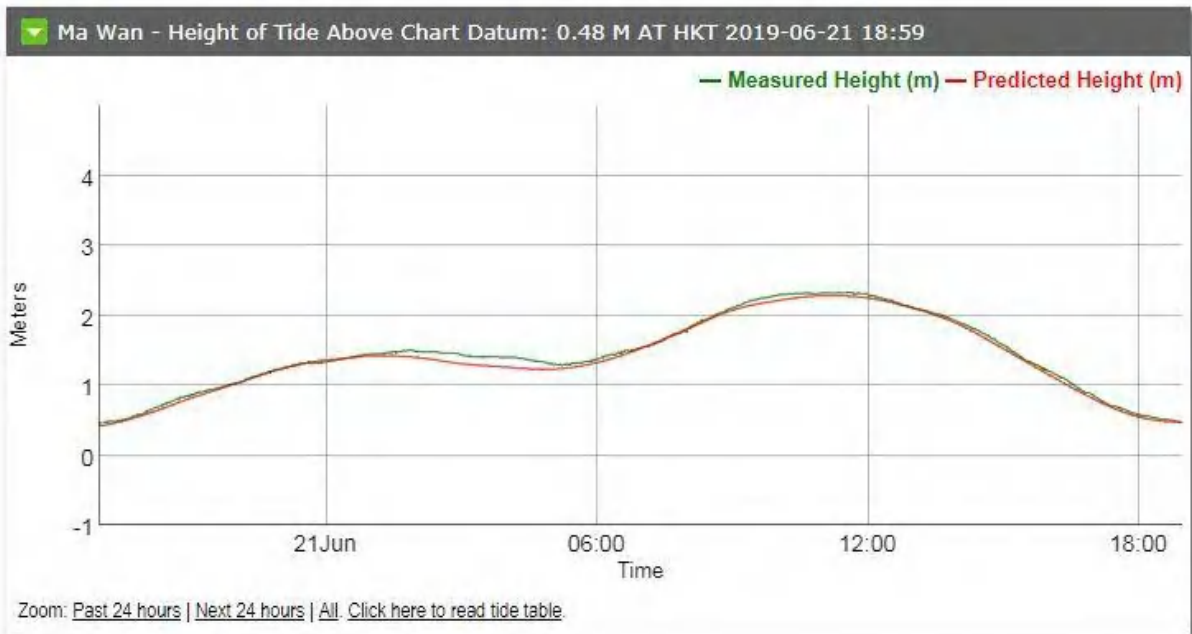
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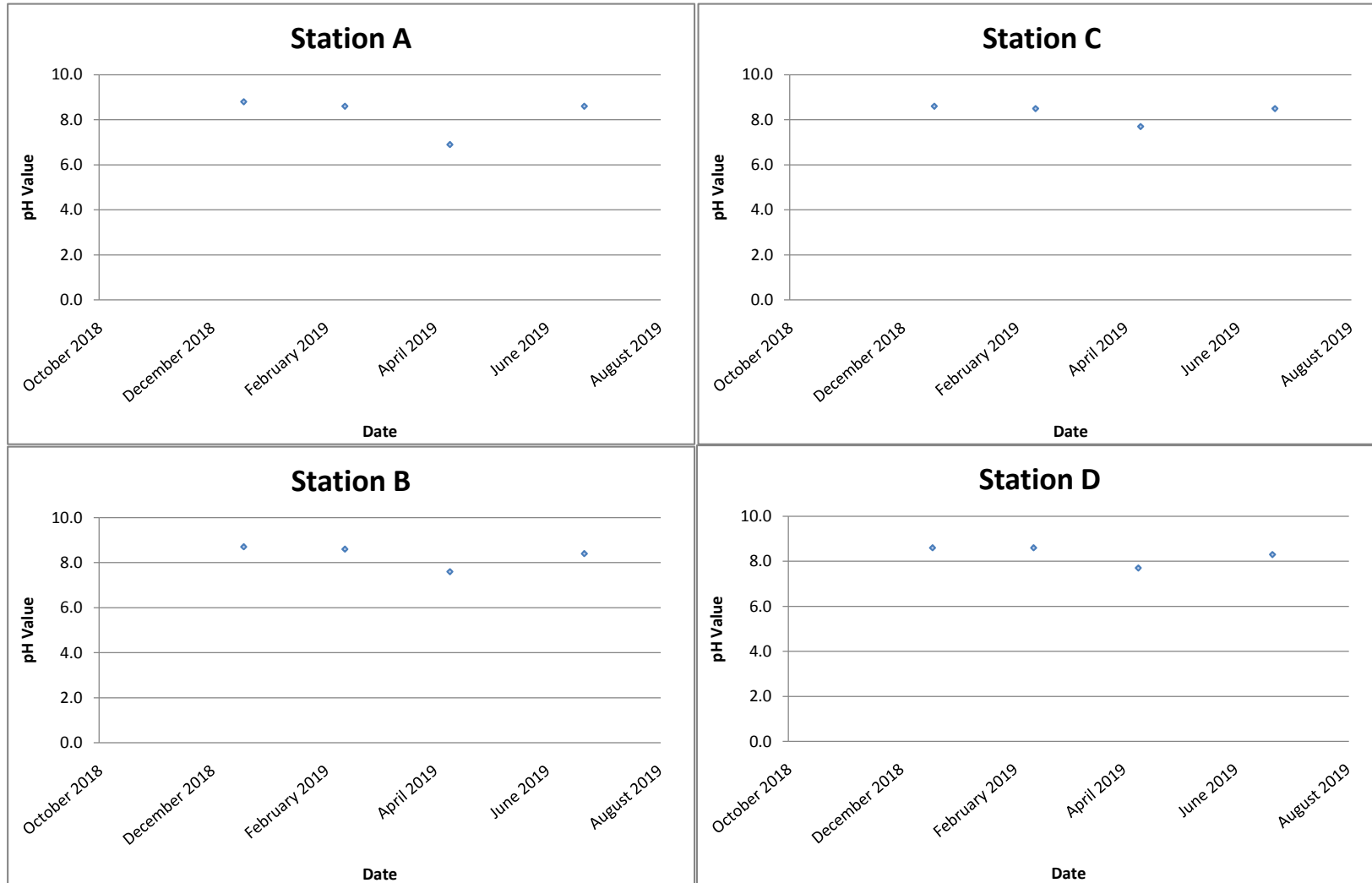


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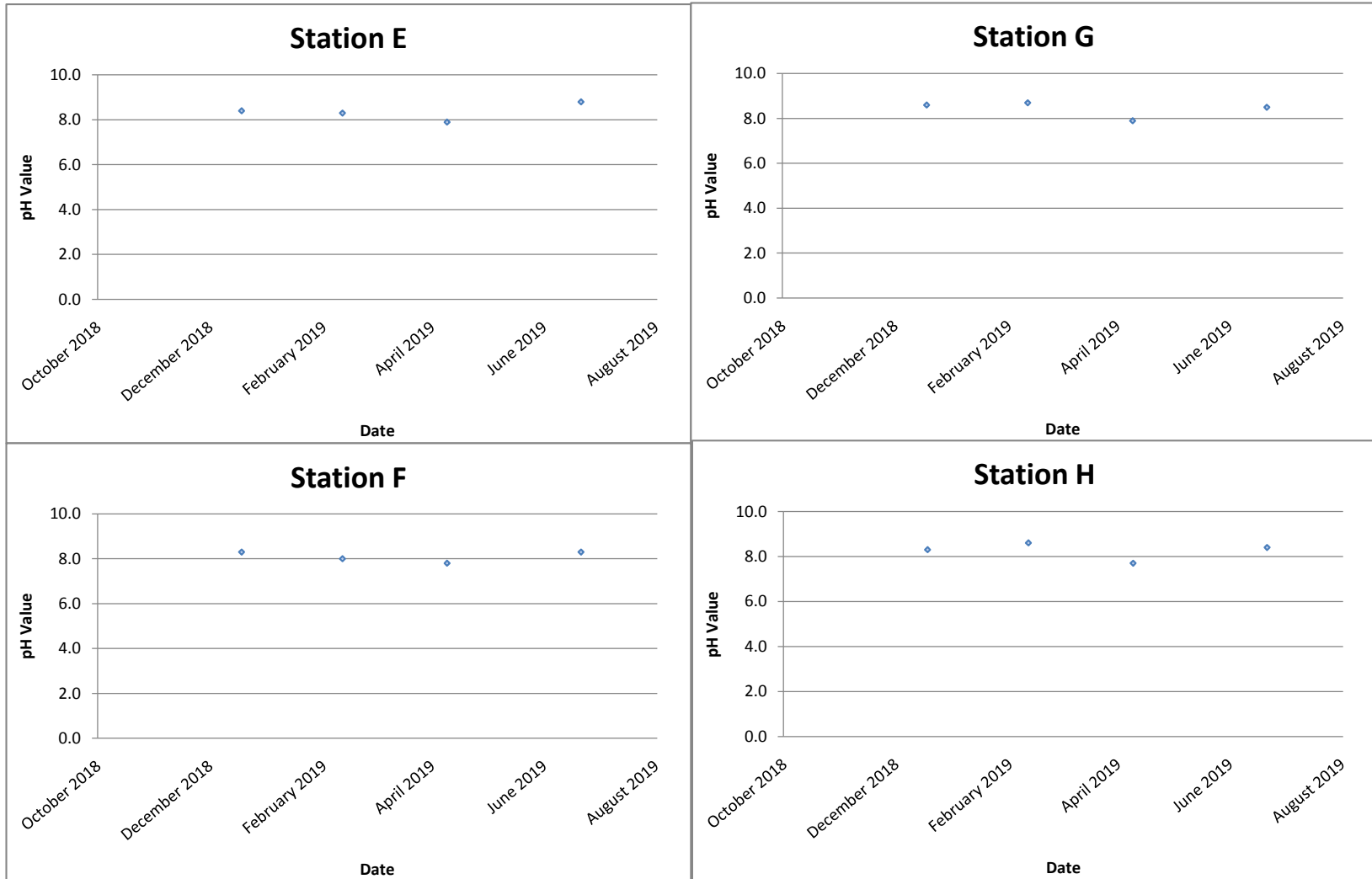
Appendix E

Graphical Presentation of Sediment Quality Monitoring and Benthic Survey

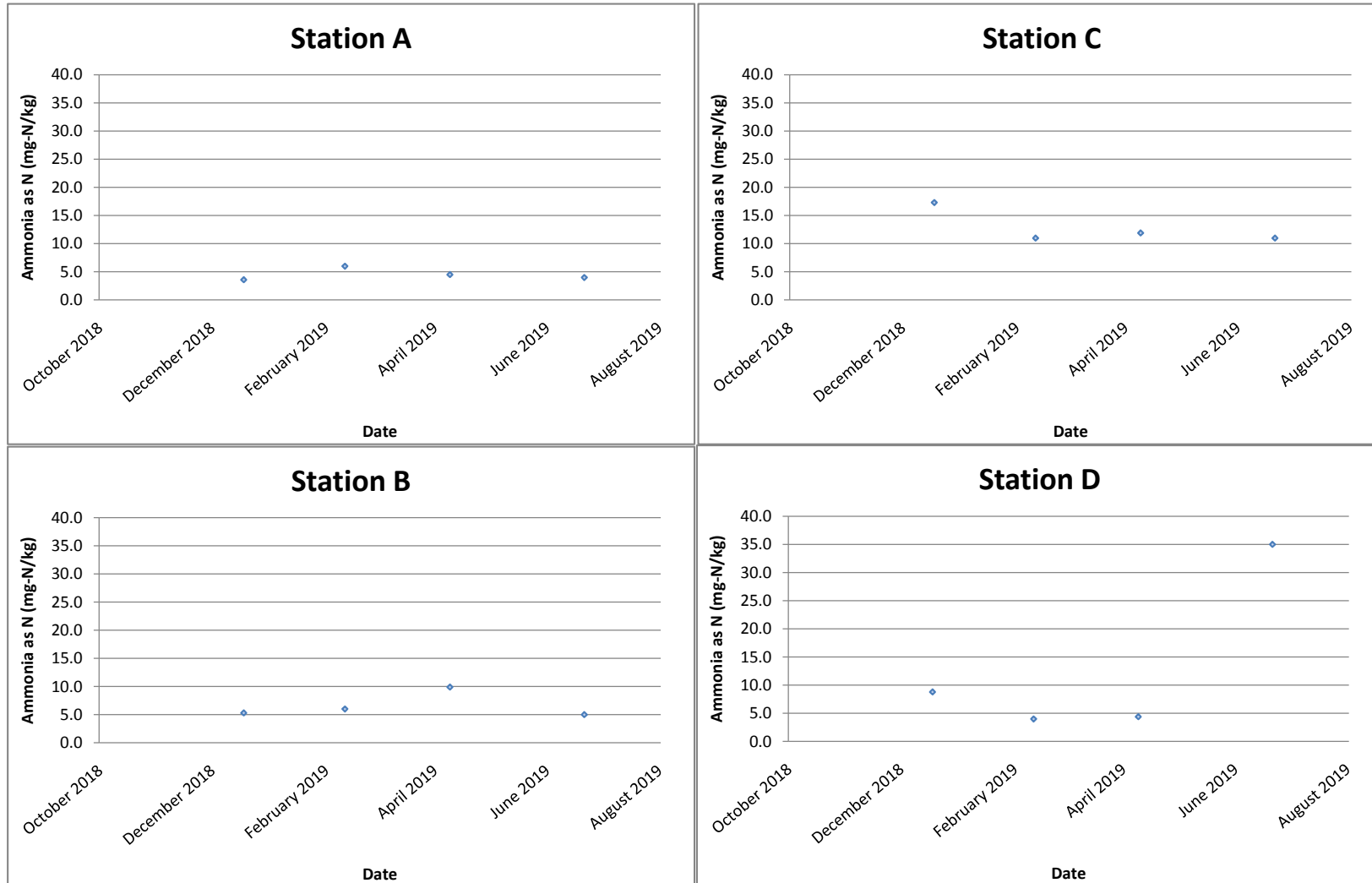
pH value



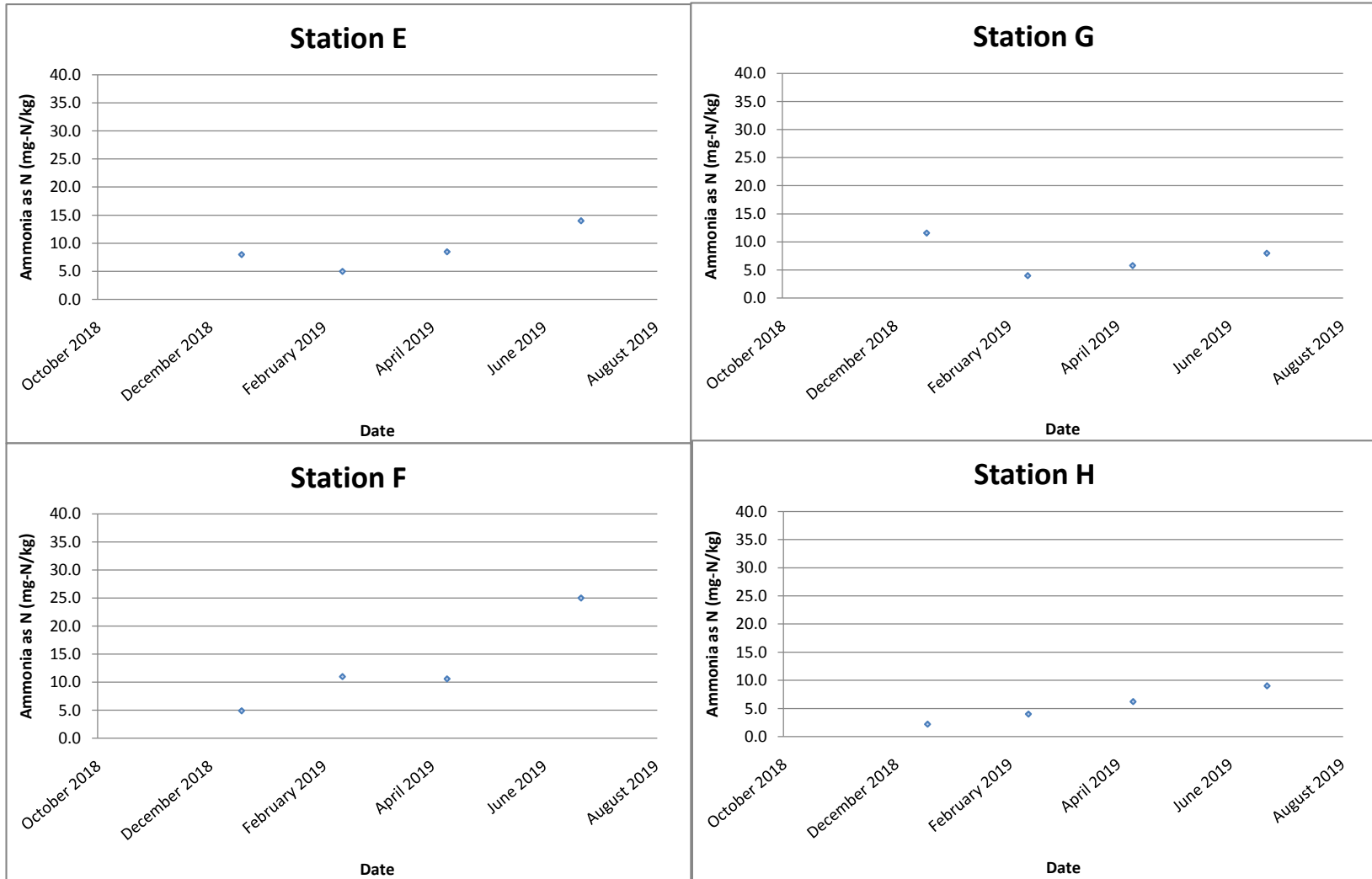
pH value



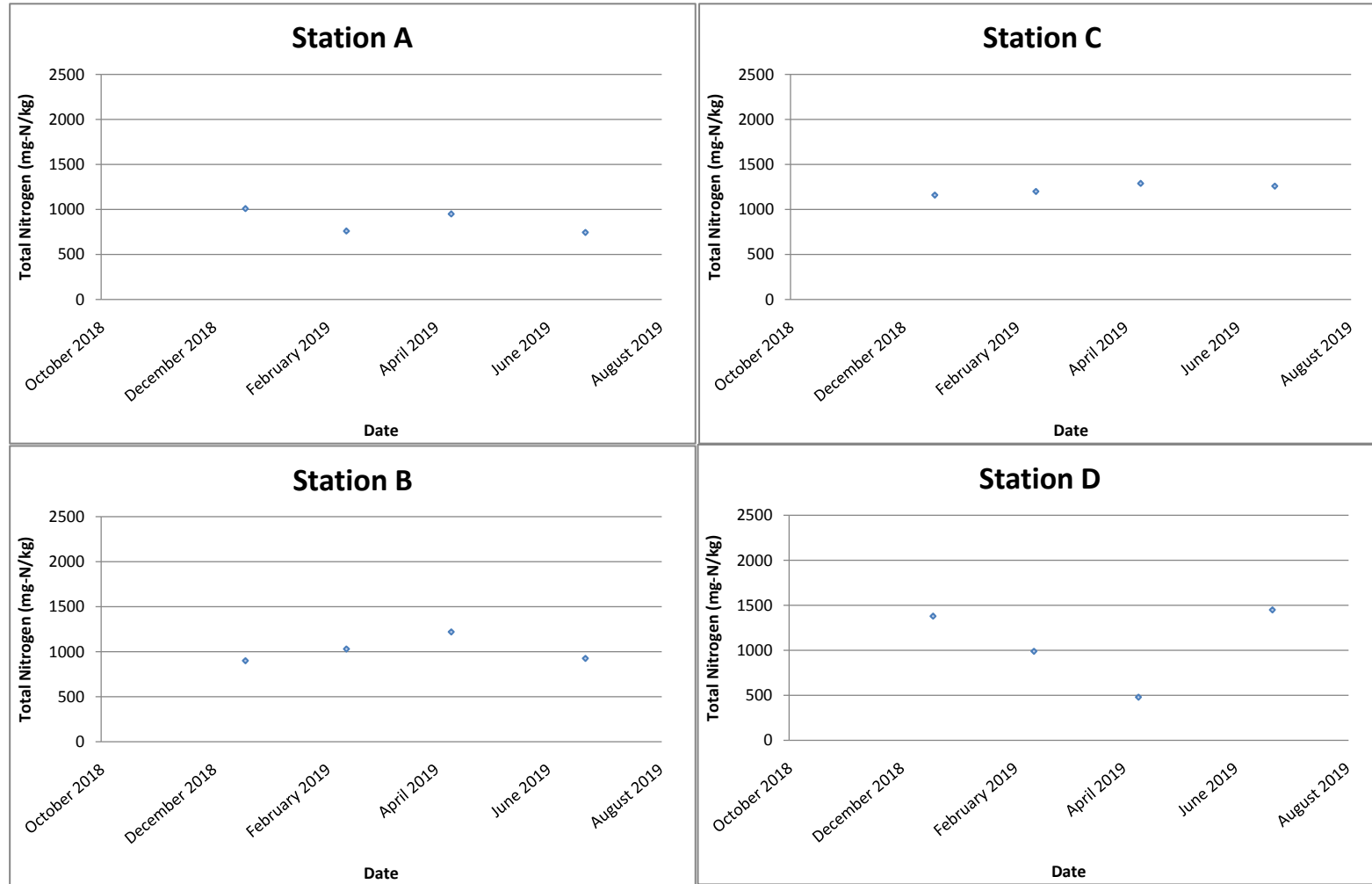
Ammonia Nitrogen (mg-N/kg)



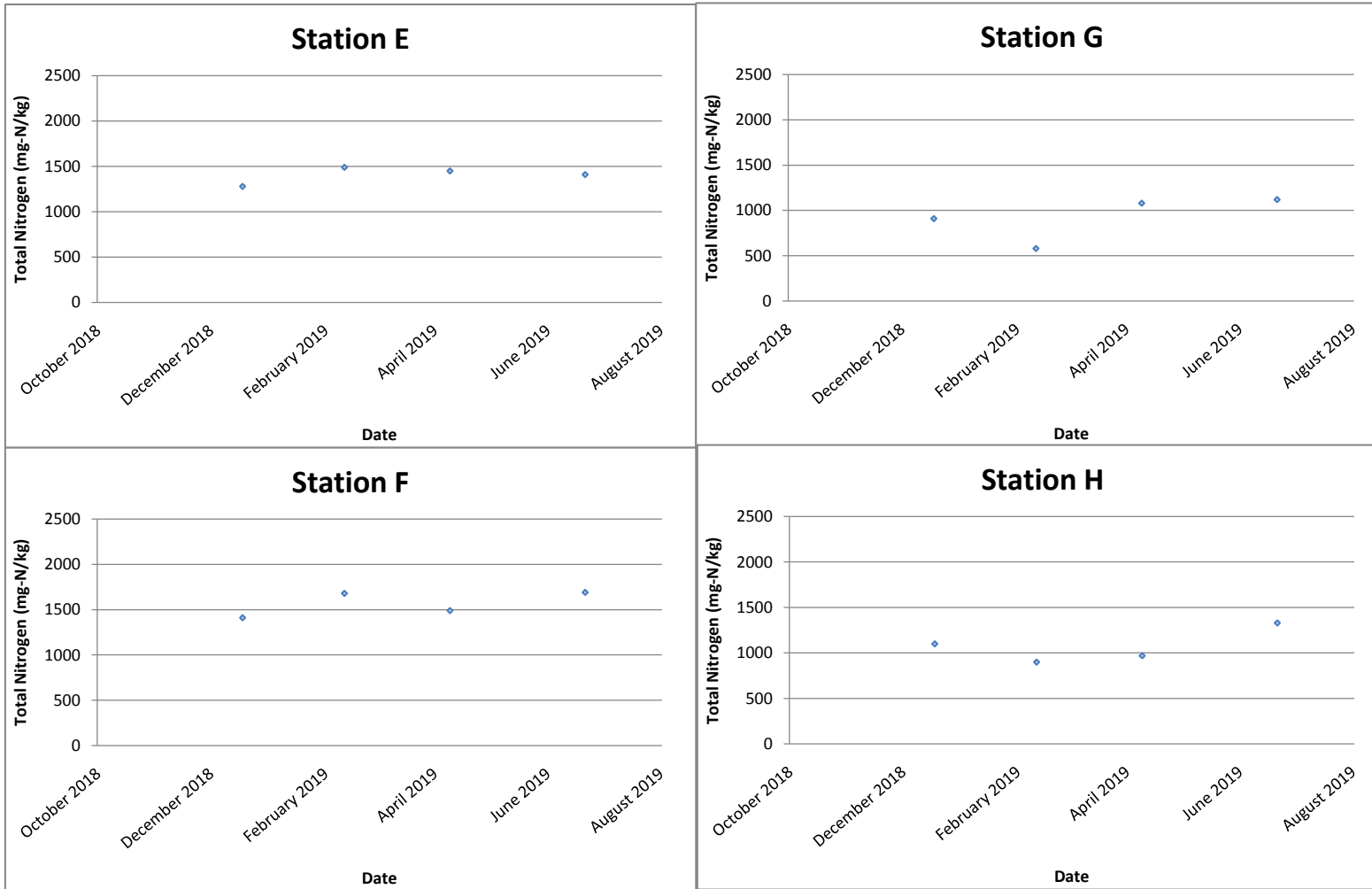
Ammonia Nitrogen (mg-N/kg)



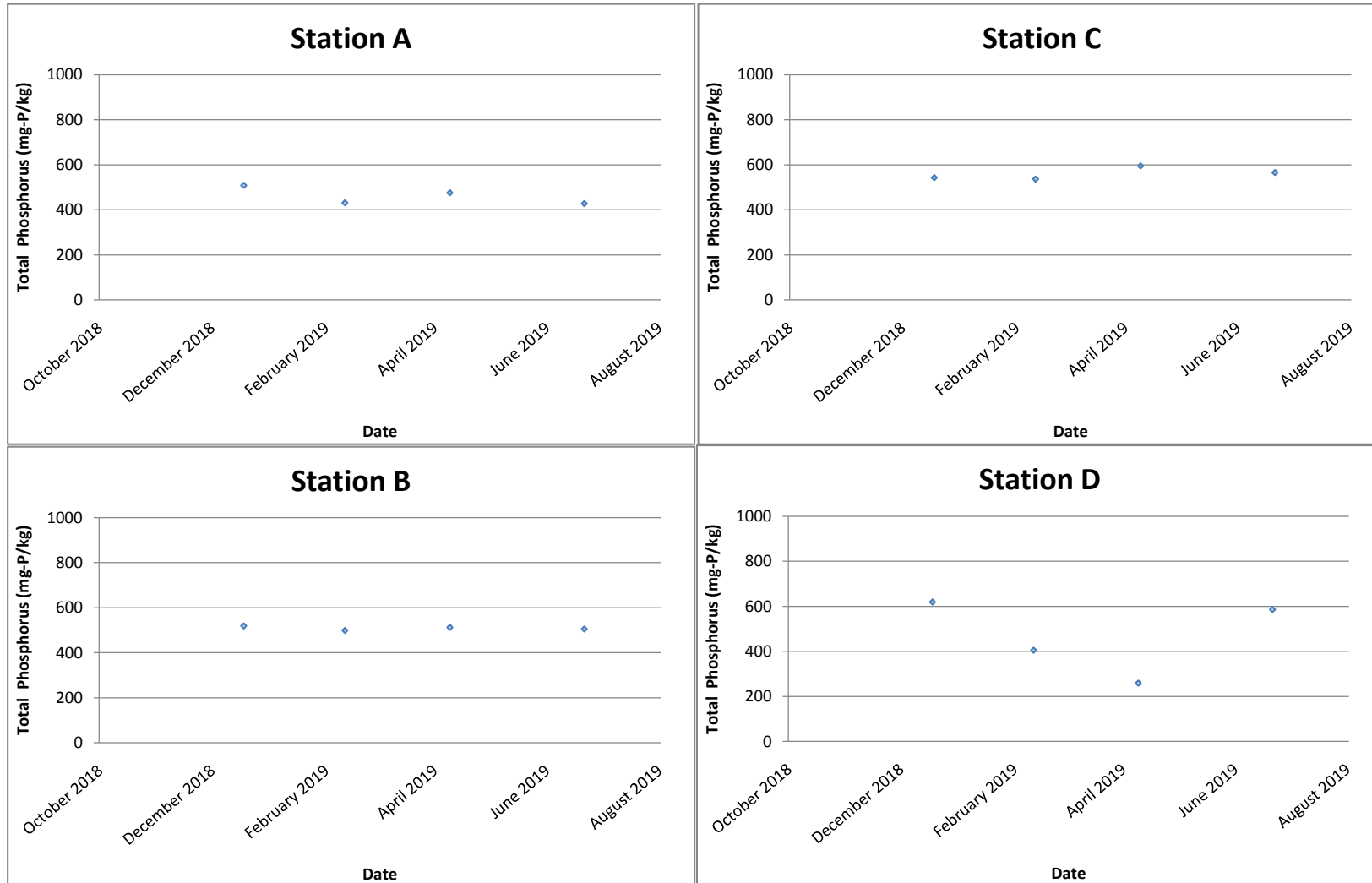
Total Nitrogen (mg-N/kg)



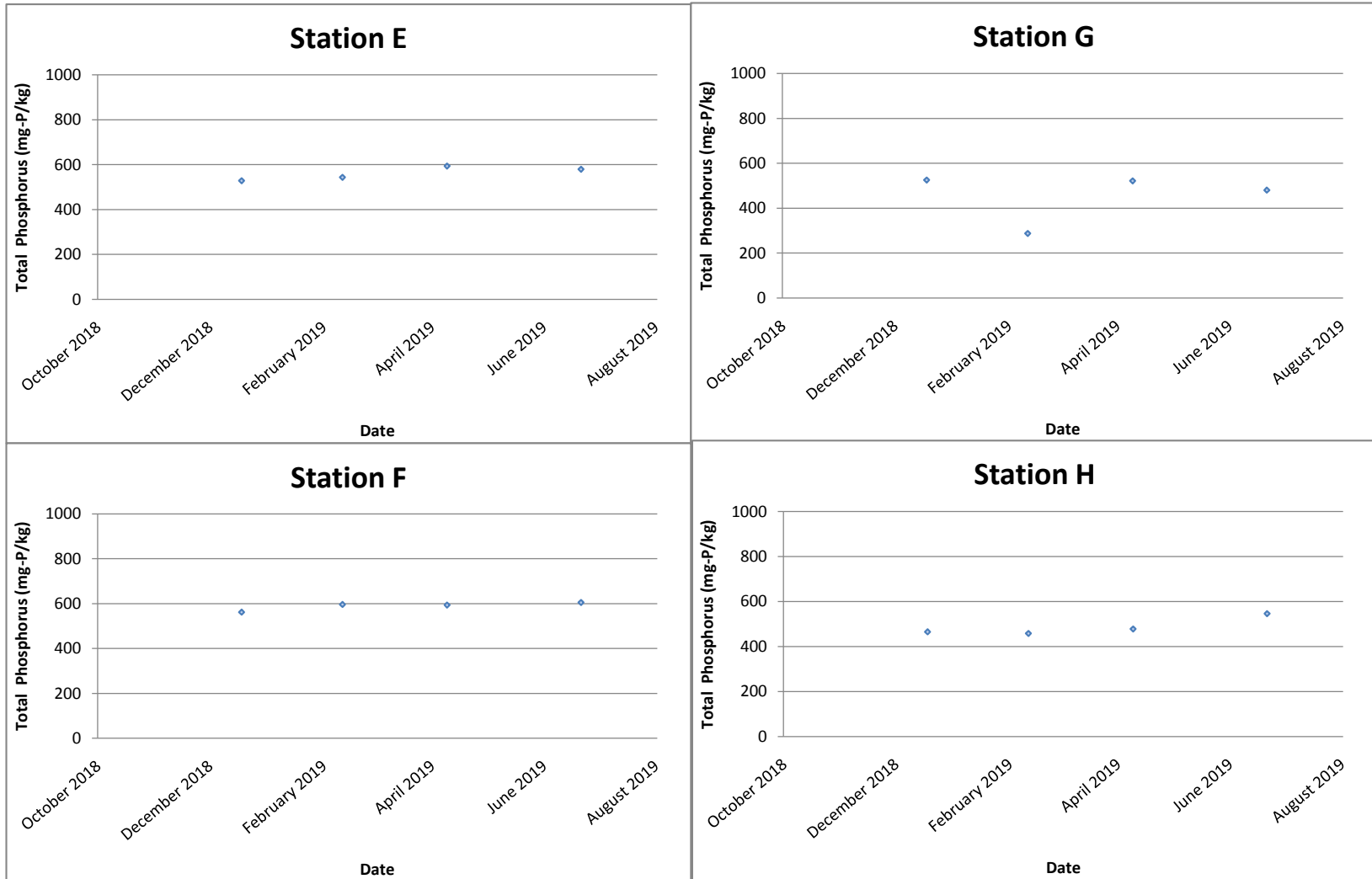
Total Nitrogen (mg-N/kg)



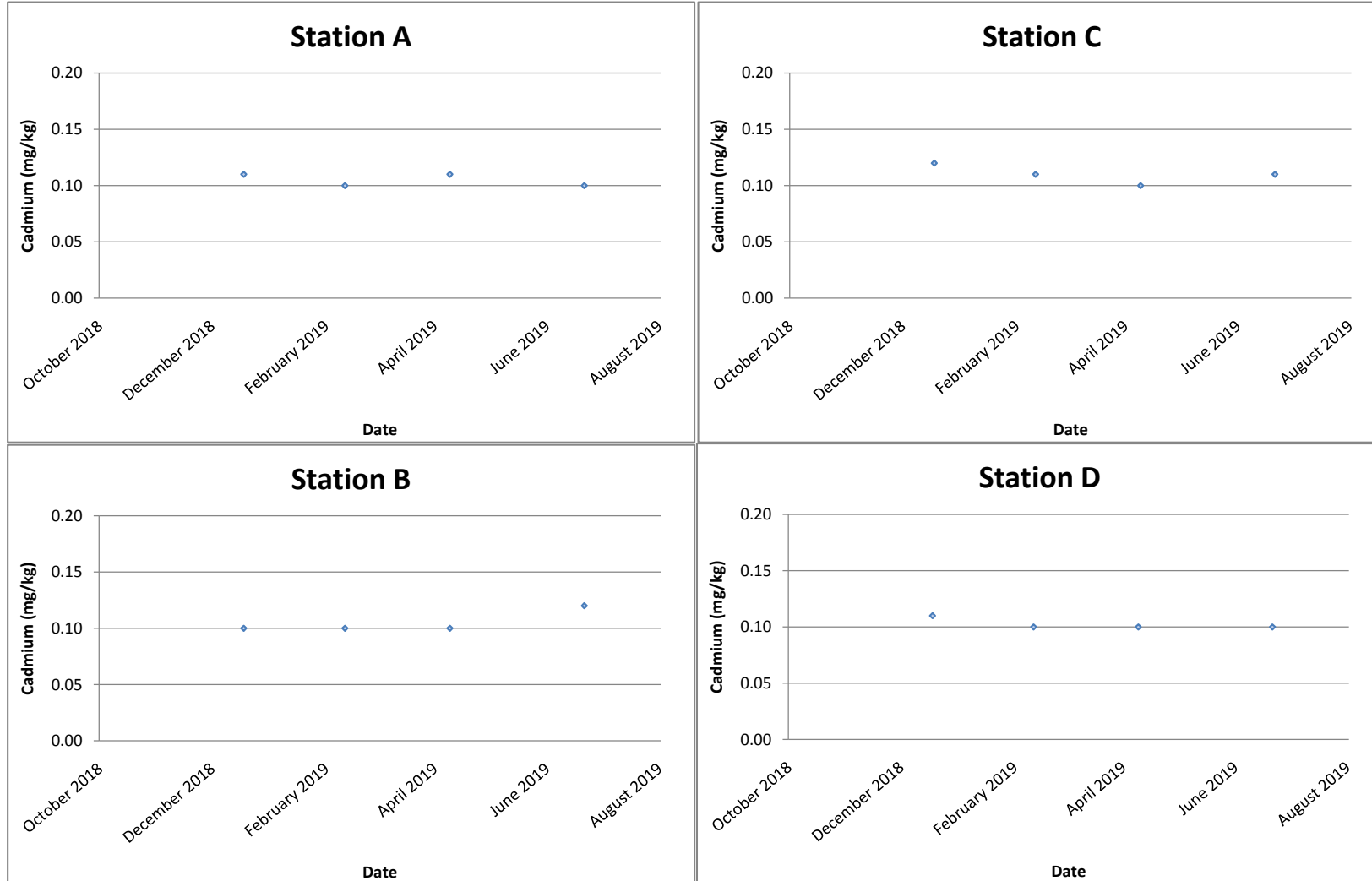
Total Phosphorus (mg-P/kg)



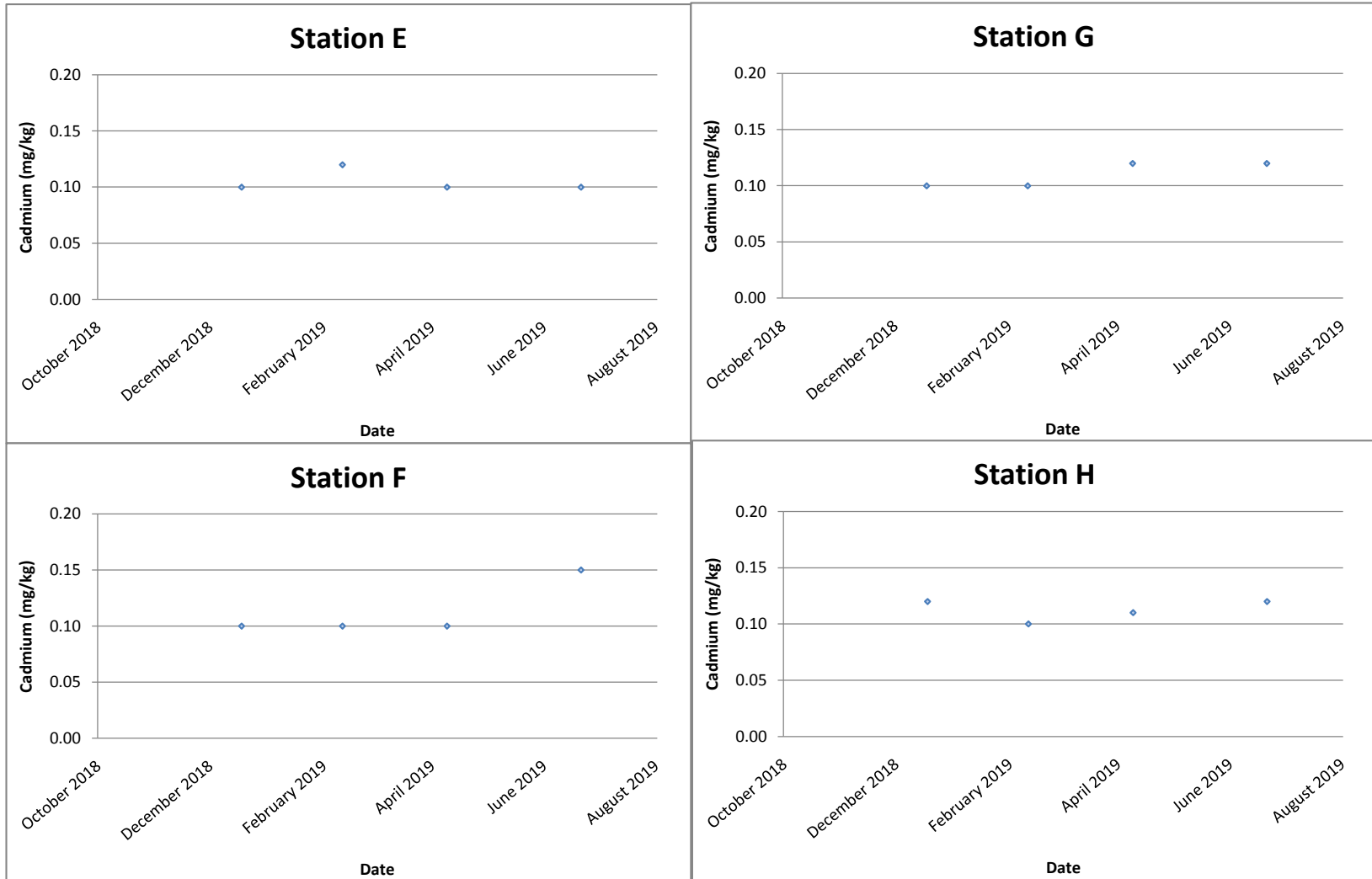
Total Phosphorus (mg-P/kg)



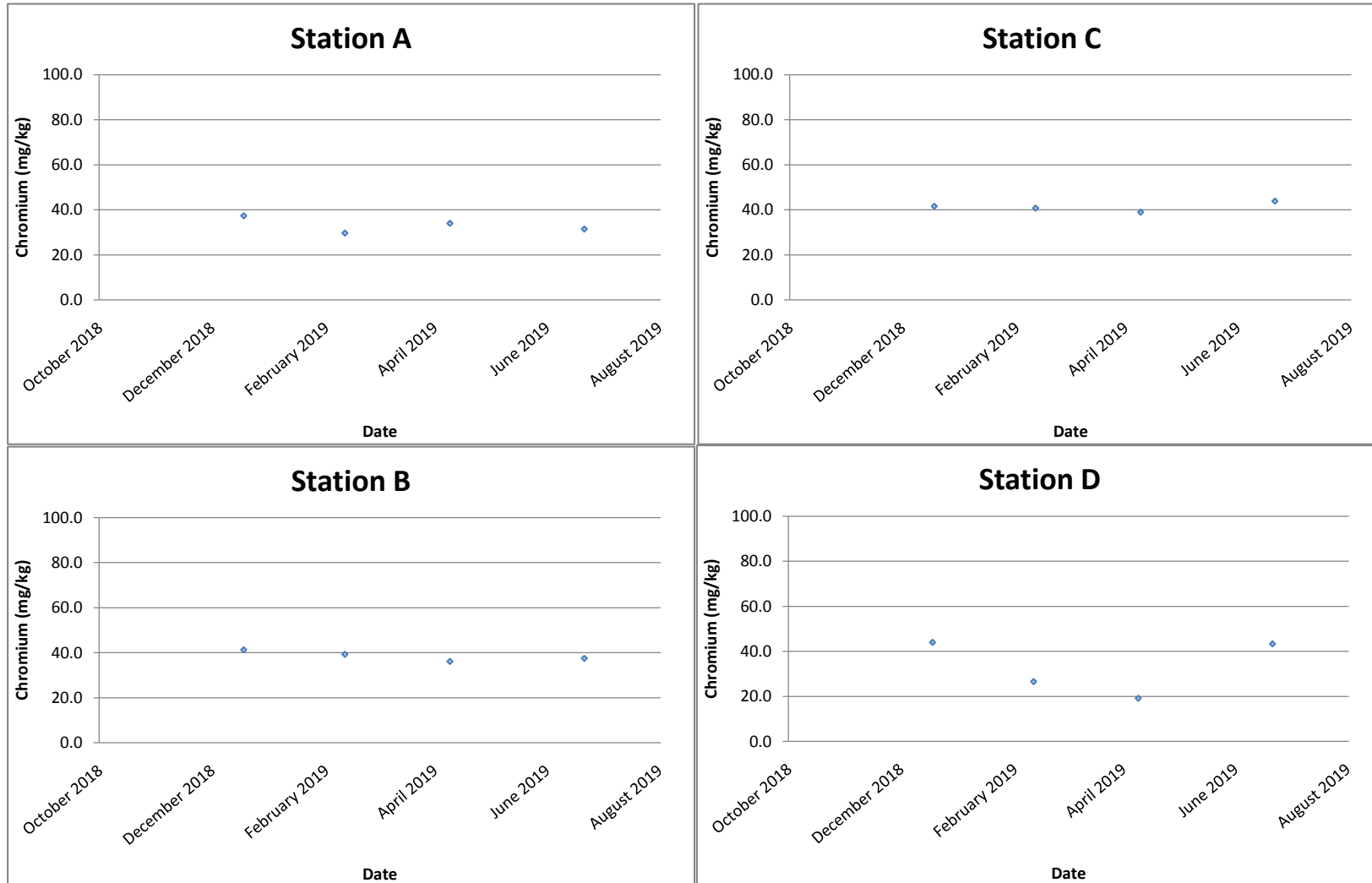
Cadmium (mg/kg)



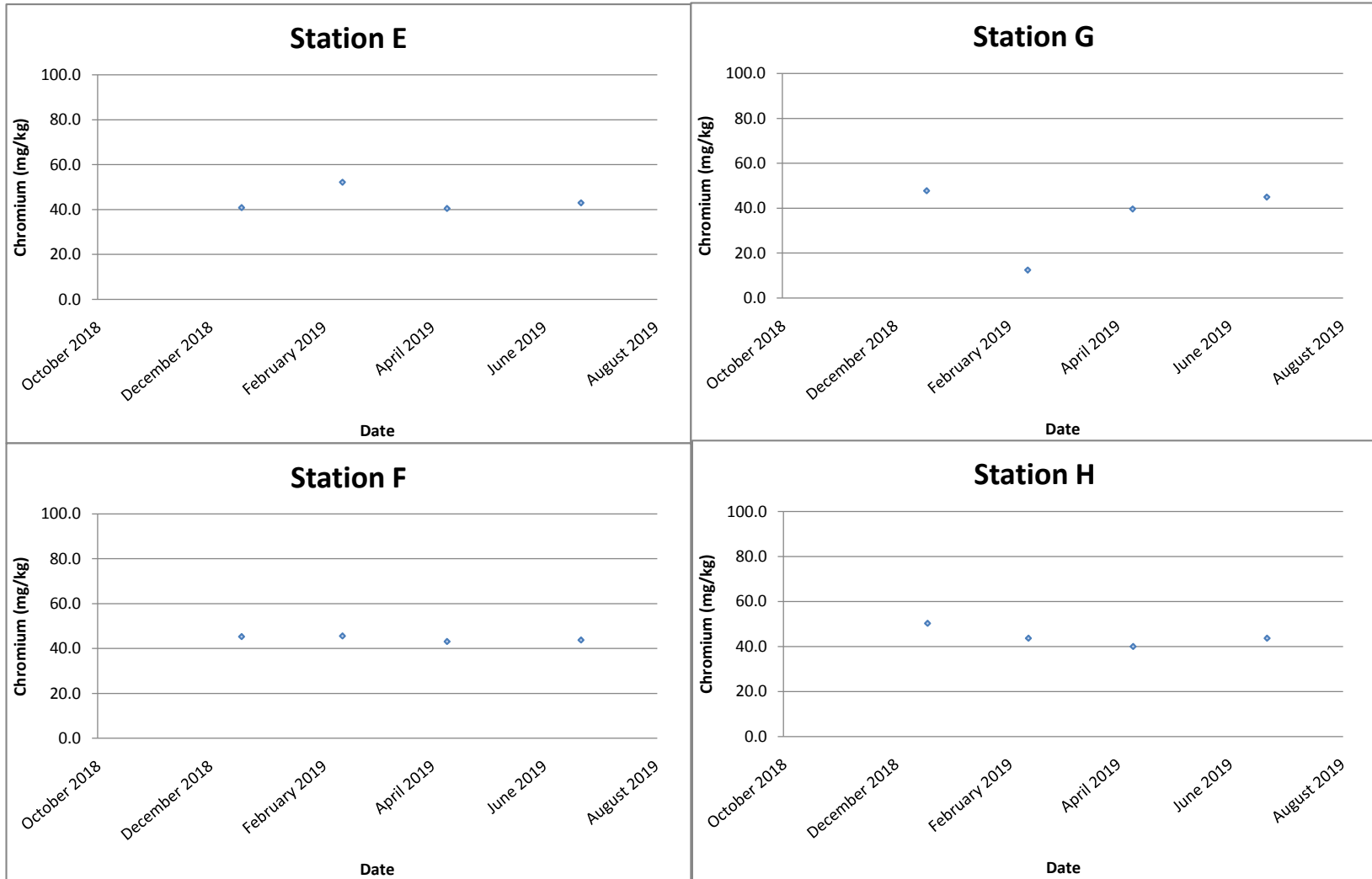
Cadmium (mg/kg)



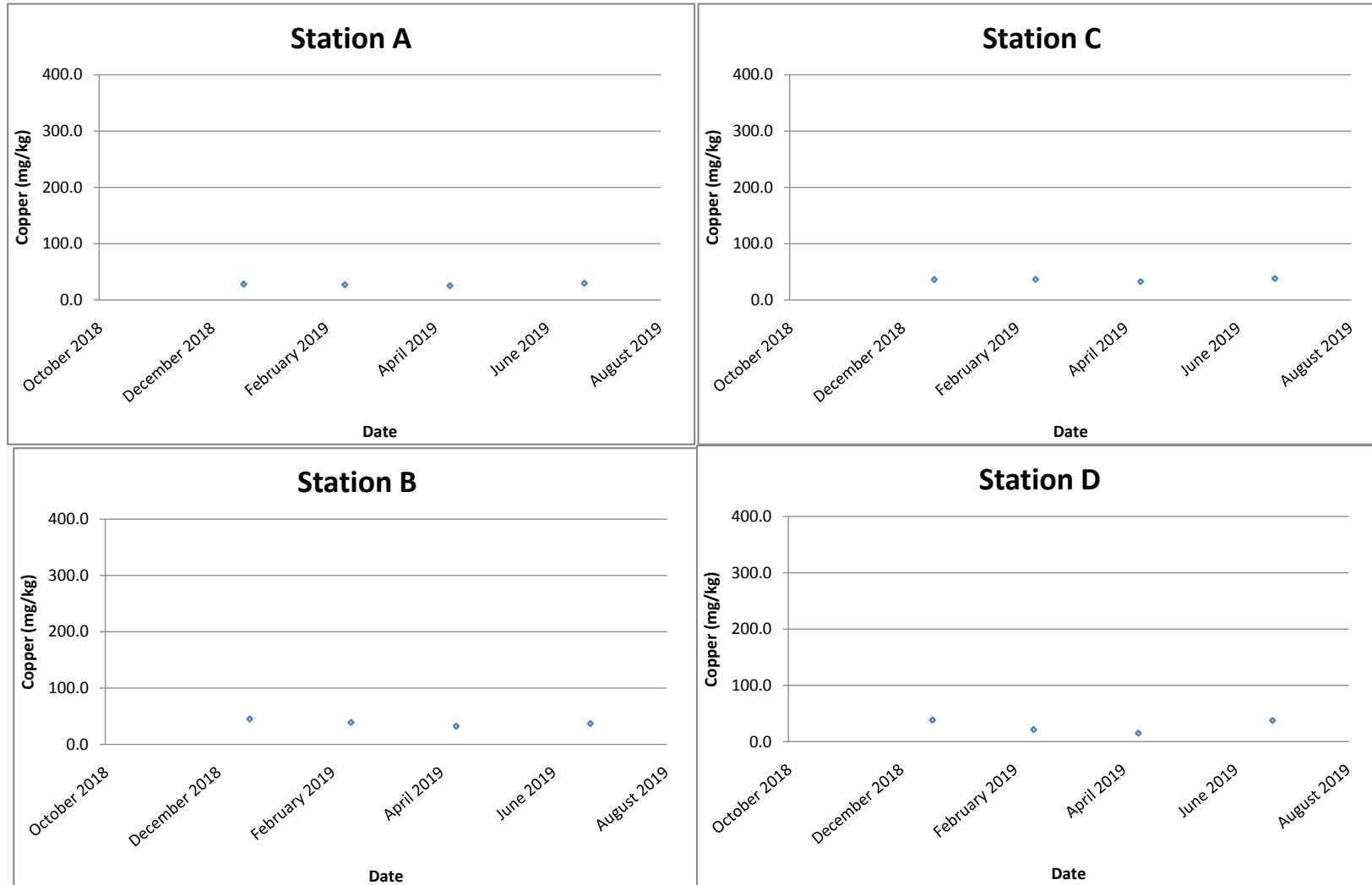
Chromium (mg/kg)



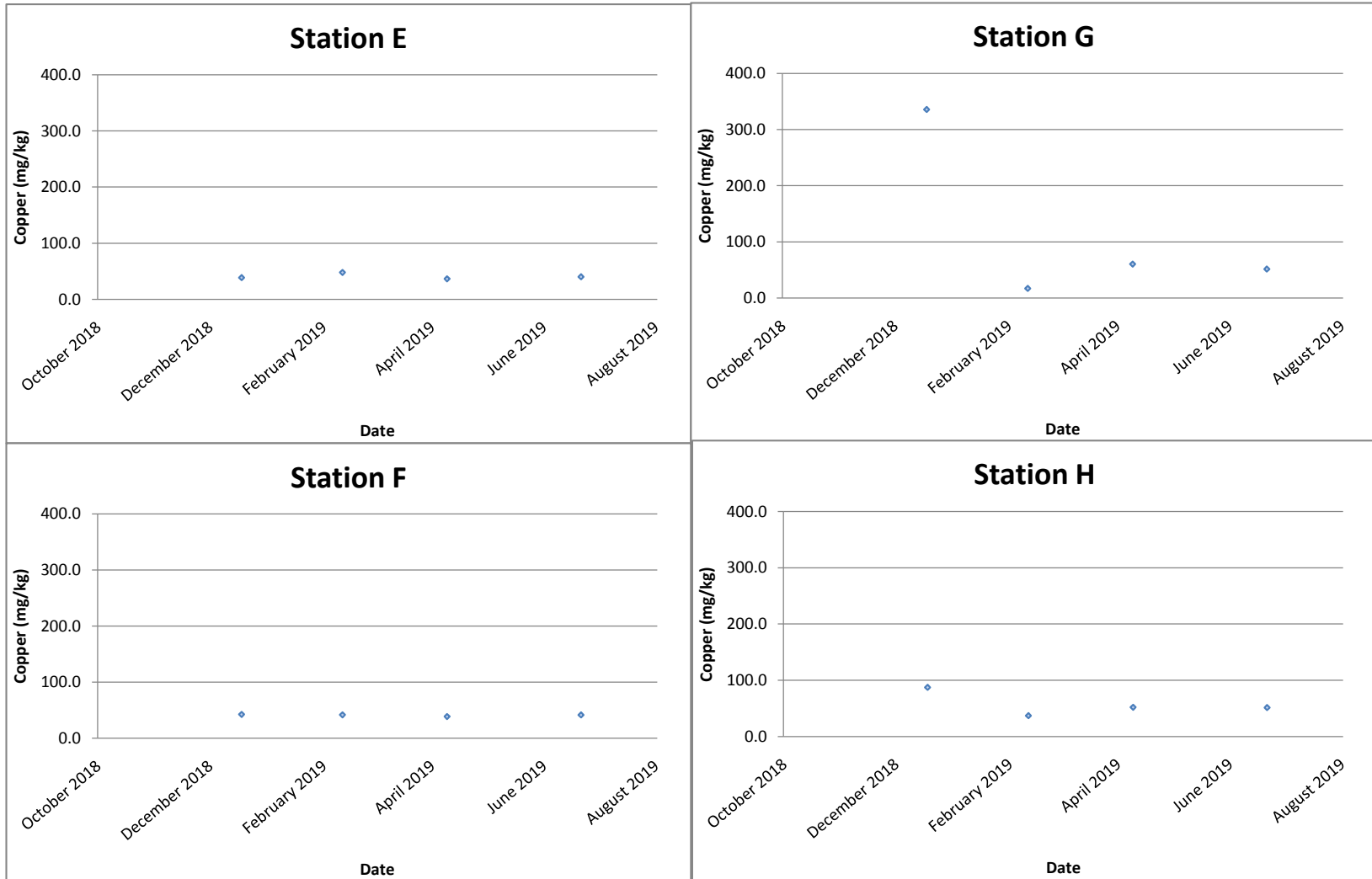
Chromium (mg/kg)



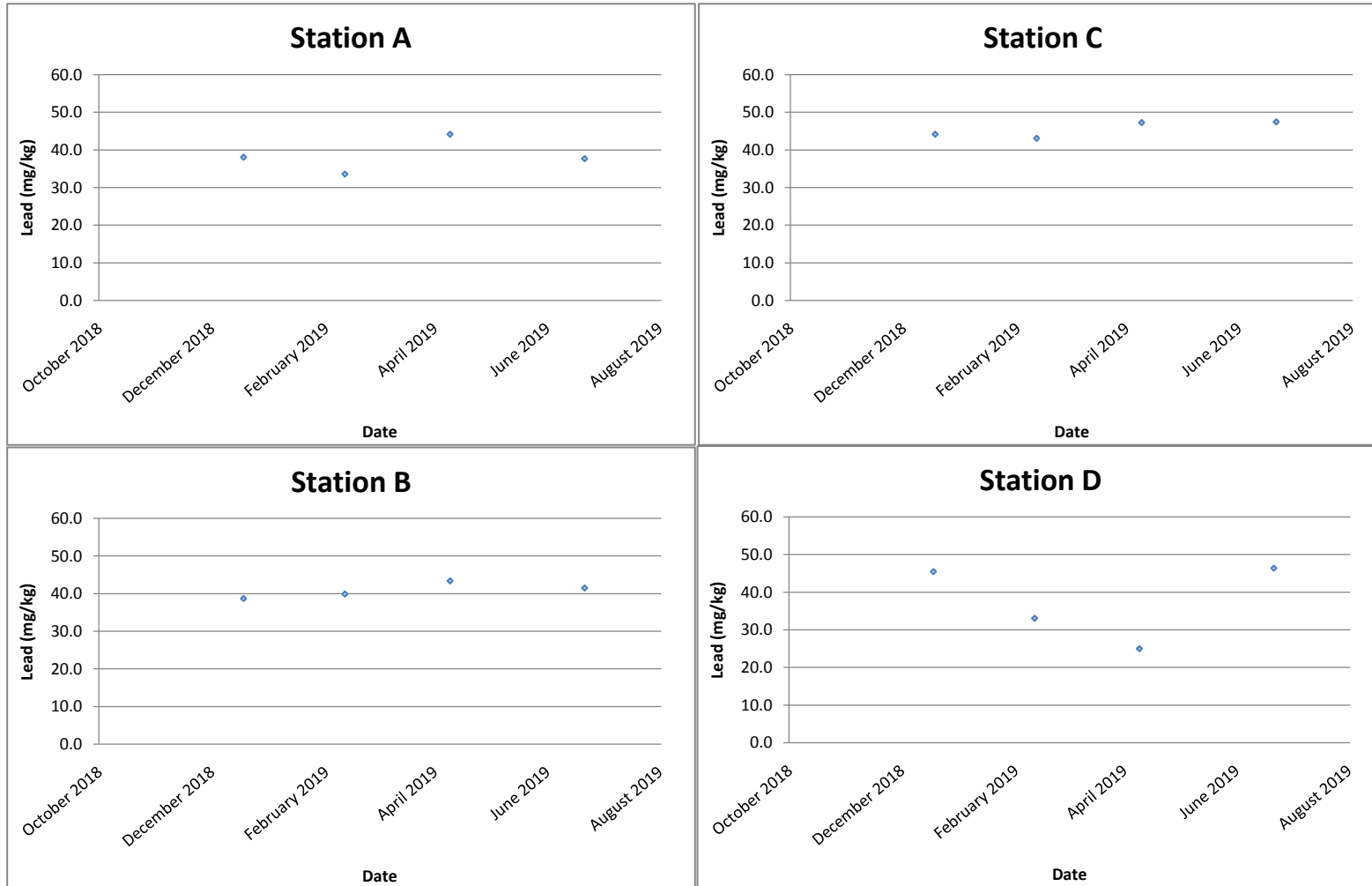
Copper (mg/kg)



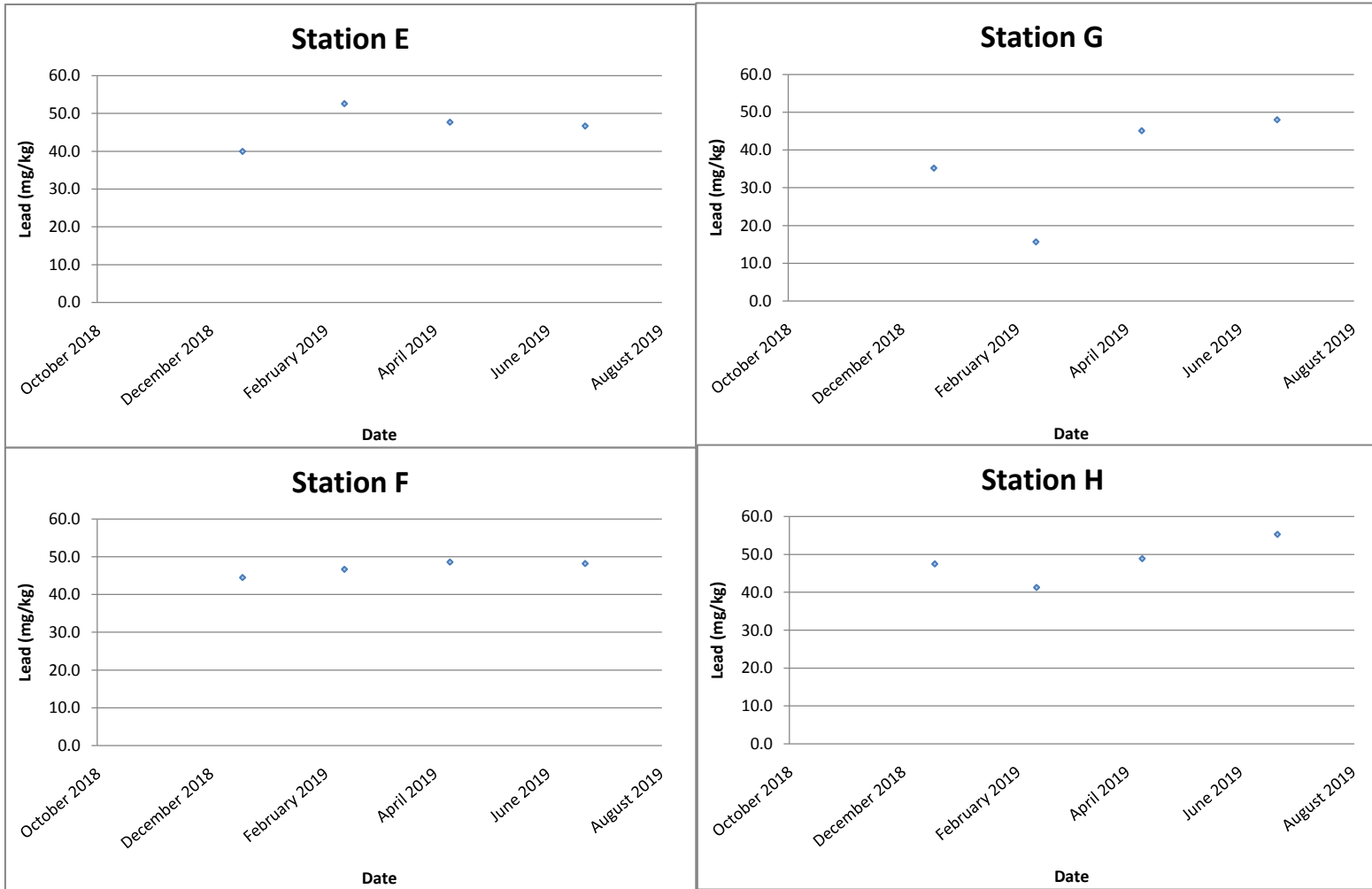
Copper (mg/kg)



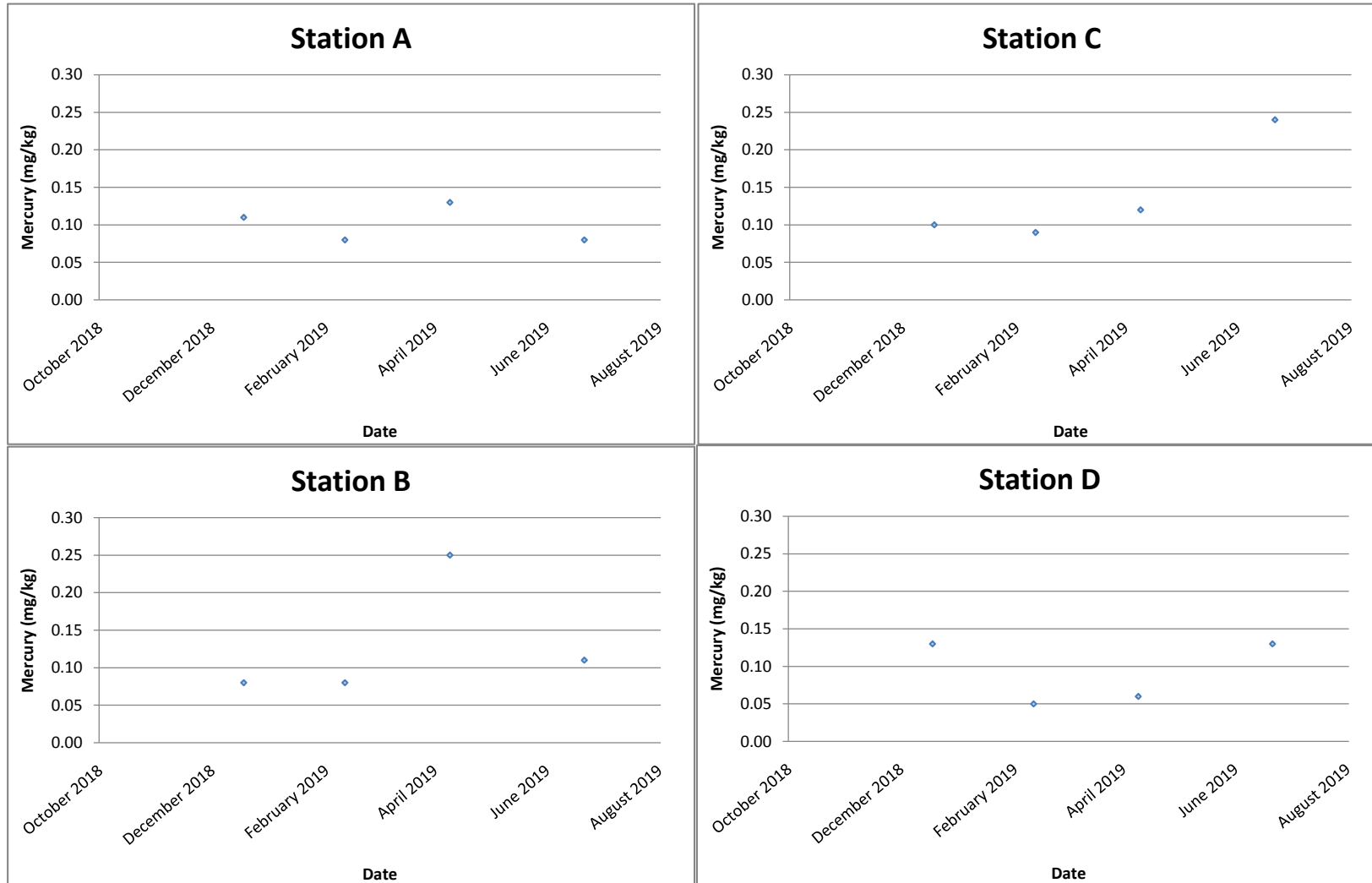
Lead (mg/kg)



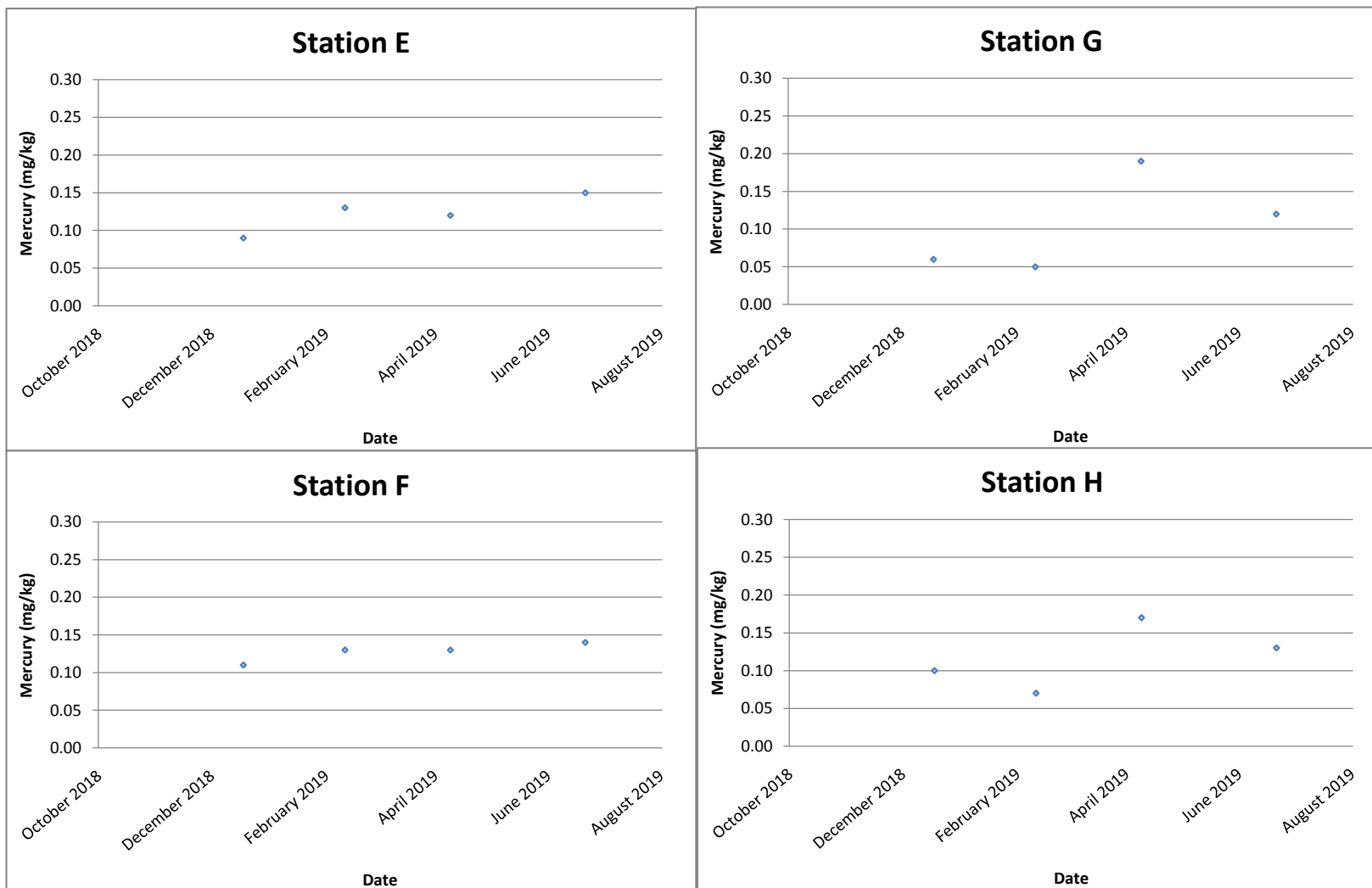
Lead (mg/kg)



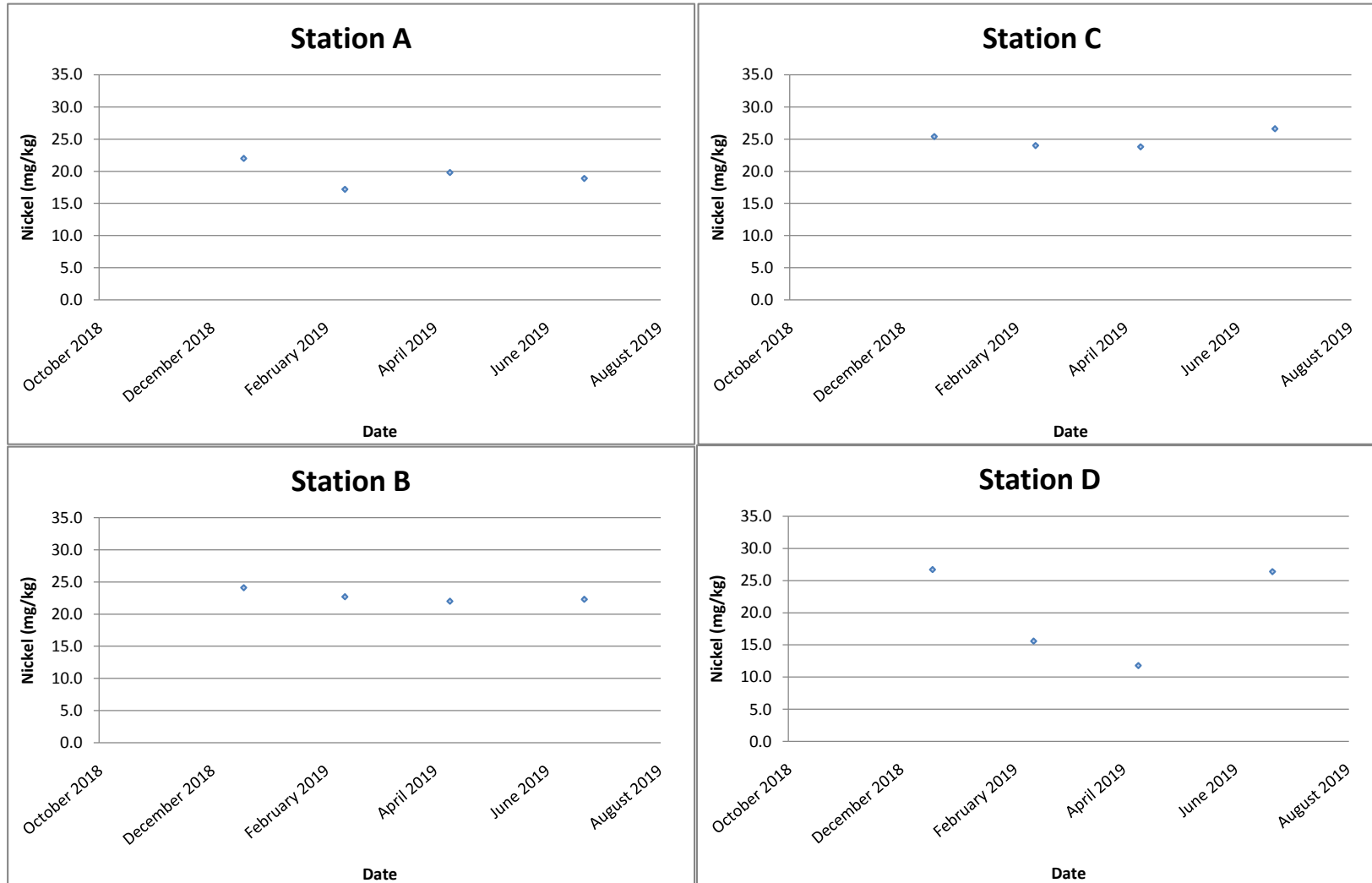
Mercury (mg/kg)



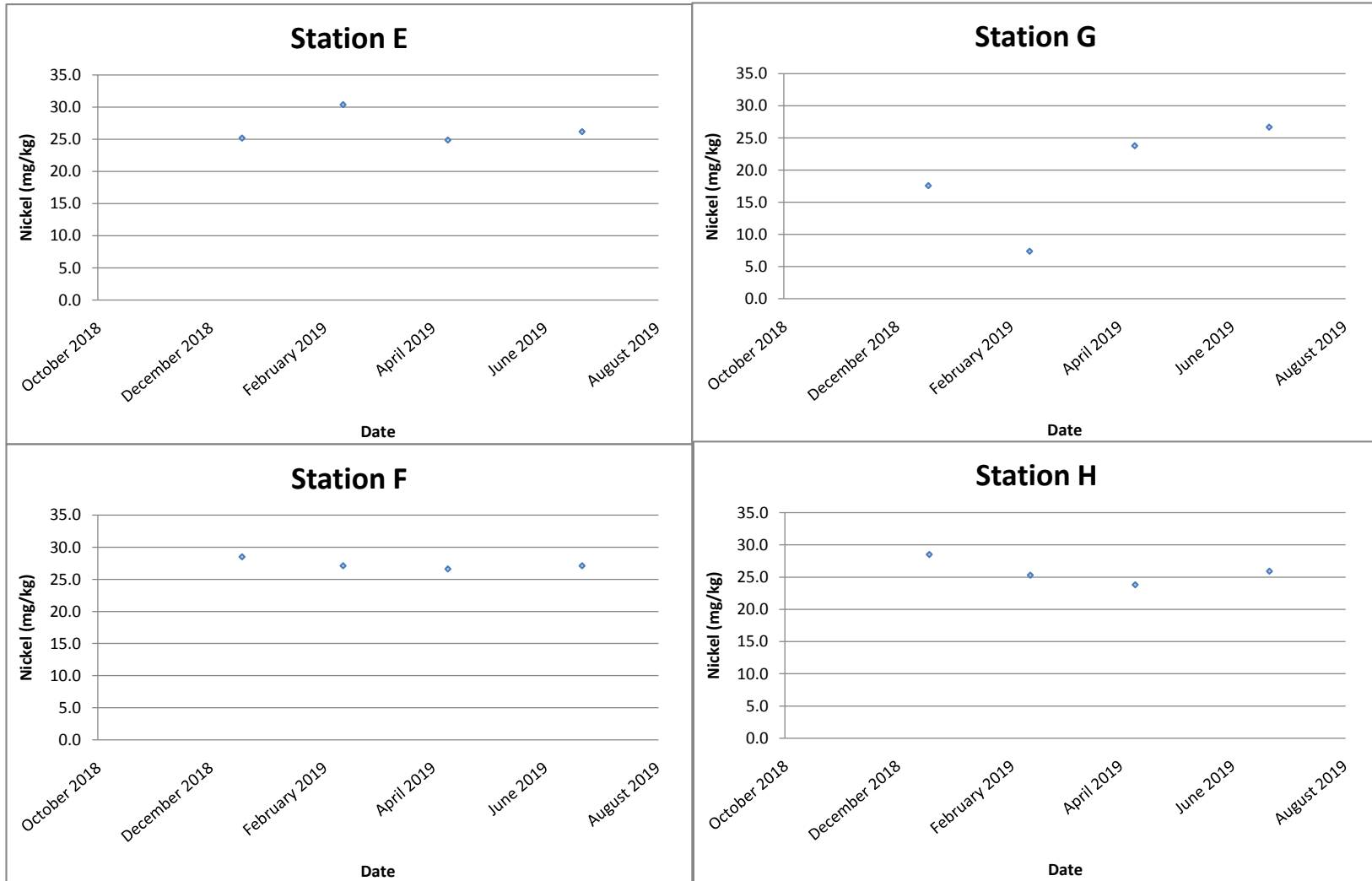
Mercury (mg/kg)



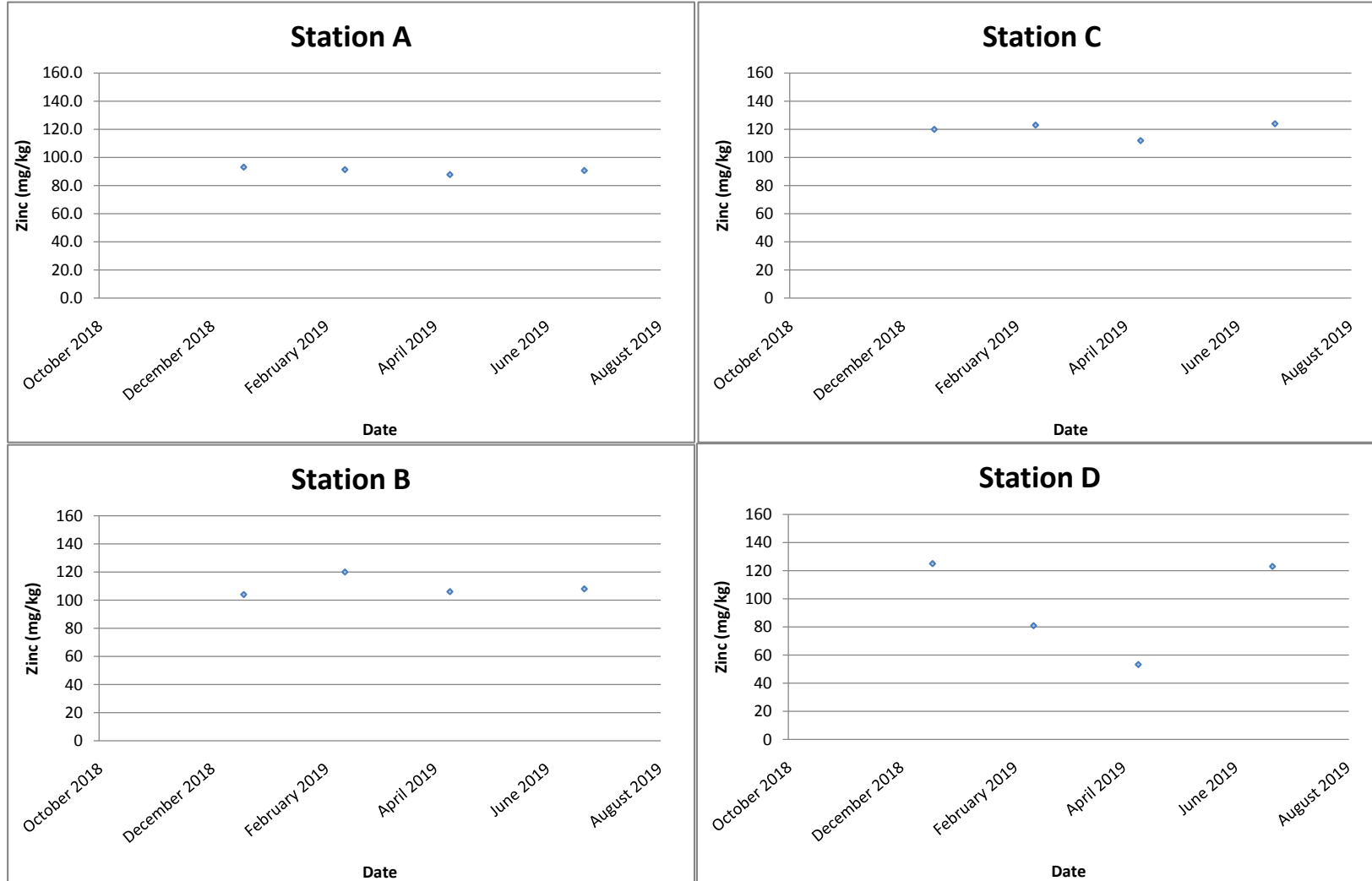
Nickel (mg/kg)



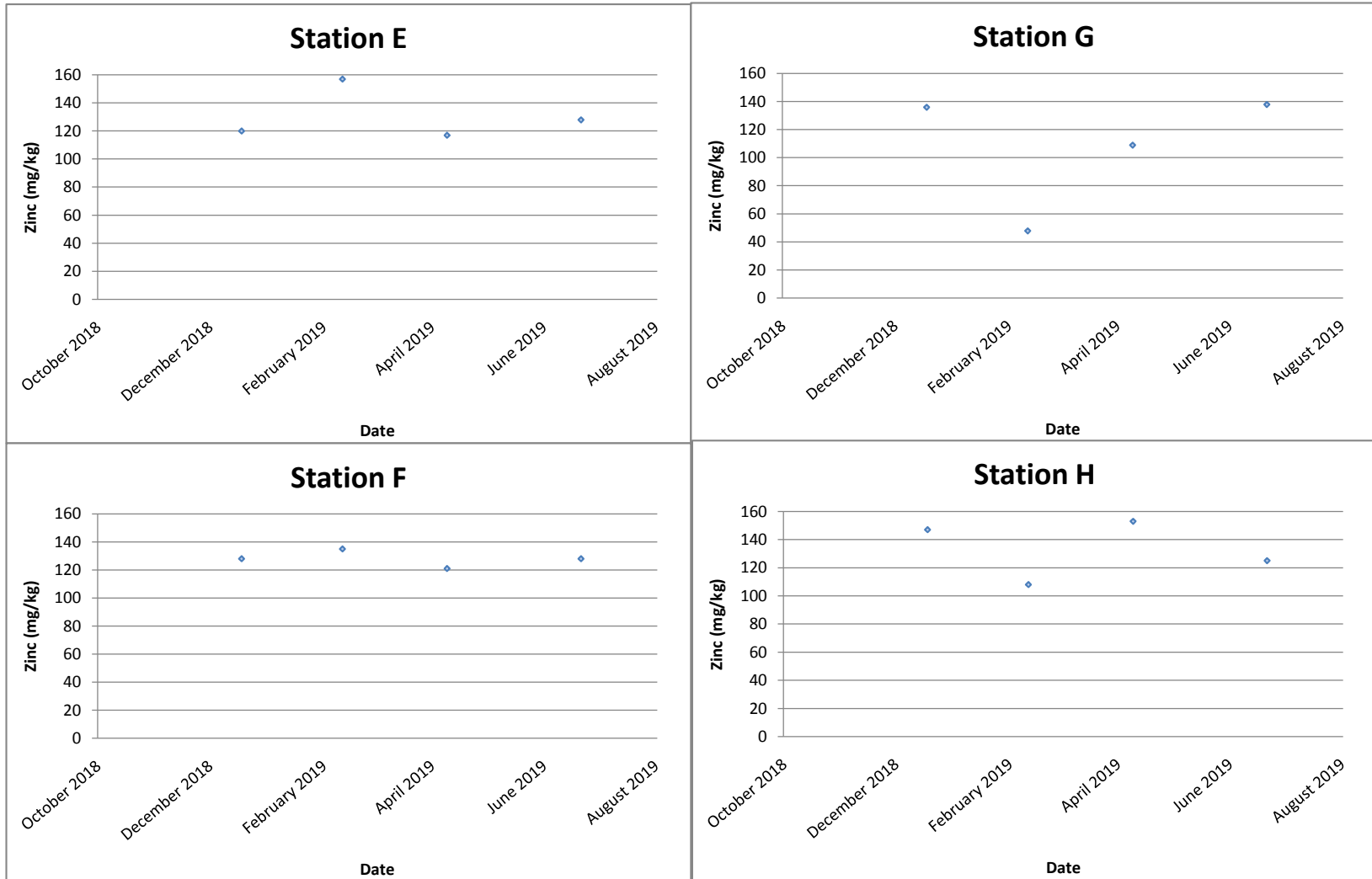
Nickel (mg/kg)



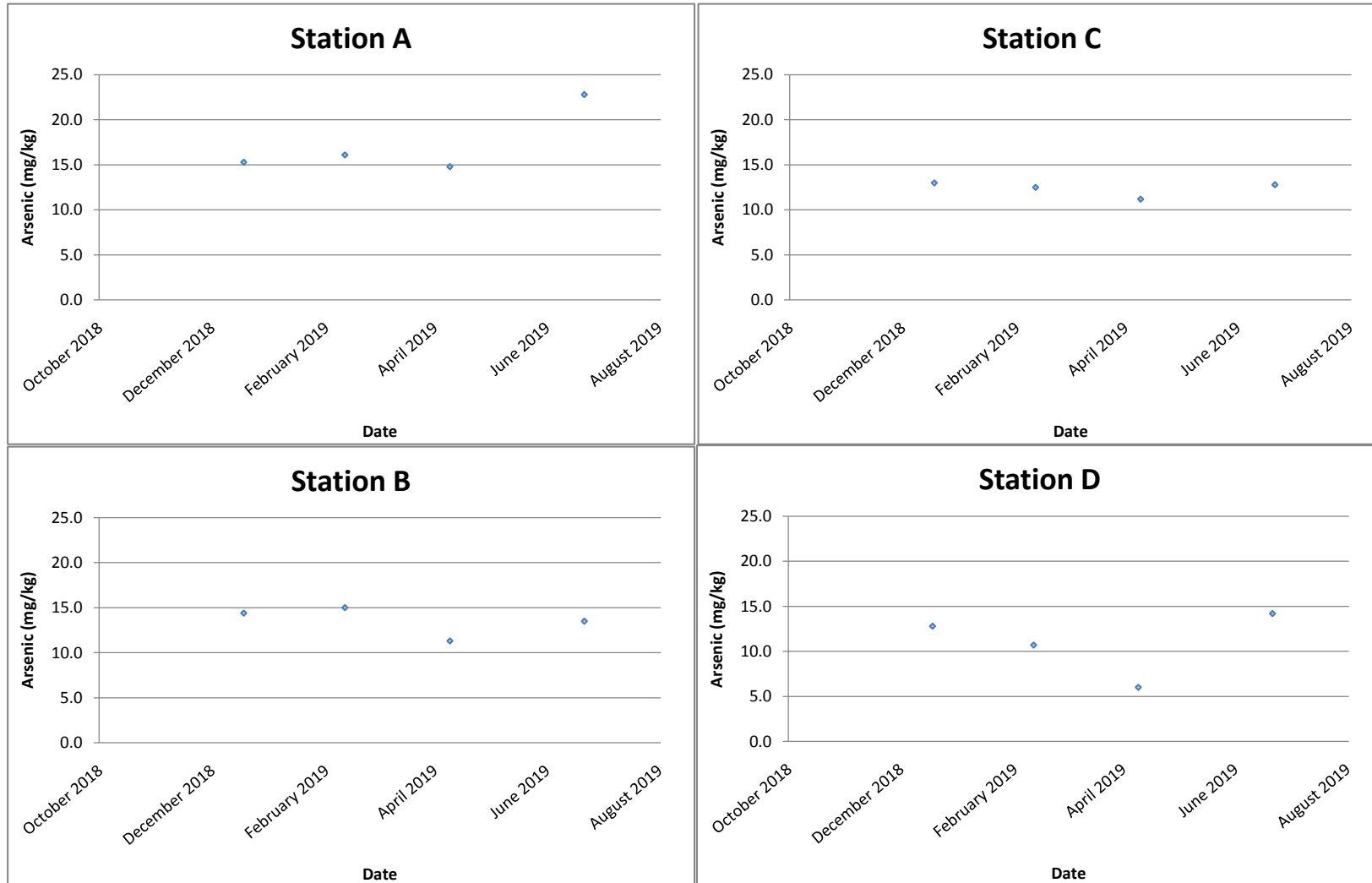
Zinc (mg/kg)



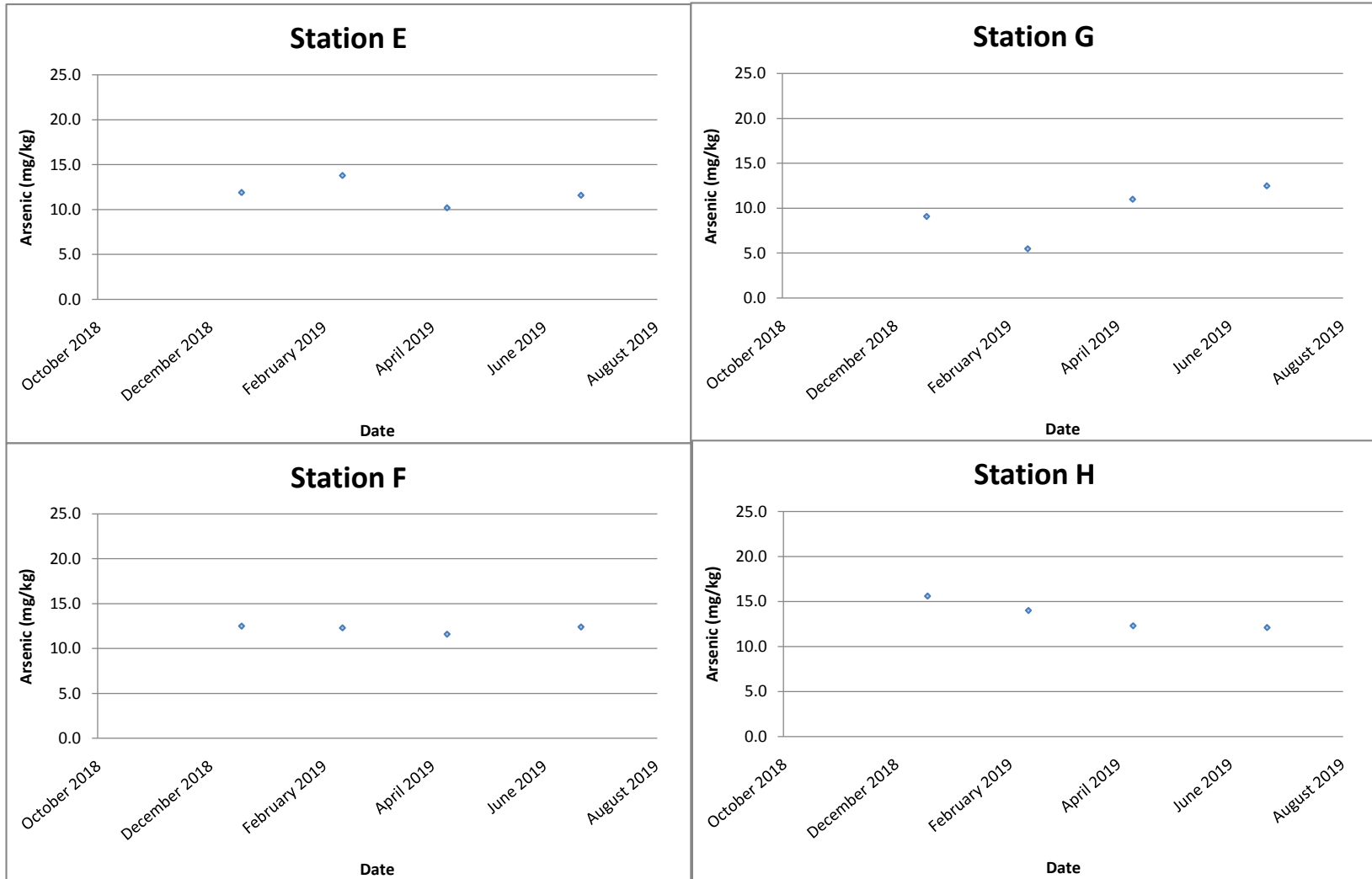
Zinc (mg/kg)



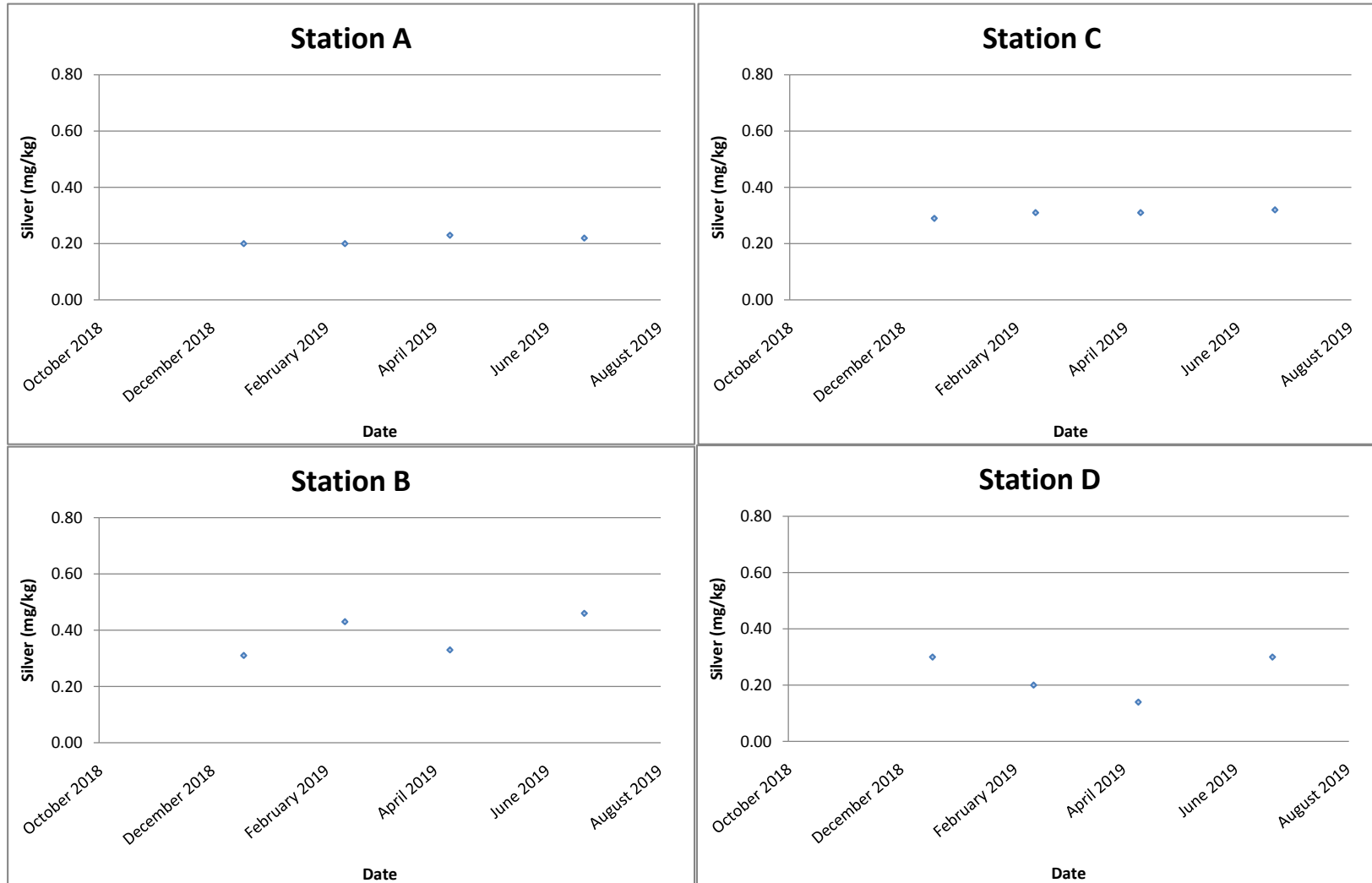
Arsenic (mg/kg)



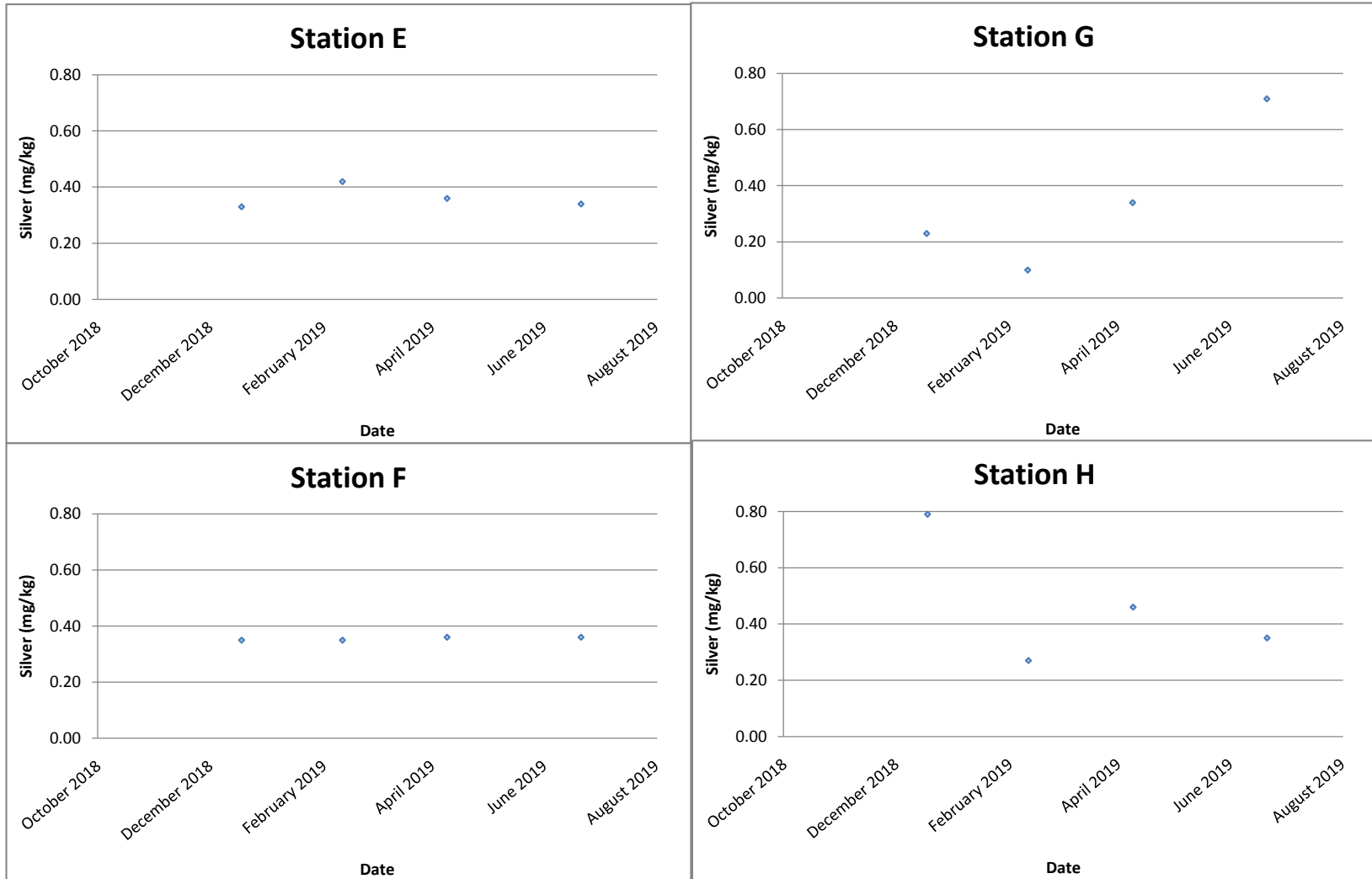
Arsenic (mg/kg)



Silver (mg/kg)



Silver (mg/kg)



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Appendix F

Environmental Mitigation Implementation Schedule (EMIS)

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EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
Air Quality					
NA	4.5	NA	Odour reduction measures like aeration, chemical dosing system shall be implemented to reduce any odour impacts to an acceptable level.	SHWSTW	Implemented
3.4	4.5	NA	Sewage treatment works including sludge thickening tanks, the sludge pump house and sludge press house shall be completely enclosed.	SHWSTW	Implemented
3.4	4.5	NA	Exhaust air shall be ventilated to an odour scrubber prior to discharge. Ventilating air to a biological treatment unit with 95% odour removal efficiency prior to stack exhaust shall be implemented	SHWSTW	Implemented
Water Quality					
3.3	NA	4.01	To avoid impacts on the marine ecology due to effluent discharge, the disinfection facility as in Part B of the EP shall be equipped with an UV disinfection system capable of removing at least 99.9% of E.coli from the sewage	SHWSTW	Implemented
Waste Management					
3.6	NA	NA	Transportation of sludge shall be carried out in fully enclosed containers, or be placed in sludge skips with tarpaulin covers	SHWSTW	Implemented
NA	NA	5.02	Trip-ticket system mentioned shall be implemented. Trip-ticket is required for each truckload delivered to the landfills facilities according to WBTC No. 31/2004.	SHWSTW	Implemented
NA	NA	5.02	The acceptance criteria for Landfill disposal should be followed, i.e. solid content of sludge waste should be more than 30%.	SHWSTW	Implemented
NA	NA	5.02	The disposal of grit & debris (if any) generated during primary screening works should follow the requirement set in the WMP Section 4.05.	SHWSTW	Implemented
NA	NA	5.03	The wet sludge should be temporarily stored at the sludge buffer tank. It should then be transported to the centrifuge building for dewatering and discharged to the container for disposal. The whole process should be managed by the automatic electronic electronic system and monitored by the operators during operation.	SHWSTW	Implemented
NA	NA	5.04	The other solid waste material such as sediment and grit, refuse containers or collection bags should be temporarily stored in slips at designated area. Operators should ensure sufficient space is identified and provided for temporary storage of waste materials to facilitate collection. Storage of waste material on site will be kept to a minimum to avoid nuisance to local residents.	SHWSTW	Implemented
NA	NA	5.05	Chemical wastes which likely to be generated by activities arise from the maintenance, shall followed the Waste Disposal (Chemical Waste) (General) Regulation, includes Schedule 1 of the Regulation.	SHWSTW	Implemented
NA	NA	5.06	In case of unlikely occurred chemical spillage, procedures should be followed as according to the WMP Section 5.06.	SHWSTW	Implemented
NA	NA	5.07	Temporary storage areas should be identify and provided for the temporary storage of general	SHWSTW	Implemented

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EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
			refuse to facilitate collection		
NA	NA	5.07	Domestics wastes refuse generated on-site will be stored in enclosed bins or compaction units separately	SHWSTW	Implemented
NA	NA	5.07	Sufficient dustbins should be provided for domestic waste if required.	SHWSTW	Implemented
NA	NA	5.07	Domestics wastes should be cleared daily and will be disposed off to the nearest licensed landfill or refuse transfer station.	SHWSTW	Implemented
NA	NA	5.07	Spearate labeled bins should be provided to segregate the waste generated by workforce. Waste recycle collector should be employed to collect the segregated waste	SHWSTW	Implemented
NA	NA	5.07	Cardboard and paper packaging (for plant, equipment and materials) should be recovered on site, properly stockpiled in dry condition and covered to prevent cross contamination by other materials.	SHWSTW	Implemented
NA	NA	5.07	Office waste should be minimized through using papers on both sides. Communication by electronic means should be used as far as possible.	SHWSTW	Implemented
NA	NA	5.07	The burning of refuse on-site is prohibited by law and shall not be undertaken	SHWSTW	Implemented
NA	NA	5.07	Toilet wastewater shall be transported to the STW for treatment	SHWSTW	Implemented
NA	NA	5.07	Arrangement for collection of recyclable materials by recycling contractors should be followed as according to the WMP Section 5.07.	SHWSTW	Implemented
NA	NA	5.08	All recycling materials removed by the recycling contractors should be properly recorded before the removal. The natures and quantities of the recycling materials, the date of removal and the name of the recycling contractor should be recorded.	SHWSTW	Implemented
NA	NA	5.09	To maintain the site in a clean and tidy condition during the operation, general measures specified in the WMP should be implemented on site at all times. Regular site inspections shall be undertaken by the management team to ensure the measures are implemented.	SHWSTW	Implemented
NA	NA	5.10	Daily cleaning should be performed daily after work within the plant and the public areas immediately next to the site.	SHWSTW	Implemented
NA	NA	5.11	The work officer in charge of the corresponding area should perform daily inspection on the items mentioned in the WMP Section 5.10. If observations were discovered, the work officer should record the result of the inspection on an inspection checklist with photos taken and submitted to the inspectors or Chief Technical Officer for review on the following day. Any deficiency should be rectified promptly.	SHWSTW	Implemented
NA	NA	5.12	Weekly tidying should be performed weekly within the site.	SHWSTW	Implemented
NA	NA	5.13	The inspector should perform Weekly Inspection on the items mentioned in the WMP Section 5.12. If observations were discovered, the work officer should record the result on an inspection checklist and submitted to the Chief Technical Officer for review on the following day. Any deficiency should be rectified promptly.	SHWSTW	Implemented

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EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
NA	NA	5.14	All wastes generated through the operational phase will be managed in accordance with the protocols set out in the WMP Section 5.14.	SHWSTW	Implemented

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