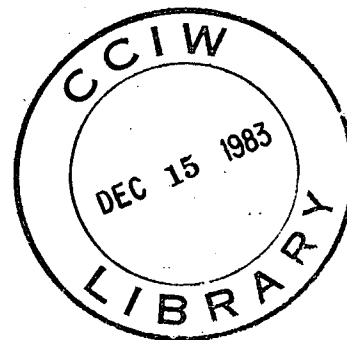


HYDRAULICS DIVISION
TECHNICAL NOTE



DATE:

November 15, 1983

REPORT NO:

83-25

TITLE:

Particle Size Data Report - Urban Runoff

AUTHOR:

G.A. Duncan

REASON FOR REPORT:

This report responds to a request for particle size data from J. Marsalek, Hydraulics Division, NWRI, Burlington, Ontario.

CORRESPONDENCE FILE NO: Study H83-302

1.0 INTRODUCTION

Four samples from the Urban Runoff Study were submitted to the laboratory by J. Marsalek for particle size analysis. The samples were collected at the Blair Road and Aldershot sites and consisted of two samples from the automatic sampler and two from the manual sampler. The samples were analysed using a sieve and sedigraph procedure. The samples were washed from their collection bottles, centrifuged to reduce the volume, and dried on the freeze-drier. Attempts to "clean" the samples using settling tube techniques and hydrogen peroxide (H_2O_2) were not successful. The sieve and sedigraph appeared to give the "best" results.

All the material has been retained in separate fractions, i.e., sieve fractions, silt and clay.

(NOTE: Silt and clay has a dispersant that may prevent chemical analysis being performed.)

2.0 PROCEDURE

The Sieve and Sedigraph Method which provides sand, silt, and clay percentages was used to analyze the samples. Briefly, the procedure consists of:

1. Splitting the sample to 2g.
2. Removing particles large enough to block Sedigraph Suction Tube (0.088 mm).
3. Dispersing sample in a Calgon suspension.
4. Automatic analysis with the Sedigraph.
5. Processing the results with SIZDIST: a FORTRAN IV computer program (Sandilands and Duncan, 1980)

3.0 RESULTS

For the Sieve and Sedigraph Method, the output consists of:

1. A histogram of the frequency distribution.
2. The percentage and cumulative percentages of the material occurring within 1/2 PHI unit.
3. Moment measures (Krumbein and Pettijohn, 1938) and graphic (Folk and Ward, 1957) statistics.
4. Percentiles.
5. Percent gravel, sand and silt/clay.
6. Ratios used to plot Folk's Ternary Classification.
7. Shepard (1954) and Fold (1974) Ternary Classification.

PHI CONVERSION

The results of samples analyzed in the Sedimentology Lab are presented using the PHI scale (Krumbein, 1934). The conversion from this PHI equation, $\phi = -\log_2 \xi$ (where ξ is the diameter in millimeters) to the Wentworth scale is listed below.

PHI (ϕ)	Millimeters	Microns	Wentworth Size Class
-5.0	32		
-4.5	24		
-4.0	16		Pebble (-2 to -6ϕ)
-3.5	12		
-3.0	8		
-2.5	6		
-2.0	4		
-1.5	2.83		Granule
-1.0	2.00		
-0.5	1.41		Very coarse sand
0.0	1.00		
0.5	0.71		Coarse sand
1.0	0.51	500	
1.5	0.35	350	Medium sand
2.0	0.25	250	
2.5	0.177	177	Fine sand
3.0	0.125	125	
3.5	0.088	88	Very fine sand
4.0	0.0625	62.5	
8.0	0.0039	3.9	Silt+ Clay+

4.0 REFERENCES

- Duncan, G.A. AND LaHaie, G.G. 1979. Size Analysis Procedures used in the Sedimentology Laboratory, NWRI. NWRI, CCIW, Hydraulic Division Manual, September 1979.
- Folk, R.L. 1968. Petrology of Sedimentary Rocks. Hemphill Publishing Co., Austin, Texas, 182 p.
- Folk, R.L. and Ward W.C. 1957. Brazos River Bar: A Study in the Significance of Grain Size Parameters. Jour. Sed. Petrology, V. 27, pp 3-26.
- Krumbein, W.C. and Pettijohn, F.J. 1938. Manual of Sedimentary Petrography. Appleton-Century-Crofts, New York, 549 p.
- Sandilands, R.G. and Duncan, G.A. 1980. SIZDIST - A Computer Program for Size Analysis. NWRI, CCIW, Hydraulics Division Technical Note, Report No. 80-08.
- Shepard, F.P. 1954. Nomenclature Based on Sand-Silt Ratios. Jour. Sed. Petrology, V. 24, pp. 151-158.

APPENDIX 1

SIZDIST OUTPUT

PHI FCT. CUMPCT.

11/15/83

1.50			
2.00	1.65	1.85	**
2.50	.98	2.83	*
3.00	2.24	5.07	**
3.50	1.56	6.63	**
4.00	.78	7.41	*
4.50	.29	7.70	
5.00	.28	7.98	
5.50	.29	8.26	
6.00	.56	8.82	*
6.50	1.40	10.22	*
7.00	4.21	14.43	****
7.50	4.21	18.64	****
8.00	2.81	21.44	***
8.50	2.81	24.25	***
9.00	5.61	29.86	*****
9.50	1.40	31.26	*
10.00	2.81	34.07	***
10.50	4.21	38.28	****
11.00	2.81	41.08	***
11.50	4.21	45.29	****
12.00	2.81	48.10	***
*****	51.90	100.00	*****

MEAN ST.DEV. SKEWNESS KURTOSIS

7.95 2.82 -.36 -.37

KRUMBEIN + PETTIJOHN (1938) MOMENT MEASURES FOR SIZE RANGE 2.0 TO 12.0 PHI

> 5 PERCENT OF THE FINES ARE NOT RESOLVED, OBTAIN FOLK STATS. GRAPHICALLY

PERCENTILES	MEDIAN*****	5TH 2.98	16TH 7.19	25TH 8.57
		75TH*****	84TH*****	95TH*****
PCT. GRAVEL	0.00	SAND 7.41	SILT (PIPETTE) 0.00	CLAY (PIPETTE) 0.00
			(SEDIGRAPH) 14.03	(SEDIGRAPH) 78.56
GRAVEL+SAND	7.41	SILT/(SILT+CLAY)	15.15PCT. GRAV+SAND/SILT+CLAY	.08
LABELS SHEPARD	-CLAY	FOLK(GMS)-MUD	(SCS)-CLAY	

COMMENTS - SAND FRACTION, QUARTZ, TAR BALLS, FIBROUS MATERIAL, SHELLS

PHI PCT. CUMPCT.

11/15/83

1.00

1.50	9.24	9.24	*****
2.00	4.31	13.55	****
2.50	3.29	16.84	***
3.00	2.98	19.82	***
3.50	1.84	21.46	**
4.00	1.64	23.10	**
4.50	.40	23.51	
5.00	.40	23.91	
5.50	.81	24.72	*
6.00	.81	25.53	*
6.50	2.43	27.96	**
7.00	3.24	31.20	***
7.50	2.43	33.62	**
8.00	3.24	35.86	***
8.50	2.43	39.29	**
9.00	2.43	41.72	**
9.50	3.24	44.96	***
10.00	3.24	48.19	***
10.50	1.52	49.81	**
11.00	3.24	53.05	***
11.50	3.24	56.29	***
12.00	4.05	60.34	****
****	39.66	100.00	*****

MEAN ST. DEV. SKEWNESS KURTOSIS

6.24 3.72 -.03 -1.49

KRUMBEIN + PETTIJOHN (1938) MOMENT MEASURES FOR SIZE RANGE 1.5 TO 12.0 PHI

> 5 PERCENT OF THE FINES ARE NOT RESOLVED, OBTAIN FOLK STATS. GRAPHICALLY

PERCENTILES	MEDIAN 10.53	5TH 1.27	16TH 2.37	25TH 5.67
		75TH*****	84TH*****	95TH*****
PCT. GRAVEL	0.00	SAND 23.10	SILT (PIPETTE) 0.00	CLAY (PIPETTE) 0.00
			(SEDIGRAPH) 13.76	(SEDIGRAPH) 63.14
GRAVEL+SAND	23.10	SILT/(SILT+CLAY)	17.89	PCT. GRAV+SAND/SILT+CLAY .30
LABELS SHEPARD	-SANDY CLAY	FOLK(GMS)-SANDY MUD		(SCS)-SANDY CLAY

COMMENTS - SAND FRACTION, QUARTZ, TAR BALLS, FIBROUS MATERIAL, SHELLS

23758

ALDERSHOT MANHOLE

SIEVE, SH. PIP., SEDIGRAPH SAMPLE WT.= .613

11/15/83

PHI PCT. CUMPCT.

-.50

0.00	1.01	1.01	*
.50	1.91	2.92	**
1.00	1.63	4.55	**
1.50	1.21	5.76	*
2.00	1.37	7.13	*
2.50	5.82	12.95	*****
3.00	2.22	15.17	**
3.50	1.47	16.64	*
4.00	1.29	17.93	*
4.50	.41	18.34	
5.00	.41	18.75	
5.50	1.64	20.39	**
6.00	6.16	26.55	*****
6.50	7.30	34.34	*****
7.00	7.39	41.73	*****
7.50	6.57	48.29	*****
8.00	4.92	53.22	*****
8.50	3.28	56.50	***
9.00	2.46	58.96	**
9.50	2.46	61.43	**
10.00	2.46	63.89	**
10.50	1.64	65.53	**
11.00	1.23	66.76	*
11.50	1.64	68.40	**
12.00	1.23	69.63	*
*****	30.37	100.00	*****

MEAN ST.DEV. SKEWNESS KURTOSIS

6.10 2.92 -.18 -.54

KRUMBEIN + PETTIJOHN (1938) MOMENT MEASURES FOR SIZE RANGE 0.0 TO 12.0 PHI

> 5 PERCENT OF THE FINES ARE NOT RESOLVED, OBTAIN FOLK STATS. GRAPHICALLY

PERCENTILES	MEDIAN	7.67	5TH	1.19	16TH	3.28	25TH	5.87
			75TH*****		84TH*****		95TH*****	
PCT. GRAVEL	0.00	SAND	17.93	SILT (PIPETTE)	0.00	CLAY (PIPETTE)	0.00	
				(SEDIGRAPH)	35.29	(SEDIGRAPH)	46.75	
GRAVEL+SAND	17.93	SILT/(SILT+CLAY)	43.00	PCT. GRAV+SAND/SILT+CLAY			.22	

LABELS SHEPARD -SILTY CLAY FOLK(GMS)-SANDY MUD (SCS)-SANDY MUD

COMMENTS - SAND FRACTION, QUARTZ, TAR BALLS, FIBROUS MATERIAL, SHELLS (SEEDS)