

Rhode Island Airport Corporation

Second Quarter 2021

Outfall Sampling

T.F. Green Airport

Prepared by:
Rhode Island Airport Corporation

July 2021

Background

The RIPDES permit identifies a total of 16 perimeter outfalls at PVD. 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) for the first three hours. The sampling began upon a precipitation event of sufficient magnitude as specified in the RIPDES permit.

Light rain began falling around 10:00 AM on June 14, 2021. Sampling commenced at 12:00 PM (noon) subsequent to measurable accumulation and continued until approximately 11:15 PM June 14, 2021.

A total of 0.53 inches of precipitation (as water equivalent) was measured at PVD during this event. 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.

Maximum daily and average monthly flows for the major outfalls were calculated and are presented in Table 3. Maximum daily and average monthly flows for the minor outfalls were calculated and are presented in Table 5. Estimated runoff volumes calculated using drainage area and depth of precipitation 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 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 001A, 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 then placed on ice in a cooler for transport to 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. Samples collected in hours four through 12 were delivered at the completion of sampling.

RIAC also collected and recorded field measurements at each outfall for temperature, pH, specific conductance, 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.

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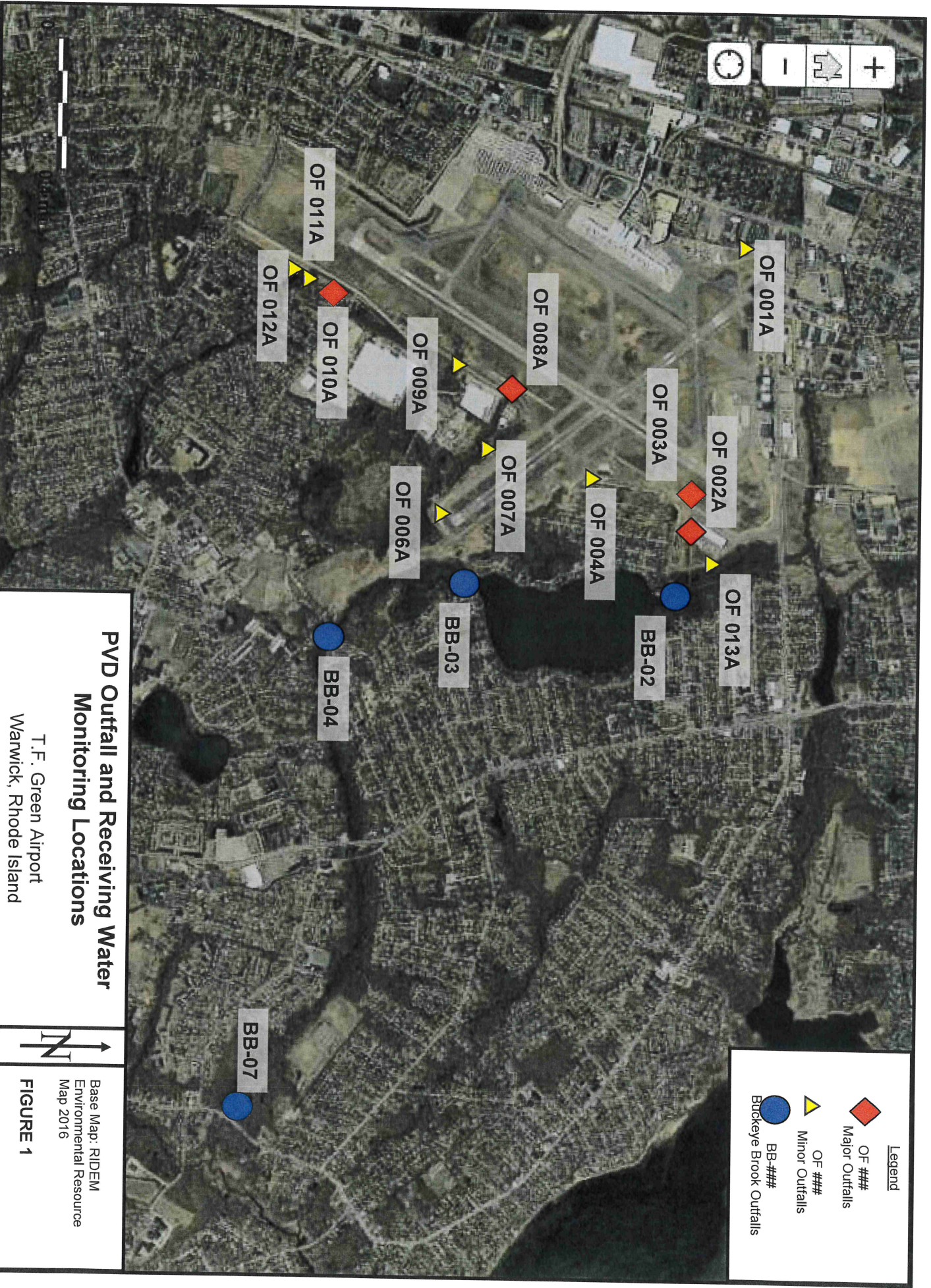
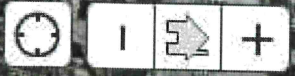
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Legend

- OF ### Major Outfalls
- OF ### Minor Outfalls
- BB-### Budekwe Brook Outfalls

**PVD Outfall and Receiving Water
Monitoring Locations**
T.F. Green Airport
Warwick, Rhode Island

Base Map: RIDEM
Environmental Resource
Map 2016

FIGURE 1

TABLE 1
 LABORATORY ANALYTICAL PARAMETERS
 T.F. GREEN AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2021

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, Dissolved Oxygen • Fecal coliform • Dissolved Potassium and Sodium • Oil & grease - 1664 • BOD, pH, and Temperature • Fecal coliform 	
OF-002A, OF-003A, OF-008A, OF-010A	<ul style="list-style-type: none"> • BOD, Surfactants, Dissolved Oxygen • pH and Temperature • 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"> • BOD, Surfactants, Dissolved Oxygen • pH and Temperature • 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

TABLE 2
PRECIPITATION AMOUNTS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2021
June 11 - 14, 2021

Date	Total Precipitation (water equivalent, in inches)
June 11, 2021	T
June 12, 2021	0.11
June 13, 2021	0.00
June 14, 2021	0.53

**TABLE 3
ANALYTICAL RESULTS
MAJOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2021**

Parameter	Major Outfalls							
	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) ^{1,8}	133,528	341,183	744,332	2,558,771	2,269,982	5,800,118	748,320	748,320
Oil & Grease (mg/l) ⁵		0.5		2.7		0.6		2
TSS (mg/l) ^{4,5}	10.2	15	3.63	4.3	8.5	15	39.8	100
Fecal Coliform (MPN/100ml) ^{7,5}	157	1,600	802	1,600	1,457	2,100	383.3	2300
BOD ₅ (mg/l) ^{2,6}	1.1	5.7	2.28	6.5	2.18	4.5	0.29	3.5
Propylene Glycol (mg/l) ^{2,6}	ND	ND	ND	ND	ND	ND	ND	ND
COD (mg/l) ^{2,6}	7.3	15	10.9	19	6.9	19	5.5	25
Dissolved Potassium (mg/l) ^{2,6}	1.7	2.9	2.53	4.60	2.28	3.80	5.05	8.10
Dissolved Sodium (mg/l) ^{2,6}	0.23	3.60	5.78	14.00	12.88	25.00	5.92	9.50
Surfactants (ug/l) ^{2,6}	178.2	320	145.1	210	150.0	230	90	300
Dissolved Oxygen (mg/l) ^{2,3}	6.25	6.87	7.20	8.10	6.60	7.04	4.75	5.74
TOC (mg/l) ^{2,6}	3.90	5.6	4.57	6.6	3.51	5.8	2.57	5.2
Total Aluminum (ug/l) ^{2,6}	134.4	210	558.1	1,600	118.5	250	290	2100
Total Chromium (ug/l) ^{2,6}	ND	ND	0.24	1.5	0.75	2.1	1.3	9.9
Total Copper (ug/l) ^{2,6}	ND	ND	ND	ND	ND	ND	1.7	20
Total Iron (ug/l) ^{2,6}	3.55	6.4	1.19	1.70	1.52	4.70	1.30	3.70
Total Lead (ug/l) ^{2,6}	1.35	2.6	0.30	2.0	ND	ND	2.3	20.0
Total Zinc (ug/l) ^{2,6}	ND	ND	ND	ND	ND	ND	ND	ND

¹ Results reported as average monthly were determined using the arithmetic average of measurement made every 15 minutes during the 12 hours of sampling. Results reported as maximum daily was the maximum flow measurements over the 12 hours of sampling. Both reported values were converted from GPM to GPD reflecting a 24 hour day

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 ANALYTICAL RESULTS
 MAJOR OUTFALLS
 T.F. GREEN AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2021

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	6.30	6.60	6.50	6.80	6.50	6.80	6.00	6.50
Temperature (°F)		68.0		66.3		68.1		68.9

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
ANALYTICAL RESULTS
MINOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2021

Parameter	Minor Outfalls															
	Outfall 001A		Outfall 004A		Outfall 006A		Outfall 007A		Outfall 009A		Outfall 011A		Outfall 012A		Outfall 013A	
	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	Average Monthly	Maximum Daily
Flow (gpd) ¹	NO FLOW	NO FLOW	433,162	433,162	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW
Oil & Grease (mg/l) ³				0.5												
TSS (mg/l) ^{2, 3}			3.1	3.3												
Fecal Coliform (MPN/100ml) ^{2, 3}			69	220												
BOD ₅ (mg/l) ^{2, 3}			1.07	3.2												
Dissolved Potassium (mg/l) ^{2, 3}			8.90	9.80												
Dissolved Sodium (mg/l) ^{2, 3}			4.45	5.10												

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 ANALYTICAL RESULTS
 MINOR OUTFALLS
 T.F. GREEN AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2021

Parameter	Outfall 001A		Outfall 004A		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		6.50	6.60	NO FLOW		NO FLOW		NO FLOW		NO FLOW		6.20	6.20	NO FLOW	
Temperature (°F)				61.5										66.7		

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
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2021**

June 14, 2021

Precip (inches): 0.53

Drainage Basin ID	PVD Storm Water Discharge	Receiving Water	Drainage Area (ac)	cu ft precip	gal precip
1	Outfall 001A	Warwick Pond	5.9	11,351.0	84,906
2	Outfall 002A	Warwick Pond	93.4	179,692.3	1,344,098
3	Outfall 003A	Warwick Pond	119.8	230,483.2	1,724,014
4	Outfall 004A	Warwick Pond	30.1	57,909.4	433,162
4B	Outfall 004B	Buckeye Brook	2	3,847.8	28,782
4C	Outfall 004C	Buckeye Brook	3	5,771.7	43,172
6	Outfall 006A	Buckeye Brook	10.7	20,585.7	153,981
6B	Outfall 006B	Buckeye Brook	1.5	2,885.9	21,586
6C	Outfall 006C	Buckeye Brook	0.8	1,539.1	11,513
6D	Outfall 006D	Buckeye Brook	0.7	1,346.7	10,074
7	Outfall 007A	Buckeye Brook	9.6	18,469.4	138,151
7B	Outfall 007B	Buckeye Brook	1.2	2,308.7	17,269
8	Outfall 008A	Buckeye Brook	240.6	462,890.3	3,462,420
9	Outfall 009A	Buckeye Brook	38.4	73,877.8	552,606
10	Outfall 010A	Tuscatucket Brook	26	50,021.4	374,160
11	Outfall 011A	Tuscatucket Brook	14	26,934.6	201,471
12	Outfall 012A	Tuscatucket Brook	46.4	89,269.0	667,732
13	Outfall 013A	Warwick Pond	28	53,869.2	402,942
TOTAL AREA			672.1	1,293,053.2	9,672,038