



Rhode Island

T. F. Green International Airport

Second Quarter 2024

Outfall Sampling

Prepared by:
Rhode Island Airport Corporation

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Background

The Rhode Island Pollutant Discharge Elimination System (RIPDES) permit (RI0021598) issued for Rhode Island TF Green International Airport (PVD) identifies a total of 16 perimeter outfalls. Outfalls 001A, 002A, 003A, 004A and 013A discharge to tributaries of Warwick Pond. Outfalls, 006A, 006B, 006C, 006D, 007A, 007B, 008A and 009A discharge to tributaries of Buckeye Brook downstream of Warwick Pond. Outfalls 010A, 011A, and 012A discharge to Tuscatucket Brook. Major outfalls, 002A, 003A, 008A, and 010A, are those outfalls which receive or may receive drainage from areas where aircraft deicing fluid is applied. Sampling for these major outfalls is defined at Part I.A.1 of the permit. Minor outfalls drain taxiways, runways and other paved services. Outfall 005A was combined with Outfall 006A during construction of Runway 34 Safety Area Improvements. Sampling for these minor outfalls is defined at Part I.A.2. of the permit. Additional sampling requirements are defined at Part I.A.5. and Parts I.C. and I.D. Table 1 lists parameters sampled. Figure 1 identifies outfall and in-stream sampling locations.

Industrial activities at PVD with the potential to impact stormwater quality include the use of glycol-based Aircraft Deicing and Anti-icing Fluids (ADFs/AAFs) and pavement deicers. Only propylene glycol (PG)-based ADFs/AAFs are used at PVD. Pavement deicers used at PVD include solid sodium formate, and liquid potassium acetate. No aircraft or pavement deicing material was applied during this event.

Summary of Storm

Second Quarter (April 1 through June 30) sampling includes the major outfalls (002A, 003A, 008A and 010A) hourly for twelve hours, and minor outfalls (001A, 004A, 006A, 007A, 009A, 011A, 012A and 013A) hourly for the first three hours. The sampling began upon a precipitation event of sufficient magnitude as specified in the RIPDES permit.

Precipitation began around 11:00 PM on June 26, 2024. Sampling commenced at 7:00 AM June 27, 2024 subsequent to measurable accumulation and continued until approximately 6:15 PM June 27, 2024.

A total of 0.96 inches of precipitation (as water equivalent) was measured at PVD between 11:00 PM June 26, 2024 and 6:00 AM June 27, 2024. Precipitation data is summarized in Table 2.

Summary of Flow

Flow meters are installed at three of the major outfalls: OF-002A, OF-003A, and OF-008A. Continuous flow measurements during the 12 hours of sampling were made using these Isco 2150 area velocity meters programmed to measure level and velocity and produce flow rate (GPM) at 15 minute increments. No flow meters are installed at minor outfalls or at outfall 010A, as it is off airport property.

Flow meters were not operational for this event. Maximum daily and average monthly flows were calculated using hourly precipitation during sampling and outfall drainage areas. Flows for the major outfalls are presented in Table 3. Flows for the minor outfalls are presented in Table 5. Estimated runoff volumes calculated using drainage area and total depth of precipitation for the entire event for all outfalls are presented in Table 7.

Sample Collection

The laboratory analytical parameters for each sample for this event are listed in Table 2. For the Second Quarter sampling event the major outfalls (002A, 003A, 008A, and 010A) were sampled hourly for twelve hours. There was no observed flow in the last four hours of sampling at Outfall 010A. The major outfall sampling results can be found in Tables 3 and 4.

The minor outfalls (001A, 004A, 006A, 007A, 009A, 011A, 012A, and 013A) were also sampled for the first three hours of the event. There was no observed flow at Outfalls 006A, 007A, 009A, 011A, and 013A. The minor outfall sampling results can be found in Tables 5 and 6.

Samples were collected and decanted into sample bottles based on the analysis necessary. The bottles were placed on ice in a cooler for transport to Rhode Island Analytical Laboratories (RIAL). Because of the short sample holding time (six hours) for some of the analytical parameters, all samples collected in the first three hours were delivered to the laboratory immediately after third hour sampling was complete. Samples collected in hours four (4) through twelve (12) were delivered at the completion of sampling.

RIAC also collected and recorded field measurements at each outfall for temperature, pH, and dissolved oxygen (DO).

Sampling Results

Tables 3-6 present a summary of field measurements and analytical results expressed as monthly average and maximum daily concentrations for both the major and minor outfalls. Table values presented as zero reflect data that was non-detect. Temperature and Oil and Grease are expressed as maximum daily only. pH is expressed as minimum daily and maximum daily.

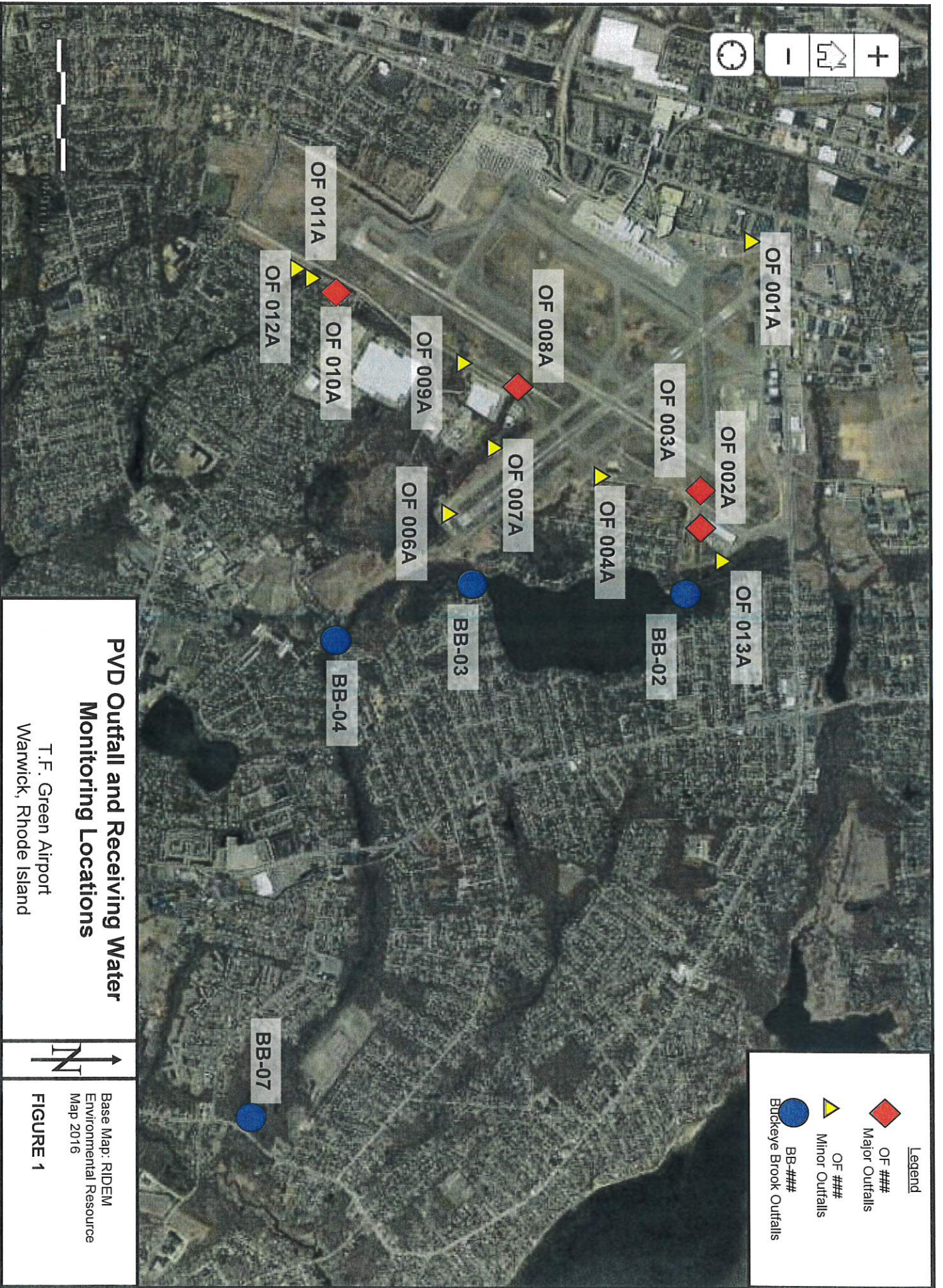


TABLE 1
 SAMPLING PARAMETERS
 RI T.F. GREEN INTERNATIONAL AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2024

Sample Identification	Hours 1-3	Hours 4-12
OF-001A, OF-004A, OF-006A, OF-007A, OF-009A, OF-011A, OF-012A, OF-013A	<ul style="list-style-type: none"> • TSS, BOD • Fecal coliform • Dissolved Potassium and Sodium • Oil & grease - 1664 • pH, Temperature, Dissolved Oxygen 	<ul style="list-style-type: none"> • BOD, Surfactants
OF-002A, OF-003A, OF-008A, OF-010A	<ul style="list-style-type: none"> • Fecal coliform • TSS, BOD, Surfactants • pH, Temperature, Dissolved Oxygen • COD, TOC • Oil & grease - 1664, TSS • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc) 	<ul style="list-style-type: none"> • pH, Temperature, Dissolved Oxygen • COD, TOC • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc)

BOD -Biological oxygen demand
 COD -Chemical oxygen demand
 TOC -Total organic carbon
 TSS -Total suspended solids
 pH, Temperature, and Dissolved Oxygen measured in the field

TABLE 2
PRECIPITATION AMOUNTS
RI T.F. GREEN INTERNATIONAL AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2024
June 24-27, 2024

Date	Total Precipitation (water equivalent, in inches)
June 24, 2024	0.00
June 25, 2024	0.00
June 26, 2024	0.44
June 27, 2024	0.52

TABLE 3
SAMPLING
MAJOR OUTFALLS
R.I.T.F. GREEN INTERNATIONAL AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2024

Parameter	Major Outfalls				Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
	Outfall 002A	Outfall 003A	Outfall 008A	Outfall 010A				
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Flow (gpd) ^{1, 6}	200,481	758,408	730,183	4,243,288	1,813,544	8,889,041	86,119	241,431
Oil & Grease (mg/l) ⁵		ND		ND		0.62		0.62
TSS (mg/l) ^{4, 5}	3.6	8.0	5.4	10.0	2.90	6.0	10.3	31.0
Fecal Coliform (MPN/100ml) ^{7, 5}	562.7	1,046.2	821.00	980.4	17,687,034.5	2,400,000,000	860.1	1203.3
BOD ₅ (mg/l) ^{2, 6}	2.2	4.2	1.6	3.3	1.91	3.8	ND	ND
Propylene Glycol (mg/l) ^{2, 6}	ND	ND	ND	ND	ND	ND	ND	ND
COD (mg/l) ^{2, 6}	ND	ND	ND	ND	14.2	26	0.8	12
Dissolved Potassium (mg/l) ^{2, 6}	3,863	4,500	3,171	3,800	7,163	35,000	4,783	14,000
Dissolved Sodium (mg/l) ^{2, 6}	10,992	18,000	5,482	8,000	3,669	7,800	27,840	40,000
Surfactants (ug/l) ^{2, 6}	ND	ND	ND	ND	0.02	0.19	0.011	0.14
Dissolved Oxygen (mg/l) ^{2, 3}	7.26	7.97	7.07	7.40	5.38	6.28	6.76	7.74
TOC (mg/l) ^{2, 6}	3.01	3.6	2.75	4.0	5.24	8.1	1.54	2.1
Total Aluminum (ug/l) ^{2, 6}	22.0	71	49.3	78	219.9	410	91.7	530
Total Chromium (ug/l) ^{2, 6}	ND	ND	ND	ND	ND	ND	0.1	1.2
Total Copper (ug/l) ^{2, 6}	ND	ND	ND	ND	ND	ND	ND	ND
Total Iron (mg/l) ^{2, 6}	1.59	3.8	3.11	3.80	0.70	1.30	0.98	2.10
Total Lead (ug/l) ^{2, 6}	1.12	18	ND	ND	0.6	12	ND	ND
Total Zinc (ug/l) ^{2, 6}	5.4	21	15.4	27	6.6	13	ND	ND

¹ Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.

² Results reported as maximum daily were the maximum of the 12 samples collected during the 12 hours of sampling.

³ Results reported as average monthly were determined using the arithmetic average of the 12 samples collected during the 12 hours of sampling.

⁴ Results reported as average monthly were determined using the arithmetic average of the 3 samples collected (when available) during the first 3 hours of sampling.

⁵ Results reported as maximum daily were the maximum of the 3 samples collected (when available) during the first 3 hours of sampling.

⁶ Results reported as average monthly were determined by using a flow-weighted average of the 12 samples collected during the 12 hours of sampling.

⁷ Results reported as average monthly were determined by using a geometric mean of the 3 samples collected (when available) during the 3 hours of sampling.

⁸ Outfall 010A: Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.

BOD₅ - Biological oxygen demand 5-day test
 COD - Chemical oxygen demand
 gpd - Gallons per day
 mg/l - Milligrams per liter
 TOC - Total organic carbon
 TSS - Total suspended solids
 ug/l - Micrograms per liter

TABLE 4
FIELD SAMPLING RESULTS
MAJOR OUTFALLS
RI T.F. GREEN INTERNATIONAL AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2024

Parameter	Major Outfalls							
	Outfall 002A		Outfall 003A		Outfall 008A		Outfall 010A	
	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²
pH	6.58	7.17	6.66	6.98	6.42	6.63	6.60	6.89
Temperature (°F)		68.0		70.7		72.9		72.0

Bold text indicates exceedance of permit standards

¹ Results reported as minimum daily were the minimum of the samples collected during the 12 hours of sampling.

² Results reported as maximum daily were the maximum of the samples collected during the 12 hours of sampling.

TABLE 5
 SAMPLING RESULTS
 MINOR OUTFALLS
 RI T.F. GREEN INTERNATIONAL AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2024

Parameter	Minor Outfalls													
	Outfall 001A		Outfall 004A		Outfall 006A		Outfall 007A		Outfall 009A		Outfall 011A		Outfall 012A	
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Flow (gpd) ¹	NO FLOW	NO FLOW	599,985	4,511,426	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	924,894	6,954,490
Oil & Grease (mg/l) ³			1.10	1.0									6.43	8.3
TSS (mg/l) ^{2,3}			7.1	10.9									1.0	1.0
Fecal Coliform (MPN/100ml) ^{2,3}			ND	ND									ND	ND
BOD ₅ (mg/l) ^{2,3}			8.17	8.3									3.83	3.9
Dissolved Potassium (mg/l) ^{2,3}			3.20	3.2									8.10	8.2

¹ Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.

² Results reported as average monthly were determined using the arithmetic average of the 3 samples collected (when available) during the first 3 hours of sampling.

³ Results reported as maximum daily were the maximum of the 3 samples collected (when available) during the first 3 hours of sampling

gpd - Gallons per day
 mg/l - Milligrams per liter
 TSS - Total suspended solids

TABLE 6
 FIELD SAMPLING RESULTS
 MINOR OUTFALLS
 RI T.F. GREEN INTERNATIONAL AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2024

Parameter	Outfall 001A		Outfall 002A		Outfall 006A		Outfall 007A		Outfall 009A		Outfall 011A		Outfall 012A		Outfall 013A	
	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²
pH	NO FLOW		6.33		6.50		NO FLOW		NO FLOW		NO FLOW		5.98		6.13	
Temperature (°F)					64.8										64.5	

Minor Outfalls

Bold text indicates exceedance of permit standards

¹ Results reported as minimum daily were the minimum of the samples collected during the 3 hours of sampling.

² Results reported as maximum daily were the maximum of the samples collected during the 3 hours of sampling.

**TABLE 7
PVD RUNOFF VOLUME CALCULATION
R.T.F. GREEN INTERNATIONAL AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2024**

June 26-27, 2024

Precip (inches):

0.96

Drainage Basin ID	PVD Storm Water Discharge	Receiving Water	Drainage Area (ac)	cu ft precip	gal precip
1	Outfall 001A	Warwick Pond	5.9	20,560.3	153,791
2	Outfall 002A	Warwick Pond	93.4	325,480.3	2,434,593
3	Outfall 003A	Warwick Pond	119.8	417,479.0	3,122,743
4	Outfall 004A	Warwick Pond	30.1	104,892.5	784,596
4B	Outfall 004B	Buckeye Brook	2	6,969.6	52,133
4C	Outfall 004C	Buckeye Brook	3	10,454.4	78,199
6	Outfall 006A	Buckeye Brook	10.7	37,287.4	278,909
6B	Outfall 006B	Buckeye Brook	1.5	5,227.2	39,099
6C	Outfall 006C	Buckeye Brook	0.8	2,787.8	20,853
6D	Outfall 006D	Buckeye Brook	0.7	2,439.4	18,246
7	Outfall 007A	Buckeye Brook	9.6	33,454.1	250,237
7B	Outfall 007B	Buckeye Brook	1.2	4,181.8	31,280
8	Outfall 008A	Buckeye Brook	240.6	838,442.9	6,271,553
9	Outfall 009A	Buckeye Brook	38.4	133,816.3	1,000,946
10	Outfall 010A	Iuscattuket Brook	26	90,604.8	677,724
11	Outfall 011A	Iuscattuket Brook	14	48,787.2	364,928
12	Outfall 012A	Iuscattuket Brook	46.4	161,694.7	1,209,477
13	Outfall 013A	Warwick Pond	28	97,574.4	729,857
TOTAL AREA			672.1	2,342,134.1	17,519,163