APPENDIX F

Back-up Quantity Calculations

CENTRALIZED QUANTITIES –

ROCK –

GRAVITY: * USE 50 cy PER 1,000 FT. OF PIPE 0' TO 12' DEEP

169,050 LF × 50 cy/1000 LF = 8,453 cy

* USE 100 cy PER 1,000 FT. OF PIPE > 12' DEEP

5,650 LF × 100 cy/1000 LF = 565 cy

LOW-PRESSURE: * USE 25 cy PER 1,000 FT. OF PIPE

115,900 LF × 25 cy/1000 LF = 2,898 cy SAY 3,000 cy

FINLAY RD. / PS #17 AREA –

NICKERSON	1840
KETTLE POND	840
DALEY	770
FINLAY	3510
COMMERCE	540

7,500 LF × 5 FT. × 10 FT. = 375,000 CF × 1 cy/27 cf

= 13,889 cy

* ASSUME 25% WILL BE ROCK –

13,889 cy × 0.25 = 3,472 cy

TOTAL: 8453 cy + 565 cy + 3000 cy + 3472 cy

= 15,490 cy

SAY 16,000 cy

UNSUITABLE MATERIAL -

		GRAVITY	LPSS
PEAT	PS. #12 AREA	4,060 LF	—
CLAY	PS #13 AREA	11,290 LF	15,670 LF
"	PS #14 AREA	10,310 LF	5,635 LF
"	PS #18 AREA	7,440 LF	9,780 LF
		33,100 LF	31,085 LF

33,100 LF x 5 FT. x 10 FT. = 1,655,000 CF

31,085 LF x 5 FT. x 6 FT. = 932,550 CF

2,587,550 CF x 1 CY/27 CF

= 95,835 CY

* ASSUME 50% WILL BE REPLACED.

.50 x 95,835 CY

= 47,917 CY

SAY 50,000 CY

2,830 PROPERTIES ⇒ 1780 GRAVITY
1050 PRESSURE

SERVICE CONNECTIONS (1½" & 6")

- FOR BUILDING CONNECTIONS IN R.O.W (1½" & 6"), ASSUME 25 LF/CONNECTION

- FOR BUILDING CONNECTIONS ON-LOT, ASSUME:
  * 85% OF HOMES ARE BETWEEN 100'-200' SETBACK FROM ROAD ⇒ USE 150 LF/CONNECTION
  * 15% OF HOMES ARE BETWEEN 300'-700' SETBACK FROM ROAD ⇒ USE 500 LF/CONNECTION

15% OF 2,830 PROPERTIES = 424.5 SAY 425 PROPERTIES

ASSUME ONLY 5% OF GRAVITY PROPERTIES WILL BE LONG GRAVITY CONNECTIONS

5% OF 1780 PROPERTIES = 89 PROPERTIES ; SAY 100 PROPERTIES

GRAVITY:

∴ 1,680 CONNECTIONS × 150 LF/CONNECTION = 252,000 LF

100 CONNECTIONS × 500 LF/CONNECTION = 50,000 LF

302,000 LF

PRESSURE:

725 CONNECTIONS × 150 LF/CONNECTION = 108,750 LF

325 CONNECTIONS × 500 LF/CONNECTION = 162,500 LF

271,250 LF

GRAVITY: 1,780 CONNS. × 25 LF/CONN. = 44,500 LF

PRESSURE: 1,050 CONNS. × 25 LF/CONN. = 26,250 LF

ORLEANS, MASSACHUSETTS

PROPOSED PUMP STATION	AVERAGE DAILY FLOW (GPD)	PEAK DAILY FLOW (GPD)	PEAK FACTOR	INFILTRATION/ INFLOW (I/I) (GPD)	TOTAL PEAK FLOW (GPD)	TOTAL PEAK FLOW (GPM)	FORCE MAIN LENGTH (LF)	FORCE MAIN SIZE (INCHES)
Pump Station #2	10,400	58,240	5.6	4,600	62,840	44	2,250	2
Pump Station #1	21,600	120,960	5.6	5,500	126,460	88	2,025	3
Pump Station #17	17,325	97,020	5.6	2,600	99,620	69	475	3
Pump Station #19	24,750	138,600	5.6	4,340	142,940	99	2,350	3
Pump Station #3	54,400	304,640	5.6	15,140	319,780	222	2,100	4
Pump Station #5	29,400	164,640	5.6	4,600	169,240	118	2,140	4
Pump Station #9	36,600	204,960	5.6	2,300	207,260	144	1,000	4
Pump Station #10	50,400	282,240	5.6	4,400	286,640	199	3,100	4
Pump Station #12	34,200	191,520	5.6	3,100	194,620	135	2,600	4
Pump Station #13	55,000	308,000	5.6	8,550	316,550	220	2,750	4
Pump Station #14	49,775	278,740	5.6	7,800	286,540	199	1,100	4
Pump Station #18	28,400	159,040	5.6	5,640	164,680	114	3,270	4
Pump Station #15	94,200	527,520	5.6	4,820	532,340	370	4,300	6
Pump Station #16	63,800	357,280	5.6	9,980	367,260	255	2,750	6
Pump Station #4	125,000	675,000	5.4	33,600	708,600	492	1,500	8
Pump Station #6	156,000	780,000	5.0	40,330	820,330	570	2,550	8
Pump Station #7	200,650	963,120	4.8	50,800	1,013,920	704	1,860	8
Pump Station #11	173,400	867,000	5.0	14,430	881,430	612	2,600	8
Pump Station #8	600,000	2,460,000	4.1	129,400	2,589,400	1,798	8,100	15

2" = 2250 LF *

3" = 2025 + 475 + 2350 = 4850 LF *

4" = 2100 + 2140 + 1000 + 3100 + 2600 + 2750 + 1100 + 3270 = 18,060 LF

6" = 4300 + 2750 = 7,050 LF

8" = 1500 + 2550 + 1860 + 2600 = 8,510 LF

15 = 8,100

WYE Counts

10 x 6 = 12

12 x 6 = 24 + 2 + 13 (Main) + 21 (Main)

15 x 6 = 12 + 8 (MAIN) + + 20 (S. Orleans/GA) + 8 + 6 + 7 + 2 :

21 x 6 = 3

Weston&Sampson®	PROJECT: STATE HIWAY FOOTAGES	DATE: PAGE:
		BY:
		CHKD BY:

SOUTH ORLEANS ROAD (RTE 28 / RTE 6A)

P.S. # 1	1140 LF		8"
P.S. # 3	3220 (8") 50' (>12') 3270 LF	50' >12 VF	8"
P.S. # 4	5025 LF		8"
P.S # 6	2445 (8") 870 (10") 3315 LF	870' OF 10" Ø	8"/10"
P.S # 7	1740 (8") 2060 (12" 0-12) 240 (12" >12") 4040 LF	2300' OF 12" Ø (240' >12 VF)	8"/12"
P.S. # 8	1380 (8") 300 (12") 1680 LF	300' OF 12" Ø	8/12"
P.S. # 8	1550 LF		8"
P.S # 12	2000 LF		8"
P.S. # 12	800 LF		8"
	22,820 LF	23,059 LF	

ROUTE 6A

P.S. # 8	1700 LF	1350' OF 12" Ø	8/12"
P.S # 9	3025 LF	1420' > 12 VF	8"
	4,725 LF	5335	

CENTRALIZED:

27,435 (0-12) x 5 x 9
710 (>12) x 7 x 15

+600 LF TO P.S. #12

CDF

STATE HIGHWAY

		Route 28		Route 6A		
8" (0-12')	—	19,300 LF	+	3555	=	22,855 LF
8" (>12')	—	50 LF	+	420	=	470 LF
10"	—	870 LF	+	—	=	870 LF
12" (0-12')	—	2,360 LF	+	1350	=	3,710 LF
12" (>12')	—	240 LF	+	—	=	240 LF
		22,820 LF		5,325 LF	=	28,145 LF

Weston&Sampson®	PROJECT: Local Streets Pavement	DATE: 3-29-2012 PAGE:
		BY: JC Potts, P.E.
		CHKD BY:

Total Gravity	174,070 LF
State Highway	− 28,275 LF
	145,795 LF
Gravel Roads	− 6,790 LF
	139,005 LF

Total LPSS	115,685 LF
Gravel Roads	− 23,140 LF
	92,545 LF

Force Mains (P.S. #10 to WWTF) − 3,100 LF

Pavement Replacement Standards −

Gravity Sewer − Temporary Trench Pavement
2" Trench Binder
1½" Full-Width Top Course

LPSS/FMs − Temporary Trench Pavement
2" Trench Binder
1½" Trench-Width Top Course

	Gravity	LPSS	FM	Total
Temporary Trench Pavement	139,005	92,545	3,100	234,650
2" Trench Binder	139,005	92,545	3,100	234,650
1½" Trench-Width Top Course	—	92,545	3,100	95,645
1½" Full-Width Top Course	139,005	—	—	139,005

	TYPE	GRAVITY	LPSS
1,035	TOWN STREETS	47,670 LF − 375	24,345 LF − 660
27,695	PRIVATE STREETS	28,460 LF − 6415	57,300 LF − 21,280
1,200	SCENIC/TOWN STREETS	69,665 LF	34,040 LF − 1,200
	STATE HIGHWAY	28,275 LF	—
	TOTAL:	174,070 LF *	115,685 LF

Δ = 260 LF (X-C EASEMENT)

GRAVEL = 1,035 LF + 27,695 LF + 1,200 LF = 29,930 LF
STATE HIGHWAY = 28,275 LF

>12 STATE HIGHWAY	50 LF	13 VF	S. ORLEANS
" " "	240 LF	14.5 VF	" "
" " "	420 LF	15.5 VF	ROUTE 6A
	710 LF	AVG. 14.33	

* CDF:

>12': 710 LF × 12.75 / (14.33 − 0.58) × 7' = ~~68,337.50~~ 63,362.5 CF = ~~8,531~~ 2,347 CY

0-12': 27,565 LF × ~~9.42~~ 8.42 / (10 − 0.58) × 5' = ~~1,298,311.5~~ 1,160,486.5 CF = ~~48,086~~ 42,981 CY

~~50,617~~ 45,328 CY

W&S GRID PAPER LTR 072811

DECENTRALIZED QUANTITIES -

ROCK -

* USE 25 CY PER 1,000 FT. OF PIPE

TOTAL STEG/STEP = 316,235 LF

316,235 LF × 25 CY/1000 LF = 7,905.9 CY

FINLAY RD / PS# 17 AREA -

7,500 LF × 4 FT. × 6 FT. = 180,000 CF × 1 CY/27 CF = 6,667 CY

* ASSUME 25% WILL BE ROCK

.25 × 6,667 CY = 1,667 CY

TOTAL = 7905.9 + 1,667 = 9,572.6 CY

SAY 10,000 CY

UNSUITABLE MATERIAL -

P.S. #12 AREA (STEG #8) = 4,060 LF × 4 FT. × 6FT. = 97,440 CF = 3609 CY

PS#13 (STEP#7 / STEG#3) = 5240 + 10430 + 8650 + 1800 = 26,120 LF

PS#14 (STEP#9 / STEG#4) = 12830 + 1630 + 2165 + 8710 + 1300 + 300 = 26,935 LF

PS#18 (STEP#8) = 14550 + 3330 = 17,880 LF

26,120 + 26,935 + 17,880 = 70,935 LF × 4FT × 6FT = 1,702,440 CF = 63,053 CY

* ASSUME 50% REPLACED

63,053 CY + 3,609 CY = 66,662.2 CY × 0.5 = 33,331.1 CY

SAY 34,000 CY

DECENTRALIZED ON-LOT PIPE QUANTITIES -

TOTAL PROPERTIES = 3,030

STEG = 762

STEP = 2,268

ASSUME 85% WILL BE BETWEEN 100' - 200' SETBACK FROM ROAD — USE 150 LF/LOT

ASSUME 15% WILL BE BETWEEN 300' - 700' SETBACK FROM ROAD — USE 500 LF/LOT

15% OF 3,030 = 455 LOT ARE BETWEEN 300' & 700' BACK

ASSUME 5% OF STEGS ARE BETWEEN 300' & 700' BACK

5% OF 762 = 38 LOTS ROUND TO 50 LOTS

ASSUME 1/2 OF THESE 50 LOTS WILL NEED PUMP DUE TO LENGTH & GRADE = 25 ADDT'L STEP TANKS

1/2" PIPE		4" PIPE	
430 LOTS x 500'/LOT	= 215,000 LF	25 LOTS x 500'/LOT	= 12,500 LF
1863 LOTS x 150'/LOT	= 279,450 LF	712 LOTS x 150'/LOT	= 106,800 LF
2,293 LOTS	494,450 LF	737 LOTS	119,300 LF

DECENTRALIZED

PAVEMENT & CDF –

	STEG	STEP	TOTAL
GRAVEL	1,585	28,170 ✓	29,755
TOWN	58,595	130,580 ✓	189,175
PRIVATE	8105	60,925	69,030
STATE HIGHWAY	11 485	16,790 ✓	28,275
	79,770	236,465	316,235

CDF :

ALL 0'-6' DEPTH

6'-1'-7" = 4.42' THICKNESS OF CDF

28,275 LF x 4' WIDE x 4.42' (DEEP) = 499,902 CF = 18,515 CY

PAVEMENT (STEP/STEG) –

316,235 - 28,275 (STATE) - 29,755 (GRAVEL) = 258,205 LF

PAVEMENT (FM/WWTP EFFLUENT LINES) –

PUMP STATION FMs – 3,100 LF

EFFLUENT DISPOSAL LINES –

163 TO 172
163 TO 173 } ALL DUAL TRENCH
163 TO 181

111 TO 112 – ALL DUAL TRENCH

111 TO 321 – ADDT'L PIPE ALONG BEACH TO GRANDVIEW = 2,250 LF

111 TO 322 – ADDT'L PIPE ALONG BEACH ROAD 3,700 LF

PAVEMENT REPLACEMENT STANDARDS -

STEG/STEP/FM/EFF. DISP. LINES - TEMPORARY TRENCH

2" BINDER (TRENCH)

1½" TOP (TRENCH)

	STEP/STEG	FM	EFF	TOTAL
TEMPORARY TRENCH PAVEMENT	258,205	3,100	5950	267,255
2" TRENCH - WIDTH BINDER COURSE	258,205	3,100	5,950	267,255
1½" TRENCH - WIDTH TOP COURSE	258,205	3,100	5,950	267,255

$30/ft

EFFLUENT DISPOSAL PIPES –

	111	To	112	≈ 4,250 LF	19,190 LF
5785 +1000	111	To	321	≈ 6,785 LF	
5785 + 2370	111	To	322	≈ 8155 LF	ALL 2" Ø
3530 + 650	163	To	172	≈ 4,180 LF	
	163	To	173	≈ 5,640 LF	14,880 LF
	163	To	181	≈ 5,060 LF	
				34,070 LF	

DISPOSAL PIPE SIZING –

SITE	DISPOSAL SIZE	
112	460,000 gpd = 0.71 cfs	75,000 gpd = 0.12 cfs
321	877,500 gpd = 1.36 cfs	260,000 gpd = 0.40 cfs
322	780,000 gpd = 1.21 cfs	150,000 gpd = 0.23 cfs
172	880,000 gpd = 1.36 cfs	150,000 gpd = 0.23 cfs
173	1,055,000 gpd = 1.63 cfs	60,000 gpd = 0.09 cfs
181	1,338,500 gpd = 2.07 cfs	150,000 gpd = 0.23 cfs

SITE	C 3 fps	
112	6" Ø	3.61 fps
321	8" Ø	3.89 fps
322	8" Ø	3.47 fps
172	8" Ø	3.89 fps
173	8" Ø	4.67 fps
181	10" Ø	3.79 fps

$V = Q/A = 2.07 / \pi \frac{(8/12)^2}{4}$