APPENDIX F

Air Quality Calculations

Emission Factor Calculations - Flood Barrier

ROG

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	ROG g/hp-hr	=	Emission Factor
Grader	0.0000315		965		0.61		5		0.68		0.7727
Dozer	0.0000458		936		0.64		8		0.99		1.2095
Paver	0.0000458		828		0.62		4		0.99		1.0840
Roller	0.0000458		748		0.56		4		0.99		1.0667
Backhoe	0.0000458		1135		0.55		8		0.99		1.2187
Compactor (other)	0.0000458		606		0.62		8		0.99		1.1277
Crane	0.0000315		1464		0.43		5		0.68		0.7791
Excavator	0.0000315		1162		0.57		4		0.68		0.7635
Frontend Loader	0.0000458		1135		0.55		8		0.99		1.2187

CO

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	CO g/hp-hr	=	Emission Factor
Grader	0.0000714		965		0.61		5		2.7		2.9101
Dozer	0.0000923		936		0.64		8		3.49		3.9323
Paver	0.0000923		828		0.62		4		3.49		3.6795
Roller	0.0000923		748		0.56		4		3.49		3.6447
Backhoe	0.0000923		1135		0.55		8		3.49		3.9509
Compactor (other)	0.0000923		606		0.62		8		3.49		3.7674
Crane	0.0000714		1464		0.43		5		2.7		2.9247
Excavator	0.0000714		1162		0.57		4		2.7		2.8892
Frontend Loader	0.0000923		1135		0.55		8		3.49		3.9509

Notes:
Construction equipment estimated to be at half its useful life at time of project.
Values for Activity, Load Factor and Half Life taken from ARB, 2001, Appendix B.
Values for Deterioration and Pollutant g/hp-hr taken from ARB, 2001, Appendix D.

Emisssion Factor Calculations - Flood Barrier

NO_x

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	Nox g/hp-hr	=	Emission Factor
Grader	0.00016		965		0.61		5		6.9		7.3709
Dozer	0.000202		936		0.64		8		8.75		9.7180
Paver	0.00016		828		0.62		4		6.9		7.2286
Roller	0.00016		748		0.56		4		6.9		7.1681
Backhoe	0.000202		1135		0.55		8		8.75		9.7588
Compactor (other)	0.000202		606		0.62		8		8.75		9.3572
Crane	0.00016		1464		0.43		5		6.9		7.4036
Excavator	0.00016		1162		0.57		4		6.9		7.3239
Frontend Loader	0.000202		1135		0.55		8		8.75		9.7588

PM

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	PM g/hp-hr	=	Emission Factor
Grader	0.0000276		965		0.61		5		0.38		0.4612
Dozer	0.0000502		936		0.64		8		0.69		0.9306
Paver	0.0000502		828		0.62		4		0.69		0.7931
Roller	0.0000502		748		0.56		4		0.69		0.7741
Backhoe	0.0000502		1135		0.55		8		0.69		0.9407
Compactor	0.0000502		606		0.62		8		0.69		0.8409
Crane	0.0000276		1464		0.43		5		0.38		0.4669
Excavator	0.0000276		1162		0.57		4		0.38		0.4531
Frontend Loader	0.0000502		1135		0.55		8		0.69		0.9407

Construction Emissions - Flood Barrier

ROG

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/2 yr project**		**lb/2 year project**
Grader	3568		162		0.61		0.7727		272450		601
Dozer	10322		82		0.64		1.2095		655178		1445
Paver	160		89		0.62		1.0840		9571		21
Roller	480		84		0.56		1.0667		24086		53
Backhoe	4032		75		0.55		1.2187		202698		447
Compactor (other)	2816		104		0.62		1.1277		204756		452
Crane	3328		149		0.43		0.7791		166134		367
Excavator	128		157		0.57		0.7635		8745		19
Frontend Loader	320		75		0.55		1.2187		16087		35
										Total	3441
With 20-foot levee crown width										Total	3606

CO

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/2 yr project**		**lb/2 year project**
Grader	3568		162		0.61		2.9101		1026088		2264
Dozer	10322		82		0.64		3.9323		2130138		4700
Paver	160		89		0.62		3.6795		32486		72
Roller	480		84		0.56		3.6447		82293		182
Backhoe	4032		75		0.55		3.9509		657121		1450
Compactor (other)	2816		104		0.62		3.7674		684074		1509
Crane	3328		149		0.43		2.9247		623627		1376
Excavator	128		157		0.57		2.8892		33095		73
Frontend Loader	320		75		0.55		3.9509		52152		115
										Total	11740
With 20-foot levee crown width										Total	12299

Note:
Total hours taken from Transporation Calculations.
Total for 20-foot levee crown width based on a 4% increase in trucks (from Transportation Calculations).

Construction Emissions - Flood Barrier

NO_x

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/2 yr project**		**lb/2 year project**
Grader	3568		162		0.61		7.3709		2598911		5734
Dozer	10322		82		0.64		9.7180		5264253		11614
Paver	160		89		0.62		7.2286		63819		141
Roller	480		84		0.56		7.1681		161850		357
Backhoe	4032		75		0.55		9.7588		1623082		3581
Compactor (other)	2816		104		0.62		9.3572		1699033		3748
Crane	3328		149		0.43		7.4036		1578636		3483
Excavator	128		157		0.57		7.3239		83893		185
Frontend Loader	320		75		0.55		9.7588		128816		284
										Total	29128
With 20-foot levee crown width										Total	30510

PM

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/2 yr project**		**lb/2 year project**
Grader	3568		162		0.61		0.4612		162626		359
Dozer	10322		82		0.64		0.9306		504091		1112
Paver	160		89		0.62		0.7931		7002		15
Roller	480		84		0.56		0.7741		17479		39
Backhoe	4032		75		0.55		0.9407		156457		345
Compactor (other)	2816		104		0.62		0.8409		152685		337
Crane	3328		149		0.43		0.4669		99549		220
Excavator	128		157		0.57		0.4531		5190		11
Frontend Loader	320		75		0.55		0.9407		12417		27
										Total	2465
With 20-foot levee crown width										Total	2587

Fugitive Dust - Flood Barrier

Off road

PM_{10} emission factor = .11 tons/acre/month[a]

Assumed 1 month equals 168 work hours.
Assumed 200 acre construction site over 2 years. Approximately 100 acres each year and 1/3 of the site would be active at any given time.

Paved road

PM_{10} emission factor = $E=k(sL/2)^{.65}(W/3)^{1.5}$ ---> E*VMT = lbs of PM_{10}

E=particulate emission factor (having units matching the units of k)
k=base emission factor for particle size range - .016lbs/VMT
sL[b]=road surface silt loading .01 g/m^2
W=average weight (tons) of the vehicles traveling the road

Assumed half of the haul trucks at full weight (25 tons) and half of the trucks empty (10 tons)
Assumed construction worker vehicles at 2 tons

Total VMT/year for haul trucks = 395,000
Total VMT/year for worker vehicles = 280,000

[a] - Source: MRI, 1996.

[b] - Silt loading factor as defined by EPA document AP-42 is .1g/m^2. According to paper by Gaffney, Shimp, 1997, the silt loading measurements taken by Midwest Research Institute were approximately one-tenth the values listed in AP-42. High values in the EPA document were attributed to silt loading samples taken in other states (predominantly Montana) known to have high loading due to road sandings and other soil sources. The values were not representative of California silt loading values. For the purpose of these calculations, a value of one-tenth the suggested EPA value was used.

Emission Factor Calculations Modified Wide Setback Levee

ROG

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	ROG g/hp-hr	=	Emission Factor
Scraper	0.0000112		1090		0.72		6		0.32		0.3727
Grader	0.0000315		965		0.61		5		0.68		0.7727
Dozer	0.0000458		936		0.64		8		0.99		1.2095
Paver	0.0000458		828		0.62		4		0.99		1.0840
Roller	0.0000458		748		0.56		4		0.99		1.0667
Backhoe	0.0000458		1135		0.55		8		0.99		1.2187
Compactor (other)	0.0000458		606		0.62		8		0.99		1.1277
Crane	0.0000315		1464		0.43		5		0.68		0.7791
Excavator	0.0000315		1162		0.57		4		0.68		0.7635
Frontend Loader	0.0000458		1135		0.55		8		0.99		1.2187

CO

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	CO g/hp-hr	=	Emission Factor
Scraper	0.0000182		1090		0.72		6		0.92		1.0057
Grader	0.0000714		965		0.61		5		2.7		2.9101
Dozer	0.0000923		936		0.64		8		3.49		3.9323
Paver	0.0000923		828		0.62		4		3.49		3.6795
Roller	0.0000923		748		0.56		4		3.49		3.6447
Backhoe	0.0000923		1135		0.55		8		3.49		3.9509
Compactor (other)	0.0000923		606		0.62		8		3.49		3.7674
Crane	0.0000714		1464		0.43		5		2.7		2.9247
Excavator	0.0000714		1162		0.57		4		2.7		2.8892
Frontend Loader	0.0000923		1135		0.55		8		3.49		3.9509

Notes:
Construction equipment estimated to be at half its useful life at time of project.
Values for Activity, Load Factor and Half Life taken from ARB, 2001, Appendix B.

Values for Deterioration and Pollutant g/hp-hr taken from ARB, 2001, Appendix D.

Emission Factor Calculations Modified Wide Setback Levee

NO_x

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	Nox g/hp-hr	=	Emission Factor
Scraper	0.000104		1090		0.72		6		6.25		6.7397
Grader	0.00016		965		0.61		5		6.9		7.3709
Dozer	0.000202		936		0.64		8		8.75		9.7180
Paver	0.00016		828		0.62		4		6.9		7.2286
Roller	0.00016		748		0.56		4		6.9		7.1681
Backhoe	0.000202		1135		0.55		8		8.75		9.7588
Compactor (other)	0.000202		606		0.62		8		8.75		9.3572
Crane	0.00016		1464		0.43		5		6.9		7.4036
Excavator	0.00016		1162		0.57		4		6.9		7.3239
Frontend Loader	0.000202		1135		0.55		8		8.75		9.7588

PM

	Deterioration	X	Activity	X	Load Factor	X	Half Life (years)	+	PM g/hp-hr	=	Emission Factor
Scraper	0.00000796		1090		0.72		6		0.15		0.1875
Grader	0.0000276		965		0.61		5		0.38		0.4612
Dozer	0.0000502		936		0.64		8		0.69		0.9306
Paver	0.0000502		828		0.62		4		0.69		0.7931
Roller	0.0000502		748		0.56		4		0.69		0.7741
Backhoe	0.0000502		1135		0.55		8		0.69		0.9407
Compactor	0.0000502		606		0.62		8		0.69		0.8409
Crane	0.0000276		1464		0.43		5		0.38		0.4669
Excavator	0.0000276		1162		0.57		4		0.38		0.4531
Frontend Loader	0.0000502		1135		0.55		8		0.69		0.9407

Construction Emissions Modified Wide Setback Levee

ROG

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/3 yr project**		**lb/3 year project**
Scraper	15040		356		0.72		0.3727		1436927		3170
Grader	4456		162		0.61		0.7727		340258		751
Dozer	9840		82		0.64		1.2095		624584		1378
Paver	264		89		0.62		1.0840		15792		35
Roller	792		84		0.56		1.0667		39742		88
Backhoe	2160		75		0.55		1.2187		108588		240
Compactor (other)	4976		104		0.62		1.1277		361814		798
Crane	5120		149		0.43		0.7791		255591		564
Excavator	1504		157		0.57		0.7635		102756		227
Frontend Loader	3200		75		0.55		1.2187		160872		355
										Total	7605
With 20-foot levee crown width										Total	8487

CO

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/3 yr project**		**lb/3 year project**
Scraper	15040		356		0.72		1.0057		3877027		8554
Grader	4456		162		0.61		2.9101		1281460		2827
Dozer	9840		82		0.64		3.9323		2030668		4480
Paver	264		89		0.62		3.6795		53602		118
Roller	792		84		0.56		3.6447		135784		300
Backhoe	2160		75		0.55		3.9509		352029		777
Compactor (other)	4976		104		0.62		3.7674		1208790		2667
Crane	5120		149		0.43		2.9247		959427		2117
Excavator	1504		157		0.57		2.8892		388861		858
Frontend Loader	3200		75		0.55		3.9509		521525		1151
										Total	23848
With 20-foot levee crown width										Total	26233

Note:
Total hours taken from Transportation Calculations.
Total for 20-foot levee crown based on a 10% increase in construction vehicle hours (from Transportation Calculations).

Construction Emissions Modified Wide Setback Levee

NO_x

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/3 yr project**	**lb/3 year project**
Scraper	15040		356		0.72		6.7397		25981958	57323
Grader	4456		162		0.61		7.3709		3245725	7161
Dozer	9840		82		0.64		9.7180		5018431	11072
Paver	264		89		0.62		7.2286		105302	232
Roller	792		84		0.56		7.1681		267052	589
Backhoe	2160		75		0.55		9.7588		869508	1918
Compactor (other)	4976		104		0.62		9.3572		3002269	6624
Crane	5120		149		0.43		7.4036		2428670	5358
Excavator	1504		157		0.57		7.3239		985745	2175
Frontend Loader	3200		75		0.55		9.7588		1288160	2842
									Total	95294
With 20-foot levee crown width									Total	104823

PM

	Total hours	X	Horsepower	X	Load Factor	X	Emission Factor	=	**g/3 yr project**	**lb/3 year project**
Scraper	15040		356		0.72		0.1875		722753	1595
Grader	4456		162		0.61		0.4612		203101	448
Dozer	9840		82		0.64		0.9306		480552	1060
Paver	264		89		0.62		0.7931		11553	25
Roller	792		84		0.56		0.7741		28840	64
Backhoe	2160		75		0.55		0.9407		83816	185
Compactor (other)	4976		104		0.62		0.8409		269801	595
Crane	5120		149		0.43		0.4669		153153	338
Excavator	1504		157		0.57		0.4531		60987	135
Frontend Loader	3200		75		0.55		0.9407		124172	274
									Total	4719
With 20-foot levee crown width										5191

Fugitive Dust - Modified Wide Setback Levee

Off-road

PM_{10} emission factor = .11 tons/acre/month[a]

Assumed 1 month equals 168 work hours.
Assumed 550 acre construction site over 3 years. Approximately 180 acres each year and 1/3 of the site would be active at any given time.

Paved-road

PM_{10} emission factor = $E=k(sL/2)^{.65}(W/3)^{1.5}$ ---> E*VMT = lbs of PM_{10}

E=particulate emission factor (having units matching the units of k)
k=base emission factor for particle size range - .016lbs/VMT
sL[b]=road surface silt loading .01 g/m^2
W=average weight (tons) of the vehicles traveling the road

Assumed half of the haul trucks at full weight (25 tons) and half of the trucks empty (10 tons)
Assumed construction worker vehicles at 2 tons

Total VMT/year for haul trucks = 263,000
Total VMT/year for worker vehicles = 187,000

[a] - Source: MRI, 1996.

[b] - silt loading factor as defined by EPA document AP-42 is .1g/m^2. According to paper by Gaffney, Shimp, 1997, the silt loading measurements taken by Midwest Research Institute were approximately one-tenth the values listed in AP-42. High values in the EPA document were attributed to silt loading samples taken in other states (predominantly Montana) known to have high loading due to road sandings and other soil sources. The values were not representative of California silt loading values. For the purpose of these calculations, a value of one-tenth the suggested EPA value was used.