

Attachment A

Literature Review Matrix

METRO FOOD GRINDER STUDY LITERATURE SEARCH MATRIX

category	document title, date	rating & comments
methods of dealing with grinders	<ol style="list-style-type: none"> 1. Kitchen Garbage Grinders in New York City, February 1991 	
treatment process effects	<ol style="list-style-type: none"> 1. The Effect of Organic Amendments From Garbage Grinding on a Biological Treatment System, June 1972 2. Addition of Garbage to Sewage, November 1950 3. Metcalf & Eddy, Wastewater Engineering - Treatment, Disposal, and Reuse 4. Kitchen Garbage Grinders in New York City, February 1991 5. MEMO: Review of the impact resulting from use of garbage disposals for food waste disposal on the West Point treatment plant, September 1988 6. West Point project data 7. MEMO: Garbage Disposal Use, August 1988 8. Waste Segregation as a Means of Enhancing Onsite Wastewater Management, August 1977 9. Food Waste Disposers - Their Effects on the Sewer System, June 1962 10. An Economic Evaluation of Garbage Grinding vs. surface collection and disposal, November 1971 11. Estimating Food Waste Loading on Sewage Treatment, June 1949 12. Effects of Community Wide Installation of Household Grinders on Environmental Sanitation, 1952 13. Ground Garbage - It's Effect upon the Sewer System and Sewage Treatment Plant, August 1946 	<p>7. discusses increased loading of grease operations effects</p>
costs	<ol style="list-style-type: none"> 1. NYC Cost Comparison: Food Waste Vs Food Disposal, December 1991 2. Impact of food waste grinders - response to NYC DOS memo, December 1991 3. Kitchen Garbage Grinders in New York City, 	<p>1. looks like a good cost comparison of treatment vs. disposal and/or reuse of curbside collected materials</p>

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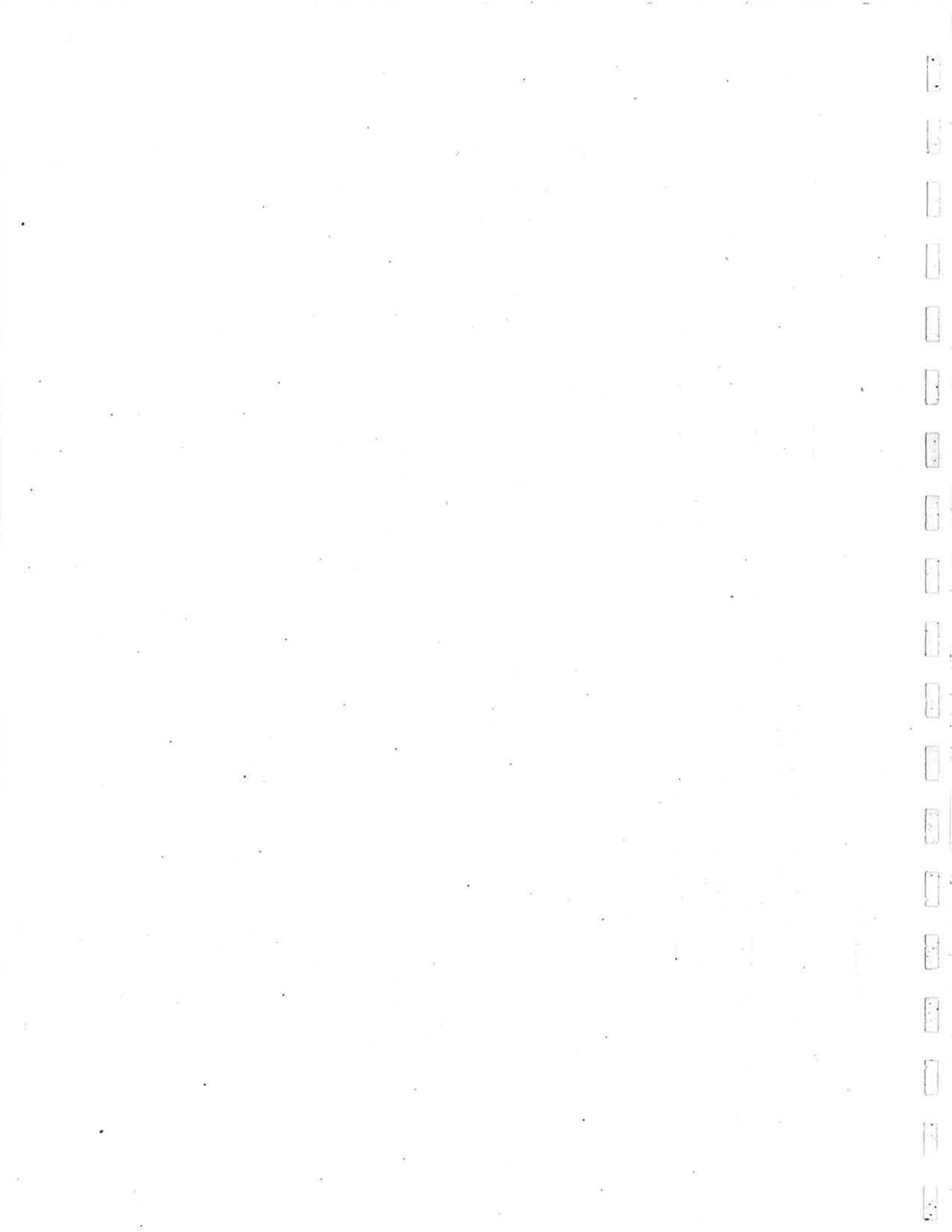
<p>water usage increases</p>	<p>February 1991 4. An Economic Evaluation of Garbage Grinding vs. surface collection and disposal, November 1971 1. Patterns of Household Usage, June 1967 2. Individual Home Wastewater Characterization and Treatment, July 1975 3. Water Requirements For Dishwashers And Food Waste Disposers, September 1962 4. Household Wastewater Characteristics, February 1974 5. Wastewater 2020 Plus (Metro Report), February, 1994 6. Kitchen Garbage Grinders in New York City, February 1991</p>	<p>1. provides data on water usage due to appliances in the home 2. data on water usage</p>
<p>loading rates to wastewater</p>	<p>1. Series of memos between Joel and NYC, March 1992 2. The Contribution From The Individual Home To The Sewer System, December 1967 3. Household Waste Characteristics, February 1974 4. Estimate of Water Pollution Potential Based on Characteristics of Domestic Sewage in Puerto Rico, January 1975 5. Individual Home Wastewater Characteristics and Treatment, July 1975 6. Effects of Garbage Grinders on Waste Loads, July 1988 7. Per Capita Loading of Domestic Wastewater, September 1972 8. MEMO: Garbage Disposal Use, August 1988 9. MEMO: Effects of Food Waste Disposal Systems on Wastewater Strength, June 1988 10. Food Processing Waste, June 1992 11. Metcalf & Eddy, Wastewater Engineering - Treatment, Disposal, and Reuse</p>	<p>10. discusses the contributions from individual food types</p>

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	<p>12. Food Waste and Garbage Disposals: The Use of Food Grinders to Dispose of Food Waste in Seattle's Retail Food Stores and Restaurants 13. Characteristics of Rural Household Wastewater, June 1976</p>	<p>13. many parameters examined</p>
<p>industrial discharge</p>	<p>1. Food Processing Waste, June 1992 2. Establishing the fees, rules, and regulations for the disposal of industrial waste into the Metropolitan Sewerage System, May 1993</p>	
<p>wastestream percents</p>	<p>1. MEMO: Solid Waste Disposed of in 1987 by Material, 1988 2. King County Waste Characterization Study, October, 1991 3. Classifying the Food Waste Stream, October 1991 4. Final 1992 Comprehensive Solid Waste Management Plan, King County 5. City of Seattle Waste Stream Composition Study for 1992 6. City of Seattle Waste Stream Composition Study for 1990 7. Seattle Solid Waste Utility Recycling Potential Assessment, 1994 8. Seattle City Integrated Waste Management Plan, 1989</p>	<p>1. discusses commercial and residential waste streams</p>
<p>rules & laws</p>	<p>1. MEMO: Stan Hummel re. King County Ordinances, March 1994 2. MEMO: Stan Hummel re. King County Ordinances, October 1988</p>	
<p>sludge production</p>	<p>1. MEMO: Sludge Production w/ Increased Garbage Disposal Use, handwritten cales, no date 2. Composting, Sludge, and Demolition Debris, June 1988 3. Groundwater Issues Related to Marketing Land</p>	

METRO FOOD GRINDER STUDY LITERATURE SEARCH MATRIX

	<p>Application of Biosolids, January 1994 4. Biosolids Long Strategy for King County Metro, January 1994</p>	
<p>collection of food wastes</p>	<p>1. MEMO: Dispos-Alls for Food Waste Recycling, August 1990 2. Food Waste Collection and Composting Demonstration Project, 1993</p>	<p>2. Matrix report</p>



Attachment B

Volunteer Collection Program

Attachment B

METRO FOOD GRINDER / DISPOSAL STUDY VOLUNTEER SEPARATION OF RESIDENTIAL FOOD WASTE

Family	Total Wt	Days	Adults	Children	Breakfast	Lunch	Dinner
1	1523g	2	3	0	2	2	2
2	749g	2	2	3	2	2	3
3	460g		2	2			
4	1016g	1	2	0	0	0	1
5	602g	2	2	0	2	0	1
86	1743g	2	3	0	2	0	2
79	1072g	2	4	0	0	2	1
10	742g	2	2	0	0	2	3
11	636g	2	2	1	2	2	3
12	1302g	2	1	0	1	0	2
13	984g	2	2	0	2	2	1
15	91g	2	2	0	0	0	1
16	251g	2	2	4	2	1	2
17	3294g	2	4	2	2	2	2
18	133g	2	2	0	2	1	2
19	241g	2	2	2	2	0	1
20	232g	2	5	0	6	0	7
			42	14			
Number	17			56			
Mean	886.6			Avg. = 269 g/cap			
Std Dev	790			= 135 g/cap/ day			
	15,071			= 0.30 lb/cap/day			

Attachment B

VOLUNTEER SURVEY RESULTS FOOD WASTE DISPOSAL METHODS

Have a garbage disposal	6
Disposal Methods	
Garbage	13
Compost	8
Worm Bin	3
Green Cone	1
Dog	1

Metro Food Waste Disposal Evaluation Volunteer Residential Collection Program

Please Read This Carefully!!

Objective

The objective is to collect samples of food waste generated in the household that would normally be processed through a food grinder and discharged to the sewer system.

Separation Procedure

It is vital to the success of the evaluation that all volunteers are conscientious in separating those food wastes that are suitable for grinding and discharge to the sewer. This collection should not reflect your normal practices of food disposal. Rather, the objective is for you to separate all of the food waste generated in your home that could be disposed of with an in sink grinder and discharged down the drain. You have been provided with a 1 gallon sealed plastic container in which to collect the material. These containers should be kept in the refrigerator once they contain food.

Include in the container: *All* of the food waste that *could* be processed through an in-sink disposal unit should be put in the container, including:

- vegetable and fruit trimmings
- cheese trimming
- plate scrapings
- refrigerated but unused left overs
- hot liquid grease

Exclude from the container: Any material that would normally be put in the garbage or that can be discharged down the drain without grinding should *not* be separated and placed in the container. Examples of *excluded* materials are:

- milk, yogurt and cottage cheese
- bones and trimmed fat from raw meat
- large seeds
- stringy materials such as artichokes

Collection Period

Please follow the following collection schedule:

1. Containers are distributed to all participants by 3 PM on Monday, October 10.
2. The separation should begin with breakfast on Tuesday, Oct. 11
3. Continue to collect for two days; through the evening meal and any late snacking on Wednesday, October 12.
4. Keep the container refrigerated throughout the period.

5. Bring the container to work on Thursday, October 13 and give to the designated recipient by 9 am. Attach the questionnaire to the container with a rubber band.

6. Grinding and analysis will begin on Thursday, October 13.

Thank You for your help!!! Your cooperation is Appreciated!

**Metro Food Waste Disposal Evaluation
Volunteer Residential Collection Program**

Volunteer Information

The data provided by the collection event will be one of the methods used to project the quantities of food waste generated by residences in the Metro service area. To do this, information about the people who contribute food waste is required.

Please complete the following brief questionnaire and return it when you bring in the collected food waste.

1. Do you normally use a food grinder for food waste disposal? ___ yes ___
no
2. What other methods of food waste disposal do you use?
___ garbage
___ compost
___ worm bin
___ green cone
___ other
3. How many people are currently living in your home? ___ adults
(>13 years) ___ children
4. How many people are were present during the collection?
(>13 years) ___ adults
___ children
5. How many meals were prepared at home during the collection period ___ breakfast
___ lunch
___ dinner
6. Were any guests served during the collection period? Please describe the numbers served and the number of meals

Thanks for Your Help!!! Your Cooperation is Appreciated!!!

Attachment C

Synthetic Food Waste Mixes

Attachment C

SYNTHETIC FOOD WASTE MIXES

Vegetables & Fruits

Potatoes	30%	7.2 oz	1/2 peelings, 1/2 cooked
Tomatoes	13%	3.1 oz	all raw
Corn	6%	1.4 oz	1/2 husk, 1/2 cooked
Lettuce	6%	1.4 oz	all raw
Green beans	5%	1.2 oz	1/2 cooked, 1/2 raw
Peas	5%	1.2 oz	all cooked
Onion	3%	0.7 oz	all raw
Apple	14%	3.4 oz	peel & core
Banana	7%	1.7 oz	peel
Orange	5%	1.2 oz	peel
Pears	6%	1.4 oz	peel & core
Carrot		2 oz	peel & ends

Meat & Cheese Mix

Beef	48%	.72 lb, 11.5 oz	cooked - grease included
Pork	19%	.23 lb, 4.5 oz	
Chicken	11%	.17 lb, 2.6 oz	Buddig Sliced cooked
Fish	6%	.09 lb, 1.4 oz	Van de Camps breaded fish fillets
Nonfat White Cheese	11%	.17 lb, 2.6 oz	Low moisture part skim mozzarella, Precious brand
Fat milk solids	5%	.075 lb, 1.2 oz	Shredded mild cheddar - Sargento brand

Grains

Wheat bread	63%	15.2 oz
Whole wheat bread	5%	1.2 oz
Cooked macaroni	5%	1.2 oz
Oatmeal	9%	2.2 oz
Corn cereal	18%	4.3 oz

NOTE: Assumes waste from all sources is same fraction of total consumption, except cheese 1/2 of meat.

Attachment D

Laboratory Analysis Data

Attachment D - Results of Sewer Travel Impact Analysis

Volunteer Group, Sample (1)														
STIRRED SAMPLE		SETTLED SAMPLE (Supernatant)					Soluble BOD		Primary Solids		Primary Volatile Solids		Secondary BOD	
Time (hr)	TS (mg/l)	VS (mg/l)	TDS (mg/l)	TSS (mg/l)	VSS (mg/l)	BOD (mg/l)	BOD (mg/l)	WP	EDRP	WP	EDRP	WP	EDRP	
Unground	243,736	179,439												
Calculated	6,327	4,523	1472.5	596		4,710			2,700					
Ground	5,196	4,644												
0	5,568	4,996	1472.5	596	549	2,810			2,708					
3	5,556	5,042	1568.8	605	565	3,185			2,632					
6	5,008	4,436	1552.5	700	652	2,920			2,798	2,798	2,514	2,896	2,896	
9	5,370	4,836	1548.8	340	272	2,670			2,701					
12	5,035	4,512	1248.8	211	181	2,160			2,772				2,420	
15	5,079	4,521	1326.3	227	204	2,680			3,068	3,022	2,741	2,547		
18	5,091	4,531	1441.3	239	207	2,800			2,607					
21	4,334	3,756	1231	300	278	2,785			2,011					
24	4,920	4,336	1470	289	273	2,555			2,361	2,500	2,186	2,670		
Averages	5,107	4,552	1,429	390	353	2,729			2,806	2,819	2,526	2,825	2,814	
Las/First	88%	87%	100%	48%	50%	91%		89%	87%					
Avg/Weighted								1.00	0.99	0.99	0.99	0.97	0.97	
Flow weighting Factor		West Point	0-9 hrs	77.6%	EDRP	0-9 hrs	82.8%	lb/wet lb	0.118	0.119	0.105	0.118	0.117	
			9-18 hrs	16.9%		9-15 hrs	17.2%	lb/dry lb	0.482	0.487	0.432	0.463	0.481	
			18-25 hrs	5.5%				adj avg	3,528	3,560	2,519	2,545		
								lb/wet lb	0.147	0.148	0.105	0.106		
								lb/dry lb	0.604	0.609	0.431	0.435		

Attachment D - Results of Sewer Travel Impact Analysis

Time (hr)	Fruits & Vegetables		SETTLED SAMPLE (Supernate)				Soluble BO		Primary Solids Weighted		Primary Volatile Solids Weighted		Secondary BOD Weighted	
	STIRRED SAMPLE		TSS (mg/l)	VSS (mg/l)	BOD (mg/l)	WP	EDRP	WP	EDRP	WP	EDRP	WP	EDRP	
	TS (mg/l)	VS (mg/l)	TDS (mg/l)	BOD (mg/l)										
Unground	149,030	134,616												
Calculated	4,056	3,448	1012.5	271	1,914	2,290			1,947					
Ground	2,756	2,314												
0	3,412	2,692	1012.5	271	1,488	1,647			1,299					
3	3,033	2,597	1153.8	273	1,890	1,124			963					
6	2,705	2,306	1385	276	1,491	562	996	996	479	822	1,602	1,602		
9	2,550	2,141	1148.8	267	1,539	652			548					
12	2,653	2,257	955	401	1,599	815			693					
15	2,719	2,274	696.3	247	1,626	1,294	1,051	1,054	1,082	888	1,621	1,613		
18	2,665	2,207	970	168	1,638	1,045			865					
21	2,716	2,258	800	126	1,773	1,308			1,087					
24	2,850	2,414	946	132	1,263	1,290	1,299		1,093	1,090	1,516	1,590		
Averages	2,811	2,350	1,007	240	1,590	1,082	1,022	1,006	901	847	833	1,601	1,604	
Las/First	84%	90%	93%	49%	85%	78%			84%					
Avg/Weighted							1.06	1.08		1.06	1.08	0.99	0.99	
						lb/wet lb	0.043	0.042		0.035	0.035	0.067	0.067	
						lb/dry lb	0.286	0.282		0.237	0.233	0.448	0.449	
						adj avg	1,422	1,400		1,269	1,249			
						lb/wet lb	0.059	0.058		0.053	0.052			
						lb/dry lb	0.398	0.392		0.355	0.350			

Attachment D - Results of Sewer Travel Impact Analysis

		Breads & Grains																			
Time (hr)	STIRRED SAMPLE		SETTLED SAMPLE (Supernatant)				Primary Solids		Primary Volatile Solids		Secondary BOD										
	TS (mg/l)	VS (mg/l)	TDS (mg/l)	TSS (mg/l)	VSS (mg/l)	BOD (mg/l)	WP	EDRP	WP	EDRP	WP	EDRP									
Unground	596,930	538,921																			
Calculated	14,797	13,144	4431.3	417																	
Ground	10,116	8,086																			
0	10,496	9,538	4431.3	417	384	2,590															
3	10,198	9,326	4441.3	319	292	2,930															
6	10,522	9,675	4352.5	295	269	3,045	5,102	5,102	4,672	4,672	3,186	3,186									
9	10,486	9,645	4762.5	346	308	4,180	4,896														
12	13,735	12,844	4626.3	296	264	4,015	8,331	7,829													
15	13,129	12,207	5061.3	258	232	5,130	7,328	7,820	7,291	7,302	4,756	4,756									
18	12,743	11,873	4240	218	195	5,123	7,803														
21	13,434	12,446	4503	220	204	5,400	8,229	8,324	7,757		5,093	5,093									
24	14,612	13,696	5474	238	217	4,785	8,418				4,133	4,133									
Averages	12,151	11,250	4,655	290	263	4,133	6,724	5,739	5,284	5,124	3,556	3,425									
Last/First	139%	144%	124%	57%	57%	185%	163%	1.17	1.18	1.22	1.16	1.21									
Avg/Weighted							lb/wet lb	0.239	0.220	0.214	0.148	0.143									
							lb/dry lb	0.401	0.369	0.358	0.248	0.239									
							adj avg	10,517	9,466	9,179											
							lb/wet lb	0.439	0.395	0.383											
							lb/dry lb	0.735	0.661	0.641											