Rino Filtration System Investigation

Rino Ecosystems Inc.

Distribution by Fisher Environmental:
Rino Ecosystems Inc. 5 Copies

Project: FE-P601 **June 1997**

Fisher Associates Environmental Engineers Limited
Toronto, Montreal, Buffalo

Head Office:
400 Esna Park, #15
Markham, Ontario
L3R 3K2

EXECUTIVE SUMMARY

Rhino Ecosystems Inc. has developed a pre-filtration system which will decrease the cleaning frequency and blockages of the grease traps. The unit is installed before the grease trap. The MOEE Sewer-Use By-Laws regulate the Biological Oxygen Demand, Total Suspended Solids, Oil and Grease loadings to the sewer system. Currently, restaurants are not regulated but have to install mandatory grease traps. Yearly loadings to the sewer system are expensive in the treatment of the waste. Also this prefiltration system would reduce the amount of waste that would not be efficiently removed by the preexisting grease trap.

Fisher Environmental tested the efficiency of the system in decreasing the above three parameters. Four restaurants in the Toronto area were sampled in the study. In most cases, the removal of total suspended solids, oil and grease were greater than 75 %. The Biological Oxygen Demand removal ranges from 40 to 90 % depending on the restaurant's discharge qualities. The optimum removal occurred after the filter bag was preconditioned with solid particulate matter.

TABLE OF CONTENTS

INTRODUCTION

Rhino Ecosystems Inc. has developed a filtration system to reduce the amount of food waste solids and grease entering the sewage system. The installation would be typically before an existing grease trap filtration system. The restaurant industry would be benefitted by this product. Previously, the restaurant industry utilized grease traps to remove oil and grease and solid matter. A major problem is the undersizing of the traps which will provide minimal grease separation. Another drawback are the gradual buildup of oil and grease in the sewers causing blockages and odours. Increased expenses are incurred due to down-time for clearing of blockages and increased number of grease trap cleaning.(KPMG)

Fisher Environmental Laboratory Inc. was commissioned by Rhino Ecosystems Inc. to undertake sampling and analysis for the RINO filtration system.

BACKGROUND

The filtration unit consists of a disposable filtration bag. The bag is produced from nylon with a range of 200 to 400 needle counts with 30-1 to 80-2 nylon twists. The elasticity of the bag allows the formation of new passages for the liquids to discharge and breakage of the bag is prevented. Changing of the filtration bag depends on the restaurants discharge rate. The disposal of the bag is through the existing disposal system.

A schematic diagram of the Rino Filtration system is inserted in Appendix A. The wastewater will flow by gravity into the cap (waterfeed cap) situated at the top of the unit directly into the filter bag. The discharged water should contain less particulate matter. The water shall then drain from the bag into the discharge area which is connected to the outlet plumbing leading to the grease trap and/or sewage system. A pump or gravity model may be used depending on the requirements of the location. (KPMG)

Rhino Ecosystems Inc. conducted a product testing period of several restaurants. For Steve's restaurant, a monthly test was done for the business hours from 6 a.m. to 9 p.m. The filtration bag containing the trapped solids was weighed. From a total of 18,700 meals served, 203 lb of waste was removed by the pre-grease trap filtration Rino system. Mid way through the month, the filtration bag was changed to a coated filtration bag. This type of bag and increased business in the establishment, resulted in higher removal of solids. The KFC restaurant collected 190 lb in one month and another monthly trial resulted in 272 lb of waste grease and solids collection. Daily logs are inserted in Appendix B. Rakers and California collected an average of 150 lb per month. Therefore, the costs of treatment to the sewage treatment plant are greatly decreased.

The MOEE developed a Model Sewer-Use By-Law to control discharges to sanitary, combined and storm sewers in Ontario. Municipalities have adopted or slightly modified these by-laws. The sewer use bylaw sets limits on discharges of oil and grease 50 PPM (Parts per Million), BOD (Biological Oxygen Demand) 300 PPM, and TSS (Total Suspended Solids) 350 PPM. These three parameters are of concern to the restaurant industry. (Phyper, 1991)

The biochemical oxygen demand (BOD) determination is an empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of wastewaters, effluents, and polluted waters. The test measures the oxygen utilized during a five day incubation period for the biochemical degradation of organic material. The oil and grease is extracted from the effluent water with dichloromethane. The measurement is done by gravimetric analysis. Total Suspended Solids are determined gravimetrically; such that these are the portion of total solids retained by a filter. (Standard Methods, 1989)

EXPERIMENTAL PROTOCOL

The main objective is to show that the filtration device is effective in the removal of solids during real situations such as operating restaurants. The sampling was done by Fisher Environmental employees. The test involves taking samples of effluent before and after the RINO filtration system. The sampling time was accomplished during peak periods of operation. Table 1 illustrates the sampling conditions for each restaurant. The optimum efficiency characteristics of the RINO filtration system will be determined. Several trials were conducted using a new bag and a preconditioned bag with previously trapped solid matter.

Table 1: Fisher Environmental Sampling Protocol

Restaurant	Filtration Bag Condition	Sampling Day	Sampling Time
KFC 2032 Kipling Ave. N. Rexdale, ON - M9W 1J9	Bag contained solids	June 3, 1997	10:45 a.m.
Rakers Billiards and Sports Bar 2625 Weston Rd. Building C, Unit 31 North York, ON	New bag	June 3, 1997	1:20 p.m.
Steve's Restaurant 3788 Bathurst St. North York, ON	New bag	June 4, 1997	8.45 a.m.
California Sandwich 2197 Queen St. E. Toronto, ON M4E 1ES	Bag contained solids	June 11, 1997	4:30 p.m.

In order to determine the effectiveness of the system, four different restaurants were included in the study. A fast food chain was included since it would be discharging large amounts of grease. Three other restaurants had varying menus so that the amount of grease and solids would vary. The test restaurants were KFC, Rakers, Steve's Restaurant, and California.

RESULTS

The certificate of analysis are inserted in Appendix C.

OBSERVATIONS

KFC Restaurant

The KFC restaurant resulted in 97.5 % removal of solids. The oil and grease removal was slightly lower at a value of 84 %. Optimal removal of solids and oil and grease resulted due to the preexisting solid material present in the filter. The removal efficiency of BOD is between 40 to 60% as compared to Rakers Restaurant.

Rakers Restaurant

The TSS removal was below the 80% compared to the KFC and the California. The other two restaurants contained filtration bags which were previously conditioned with solid particulate matter. The Rakers filtration bag was changed before sampling was commenced. As a result the lack of particulate matter, caused a slightly lower removal. But the removal was not as low as Steve's Restaurant. The particulate matter consisted of larger particles therefore satisfactory removal was obtained. The oil and grease removal was minimal. At higher temperatures, the viscosity of oils decreases allowing the passage of the material through the filter bag pores. The lack of particulate matter within the bag allowed the hot water and oil mixture to pass through the pores. Sufficient BOD removal was achieved.

Steve's Restaurant

Steve's restaurant had different conditions imposed. The filter bag was new and no previous flow of wastewater was put through the bag before sampling was done. The removal of the oil and grease was efficient with a percentage of 82. But the solids removal was very low. Upon observation of the samples, there was a

white powder-like substance (eg. starch, flour), on the bottom of the bottles. The sample before and after the RINO both consisted of this substance. Since the bag was new it did not contain larger solid particles which would form a filter cake. This would aid in the further trapping of solids. The particles were smaller in size than the pores of the filter bag. The solids concentration was very high due to these particulates. The BOD removal efficiency was low due the presence of the starch material which increased the amount of carbon matter.

California Sandwich

California Sandwich indicated high removal efficiencies for all the parameters. The oil and grease was 89%, BOD, 91% and the TSS, 88.7%. The wastewater contained the lowest oil and grease concentration compared to the other three restaurants. The solids content was consistent to the value obtained at the KFC location were high removal was achieved. The bag contained solids which were collected prior to sampling therefore as the KFC location, the filter cake provided increased removal of solids. The solid particles were larger than Steve's restaurant, such that the effluent was much clearer in appearance than the discharged water before the RINO system filtration unit.

Comparison of Job # 97-3868 results

On April 16, 1997, Rhino Ecosystems Inc. submitted 4 samples for analysis. The certificate of analysis is inserted in Appendix D under JOB # 97-3868. The two restaurants of interest was KFC and Steve's. The parameter concentrations vary considerable due to the fact that the discharges to the sewer vary daily and hourly. The KFC restaurant coefficient of removal are comparable. The only exception is Steve's BOD value which is slightly lower than the previous results.

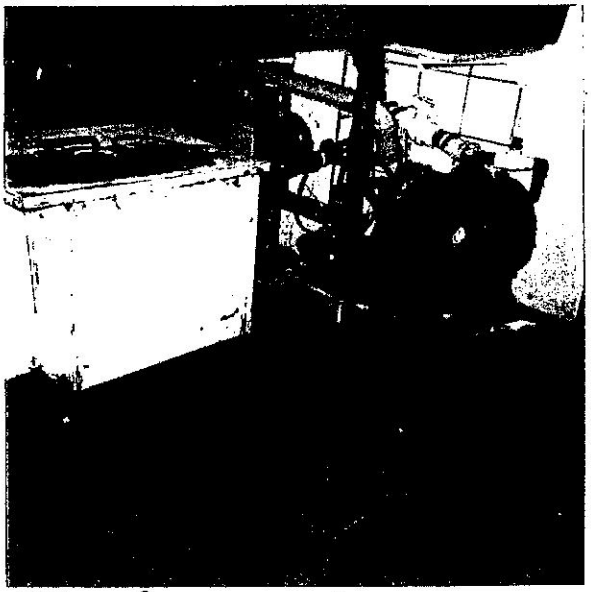
CONCLUSIONS

Overall efficiency rates are satisfactory in the removal of total suspended solids, biological oxygen demand, and oil and grease. In most cases, the removal of total suspended solids, and oil and grease are greater than 75 %. The BOD removal is variable depending on the restaurants discharge qualities. The optimum removal occurs after the filtration bag has been preconditioned with solid particulate matter.

APPENDIX A

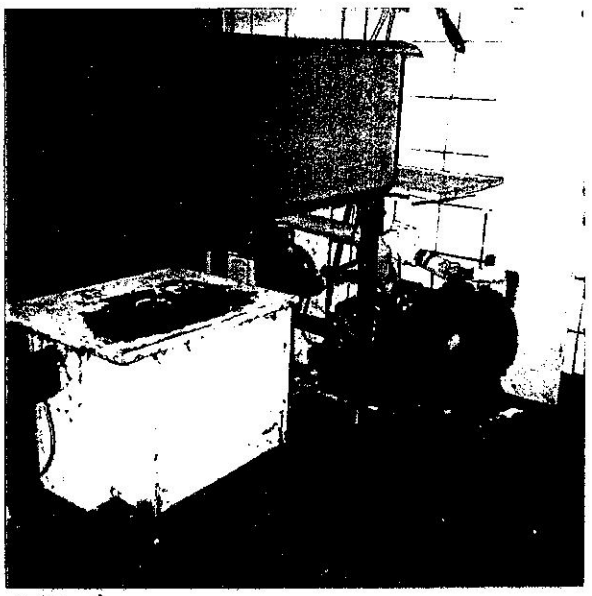
RHINO
Ecosystems Inc.
Refuse In Nothing Our

Ph. (416) 368-6618
Fx. (416) 365-2206

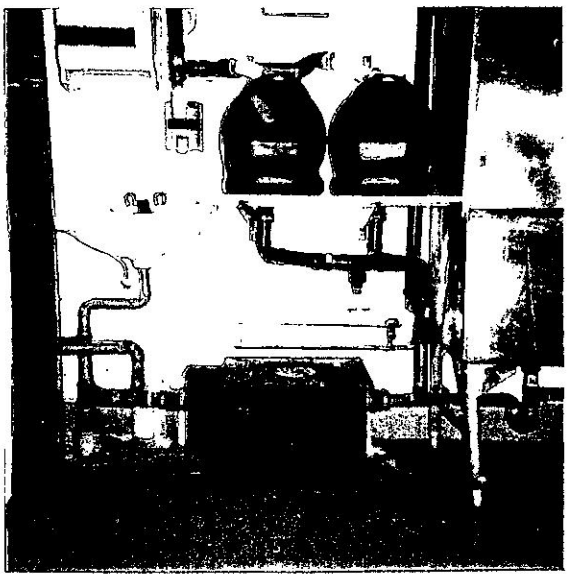


1 Rakers Sports Bar
2652 Weston Rd. Toronto
George Kandaharian (416) 249-7665

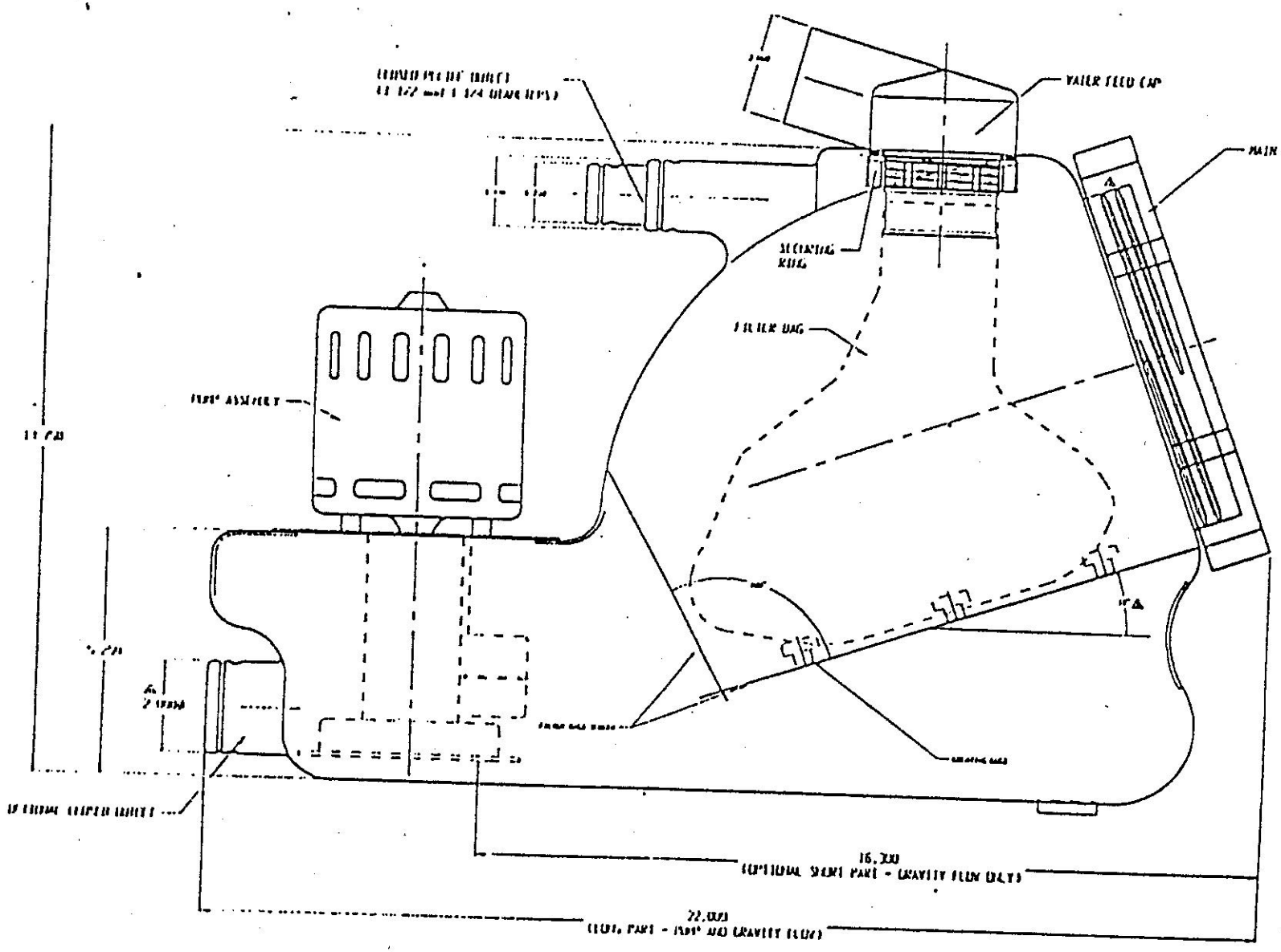
2 California Sandwiches
2197 Queen St. Toronto
Lino Tassone (416) 699-1662



Rakers
Rinotm Duplex Pump Unit



California Sandwiches
Rinotm Dual Gravity Units



RHINO

Ecosystems Inc

HIGH GREASE TRAP FILTRATION SYSTE

BLOW MOULD ENGINEERI

Fisher Environmental Laboratories

FULL RANGE ANALYTICAL SERVICES • COMPLIANCE PACKAGES
MOBILE LABORATORY • EMERGENCY SERVICES • CAEAL CERT.

400 ESNA PARK, # 15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718

Client: Rhino Ecosystems Inc.

Address: 125 Toryork Rd.
Toronto, ON
M9L 1X9

Attn.: Mr. Chuck Cini
Fax #: (416) 744-3256

Job #: 97-3998
Received: June 3, 1997
Reported: June 26, 1997

Certificate of Analysis

Analysis Requested: Oil and Grease, BOD, TSS
Sample Description: KFC Restaurant Effluent Samples

Parameter	Sample Concentrations		
	KFC into Rino	KFC out of Rino	Coefficient of Efficiency
Oil and Grease	24.7 %	4 %	84 %
BOD	10,750 PPM	4,580 PPM	57 %
TSS	40,560 PPM	1,020 PPM	97.5 %

Approved by: Radivoje Srejic
Radivoje Srejic, B.Sc., M.Sc.
Senior Chemist

Reviewed by: L. Barzelatto
Laura Barzelatto, M.Eng., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO CHARTERED Laura M. Barzelatto, M.Eng., C. Chem.

Fisher Environmental Laboratories

FULL RANGE ANALYTICAL SERVICES • COMPLIANCE PACKAGES · MOBILE LABORATORY • EMERGENCY SERVICES • CAEAL CERT.

400 ESNA PARK, # 15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718

Client: Rhino Ecosystems Inc.

Address: 125 Toryork Rd.
Toronto, ON
M9L 1X9

Attn.: Mr. Chuck Cini
Fax #: (416) 744-3256

Job #: 97-3998
Received: June 3, 1997
Reported: June 26, 1997

Certificate of Analysis

Analysis Requested: Oil and Grease, BOD, TSS
Sample Description: Rakers Restaurant Effluent Samples

Parameter	Sample Concentrations		
	Rakers into Rino	Rakers out of Rino	Coefficient of Efficiency
Oil and Grease	11.1 %	10.8 %	3 %
BOD	3,060 PPM	1,790 PPM	41.5 %
TSS	6,530 PPM	1,983 PPM	69.6 %

Approved by: Radivoje Srejic
Radivoje Srejic, B.Sc., M.Sc.
Senior Chemist

Reviewed by: L. Barzelatto
Laura Barzelatto, M.Eng., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO CHARTERED Laura M. Barzelatto, M.Eng. CHEMIST

Fisher Environmental Laboratories

FULL RANGE ANALYTICAL SERVICES • COMPLIANCE PACKAGES
MOBILE LABORATORY • EMERGENCY SERVICES • CAEAL CERT.

400 ESNA PARK, # 15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718

Client: Rhino Ecosystems Inc.

Address: 125 Toryork Rd.
Toronto, ON
M9L 1X9

Attn.: Mr. Chuck Cini
Fax #: (416) 744-3256

Job #: 97-3998
Received: June 4, 1997
Reported: June 26, 1997

Certificate of Analysis

Analysis Requested: Oil and Grease, BOD, TSS
Sample Description: Steve's Restaurant Effluent Samples

Parameter	Sample Concentrations		
	Steve's into Rino	Steve's out of Rino	Coefficient of Efficiency
Oil and Grease	90.6 %	16.9 %	82 %
BOD	43,250 PPM	36,415 PPM	15 %
TSS	45,310 PPM	38,960 PPM	14 %

Approved by: Radivoje Srejic
Radivoje Srejic, B.Sc., M.Sc.
Senior Chemist

Reviewed by: L. Barzelatto
Laura Barzelatto, M.Eng., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Laura M. Barzelatto, M.Eng.
THE

Fisher Environmental Laboratories

FULL RANGE ANALYTICAL SERVICES • COMPLIANCE PACKAGES
MOBILE LABORATORY • EMERGENCY SERVICES • CAEAL CERT.

400 ESNA PARK, # 15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718

Client: Rhino Ecosystems Inc.

Address: 125 Toryork Rd.
Toronto, ON
M9L 1X9

Attn.: Mr. Chuck Cini
Fax #: (416) 744-3256

Job #: 97-3868
Received: April 16, 1997
Reported: April 22, 1997

Certificate of Analysis

Analysis Requested: Oil and Grease, BOD, TSS
Sample Description: 4 Effluent Samples

Parameter	Sample Concentrations					
	KFC into Rino	KFC out of Rino	Coefficient of Efficiency	Steve's into Rino	Steve's out of Rino	Coefficient of Efficiency
Oil and Grease	3.54 %	0.07 %	98 %	4.98 %	1.18 %	76 %
BOD	2,400 PPM	1,470 PPM	39 %	3,000 PPM	1,760 PPM	41 %
TSS	14,657 PPM	747 PPM	95 %	3,557 PPM	2,967 PPM	17 %

Approved by: Radivoje Srejic
Radivoje Srejic, B.Sc., M.Sc.
Senior Chemist

Reviewed by: L. Barzelatto
Laura Barzelatto, M.Eng., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO CHARTERED CHEMIST

Fisher Environmental Laboratories

FULL RANGE ANALYTICAL SERVICES • COMPLIANCE PACKAGES
MOBILE LABORATORY • EMERGENCY SERVICES • CAEAL CERT.

400 ESNA PARK, # 15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718

Client: Rhino Ecosystems Inc.

Address: 125 Toryork Rd.
Toronto, ON
M9L 1X9

Attn.: Mr. Chuck Cini
Fax #: (416) 744-3256

Job #: 97-3998
Received: June 11, 1997
Reported: June 26, 1997

Certificate of Analysis

Analysis Requested: Oil and Grease, BOD, TSS
Sample Description: California Sandwich Effluent Samples

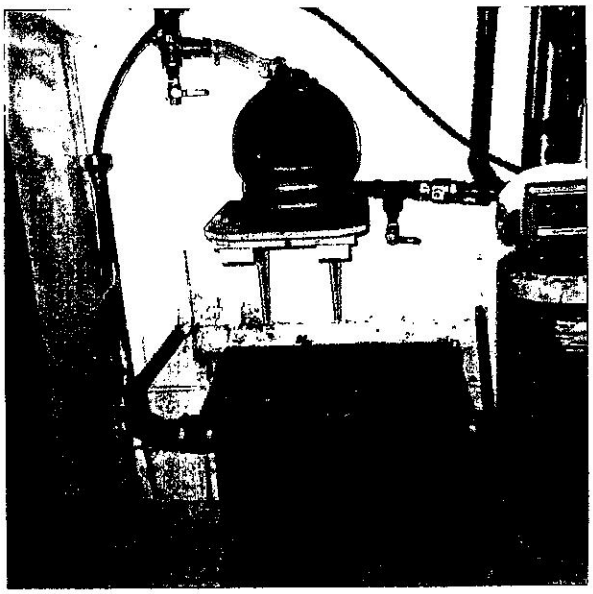
Parameter	Sample Concentrations		
	California into Rino	California out of Rino	Coefficient of Efficiency
Oil and Grease	6 %	0.7 %	89 %
BOD	10,680 PPM	950 PPM	91.1 %
TSS	31,255 PPM	3,525 PPM	88.7 %

Approved by: Radivoje Srejic
Radivoje Srejic, B.Sc., M.Sc.
Senior Chemist

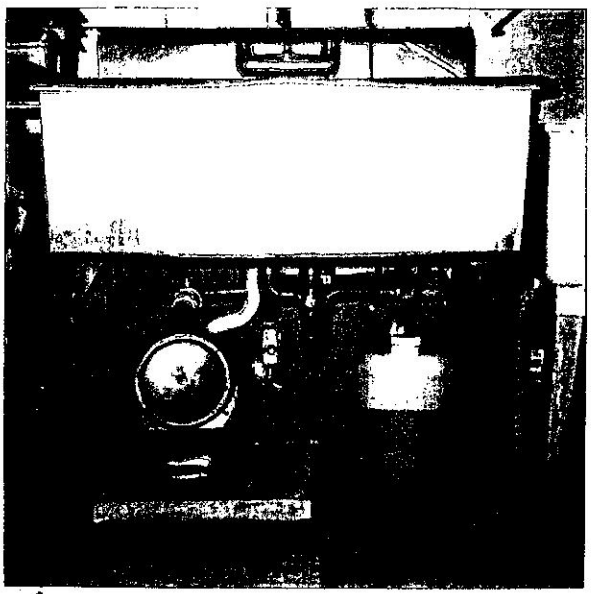
Reviewed by:
Laura Barzelatto, M.Eng., C. Chem.
Laboratory Manager

3 Steve's Restaurant
3788 Bathurst St. Toronto
George Nastos (416)633-8812

4 Acquazzura Ristorante
137 Avenue Rd. Toronto
Tony Didiano (416)920-4946



Steve's
Rinom Single Gravity Unit



Acquazzura
Rinom Duplex Pump Unit

Steve's Restaurant

DAY	DATE	TIME	VOLUME (mL)	WEIGHT (lb)
Wednesday	Jan 24	5 PM to 9 PM	220	3.5
Thursday	Jan 25	6 PM to 9 PM	200	4
Friday	Jan 26	6 AM to 9 PM	750	4
Saturday	Jan 27	6 AM to 9 PM	700	5.5
Sunday	Jan 28	6 AM to 9 PM	730	6
Monday	Jan 29	6 AM to 9 PM	500	3
Tuesday	Jan 30	6 AM to 9 PM	350	5
Wednesday	Jan 31	6 AM to 9 PM	300	3
Thursday	Feb 1	6 AM to 9 PM	275	3.5
Friday	Feb 2	6 AM to 9 PM	375	5.5
Saturday	Feb 3	6 AM to 9 PM	675	9
Sunday	Feb 4	6 AM to 9 PM	650	7.5
Monday	Feb 5	6 AM to 9 PM	450	5
Tuesday	Feb 6	6 AM to 9 PM	380	5
Wednesday	Feb 7	6 AM to 9 PM	450	8.5
Thursday	Feb 8	6 AM to 9 PM	595	7
Friday	Feb 9	6 AM to 9 PM	620	4.5
Saturday	Feb 10	6 AM to 9 PM	720	6.5
Sunday	Feb 11	6 AM to 9 PM	660	5.5
Monday	Feb 12	6 AM to 9 PM	400	5
Tuesday	Feb 13	6 AM to 9 PM	520	5.5
Wednesday	Feb 14	6 AM to 9 PM	400	4.5
Thursday	Feb 15	6 AM to 9 PM	530	6.5
Friday	Feb 16	6 AM to 9 PM	675	7.5
Saturday	Feb 17	6 AM to 9 PM	725	9.5
Sunday	Feb 18	6 AM to 9 PM	750	10
Monday	Feb 19	6 AM to 9 PM	550	5.5
Tuesday	Feb 20	6 AM to 9 PM	650	7.5
Wednesday	Feb 21	6 AM to 9 PM	700	8.5
Thursday	Feb 22	6 AM to 9 PM	550	6.25
Friday	Feb 23	6 AM to 9 PM	850	8
Saturday	Feb 24	6 AM to 9 PM	900	9.5
Sunday	Feb 25	6 AM to 9 PM	900	10.25

KFC

DAY	DATE	TIME	VOLUME (mL)	WEIGHT (lb)
Tuesday	July 16, 1996	4:00 PM	1200	4
Wednesday	July 17, 1996	6:10	2200	8
Thursday	July 18, 1996	12:00 PM	2800	8
Friday	July 19, 1996	11:00	1800	4
Friday	July 19, 1996	9:00	2800	8.5
Friday	July 19, 1996	7:00 PM	4000	10
Saturday	July 20, 1996	9:00	2800	8.5
Saturday	July 20, 1996	5:00	2600	8
Sunday	July 21, 1996	10:00	1900	5.5
Sunday	July 21, 1996	6:00 PM	1800	6
Monday	July 22, 1996	11:00	1800	5
Tuesday	July 23, 1996	10:00	1800	5
Wednesday	July 24, 1996	10:00	3600	10
Wednesday	July 24, 1996	8:40 PM	2600	8.5
Thursday	July 25, 1996	10:00	2600	7.5
Friday	July 26, 1996	8:40	2600	8.5
Friday	July 26, 1996	3:00 PM	-	7
Saturday	July 27, 1996	9:00	-	7
Saturday	July 27, 1996	5:00 PM	2600	7.5
Sunday	July 28, 1996	10:00	1000	4
Sunday	July 28, 1996	6:00 PM	2800	8
Monday	July 29, 1996	10:30	900	3
Tuesday	July 30, 1996	9:00	1500	5
Wednesday	July 31, 1996	10:00	1100	4

KFC

DAY	DATE	TIME	VOLUME (mL)	WEIGHT (lb)
Monday	June 24, 1996	9:00	3000	6.5
Monday	June 24, 1996	10:30	2000	7
Tuesday	June 25, 1996	8:30 PM	800	3
Wednesday	June 26, 1996	8:30 PM	1200	4.5
Friday	June 28, 1996	8:30	3500	8.5
Friday	June 28, 1996	6:30 PM	1500	5.5
Sunday	June 29, 1996	2:30 PM	1800	6
Monday	June 30, 1996	2:30 PM	2800	8
Tuesday	July 1, 1996	1:15 PM	1200	4
Wednesday	July 2, 1996	9:00	2000	6.5
Thursday	July 1, 1996			
Friday	July 3, 1996	11:30	1800	5
Saturday	July 4, 1996	10:00	1700	5
Sunday	July 5, 1996	9:00	2300	7
Monday	July 6, 1996	9:00	2600	8
Monday	July 6, 1996	7:30 PM	1800	5.5
Tuesday	July 7, 1996	1:00 PM	1800	5.5
Wednesday	July 8, 1996	2:00 PM	2100	6
Thursday	July 9, 1996	1:00 PM	500	2
Friday	July 10, 1996	1:00 PM	1800	5.5
Saturday	July 11, 1996	12:00	1200	5
Sunday	July 12, 1996	9:00	2800	7.5
Sunday	July 12, 1996	7:30 PM	3600	9
Monday	July 13, 1996	2:00 PM	3000	8
Tuesday	July 14, 1996	10:00	2000	6
Tuesday	July 14, 1996	8:00 PM	3000	8.5
Wednesday	July 15, 1996	2:00 PM	1200	3.5

REFERENCES

KPMG - Rhino Ecosystems Inc.

Phyper, John-David, Ibbotson, Brett, The Handbook of Environmental Compliance in Ontario, McGraw-Hill Ryerson Ltd., 1991