HCM Signalized Intersection Capacity Analysis
7: Laulaunui Street & Fort Weaver Road
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑↱		↰	↑	↱	↰	↑↑↑	↱	↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		*0.99		1.00	1.00	1.00	1.00	*0.99	1.00	1.00	*0.99	1.00
Frt		0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		3518		1770	1863	1583	1770	5532	1583	1770	5532	1583
Flt Permitted		0.96		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		3518		1770	1863	1583	1770	5532	1583	1770	5532	1583
Volume (vph)	209	37	13	61	4	229	56	2756	89	228	4188	82
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	211	37	13	62	4	231	57	2784	90	230	4230	83
RTOR Reduction (vph)	0	3	0	0	0	213	0	0	25	0	0	18
Lane Group Flow (vph)	0	258	0	62	4	18	57	2784	65	230	4230	65
Turn Type	Split			Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			6
Actuated Green, G (s)		14.8		5.0	5.0	5.0	5.0	89.0	89.0	24.0	108.0	108.0
Effective Green, g (s)		14.8		5.0	5.0	5.0	5.0	89.0	89.0	24.0	108.0	108.0
Actuated g/C Ratio		0.10		0.03	0.03	0.03	0.03	0.60	0.60	0.16	0.73	0.73
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		350		59	63	53	59	3309	947	285	4015	1149
v/s Ratio Prot		c0.07		c0.04	0.00		0.03	c0.50		0.13	c0.76	
v/s Ratio Perm						0.01			0.04			0.04
v/c Ratio		1.19dl		1.05	0.06	0.35	0.97	0.84	0.07	0.81	1.05	0.06
Uniform Delay, d1		65.1		71.9	69.6	70.3	71.8	24.2	12.5	60.2	20.4	5.8
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		7.9		132.1	0.4	3.9	104.1	2.8	0.1	15.3	31.0	0.1
Delay (s)		73.0		204.0	70.1	74.2	175.9	27.0	12.7	75.4	51.4	5.9
Level of Service		E		F	E	E	F	C	B	E	D	A
Approach Delay (s)		73.0			101.3			29.4			51.8	
Approach LOS		E			F			C			D	

Intersection Summary			
HCM Average Control Delay	46.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	148.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	112.5%	ICU Level of Service	H
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Old Fort Weaver Rd & Fort Weaver Road
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰↰	↑	↱		↰↑	↱	↰↰	↑↑↑↱		↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	1.00	1.00		0.95	1.00	0.97	*0.99		1.00	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4990	1863	1583		3514	1583	3433	5531		1770	5532	1583
Flt Permitted	0.95	1.00	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4990	1863	1583		3514	1583	3433	5531		1770	5532	1583
Volume (vph)	731	189	418	37	214	48	539	2120	3	190	3187	884
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	738	191	422	37	216	48	544	2141	3	192	3219	893
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	197
Lane Group Flow (vph)	738	191	422	0	253	48	544	2144	0	192	3219	696
Turn Type	Split		Free	Split		Free	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free						6
Actuated Green, G (s)	17.0	17.0	130.0		8.0	130.0	18.0	70.5		18.5	71.0	71.0
Effective Green, g (s)	17.0	17.0	130.0		8.0	130.0	18.0	70.5		18.5	71.0	71.0
Actuated g/C Ratio	0.13	0.13	1.00		0.06	1.00	0.14	0.54		0.14	0.55	0.55
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	653	244	1583		216	1583	475	3000		252	3021	865
v/s Ratio Prot	c0.15	0.10			c0.07		c0.16	0.39		0.11	c0.58	
v/s Ratio Perm			0.27			0.03						0.44
v/c Ratio	1.13	0.78	0.27		1.17	0.03	1.15	0.71		0.76	1.07	0.80
Uniform Delay, d1	56.5	54.7	0.0		61.0	0.0	56.0	22.2		53.6	29.5	23.9
Progression Factor	1.07	1.08	1.00		1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	74.2	12.6	0.3		115.2	0.0	87.6	1.5		12.7	37.2	7.8
Delay (s)	134.6	71.6	0.3		176.2	0.0	143.6	23.7		66.4	66.7	31.7
Level of Service	F	E	A		F	A	F	C		E	E	C
Approach Delay (s)		83.8			148.1			48.0			59.4	
Approach LOS		F			F			D			E	

Intersection Summary			
HCM Average Control Delay	62.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Renton Road & Fort Weaver Road
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↑	↱		↰↑	↱	↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00		1.00	1.00	1.00	*0.99	1.00	0.97	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1752	1761	1583		1858	1583	1770	5532	1583	3433	5532	1583
Flt Permitted	0.95	0.95	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1752	1761	1583		1858	1583	1770	5532	1583	3433	5532	1583
Volume (vph)	723	22	43	9	151	320	45	2086	75	506	3054	518
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	730	22	43	9	153	323	45	2107	76	511	3085	523
RTOR Reduction (vph)	0	0	0	0	0	295	0	0	6	0	0	38
Lane Group Flow (vph)	366	386	43	0	162	28	45	2107	70	511	3085	485
Turn Type	Split		Free	Split		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	4	4		8	8		5	2	8	1	6	4
Permitted Phases			Free			8			2			6
Actuated Green, G (s)	20.0	20.0	138.8		12.0	12.0	4.7	66.7	78.7	24.1	86.1	106.1
Effective Green, g (s)	20.0	20.0	138.8		12.0	12.0	4.7	66.7	78.7	24.1	86.1	106.1
Actuated g/C Ratio	0.14	0.14	1.00		0.09	0.09	0.03	0.48	0.57	0.17	0.62	0.76
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	252	254	1583		161	137	60	2658	898	596	3432	1256
v/s Ratio Prot	0.21	c0.22			c0.09		0.03	0.38	0.01	c0.15	c0.56	0.06
v/s Ratio Perm			0.03			0.02			0.04			0.25
v/c Ratio	1.45	1.52	0.03		1.01	0.20	0.75	0.79	0.08	0.86	0.90	0.39
Uniform Delay, d1	59.4	59.4	0.0		63.4	59.0	66.5	30.2	13.6	55.7	22.6	5.5
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	224.4	253.0	0.0		72.6	0.7	40.4	2.5	0.0	11.7	4.3	0.2
Delay (s)	283.8	312.4	0.0		136.0	59.7	106.9	32.8	13.6	67.4	26.9	5.7
Level of Service	F	F	A		F	E	F	C	B	E	C	A
Approach Delay (s)		282.3			85.2			33.6			29.2	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM Average Control Delay	60.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	138.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Farrington Hwy & D Street
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑		↰↰	↑↑↑↱			↑↱	↱	↰	↰↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.99		*0.99	*0.99			*0.99	*0.99	*0.99	*0.99	
Frt	1.00	1.00		1.00	1.00			1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.98	
Satd. Flow (prot)	1770	5532		3504	5506			1844	1567	1752	1659	
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.98	
Satd. Flow (perm)	1770	5532		3504	5506			1844	1567	1752	1659	
Volume (vph)	108	2029	0	408	2186	73	0	79	45	226	9	92
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	2205	0	443	2376	79	0	86	49	246	10	100
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	45	0	34	0
Lane Group Flow (vph)	117	2205	0	443	2452	0	0	86	4	174	148	0
Turn Type	Prot			Prot					Perm	Split		
Protected Phases	5	2		1	6			8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	12.9	65.4		21.0	73.5			11.3	11.3	16.3	16.3	
Effective Green, g (s)	12.9	65.4		21.0	73.5			11.3	11.3	16.3	16.3	
Actuated g/C Ratio	0.10	0.50		0.16	0.57			0.09	0.09	0.13	0.13	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	176	2783		566	3113			160	136	220	208	
v/s Ratio Prot	0.07	c0.40		0.13	c0.45			c0.05		c0.10	0.09	
v/s Ratio Perm									0.00			
v/c Ratio	0.66	0.79		0.78	0.79			0.54	0.03	0.79	0.71	
Uniform Delay, d1	56.5	26.7		52.3	22.1			56.8	54.3	55.2	54.6	
Progression Factor	0.98	0.71		0.67	0.35			1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.2	1.6		6.4	1.9			3.4	0.1	17.4	10.9	
Delay (s)	61.3	20.5		41.7	9.7			60.3	54.4	72.6	65.5	
Level of Service	E	C		D	A			E	D	E	E	
Approach Delay (s)		22.5			14.6			58.2			69.0	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Farrington Hwy & E Street

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱			↑↑↑↱		↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	*0.99			*0.99		1.00	1.00		1.00	1.00	
Frt	1.00	0.98			1.00		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5421			5518		1770	1851		1770	1744	
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5421			5518		1770	1851		1770	1744	
Volume (vph)	75	1950	303	0	2238	40	179	106	5	182	125	93
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	2120	329	0	2433	43	195	115	5	198	136	101
RTOR Reduction (vph)	0	16	0	0	1	0	0	1	0	0	21	0
Lane Group Flow (vph)	82	2433	0	0	2475	0	195	119	0	198	216	0
Turn Type	Prot						Split			Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	8.0	81.5			69.5		18.9	18.9		17.6	17.6	
Effective Green, g (s)	8.0	81.5			69.5		18.9	18.9		17.6	17.6	
Actuated g/C Ratio	0.06	0.63			0.53		0.15	0.15		0.14	0.14	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	109	3399			2950		257	269		240	236	
v/s Ratio Prot	0.05	c0.45			c0.45		c0.11	0.06		0.11	c0.12	
v/s Ratio Perm												
v/c Ratio	0.75	0.72			0.84		0.76	0.44		0.82	0.92	
Uniform Delay, d1	60.0	16.4			25.5		53.4	50.7		54.7	55.5	
Progression Factor	0.87	0.76			0.32		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.7	0.7			1.8		12.1	1.2		20.1	36.4	
Delay (s)	66.8	13.2			10.0		65.5	51.9		74.8	91.8	
Level of Service	E	B			B		E	D		E	F	
Approach Delay (s)		14.9			10.0			60.3			84.1	
Approach LOS		B			B			E			F	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Fort Barrette Road & Farrington Hwy

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰↰	↑↱	↱	↰↰	↑↑	↱	↰↰	↑↑	↱	↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	*0.99	*0.99	*0.99	1.00	*0.99	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.96	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	3544	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	3544	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Volume (vph)	493	482	722	355	404	111	677	654	746	225	961	763
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	498	487	729	359	408	112	684	661	754	227	971	771
RTOR Reduction (vph)	0	32	13	0	0	74	0	0	199	0	0	248
Lane Group Flow (vph)	498	626	545	359	408	38	684	661	555	227	971	523
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		Perm	Prot		Perm
Protected Phases	1	6	7	5	2	3	7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	18.0	23.3	48.3	13.7	19.0	35.0	25.0	50.0	50.0	16.0	41.0	41.0
Effective Green, g (s)	18.0	23.3	48.3	13.7	19.0	35.0	25.0	50.0	50.0	16.0	41.0	41.0
Actuated g/C Ratio	0.15	0.20	0.41	0.12	0.16	0.29	0.21	0.42	0.42	0.13	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	530	694	636	403	589	519	736	1550	665	238	1271	545
v/s Ratio Prot	0.14	c0.18	0.18	c0.10	0.11	0.01	c0.20	0.18		0.13	0.26	
v/s Ratio Perm			0.17			0.01			0.35			c0.33
v/c Ratio	0.94	0.90	0.86	0.89	0.69	0.07	0.93	0.43	0.83	0.95	0.76	0.96
Uniform Delay, d1	50.0	46.7	32.2	51.9	47.2	30.3	46.1	24.4	30.8	51.1	34.7	38.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.6	14.9	11.0	21.0	6.6	0.1	17.9	0.2	8.8	45.2	2.8	28.6
Delay (s)	74.6	61.7	43.2	72.9	53.8	30.4	64.1	24.6	39.6	96.4	37.5	66.8
Level of Service	E	E	D	E	D	C	E	C	D	F	D	E
Approach Delay (s)		59.4			58.6			42.9			55.8	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	53.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	119.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: WB Ramps & North-South Road

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	WBL2	WBL	WBR	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰		↱				↑↑	↱	↰↰	↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Lane Util. Factor	*0.99		1.00				*0.99	1.00	0.97	*0.99	
Frt	1.00		0.85				1.00	0.85	1.00	1.00	
Flt Protected	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3504		1583				3688	1583	3433	3688	
Flt Permitted	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3504		1583				3688	1583	3433	3688	
Volume (vph)	1986	0	412	0	0	0	469	86	302	514	0
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	2006	0	416	0	0	0	474	87	305	519	0
RTOR Reduction (vph)	0	0	47	0	0	0	0	71	0	0	0
Lane Group Flow (vph)	2006	0	369	0	0	0	474	16	305	519	0
Turn Type	Prot		custom					Perm	Prot		
Protected Phases	8		8				6		5	2	
Permitted Phases								6			
Actuated Green, G (s)	86.3		86.3				26.0	26.0	15.7	45.7	
Effective Green, g (s)	86.3		86.3				26.0	26.0	15.7	45.7	
Actuated g/C Ratio	0.62		0.62				0.19	0.19	0.11	0.33	
Clearance Time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0				3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	2160		976				685	294	385	1204	
v/s Ratio Prot	c0.57		0.23				c0.13		c0.09	0.14	
v/s Ratio Perm								0.01			
v/c Ratio	0.93		0.38				0.69	0.05	0.79	0.43	
Uniform Delay, d1	24.1		13.4				53.3	46.9	60.6	37.0	
Progression Factor	1.00		1.00				1.00	1.00	0.70	1.06	
Incremental Delay, d2	7.6		0.2				5.7	0.4	7.7	0.8	
Delay (s)	31.7		13.7				58.9	47.2	49.8	39.9	
Level of Service	C		B				E	D	D	D	
Approach Delay (s)		28.6		0.0			57.1			43.6	
Approach LOS		C		A			E			D	

Intersection Summary			
HCM Average Control Delay	36.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: EB Ramps & North-South Road

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL2	EBL	EBR	SBL	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰		↱↱			↰↰	↑↑			↑↑	↱↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00		0.88			0.97	*0.99			*0.99	*0.99
Frt	1.00		0.85			1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1770		2787			3433	3688			3688	3135
Flt Permitted	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (perm)	1770		2787			3433	3688			3688	3135
Volume (vph)	92	0	952	0	0	206	2248	0	0	724	2003
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	93	0	962	0	0	208	2271	0	0	731	2023
RTOR Reduction (vph)	0	0	4	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	93	0	958	0	0	208	2271	0	0	731	2023
Turn Type	Prot		custom			Prot					Free
Protected Phases	4		4			1	6			2	
Permitted Phases											Free
Actuated Green, G (s)	24.0		24.0			16.0	38.0			18.0	70.0
Effective Green, g (s)	24.0		24.0			16.0	38.0			18.0	70.0
Actuated g/C Ratio	0.34		0.34			0.23	0.54			0.26	1.00
Clearance Time (s)	4.0		4.0			4.0	4.0			4.0	
Vehicle Extension (s)	3.0		3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)	607		956			785	2002			948	3135
v/s Ratio Prot	0.05		c0.34			0.06	c0.62			0.20	
v/s Ratio Perm											0.65
v/c Ratio	0.15		1.00			0.26	1.13			0.77	0.65
Uniform Delay, d1	16.0		23.0			22.2	16.0			24.1	0.0
Progression Factor	1.00		1.00			1.00	1.19			1.00	1.00
Incremental Delay, d2	0.1		29.6			0.1	63.7			6.0	1.0
Delay (s)	16.1		52.6			22.2	82.7			30.1	1.0
Level of Service	B		D			C	F			C	A
Approach Delay (s)		49.4		0.0			77.6			8.8	
Approach LOS		D		A			E			A	

Intersection Summary			
HCM Average Control Delay	42.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: North-South Road & Farrington Hwy
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00	*0.99	*0.99	1.00	*0.99	*0.99	1.00	*0.99	*0.99	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	5532	1583	5256	5532	1583	3504	3688	1583	3504	3688	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	5532	1583	5256	5532	1583	3504	3688	1583	3504	3688	2787
Volume (vph)	717	1856	607	876	1562	386	407	740	537	529	847	758
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	724	1875	613	885	1578	390	411	747	542	534	856	766
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	724	1875	613	885	1578	390	411	747	542	534	856	766
Turn Type	Prot		Free	Prot		Free	Prot		Free	Prot		Free
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			Free			Free			Free
Actuated Green, G (s)	25.0	41.0	120.0	20.0	36.0	120.0	16.0	25.0	120.0	18.0	27.0	120.0
Effective Green, g (s)	25.0	41.0	120.0	20.0	36.0	120.0	16.0	25.0	120.0	18.0	27.0	120.0
Actuated g/C Ratio	0.21	0.34	1.00	0.17	0.30	1.00	0.13	0.21	1.00	0.15	0.22	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	730	1890	1583	876	1660	1583	467	768	1583	526	830	2787
v/s Ratio Prot	c0.21	c0.34		0.17	0.29		0.12	0.20		c0.15	c0.23	
v/s Ratio Perm			c0.39			0.25			0.34			0.27
v/c Ratio	0.99	0.99	0.39	1.01	0.95	0.25	0.88	0.97	0.34	1.02	1.03	0.27
Uniform Delay, d1	47.4	39.3	0.0	50.0	41.1	0.0	51.1	47.2	0.0	51.0	46.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	31.1	18.9	0.7	33.0	13.1	0.4	20.5	26.5	0.6	43.1	39.5	0.2
Delay (s)	78.5	58.2	0.7	83.0	54.3	0.4	71.6	73.6	0.6	94.1	86.0	0.2
Level of Service	E	E	A	F	D	A	E	E	A	F	F	A
Approach Delay (s)		51.8			55.8			49.8			57.6	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM Average Control Delay	53.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: North-South Road & North UH Connector
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99	0.86	*0.99	*0.99		*0.99	*0.99		*0.99	1.00	*0.99
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5532	1362	3504	5396		3504	3466		3504	1863	3135
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	5532	1362	3504	5396		3504	3466		3504	1863	3135
Volume (vph)	73	1834	457	642	1906	374	273	421	282	374	117	717
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	74	1853	462	648	1925	378	276	425	285	378	118	724
RTOR Reduction (vph)	0	0	205	0	25	0	0	93	0	0	0	17
Lane Group Flow (vph)	74	1853	257	648	2278	0	276	617	0	378	118	707
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	5	2		1	6		7	4		3	8	1
Permitted Phases			2									8
Actuated Green, G (s)	8.8	46.8	46.8	26.4	64.4		14.5	24.6		16.2	26.3	52.7
Effective Green, g (s)	8.8	46.8	46.8	26.4	64.4		14.5	24.6		16.2	26.3	52.7
Actuated g/C Ratio	0.07	0.36	0.36	0.20	0.50		0.11	0.19		0.12	0.20	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	120	1992	490	712	2673		391	656		437	377	1271
v/s Ratio Prot	0.04	c0.33		c0.18	0.42		0.08	c0.18		c0.11	0.06	0.11
v/s Ratio Perm			0.19									0.11
v/c Ratio	0.62	0.93	0.52	0.91	0.85		0.71	0.94		0.86	0.31	0.56
Uniform Delay, d1	59.0	40.0	32.8	50.6	28.6		55.7	52.0		55.8	44.2	29.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.54	0.48	0.81
Incremental Delay, d2	9.1	9.3	4.0	15.8	3.7		5.7	21.6		7.2	0.2	0.2
Delay (s)	68.0	49.3	36.8	66.4	32.3		61.4	73.6		37.6	21.3	24.3
Level of Service	E	D	D	E	C		E	E		D	C	C
Approach Delay (s)		47.5			39.8			70.2			28.1	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM Average Control Delay	44.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: East-West Rd & North-South Road

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰↰	↑↱		↰↰	↑↑↑	↱	↰↰	↑↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	*0.99	0.95		0.97	*0.99		*0.99	*0.99	1.00	*0.99	*0.99	
Frt	1.00	0.94		1.00	0.89		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3504	3313		3433	3283		3504	5532	1583	3504	5358	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3504	3313		3433	3283		3504	5532	1583	3504	5358	
Volume (vph)	308	312	232	361	192	525	110	1530	277	504	1626	432
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	311	315	234	365	194	530	111	1545	280	509	1642	436
RTOR Reduction (vph)	0	102	0	0	197	0	0	0	172	0	39	0
Lane Group Flow (vph)	311	447	0	365	527	0	111	1545	108	509	2039	0
Turn Type	Prot			Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	14.5	21.3		14.6	21.4		7.7	45.1	45.1	20.0	57.4	
Effective Green, g (s)	14.5	21.3		14.6	21.4		7.7	45.1	45.1	20.0	57.4	
Actuated g/C Ratio	0.12	0.18		0.12	0.18		0.07	0.39	0.39	0.17	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	434	603		428	600		231	2132	610	599	2629	
v/s Ratio Prot	0.09	0.13		c0.11	c0.16		0.03	0.28		c0.15	c0.38	
v/s Ratio Perm									0.07			
v/c Ratio	0.72	0.74		0.85	1.10dr		0.48	0.72	0.18	0.85	0.78	
Uniform Delay, d1	49.3	45.2		50.1	46.5		52.7	30.7	23.7	47.0	24.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.6	4.9		15.1	13.7		1.6	2.2	0.6	14.1	2.3	
Delay (s)	54.8	50.1		65.2	60.3		54.3	32.8	24.3	61.1	26.8	
Level of Service	D	D		E	E		D	C	C	E	C	
Approach Delay (s)		51.8			61.9			32.8			33.6	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM Average Control Delay	40.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: North-South Road & Kapolei Parkway

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰	↑↑↑	↱	↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99	1.00	1.00	*0.99	1.00	*0.99	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5532	1583	1770	5532	1583	3504	5532	1583	1770	5532	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5532	1583	1770	5532	1583	3504	5532	1583	1770	5532	1583
Volume (vph)	378	875	155	494	1001	725	704	643	505	121	568	339
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	382	884	157	499	1011	732	711	649	510	122	574	342
RTOR Reduction (vph)	0	0	122	0	0	285	0	0	341	0	0	297
Lane Group Flow (vph)	382	884	35	499	1011	447	711	649	169	122	574	45
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Actuated Green, G (s)	26.9	26.6	26.6	36.3	36.0	36.0	25.0	30.2	30.2	10.6	15.8	15.8
Effective Green, g (s)	26.9	26.6	26.6	36.3	36.0	36.0	25.0	30.2	30.2	10.6	15.8	15.8
Actuated g/C Ratio	0.22	0.22	0.22	0.30	0.30	0.30	0.21	0.25	0.25	0.09	0.13	0.13
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	398	1229	352	537	1664	476	732	1396	399	157	730	209
v/s Ratio Prot	0.22	0.16		c0.28	0.18		c0.20	0.12		0.07	c0.10	
v/s Ratio Perm			0.02			c0.28			0.11			0.03
v/c Ratio	0.96	0.72	0.10	0.93	0.61	0.94	0.97	0.46	0.42	0.78	0.79	0.22
Uniform Delay, d1	45.9	43.1	37.0	40.5	35.8	40.8	47.0	37.9	37.5	53.4	50.3	46.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	34.3	3.6	0.6	22.5	1.7	28.7	26.2	0.2	0.7	21.1	5.6	0.5
Delay (s)	80.2	46.7	37.6	62.9	37.5	69.5	73.2	38.2	38.2	74.5	55.9	46.9
Level of Service	F	D	D	E	D	E	E	D	D	E	E	D
Approach Delay (s)		54.7			53.6			51.5			55.1	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	53.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	119.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: East-West Rd & Old Fort Weaver Rd
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	3539	1583	3433	1583
Flt Permitted	0.23	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	433	1863	3539	1583	3433	1583
Volume (vph)	37	533	689	948	805	93
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	37	538	696	958	813	94
RTOR Reduction (vph)	0	0	0	0	0	38
Lane Group Flow (vph)	37	538	696	958	813	56
Turn Type	Perm			pm+ov		Perm
Protected Phases		4	8	6	6	
Permitted Phases	4			8		6
Actuated Green, G (s)	44.6	44.6	44.6	122.0	77.4	77.4
Effective Green, g (s)	44.6	44.6	44.6	122.0	77.4	77.4
Actuated g/C Ratio	0.34	0.34	0.34	0.94	0.60	0.60
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	149	639	1214	1583	2044	942
v/s Ratio Prot		c0.29	0.20	c0.36	0.24	
v/s Ratio Perm	0.09			0.24		0.04
v/c Ratio	0.25	0.84	0.57	0.61	0.40	0.06
Uniform Delay, d1	30.7	39.4	34.9	0.6	13.9	11.0
Progression Factor	0.69	0.77	0.81	1.00	0.75	0.43
Incremental Delay, d2	0.7	8.0	0.2	0.2	0.2	0.0
Delay (s)	22.0	38.4	28.5	0.7	10.7	4.8
Level of Service	C	D	C	A	B	A
Approach Delay (s)		37.4	12.4		10.1	
Approach LOS		D	B		B	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Farrington Hwy & B Street
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰	↑↑	↱	↰↰	↑↑	↱	↰	↑	↱	↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	*0.99	1.00	0.97	*0.99	1.00	1.00	1.00	1.00	*0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3688	1583	3433	3688	1583	1770	1863	1583	3504	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3688	1583	3433	3688	1583	1770	1863	1583	3504	1863	1583
Volume (vph)	221	1384	344	375	1728	74	146	282	195	264	143	171
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	223	1398	347	379	1745	75	147	285	197	267	144	173
RTOR Reduction (vph)	0	0	43	0	0	28	0	0	9	0	0	34
Lane Group Flow (vph)	223	1398	304	379	1745	47	147	285	188	267	144	139
Turn Type	Prot		pm+ov	Prot		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6		7	4	5	3	8	1
Permitted Phases			2			6			4			8
Actuated Green, G (s)	9.0	55.5	66.5	15.5	62.0	62.0	17.3	20.7	29.7	11.0	14.4	29.9
Effective Green, g (s)	9.0	55.5	66.5	15.5	62.0	62.0	17.3	20.7	29.7	11.0	14.4	29.9
Actuated g/C Ratio	0.08	0.47	0.56	0.13	0.52	0.52	0.15	0.17	0.25	0.09	0.12	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	260	1724	887	448	1926	827	258	325	396	325	226	399
v/s Ratio Prot	0.06	0.38	0.03	c0.11	c0.47		0.08	c0.15	0.04	c0.08	0.08	0.05
v/s Ratio Perm			0.16			0.03			0.08			0.04
v/c Ratio	0.86	0.81	0.34	0.85	0.91	0.06	0.57	0.88	0.47	0.82	0.64	0.35
Uniform Delay, d1	54.2	27.1	14.2	50.4	25.7	14.0	47.2	47.8	37.9	52.9	49.7	36.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.3	4.3	0.2	13.7	7.6	0.1	2.9	22.3	0.9	15.3	5.8	0.5
Delay (s)	77.5	31.4	14.4	64.1	33.3	14.1	50.1	70.0	38.8	68.1	55.4	37.0
Level of Service	E	C	B	E	C	B	D	E	D	E	E	D
Approach Delay (s)		33.6			38.0			55.6			55.8	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	40.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	118.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: East-West Rd & A Street

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.85		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1841		1770	1863	1583	1770	1585		1770	1631	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1841		1770	1863	1583	1770	1585		1770	1631	
Volume (vph)	164	661	55	34	683	513	12	1	135	44	6	31
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	178	718	60	37	742	558	13	1	147	48	7	34
RTOR Reduction (vph)	0	2	0	0	0	174	0	138	0	0	32	0
Lane Group Flow (vph)	178	776	0	37	742	384	13	10	0	48	9	0
Turn Type	Prot			Prot		Perm	Split			Split		
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases						6						
Actuated Green, G (s)	18.4	92.7		4.8	79.1	79.1	7.7	7.7		8.8	8.8	
Effective Green, g (s)	18.4	92.7		4.8	79.1	79.1	7.7	7.7		8.8	8.8	
Actuated g/C Ratio	0.14	0.71		0.04	0.61	0.61	0.06	0.06		0.07	0.07	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	251	1313		65	1134	963	105	94		120	110	
v/s Ratio Prot	c0.10	0.42		0.02	c0.40		c0.01	0.01		c0.03	0.01	
v/s Ratio Perm						0.24						
v/c Ratio	0.71	0.59		0.57	0.65	0.40	0.12	0.10		0.40	0.08	
Uniform Delay, d1	53.2	9.3		61.6	16.6	13.2	58.0	57.9		58.1	56.8	
Progression Factor	1.00	1.00		0.96	0.35	0.08	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.8	2.0		4.9	1.3	0.5	0.5	0.5		2.2	0.3	
Delay (s)	62.1	11.2		64.2	7.2	1.6	58.5	58.4		60.3	57.2	
Level of Service	E	B		E	A	A	E	E		E	E	
Approach Delay (s)		20.7			6.4			58.4			58.8	
Approach LOS		C			A			E			E	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Farrington Hwy & 2nd Avenue

2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰↰	↑↑	↱	↰	↑↑	↱↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95	1.00	1.00	0.95	0.88	0.97	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5021		3433	3539	1583	1770	3539	2787	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5021		3433	3539	1583	1770	3539	2787	3433	3539	1583
Volume (vph)	180	1404	130	555	1708	237	103	297	410	515	356	308
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	196	1526	141	603	1857	258	112	323	446	560	387	335
RTOR Reduction (vph)	0	8	0	0	0	80	0	0	7	0	0	169
Lane Group Flow (vph)	196	1659	0	603	1857	178	112	323	439	560	387	166
Turn Type	Prot			Prot		Perm	Prot		pm+ov	Prot		Perm
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	14.0	52.0		26.0	64.0	64.0	11.0	16.0	42.0	20.0	25.0	25.0
Effective Green, g (s)	14.0	52.0		26.0	64.0	64.0	11.0	16.0	42.0	20.0	25.0	25.0
Actuated g/C Ratio	0.11	0.40		0.20	0.49	0.49	0.08	0.12	0.32	0.15	0.19	0.19
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	191	2008		687	1742	779	150	436	900	528	681	304
v/s Ratio Prot	c0.11	0.33		0.18	c0.52		0.06	c0.09	0.10	c0.16	c0.11	
v/s Ratio Perm						0.11			0.06			0.10
v/c Ratio	1.03	0.83		0.88	1.07	0.23	0.75	0.74	0.49	1.06	0.57	0.55
Uniform Delay, d1	58.0	34.9		50.5	33.0	18.9	58.1	55.0	35.3	55.0	47.6	47.4
Progression Factor	1.00	1.00		0.70	0.56	0.10	0.75	0.73	0.71	0.80	0.76	0.64
Incremental Delay, d2	72.1	4.0		6.9	36.7	0.4	13.8	8.1	0.3	42.2	1.3	2.7
Delay (s)	130.1	39.0		42.2	55.0	2.3	57.1	48.2	25.3	86.3	37.6	33.0
Level of Service	F	D		D	E	A	E	D	C	F	D	C
Approach Delay (s)		48.6			47.2			37.7			57.6	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	48.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	4551	349	0	4748
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	4947	379	0	5161
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			868			
pX, platoon unblocked	0.37	0.37			0.37	
vC, conflicting volume	6427	1426			5326	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	10601	0			7607	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	0	399			0	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	0	1413	1413	1413	1086	1290	1290	1290	1290
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	379	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.83	0.83	0.83	0.64	0.76	0.76	0.76	0.76
Queue Length 95th (ft)	0	0	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A								
Approach Delay (s)	0.0	0.0				0.0			
Approach LOS	A								

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	4433	118	0	4297
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	4818	128	0	4671
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1232			
pX, platoon unblocked	0.41	0.41			0.41	
vC, conflicting volume	6050	1269			4947	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	9049	0			6332	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	0	440			2	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	0	1377	1377	1377	817	1168	1168	1168	1168
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	128	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.81	0.81	0.81	0.48	0.69	0.69	0.69	0.69
Queue Length 95th (ft)	0	0	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A								
Approach Delay (s)	0.0	0.0				0.0			
Approach LOS	A								

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
25: East-West Rd & B Street
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Volume (vph)	414	290	644	95	337	588
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	450	315	700	103	366	639
RTOR Reduction (vph)	0	0	0	45	0	395
Lane Group Flow (vph)	450	315	700	58	366	244
Turn Type	Prot			Prot		Prot
Protected Phases	5	2	6	6	4	4
Permitted Phases						
Actuated Green, G (s)	36.0	93.0	53.0	53.0	29.0	29.0
Effective Green, g (s)	36.0	93.0	53.0	53.0	29.0	29.0
Actuated g/C Ratio	0.28	0.72	0.41	0.41	0.22	0.22
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	490	1333	760	645	395	353
v/s Ratio Prot	c0.25	0.17	c0.38	0.04	c0.21	0.15
v/s Ratio Perm						
v/c Ratio	0.92	0.24	0.92	0.09	0.93	0.69
Uniform Delay, d1	45.6	6.3	36.5	23.7	49.5	46.4
Progression Factor	0.80	0.66	1.68	2.63	1.00	1.00
Incremental Delay, d2	19.3	0.3	16.5	0.2	30.1	10.6
Delay (s)	55.6	4.6	77.7	62.5	79.6	57.0
Level of Service	E	A	E	E	E	E
Approach Delay (s)		34.6	75.8		65.2	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	59.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
26: Farrington Hwy &
2030 + PRO (With Transit Corridor) - PM Peak Mitigations

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	*0.99	*0.99	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3688	3688	1583
Flt Permitted	0.95	1.00	0.05	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	98	3688	3688	1583
Volume (vph)	199	173	94	1485	2229	137
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	201	175	95	1500	2252	138
RTOR Reduction (vph)	0	16	0	0	0	33
Lane Group Flow (vph)	201	159	95	1500	2252	105
Turn Type		Perm	Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	16.0	16.0	76.0	76.0	76.0	76.0
Effective Green, g (s)	16.0	16.0	76.0	76.0	76.0	76.0
Actuated g/C Ratio	0.16	0.16	0.76	0.76	0.76	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	283	253	74	2803	2803	1203
v/s Ratio Prot	c0.11			0.41	0.61	
v/s Ratio Perm		0.10	c0.97			0.07
v/c Ratio	0.71	0.63	1.28	0.54	0.80	0.09
Uniform Delay, d1	39.8	39.2	12.0	4.9	7.4	3.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.1	11.3	198.5	0.7	2.6	0.1
Delay (s)	53.9	50.5	210.5	5.6	9.9	3.2
Level of Service	D	D	F	A	A	A
Approach Delay (s)	52.3			17.8	9.6	
Approach LOS	D			B	A	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX A-6

MITIGATIONS
YEAR 2030 PLUS PROJECT CONDITIONS
SCENARIO B: WITHOUT TRANSIT CORRIDOR SCENARIO

HCM Signalized Intersection Capacity Analysis
1: Kunia Loop & Kunia Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↰	↱	↑↑	↱		↓↓↓
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	0.97	1.00	0.95	1.00		0.91
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	3433	1583	3539	1583		5085
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	3433	1583	3539	1583		5085
Volume (vph)	724	37	1781	498	0	1309
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	787	40	1936	541	0	1423
RTOR Reduction (vph)	0	10	0	196	0	0
Lane Group Flow (vph)	787	30	1936	345	0	1423
Turn Type		Perm		Perm		
Protected Phases	8		2			6
Permitted Phases		8		2		
Actuated Green, G (s)	26.8	26.8	61.1	61.1		61.1
Effective Green, g (s)	26.8	26.8	61.1	61.1		61.1
Actuated g/C Ratio	0.28	0.28	0.64	0.64		0.64
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	959	442	2255	1009		3240
v/s Ratio Prot	c0.23		c0.55			0.28
v/s Ratio Perm		0.02		0.22		
v/c Ratio	0.82	0.07	0.86	0.34		0.44
Uniform Delay, d1	32.3	25.4	13.9	8.1		8.8
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	5.7	0.1	4.5	0.9		0.4
Delay (s)	38.0	25.4	18.5	9.0		9.2
Level of Service	D	C	B	A		A
Approach Delay (s)	37.4		16.4			9.2
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	95.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: H-1 WB On-Ramp & Kunia Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						↱	↰	↑↑↑			↓↓↓	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)						4.0	4.0	4.0			4.0	
Lane Util. Factor						1.00	1.00	0.91			0.91	
Frt						0.86	1.00	1.00			0.98	
Flt Protected						1.00	0.95	1.00			1.00	
Satd. Flow (prot)						1611	1770	5085			4960	
Flt Permitted						1.00	0.95	1.00			1.00	
Satd. Flow (perm)						1611	1770	5085			4960	
Volume (vph)	0	0	0	0	0	530	165	1748	0	0	1697	333
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	576	179	1900	0	0	1845	362
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	15	0
Lane Group Flow (vph)	0	0	0	0	0	576	179	1900	0	0	2192	0
Turn Type						Free	Prot					
Protected Phases							5	2			6	
Permitted Phases						Free						
Actuated Green, G (s)						110.0	15.1	110.0			86.9	
Effective Green, g (s)						110.0	15.1	110.0			86.9	
Actuated g/C Ratio						1.00	0.14	1.00			0.79	
Clearance Time (s)							4.0	4.0			4.0	
Vehicle Extension (s)							3.0	3.0			3.0	
Lane Grp Cap (vph)						1611	243	5085			3918	
v/s Ratio Prot							c0.10	0.37			c0.44	
v/s Ratio Perm						0.36						
v/c Ratio						0.36	0.74	0.37			0.56	
Uniform Delay, d1						0.0	45.5	0.0			4.3	
Progression Factor						1.00	1.07	1.00			1.00	
Incremental Delay, d2						0.6	9.8	0.2			0.6	
Delay (s)						0.6	58.5	0.2			4.9	
Level of Service						A	E	A			A	
Approach Delay (s)		0.0			0.6			5.2			4.9	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	4.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: H-1 EB & Kunia Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations	↰↰	↱	↑↑↑↑			↑↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	0.97	1.00	0.86			0.91
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3433	1583	6408			5085
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3433	1583	6408			5085
Volume (vph)	403	363	2072	0	0	1509
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	438	395	2252	0	0	1640
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	438	395	2252	0	0	1640
Turn Type		Free				
Protected Phases	4		6			2
Permitted Phases		Free				
Actuated Green, G (s)	17.4	110.0	84.6			84.6
Effective Green, g (s)	17.4	110.0	84.6			84.6
Actuated g/C Ratio	0.16	1.00	0.77			0.77
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	543	1583	4928			3911
v/s Ratio Prot	c0.13		c0.35			0.32
v/s Ratio Perm		0.25				
v/c Ratio	0.81	0.25	0.46			0.42
Uniform Delay, d1	44.7	0.0	4.5			4.3
Progression Factor	1.00	1.00	0.76			1.02
Incremental Delay, d2	8.6	0.4	0.3			0.3
Delay (s)	53.2	0.4	3.8			4.8
Level of Service	D	A	A			A
Approach Delay (s)	28.2		3.8			4.8
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	8.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Farrington Hwy & Fort Weaver Road SB Ramp
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↱		↰↰	↑↑↑				↱			↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0				4.0			4.0
Lane Util. Factor		0.91		0.97	0.91				1.00			1.00
Frt		0.98		1.00	1.00				0.86			0.86
Flt Protected		1.00		0.95	1.00				1.00			1.00
Satd. Flow (prot)		5006		3433	5085				1611			1611
Flt Permitted		1.00		0.95	1.00				1.00			1.00
Satd. Flow (perm)		5006		3433	5085				1611			1611
Volume (vph)	0	2066	240	498	721	0	0	0	429	0	0	481
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2246	261	541	784	0	0	0	466	0	0	523
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2495	0	541	784	0	0	0	466	0	0	523
Turn Type				Prot					Free			Free
Protected Phases		2		1	6							
Permitted Phases									Free			Free
Actuated Green, G (s)		71.2		30.8	110.0				110.0			110.0
Effective Green, g (s)		71.2		30.8	110.0				110.0			110.0
Actuated g/C Ratio		0.65		0.28	1.00				1.00			1.00
Clearance Time (s)		4.0		4.0	4.0							
Vehicle Extension (s)		3.0		3.0	3.0							
Lane Grp Cap (vph)		3240		961	5085				1611			1611
v/s Ratio Prot		c0.50		c0.16	0.15							
v/s Ratio Perm									0.29			0.32
v/c Ratio		0.77		0.56	0.15				0.29			0.32
Uniform Delay, d1		13.6		33.8	0.0				0.0			0.0
Progression Factor		0.52		1.90	1.00				1.00			1.00
Incremental Delay, d2		1.3		0.6	0.1				0.5			0.5
Delay (s)		8.3		65.0	0.1				0.5			0.5
Level of Service		A		E	A				A			A
Approach Delay (s)		8.3			26.6			0.5			0.5	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Farrington Hwy & Fort Weaver Road NB Ramps
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑			↑↑↑	↱			↱			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0			
Lane Util. Factor	0.97	*0.99			*0.99	1.00			1.00			
Frt	1.00	1.00			1.00	0.85			0.86			
Flt Protected	0.95	1.00			1.00	1.00			1.00			
Satd. Flow (prot)	3433	5532			5532	1583			1611			
Flt Permitted	0.95	1.00			1.00	1.00			1.00			
Satd. Flow (perm)	3433	5532			5532	1583			1611			
Volume (vph)	1165	1330	0	0	1218	567	0	0	911	0	0	0
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	1177	1343	0	0	1230	573	0	0	920	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	55	0	0	0	0	0	0
Lane Group Flow (vph)	1177	1343	0	0	1230	518	0	0	920	0	0	0
Turn Type	Prot					Perm			Free			
Protected Phases	5	2			6							
Permitted Phases						6			Free			
Actuated Green, G (s)	64.6	110.0			37.4	37.4			110.0			
Effective Green, g (s)	64.6	110.0			37.4	37.4			110.0			
Actuated g/C Ratio	0.59	1.00			0.34	0.34			1.00			
Clearance Time (s)	4.0	4.0			4.0	4.0						
Vehicle Extension (s)	3.0	3.0			3.0	3.0						
Lane Grp Cap (vph)	2016	5532			1881	538			1611			
v/s Ratio Prot	0.34	0.24			0.22							
v/s Ratio Perm						c0.33			c0.57			
v/c Ratio	0.58	0.24			0.65	0.96			0.57			
Uniform Delay, d1	14.3	0.0			30.8	35.6			0.0			
Progression Factor	0.23	1.00			1.00	1.00			1.00			
Incremental Delay, d2	0.3	0.1			1.8	30.5			1.5			
Delay (s)	3.6	0.1			32.6	66.1			1.5			
Level of Service	A	A			C	E			A			
Approach Delay (s)		1.7			43.2			1.5			0.0	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Farrington Hwy & Leoku Street
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰	↑↑↑	↱		↰↑	↱		↰↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00	1.00	*0.99	1.00		1.00	1.00		*0.99	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	3504	5532	1583	1770	5532	1583		1780	1583		3568	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	3504	5532	1583	1770	5532	1583		1780	1583		3568	1583
Volume (vph)	147	1938	155	119	1699	156	56	5	48	92	45	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	2107	168	129	1847	170	61	5	52	100	49	36
RTOR Reduction (vph)	0	0	75	0	0	92	0	0	49	0	0	33
Lane Group Flow (vph)	160	2107	93	129	1847	78	0	66	3	0	149	3
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	17.9	47.9	47.9	9.7	39.7	39.7		5.4	5.4		7.2	7.2
Effective Green, g (s)	17.9	47.9	47.9	9.7	39.7	39.7		5.4	5.4		7.2	7.2
Actuated g/C Ratio	0.21	0.56	0.56	0.11	0.46	0.46		0.06	0.06		0.08	0.08
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	728	3074	880	199	2548	729		112	99		298	132
v/s Ratio Prot	0.05	c0.38		c0.07	c0.33			c0.04			c0.04	
v/s Ratio Perm			0.06			0.05			0.00			0.00
v/c Ratio	0.22	0.69	0.11	0.65	0.72	0.11		0.59	0.03		0.50	0.02
Uniform Delay, d1	28.4	13.7	9.0	36.6	18.8	13.2		39.3	37.9		37.8	36.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.6	0.1	7.1	1.0	0.1		20.7	0.6		1.3	0.1
Delay (s)	28.5	14.4	9.1	43.7	19.9	13.3		60.1	38.6		39.1	36.3
Level of Service	C	B	A	D	B	B		E	D		D	D
Approach Delay (s)		15.0			20.8			50.6			38.6	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	86.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Laulaunui Street & Fort Weaver Road 2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↑↱		↰	↑	↱	↰	↑↑↑	↱	↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	*0.99		1.00	1.00	1.00	1.00	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.97		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3509		1770	1863	1583	1770	5532	1583	1770	5532	1583
Flt Permitted	0.95	0.97		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3509		1770	1863	1583	1770	5532	1583	1770	5532	1583
Volume (vph)	96	24	12	72	4	235	48	4056	53	92	1419	170
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	97	24	12	73	4	237	48	4097	54	93	1433	172
RTOR Reduction (vph)	0	10	0	0	0	101	0	0	10	0	0	51
Lane Group Flow (vph)	49	74	0	73	4	136	48	4097	44	93	1433	121
Turn Type	Split			Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			6
Actuated Green, G (s)	9.8	9.8		10.0	10.0	10.0	7.4	101.0	101.0	7.9	101.5	101.5
Effective Green, g (s)	9.8	9.8		10.0	10.0	10.0	7.4	101.0	101.0	7.9	101.5	101.5
Actuated g/C Ratio	0.07	0.07		0.07	0.07	0.07	0.05	0.70	0.70	0.05	0.70	0.70
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	109	238		122	129	109	91	3861	1105	97	3880	1110
v/s Ratio Prot	c0.03	0.02		0.04	0.00		0.03	c0.74		c0.05	0.26	
v/s Ratio Perm						c0.09			0.03			0.08
v/c Ratio	0.45	0.31		0.60	0.03	1.24	0.53	1.06	0.04	0.96	0.37	0.11
Uniform Delay, d1	64.9	64.2		65.4	62.8	67.3	66.9	21.8	6.8	68.2	8.7	7.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	0.7		7.7	0.1	165.4	5.4	34.0	0.1	77.0	0.3	0.2
Delay (s)	67.8	65.0		73.1	62.9	232.8	72.4	55.9	6.9	145.3	9.0	7.2
Level of Service	E	E		E	E	F	E	E	A	F	A	A
Approach Delay (s)		66.0			193.5			55.5			16.3	
Approach LOS		E			F			E			B	

Intersection Summary			
HCM Average Control Delay	52.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	144.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
8: Old Fort Weaver Road & Fort Weaver Road 2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰↰	↑	↱		↰↑	↱	↰↰	↑↑↑↱		↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	1.00	1.00		1.00	1.00	0.97	*0.99		1.00	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4990	1863	1583		1862	1583	3433	5532		1770	5532	1583
Flt Permitted	0.95	1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4990	1863	1583		1862	1583	3433	5532		1770	5532	1583
Volume (vph)	851	126	403	4	484	262	299	3044	1	21	949	532
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	860	127	407	4	489	265	302	3075	1	21	959	537
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	291
Lane Group Flow (vph)	860	127	407	0	493	265	302	3076	0	21	959	246
Turn Type	Split		Free	Split		Free	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free						6
Actuated Green, G (s)	31.5	31.5	145.0		14.1	145.0	17.0	81.1		2.3	66.4	66.4
Effective Green, g (s)	31.5	31.5	145.0		14.1	145.0	17.0	81.1		2.3	66.4	66.4
Actuated g/C Ratio	0.22	0.22	1.00		0.10	1.00	0.12	0.56		0.02	0.46	0.46
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	1084	405	1583		181	1583	402	3094		28	2533	725
v/s Ratio Prot	c0.17	0.07			c0.26		c0.09	c0.56		0.01	0.17	
v/s Ratio Perm			0.26			0.17						0.16
v/c Ratio	0.79	0.31	0.26		2.72	0.17	0.75	0.99		0.75	0.38	0.34
Uniform Delay, d1	53.7	47.7	0.0		65.5	0.0	62.0	31.7		71.1	25.8	25.2
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.1	0.4	0.4		791.1	0.2	7.7	14.9		71.8	0.4	1.3
Delay (s)	57.7	48.1	0.4		856.5	0.2	69.7	46.6		142.9	26.2	26.5
Level of Service	E	D	A		F	A	E	D		F	C	C
Approach Delay (s)		40.1			557.2			48.7			27.9	
Approach LOS		D			F			D			C	

Intersection Summary			
HCM Average Control Delay	97.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	117.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
9: Renton Road & Fort Weaver Road

2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00		1.00	1.00	1.00	*0.99	1.00	0.97	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1752	1766	1583		1860	1583	1770	5532	1583	3433	5532	1583
Flt Permitted	0.95	0.96	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1752	1766	1583		1860	1583	1770	5532	1583	3433	5532	1583
Volume (vph)	468	31	36	10	339	217	89	2658	1	251	1023	85
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	473	31	36	10	342	219	90	2685	1	254	1033	86
RTOR Reduction (vph)	0	0	0	0	0	97	0	0	0	0	0	33
Lane Group Flow (vph)	246	258	36	0	352	122	90	2685	1	254	1033	53
Turn Type	Split		Free	Split		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	4	4		8	8		5	2	8	1	6	4
Permitted Phases			Free			8			2			6
Actuated Green, G (s)	20.0	20.0	140.0		26.0	26.0	11.6	68.0	94.0	10.0	66.4	86.4
Effective Green, g (s)	20.0	20.0	140.0		26.0	26.0	11.6	68.0	94.0	10.0	66.4	86.4
Actuated g/C Ratio	0.14	0.14	1.00		0.19	0.19	0.08	0.49	0.67	0.07	0.47	0.62
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	250	252	1583		345	294	147	2687	1063	245	2624	1022
v/s Ratio Prot	0.14	c0.15			c0.19		0.05	c0.49	0.00	c0.07	0.19	0.01
v/s Ratio Perm			c0.02			0.08			0.00			0.03
v/c Ratio	0.98	1.02	0.02		1.02	0.42	0.61	1.00	0.00	1.04	0.39	0.05
Uniform Delay, d1	59.8	60.0	0.0		57.0	50.3	62.0	36.0	7.6	65.0	23.8	10.6
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	52.1	63.0	0.0		53.7	1.0	7.3	17.2	0.0	67.4	0.4	0.0
Delay (s)	111.9	123.0	0.0		110.7	51.2	69.4	53.2	7.6	132.4	24.2	10.6
Level of Service	F	F	A		F	D	E	D	A	F	C	B
Approach Delay (s)		109.7			87.9			53.7			43.4	
Approach LOS		F			F			D			D	

Intersection Summary			
HCM Average Control Delay	60.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Farrington Hwy & D Street

2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.99		*0.99	*0.99			*0.99	*0.99	*0.99	*0.99	
Frt	1.00	1.00		1.00	0.99			0.91	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5532		3504	5478			1669	1567	1752	1678	
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5532		3504	5478			1669	1567	1752	1678	
Volume (vph)	146	1756	0	240	899	63	0	65	347	205	230	345
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	147	1774	0	242	908	64	0	66	351	207	232	348
RTOR Reduction (vph)	0	0	0	0	8	0	0	59	212	0	49	0
Lane Group Flow (vph)	147	1774	0	242	964	0	0	120	26	207	531	0
Turn Type	Prot			Prot					Perm	Split		
Protected Phases	5	2		1	6			8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	12.0	42.8		7.0	37.8			12.2	12.2	32.0	32.0	
Effective Green, g (s)	12.0	42.8		7.0	37.8			12.2	12.2	32.0	32.0	
Actuated g/C Ratio	0.11	0.39		0.06	0.34			0.11	0.11	0.29	0.29	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	193	2152		223	1882			185	174	510	488	
v/s Ratio Prot	0.08	c0.32		c0.07	0.18			c0.07		0.12	c0.32	
v/s Ratio Perm									0.02			
v/c Ratio	0.76	0.82		1.09	0.51			0.65	0.15	0.41	1.09	
Uniform Delay, d1	47.6	30.2		51.5	28.8			46.9	44.2	31.4	39.0	
Progression Factor	0.74	0.81		0.61	0.39			1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.1	3.0		84.4	1.0			7.9	0.4	0.5	66.8	
Delay (s)	48.2	27.5		115.8	12.2			54.8	44.6	31.9	105.8	
Level of Service	D	C		F	B			D	D	C	F	
Approach Delay (s)		29.1			32.8			49.0			86.3	
Approach LOS		C			C			D			F	

Intersection Summary			
HCM Average Control Delay	42.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

11: Farrington Hwy & E Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	*0.99			*0.99		1.00	1.00		1.00	1.00	
Frt	1.00	0.99			1.00		1.00	1.00		1.00	0.92	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5503			5515		1770	1856		1770	1722	
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5503			5515		1770	1856		1770	1722	
Volume (vph)	51	1764	64	0	1217	27	218	189	5	133	49	50
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	1917	70	0	1323	29	237	205	5	145	53	54
RTOR Reduction (vph)	0	3	0	0	1	0	0	1	0	0	34	0
Lane Group Flow (vph)	55	1984	0	0	1351	0	237	209	0	145	73	0
Turn Type	Prot						Split			Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	4.8	65.4			56.6		19.2	19.2		13.4	13.4	
Effective Green, g (s)	4.8	65.4			56.6		19.2	19.2		13.4	13.4	
Actuated g/C Ratio	0.04	0.59			0.51		0.17	0.17		0.12	0.12	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	77	3272			2838		309	324		216	210	
v/s Ratio Prot	0.03	c0.36			0.24		c0.13	0.11		c0.08	0.04	
v/s Ratio Perm												
v/c Ratio	0.71	0.61			0.48		0.77	0.65		0.67	0.35	
Uniform Delay, d1	51.9	14.1			17.2		43.3	42.2		46.2	44.3	
Progression Factor	1.00	1.00			0.59		1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.8	0.8			0.4		10.8	4.4		7.9	1.0	
Delay (s)	78.7	15.0			10.6		54.1	46.6		54.1	45.3	
Level of Service	E	B			B		D	D		D	D	
Approach Delay (s)		16.7			10.6			50.6			50.4	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

12: Fort Barrette Road & Farrington Hwy

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	*0.99	*0.99	*0.99	1.00	*0.99	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.96	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	3539	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	3539	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Volume (vph)	377	708	799	572	579	161	338	441	485	80	743	707
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	381	715	807	578	585	163	341	445	490	81	751	714
RTOR Reduction (vph)	0	35	160	0	0	112	0	0	276	0	0	257
Lane Group Flow (vph)	381	944	383	578	585	51	341	445	214	81	751	457
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	17.3	34.2	34.2	20.0	36.9	36.9	12.9	39.9	39.9	8.6	35.6	35.6
Effective Green, g (s)	17.3	34.2	34.2	20.0	36.9	36.9	12.9	39.9	39.9	8.6	35.6	35.6
Actuated g/C Ratio	0.15	0.29	0.29	0.17	0.31	0.31	0.11	0.34	0.34	0.07	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	511	1020	451	590	1146	492	381	1240	532	128	1106	475
v/s Ratio Prot	0.11	c0.27		c0.16	c0.16		c0.10	0.12		0.05	0.20	
v/s Ratio Perm			0.24			0.03			0.14			c0.29
v/c Ratio	0.75	0.93	0.85	0.98	0.51	0.10	0.90	0.36	0.40	0.63	0.68	0.96
Uniform Delay, d1	48.6	41.0	39.8	49.1	33.5	29.1	52.2	29.7	30.3	53.5	36.5	40.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.9	13.6	13.9	31.5	1.6	0.4	22.5	0.2	0.5	9.8	1.7	31.6
Delay (s)	54.4	54.6	53.7	80.6	35.1	29.5	74.7	29.9	30.8	63.3	38.2	72.5
Level of Service	D	D	D	F	D	C	E	C	C	E	D	E
Approach Delay (s)		54.3			54.3			42.2			55.4	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	52.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	118.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: WB Ramps & North-South Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	WBL2	WBL	WBR	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰		↱				↑↑	↱	↰↰	↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Lane Util. Factor	*0.99		1.00				*0.99	1.00	0.97	*0.99	
Frt	1.00		0.85				1.00	0.85	1.00	1.00	
Flt Protected	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3504		1583				3688	1583	3433	3688	
Flt Permitted	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3504		1583				3688	1583	3433	3688	
Volume (vph)	1414	0	115	0	0	0	1103	248	585	244	0
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	1428	0	116	0	0	0	1114	251	591	246	0
RTOR Reduction (vph)	0	0	70	0	0	0	0	173	0	0	0
Lane Group Flow (vph)	1428	0	46	0	0	0	1114	78	591	246	0
Turn Type	Prot		custom					Perm	Prot		
Protected Phases	8		8				6		5	2	
Permitted Phases								6			
Actuated Green, G (s)	40.0		40.0				31.0	31.0	17.0	52.0	
Effective Green, g (s)	40.0		40.0				31.0	31.0	17.0	52.0	
Actuated g/C Ratio	0.40		0.40				0.31	0.31	0.17	0.52	
Clearance Time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0				3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1402		633				1143	491	584	1918	
v/s Ratio Prot	c0.41		0.03				c0.30		c0.17	0.07	
v/s Ratio Perm								0.05			
v/c Ratio	1.02		0.07				0.97	0.16	1.01	0.13	
Uniform Delay, d1	30.0		18.5				34.1	25.0	41.5	12.3	
Progression Factor	1.00		1.00				1.00	1.00	0.44	0.48	
Incremental Delay, d2	28.8		0.0				21.2	0.7	35.9	0.1	
Delay (s)	58.8		18.6				55.3	25.7	54.1	6.1	
Level of Service	E		B				E	C	D	A	
Approach Delay (s)		55.8		0.0			49.9			40.0	
Approach LOS		E		A			D			D	

Intersection Summary			
HCM Average Control Delay	50.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: EB Ramps & North-South Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL2	EBL	EBR	SBL	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰		↱↱			↰↰	↑↑↑			↑↑	↱↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00		0.88			0.97	*0.99			*0.99	*0.99
Frt	1.00		0.85			1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1770		2787			3433	5532			3688	3135
Flt Permitted	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (perm)	1770		2787			3433	5532			3688	3135
Volume (vph)	51	0	689	0	0	803	1714	0	0	778	2380
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	52	0	696	0	0	811	1731	0	0	786	2404
RTOR Reduction (vph)	0	0	34	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	52	0	662	0	0	811	1731	0	0	786	2404
Turn Type	Prot		custom			Prot					Free
Protected Phases	4					1	6			2	
Permitted Phases			4								Free
Actuated Green, G (s)	26.9		26.9			28.7	65.1			32.4	100.0
Effective Green, g (s)	26.9		26.9			28.7	65.1			32.4	100.0
Actuated g/C Ratio	0.27		0.27			0.29	0.65			0.32	1.00
Clearance Time (s)	4.0		4.0			4.0	4.0			4.0	
Vehicle Extension (s)	3.0		3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)	476		750			985	3601			1195	3135
v/s Ratio Prot	0.03					0.24	0.31			0.21	
v/s Ratio Perm			c0.24								c0.77
v/c Ratio	0.11		0.88			0.82	0.48			0.66	0.77
Uniform Delay, d1	27.5		35.0			33.3	8.9			29.0	0.0
Progression Factor	1.00		1.00			0.97	0.23			1.00	1.00
Incremental Delay, d2	0.1		11.9			1.3	0.1			2.8	1.9
Delay (s)	27.6		47.0			33.5	2.1			31.9	1.9
Level of Service	C		D			C	A			C	A
Approach Delay (s)		45.6		0.0			12.1			9.3	
Approach LOS		D		A			B			A	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

15: North-South Road & Farrington Hwy

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	*0.99	*0.99	*0.99	1.00	*0.99	*0.99	*0.99	*0.99	*0.99	*0.99
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	5532	3135	5256	5532	1583	3504	3688	3135	3504	3688	3135
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	5532	3135	5256	5532	1583	3504	3688	3135	3504	3688	3135
Volume (vph)	765	1166	567	463	1804	349	544	404	227	176	488	810
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	773	1178	573	468	1822	353	549	408	229	178	493	818
RTOR Reduction (vph)	0	0	0	0	0	207	0	0	0	0	0	542
Lane Group Flow (vph)	773	1178	573	468	1822	146	549	408	229	178	493	276
Turn Type	Prot		Free	Prot		Perm	Prot		Free	Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			2			Free			8
Actuated Green, G (s)	24.0	46.4	110.0	14.6	37.0	37.0	17.0	22.2	110.0	10.8	16.0	16.0
Effective Green, g (s)	24.0	46.4	110.0	14.6	37.0	37.0	17.0	22.2	110.0	10.8	16.0	16.0
Actuated g/C Ratio	0.22	0.42	1.00	0.13	0.34	0.34	0.15	0.20	1.00	0.10	0.15	0.15
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	765	2333	3135	698	1861	532	542	744	3135	344	536	456
v/s Ratio Prot	c0.22	0.21		0.09	c0.33		c0.16	0.11		0.05	c0.13	
v/s Ratio Perm			0.18			0.09			0.07			0.09
v/c Ratio	1.01	0.50	0.18	0.67	0.98	0.27	1.01	0.55	0.07	0.52	0.92	0.61
Uniform Delay, d1	43.0	23.4	0.0	45.4	36.1	26.7	46.5	39.4	0.0	47.1	46.4	44.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	35.1	0.2	0.1	2.5	16.0	0.3	41.9	2.9	0.0	1.3	23.4	5.9
Delay (s)	78.1	23.5	0.1	47.9	52.1	27.0	88.4	42.3	0.0	48.4	69.7	49.9
Level of Service	E	C	A	D	D	C	F	D	A	D	E	D
Approach Delay (s)		34.9			48.0			55.5			56.3	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	46.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

16: North-South Road & North UH Connector

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99	0.86	*0.99	*0.99		*0.99	*0.99		*0.99	1.00	*0.99
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5532	1362	3504	5424		3504	3608		3504	1863	3135
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	5532	1362	3504	5424		3504	3608		3504	1863	3135
Volume (vph)	51	2067	233	489	940	141	220	163	28	367	107	329
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	52	2088	235	494	949	142	222	165	28	371	108	332
RTOR Reduction (vph)	0	0	105	0	17	0	0	13	0	0	0	38
Lane Group Flow (vph)	52	2088	130	494	1074	0	222	180	0	371	108	294
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	5	2		1	6		7	4		3	8	1
Permitted Phases			2									8
Actuated Green, G (s)	6.7	54.9	54.9	17.9	66.1		12.4	11.9		14.0	13.5	31.4
Effective Green, g (s)	6.7	54.9	54.9	17.9	66.1		12.4	11.9		14.0	13.5	31.4
Actuated g/C Ratio	0.06	0.48	0.48	0.16	0.58		0.11	0.10		0.12	0.12	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	103	2648	652	547	3126		379	374		428	219	968
v/s Ratio Prot	0.03	c0.38		c0.14	0.20		0.06	0.05		c0.11	c0.06	0.05
v/s Ratio Perm			0.10									0.05
v/c Ratio	0.50	0.79	0.20	0.90	0.34		0.59	0.48		0.87	0.49	0.30
Uniform Delay, d1	52.4	25.0	17.2	47.5	12.8		48.7	48.5		49.4	47.4	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	2.5	0.7	18.2	0.3		2.3	1.0		16.6	1.7	0.2
Delay (s)	56.2	27.5	17.9	65.7	13.1		51.0	49.5		66.1	49.1	33.2
Level of Service	E	C	B	E	B		D	D		E	D	C
Approach Delay (s)		27.2			29.5			50.3			50.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	114.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: East-West Rd. & North-South Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰↰	↑↱		↰↰	↑↑↱		↰↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	*0.99	0.95		0.97	*0.99		*0.99	*0.99		*0.99	*0.99	
Frt	1.00	0.95		1.00	0.87		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3504	3363		3433	3217		3504	5428		3504	5407	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3504	3363		3433	3217		3504	5428		3504	5407	
Volume (vph)	244	225	112	245	113	652	207	1454	209	193	970	173
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	265	245	122	266	123	709	225	1580	227	210	1054	188
RTOR Reduction (vph)	0	57	0	0	177	0	0	19	0	0	26	0
Lane Group Flow (vph)	265	310	0	266	655	0	225	1788	0	210	1216	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	13.0	24.1		12.5	23.6		11.0	38.0		16.0	43.0	
Effective Green, g (s)	13.0	24.1		12.5	23.6		11.0	38.0		16.0	43.0	
Actuated g/C Ratio	0.12	0.23		0.12	0.22		0.10	0.36		0.15	0.40	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	427	760		403	712		362	1935		526	2181	
v/s Ratio Prot	0.08	0.09		c0.08	c0.20		c0.06	c0.33		c0.06	0.22	
v/s Ratio Perm												
v/c Ratio	0.62	0.41		0.66	1.36dr		0.62	0.92		0.40	0.56	
Uniform Delay, d1	44.5	35.2		45.0	40.6		45.8	32.9		41.0	24.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.8	0.4		4.0	17.2		3.3	9.0		2.3	1.0	
Delay (s)	47.3	35.5		49.0	57.8		49.1	41.9		43.2	25.5	
Level of Service	D	D		D	E		D	D		D	C	
Approach Delay (s)		40.4			55.7			42.7			28.1	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	41.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	106.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
18: North-South Road & Kapolei Parkway
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰	↑↑↱		↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.91	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5001		3433	5085	1583	3433	5085	1583	1770	5085	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5001		3433	5085	1583	3433	5085	1583	1770	5085	1583
Volume (vph)	245	519	64	229	500	597	860	315	316	118	637	491
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	564	70	249	543	649	935	342	343	128	692	534
RTOR Reduction (vph)	0	15	0	0	0	396	0	0	215	0	0	203
Lane Group Flow (vph)	266	619	0	249	543	253	935	342	128	128	692	331
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases						6			4			8
Actuated Green, G (s)	16.0	23.8		11.2	19.0	19.0	28.0	37.4	37.4	11.6	21.0	21.0
Effective Green, g (s)	16.0	23.8		11.2	19.0	19.0	28.0	37.4	37.4	11.6	21.0	21.0
Actuated g/C Ratio	0.16	0.24		0.11	0.19	0.19	0.28	0.37	0.37	0.12	0.21	0.21
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	283	1190		384	966	301	961	1902	592	205	1068	332
v/s Ratio Prot	c0.15	0.12		0.07	0.11		c0.27	0.07		0.07	0.14	
v/s Ratio Perm						c0.16			0.08			c0.21
v/c Ratio	0.94	0.52		0.65	0.56	0.84	0.97	0.18	0.22	0.62	0.65	1.00
Uniform Delay, d1	41.5	33.1		42.5	36.7	39.0	35.6	21.0	21.3	42.1	36.1	39.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	37.2	1.6		3.7	2.4	23.7	22.5	0.0	0.2	5.8	1.4	48.2
Delay (s)	78.7	34.8		46.3	39.1	62.7	58.1	21.1	21.5	47.9	37.5	87.7
Level of Service	E	C		D	D	E	E	C	C	D	D	F
Approach Delay (s)		47.8			51.0			42.6			58.3	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	49.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: East-West Rd. & Old Fort Weaver Rd
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	3539	1583	3433	1583
Flt Permitted	0.56	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1046	1863	3539	1583	3433	1583
Volume (vph)	21	893	310	1006	487	45
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	21	902	313	1016	492	45
RTOR Reduction (vph)	0	0	0	467	0	29
Lane Group Flow (vph)	21	902	313	549	492	16
Turn Type	Perm			Perm		Perm
Protected Phases		4	8		6	
Permitted Phases	4			8		6
Actuated Green, G (s)	45.8	45.8	45.8	45.8	31.0	31.0
Effective Green, g (s)	45.8	45.8	45.8	45.8	31.0	31.0
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.37	0.37
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	565	1006	1911	855	1255	579
v/s Ratio Prot		c0.48	0.09		c0.14	
v/s Ratio Perm	0.02			0.35		0.01
v/c Ratio	0.04	0.90	0.16	0.64	0.39	0.03
Uniform Delay, d1	9.2	17.4	9.8	13.7	19.9	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	10.4	0.0	1.7	0.9	0.1
Delay (s)	9.2	27.8	9.9	15.4	20.8	17.3
Level of Service	A	C	A	B	C	B
Approach Delay (s)		27.4	14.1		20.5	
Approach LOS		C	B		C	

Intersection Summary			
HCM Average Control Delay	19.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	84.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Farrington Hwy & B Street
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰	↑↑	↱	↰↰	↑↑	↱	↰	↑	↱	↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	1770	1863	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	1770	1863	1583	3433	1863	1583
Volume (vph)	215	1127	203	124	897	87	49	137	126	343	223	206
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	1225	221	135	975	95	53	149	137	373	242	224
RTOR Reduction (vph)	0	0	102	0	0	60	0	0	12	0	0	60
Lane Group Flow (vph)	234	1225	119	135	975	35	53	149	125	373	242	164
Turn Type	Prot		pm+ov	Prot		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6		7	4	5	3	8	1
Permitted Phases			2			6			4			8
Actuated Green, G (s)	11.5	36.7	50.1	8.6	33.8	33.8	4.4	18.1	29.6	13.4	27.1	35.7
Effective Green, g (s)	11.5	36.7	50.1	8.6	33.8	33.8	4.4	18.1	29.6	13.4	27.1	35.7
Actuated g/C Ratio	0.12	0.40	0.54	0.09	0.36	0.36	0.05	0.20	0.32	0.14	0.29	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	425	1400	923	318	1289	577	84	363	573	496	544	677
v/s Ratio Prot	c0.07	c0.35	0.02	0.04	0.28		0.03	0.08	0.03	c0.11	c0.13	0.02
v/s Ratio Perm			0.06			0.02			0.05			0.08
v/c Ratio	0.55	0.88	0.13	0.42	0.76	0.06	0.63	0.41	0.22	0.75	0.44	0.24
Uniform Delay, d1	38.2	25.9	10.6	39.8	25.9	19.2	43.4	32.7	23.1	38.1	26.7	19.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	6.4	0.1	0.9	2.6	0.0	14.4	3.4	0.2	6.4	2.6	0.2
Delay (s)	39.8	32.3	10.6	40.7	28.5	19.2	57.8	36.1	23.3	44.5	29.4	19.6
Level of Service	D	C	B	D	C	B	E	D	C	D	C	B
Approach Delay (s)		30.5			29.1			34.3			33.5	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	31.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

21: East-West Rd. & A Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰	↱		↰	↑	↱	↰	↱		↰	↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.86		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1842		1770	1863	1583	1770	1597		1770	1630	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1842		1770	1863	1583	1770	1597		1770	1630	
Volume (vph)	90	328	27	31	700	74	93	7	140	44	7	37
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	357	29	34	761	80	101	8	152	48	8	40
RTOR Reduction (vph)	0	2	0	0	0	39	0	133	0	0	36	0
Lane Group Flow (vph)	98	384	0	34	761	41	101	27	0	48	12	0
Turn Type	Prot			Prot		Perm	Split			Split		
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases						6						
Actuated Green, G (s)	5.0	41.3		2.2	38.5	38.5	9.5	9.5		7.5	7.5	
Effective Green, g (s)	5.0	41.3		2.2	38.5	38.5	9.5	9.5		7.5	7.5	
Actuated g/C Ratio	0.07	0.54		0.03	0.50	0.50	0.12	0.12		0.10	0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	116	994		51	938	797	220	198		174	160	
v/s Ratio Prot	c0.06	c0.21		0.02	c0.41		c0.06	0.02		c0.03	0.01	
v/s Ratio Perm						0.03						
v/c Ratio	0.84	0.39		0.67	0.81	0.05	0.46	0.14		0.28	0.07	
Uniform Delay, d1	35.4	10.2		36.8	16.0	9.7	31.1	29.8		32.0	31.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	40.0	0.3		28.3	5.4	0.0	1.5	0.3		0.9	0.2	
Delay (s)	75.3	10.5		65.1	21.3	9.7	32.6	30.2		32.8	31.5	
Level of Service	E	B		E	C	A	C	C		C	C	
Approach Delay (s)		23.6			22.0			31.1			32.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	76.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

22: Farrington Hwy & 2nd Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰↰	↑↑	↱	↰	↑↑	↱↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95	1.00	1.00	0.95	0.88	0.97	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5044		3433	3539	1583	1770	3539	2787	3433	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5044		3433	3539	1583	1770	3539	2787	3433	3539	1583
Volume (vph)	172	1091	63	241	945	299	98	391	547	241	259	138
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	187	1186	68	262	1027	325	107	425	595	262	282	150
RTOR Reduction (vph)	0	4	0	0	0	159	0	0	47	0	0	115
Lane Group Flow (vph)	187	1250	0	262	1027	166	107	425	548	262	282	35
Turn Type	Prot			Prot		Perm	Prot		pm+ov	Prot		Perm
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	29.0	67.1		17.9	56.0	56.0	14.1	28.0	45.9	21.0	34.9	34.9
Effective Green, g (s)	29.0	67.1		17.9	56.0	56.0	14.1	28.0	45.9	21.0	34.9	34.9
Actuated g/C Ratio	0.19	0.45		0.12	0.37	0.37	0.09	0.19	0.31	0.14	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	342	2256		410	1321	591	166	661	853	481	823	368
v/s Ratio Prot	0.11	c0.25		0.08	c0.29		0.06	c0.12	0.08	c0.08	0.08	
v/s Ratio Perm						0.11			0.12			0.02
v/c Ratio	0.55	0.55		0.64	0.78	0.28	0.64	0.64	0.64	0.54	0.34	0.09
Uniform Delay, d1	54.6	30.5		63.0	41.5	32.9	65.5	56.4	45.0	60.0	48.0	45.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	1.0		3.3	4.6	1.2	8.3	4.8	1.7	1.3	1.1	0.5
Delay (s)	56.4	31.4		66.2	46.1	34.1	73.8	61.1	46.6	61.3	49.1	45.7
Level of Service	E	C		E	D	C	E	E	D	E	D	D
Approach Delay (s)		34.7			46.9			54.7			53.0	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	46.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
23: 2nd Avenue & Kunia Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	1976	301	0	5208
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2148	327	0	5661
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			870			
pX, platoon unblocked	0.91	0.91			0.91	
vC, conflicting volume	3727	701			2475	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3698	358			2317	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	3	578			192	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	0	614	614	614	634	1415	1415	1415	1415
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	327	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.36	0.36	0.36	0.37	0.83	0.83	0.83	0.83
Queue Length 95th (ft)	0	0	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A								
Approach Delay (s)	0.0	0.0				0.0			
Approach LOS	A								

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
24: 3rd Avenue & Kunia Road
2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	7	1846	129	0	5208
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	8	2007	140	0	5661
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1234			
pX, platoon unblocked	0.98	0.98			0.98	
vC, conflicting volume	3492	572			2147	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3483	510			2113	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			100	
cM capacity (veh/h)	5	499			251	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	8	573	573	573	427	1415	1415	1415	1415
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	8	0	0	0	140	0	0	0	0
cSH	499	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.34	0.34	0.34	0.25	0.83	0.83	0.83	0.83
Queue Length 95th (ft)	1	0	0	0	0	0	0	0	0
Control Delay (s)	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B								
Approach Delay (s)	12.3	0.0				0.0			
Approach LOS	B								

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
25: East-West Rd. & B Street

2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations	↰	↑	↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Volume (vph)	156	302	313	86	648	492
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	170	328	340	93	704	535
RTOR Reduction (vph)	0	0	0	73	0	208
Lane Group Flow (vph)	170	328	340	20	704	327
Turn Type	Prot			Prot		Prot
Protected Phases	5	2	6	6	4	4
Permitted Phases						
Actuated Green, G (s)	15.4	45.3	25.9	25.9	65.5	65.5
Effective Green, g (s)	15.4	45.3	25.9	25.9	65.5	65.5
Actuated g/C Ratio	0.13	0.38	0.22	0.22	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	229	710	406	345	976	873
v/s Ratio Prot	c0.10	0.18	c0.18	0.01	c0.40	0.21
v/s Ratio Perm						
v/c Ratio	0.74	0.46	0.84	0.06	0.72	0.37
Uniform Delay, d1	49.8	27.6	44.4	36.8	19.9	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.2	0.5	14.0	0.1	4.6	1.2
Delay (s)	62.0	28.1	58.4	36.9	24.5	16.3
Level of Service	E	C	E	D	C	B
Approach Delay (s)		39.7	53.8		20.9	
Approach LOS		D	D		C	

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	118.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
26: Farrington Hwy &

2030 + PRO (without Transit Corridor) - AM Peak Mitigations

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	*0.99	*0.99	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3688	3688	1583
Flt Permitted	0.95	1.00	0.13	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	235	3688	3688	1583
Volume (vph)	109	234	51	1066	1384	134
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	110	236	52	1077	1398	135
RTOR Reduction (vph)	0	30	0	0	0	55
Lane Group Flow (vph)	110	206	52	1077	1398	80
Turn Type		Perm	Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	33.0	33.0	59.0	59.0	59.0	59.0
Effective Green, g (s)	33.0	33.0	59.0	59.0	59.0	59.0
Actuated g/C Ratio	0.33	0.33	0.59	0.59	0.59	0.59
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	584	522	139	2176	2176	934
v/s Ratio Prot	0.06			0.29	c0.38	
v/s Ratio Perm		c0.13	0.22			0.05
v/c Ratio	0.19	0.39	0.37	0.49	0.64	0.09
Uniform Delay, d1	23.9	25.8	10.8	11.9	13.5	8.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	2.2	7.5	0.8	1.5	0.2
Delay (s)	24.6	28.0	18.3	12.7	15.0	9.0
Level of Service	C	C	B	B	B	A
Approach Delay (s)	27.0			12.9	14.5	
Approach LOS	C			B	B	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: Kunia Loop & Kunia Road
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↰	↱	↑↑	↱		↑↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0		4.0
Lane Util. Factor	*0.99	1.00	*0.99	1.00		*0.99
Frt	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	3504	1583	3688	1583		5532
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	3504	1583	3688	1583		5532
Volume (vph)	892	41	2670	918	0	2765
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	901	41	2697	927	0	2793
RTOR Reduction (vph)	0	4	0	180	0	0
Lane Group Flow (vph)	901	37	2697	747	0	2793
Turn Type		Perm		Perm		
Protected Phases	8		2			6
Permitted Phases		8		2		
Actuated Green, G (s)	37.0	37.0	105.0	105.0		105.0
Effective Green, g (s)	37.0	37.0	105.0	105.0		105.0
Actuated g/C Ratio	0.25	0.25	0.70	0.70		0.70
Clearance Time (s)	4.0	4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	864	390	2582	1108		3872
v/s Ratio Prot	c0.26		c0.73			0.50
v/s Ratio Perm		0.02		0.47		
v/c Ratio	1.04	0.10	1.04	0.67		0.72
Uniform Delay, d1	56.5	43.6	22.5	12.8		13.6
Progression Factor	1.00	1.00	1.14	1.39		1.00
Incremental Delay, d2	42.4	0.1	29.5	2.8		1.2
Delay (s)	98.9	43.7	55.2	20.5		14.8
Level of Service	F	D	E	C		B
Approach Delay (s)	96.5		46.3			14.8
Approach LOS	F		D			B

Intersection Summary			
HCM Average Control Delay	40.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	105.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: H-1 WB On-Ramp & Kunia Road
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations						↱	↰	↑↑↑			↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)						4.0	4.0	4.0			4.0	
Lane Util. Factor						1.00	1.00	*0.99			*0.99	
Frt						0.86	1.00	1.00			0.99	
Flt Protected						1.00	0.95	1.00			1.00	
Satd. Flow (prot)						1611	1770	5532			5455	
Flt Permitted						1.00	0.95	1.00			1.00	
Satd. Flow (perm)						1611	1770	5532			5455	
Volume (vph)	0	0	0	0	0	1230	427	2358	0	0	3316	341
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	0	0	0	0	1242	431	2382	0	0	3349	344
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	0	1242	431	2382	0	0	3684	0
Turn Type						Free	Prot					
Protected Phases							5	2			6	
Permitted Phases						Free						
Actuated Green, G (s)						150.0	37.3	150.0			104.7	
Effective Green, g (s)						150.0	37.3	150.0			104.7	
Actuated g/C Ratio						1.00	0.25	1.00			0.70	
Clearance Time (s)							4.0	4.0			4.0	
Vehicle Extension (s)							3.0	3.0			3.0	
Lane Grp Cap (vph)						1611	440	5532			3808	
v/s Ratio Prot							c0.24	0.43			c0.68	
v/s Ratio Perm						0.77						
v/c Ratio						0.77	0.98	0.43			0.97	
Uniform Delay, d1						0.0	56.0	0.0			21.1	
Progression Factor						1.00	1.02	1.00			0.57	
Incremental Delay, d2						3.6	34.6	0.2			5.8	
Delay (s)						3.6	91.7	0.2			17.7	
Level of Service						A	F	A			B	
Approach Delay (s)		0.0			3.6			14.2			17.7	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: H-1 EB & Kunia Road

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations	↰↰	↱	↑↑↑↑			↑↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			4.0
Lane Util. Factor	*0.99	1.00	*0.99			*0.99
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3504	1583	7376			5532
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3504	1583	7376			5532
Volume (vph)	530	584	4854	0	0	2355
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	576	635	5276	0	0	2560
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	576	635	5276	0	0	2560
Turn Type		Free				
Protected Phases	4		6			2
Permitted Phases		Free				
Actuated Green, G (s)	27.1	150.0	114.9			114.9
Effective Green, g (s)	27.1	150.0	114.9			114.9
Actuated g/C Ratio	0.18	1.00	0.77			0.77
Clearance Time (s)	4.0		4.0			4.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	633	1583	5650			4238
v/s Ratio Prot	c0.16		c0.72			0.46
v/s Ratio Perm		0.40				
v/c Ratio	0.91	0.40	0.93			0.60
Uniform Delay, d1	60.3	0.0	14.4			7.6
Progression Factor	1.00	1.00	0.85			0.86
Incremental Delay, d2	17.0	0.8	3.9			0.6
Delay (s)	77.3	0.8	16.1			7.2
Level of Service	E	A	B			A
Approach Delay (s)	37.1		16.1			7.2
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	141.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Farrington Hwy & Fort Weaver Road SB Ramp

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↱		↰↰	↑↑↑				↱			↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0				4.0			4.0
Lane Util. Factor		*0.99		*0.99	*0.99				1.00			1.00
Frt		0.98		1.00	1.00				0.86			0.86
Flt Protected		1.00		0.95	1.00				1.00			1.00
Satd. Flow (prot)		5402		3504	5532				1611			1611
Flt Permitted		1.00		0.95	1.00				1.00			1.00
Satd. Flow (perm)		5402		3504	5532				1611			1611
Volume (vph)	0	2308	429	779	1962	0	0	0	440	0	0	903
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	0	2331	433	787	1982	0	0	0	444	0	0	912
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2746	0	787	1982	0	0	0	444	0	0	912
Turn Type				Prot					Free			Free
Protected Phases		2		1	6							
Permitted Phases									Free			Free
Actuated Green, G (s)		92.0		50.0	150.0				150.0			150.0
Effective Green, g (s)		92.0		50.0	150.0				150.0			150.0
Actuated g/C Ratio		0.61		0.33	1.00				1.00			1.00
Clearance Time (s)		4.0		4.0	4.0							
Vehicle Extension (s)		3.0		3.0	3.0							
Lane Grp Cap (vph)		3313		1168	5532				1611			1611
v/s Ratio Prot		c0.51		c0.22	0.36							
v/s Ratio Perm									0.28			0.57
v/c Ratio		0.83		0.67	0.36				0.28			0.57
Uniform Delay, d1		22.8		43.0	0.0				0.0			0.0
Progression Factor		0.26		1.14	1.00				1.00			1.00
Incremental Delay, d2		1.1		0.8	0.1				0.4			1.4
Delay (s)		7.1		49.8	0.1				0.4			1.4
Level of Service		A		D	A				A			A
Approach Delay (s)		7.1			14.2			0.4			1.4	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Farrington Hwy & Fort Weaver Road NB Ramps
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑			↑↑↑	↱			↱			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0			4.0			
Lane Util. Factor	0.97	*0.99			*0.99	1.00			1.00			
Frt	1.00	1.00			1.00	0.85			0.86			
Flt Protected	0.95	1.00			1.00	1.00			1.00			
Satd. Flow (prot)	3433	5532			5532	1583			1611			
Flt Permitted	0.95	1.00			1.00	1.00			1.00			
Satd. Flow (perm)	3433	5532			5532	1583			1611			
Volume (vph)	1429	1319	0	0	2743	1164	0	0	647	0	0	0
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	1443	1332	0	0	2771	1176	0	0	654	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	1	0	0	0	0	0	0
Lane Group Flow (vph)	1443	1332	0	0	2771	1175	0	0	654	0	0	0
Turn Type	Prot					Perm			Free			
Protected Phases	5	2			6							
Permitted Phases						6			Free			
Actuated Green, G (s)	51.0	150.0			91.0	91.0			150.0			
Effective Green, g (s)	51.0	150.0			91.0	91.0			150.0			
Actuated g/C Ratio	0.34	1.00			0.61	0.61			1.00			
Clearance Time (s)	4.0	4.0			4.0	4.0						
Vehicle Extension (s)	3.0	3.0			3.0	3.0						
Lane Grp Cap (vph)	1167	5532			3356	960			1611			
v/s Ratio Prot	c0.42	0.24			0.50							
v/s Ratio Perm						c0.74			0.41			
v/c Ratio	1.24	0.24			0.83	1.22			0.41			
Uniform Delay, d1	49.5	0.0			23.2	29.5			0.0			
Progression Factor	0.59	1.00			0.32	0.31			1.00			
Incremental Delay, d2	111.5	0.1			0.2	101.6			0.8			
Delay (s)	140.5	0.1			7.6	110.7			0.8			
Level of Service	F	A			A	F			A			
Approach Delay (s)		73.1			38.3			0.8			0.0	
Approach LOS		E			D			A			A	

Intersection Summary			
HCM Average Control Delay	48.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	119.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: Farrington Hwy & Leoku Street
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰	↑↑↑	↱		↰↑	↱		↰↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00	1.00	*0.99	1.00		1.00	1.00		*0.99	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.96	1.00
Satd. Flow (prot)	3504	5532	1583	1770	5532	1583		1785	1583		3530	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.96	1.00
Satd. Flow (perm)	3504	5532	1583	1770	5532	1583		1785	1583		3530	1583
Volume (vph)	286	1564	116	135	3606	515	197	29	130	243	28	99
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	289	1580	117	136	3642	520	199	29	131	245	28	100
RTOR Reduction (vph)	0	0	50	0	0	132	0	0	42	0	0	87
Lane Group Flow (vph)	289	1580	67	136	3642	388	0	228	89	0	273	13
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.9	85.8	85.8	16.1	90.0	90.0		17.0	17.0		15.1	15.1
Effective Green, g (s)	11.9	85.8	85.8	16.1	90.0	90.0		17.0	17.0		15.1	15.1
Actuated g/C Ratio	0.08	0.57	0.57	0.11	0.60	0.60		0.11	0.11		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	278	3164	905	190	3319	950		202	179		355	159
v/s Ratio Prot	c0.08	0.29		c0.08	c0.66			c0.13			c0.08	
v/s Ratio Perm			0.04			0.24			0.06			0.01
v/c Ratio	1.04	0.50	0.07	0.72	1.10	0.41		1.13	0.50		1.39dl	0.08
Uniform Delay, d1	69.0	19.2	14.3	64.7	30.0	15.9		66.5	62.5		65.8	61.2
Progression Factor	0.97	1.38	2.12	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	63.8	0.5	0.2	12.1	49.2	1.3		102.2	9.6		9.6	0.2
Delay (s)	130.7	27.0	30.6	76.8	79.2	17.2		168.7	72.1		75.4	61.4
Level of Service	F	C	C	E	E	B		F	E		E	E
Approach Delay (s)		42.3			71.6			133.5			71.6	
Approach LOS		D			E			F			E	

Intersection Summary			
HCM Average Control Delay	66.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.0%	ICU Level of Service	G
Analysis Period (min)	15		
dl Defacto Left Lane. Recode with 1 though lane as a left lane.			
c Critical Lane Group			

7: Laulaunui Street & Fort Weaver Road

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↑↱		↰	↑	↱	↰	↑↑↑	↱	↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	*0.99		1.00	1.00	1.00	1.00	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.97		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3523		1770	1863	1583	1770	5532	1583	1770	5532	1583
Flt Permitted	0.95	0.97		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3523		1770	1863	1583	1770	5532	1583	1770	5532	1583
Volume (vph)	209	37	13	62	4	231	56	2896	100	231	4375	82
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	211	37	13	63	4	233	57	2925	101	233	4419	83
RTOR Reduction (vph)	0	5	0	0	0	213	0	0	27	0	0	17
Lane Group Flow (vph)	106	150	0	63	4	20	57	2925	74	233	4419	66
Turn Type	Split			Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8			2			6
Actuated Green, G (s)	13.7	13.7		5.0	5.0	5.0	5.0	89.0	89.0	24.0	108.0	108.0
Effective Green, g (s)	13.7	13.7		5.0	5.0	5.0	5.0	89.0	89.0	24.0	108.0	108.0
Actuated g/C Ratio	0.09	0.09		0.03	0.03	0.03	0.03	0.60	0.60	0.16	0.73	0.73
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	149	327		60	63	54	60	3333	954	288	4045	1158
v/s Ratio Prot	c0.07	0.04		c0.04	0.00		0.03	c0.53		0.13	c0.80	
v/s Ratio Perm						0.01			0.05			0.04
v/c Ratio	0.71	0.46		1.05	0.06	0.38	0.95	0.88	0.08	0.81	1.09	0.06
Uniform Delay, d1	65.1	63.5		71.3	69.1	69.8	71.2	24.8	12.2	59.6	19.8	5.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.8	1.0		130.8	0.4	4.4	97.0	3.6	0.2	15.3	46.3	0.1
Delay (s)	79.9	64.5		202.2	69.5	74.2	168.2	28.4	12.4	74.9	66.2	5.7
Level of Service	E	E		F	E	E	F	C	B	E	E	A
Approach Delay (s)		70.8			101.0			30.4			65.5	
Approach LOS		E			F			C			E	

Intersection Summary			
HCM Average Control Delay	54.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	147.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

8: Old Fort Weaver Rd & Fort Weaver Road

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰↰	↑	↱		↰↑	↱	↰↰	↑↑↑↱		↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.94	1.00	1.00		1.00	1.00	0.97	*0.99		1.00	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	4990	1863	1583		1849	1583	3433	5531		1770	5532	1583
Flt Permitted	0.95	1.00	1.00		0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	4990	1863	1583		1849	1583	3433	5531		1770	5532	1583
Volume (vph)	837	200	483	37	219	89	563	2123	3	193	3255	1002
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	845	202	488	37	221	90	569	2144	3	195	3288	1012
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	2
Lane Group Flow (vph)	845	202	488	0	258	90	569	2147	0	195	3288	1010
Turn Type	Split		Free	Split		Free	Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			Free			Free						6
Actuated Green, G (s)	22.0	22.0	150.0		9.0	150.0	22.0	82.4		20.6	81.0	103.0
Effective Green, g (s)	22.0	22.0	150.0		9.0	150.0	22.0	82.4		20.6	81.0	103.0
Actuated g/C Ratio	0.15	0.15	1.00		0.06	1.00	0.15	0.55		0.14	0.54	0.69
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	732	273	1583		111	1583	504	3038		243	2987	1129
v/s Ratio Prot	c0.17	0.11			c0.14		c0.17	0.39		0.11	c0.59	0.13
v/s Ratio Perm			c0.31			0.06						0.51
v/c Ratio	1.15	0.74	0.31		2.32	0.06	1.13	0.71		0.80	1.10	0.89
Uniform Delay, d1	64.0	61.3	0.0		70.5	0.0	64.0	24.9		62.7	34.5	19.1
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	84.6	10.1	0.5		623.2	0.1	80.6	1.4		17.2	51.2	9.3
Delay (s)	148.6	71.3	0.5		693.7	0.1	144.6	26.3		79.9	85.7	28.4
Level of Service	F	E	A		F	A	F	C		E	F	C
Approach Delay (s)		91.3			514.3			51.1			72.5	
Approach LOS		F			F			D			E	

Intersection Summary			
HCM Average Control Delay	86.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	121.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

9: Renton Road & Fort Weaver Road — 2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	1.00		1.00	1.00	1.00	*0.99	1.00	0.97	*0.99	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1752	1761	1583		1858	1583	1770	5532	1583	3433	5532	1583
Flt Permitted	0.95	0.96	1.00		1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1752	1761	1583		1858	1583	1770	5532	1583	3433	5532	1583
Volume (vph)	725	23	43	9	151	326	45	2103	75	514	3074	519
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	732	23	43	9	153	329	45	2124	76	519	3105	524
RTOR Reduction (vph)	0	0	0	0	0	225	0	0	11	0	0	230
Lane Group Flow (vph)	368	387	43	0	162	104	45	2124	65	519	3105	294
Turn Type	Split		Free	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			8			2			6
Actuated Green, G (s)	16.0	16.0	100.8		9.0	9.0	3.2	43.0	43.0	16.8	56.6	56.6
Effective Green, g (s)	16.0	16.0	100.8		9.0	9.0	3.2	43.0	43.0	16.8	56.6	56.6
Actuated g/C Ratio	0.16	0.16	1.00		0.09	0.09	0.03	0.43	0.43	0.17	0.56	0.56
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	278	280	1583		166	141	56	2360	675	572	3106	889
v/s Ratio Prot	0.21	c0.22			c0.09		0.03	c0.38		0.15	c0.56	
v/s Ratio Perm			0.03			0.07			0.04			0.19
v/c Ratio	1.32	1.38	0.03		0.98	0.74	0.80	0.90	0.10	0.91	1.00	0.33
Uniform Delay, d1	42.4	42.4	0.0		45.8	44.8	48.5	26.9	17.3	41.2	22.1	11.9
Progression Factor	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	168.6	192.7	0.0		62.1	18.1	55.1	6.1	0.3	18.1	16.1	1.0
Delay (s)	211.0	235.1	0.0		107.9	62.9	103.6	32.9	17.6	59.3	38.2	12.9
Level of Service	F	F	A		F	E	F	C	B	E	D	B
Approach Delay (s)		211.3			77.7			33.8			37.6	
Approach LOS		F			E			C			D	

Intersection Summary			
HCM Average Control Delay	57.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	100.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

10: Farrington Hwy & D Street — 2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.99		*0.99	*0.99			*0.99	*0.99	*0.99	*0.99	
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.99	
Satd. Flow (prot)	1770	5532		3504	5473			1844	1567	1752	1613	
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00	0.95	0.99	
Satd. Flow (perm)	1770	5532		3504	5473			1844	1567	1752	1613	
Volume (vph)	99	2335	0	425	2265	175	0	179	45	357	7	259
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	100	2359	0	429	2288	177	0	181	45	361	7	262
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	40	0	84	0
Lane Group Flow (vph)	100	2359	0	429	2459	0	0	181	5	293	253	0
Turn Type	Prot			Prot					Perm	Split		
Protected Phases	5	2		1	6			8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	10.7	69.8		20.0	79.1			17.2	17.2	27.0	27.0	
Effective Green, g (s)	10.7	69.8		20.0	79.1			17.2	17.2	27.0	27.0	
Actuated g/C Ratio	0.07	0.47		0.13	0.53			0.11	0.11	0.18	0.18	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	126	2574		467	2886			211	180	315	290	
v/s Ratio Prot	0.06	c0.43		0.12	c0.45			c0.10		c0.17	0.16	
v/s Ratio Perm									0.00			
v/c Ratio	0.79	0.92		0.92	0.85			0.86	0.03	0.93	0.87	
Uniform Delay, d1	68.6	37.4		64.2	30.4			65.2	59.0	60.6	59.8	
Progression Factor	1.05	0.65		0.78	0.55			1.00	1.00	1.00	1.00	
Incremental Delay, d2	19.2	4.4		21.6	3.2			27.4	0.1	33.0	23.6	
Delay (s)	91.3	28.8		71.7	19.8			92.6	59.0	93.5	83.4	
Level of Service	F	C		E	B			F	E	F	F	
Approach Delay (s)		31.4			27.5			85.9			88.1	
Approach LOS		C			C			F			F	

Intersection Summary			
HCM Average Control Delay	37.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Farrington Hwy & E Street
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	*0.99			*0.99		1.00	1.00		1.00	1.00	
Frt	1.00	0.98			1.00		1.00	0.99		1.00	0.94	
Flt Protected	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	5428			5519		1770	1851		1770	1743	
Flt Permitted	0.95	1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	5428			5519		1770	1851		1770	1743	
Volume (vph)	77	2202	318	0	2482	42	203	110	5	227	130	97
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	78	2224	321	0	2507	42	205	111	5	229	131	98
RTOR Reduction (vph)	0	13	0	0	1	0	0	1	0	0	18	0
Lane Group Flow (vph)	78	2532	0	0	2548	0	205	115	0	229	211	0
Turn Type	Prot						Split			Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	8.0	94.5			82.5		22.2	22.2		21.3	21.3	
Effective Green, g (s)	8.0	94.5			82.5		22.2	22.2		21.3	21.3	
Actuated g/C Ratio	0.05	0.63			0.55		0.15	0.15		0.14	0.14	
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	94	3420			3035		262	274		251	248	
v/s Ratio Prot	0.04	c0.47			c0.46		c0.12	0.06		c0.13	0.12	
v/s Ratio Perm												
v/c Ratio	0.83	0.74			0.84		0.78	0.42		0.91	0.85	
Uniform Delay, d1	70.3	19.2			28.2		61.6	58.1		63.4	62.8	
Progression Factor	0.75	0.55			0.65		1.00	1.00		1.00	1.00	
Incremental Delay, d2	27.8	0.8			1.5		14.1	1.0		34.2	23.3	
Delay (s)	80.6	11.4			19.8		75.7	59.1		97.6	86.1	
Level of Service	F	B			B		E	E		F	F	
Approach Delay (s)		13.5			19.8			69.7			91.9	
Approach LOS		B			B			E			F	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Fort Barrette Road & Farrington Hwy
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	*0.99	*0.99	*0.99	1.00	*0.99	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.95	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	3507	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	3507	1567	3504	3688	1583	3504	3688	1583	1770	3688	1583
Volume (vph)	493	483	724	355	405	113	678	660	746	226	1028	677
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	498	488	731	359	409	114	685	667	754	228	1038	684
RTOR Reduction (vph)	0	55	251	0	0	94	0	0	206	0	0	221
Lane Group Flow (vph)	498	670	243	359	409	20	685	667	548	228	1038	463
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	19.1	26.2	26.2	13.0	20.1	20.1	24.4	45.2	45.2	16.6	37.4	37.4
Effective Green, g (s)	19.1	26.2	26.2	13.0	20.1	20.1	24.4	45.2	45.2	16.6	37.4	37.4
Actuated g/C Ratio	0.16	0.22	0.22	0.11	0.17	0.17	0.21	0.39	0.39	0.14	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	572	785	351	389	634	272	731	1425	612	251	1179	506
v/s Ratio Prot	c0.14	c0.19		0.10	0.11		c0.20	0.18		0.13	0.28	
v/s Ratio Perm			0.16			0.01			c0.35			0.29
v/c Ratio	0.87	0.85	0.69	0.92	0.65	0.07	0.94	0.47	0.90	0.91	0.88	0.91
Uniform Delay, d1	47.7	43.6	41.7	51.5	45.1	40.6	45.5	26.9	33.7	49.5	37.7	38.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.6	8.9	5.8	27.1	5.0	0.5	19.3	0.2	15.6	33.1	7.9	21.1
Delay (s)	61.3	52.5	47.5	78.6	50.1	41.1	64.9	27.1	49.2	82.6	45.6	59.4
Level of Service	E	D	D	E	D	D	E	C	D	F	D	E
Approach Delay (s)		53.6			60.6			47.3			54.7	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: WB Ramps & North-South Road
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	WBL2	WBL	WBR	NBL	NBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰		↱				↑↑	↱	↰↰	↑↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Lane Util. Factor	*0.99		1.00				*0.99	1.00	0.97	*0.99	
Frt	1.00		0.85				1.00	0.85	1.00	1.00	
Flt Protected	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3504		1583				3688	1583	3433	3688	
Flt Permitted	0.95		1.00				1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3504		1583				3688	1583	3433	3688	
Volume (vph)	2099	0	412	0	0	0	495	86	368	585	0
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	2120	0	416	0	0	0	500	87	372	591	0
RTOR Reduction (vph)	0	0	57	0	0	0	0	70	0	0	0
Lane Group Flow (vph)	2120	0	359	0	0	0	500	17	372	591	0
Turn Type	Prot		custom					Perm	Prot		
Protected Phases	8		8				6		5	2	
Permitted Phases								6			
Actuated Green, G (s)	74.0		74.0				25.1	25.1	18.9	48.0	
Effective Green, g (s)	74.0		74.0				25.1	25.1	18.9	48.0	
Actuated g/C Ratio	0.57		0.57				0.19	0.19	0.15	0.37	
Clearance Time (s)	4.0		4.0				4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0				3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1995		901				712	306	499	1362	
v/s Ratio Prot	c0.61		0.23				c0.14		c0.11	0.16	
v/s Ratio Perm								0.01			
v/c Ratio	1.06		0.40				0.70	0.05	0.75	0.43	
Uniform Delay, d1	28.0		15.6				49.0	42.8	53.2	30.8	
Progression Factor	1.00		1.00				1.00	1.00	1.00	1.00	
Incremental Delay, d2	39.2		0.3				5.7	0.3	6.0	1.0	
Delay (s)	67.2		15.9				54.7	43.1	59.2	31.8	
Level of Service	E		B				D	D	E	C	
Approach Delay (s)		58.8		0.0			53.0			42.4	
Approach LOS		E		A			D			D	

Intersection Summary			
HCM Average Control Delay	54.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: EB Ramps & North-South Road
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL2	EBL	EBR	SBL	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰		↱↱			↰↰	↑↑↑			↑↑	↱↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0			4.0	4.0			4.0	4.0
Lane Util. Factor	1.00		0.88			0.97	*0.99			*0.99	*0.99
Frt	1.00		0.85			1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (prot)	1770		2787			3433	5532			3688	3135
Flt Permitted	0.95		1.00			0.95	1.00			1.00	1.00
Satd. Flow (perm)	1770		2787			3433	5532			3688	3135
Volume (vph)	92	0	1018	0	0	207	2387	0	0	861	2122
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	93	0	1028	0	0	209	2411	0	0	870	2143
RTOR Reduction (vph)	0	0	3	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	93	0	1025	0	0	209	2411	0	0	870	2143
Turn Type	Prot		custom			Prot					Free
Protected Phases	4		4			1	6			2	
Permitted Phases											Free
Actuated Green, G (s)	23.0		23.0			9.3	39.0			25.7	70.0
Effective Green, g (s)	23.0		23.0			9.3	39.0			25.7	70.0
Actuated g/C Ratio	0.33		0.33			0.13	0.56			0.37	1.00
Clearance Time (s)	4.0		4.0			4.0	4.0			4.0	
Vehicle Extension (s)	3.0		3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)	582		916			456	3082			1354	3135
v/s Ratio Prot	0.05		c0.37			0.06	c0.44			0.24	
v/s Ratio Perm											c0.68
v/c Ratio	0.16		1.12			0.46	0.78			0.64	0.68
Uniform Delay, d1	16.7		23.5			28.0	12.2			18.3	0.0
Progression Factor	1.00		1.00			1.00	1.00			0.67	1.00
Incremental Delay, d2	0.1		68.2			0.7	2.1			0.9	0.5
Delay (s)	16.8		91.7			28.8	14.2			13.2	0.5
Level of Service	B		F			C	B			B	A
Approach Delay (s)		85.5		0.0			15.4			4.1	
Approach LOS		F		A			B			A	

Intersection Summary			
HCM Average Control Delay	22.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: North-South Road & Farrington Hwy
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	*0.99	*0.99	0.88	*0.99	*0.99	1.00	*0.99	*0.99	0.88	*0.99	*0.99	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3504	5532	2787	5256	5532	1583	3504	3688	2787	3504	3688	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3504	5532	2787	5256	5532	1583	3504	3688	2787	3504	3688	2787
Volume (vph)	815	1917	650	880	1657	393	411	756	542	539	920	915
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	823	1936	657	889	1674	397	415	764	547	544	929	924
RTOR Reduction (vph)	0	0	0	0	0	163	0	0	0	0	0	522
Lane Group Flow (vph)	823	1936	657	889	1674	234	415	764	547	544	929	402
Turn Type	Prot		Free	Prot		Perm	Prot		Free	Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			Free			2			Free			8
Actuated Green, G (s)	33.0	48.0	140.0	29.0	44.0	44.0	16.0	27.0	140.0	20.0	31.0	31.0
Effective Green, g (s)	33.0	48.0	140.0	29.0	44.0	44.0	16.0	27.0	140.0	20.0	31.0	31.0
Actuated g/C Ratio	0.24	0.34	1.00	0.21	0.31	0.31	0.11	0.19	1.00	0.14	0.22	0.22
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	826	1897	2787	1089	1739	498	400	711	2787	501	817	617
v/s Ratio Prot	c0.23	c0.35		0.17	0.30		0.12	0.21		c0.16	c0.25	
v/s Ratio Perm			0.24			0.15			0.20			0.14
v/c Ratio	1.00	1.02	0.24	0.82	0.96	0.47	1.04	1.07	0.20	1.09	1.14	0.65
Uniform Delay, d1	53.4	46.0	0.0	53.0	47.2	38.6	62.0	56.5	0.0	60.0	54.5	49.6
Progression Factor	1.03	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.8	19.3	0.1	4.8	14.4	3.2	55.0	55.6	0.2	65.4	76.4	5.3
Delay (s)	75.1	60.6	0.1	57.8	61.6	41.8	117.0	112.1	0.2	125.4	130.9	54.8
Level of Service	E	E	A	E	E	D	F	F	A	F	F	D
Approach Delay (s)		52.4			57.8			77.8			100.4	
Approach LOS		D			E			E			F	

Intersection Summary			
HCM Average Control Delay	69.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: North-South Road & North UH Connector
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99	0.86	*0.99	*0.99		*0.99	*0.99		*0.99	1.00	*0.99
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	5532	1362	3504	5397		3504	3445		3504	1863	3135
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	5532	1362	3504	5397		3504	3445		3504	1863	3135
Volume (vph)	73	1846	475	676	1942	380	315	427	334	390	121	770
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	74	1865	480	683	1962	384	318	431	337	394	122	778
RTOR Reduction (vph)	0	0	189	0	22	0	0	95	0	0	0	14
Lane Group Flow (vph)	74	1865	291	683	2324	0	318	673	0	394	122	764
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	5	2		1	6		7	4		3	8	1
Permitted Phases			2									8
Actuated Green, G (s)	12.0	54.4	54.4	31.0	73.4		17.8	30.6		18.0	30.8	61.8
Effective Green, g (s)	12.0	54.4	54.4	31.0	73.4		17.8	30.6		18.0	30.8	61.8
Actuated g/C Ratio	0.08	0.36	0.36	0.21	0.49		0.12	0.20		0.12	0.21	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	142	2006	494	724	2641		416	703		420	383	1292
v/s Ratio Prot	0.04	c0.34		c0.19	0.43		0.09	c0.20		c0.11	0.07	0.12
v/s Ratio Perm			0.21									0.12
v/c Ratio	0.52	0.93	0.59	0.94	0.88		0.76	0.96		0.94	0.32	0.59
Uniform Delay, d1	66.2	46.0	38.8	58.6	34.3		64.1	59.1		65.4	50.7	34.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.70	0.97	0.59
Incremental Delay, d2	3.4	9.2	5.1	20.7	4.6		8.1	23.7		4.5	0.0	0.1
Delay (s)	69.7	55.2	43.9	79.3	38.9		72.2	82.8		50.2	49.1	20.3
Level of Service	E	E	D	E	D		E	F		D	D	C
Approach Delay (s)		53.4			48.0			79.7			32.1	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

17: East-West Rd. & North-South Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	*0.99	0.95		0.97	*0.99		*0.99	*0.99		*0.99	*0.99	
Frt	1.00	0.94		1.00	0.89		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3504	3313		3433	3283		3504	5404		3504	5396	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3504	3313		3433	3283		3504	5404		3504	5396	
Volume (vph)	310	312	232	367	193	531	110	1553	284	611	1718	337
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	313	315	234	371	195	536	111	1569	287	617	1735	340
RTOR Reduction (vph)	0	98	0	0	224	0	0	28	0	0	31	0
Lane Group Flow (vph)	313	451	0	371	507	0	111	1828	0	617	2045	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	14.1	20.0		12.0	17.9		6.9	40.0		20.0	53.1	
Effective Green, g (s)	14.1	20.0		12.0	17.9		6.9	40.0		20.0	53.1	
Actuated g/C Ratio	0.13	0.19		0.11	0.17		0.06	0.37		0.19	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	457	614		381	544		224	2001		649	2653	
v/s Ratio Prot	0.09	0.14		c0.11	c0.15		0.03	c0.34		c0.18	0.38	
v/s Ratio Perm												
v/c Ratio	0.68	0.73		0.97	1.11dr		0.50	0.91		0.95	0.77	
Uniform Delay, d1	44.8	41.5		47.8	44.4		48.9	32.4		43.5	22.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.2	4.6		38.9	22.9		1.7	7.9		25.1	2.2	
Delay (s)	49.1	46.1		86.7	67.3		50.6	40.3		68.6	24.7	
Level of Service	D	D		F	E		D	D		E	C	
Approach Delay (s)		47.1			73.9			40.9			34.8	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	44.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	108.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

18: North-South Road & Kapolei Parkway

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99		0.97	*0.99	1.00	*0.99	*0.99	1.00	1.00	*0.99	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5408		3433	5532	1583	3504	5532	1583	1770	5532	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5408		3433	5532	1583	3504	5532	1583	1770	5532	1583
Volume (vph)	378	879	155	507	1075	735	716	643	505	121	568	352
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	382	888	157	512	1086	742	723	649	510	122	574	356
RTOR Reduction (vph)	0	21	0	0	0	304	0	0	304	0	0	297
Lane Group Flow (vph)	382	1024	0	512	1086	438	723	649	206	122	574	59
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases						6			4			8
Actuated Green, G (s)	29.3	45.9		23.4	40.0	40.0	27.9	32.4	32.4	11.5	16.0	16.0
Effective Green, g (s)	29.3	45.9		23.4	40.0	40.0	27.9	32.4	32.4	11.5	16.0	16.0
Actuated g/C Ratio	0.23	0.36		0.18	0.31	0.31	0.22	0.25	0.25	0.09	0.12	0.12
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	401	1921		622	1713	490	757	1387	397	158	685	196
v/s Ratio Prot	c0.22	0.19		0.15	0.20		c0.21	0.12		0.07	c0.10	
v/s Ratio Perm						c0.28			0.13			0.04
v/c Ratio	0.95	0.53		0.82	0.63	0.89	0.96	0.47	0.52	0.77	0.84	0.30
Uniform Delay, d1	49.3	33.1		50.9	38.3	42.6	50.0	41.1	41.7	57.6	55.3	51.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	32.7	1.1		8.7	1.8	21.4	22.2	0.3	1.1	20.5	8.8	0.9
Delay (s)	82.0	34.2		59.6	40.1	64.0	72.2	41.3	42.8	78.1	64.2	52.4
Level of Service	F	C		E	D	E	E	D	D	E	E	D
Approach Delay (s)		47.0			51.9			53.6			61.8	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	52.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	129.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: East-West Rd. & Old Fort Weaver Rd — 2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	3539	1583	3433	1583
Flt Permitted	0.19	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	351	1863	3539	1583	3433	1583
Volume (vph)	37	621	829	955	898	94
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	37	627	837	965	907	95
RTOR Reduction (vph)	0	0	0	595	0	42
Lane Group Flow (vph)	37	627	837	370	907	53
Turn Type	Perm			Perm		Perm
Protected Phases		4	8		6	
Permitted Phases	4			8		6
Actuated Green, G (s)	49.9	49.9	49.9	49.9	72.1	72.1
Effective Green, g (s)	49.9	49.9	49.9	49.9	72.1	72.1
Actuated g/C Ratio	0.38	0.38	0.38	0.38	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	135	715	1358	608	1904	878
v/s Ratio Prot		c0.34	0.24		c0.26	
v/s Ratio Perm	0.11			0.23		0.03
v/c Ratio	0.27	0.88	0.62	0.61	0.48	0.06
Uniform Delay, d1	27.6	37.2	32.3	32.2	17.5	13.3
Progression Factor	1.22	1.20	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	9.4	0.8	1.7	0.9	0.1
Delay (s)	34.5	54.1	33.2	33.9	18.4	13.5
Level of Service	C	D	C	C	B	B
Approach Delay (s)		53.0	33.6		17.9	
Approach LOS		D	C		B	

Intersection Summary			
HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Farrington Hwy & B Street — 2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations	↰↰	↑↑	↱	↰↰	↑↑	↱	↰	↑	↱	↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	*0.99	1.00	0.97	*0.99	1.00	1.00	1.00	1.00	*0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3688	1583	3433	3688	1583	1770	1863	1583	3504	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3688	1583	3433	3688	1583	1770	1863	1583	3504	1863	1583
Volume (vph)	229	1443	356	554	1792	80	152	182	307	274	143	178
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	231	1458	360	560	1810	81	154	184	310	277	144	180
RTOR Reduction (vph)	0	0	46	0	0	23	0	0	5	0	0	16
Lane Group Flow (vph)	231	1458	314	560	1810	58	154	184	305	277	144	164
Turn Type	Prot		pm+ov	Prot		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6		7	4	5	3	8	1
Permitted Phases			2			6			4			8
Actuated Green, G (s)	31.0	72.8	84.8	32.2	74.0	74.0	13.0	17.0	48.0	12.0	16.0	48.2
Effective Green, g (s)	31.0	72.8	84.8	32.2	74.0	74.0	13.0	17.0	48.0	12.0	16.0	48.2
Actuated g/C Ratio	0.21	0.49	0.57	0.21	0.49	0.49	0.09	0.11	0.32	0.08	0.11	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	709	1790	937	737	1819	781	153	211	507	280	199	551
v/s Ratio Prot	0.07	c0.40	0.03	0.16	c0.49		c0.09	c0.10	0.12	0.08	0.08	0.06
v/s Ratio Perm			0.17			0.04			0.07			0.04
v/c Ratio	0.33	0.81	0.34	0.76	1.00	0.07	1.01	0.87	0.60	0.99	0.72	0.30
Uniform Delay, d1	50.6	32.9	17.5	55.3	37.8	20.0	68.5	65.4	43.0	68.9	64.9	38.2
Progression Factor	1.00	1.00	1.00	0.95	0.48	0.09	1.00	1.00	1.00	1.00	0.91	0.96
Incremental Delay, d2	0.3	4.2	0.2	1.8	12.2	0.1	74.5	35.8	2.0	44.0	16.3	0.2
Delay (s)	50.9	37.1	17.7	54.2	30.4	1.9	143.0	101.3	45.0	113.2	75.5	37.0
Level of Service	D	D	B	D	C	A	F	F	D	F	E	D
Approach Delay (s)		35.2			34.9			84.3			81.4	
Approach LOS		D			C			F			F	

Intersection Summary			
HCM Average Control Delay	45.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: East-West Rd. & A Street
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.86		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1844		1770	1863	1583	1770	1599		1770	1631	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1844		1770	1863	1583	1770	1599		1770	1631	
Volume (vph)	170	768	56	34	689	616	91	8	140	46	6	31
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	835	61	37	749	670	99	9	152	50	7	34
RTOR Reduction (vph)	0	1	0	0	0	240	0	139	0	0	32	0
Lane Group Flow (vph)	185	895	0	37	749	430	99	22	0	50	9	0
Turn Type	Prot			Prot		Perm	Split			Split		
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases						6						
Actuated Green, G (s)	34.6	105.3		6.2	76.9	76.9	13.0	13.0		9.5	9.5	
Effective Green, g (s)	34.6	105.3		6.2	76.9	76.9	13.0	13.0		9.5	9.5	
Actuated g/C Ratio	0.23	0.70		0.04	0.51	0.51	0.09	0.09		0.06	0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	408	1294		73	955	812	153	139		112	103	
v/s Ratio Prot	c0.10	c0.49		0.02	c0.40		c0.06	0.01		c0.03	0.01	
v/s Ratio Perm						0.27						
v/c Ratio	0.45	0.69		0.51	0.78	0.53	0.65	0.16		0.45	0.09	
Uniform Delay, d1	49.6	12.9		70.4	29.8	24.5	66.3	63.4		67.7	66.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	3.0		5.4	4.3	0.6	9.1	0.5		2.8	0.4	
Delay (s)	50.4	16.0		75.8	34.1	25.1	75.3	64.0		70.5	66.5	
Level of Service	D	B		E	C	C	E	E		E	E	
Approach Delay (s)		21.9			31.0			68.3			68.7	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	32.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Farrington Hwy & 2nd Avenue
2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	*0.99		*0.99	*0.99	1.00	1.00	0.95	*0.99	*0.99	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5469		3504	3688	1583	1770	3539	3135	3504	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	5469		3504	3688	1583	1770	3539	3135	3504	3539	1583
Volume (vph)	186	1527	127	690	1836	246	106	297	513	558	356	320
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	188	1542	128	697	1855	248	107	300	518	564	360	323
RTOR Reduction (vph)	0	7	0	0	0	70	0	0	5	0	0	161
Lane Group Flow (vph)	188	1663	0	697	1855	178	107	300	513	564	360	162
Turn Type	Prot			Prot		Perm	Prot		pm+ov	Prot		Perm
Protected Phases	5	2		1	6		3	8	1	7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	16.0	54.0		34.0	72.0	72.0	11.5	23.0	57.0	23.0	34.5	34.5
Effective Green, g (s)	16.0	54.0		34.0	72.0	72.0	11.5	23.0	57.0	23.0	34.5	34.5
Actuated g/C Ratio	0.11	0.36		0.23	0.48	0.48	0.08	0.15	0.38	0.15	0.23	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	189	1969		794	1770	760	136	543	1275	537	814	364
v/s Ratio Prot	c0.11	0.30		0.20	c0.50		c0.06	c0.08	0.09	c0.16	0.10	
v/s Ratio Perm						0.11			0.07			0.10
v/c Ratio	0.99	0.84		0.88	1.05	0.23	0.79	0.55	0.40	1.05	0.44	0.45
Uniform Delay, d1	67.0	44.1		56.0	39.0	22.9	68.0	58.7	34.0	63.5	49.5	49.5
Progression Factor	0.77	0.76		0.69	0.56	0.13	1.00	1.00	1.00	0.78	0.74	0.63
Incremental Delay, d2	50.5	3.0		6.0	29.9	0.4	25.2	4.0	0.2	27.8	0.2	0.4
Delay (s)	101.8	36.6		44.4	51.8	3.3	93.3	62.8	34.2	77.4	36.6	31.4
Level of Service	F	D		D	D	A	F	E	C	E	D	C
Approach Delay (s)		43.2			45.7			50.3			53.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	47.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
23: 2nd Avenue & Kunia Road

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	4998	440	0	5283
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	5433	478	0	5742
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			870			
pX, platoon unblocked						
vC, conflicting volume	7107	1597			5911	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	7107	1597			5911	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	0	95			7	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	0	1552	1552	1552	1254	1436	1436	1436	1436
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	0	0	0	0	478	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.91	0.91	0.91	0.74	0.84	0.84	0.84	0.84
Queue Length 95th (ft)	0	0	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	A								
Approach Delay (s)	0.0	0.0				0.0			
Approach LOS	A								

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
24: 3rd Avenue & Kunia Road

2030 + PRO (without Transit Corridor) - PM Peak Mitigations

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations		↱	↑↑↑↱			↑↑↑↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	14	4808	189	0	5283
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	15	5226	205	0	5742
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)			1234			
pX, platoon unblocked						
vC, conflicting volume	6764	1409			5432	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	6764	1409			5432	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	88			100	
cM capacity (veh/h)	0	128			11	

Direction, Lane #	EB 1	SE 1	SE 2	SE 3	SE 4	NW 1	NW 2	NW 3	NW 4
Volume Total	15	1493	1493	1493	952	1436	1436	1436	1436
Volume Left	0	0	0	0	0	0	0	0	0
Volume Right	15	0	0	0	205	0	0	0	0
cSH	128	1700	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.88	0.88	0.88	0.56	0.84	0.84	0.84	0.84
Queue Length 95th (ft)	10	0	0	0	0	0	0	0	0
Control Delay (s)	36.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	E								
Approach Delay (s)	36.9	0.0				0.0			
Approach LOS	E								

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations	↰	↑	↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	*0.99	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1752	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1752	1583
Volume (vph)	519	371	763	98	342	533
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	524	375	771	99	345	538
RTOR Reduction (vph)	0	0	0	39	0	406
Lane Group Flow (vph)	524	375	771	60	345	132
Turn Type	Prot			Prot		Prot
Protected Phases	5	2	6	6	4	4
Permitted Phases						
Actuated Green, G (s)	38.0	97.0	55.0	55.0	25.0	25.0
Effective Green, g (s)	38.0	97.0	55.0	55.0	25.0	25.0
Actuated g/C Ratio	0.29	0.75	0.42	0.42	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	517	1390	788	670	337	304
v/s Ratio Prot	c0.30	0.20	c0.41	0.04	c0.20	0.08
v/s Ratio Perm						
v/c Ratio	1.01	0.27	0.98	0.09	1.02	0.43
Uniform Delay, d1	46.0	5.2	36.9	22.5	52.5	46.3
Progression Factor	1.00	1.00	1.29	2.07	1.00	1.00
Incremental Delay, d2	43.0	0.5	24.5	0.2	55.2	4.5
Delay (s)	89.0	5.7	72.1	46.8	107.7	50.7
Level of Service	F	A	E	D	F	D
Approach Delay (s)		54.3	69.2		73.0	
Approach LOS		D	E		E	

Intersection Summary			
HCM Average Control Delay	65.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	*0.99	*0.99	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3688	3688	1583
Flt Permitted	0.95	1.00	0.05	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	98	3688	3688	1583
Volume (vph)	200	209	96	1497	2295	155
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	202	211	97	1512	2318	157
RTOR Reduction (vph)	0	14	0	0	0	38
Lane Group Flow (vph)	202	197	97	1512	2318	119
Turn Type		Perm	Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	16.0	16.0	76.0	76.0	76.0	76.0
Effective Green, g (s)	16.0	16.0	76.0	76.0	76.0	76.0
Actuated g/C Ratio	0.16	0.16	0.76	0.76	0.76	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	283	253	74	2803	2803	1203
v/s Ratio Prot	0.11			0.41	0.63	
v/s Ratio Perm		c0.12	c0.99			0.08
v/c Ratio	0.71	0.78	1.31	0.54	0.83	0.10
Uniform Delay, d1	39.8	40.3	12.0	4.9	7.8	3.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.3	20.6	208.6	0.2	2.1	0.0
Delay (s)	54.1	60.9	220.6	5.1	9.9	3.2
Level of Service	D	E	F	A	A	A
Approach Delay (s)	57.6			18.1	9.5	
Approach LOS	E			B	A	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX B

REEWAY SEGMENT LOS ANALYSIS

APPENDIX B-1

EXISTING CONDITIONS

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	1582	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	439	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	603	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	603	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	10.6	pc/mi/ln
Level of service, LOS	**A**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3808	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1058	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1451	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1451	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	25.5	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7067	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1963	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2020	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2020	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	4	
Density, D	35.7	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4468	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1241	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1703	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	1703	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	28.4	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/16/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2004)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	1777	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	494	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	677	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	677	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	11.9	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	1482	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	412	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	565	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	565	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	9.9	pc/mi/ln
Level of service, LOS	**A**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3331	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	925	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1269	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1269	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	22.3	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4366	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1213	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1248	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1248	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	21.3	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	3069	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	853	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1170	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1170	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	20.5	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2004)**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	4078	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1133	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1554	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1554	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	27.3	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	1762	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	489	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	672	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	672	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	11.8	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4077	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1133	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1554	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1554	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	27.3	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4446	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1235	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1271	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1271	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	21.7	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	2652	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	737	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1011	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1011	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	17.7	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2004)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3196	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	888	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1218	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1218	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	21.4	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	2223	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	618	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	847	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	847	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	14.9	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	PM Peak
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Existing (Year 2005)
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4079	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1133	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1555	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	62.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1555	pc/h/ln
Free-flow speed, FFS	62.0	mi/h
Average passenger-car speed, S	62.0	mi/h
Number of lanes, N	3	
Density, D	25.1	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7425	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2063	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2122	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2122	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	54.9	mi/h
Number of lanes, N	4	
Density, D	38.6	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	7/13/2006
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2005)**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	5824	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1618	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2220	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2220	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	51.8	mi/h
Number of lanes, N	3	
Density, D	42.8	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	BPK
Agency or Company:	Wilbur Smith Associates
Date Performed:	
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Existing (Year 2004)**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	2534	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	704	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	966	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	966	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	16.9	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX B-2
YEAR 2030 CONDITIONS

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5434	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1509	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2071	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2071	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	54.8	mi/h
Number of lanes, N	3	
Density, D	37.8	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	8197	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2277	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2343	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2343	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst: MM
Agency or Company: Wilbur Smith Associates
Date Performed: 2/7/07
Analysis Time Period: **AM Peak**
Freeway/Direction: **H1 EB**
From/To: **W/O Paiwa St**
Jurisdiction: Kapolei
Analysis Year: **Year 2030**
Description: East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	9906	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2752	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2265	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2265	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	52.2	mi/h
Number of lanes, N	5	
Density, D	43.4	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst: TSO
Agency or Company: Wilbur Smith Associates
Date Performed: 11/15/06
Analysis Time Period: **AM Peak**
Freeway/Direction: **H1 EB**
From/To: **E/O Kamehameha Hwy**
Jurisdiction: Kapolei
Analysis Year: **Year 2030**
Description: East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7512	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2087	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2147	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Rural Freeway	

LOS and Performance Measures

Flow rate, vp	2147	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	55.3	mi/h
Number of lanes, N	4	
Density, D	38.8	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3184	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	884	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1213	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1213	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	21.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3259	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	905	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1242	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1242	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3735	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1038	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1068	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1068	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	18.3	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/7/07
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4366	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1213	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	998	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	998	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	16.6	pc/mi/ln
Level of service, LOS	**B**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3069	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	853	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1170	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1170	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	20.5	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	6273	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1743	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1793	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1793	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.3	mi/h
Number of lanes, N	4	
Density, D	30.7	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4680	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1300	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1784	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1784	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	56.9	mi/h
Number of lanes, N	3	
Density, D	31.3	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5833	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1620	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1667	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1667	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	28.5	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/7/07
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7137	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1983	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1632	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1632	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	27.2	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4249	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1180	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1619	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1619	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	28.4	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

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                HCS+: Basic Freeway Segments Release 5.2

_______________________Operational Analysis_______________________________

Analyst:                 TSO
Agency or Company:       Wilbur Smith Associates
Date Performed:          11/15/06
Analysis Time Period:    PM Peak
Freeway/Direction:       H2 NB
From/To:                 At Ka Uka Blvd
Jurisdiction:            Kapolei
Analysis Year:           Year 2030
Description:  East Kapolei TIAR

_______________________Flow Inputs and Adjustments_________________________

Volume, V                                  6220           veh/h
Peak-hour factor, PHF                      0.90
Peak 15-min volume, v15                    1728           v
Trucks and buses                           5              %
Recreational vehicles                      2              %
Terrain type:                              Level
    Grade                                  0.00           %
    Segment length                         0.00           mi
Trucks and buses PCE, ET                   1.5
Recreational vehicle PCE, ER               1.2
Heavy vehicle adjustment, fHV              0.972
Driver population factor, fp               1.00
Flow rate, vp                              2371           pc/h/ln

_______________________Speed Inputs and Adjustments________________________

Lane width                                 12.0           ft
Right-shoulder lateral clearance           6.0            ft
Interchange density                        0.50           interchange/mi
Number of lanes, N                         3
Free-flow speed:                           Base
     FFS or BFFS                           60.0           mi/h
Lane width adjustment, fLW                 0.0            mi/h
Lateral clearance adjustment, fLC          0.0            mi/h
Interchange density adjustment, fID        0.0            mi/h
Number of lanes adjustment, fN             3.0            mi/h
Free-flow speed, FFS                       57.0           mi/h
                                           Urban Freeway

_______________________LOS and Performance Measures________________________

Flow rate, vp                              2371           pc/h/ln
Free-flow speed, FFS                       57.0           mi/h
Average passenger-car speed, S                            mi/h
Number of lanes, N                         3
Density, D                                                pc/mi/ln
Level of service, LOS                      F

  Overall results are not computed when free-flow speed is less than 55 mph.
```

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                HCS+: Basic Freeway Segments Release 5.2

_______________________Operational Analysis_______________________________

Analyst:                 TSO
Agency or Company:       Wilbur Smith Associates
Date Performed:          11/15/06
Analysis Time Period:    PM Peak
Freeway/Direction:       H1 WB
From/To:                 S/O Makakilo Drive
Jurisdiction:            Kapolei
Analysis Year:           Year 2030
Description:  East Kapolei TIAR

_______________________Flow Inputs and Adjustments_________________________

Volume, V                                  6365           veh/h
Peak-hour factor, PHF                      0.90
Peak 15-min volume, v15                    1768           v
Trucks and buses                           5              %
Recreational vehicles                      2              %
Terrain type:                              Level
    Grade                                  0.00           %
    Segment length                         0.00           mi
Trucks and buses PCE, ET                   1.5
Recreational vehicle PCE, ER               1.2
Heavy vehicle adjustment, fHV              0.972
Driver population factor, fp               1.00
Flow rate, vp                              2426           pc/h/ln

_______________________Speed Inputs and Adjustments________________________

Lane width                                 12.0           ft
Right-shoulder lateral clearance           6.0            ft
Interchange density                        0.50           interchange/mi
Number of lanes, N                         3
Free-flow speed:                           Base
     FFS or BFFS                           60.0           mi/h
Lane width adjustment, fLW                 0.0            mi/h
Lateral clearance adjustment, fLC          0.0            mi/h
Interchange density adjustment, fID        0.0            mi/h
Number of lanes adjustment, fN             3.0            mi/h
Free-flow speed, FFS                       57.0           mi/h
                                           Urban Freeway

_______________________LOS and Performance Measures________________________

Flow rate, vp                              2426           pc/h/ln
Free-flow speed, FFS                       57.0           mi/h
Average passenger-car speed, S                            mi/h
Number of lanes, N                         3
Density, D                                                pc/mi/ln
Level of service, LOS                      F

  Overall results are not computed when free-flow speed is less than 55 mph.
```

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7860	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2183	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2247	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2247	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	51.9	mi/h
Number of lanes, N	4	
Density, D	43.3	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/7/07
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7931	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2203	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1511	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1511	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	6	
Density, D	25.2	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	7766	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2157	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2220	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2220	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	52.7	mi/h
Number of lanes, N	4	
Density, D	42.2	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	TSO
Agency or Company:	Wilbur Smith Associates
Date Performed:	11/15/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4616	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1282	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1319	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1319	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	22.5	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX B-3
YEAR 2030 PLUS PROJECT CONDITIONS
SCENARIO A: WITH TRANSIT CORRIDOR SCENARIO

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	5892	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1637	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2246	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2246	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	51.1	mi/h
Number of lanes, N	3	
Density, D	43.9	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	9143	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2540	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2613	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2613	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst: MM
Agency or Company: Wilbur Smith Associates
Date Performed: 2/8/07
Analysis Time Period: **AM Peak**
Freeway/Direction: **H1 EB**
From/To: **W/O Paiwa St**
Jurisdiction: Kapolei
Analysis Year: **Year 2030 with Reduction**
Description: East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	11906	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3307	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2723	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2723	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	5	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst: MM
Agency or Company: Wilbur Smith Associates
Date Performed: 12/22/06
Analysis Time Period: **AM Peak**
Freeway/Direction: **H1 EB**
From/To: **E/O Kamehameha Hwy**
Jurisdiction: Kapolei
Analysis Year: 2030 with Transit Reduction
Description: East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	8435	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2343	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2411	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2411	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3597	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	999	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1371	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1371	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	24.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3756	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1043	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1431	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1431	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	25.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/2006
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	4491	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1248	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1284	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1284	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	21.9	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 with Reduction**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	5858	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1627	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1340	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1340	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	22.3	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	3757	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1044	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1432	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1432	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	25.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	6581	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1828	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1881	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1881	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	57.9	mi/h
Number of lanes, N	4	
Density, D	32.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	5334	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1482	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2033	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2033	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	55.3	mi/h
Number of lanes, N	3	
Density, D	36.7	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	6891	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1914	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1970	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1970	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	57.2	mi/h
Number of lanes, N	4	
Density, D	34.5	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 with Reduction**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	9139	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2539	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2090	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2090	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.5	mi/h
Number of lanes, N	5	
Density, D	37.0	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5173	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1437	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1971	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1971	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	56.0	mi/h
Number of lanes, N	3	
Density, D	35.2	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

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                 HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis_________________________________

Analyst:                MM
Agency or Company:      Wilbur Smith Associates
Date Performed:         12/22/06
Analysis Time Period:   PM Peak
Freeway/Direction:      H2 NB
From/To:                At Ka Uka Blvd
Jurisdiction:           Kapolei
Analysis Year:          Year 2030 with Reduction
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments__________________________

Volume, V                                    6663          veh/h
Peak-hour factor, PHF                        0.90
Peak 15-min volume, v15                      1851          v
Trucks and buses                             5             %
Recreational vehicles                        2             %
Terrain type:                                Level
    Grade                                    0.00          %
    Segment length                           0.00          mi
Trucks and buses PCE, ET                     1.5
Recreational vehicle PCE, ER                 1.2
Heavy vehicle adjustment, fHV                0.972
Driver population factor, fp                 1.00
Flow rate, vp                                2539          pc/h/ln

_________________________Speed Inputs and Adjustments_________________________

Lane width                                   12.0          ft
Right-shoulder lateral clearance             6.0           ft
Interchange density                          0.50          interchange/mi
Number of lanes, N                           3
Free-flow speed:                             Base
     FFS or BFFS                             60.0          mi/h
Lane width adjustment, fLW                   0.0           mi/h
Lateral clearance adjustment, fLC            0.0           mi/h
Interchange density adjustment, fID          0.0           mi/h
Number of lanes adjustment, fN               3.0           mi/h
Free-flow speed, FFS                         57.0          mi/h
                                             Urban Freeway

_________________________LOS and Performance Measures_________________________

Flow rate, vp                                2539          pc/h/ln
Free-flow speed, FFS                         57.0          mi/h
Average passenger-car speed, S                             mi/h
Number of lanes, N                           3
Density, D                                                 pc/mi/ln
Level of service, LOS                        F

 Overall results are not computed when free-flow speed is less than 55 mph.
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                 HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis_________________________________

Analyst:                MM
Agency or Company:      Wilbur Smith Associates
Date Performed:         12/22/06
Analysis Time Period:   PM Peak
Freeway/Direction:      H1 WB
From/To:                S/O Makakilo Drive
Jurisdiction:           Kapolei
Analysis Year:          Year 2030 with Reduction
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments__________________________

Volume, V                                    7022          veh/h
Peak-hour factor, PHF                        0.90
Peak 15-min volume, v15                      1951          v
Trucks and buses                             5             %
Recreational vehicles                        2             %
Terrain type:                                Level
    Grade                                    0.00          %
    Segment length                           0.00          mi
Trucks and buses PCE, ET                     1.5
Recreational vehicle PCE, ER                 1.2
Heavy vehicle adjustment, fHV                0.972
Driver population factor, fp                 1.00
Flow rate, vp                                2676          pc/h/ln

_________________________Speed Inputs and Adjustments_________________________

Lane width                                   12.0          ft
Right-shoulder lateral clearance             6.0           ft
Interchange density                          0.50          interchange/mi
Number of lanes, N                           3
Free-flow speed:                             Base
     FFS or BFFS                             60.0          mi/h
Lane width adjustment, fLW                   0.0           mi/h
Lateral clearance adjustment, fLC            0.0           mi/h
Interchange density adjustment, fID          0.0           mi/h
Number of lanes adjustment, fN               3.0           mi/h
Free-flow speed, FFS                         57.0          mi/h
                                             Urban Freeway

_________________________LOS and Performance Measures_________________________

Flow rate, vp                                2676          pc/h/ln
Free-flow speed, FFS                         57.0          mi/h
Average passenger-car speed, S                             mi/h
Number of lanes, N                           3
Density, D                                                 pc/mi/ln
Level of service, LOS                        F

 Overall results are not computed when free-flow speed is less than 55 mph.
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HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	8875	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2465	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2537	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2537	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 with Reduction**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	10131	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2814	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1931	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	6	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1931	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.7	mi/h
Number of lanes, N	6	
Density, D	32.9	pc/mi/ln
Level of service, LOS	**D**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	8781	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2439	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2510	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2510	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5070	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1408	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1449	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1449	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	24.8	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX B-4
YEAR 2030 PLUS PROJECT CONDITIONS
SCENARIO B: WITHOUT TRANSIT CORRIDOR SCENARIO

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5928	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1647	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2259	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2259	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	50.8	mi/h
Number of lanes, N	3	
Density, D	44.5	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	9217	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2560	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2635	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2635	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 without Reduction**
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	12062	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3351	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2758	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2758	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	5	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	2030 with Transit Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	8435	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2343	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2411	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2411	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	3629	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1008	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1383	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1383	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	24.3	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	3794	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1054	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1446	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1446	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	3	
Density, D	25.4	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	4549	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1264	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1300	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1300	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	22.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**AM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 with Reduction**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5858	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1627	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1340	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1340	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	5	
Density, D	22.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

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              HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis____________________________________

Analyst:                MM
Agency or Company:      Wilbur Smith Associates
Date Performed:         12/22/06
Analysis Time Period:   AM Peak
Freeway/Direction:      H1 WB
From/To:                E/O Kamehameha Hwy
Jurisdiction:           Kapolei
Analysis Year:          Year 2030 without Reduction
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments_____________________________

Volume, V                                    3811           veh/h
Peak-hour factor, PHF                        0.90
Peak 15-min volume, v15                      1059           v
Trucks and buses                             5              %
Recreational vehicles                        2              %
Terrain type:                                Level
    Grade                                    0.00           %
    Segment length                           0.00           mi
Trucks and buses PCE, ET                     1.5
Recreational vehicle PCE, ER                 1.2
Heavy vehicle adjustment, fHV                0.972
Driver population factor, fp                 1.00
Flow rate, vp                                1452           pc/h/ln

_________________________Speed Inputs and Adjustments____________________________

Lane width                                   12.0           ft
Right-shoulder lateral clearance             6.0            ft
Interchange density                          0.50           interchange/mi
Number of lanes, N                           3
Free-flow speed:                             Base
     FFS or BFFS                             60.0           mi/h
Lane width adjustment, fLW                   0.0            mi/h
Lateral clearance adjustment, fLC            0.0            mi/h
Interchange density adjustment, fID          0.0            mi/h
Number of lanes adjustment, fN               3.0            mi/h
Free-flow speed, FFS                         57.0           mi/h
                                             Urban Freeway

_________________________LOS and Performance Measures___________________________

Flow rate, vp                                1452           pc/h/ln
Free-flow speed, FFS                         57.0           mi/h
Average passenger-car speed, S               57.0           mi/h
Number of lanes, N                           3
Density, D                                   25.5           pc/mi/ln
Level of service, LOS                        C

  Overall results are not computed when free-flow speed is less than 55 mph.
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              HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis____________________________________

Analyst:                MM
Agency or Company:      Wilbur Smith Associates
Date Performed:         12/22/06
Analysis Time Period:   AM Peak
Freeway/Direction:      H2 SB
From/To:                At Ka Uka Blvd
Jurisdiction:           Kapolei
Analysis Year:
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments_____________________________

Volume, V                                    6605           veh/h
Peak-hour factor, PHF                        0.90
Peak 15-min volume, v15                      1835           v
Trucks and buses                             5              %
Recreational vehicles                        2              %
Terrain type:                                Level
    Grade                                    0.00           %
    Segment length                           0.00           mi
Trucks and buses PCE, ET                     1.5
Recreational vehicle PCE, ER                 1.2
Heavy vehicle adjustment, fHV                0.972
Driver population factor, fp                 1.00
Flow rate, vp                                1888           pc/h/ln

_________________________Speed Inputs and Adjustments____________________________

Lane width                                   12.0           ft
Right-shoulder lateral clearance             6.0            ft
Interchange density                          0.50           interchange/mi
Number of lanes, N                           4
Free-flow speed:                             Base
     FFS or BFFS                             60.0           mi/h
Lane width adjustment, fLW                   0.0            mi/h
Lateral clearance adjustment, fLC            0.0            mi/h
Interchange density adjustment, fID          0.0            mi/h
Number of lanes adjustment, fN               1.5            mi/h
Free-flow speed, FFS                         58.5           mi/h
                                             Urban Freeway

_________________________LOS and Performance Measures___________________________

Flow rate, vp                                1888           pc/h/ln
Free-flow speed, FFS                         58.5           mi/h
Average passenger-car speed, S               57.9           mi/h
Number of lanes, N                           4
Density, D                                   32.6           pc/mi/ln
Level of service, LOS                        D

  Overall results are not computed when free-flow speed is less than 55 mph.
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HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	5392	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1498	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2055	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2055	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	37.3	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Kunia Rd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	6985	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1940	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1997	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1997	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	56.9	mi/h
Number of lanes, N	4	
Density, D	35.1	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	2/8/07
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**W/O Paiwa St**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030 without Reduction**
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	9309	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2586	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2129	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2129	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	55.7	mi/h
Number of lanes, N	5	
Density, D	38.2	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 EB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 with Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5173	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1437	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1971	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1971	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S	56.0	mi/h
Number of lanes, N	3	
Density, D	35.2	pc/mi/ln
Level of service, LOS	**E**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 NB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	6668	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1852	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2541	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2541	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	3	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**S/O Makakilo Drive**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description: East Kapolei TIAR	

Flow Inputs and Adjustments

Volume, V	7080	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1967	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2698	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	57.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2698	pc/h/ln
Free-flow speed, FFS	57.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	3	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

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                 HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis__________________________

Analyst:                 MM
Agency or Company:       Wilbur Smith Associates
Date Performed:          12/22/06
Analysis Time Period:    PM Peak
Freeway/Direction:       H1 WB
From/To:                 W/O Kunia Rd
Jurisdiction:            Kapolei
Analysis Year:           Year 2030 without Reduction
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments___________________

Volume, V                                   8964          veh/h
Peak-hour factor, PHF                       0.90
Peak 15-min volume, v15                     2490          v
Trucks and buses                            5             %
Recreational vehicles                       2             %
Terrain type:                               Level
    Grade                                   0.00          %
    Segment length                          0.00          mi
Trucks and buses PCE, ET                    1.5
Recreational vehicle PCE, ER                1.2
Heavy vehicle adjustment, fHV               0.972
Driver population factor, fp                1.00
Flow rate, vp                               2562          pc/h/ln

_________________________Speed Inputs and Adjustments__________________

Lane width                                  12.0          ft
Right-shoulder lateral clearance            6.0           ft
Interchange density                         0.50          interchange/mi
Number of lanes, N                          4
Free-flow speed:                            Base
     FFS or BFFS                            60.0          mi/h
Lane width adjustment, fLW                  0.0           mi/h
Lateral clearance adjustment, fLC           0.0           mi/h
Interchange density adjustment, fID         0.0           mi/h
Number of lanes adjustment, fN              1.5           mi/h
Free-flow speed, FFS                        58.5          mi/h
                                            Urban Freeway

_________________________LOS and Performance Measures__________________

Flow rate, vp                               2562          pc/h/ln
Free-flow speed, FFS                        58.5          mi/h
Average passenger-car speed, S                            mi/h
Number of lanes, N                          4
Density, D                                                pc/mi/ln
Level of service, LOS                       F

  Overall results are not computed when free-flow speed is less than 55 mph.
```

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                 HCS+: Basic Freeway Segments Release 5.2

_________________________Operational Analysis__________________________

Analyst:                 MM
Agency or Company:       Wilbur Smith Associates
Date Performed:          2/8/07
Analysis Time Period:    PM Peak
Freeway/Direction:       H1 WB
From/To:                 W/O Paiwa St
Jurisdiction:            Kapolei
Analysis Year:           Year 2030 with Reduction
Description:  East Kapolei TIAR

_________________________Flow Inputs and Adjustments___________________

Volume, V                                   10131         veh/h
Peak-hour factor, PHF                       0.90
Peak 15-min volume, v15                     2814          v
Trucks and buses                            5             %
Recreational vehicles                       2             %
Terrain type:                               Level
    Grade                                   0.00          %
    Segment length                          0.00          mi
Trucks and buses PCE, ET                    1.5
Recreational vehicle PCE, ER                1.2
Heavy vehicle adjustment, fHV               0.972
Driver population factor, fp                1.00
Flow rate, vp                               1931          pc/h/ln

_________________________Speed Inputs and Adjustments__________________

Lane width                                  12.0          ft
Right-shoulder lateral clearance            6.0           ft
Interchange density                         0.50          interchange/mi
Number of lanes, N                          6
Free-flow speed:                            Base
     FFS or BFFS                            60.0          mi/h
Lane width adjustment, fLW                  0.0           mi/h
Lateral clearance adjustment, fLC           0.0           mi/h
Interchange density adjustment, fID         0.0           mi/h
Number of lanes adjustment, fN              0.0           mi/h
Free-flow speed, FFS                        60.0          mi/h
                                            Urban Freeway

_________________________LOS and Performance Measures__________________

Flow rate, vp                               1931          pc/h/ln
Free-flow speed, FFS                        60.0          mi/h
Average passenger-car speed, S              58.7          mi/h
Number of lanes, N                          6
Density, D                                  32.9          pc/mi/ln
Level of service, LOS                       D

  Overall results are not computed when free-flow speed is less than 55 mph.
```

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H1 WB**
From/To:	**E/O Kamehameha Hwy**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	8867	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2463	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	2534	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2534	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	**F**	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.2

Operational Analysis

Analyst:	MM
Agency or Company:	Wilbur Smith Associates
Date Performed:	12/22/06
Analysis Time Period:	**PM Peak**
Freeway/Direction:	**H2 SB**
From/To:	**At Ka Uka Blvd**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030 without Reduction
Description:	East Kapolei TIAR

Flow Inputs and Adjustments

Volume, V	5108	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1419	v
Trucks and buses	5	%
Recreational vehicles	2	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.972	
Driver population factor, fp	1.00	
Flow rate, vp	1460	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	58.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1460	pc/h/ln
Free-flow speed, FFS	58.5	mi/h
Average passenger-car speed, S	58.5	mi/h
Number of lanes, N	4	
Density, D	25.0	pc/mi/ln
Level of service, LOS	**C**	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX C

RAMP-FREEWAY JUNCTION LOS ANALYSIS

APPENDIX C-1

EXISTING CONDITIONS

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Existing**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	5197	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	530	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5197		530			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1444		147			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5774		589			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.589 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3641 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5774	6810	No
v_{12}	3641	4400	No
$v_{FO} = v_F - v_R$	5185	6810	No
v_R	589	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 31.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	D_S = 0.481	
Space mean speed in ramp influence area,	S_R = 49.8	mph
Space mean speed in outer lanes,	S_0 = 58.1	mph
Space mean speed for all vehicles,	S = 52.6	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Existing
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	4667	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1765	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4667		1765			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1296		490			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5186		1961			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3412 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5186	6810	No
v_{12}	3412	4400	No
$v_{FO} = v_F - v_R$	3225	6810	No
v_R	1961	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 20.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.604	
Space mean speed in ramp influence area,	S_R = 47.9	mph
Space mean speed in outer lanes,	S_0 = 59.5	mph
Space mean speed for all vehicles,	S = 51.4	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Existing**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	2902	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	429	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2902	429		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	806	119		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3224	477		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.591 Using Equation 1

$v_{12} = v_F \,(P_{FM}) = 1907$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3701	6810	No
v_{R12}	2384	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A = 20.7$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	$M_S = 0.328$	
Space mean speed in ramp influence area,	$S_R = 52.1$	mph
Space mean speed in outer lanes,	$S_0 = 54.1$	mph
Space mean speed for all vehicles,	$S = 52.8$	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Existing**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	3808	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	756	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3808		756			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1058		210			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4231		840			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.616 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2927 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4231	6810	No
v_{12}	2927	4400	No
$v_{FO} = v_F - v_R$	3391	6810	No
v_R	840	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 24.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.504	
Space mean speed in ramp influence area,	S_R = 49.4	mph
Space mean speed in outer lanes,	S_0 = 61.3	mph
Space mean speed for all vehicles,	S = 52.6	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 1/5/2007
Analysis time period: PM Peak
Freeway/Dir of Travel: **H1 WB**
Junction: **F Weaver Rd & H1 Off Ramp**
Jurisdiction: Kapolei
Analysis Year: **Existing**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	7368	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1230	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	7368		1230			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2047		342			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	8187		1367			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.492 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4725 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8187	6810	Yes
v_{12}	4725	4400	Yes
$v_{FO} = v_F - v_R$	6820	6810	Yes
v_R	1367	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 40.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.551	
Space mean speed in ramp influence area,	S_R = 48.7	mph
Space mean speed in outer lanes,	S_0 = 52.9	mph
Space mean speed for all vehicles,	S = 50.4	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**PM Peak**
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Existing
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	6138	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2657	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6138		2657			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1705		738			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6820		2952			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4693 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6820	6810	Yes
v_{12}	4693	4400	Yes
$v_{FO} = v_F - v_R$	3868	6810	No
v_R	2952	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 31.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.694	
Space mean speed in ramp influence area,	S_R = 46.6	mph
Space mean speed in outer lanes,	S_0 = 58.1	mph
Space mean speed for all vehicles,	S = 49.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Existing**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	3481	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	598	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3481		598			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	967		166			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3868		664			pcph

Estimation of V12 Merge Areas

$L_{EQ} =$ (Equation 25-2 or 25-3)

$P_{FM} =$ 0.591 Using Equation 1

$v_{12} = v_F (P_{FM}) =$ 2288 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4532	6810	No
v_{R12}	2952	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A =$ 25.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.361	
Space mean speed in ramp influence area,	S_R = 51.6	mph
Space mean speed in outer lanes,	S_0 = 53.1	mph
Space mean speed for all vehicles,	S = 52.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Existing**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	57.0	mph
Volume on freeway	4077	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	497	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4077		497			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1133		138			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4530		552			pcph

Estimation of V12 Diverge Areas

$L_{EQ} =$ (Equation 25-8 or 25-9)

$P_{FD} =$ 0.621 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD} =$ 3024 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4530	6810	No
v_{12}	3024	4400	No
$v_{FO} = v_F - v_R$	3978	6810	No
v_R	552	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D =$ 25.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	$D_S = 0.478$	
Space mean speed in ramp influence area,	$S_R = 49.8$	mph
Space mean speed in outer lanes,	$S_0 = 60.6$	mph
Space mean speed for all vehicles,	$S = 53.0$	mph

APPENDIX C-2

YEAR 2030 CONDITIONS

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3537	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	280	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3537		280			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	983		78			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3930		311			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1889 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3930	9140	No
v_{12}	1889	4400	No
$v_{FO} = v_F - v_R$	3619	9140	No
v_R	311	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 16.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	D_S = 0.456	
Space mean speed in ramp influence area,	S_R = 51.0	mph
Space mean speed in outer lanes,	S_0 = 64.1	mph
Space mean speed for all vehicles,	S = 57.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/7/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H1 WB**
Junction:	F Weaver Rd & H1 Loop Off Ramp
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description: East Kapolei TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3567	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	235	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3567		235			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	991		65			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3963		261			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1224 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3963	9140	No
v_{12}	1224	4400	No
$v_{FO} = v_F - v_R$	3702	9140	No
v_R	261	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 1.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **A**

Speed Estimation

Intermediate speed variable,	D_S = 0.451	
Space mean speed in ramp influence area,	S_R = 51.1	mph
Space mean speed in outer lanes,	S_0 = 62.7	mph
Space mean speed for all vehicles,	S = 58.6	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3257	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	478	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3257		478			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	905		133			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3619		531			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.311 Using Equation 4

$v_{12} = v_F (P_{FM}) = 1124$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4150	9140	No
v_{R12}	1655	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A = 15.0$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	$M_S = 0.306$	
Space mean speed in ramp influence area,	$S_R = 53.4$	mph
Space mean speed in outer lanes,	$S_0 = 55.8$	mph
Space mean speed for all vehicles,	$S = 54.8$	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8197	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	639	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8197		639			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2277		178			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9108		710			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4372 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9108	9140	No
v_{12}	4372	4400	No
$v_{FO} = v_F - v_R$	8398	9140	No
v_R	710	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 37.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **E**

Speed Estimation

Intermediate speed variable,	D_S = 0.492	
Space mean speed in ramp influence area,	S_R = 50.4	mph
Space mean speed in outer lanes,	S_0 = 58.8	mph
Space mean speed for all vehicles,	S = 54.5	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/7/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	Fort Weaver Rd & H-1 On Ramp
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8333	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1667	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	751	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8333		1667		751	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2315		463		209	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	9259		1852		834	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1935 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	11111	9140	Yes
v_{R12}	3787	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 24.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	M_S = 0.388	
Space mean speed in ramp influence area,	S_R = 52.1	mph
Space mean speed in outer lanes,	S_0 = 43.8	mph
Space mean speed for all vehicles,	S = 46.3	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	7558	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	751	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1807	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	7558		751		1807	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2099		209		502	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	8398		834		2008	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.273 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2291 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9232	9140	Yes
v_{R12}	3125	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 26.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.375	
Space mean speed in ramp influence area,	S_R = 52.3	mph
Space mean speed in outer lanes,	S_0 = 47.5	mph
Space mean speed for all vehicles,	S = 49.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3735	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	927	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3735		927			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1038		258			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4150		1030			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2390 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4150	9140	No
v_{12}	2390	4400	No
$v_{FO} = v_F - v_R$	3120	9140	No
v_R	1030	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 20.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.521	
Space mean speed in ramp influence area,	S_R = 49.9	mph
Space mean speed in outer lanes,	S_0 = 64.2	mph
Space mean speed for all vehicles,	S = 55.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	2808	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	415	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2808		415			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	780		115			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3120		461			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.319 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 997 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3581	9140	No
v_{R12}	1458	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.303	
Space mean speed in ramp influence area,	S_R = 53.5	mph
Space mean speed in outer lanes,	S_0 = 56.5	mph
Space mean speed for all vehicles,	S = 55.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5681	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	298	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5681		298			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1578		83			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6312		331			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2939 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6312	9140	No
v_{12}	2939	4400	No
$v_{FO} = v_F - v_R$	5981	9140	No
v_R	331	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 25.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.458	
Space mean speed in ramp influence area,	S_R = 50.9	mph
Space mean speed in outer lanes,	S_0 = 61.5	mph
Space mean speed for all vehicles,	S = 56.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5383	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2814	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5383		2814			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1495		782			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5981		3127			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1250 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9108	9140	No
v_{R12}	4377	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 28.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	M_S = 0.526	
Space mean speed in ramp influence area,	S_R = 49.8	mph
Space mean speed in outer lanes,	S_0 = 51.6	mph
Space mean speed for all vehicles,	S = 50.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8777	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	303	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8777		303			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2438		84			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9752		337			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4442 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9752	9140	Yes
v_{12}	4442	4400	Yes
$v_{FO} = v_F - v_R$	9415	9140	Yes
v_R	337	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 38.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.458	
Space mean speed in ramp influence area,	S_R = 50.9	mph
Space mean speed in outer lanes,	S_0 = 57.7	mph
Space mean speed for all vehicles,	S = 54.4	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/7/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8519	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1126	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8519		1126			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2366		313			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9466		1251			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3387 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9466	9140	Yes
v_{12}	3387	4400	No
$v_{FO} = v_F - v_R$	8215	9140	No
v_R	1251	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 19.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.541	
Space mean speed in ramp influence area,	S_R = 49.6	mph
Space mean speed in outer lanes,	S_0 = 56.2	mph
Space mean speed for all vehicles,	S = 53.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	7348	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	512	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7348	512		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2041	142		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	8164	569		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.306 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2498 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8733	9140	No
v_{R12}	3067	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 26.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.370	
Space mean speed in ramp influence area,	S_R = 52.4	mph
Space mean speed in outer lanes,	S_0 = 48.8	mph
Space mean speed for all vehicles,	S = 50.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5833	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	873	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5833		873			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1620		243			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6481		970			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3373 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6481	9140	No
v_{12}	3373	4400	No
$v_{FO} = v_F - v_R$	5511	9140	No
v_R	970	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ = 28.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	D_S = 0.515	
Space mean speed in ramp influence area,	S_R = 50.0	mph
Space mean speed in outer lanes,	S_0 = 62.0	mph
Space mean speed for all vehicles,	S = 55.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 2/7/2007
Analysis time period: PM Peak
Freeway/Dir of Travel: **H-1 EB**
Junction: **Fort Weaver Rd and H-1 On Ramp**
Jurisdiction: Kapolei
Analysis Year: **Year 2030**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5881	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1423	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	843	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5881		1423		843	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1634		395		234	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	6534		1581		937	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1366 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8115	9140	No
v_{R12}	2947	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 18.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.290	
Space mean speed in ramp influence area,	S_R = 53.7	mph
Space mean speed in outer lanes,	S_0 = 50.3	mph
Space mean speed for all vehicles,	S = 51.5	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**PM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4960	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	843	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1313	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4960		843		1313	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1378		234		365	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	5511		937		1459	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.260 Using Equation 4

$v_{12} = v_F (P_{FM}) = 1433$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6448	9140	No
v_{R12}	2370	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A = 20.4$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	$M_S = 0.328$	
Space mean speed in ramp influence area,	$S_R = 53.1$	mph
Space mean speed in outer lanes,	$S_0 = 53.0$	mph
Space mean speed for all vehicles,	$S = 53.0$	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**PM Peak**
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	Year 2030
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	7860	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1602	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	7860		1602			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2183		445			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	8733		1780			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD} = 4812$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8733	9140	No
v_{12}	4812	4400	Yes
$v_{FO} = v_F - v_R$	6953	9140	No
v_R	1780	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D = 41.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	$D_S = 0.588$	
Space mean speed in ramp influence area,	$S_R = 48.8$	mph
Space mean speed in outer lanes,	$S_0 = 60.4$	mph
Space mean speed for all vehicles,	$S = 53.4$	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	7860	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7860	230		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2183	64		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	8733	256		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.345 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 3014 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8989	9140	No
v_{R12}	3270	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 27.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.389	
Space mean speed in ramp influence area,	S_R = 52.1	mph
Space mean speed in outer lanes,	S_0 = 48.6	mph
Space mean speed for all vehicles,	S = 49.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**Year 2030**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4589	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	396	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4589		396			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1275		110			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5099		440			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2471 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5099	9140	No
v_{12}	2471	4400	No
$v_{FO} = v_F - v_R$	4659	9140	No
v_R	440	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 21.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable, D_S = 0.468

Space mean speed in ramp influence area, S_R = 50.8 mph

Space mean speed in outer lanes, S_0 = 62.9 mph

Space mean speed for all vehicles, S = 56.4 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 1/5/2007
Analysis time period: PM Peak
Freeway/Dir of Travel: **H-1 EB**
Junction: **North-South Rd and H-1 On Ramp**
Jurisdiction: Kapolei
Analysis Year: **Year 2030**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4193	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1640	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4193	1640		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1165	456		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4659	1822		pcph

Estimation of V12 Merge Areas

$L_{EQ} =$ (Equation 25-2 or 25-3)

$P_{FM} =$ 0.209 Using Equation 0

$v_{12} = v_F (P_{FM}) =$ 974 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6481	9140	No
v_{R12}	2796	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A =$ 17.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.280	
Space mean speed in ramp influence area,	S_R = 53.9	mph
Space mean speed in outer lanes,	S_0 = 53.7	mph
Space mean speed for all vehicles,	S = 53.8	mph

APPENDIX C-3

YEAR 2030 PLUS PROJECT CONDITIONS

SCENARIO A: WITH TRANSIT CORRIDOR SCENARIO

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5299	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	280	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5299		280			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1472		78			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5888		311			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2743 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5888	9140	No
v_{12}	2743	4400	No
$v_{FO} = v_F - v_R$	5577	9140	No
v_R	311	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 23.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.456	
Space mean speed in ramp influence area,	S_R = 51.0	mph
Space mean speed in outer lanes,	S_0 = 61.9	mph
Space mean speed for all vehicles,	S = 56.3	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4984	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1078	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4984		1078			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1384		299			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5538		1198			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2326 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5538	9140	No
v_{12}	2326	4400	No
$v_{FO} = v_F - v_R$	4340	9140	No
v_R	1198	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 10.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	D_S = 0.536	
Space mean speed in ramp influence area,	S_R = 49.7	mph
Space mean speed in outer lanes,	S_0 = 61.8	mph
Space mean speed for all vehicles,	S = 56.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3906	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	585	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3906		585			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1085		163			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4340		650			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.296 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1284 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4990	9140	No
v_{R12}	1934	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.313	
Space mean speed in ramp influence area,	S_R = 53.3	mph
Space mean speed in outer lanes,	S_0 = 54.8	mph
Space mean speed for all vehicles,	S = 54.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	9143	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	812	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	9143		812			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2540		226			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	10159		902			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4938 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10159	9140	Yes
v_{12}	4938	4400	Yes
$v_{FO} = v_F - v_R$	9257	9140	Yes
v_R	902	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 42.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.509	
Space mean speed in ramp influence area,	S_R = 50.1	mph
Space mean speed in outer lanes,	S_0 = 57.9	mph
Space mean speed for all vehicles,	S = 53.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**Fort Weaver Rd & H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	9082	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2893	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	751	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	9082		2893		751	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2523		804		209	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	10091		3214		834	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2109 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	13305	9140	Yes
v_{R12}	5323	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 36.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 1.015	
Space mean speed in ramp influence area,	S_R = 41.7	mph
Space mean speed in outer lanes,	S_0 = 41.8	mph
Space mean speed for all vehicles,	S = 41.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	2030 + Project w Transit Red
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8331	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	751	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3030	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8331		751		3030	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2314		209		842	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	9257		834		3367	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.273 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2526 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10091	9140	Yes
v_{R12}	3360	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.398	
Space mean speed in ramp influence area,	S_R = 51.9	mph
Space mean speed in outer lanes,	S_0 = 45.6	mph
Space mean speed for all vehicles,	S = 47.5	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4491	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1628	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4491		1628			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1248		452			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4990		1809			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3196 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4990	9140	No
v_{12}	3196	4400	No
$v_{FO} = v_F - v_R$	3181	9140	No
v_R	1809	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 27.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable, D_S = 0.591

Space mean speed in ramp influence area, S_R = 48.8 mph

Space mean speed in outer lanes, S_0 = 64.2 mph

Space mean speed for all vehicles, S = 53.4 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	2863	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	967	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2863	967		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	795	269		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3181	1074		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.243 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 772 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4255	9140	No
v_{R12}	1846	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 16.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.311	
Space mean speed in ramp influence area,	S_R = 53.4	mph
Space mean speed in outer lanes,	S_0 = 56.0	mph
Space mean speed for all vehicles,	S = 54.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 1/5/2007
Analysis time period: AM Peak
Freeway/Dir of Travel: **H1 EB**
Junction: **North South Rd & H1 Off Ramp**
Jurisdiction: Kapolei
Analysis Year: **2030 + Pro with Transit Red.**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6081	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	762	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6081		762			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1689		212			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6757		847			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3424 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6757	9140	No
v_{12}	3424	4400	No
$v_{FO} = v_F - v_R$	5910	9140	No
v_R	847	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 29.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	D_S = 0.504	
Space mean speed in ramp influence area,	S_R = 50.2	mph
Space mean speed in outer lanes,	S_0 = 61.6	mph
Space mean speed for all vehicles,	S = 55.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5319	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	3824	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5319		3824			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1478		1062			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5910		4249			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1235 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10159	9140	Yes
v_{R12}	5484	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 36.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 1.155	
Space mean speed in ramp influence area,	S_R = 39.4	mph
Space mean speed in outer lanes,	S_0 = 51.7	mph
Space mean speed for all vehicles,	S = 44.3	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	10977	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	303	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	10977		303			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	3049		84			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	12197		337			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5508 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12197	9140	Yes
v_{12}	5508	4400	Yes
$v_{FO} = v_F - v_R$	11860	9140	Yes
v_R	337	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 47.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.458	
Space mean speed in ramp influence area,	S_R = 50.9	mph
Space mean speed in outer lanes,	S_0 = 55.0	mph
Space mean speed for all vehicles,	S = 53.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	10544	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2354	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	10544		2354			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2929		654			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	11716		2616			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4982 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11716	9140	Yes
v_{12}	4982	4400	Yes
$v_{FO} = v_F - v_R$	9100	9140	No
v_R	2616	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 33.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable, D_S = 0.663

Space mean speed in ramp influence area, S_R = 47.6 mph

Space mean speed in outer lanes, S_0 = 54.9 mph

Space mean speed for all vehicles, S = 51.5 mph

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Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8190	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	685	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8190	685		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2275	190		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	9100	761		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.282 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2566 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9861	9140	Yes
v_{R12}	3327	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 27.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.395	
Space mean speed in ramp influence area,	S_R = 52.0	mph
Space mean speed in outer lanes,	S_0 = 46.2	mph
Space mean speed for all vehicles,	S = 48.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6891	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1121	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6891		1121			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1914		311			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	7657		1246			pcph

Estimation of V12 Diverge Areas

$L_{EQ} =$ (Equation 25-8 or 25-9)

$P_{FD} =$ 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD} =$ 4041 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7657	9140	No
v_{12}	4041	4400	No
$v_{FO} = v_F - v_R$	6411	9140	No
v_R	1246	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D =$ 34.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	D_S = 0.540	
Space mean speed in ramp influence area,	S_R = 49.6	mph
Space mean speed in outer lanes,	S_0 = 61.0	mph
Space mean speed for all vehicles,	S = 54.4	mph

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                    HCS+: Ramps and Ramp Junctions Release 5.2

_________________________________Merge Analysis_______________________________

Analyst:                  MM
Agency/Co.:               Wilbur Smith Associates
Date performed:           2/8/2007
Analysis time period:     PM Peak
Freeway/Dir of Travel:    H-1 EB
Junction:                 Fort Weaver Rd and H-1 On Ramp
Jurisdiction:             Kapolei
Analysis Year:            2030 + Project w Transit Red
Description:  East Kapolei TIAR

__________________________________Freeway Data________________________________

Type of analysis                            Merge
Number of lanes in freeway                  4
Free-flow speed on freeway                  58.5           mph
Volume on freeway                           6613           vph

__________________________________On Ramp Data________________________________

Side of freeway                             Right
Number of lanes in ramp                     2
Free-flow speed on ramp                     35.0           mph
Volume on ramp                              2615           vph
Length of first accel/decel lane            500            ft
Length of second accel/decel lane           500            ft

_________________________Adjacent Ramp Data (if one exists)____________________

Does adjacent ramp exist?                   Yes
Volume on adjacent Ramp                     843            vph
Position of adjacent Ramp                   Downstream
Type of adjacent Ramp                       On
Distance to adjacent Ramp                   500            ft

____________________Conversion to pc/h Under Base Conditions___________________

Junction Components                    Freeway     Ramp        Adjacent
                                                               Ramp
Volume, V (vph)                        6613        2615        843        vph
Peak-hour factor, PHF                  0.90        0.90        0.90
Peak 15-min volume, v15                1837        726         234        v
Trucks and buses                       0           0           0          %
Recreational vehicles                  0           0           0          %
Terrain type:                          Level       Level       Level
     Grade                                     %           %           %
     Length                                    mi          mi          mi
Trucks and buses PCE, ET               1.5         1.5         1.5
Recreational vehicle PCE, ER           1.2         1.2         1.2
Heavy vehicle adjustment, fHV          1.000       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          7348        2906        937        pcph

_________________________Estimation of V12 Merge Areas________________________

                 L   =              (Equation 25-2 or 25-3)
                  EQ
                 P   =     0.209   Using Equation  0
                  FM
                 v   = v   (P   ) =  1536   pc/h
                  12    F    FM

______________________________Capacity Checks_________________________________

                              Actual        Maximum        LOS F?
      v                       10254         9140           Yes
       FO
      v                       4442          4600           No
       R12

_________________Level of Service Determination (if not F)___________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   29.4   pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation_________________________________

Intermediate speed variable,                 M  = 0.547
                                              S
Space mean speed in ramp influence area,     S  = 49.5     mph
                                              R
Space mean speed in outer lanes,             S  = 48.3     mph
                                              0
Space mean speed for all vehicles,           S  = 48.8     mph
______________________________________________________________________________
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HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**PM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	2030 + Project w Transit Red
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5770	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	843	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2502	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5770	843	2502	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1603	234	695	v
Trucks and buses	0	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	1.000	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6411	937	2780	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.260 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1667 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7348	9140	No
v_{R12}	2604	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.339	
Space mean speed in ramp influence area,	S_R = 52.9	mph
Space mean speed in outer lanes,	S_0 = 51.5	mph
Space mean speed for all vehicles,	S = 52.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8875	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2511	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8875		2511			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2465		698			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9861		2790			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5873 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9861	9140	Yes
v_{12}	5873	4400	Yes
$v_{FO} = v_F - v_R$	7071	9140	No
v_R	2790	2000	Yes

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 50.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.679	
Space mean speed in ramp influence area,	S_R = 47.3	mph
Space mean speed in outer lanes,	S_0 = 60.3	mph
Space mean speed for all vehicles,	S = 51.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6364	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	957	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6364		957			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1768		266			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	7071		1063			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.244 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1727 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8134	9140	No
v_{R12}	2790	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 23.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.349	
Space mean speed in ramp influence area,	S_R = 52.7	mph
Space mean speed in outer lanes,	S_0 = 49.7	mph
Space mean speed for all vehicles,	S = 50.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5405	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1060	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5405		1060			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1501		294			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6006		1178			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3283 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6006	9140	No
v_{12}	3283	4400	No
$v_{FO} = v_F - v_R$	4828	9140	No
v_R	1178	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 28.0- pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.534	
Space mean speed in ramp influence area,	S_R = 49.7	mph
Space mean speed in outer lanes,	S_0 = 62.8	mph
Space mean speed for all vehicles,	S = 54.9	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Pro with Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4345	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2546	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4345		2546			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1207		707			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4828		2829			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1009 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7657	9140	No
v_{R12}	3838	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 24.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.397	
Space mean speed in ramp influence area,	S_R = 51.9	mph
Space mean speed in outer lanes,	S_0 = 53.4	mph
Space mean speed for all vehicles,	S = 52.7	mph

APPENDIX C-4

YEAR 2030 PLUS PROJECT CONDITIONS
SCENARIO B: WITHOUT TRANSIT CORRIDOR SCENARIO

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 1/5/2007
Analysis time period: AM Peak
Freeway/Dir of Travel: **H1 WB**
Junction: **F Weaver Rd & H1 Off Ramp**
Jurisdiction: Kapolei
Analysis Year: **2030 + Project w/o Transit Red**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5415	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	280	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5415		280			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1504		78			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6017		311			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2799 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6017	9140	No
v_{12}	2799	4400	No
$v_{FO} = v_F - v_R$	5706	9140	No
v_R	311	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 23.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.456	
Space mean speed in ramp influence area,	S_R = 51.0	mph
Space mean speed in outer lanes,	S_0 = 61.8	mph
Space mean speed for all vehicles,	S = 56.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5109	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1153	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5109		1153			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1419		320			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5677		1281			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2424 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5677	9140	No
v_{12}	2424	4400	No
$v_{FO} = v_F - v_R$	4396	9140	No
v_R	1281	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 11.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable, D_S = 0.543

Space mean speed in ramp influence area, S_R = 49.5 mph

Space mean speed in outer lanes, S_0 = 61.7 mph

Space mean speed for all vehicles, S = 55.9 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst: MM
Agency/Co.: Wilbur Smith Associates
Date performed: 1/5/2007
Analysis time period: AM Peak
Freeway/Dir of Travel: **H-1 WB**
Junction: **Fort Weaver Rd and H-1 On Ramp**
Jurisdiction: Kapolei
Analysis Year: **2030 + Project w/o Transit Red**
Description: East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	3956	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	593	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3956	593		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1099	165		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4396	659		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.295 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1296 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5055	9140	No
v_{R12}	1955	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 17.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.314	
Space mean speed in ramp influence area,	S_R = 53.3	mph
Space mean speed in outer lanes,	S_0 = 54.7	mph
Space mean speed for all vehicles,	S = 54.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	9217	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	826	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	9217		826			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2560		229			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	10241		918			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4983 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10241	9140	Yes
v_{12}	4983	4400	Yes
$v_{FO} = v_F - v_R$	9323	9140	Yes
v_R	918	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 42.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.511	
Space mean speed in ramp influence area,	S_R = 50.1	mph
Space mean speed in outer lanes,	S_0 = 57.8	mph
Space mean speed for all vehicles,	S = 53.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**Fort Weaver Rd & H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	9142	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2999	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	751	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	9142		2999		751	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2539		833		209	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	10158		3332		834	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2123 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	13490	9140	Yes
v_{R12}	5455	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 37.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 1.128	
Space mean speed in ramp influence area,	S_R = 39.9	mph
Space mean speed in outer lanes,	S_0 = 41.7	mph
Space mean speed for all vehicles,	S = 40.9	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**AM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	2030 + Project w/o Transit Red
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8391	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	751	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3126	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8391		751		3126	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	2331		209		868	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	9323		834		3473	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.273 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2544 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10157	9140	Yes
v_{R12}	3378	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 28.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.400	
Space mean speed in ramp influence area,	S_R = 51.9	mph
Space mean speed in outer lanes,	S_0 = 45.4	mph
Space mean speed for all vehicles,	S = 47.4	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4549	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1682	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4549		1682			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1264		467			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	5054		1869			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3258 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5054	9140	No
v_{12}	3258	4400	No
$v_{FO} = v_F - v_R$	3185	9140	No
v_R	1869	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 27.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	D_S = 0.596	
Space mean speed in ramp influence area,	S_R = 48.7	mph
Space mean speed in outer lanes,	S_0 = 64.2	mph
Space mean speed for all vehicles,	S = 53.2	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	2867	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1010	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2867		1010			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	796		281			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	3186		1122			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.237 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 755 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4308	9140	No
v_{R12}	1877	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 16.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **B**

Speed Estimation

Intermediate speed variable,	M_S = 0.311	
Space mean speed in ramp influence area,	S_R = 53.4	mph
Space mean speed in outer lanes,	S_0 = 55.9	mph
Space mean speed for all vehicles,	S = 54.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6309	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	798	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6309		798			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1753		222			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	7010		887			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3557 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7010	9140	No
v_{12}	3557	4400	No
$v_{FO} = v_F - v_R$	6123	9140	No
v_R	887	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 30.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable, D_S = 0.508

Space mean speed in ramp influence area, S_R = 50.1 mph

Space mean speed in outer lanes, S_0 = 61.3 mph

Space mean speed for all vehicles, S = 55.1 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	AM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5511	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	3706	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5511	3706		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1531	1029		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	6123	4118		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1280 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10241	9140	Yes
v_{R12}	5398	4600	Yes

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 36.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 1.078	
Space mean speed in ramp influence area,	S_R = 40.7	mph
Space mean speed in outer lanes,	S_0 = 51.2	mph
Space mean speed for all vehicles,	S = 45.1	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	11163	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	303	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	11163		303			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	3101		84			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	12403		337			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5598 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12403	9140	Yes
v_{12}	5598	4400	Yes
$v_{FO} = v_F - v_R$	12066	9140	Yes
v_R	337	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 47.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.458	
Space mean speed in ramp influence area,	S_R = 50.9	mph
Space mean speed in outer lanes,	S_0 = 54.8	mph
Space mean speed for all vehicles,	S = 53.0	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**F Weaver Rd & H1 Loop Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	10757	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2495	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	10757		2495			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2988		693			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	11952		2772			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5159 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11952	9140	Yes
v_{12}	5159	4400	Yes
$v_{FO} = v_F - v_R$	9180	9140	Yes
v_R	2772	3800	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 35.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.677	
Space mean speed in ramp influence area,	S_R = 47.3	mph
Space mean speed in outer lanes,	S_0 = 54.8	mph
Space mean speed for all vehicles,	S = 51.3	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8262	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	702	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8262		702			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2295		195			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9180		780			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.280 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2567 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	9960	9140	Yes
v_{R12}	3347	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.397	
Space mean speed in ramp influence area,	S_R = 52.0	mph
Space mean speed in outer lanes,	S_0 = 45.9	mph
Space mean speed for all vehicles,	S = 47.8	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**F Weaver Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6985	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1146	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6985		1146			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1940		318			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	7761		1273			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4102 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7761	9140	No
v_{12}	4102	4400	No
$v_{FO} = v_F - v_R$	6488	9140	No
v_R	1273	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 35.0+ pc/mi/ln

Level of service for ramp-freeway junction areas of influence **E**

Speed Estimation

Intermediate speed variable, D_S = 0.543

Space mean speed in ramp influence area, S_R = 49.5 mph

Space mean speed in outer lanes, S_0 = 60.9 mph

Space mean speed for all vehicles, S = 54.3 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	2/8/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**Fort Weaver Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030 + Project w/o Transit Red**
Description: East Kapolei TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6682	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2743	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	843	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6682		2743		843	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1856		762		234	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	7424		3048		937	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1552 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10472	9140	Yes
v_{R12}	4600	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 30.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	M_S = 0.604	
Space mean speed in ramp influence area,	S_R = 48.5	mph
Space mean speed in outer lanes,	S_0 = 48.2	mph
Space mean speed for all vehicles,	S = 48.3	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	**PM Peak**
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**F Weaver Rd & H-1 Loop On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	2030 + Project w/o Transit Red

Description: East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5839	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	843	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2601	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5839		843		2601	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1622		234		723	v
Trucks and buses	0		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	
Heavy vehicle adjustment, fHV	1.000		1.000		1.000	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	6488		937		2890	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.260 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1687 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7425	9140	No
v_{R12}	2624	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.340	
Space mean speed in ramp influence area,	S_R = 52.9	mph
Space mean speed in outer lanes,	S_0 = 51.4	mph
Space mean speed for all vehicles,	S = 51.9	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 WB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	8964	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2588	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8964		2588			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2490		719			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	9960		2876			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5965 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9960	9140	Yes
v_{12}	5965	4400	Yes
$v_{FO} = v_F - v_R$	7084	9140	No
v_R	2876	2000	Yes

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 51.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **F**

Speed Estimation

Intermediate speed variable,	D_S = 0.687	
Space mean speed in ramp influence area,	S_R = 47.2	mph
Space mean speed in outer lanes,	S_0 = 60.3	mph
Space mean speed for all vehicles,	S = 51.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 WB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	6376	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1020	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6376		1020			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1771		283			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%	%	
Length		mi		mi	mi	
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	7084		1133			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.235 Using Equation 4

$v_{12} = v_F \, (P_{FM})$ = 1668 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8217	9140	No
v_{R12}	2801	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 23.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.350	
Space mean speed in ramp influence area,	S_R = 52.7	mph
Space mean speed in outer lanes,	S_0 = 49.5	mph
Space mean speed for all vehicles,	S = 50.6	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Diverge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H1 EB**
Junction:	**North South Rd & H1 Off Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	5478	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1116	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	5478		1116			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1522		310			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	6087		1240			pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3353 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6087	9140	No
v_{12}	3353	4400	No
$v_{FO} = v_F - v_R$	4847	9140	No
v_R	1240	2000	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 28.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **D**

Speed Estimation

Intermediate speed variable,	D_S = 0.540	
Space mean speed in ramp influence area,	S_R = 49.6	mph
Space mean speed in outer lanes,	S_0 = 62.7	mph
Space mean speed for all vehicles,	S = 54.7	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Merge Analysis

Analyst:	MM
Agency/Co.:	Wilbur Smith Associates
Date performed:	1/5/2007
Analysis time period:	PM Peak
Freeway/Dir of Travel:	**H-1 EB**
Junction:	**North-South Rd and H-1 On Ramp**
Jurisdiction:	Kapolei
Analysis Year:	**2030+ Pro without Transit Red.**
Description:	East Kapolei TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	58.5	mph
Volume on freeway	4362	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2623	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4362		2623			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1212		729			v
Trucks and buses	0		0			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			
Heavy vehicle adjustment, fHV	1.000		1.000			
Driver population factor, fP	1.00		1.00			
Flow rate, vp	4847		2914			pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1013 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	7761	9140	No
v_{R12}	3927	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 25.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence **C**

Speed Estimation

Intermediate speed variable,	M_S = 0.414	
Space mean speed in ramp influence area,	S_R = 51.7	mph
Space mean speed in outer lanes,	S_0 = 53.4	mph
Space mean speed for all vehicles,	S = 52.5	mph

APPENDIX D

SIGNAL WARRANT ANALYSIS

APPENDIX D-1

YEAR 2030 CONDITIONS

Year 2030 Conditions

#2

Figure 4C-101. Traffic Signal Warrants Worksheet (Sheet 1 of 4)

DIST ___ CO Honolulu RTE ___ KPM ___ CALC: TSO DATE 2/12/07 CHK ___ DATE ___

Major St: Kunia Rd. Critical Approach Speed 40 ~~km/h~~ mph

Minor St: H1 WB Ramps Critical Approach Speed ___ km/h

Critical speed of major street traffic > 64 km/h (40 mph) ☐ or In built up area of isolated community of < 10,000 population ☐ } RURAL (R)

☒ URBAN (U)

WARRANT 3 - Peak Hour — PART A or PART B SATISFIED YES ☒ NO ☐

PART A
(All parts 1, 2, and 3 below must be satisfied) SATISFIED YES ☐ NO ☐

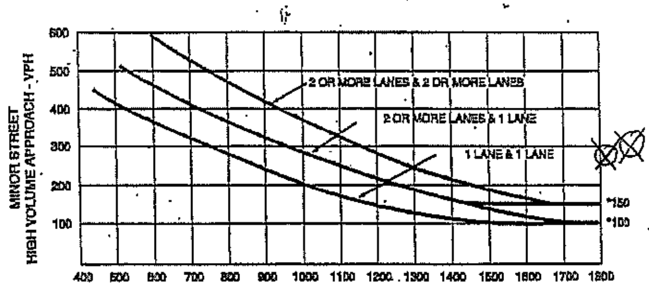
1. The total delay experienced for traffic on one minor street approach controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach; AND — Yes ☐ No ☐
2. The volume on the same minor street approach equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND — Yes ☐ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches. — Yes ☐ No ☐

PART B SATISFIED YES ☒ NO ☐

APPROACH LANES	One	2 or More	AM	PM		Hour
Both Approaches - Major Street		X	3101	4580		
Highest Approaches - Minor Street	X		280	303		

The plotted points for vehicles per hour on major streets (both approaches) and the corresponding per hour higher volume vehicle minor street approach (one direction only) for one hour (any consecutive 15 minute period) fall above the applicable curves in MUTCD Figure 4C-3 or 4C-4.

Figure 4C-3. Warrant 3, Peak Hour



MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Year 2030 Conditions

#10

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Figure 4C-101. Traffic Signal Warrants Worksheet (Sheet 1 of 4)

DIST ___ CO Honolulu RTE ___ KPM ___ CALC: TSO DATE 2/12/07 CHK ___ DATE ___

Major St: Farrington Hwy Critical Approach Speed ___ km/h

Minor St: East Old Fort Weaver Rd. Critical Approach Speed ___ km/h

Critical speed of major street traffic > 64 km/h (40 mph) ☐ or In built up area of isolated community of < 10,000 population ☐ } RURAL (R)

☒ URBAN (U)

WARRANT 3 - Peak Hour — PART A or PART B SATISFIED YES ☒ NO ☐

PART A
(All parts 1, 2, and 3 below must be satisfied) SATISFIED YES ☐ NO ☐

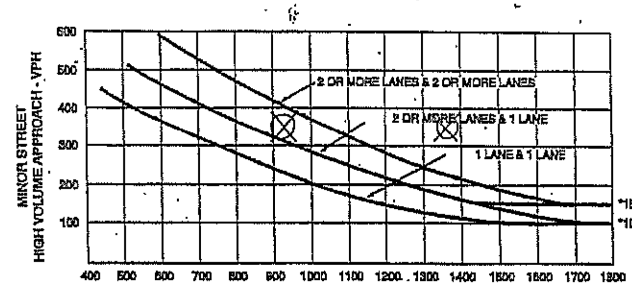
1. The total delay experienced for traffic on one minor street approach controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach; AND — Yes ☐ No ☐
2. The volume on the same minor street approach equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND — Yes ☐ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches. — Yes ☐ No ☐

PART B SATISFIED YES ☒ NO ☐

APPROACH LANES	One	2 or More	AM	PM		Hour
Both Approaches - Major Street		X	928	1358		
Highest Approaches - Minor Street	X		347	354		

The plotted points for vehicles per hour on major streets (both approaches) and the corresponding per hour higher volume vehicle minor street approach (one direction only) for one hour (any consecutive 15 minute period) fall above the applicable curves in MUTCD Figure 4C-3 or 4C-4.

Figure 4C-3. Warrant 3, Peak Hour



MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Year 2030 Conditions

#11

Figure 4C-101. Traffic Signal Warrants Worksheet (Sheet 1 of 4)

Honolulu DIST CO RTE KPM   CALC: TSO DATE 2/12/07   CHK ____ DATE ____

Major St: Farrington Hwy   Critical Approach Speed 40 ~~km/h~~ mph
Minor St: West Old Fort Weaver Rd.   Critical Approach Speed ____ km/h

Critical speed of major street traffic > 64 km/h (40 mph) ☐ or
In built up area of isolated community of < 10,000 population ☐ } RURAL (R)
☒ URBAN (U)

WARRANT 3 - Peak Hour   PART A or PART B SATISFIED   YES ☒ NO ☐

PART A
(All parts 1, 2, and 3 below must be satisfied)   SATISFIED YES ☐ NO ☐

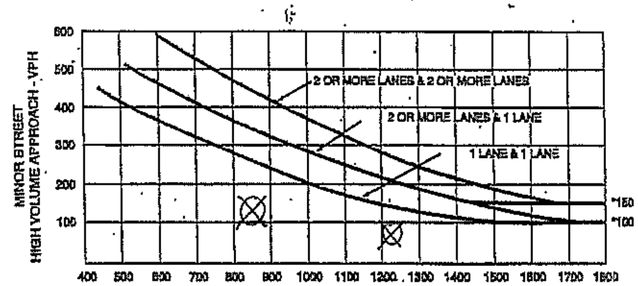
1. The total delay experienced for traffic on one minor street approach controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach; AND   Yes ☐ No ☐
2. The volume on the same minor street approach equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND   Yes ☐ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.   Yes ☐ No ☐

PART B   SATISFIED YES ☒ NO ☐

APPROACH LANES	One	2 or More	AM	PM		Hour
Both Approaches - Major Street		X	854	1221		
Highest Approaches - Minor Street	X		120	80		

The plotted points for vehicles per hour on major streets (both approaches) and the corresponding per hour higher volume vehicle minor street approach (one direction only) for one hour (any consecutive 15 minute period) fall above the applicable curves in MUTCD Figure 4C-3 or 4C-4.

Figure 4C-3. Warrant 3, Peak Hour



MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

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Year 2030 Conditions

#19

Figure 4C-101. Traffic Signal Warrants Worksheet (Sheet 1 of 4)

Honolulu DIST CO RTE KPM   CALC: TSO DATE 2/12/07   CHK ____ DATE ____

Major St: East-West Rd.   Critical Approach Speed 40 ~~km/h~~ mph
Minor St: Old Fort Weaver Rd.   Critical Approach Speed ____ km/h

Critical speed of major street traffic > 64 km/h (40 mph) ☐ or
In built up area of isolated community of < 10,000 population ☐ } RURAL (R)
☒ URBAN (U)

WARRANT 3 - Peak Hour   PART A or PART B SATISFIED   YES ☒ NO ☐

PART A
(All parts 1, 2, and 3 below must be satisfied)   SATISFIED YES ☐ NO ☐

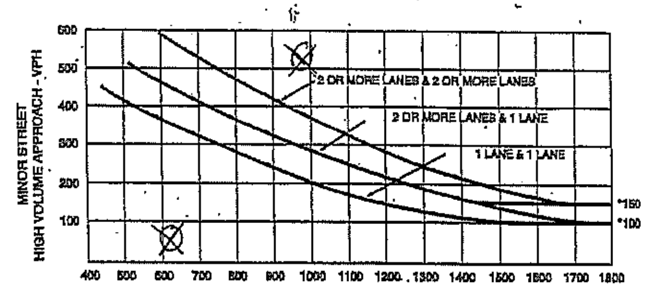
1. The total delay experienced for traffic on one minor street approach controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach; AND   Yes ☐ No ☐
2. The volume on the same minor street approach equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND   Yes ☐ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.   Yes ☐ No ☐

PART B   SATISFIED YES ☒ NO ☐

APPROACH LANES	One	2 or More	AM	PM		Hour
Both Approaches - Major Street		X	611	973		
Highest Approaches - Minor Street		X	42	518		

The plotted points for vehicles per hour on major streets (both approaches) and the corresponding per hour higher volume vehicle minor street approach (one direction only) for one hour (any consecutive 15 minute period) fall above the applicable curves in MUTCD Figure 4C-3 or 4C-4.

Figure 4C-3. Warrant 3, Peak Hour



MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

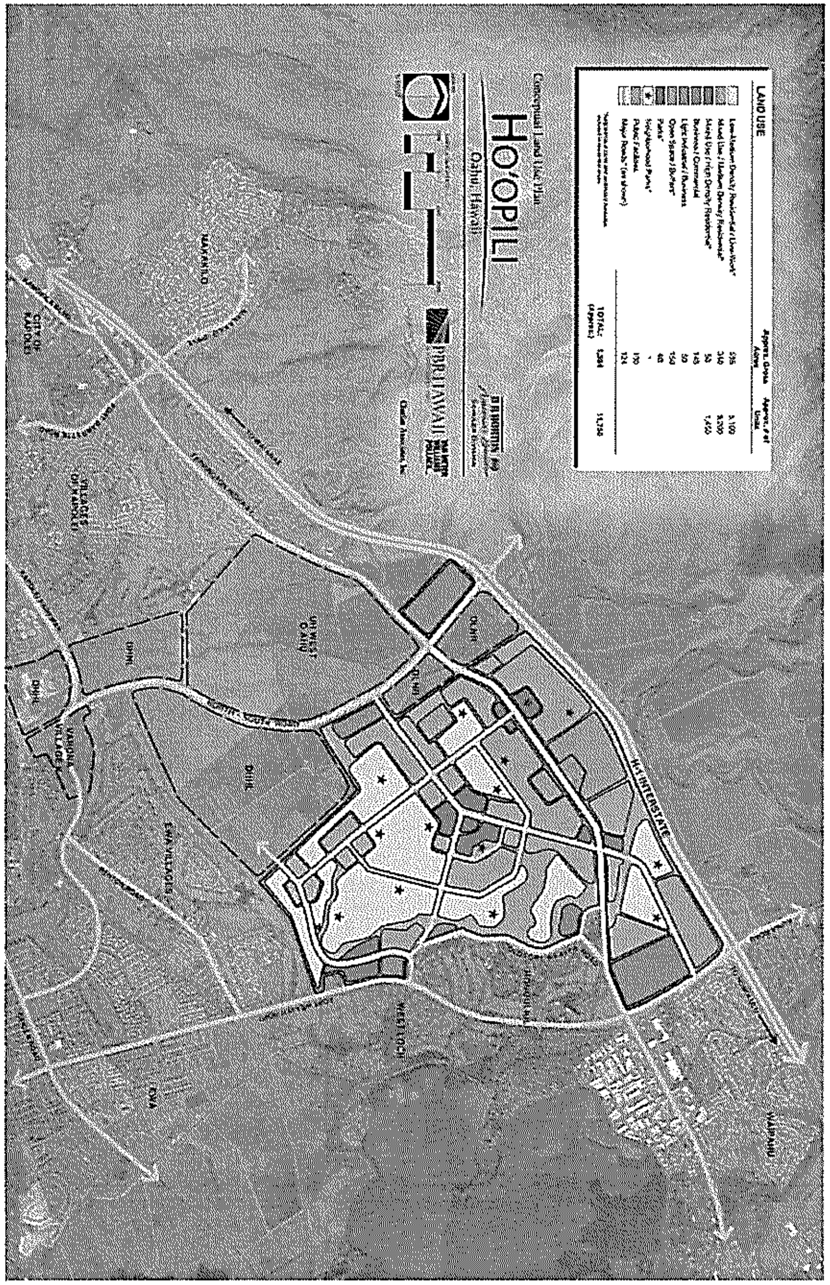
APPENDIX E

HO'OPILI CONCEPTUAL LANDUSE PLAN

APPENDIX E-1

HO'OPILI LAND USE PLAN

OMPO MODEL LAND USE ASSUMPTIONS



IgEOIMPO TiMH
dLdUeMH

The following presents the most recent land use assumptions incorporated in the OMPO model. These same assumptions were used in calculating the travel demand for the proposed Project.

2000 Land Use Model Inputs to the Travel Model

Table 1. Estimated 1994 Base-Year Households

District		Total Households in 1994 Base Year			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	6,153	6,281	128	2.1%
2	Kakaako	2,853	2,361	(492)	-17.3%
3	Makiki	16,190	15,649	(541)	-3.3%
4	McCully	15,021	15,107	86	0.6%
5	Waikiki	11,663	11,332	(331)	-2.8%
6	Diamond Hd	8,813	9,020	207	2.3%
7	Kaimuki	9,410	9,411	1	0.0%
8	Manoa	5,756	5,894	138	2.4%
9	Nuuanu	10,893	11,330	437	4.0%
10	Kalihi	8,876	8,705	(171)	-1.9%
11	Iwilei	5,163	5,389	226	4.4%
12	Airport PH	5,422	5,850	428	7.9%
13	Salt Lake	13,865	13,370	(495)	-3.6%
14	PC Aiea	22,019	21,959	(60)	-0.3%
15	Waipahu	16,220	15,921	(299)	-1.8%
16	Mililani	23,466	19,597	(3,869)	-16.5%
17	Ewa	17,532	17,541	9	0.0%
18	Waianae	9,787	9,787	(0)	0.0%
19	NorthShore	5,465	5,489	24	0.4%
20	Koolauloa	3,414	3,414	(0)	0.0%
21	Kaneohe	17,886	17,860	(26)	-0.1%
22	Kailua	14,980	14,994	14	0.1%
23	E Honolulu	14,786	14,758	(28)	-0.2%
	Total	265,636	261,019	(4,617)	-1.7%

Table 2. Estimated 2000 Households

District		Total Households				2000-1994 Gain (Loss)	
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim
1	Downtown	6,635	6,631	(4)	-0.1%	482	350
2	Kakaako	3,077	3,096	19	0.6%	224	735
3	Makiki	17,459	17,394	(65)	-0.4%	1,269	1,745
4	McCully	16,198	16,550	352	2.2%	1,177	1,443
5	Waikiki	12,577	12,059	(518)	-4.1%	914	727
6	Diamond Hd	9,504	9,988	484	5.1%	691	968
7	Kaimuki	10,147	10,970	823	8.1%	737	1,559
8	Manoa	6,207	6,202	(5)	-0.1%	451	308
9	Nuuanu	11,746	12,505	759	6.5%	853	1,175
10	Kalihi	9,572	9,888	316	3.3%	696	1,183
11	Iwilei	5,568	5,850	282	5.1%	405	461
12	Airport PH	5,847	6,211	364	6.2%	425	361
13	Salt Lake	14,951	14,673	(278)	-1.9%	1,086	1,303
14	PC Aiea	23,744	24,502	758	3.2%	1,725	2,543
15	Waipahu	17,491	19,167	1,676	9.6%	1,271	3,246
16	Mililani	25,305	25,000	(305)	-1.2%	1,839	5,403
17	Ewa	18,906	20,117	1,211	6.4%	1,374	2,576
18	Waianae	10,554	9,543	(1,011)	-9.6%	767	(244)
19	NorthShore	5,893	5,033	(860)	-14.6%	428	(456)
20	Koolauloa	3,682	2,651	(1,031)	-28.0%	268	(763)
21	Kaneohe	19,288	18,375	(913)	-4.7%	1,402	515
22	Kailua	16,154	14,678	(1,476)	-9.1%	1,174	(316)
23	E Honolulu	15,945	15,366	(579)	-3.6%	1,159	608
	Total	286,450	286,449	(1)	0.0%	20,814	25,430

Table 3. Estimated 2000 Housing Units

District		Housing Units				% Vacancy	
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim
1	Downtown	7,121	6,655	(466)	-6.5%	6.8%	0.4%
2	Kakaako	3,970	2,989	(981)	-24.7%	22.5%	-3.6%
3	Makiki	19,044	17,478	(1,566)	-8.2%	8.3%	0.5%
4	McCully	18,242	16,794	(1,448)	-7.9%	11.2%	1.5%
5	Waikiki	20,075	12,225	(7,850)	-39.1%	37.3%	1.4%
6	Diamond Hd	10,296	10,632	336	3.3%	7.7%	6.1%
7	Kaimuki	10,627	11,342	715	6.7%	4.5%	3.3%
8	Manoa	6,513	6,868	355	5.5%	4.7%	9.7%
9	Nuuanu	12,471	12,871	400	3.2%	5.8%	2.8%
10	Kalihi	10,133	10,313	180	1.8%	5.5%	4.1%
11	Iwilei	6,152	5,963	(189)	-3.1%	9.5%	1.9%
12	Airport PH	6,523	6,397	(126)	-1.9%	10.4%	2.9%
13	Salt Lake	16,389	15,175	(1,214)	-7.4%	8.8%	3.3%
14	PC Aiea	24,588	26,009	1,421	5.8%	3.4%	5.8%
15	Waipahu	18,471	20,414	1,943	10.5%	5.3%	6.1%
16	Mililani	27,407	27,550	143	0.5%	7.7%	9.3%
17	Ewa	20,775	22,728	1,953	9.4%	9.0%	11.5%
18	Waianae	12,378	12,096	(282)	-2.3%	14.7%	21.1%
19	NorthShore	6,648	6,913	265	4.0%	11.4%	27.2%
20	Koolauloa	4,473	4,499	26	0.6%	17.7%	41.1%
21	Kaneohe	20,091	20,960	869	4.3%	4.0%	12.3%
22	Kailua	16,873	17,771	898	5.3%	4.3%	17.4%
23	E Honolulu	16,728	18,117	1,389	8.3%	4.7%	15.2%
	Total	315,988	312,759	(3,229)	-1.0%	9.3%	8.4%

Table 4. Estimated 2000 Population Living in Households

District		Population Living in Households				Average Size of Household		
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	%+/- Diff.
1	Downtown	13,737	16,469	2,732	19.9%	2.07	2.48	20.0%
2	Kakaako	5,707	8,007	2,300	40.3%	1.85	2.59	39.4%
3	Makiki	33,850	43,321	9,471	28.0%	1.94	2.49	28.5%
4	McCully	31,696	40,684	8,988	28.4%	1.96	2.46	25.6%
5	Waikiki	21,682	28,620	6,938	32.0%	1.72	2.37	37.7%
6	Diamond Hd	25,577	28,543	2,966	11.6%	2.69	2.86	6.2%
7	Kaimuki	28,101	31,602	3,501	12.5%	2.77	2.88	4.0%
8	Manoa	16,646	17,760	1,114	6.7%	2.68	2.86	6.8%
9	Nuuanu	30,828	35,539	4,711	15.3%	2.62	2.84	8.3%
10	Kalihi	37,587	30,835	(6,752)	-18.0%	3.93	3.12	-20.6%
11	Iwilei	20,209	17,485	(2,724)	-13.5%	3.63	2.99	-17.6%
12	Airport PH	19,785	19,018	(767)	-3.9%	3.38	3.06	-9.5%
13	Salt Lake	46,134	45,075	(1,059)	-2.3%	3.09	3.07	-0.4%
14	PC Aiea	71,380	75,325	3,945	5.5%	3.01	3.07	2.3%
15	Waipahu	62,575	61,492	(1,083)	-1.7%	3.58	3.21	-10.3%
16	Mililani	79,488	78,729	(759)	-1.0%	3.14	3.15	0.3%
17	Ewa	68,202	61,355	(6,847)	-10.0%	3.61	3.05	-15.5%
18	Waianae	41,877	30,781	(11,096)	-26.5%	3.97	3.23	-18.7%
19	NorthShore	17,980	17,185	(795)	-4.4%	3.05	3.41	11.9%
20	Koolauloa	13,793	9,267	(4,526)	-32.8%	3.75	3.50	-6.7%
21	Kaneohe	61,371	56,588	(4,783)	-7.8%	3.18	3.08	-3.2%
22	Kailua	51,001	45,302	(5,699)	-11.2%	3.16	3.09	-2.2%
23	E Honolulu	46,005	46,222	217	0.5%	2.89	3.01	4.3%
	Total	845,211	845,204	(7)	0.0%	2.95	2.95	0.0%

Table 5. Estimated 2000 Mean Household Income[2]

District		Mean Household Income		
No.	Name	Conventional	UrbanSim	%+/- Diff.
1	Downtown	$ 29,675	$ 33,664	13.4%
2	Kakaako	$ 19,477	$ 21,067	8.2%
3	Makiki	$ 104,506	$ 112,846	8.0%
4	McCully	$ 81,878	$ 100,865	23.2%
5	Waikiki	$ 69,235	$ 73,445	6.1%
6	Diamond Hd	$ 77,288	$ 80,521	4.2%
7	Kaimuki	$ 80,541	$ 83,835	4.1%
8	Manoa	$ 62,578	$ 55,153	-11.9%
9	Nuuanu	$ 94,869	$ 100,479	5.9%
10	Kalihi	$ 64,537	$ 72,380	12.2%
11	Iwilei	$ 28,152	$ 34,051	21.0%
12	Airport PH	$ 29,833	$ 39,295	31.7%
13	Salt Lake	$ 111,270	$ 109,003	-2.0%
14	PC Aiea	$ 208,921	$ 193,062	-7.6%
15	Waipahu	$ 138,727	$ 139,531	0.6%
16	Mililani	$ 158,351	$ 180,956	14.3%
17	Ewa	$ 141,304	$ 138,487	-2.0%
18	Waianae	$ 60,780	$ 61,647	1.4%
19	NorthShore	$ 38,531	$ 37,337	-3.1%
20	Koolauloa	$ 22,844	$ 21,209	-7.2%
21	Kaneohe	$ 155,974	$ 141,785	-9.1%
22	Kailua	$ 147,219	$ 120,867	-17.9%
23	E Honolulu	$ 181,207	$ 146,494	-19.2%
	Total	$ 48,820	$ 48,566	-0.5%

Table 6. 1994 Base-Year Total Employment

District		Total Employment in 1994 Base Year			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	61,660	60,580	(1,080)	-1.8%
2	Kakaako	24,666	26,564	1,898	7.7%
3	Makiki	18,996	18,221	(775)	-4.1%
4	McCully	26,627	25,982	(645)	-2.4%
5	Waikiki	34,125	34,190	65	0.2%
6	Diamond Hd	10,646	10,794	148	1.4%
7	Kaimuki	6,585	6,573	(12)	-0.2%
8	Manoa	10,666	10,985	319	3.0%
9	Nuuanu	8,448	8,040	(408)	-4.8%
10	Kalihi	5,025	5,510	485	9.7%
11	Iwilei	34,395	36,751	2,356	6.8%
12	Airport PH	67,626	64,607	(3,019)	-4.5%
13	Salt Lake	26,991	28,991	2,000	7.4%
14	PC Aiea	27,003	25,480	(1,523)	-5.6%
15	Waipahu	13,544	13,588	44	0.3%
16	Mililani	39,936	39,944	8	0.0%
17	Ewa	16,954	17,040	86	0.5%
18	Waianae	6,853	6,829	(24)	-0.3%
19	NorthShore	3,907	3,910	3	0.1%
20	Koolauloa	4,810	4,813	3	0.1%
21	Kaneohe	24,869	23,779	(1,090)	-4.4%
22	Kailua	13,360	14,489	1,129	8.5%
23	E Honolulu	6,132	6,165	33	0.5%
	Total	493,824	493,825	1	0.0%

Table 7. Estimated 2000 Total Employment

District		Total Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	57,110	61,941	4,831	8.5%
2	Kakaako	24,878	23,128	(1,750)	-7.0%
3	Makiki	21,673	19,188	(2,485)	-11.5%
4	McCully	29,995	26,092	(3,903)	-13.0%
5	Waikiki	36,929	32,147	(4,782)	-12.9%
6	Diamond Hd	11,385	11,778	393	3.5%
7	Kaimuki	8,176	7,611	(565)	-6.9%
8	Manoa	14,468	10,981	(3,487)	-24.1%
9	Nuuanu	11,454	9,039	(2,415)	-21.1%
10	Kalihi	5,877	6,555	678	11.5%
11	Iwilei	39,155	38,949	(206)	-0.5%
12	Airport PH	56,668	56,691	23	0.0%
13	Salt Lake	23,283	29,491	6,208	26.7%
14	PC Aiea	28,159	29,120	961	3.4%
15	Waipahu	15,334	15,644	310	2.0%
16	Mililani	33,399	37,265	3,866	11.6%
17	Ewa	18,473	19,258	785	4.2%
18	Waianae	7,902	7,702	(200)	-2.5%
19	NorthShore	4,629	4,556	(73)	-1.6%
20	Koolauloa	5,934	5,233	(701)	-11.8%
21	Kaneohe	21,972	23,267	1,295	5.9%
22	Kailua	15,660	15,733	73	0.5%
23	E Honolulu	6,794	7,938	1,144	16.8%
	Total	499,307	499,307	-	0.0%

Table 8. Estimated 2000 Accessibilities

District		Access to Employment			Access to Population		
No.	Name	0-Cars	1-Car	2+ Car	0-Cars	1-Car	2+ Car
1	Downtown	0.463	0.882	1.000	0.729	0.845	0.933
2	Kakaako	0.121	0.432	0.892	0.345	0.492	0.895
3	Makiki	0.248	0.423	0.864	0.922	0.974	1.000
4	McCully	0.324	0.397	0.787	0.798	0.848	0.945
5	Waikiki	0.142	0.242	0.706	0.354	0.466	0.825
6	Diamond Hd	0.405	0.438	0.696	1.000	1.000	0.889
7	Kaimuki	0.269	0.330	0.674	0.727	0.775	0.859
8	Manoa	0.335	0.392	0.728	0.620	0.701	0.896
9	Nuuanu	0.301	0.457	0.828	0.783	0.863	0.962
10	Kalihi	0.368	0.429	0.799	0.726	0.799	0.960
11	Iwilei	1.000	1.000	0.941	0.799	0.871	0.989
12	Airport PH	0.467	0.495	0.772	0.277	0.414	0.871
13	Salt Lake	0.291	0.356	0.734	0.308	0.442	0.864
14	PC Alea	0.257	0.315	0.669	0.457	0.555	0.860
15	Waipahu	0.125	0.196	0.560	0.347	0.449	0.773
16	Mililani	0.141	0.201	0.514	0.275	0.367	0.651
17	Ewa	0.050	0.115	0.416	0.118	0.228	0.586
18	Waianae	0.016	0.055	0.225	0.038	0.106	0.328
19	NorthShore	0.030	0.069	0.249	0.051	0.121	0.343
20	Koolauloa	0.009	0.043	0.183	0.016	0.069	0.242
21	Kaneohe	0.111	0.177	0.495	0.329	0.408	0.641
22	Kailua	0.120	0.176	0.455	0.287	0.362	0.589
23	E Honolulu	0.041	0.126	0.505	0.110	0.229	0.621

Table 9. Estimated 2000 Employment in Wholesale/TCPU and Manufacturing Sectors

District		Wholesale/TCPU Employment				Manufacturing Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	5,290	5,286	(4)	-0.1%	1,449	4,937	3,488	240.7%
2	Kakaako	4,225	3,962	(263)	-6.2%	2,028	1,139	(889)	-43.8%
3	Makiki	1,187	1,022	(165)	-13.9%	559	319	(240)	-42.9%
4	McCully	2,014	1,829	(185)	-9.2%	1,274	549	(725)	-56.9%
5	Waikiki	902	853	(49)	-5.4%	616	938	322	52.3%
6	Diamond Hd	332	309	(23)	-6.9%	294	130	(164)	-55.8%
7	Kaimuki	239	229	(10)	-4.2%	483	245	(238)	-49.3%
8	Manoa	308	300	(8)	-2.6%	125	81	(44)	-35.2%
9	Nuuanu	167	182	15	9.0%	285	183	(102)	-35.8%
10	Kalihi	116	114	(2)	-1.7%	95	53	(42)	-44.2%
11	Iwilei	5,576	5,424	(152)	-2.7%	7,963	6,077	(1,886)	-23.7%
12	Airport PH	12,198	11,466	(732)	-6.0%	5,289	3,966	(1,323)	-25.0%
13	Salt Lake	527	802	275	52.2%	1,419	2,987	1,568	110.5%
14	PC Aiea	1,467	1,736	269	18.3%	2,849	2,706	(143)	-5.0%
15	Waipahu	738	821	83	11.2%	1,498	1,135	(363)	-24.2%
16	Mililani	1,454	1,684	230	15.8%	570	1,414	844	148.1%
17	Ewa	1,073	1,132	59	5.5%	2,234	1,161	(1,073)	-48.0%
18	Waianae	207	281	74	35.7%	136	207	71	52.2%
19	NorthShore	142	250	108	76.1%	373	278	(95)	-25.5%
20	Koolauloa	242	341	99	40.9%	103	210	107	103.9%
21	Kaneohe	810	989	179	22.1%	427	1,140	713	167.0%
22	Kailua	557	759	202	36.3%	671	902	231	34.4%
23	E Honolulu	437	437	-	0.0%	218	201	(17)	-7.8%
	Total	40,208	40,208	-	0.0%	30,958	30,958	-	0.0%

Table 10. Estimated 2000 Employment in FIRE and Service Sectors

District		Finance, Insur.. Real Est. Employment				Service Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	10,207	9,894	(313)	-3.1%	23,941	25,989	2,048	8.6%
2	Kakaako	1,539	1,610	71	4.6%	7,387	6,783	(604)	-8.2%
3	Makiki	1,474	1,340	(134)	-9.1%	13,443	11,658	(1,785)	-13.3%
4	McCully	4,609	3,690	(919)	-19.9%	10,699	9,292	(1,407)	-13.2%
5	Waikiki	1,737	1,571	(166)	-9.6%	9,225	6,689	(2,536)	-27.5%
6	Diamond Hd	666	614	(52)	-7.8%	4,934	4,385	(549)	-11.1%
7	Kaimuki	509	428	(81)	-15.9%	4,349	3,426	(923)	-21.2%
8	Manoa	342	338	(4)	-1.2%	11,785	7,980	(3,805)	-32.3%
9	Nuuanu	528	446	(82)	-15.5%	8,939	6,036	(2,903)	-32.5%
10	Kalihi	277	237	(40)	-14.4%	3,652	3,703	51	1.4%
11	Iwilei	2,499	2,636	137	5.5%	11,581	11,842	261	2.3%
12	Airport PH	1,619	1,678	59	3.6%	9,758	13,930	4,172	42.8%
13	Salt Lake	186	961	775	416.7%	8,548	11,412	2,864	33.5%
14	PC Alea	1,215	1,477	262	21.6%	9,017	10,551	1,534	17.0%
15	Waipahu	591	653	62	10.5%	5,309	5,468	159	3.0%
16	Mililani	1,223	1,482	259	21.2%	7,978	11,190	3,212	40.3%
17	Ewa	1,018	916	(102)	-10.0%	6,129	7,049	920	15.0%
18	Waianae	291	284	(7)	-2.4%	3,642	3,323	(319)	-8.8%
19	NorthShore	153	154	1	0.7%	1,465	1,468	3	0.2%
20	Koolauloa	228	262	34	14.9%	3,244	2,297	(947)	-29.2%
21	Kaneohe	568	753	185	32.6%	6,750	8,084	1,334	19.8%
22	Kailua	715	813	98	13.7%	7,903	6,738	(1,165)	-14.7%
23	E Honolulu	522	479	(43)	-8.2%	2,799	3,184	385	13.8%
	Total	32,716	32,716	-	0.0%	182,477	182,477	-	0.0%

Table 11. Estimated 2000 Employment in Military and Government Sectors

District		Military Employment				Government Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff
1	Downtown	115	135	20	17.4%	9,329	7,626	(1,703)	-18.3%
2	Kakaako	240	314	74	30.8%	1,739	1,982	243	14.0%
3	Makiki	35	134	99	282.9%	1,610	1,384	(226)	-14.0%
4	McCully	30	116	86	286.7%	392	576	184	46.9%
5	Waikiki	148	207	59	39.9%	395	489	94	23.8%
6	Diamond Hd	344	389	45	13.1%	740	1,289	549	74.2%
7	Kaimuki	8	153	145	1812.5%	154	475	321	208.4%
8	Manoa	82	249	167	203.7%	339	468	129	38.1%
9	Nuuanu	36	202	166	461.1%	260	463	203	78.1%
10	Kalihi	4	232	228	5700.0%	391	613	222	56.8%
11	Iwilei	134	295	161	120.1%	1,325	2,012	687	51.8%
12	Airport PH	10,163	9,071	(1,092)	-10.7%	6,363	5,331	(1,032)	-16.2%
13	Salt Lake	6,116	5,661	(455)	-7.4%	3,403	3,371	(32)	-0.9%
14	PC Alea	2,671	2,758	87	3.3%	1,512	1,040	(472)	-31.2%
15	Waipahu	4	364	360	9000.0%	571	717	146	25.6%
16	Mililani	12,230	11,258	(972)	-7.9%	2,586	2,687	101	3.9%
17	Ewa	354	742	388	109.6%	951	1,266	315	33.1%
18	Waianae	47	317	270	574.5%	392	393	1	0.3%
19	NorthShore	126	203	77	61.1%	59	131	72	122.0%
20	Koolauloa	33	60	27	81.8%	134	190	56	41.8%
21	Kaneohe	7,216	6,701	(515)	-7.1%	1,461	1,098	(363)	-24.8%
22	Kailua	288	559	271	94.1%	610	829	219	35.9%
23	E Honolulu	-	304	304	n/a	240	526	286	119.2%
	Total	40,424	40,424	-	0.0%	34,956	34,956	-	0.0%

Table 12. Estimated 2000 Employment in Agriculture and Construction Sectors

District		Agricultural Employment				Construction Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	290	168	(122)	-42.1%	846	1,162	316	37.4%
2	Kakaako	221	155	(66)	-29.9%	908	929	21	2.3%
3	Makiki	20	42	22	110.0%	893	765	(128)	-14.3%
4	McCully	141	105	(36)	-25.5%	528	493	(35)	-6.6%
5	Waikiki	94	86	(8)	-8.5%	364	395	31	8.5%
6	Diamond Hd	10	55	45	450.0%	423	383	(40)	-9.5%
7	Kaimuki	53	84	31	58.5%	270	270	-	0.0%
8	Manoa	30	80	50	166.7%	276	245	(31)	-11.2%
9	Nuuanu	17	68	51	300.0%	220	236	16	7.3%
10	Kalihi	37	75	38	102.7%	312	246	(66)	-21.2%
11	Iwilei	287	229	(58)	-20.2%	2,494	2,621	127	5.1%
12	Airport PH	71	280	209	294.4%	1,940	1,906	(34)	-1.8%
13	Salt Lake	-	123	123	n/a	775	860	85	11.0%
14	PC Alea	118	225	107	90.7%	1,339	1,458	119	8.9%
15	Waipahu	66	192	126	190.9%	1,746	1,651	(95)	-5.4%
16	Mililani	667	599	(68)	-10.2%	2,232	2,281	49	2.2%
17	Ewa	245	329	84	34.3%	3,515	3,171	(344)	-9.8%
18	Waianae	665	438	(227)	-34.1%	944	867	(77)	-8.2%
19	NorthShore	462	265	(197)	-42.6%	502	463	(39)	-7.8%
20	Koolauloa	422	237	(185)	-43.8%	189	240	51	27.0%
21	Kaneohe	379	413	34	9.0%	831	723	(108)	-13.0%
22	Kailua	394	339	(55)	-14.0%	758	1,024	266	35.1%
23	E Honolulu	54	156	102	188.9%	794	710	(84)	-10.6%
	Total	4,743	4,743	-	0.0%	23,099	23,099	-	0.0%

Table 13. Estimated 2000 Employment in the Retail Sector

District		Resident-Oriented Retail Employment				Visitor-Oriented Retail Employment			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	4,819	6,026	1,207	25.0%	-	-	-	n/a
2	Kakaako	6,213	5,918	(295)	-4.7%	-	-	-	n/a
3	Makiki	2,145	2,181	36	1.7%	-	-	-	n/a
4	McCully	6,634	6,334	(300)	-4.5%	2,049	1,589	(460)	-22.4%
5	Waikiki	-	-	-	n/a	17,740	15,864	(1,876)	-10.6%
6	Diamond Hd	3,019	3,219	200	6.6%	-	-	-	n/a
7	Kaimuki	1,827	1,920	93	5.1%	-	-	-	n/a
8	Manoa	1,019	1,048	29	2.8%	-	-	-	n/a
9	Nuuanu	896	1,067	171	19.1%	-	-	-	n/a
10	Kalihi	855	1,035	180	21.1%	-	-	-	n/a
11	Iwilei	6,613	7,066	453	6.9%	-	-	-	n/a
12	Airport PH	8,209	7,838	(371)	-4.5%	-	-	-	n/a
13	Salt Lake	2,053	3,066	1,013	49.3%	-	-	-	n/a
14	PC Alea	7,115	6,437	(678)	-9.5%	-	-	-	n/a
15	Waipahu	4,370	4,092	(278)	-6.4%	-	-	-	n/a
16	Mililani	3,837	3,997	160	4.2%	-	-	-	n/a
17	Ewa	2,456	2,893	437	17.8%	-	-	-	n/a
18	Waianae	1,344	1,385	41	3.1%	-	-	-	n/a
19	NorthShore	1,130	1,136	6	0.5%	-	-	-	n/a
20	Koolauloa	1,005	1,080	75	7.5%	-	-	-	n/a
21	Kaneohe	3,092	3,005	(87)	-2.8%	-	-	-	n/a
22	Kailua	3,245	3,290	45	1.4%	-	-	-	n/a
23	E Honolulu	1,452	1,651	199	13.7%	-	-	-	n/a
	Total	73,348	75,684	2,336	3.2%	19,789	17,453	(2,336)	-11.8%

Table 14. Estimated 2000 Hotel Rooms and Employment in the Hotel Sector

District		Hotel Rooms		Hotel Employment			
No.	Name	Conventional	UrbanSim	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	26	1,195	824	718	(106)	-12.9%
2	Kakaako	-	561	378	336	(42)	-11.1%
3	Makiki	39	573	307	343	36	11.7%
4	McCully	1,369	2,536	1,625	1,519	(106)	-6.5%
5	Waikiki	24,018	8,443	5,708	5,055	(653)	-11.4%
6	Diamond Hd	368	1,677	623	1,005	382	61.3%
7	Kaimuki	-	636	284	381	97	34.2%
8	Manoa	46	320	162	192	30	18.5%
9	Nuuanu	-	262	106	156	50	47.2%
10	Kalihi	-	412	138	247	109	79.0%
11	Iwilei	-	1,247	683	747	64	9.4%
12	Airport PH	696	2,047	1,058	1,225	167	15.8%
13	Salt Lake	-	414	256	248	(8)	-3.1%
14	PC Alea	-	1,218	856	732	(124)	-14.5%
15	Waipahu	-	919	441	551	110	24.9%
16	Mililani	192	1,126	622	673	51	8.2%
17	Ewa	390	1,000	498	599	101	20.3%
18	Waianae	-	347	234	207	(27)	-11.5%
19	NorthShore	-	347	217	208	(9)	-4.1%
20	Koolauloa	537	528	334	316	(18)	-5.4%
21	Kaneohe	16	601	438	361	(77)	-17.6%
22	Kailua	14	803	519	480	(39)	-7.5%
23	E Honolulu	-	485	278	290	12	4.3%
	Total	27,711	27,697	16,589	16,589	-	0.0%

Table 15. Estimated 2000 Public and Private College Students

District		Public College Students				Private College Students			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	-	-	-	n/a	5,218	5,008	(210)	-4.0%
2	Kakaako	-	-	-	n/a	-	-	-	n/a
3	Makiki	-	-	-	n/a	33	32	(1)	-3.0%
4	McCully	-	-	-	n/a	139	133	(6)	-4.3%
5	Waikiki	-	-	-	n/a	-	-	-	n/a
6	Diamond Hd	8,163	7,833	(330)	-4.0%	-	-	-	n/a
7	Kaimuki	-	-	-	n/a	888	852	(36)	-4.1%
8	Manoa	22,234	21,337	(897)	-4.0%	-	-	-	n/a
9	Nuuanu	-	-	-	n/a	-	-	-	n/a
10	Kalihi	-	-	-	n/a	-	-	-	n/a
11	Iwilei	5,260	5,048	(212)	-4.0%	-	-	-	n/a
12	Airport PH	-	-	-	n/a	-	-	-	n/a
13	Salt Lake	-	-	-	n/a	-	-	-	n/a
14	PC Alea	-	-	-	n/a	-	-	-	n/a
15	Waipahu	7,906	7,587	(319)	-4.0%	-	-	-	n/a
16	Mililani	-	-	-	n/a	-	-	-	n/a
17	Ewa	-	-	-	n/a	-	-	-	n/a
18	Waianae	-	-	-	n/a	-	-	-	n/a
19	NorthShore	-	-	-	n/a	-	-	-	n/a
20	Koolauloa	-	-	-	n/a	2,193	2,104	(89)	-4.1%
21	Kaneohe	1,814	1,741	(73)	-4.0%	-	-	-	n/a
22	Kailua	-	-	-	n/a	-	-	-	n/a
23	E Honolulu	-	-	-	n/a	122	117	(5)	-4.1%
	Total	45,377	43,546	(1,831)	-4.0%	8,593	8,246	(347)	-4.0%

Table 16. Estimated 2000 Public and Private K-12 Students

District		Public K-12 Students				Private K-12 Students			
No.	Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1	Downtown	1,681	1,662	(19)	-1.1%	688	681	(7)	-1.0%
2	Kakaako	2,229	3,345	1,116	50.1%	-	-	-	n/a
3	Makiki	992	1,303	311	31.4%	6,251	8,210	1,959	31.3%
4	McCully	3,089	3,946	857	27.7%	2,075	2,651	576	27.8%
5	Waikiki	893	1,422	529	59.2%	255	406	151	59.2%
6	Diamond Hd	4,034	4,237	203	5.0%	76	80	4	5.3%
7	Kaimuki	3,110	3,513	403	13.0%	2,705	3,053	348	12.9%
8	Manoa	1,647	1,759	112	6.8%	1,988	2,123	135	6.8%
9	Nuuanu	6,080	6,849	769	12.6%	3,026	3,411	385	12.7%
10	Kalihi	5,104	4,512	(592)	-11.6%	4,478	3,962	(516)	-11.5%
11	Iwilei	5,298	4,327	(971)	-18.3%	824	673	(151)	-18.3%
12	Airport PH	6,232	4,542	(1,690)	-27.1%	923	673	(250)	-27.1%
13	Salt Lake	8,502	7,451	(1,051)	-12.4%	254	223	(31)	-12.2%
14	PC Alea	13,610	12,853	(757)	-5.6%	884	835	(49)	-5.5%
15	Waipahu	7,913	6,976	(937)	-11.8%	680	599	(81)	-11.9%
16	Mililani	16,537	13,752	(2,785)	-16.8%	1,263	1,051	(212)	-16.8%
17	Ewa	8,753	8,122	(631)	-7.2%	450	417	(33)	-7.3%
18	Waianae	11,043	8,067	(2,976)	-26.9%	100	73	(27)	-27.0%
19	NorthShore	2,781	2,411	(370)	-13.3%	275	238	(37)	-13.5%
20	Koolauloa	4,234	3,108	(1,126)	-26.6%	-	-	-	n/a
21	Kaneohe	8,683	7,064	(1,619)	-18.6%	1,031	840	(191)	-18.5%
22	Kailua	8,484	7,106	(1,378)	-16.2%	1,383	1,159	(224)	-16.2%
23	E Honolulu	6,055	5,493	(562)	-9.3%	518	470	(49)	-9.4%
	Total	136,984	123,820	(13,164)	-9.6%	30,128	31,828	1,700	5.6%

2030 Land Use Model Inputs to the Travel Model

Table 1. Estimated 2030 Households

District	Total Households				% Change Since 2000	
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim
1 Downtown	12,024	8,174	(3,850)	-32.0%	81.2%	23.3%
2 Kakaako	17,001	4,093	(12,908)	-75.9%	452.5%	32.2%
3 Makiki	20,887	19,605	(1,282)	-6.1%	19.6%	12.7%
4 McCully	20,417	18,853	(1,564)	-7.7%	26.0%	13.9%
5 Waikiki	15,341	13,553	(1,788)	-11.7%	22.0%	12.4%
6 Diamond Hd	10,194	13,954	3,760	36.9%	7.3%	39.7%
7 Kaimuki	11,499	15,180	3,681	32.0%	13.3%	38.4%
8 Manoa	6,545	8,014	1,469	22.4%	5.4%	29.2%
9 Nuuanu	13,497	16,394	2,897	21.5%	14.9%	31.1%
10 Kalihi	10,302	13,839	3,537	34.3%	7.6%	40.0%
11 Iwilei	7,284	6,592	(692)	-9.5%	30.8%	12.7%
12 Airport PH	6,908	7,317	409	5.9%	18.1%	17.8%
13 Salt Lake	15,346	18,210	2,864	18.7%	2.6%	24.1%
14 PC Alea	24,053	33,969	9,916	41.2%	1.3%	38.5%
15 Waipahu	31,397	27,729	(3,668)	-11.7%	79.5%	44.7%
16 Mililani	28,406	35,325	6,919	24.4%	12.3%	41.3%
17 Ewa	54,996	29,462	(25,534)	-46.4%	190.9%	46.5%
18 Waianae	13,694	14,864	1,170	8.5%	29.8%	55.8%
19 NorthShore	6,853	6,548	(305)	-4.5%	16.3%	30.1%
20 Koolauloa	4,668	4,981	313	6.7%	26.8%	87.9%
21 Kaneohe	20,301	24,259	3,958	19.5%	5.3%	32.0%
22 Kailua	16,908	21,076	4,168	24.7%	4.7%	43.6%
23 E Honolulu	18,477	25,008	6,531	35.3%	15.9%	62.7%
Total	386,998	386,999	1	0.0%	35.1%	35.1%

Table 2. Estimated 2030 Housing Units and Vacancy Rates[2]

District	2030 Housing Units				% Change Since 2000		% Vacancy	
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Conventional	UrbanSim
1 Downtown	13,565	8,222	(5,343)	-39.4%	90.5%	23.5%	11.4%	0.6%
2 Kakaako	20,722	3,956	(16,766)	-80.9%	422.0%	32.4%	18.0%	-3.5%
3 Makiki	22,782	19,785	(2,997)	-13.2%	19.6%	13.2%	8.3%	0.9%
4 McCully	23,047	19,054	(3,993)	-17.3%	26.3%	13.5%	11.4%	1.1%
5 Waikiki	24,474	13,751	(10,723)	-43.8%	21.6%	12.5%	37.3%	1.4%
6 Diamond Hd	11,016	14,401	3,385	30.7%	7.0%	35.4%	7.5%	3.1%
7 Kaimuki	12,024	15,550	3,526	29.3%	13.1%	37.1%	4.4%	2.4%
8 Manoa	6,881	8,578	1,697	24.7%	5.7%	24.9%	4.9%	6.6%
9 Nuuanu	14,337	16,766	2,429	16.9%	15.0%	30.3%	5.9%	2.2%
10 Kalihi	10,921	14,272	3,351	30.7%	7.8%	38.4%	5.7%	3.0%
11 Iwilei	8,062	6,896	(1,166)	-14.5%	31.0%	15.6%	9.7%	4.4%
12 Airport PH	7,666	7,678	12	0.2%	17.5%	20.0%	9.9%	4.7%
13 Salt Lake	16,791	18,747	1,956	11.6%	2.5%	23.5%	8.6%	2.9%
14 PC Alea	24,913	35,022	10,109	40.6%	1.3%	34.7%	3.5%	3.0%
15 Waipahu	32,978	28,949	(4,029)	-12.2%	78.5%	41.8%	4.8%	4.2%
16 Mililani	30,682	36,836	6,154	20.1%	11.9%	33.7%	7.4%	4.1%
17 Ewa	60,399	32,456	(27,943)	-46.3%	190.7%	42.8%	8.9%	9.2%
18 Waianae	15,969	17,584	1,615	10.1%	29.0%	45.4%	14.2%	15.5%
19 NorthShore	7,775	10,482	2,707	34.8%	17.0%	51.6%	11.9%	37.5%
20 Koolauloa	5,563	6,671	1,108	19.9%	24.4%	48.3%	16.1%	25.3%
21 Kaneohe	21,153	27,653	6,500	30.7%	5.3%	31.9%	4.0%	12.3%
22 Kailua	17,664	23,659	5,995	33.9%	4.7%	33.1%	4.3%	10.9%
23 E Honolulu	19,434	26,056	6,622	34.1%	16.2%	43.8%	4.9%	4.0%
Total	428,818	413,024	(15,794)	-3.7%	35.7%	32.1%	9.8%	6.3%

Table 3. Estimated 2030 Population Living in Households

District	Population Living in Households				% Change Since 2000		Average Size of Household		
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Conventional	UrbanSim	%+/- Diff.
1 Downtown	22,928	20,173	(2,755)	-12.0%	65.9%	22.5%	1.91	2.47	29.4%
2 Kakaako	30,540	11,901	(18,639)	-61.0%	435.1%	48.6%	1.80	2.91	61.9%
3 Makiki	39,983	50,179	10,196	25.5%	18.1%	15.8%	1.91	2.56	33.7%
4 McCully	39,119	48,914	9,795	25.0%	23.4%	20.2%	1.92	2.59	35.4%
5 Waikiki	26,034	35,519	9,485	36.4%	20.1%	24.1%	1.70	2.62	54.4%
6 Diamond Hd	26,809	39,559	12,750	47.6%	4.8%	38.6%	2.63	2.83	7.8%
7 Kaimuki	31,418	43,306	11,888	37.8%	11.8%	37.0%	2.73	2.85	4.4%
8 Manoa	17,050	21,858	4,808	28.2%	2.4%	23.1%	2.61	2.73	4.7%
9 Nuuanu	34,612	45,022	10,410	30.1%	12.3%	26.7%	2.56	2.75	7.1%
10 Kalihi	39,959	38,796	(1,163)	-2.9%	6.3%	25.8%	3.88	2.80	-27.7%
11 Iwilei	24,811	17,711	(7,100)	-28.6%	22.8%	1.3%	3.41	2.69	-21.1%
12 Airport PH	22,883	20,542	(2,341)	-10.2%	15.7%	8.0%	3.31	2.81	-15.2%
13 Salt Lake	46,378	50,548	4,170	9.0%	0.5%	12.1%	3.02	2.78	-8.2%
14 PC Aiea	70,822	95,840	25,018	35.3%	-0.8%	27.2%	2.94	2.82	-4.2%
15 Waipahu	100,146	77,735	(22,411)	-22.4%	60.0%	25.4%	3.19	2.80	-12.1%
16 Mililani	83,208	104,966	21,758	26.1%	4.7%	33.3%	2.93	2.97	1.4%
17 Ewa	184,545	81,917	(102,628)	-55.6%	170.6%	33.5%	3.36	2.78	-17.1%
18 Waianae	50,252	43,627	(6,625)	-13.2%	20.0%	41.7%	3.67	2.94	-20.0%
19 NorthShore	19,560	21,561	2,001	10.2%	8.8%	25.5%	2.85	3.29	15.4%
20 Koolauloa	15,971	16,922	951	6.0%	15.8%	82.6%	3.42	3.40	-0.7%
21 Kaneohe	60,074	69,405	9,331	15.5%	-2.1%	22.6%	2.96	2.86	-3.3%
22 Kailua	49,733	58,362	8,629	17.4%	-2.5%	28.8%	2.94	2.77	-5.9%
23 E Honolulu	49,513	71,943	22,430	45.3%	7.6%	55.6%	2.68	2.88	7.4%
Total	1,086,348	1,086,306	(42)	0.0%	28.5%	28.5%	2.81	2.81	0.0%

Table 4. Estimated 2030 Mean Household Income[3]

District	Mean Household Income			% Change Since 2000	
No. Name	Conventional	UrbanSim	%+/- Diff.	Conventional	UrbanSim
1 Downtown	$ 28,091	$ 33,662	19.8%	-5.3%	0.0%
2 Kakaako	$ 45,776	$ 25,561	-44.2%	135.0%	21.3%
3 Makiki	$ 68,544	$ 100,212	46.2%	-34.4%	-11.2%
4 McCully	$ 56,938	$ 98,846	73.6%	-30.5%	-2.0%
5 Waikiki	$ 46,573	$ 69,048	48.3%	-32.7%	-6.0%
6 Diamond Hd	$ 45,766	$ 88,702	93.8%	-40.8%	10.2%
7 Kaimuki	$ 50,887	$ 95,123	86.9%	-36.8%	13.5%
8 Manoa	$ 36,294	$ 45,065	24.2%	-42.0%	-18.3%
9 Nuuanu	$ 60,120	$ 95,969	59.6%	-36.6%	-4.5%
10 Kalihi	$ 38,422	$ 81,901	113.2%	-40.5%	13.2%
11 Iwilei	$ 19,575	$ 31,252	59.7%	-30.5%	-8.2%
12 Airport PH	$ 19,239	$ 41,413	115.3%	-35.5%	5.4%
13 Salt Lake	$ 63,537	$ 104,703	64.8%	-42.9%	-3.9%
14 PC Aiea	$ 116,906	$ 205,222	75.5%	-44.0%	6.3%
15 Waipahu	$ 138,359	$ 167,445	21.0%	-0.3%	20.0%
16 Mililani	$ 95,007	$ 232,124	144.3%	-40.0%	28.3%
17 Ewa	$ 244,043	$ 178,024	-27.1%	72.7%	28.5%
18 Waianae	$ 43,480	$ 103,361	137.7%	-28.5%	67.7%
19 NorthShore	$ 24,350	$ 48,945	101.0%	-36.8%	31.1%
20 Koolauloa	$ 15,929	$ 39,132	145.7%	-30.3%	84.5%
21 Kaneohe	$ 90,423	$ 149,416	65.2%	-42.0%	5.4%
22 Kailua	$ 85,096	$ 130,193	53.0%	-42.2%	7.7%
23 E Honolulu	$ 115,503	$ 163,544	41.6%	-36.3%	11.6%
Total	$ 48,123	$ 49,189	2.2%	-1.4%	1.3%

Table 5. Estimated 2030 Total Employment and Non-Residential Floor Area[4]

District	Total Employment				% Change Since 2000		Non-Residential Sq Ft (000's)		
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	2000	2030	% Change
1 Downtown	64,983	70,923	5,940	9.1%	13.8%	14.5%	26,907	29,455	9.5%
2 Kakaako	39,684	30,199	(9,485)	-23.9%	59.5%	30.6%	11,123	14,070	26.5%
3 Makiki	23,200	21,666	(1,534)	-6.6%	7.0%	12.9%	7,247	7,596	4.8%
4 McCully	40,727	30,518	(10,209)	-25.1%	35.8%	17.0%	10,228	10,991	7.5%
5 Waikiki	44,913	31,419	(13,494)	-30.0%	21.6%	-2.3%	12,677	13,124	3.5%
6 Diamond Hd	13,675	14,604	929	6.8%	20.1%	24.0%	4,023	5,129	27.5%
7 Kaimuki	9,658	10,913	1,255	13.0%	18.1%	43.4%	2,154	2,834	31.6%
8 Manoa	15,581	13,192	(2,389)	-15.3%	7.7%	20.1%	4,338	4,602	6.1%
9 Nuuanu	14,189	11,447	(2,742)	-19.3%	23.9%	26.6%	2,678	3,066	14.5%
10 Kalihi	7,949	9,156	1,207	15.2%	35.3%	39.7%	1,874	2,488	32.7%
11 Iwilei	42,091	44,404	2,313	5.5%	7.5%	14.0%	21,824	24,039	10.2%
12 Airport PH	57,214	75,244	18,030	31.5%	1.0%	32.7%	34,598	39,833	15.2%
13 Salt Lake	25,082	33,934	8,852	35.3%	7.7%	15.1%	11,826	12,327	4.2%
14 PC Aiea	31,650	37,854	6,204	19.6%	12.4%	30.0%	11,171	13,687	22.5%
15 Waipahu	33,955	22,996	(10,959)	-32.3%	121.4%	47.0%	6,176	9,251	49.8%
16 Mililani	38,425	51,554	13,129	34.2%	15.0%	38.3%	14,765	17,228	15.7%
17 Ewa	63,932	30,599	(33,333)	-52.1%	246.1%	58.9%	7,799	13,781	76.7%
18 Waianae	11,196	12,680	1,484	13.3%	41.7%	64.6%	2,556	5,021	96.4%
19 NorthShore	4,137	6,802	2,665	64.4%	-10.6%	49.3%	1,406	2,242	59.4%
20 Koolauloa	6,753	7,316	563	8.3%	13.8%	39.8%	1,863	2,523	35.5%
21 Kaneohe	22,159	31,312	9,153	41.3%	0.9%	34.6%	8,340	9,927	19.0%
22 Kailua	15,436	20,352	4,916	31.8%	-1.4%	29.4%	5,491	6,435	17.2%
23 E Honolulu	6,349	13,854	7,505	118.2%	-6.5%	74.5%	2,250	3,625	61.1%
Total	632,938	632,938	-	0.0%	26.8%	26.8%	213,305	253,273	16.7%

Table 6. Estimated 2000 and 2030 Home Access to Employment Ratings

District	0-Cars			1-Car			2-Cars		
No. Name	2000	2030	% Change	2000	2030	% Change	2000	2030	% Change
1 Downtown	6,574	2,279	-65.3%	15,836	15,820	-0.1%	44,503	15,117	-66.0%
2 Kakaako	1,720	2,701	57.0%	7,747	16,388	111.5%	39,674	15,521	-60.9%
3 Makiki	3,516	3,113	-11.5%	7,591	16,451	116.7%	38,433	15,452	-59.8%
4 McCully	4,595	3,234	-29.6%	7,132	17,748	148.8%	35,040	16,783	-52.1%
5 Waikiki	2,009	3,773	87.8%	4,336	19,367	346.7%	31,434	18,127	-42.3%
6 Diamond Hd	5,750	5,029	-12.5%	7,866	20,391	159.2%	30,978	18,810	-39.3%
7 Kaimuki	3,820	5,069	32.7%	5,926	20,692	249.2%	29,981	19,043	-36.5%
8 Manoa	4,756	4,875	2.5%	7,044	19,147	171.8%	32,382	17,518	-45.9%
9 Nuuanu	4,274	3,721	-12.9%	8,204	16,712	103.7%	36,857	15,408	-58.2%
10 Kalihi	5,222	4,160	-20.3%	7,693	16,171	110.2%	35,549	14,850	-58.2%
11 Iwilei	14,195	3,200	-77.5%	17,953	15,009	-16.4%	41,660	14,122	-66.3%
12 Airport PH	6,636	4,286	-35.4%	8,895	16,856	89.5%	34,358	15,716	-54.3%
13 Salt Lake	4,133	5,314	28.6%	6,395	18,220	184.9%	32,662	16,665	-49.0%
14 PC Aiea	3,648	6,818	86.9%	5,658	22,478	297.3%	29,767	20,808	-30.1%
15 Waipahu	1,774	7,646	331.0%	3,517	30,441	765.5%	24,907	29,391	18.0%
16 Mililani	2,006	10,588	427.4%	3,614	37,799	945.8%	22,868	37,501	64.0%
17 Ewa	708	9,770	1279.8%	2,072	41,055	1880.9%	18,535	40,493	118.5%
18 Waianae	227	42,921	18786.9%	989	128,363	12882.4%	10,032	130,006	1195.9%
19 NorthShore	420	21,152	4941.3%	1,245	63,869	5028.9%	11,081	64,591	482.9%
20 Koolauloa	130	16,853	12884.4%	772	66,544	8517.8%	8,162	65,794	706.1%
21 Kaneohe	1,569	7,702	390.9%	3,180	25,850	713.0%	22,022	23,953	8.8%
22 Kailua	1,696	6,318	272.4%	3,166	26,141	725.7%	20,263	24,514	21.0%
23 E Honolulu	583	8,176	1301.7%	2,258	30,581	1254.2%	22,484	28,410	28.4%
Total	79,963	188,698	136.0%	139,094	702,092	404.8%	653,832	678,592	3.8%

Table 7. Estimated 2000 and 2030 Work Access to Population Ratings

District	0-Cars			1-Car			2-Cars		
No. Name	2000	2030	% Change	2000	2030	% Change	2000	2030	% Change
1 Downtown	10,204	4,064	-60.2%	14,312	31,302	118.7%	50,635	29,094	-42.5%
2 Kakaako	4,820	4,685	-2.8%	8,330	32,129	285.7%	48,587	29,535	-39.2%
3 Makiki	12,903	5,003	-61.2%	16,495	30,870	87.2%	54,264	28,294	-47.9%
4 McCully	11,158	4,909	-56.0%	14,367	32,948	129.3%	51,262	30,487	-40.5%
5 Waikiki	4,965	5,737	15.6%	7,887	36,000	356.5%	44,761	32,994	-26.3%
6 Diamond Hd	13,950	7,590	-45.6%	15,935	36,551	115.8%	48,265	33,217	-31.2%
7 Kaimuki	10,173	7,609	-25.2%	13,119	37,007	182.1%	46,518	33,578	-28.0%
8 Manoa	8,673	7,368	-15.0%	11,878	34,600	191.3%	48,641	31,171	-35.9%
9 Nuuanu	10,956	6,105	-44.3%	14,616	30,967	111.9%	52,196	27,941	-46.5%
10 Kalihi	10,162	6,612	-34.9%	13,536	29,607	118.7%	52,096	26,401	-49.3%
11 Iwilei	11,174	5,135	-54.0%	14,746	28,729	94.8%	53,642	26,079	-51.4%
12 Airport PH	3,882	6,391	64.6%	7,005	31,198	345.4%	47,283	27,920	-41.0%
13 Salt Lake	4,310	8,256	91.6%	7,495	32,946	339.6%	46,885	29,075	-38.0%
14 PC Aiea	6,384	9,607	50.3%	9,404	37,792	301.9%	46,643	33,764	-27.6%
15 Waipahu	4,849	10,851	123.8%	7,601	50,621	565.9%	41,955	46,795	11.5%
16 Mililani	3,848	15,743	309.1%	6,209	63,465	922.1%	35,304	60,184	70.5%
17 Ewa	1,656	14,092	750.8%	3,869	68,193	1662.8%	31,790	64,447	102.7%
18 Waianae	532	62,863	11712.6%	1,799	210,063	11576.4%	17,788	204,910	1052.0%
19 NorthShore	717	31,364	4274.6%	2,045	104,855	5027.1%	18,621	101,332	444.2%
20 Koolauloa	222	26,349	11776.3%	1,174	113,423	9564.5%	13,113	107,570	720.3%
21 Kaneohe	4,604	12,176	164.5%	6,916	45,333	555.5%	34,790	40,760	17.2%
22 Kailua	4,014	10,026	149.8%	6,132	45,553	642.8%	31,936	41,477	29.9%
23 E Honolulu	1,544	12,450	706.5%	3,881	54,119	1294.5%	33,710	49,376	46.5%
Total	145,738	285,016	95.6%	209,752	1,218,271	480.8%	950,790	1,136,404	19.5%

Table 8. Estimated 2030 Employment in Wholesale/TCPU and Manufacturing Sectors

District	Wholesale/TCPU Employment				Manufacturing Employment			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	6,117	6,155	38	0.6%	1,499	6,935	5,436	362.6%
2 Kakaako	5,320	3,169	(2,151)	-40.4%	1,975	1,695	(280)	-14.2%
3 Makiki	1,369	737	(632)	-46.2%	569	185	(384)	-67.5%
4 McCully	2,796	1,110	(1,686)	-60.3%	1,270	293	(977)	-76.9%
5 Waikiki	1,410	891	(519)	-36.8%	616	1,039	423	68.7%
6 Diamond Hd	542	197	(345)	-63.7%	331	59	(272)	-82.2%
7 Kaimuki	386	193	(193)	-50.0%	445	163	(282)	-63.4%
8 Manoa	417	223	(194)	-46.5%	118	66	(52)	-44.1%
9 Nuuanu	391	265	(126)	-32.2%	268	134	(134)	-50.0%
10 Kalihi	208	256	48	23.1%	108	82	(26)	-24.1%
11 Iwilei	6,305	5,293	(1,012)	-16.1%	7,954	4,099	(3,855)	-48.5%
12 Airport PH	12,651	12,601	(50)	-0.4%	5,257	4,144	(1,113)	-21.2%
13 Salt Lake	762	1,740	978	128.3%	1,441	3,698	2,257	156.6%
14 PC Aiea	1,943	3,468	1,525	78.5%	2,846	2,492	(354)	-12.4%
15 Waipahu	1,003	1,911	908	90.5%	3,219	1,070	(2,149)	-66.8%
16 Mililani	1,591	3,522	1,931	121.4%	568	2,812	2,244	395.1%
17 Ewa	3,984	2,004	(1,980)	-49.7%	4,279	1,188	(3,091)	-72.2%
18 Waianae	255	1,072	817	320.4%	136	603	467	343.4%
19 NorthShore	146	548	402	275.3%	335	460	125	37.3%
20 Koolauloa	305	531	226	74.1%	141	398	257	182.3%
21 Kaneohe	936	2,240	1,304	139.3%	427	1,816	1,389	325.3%
22 Kailua	669	1,419	750	112.1%	670	1,071	401	59.9%
23 E Honolulu	510	471	(39)	-7.6%	218	188	(30)	-13.8%
Total	50,016	50,016	-	0.0%	34,690	34,690	-	0.0%

Table 9. Estimated 2030 Employment in FIRE and Service Sectors

District	Finance, Insur., Real Est. Employment				Service Employment			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	11,086	7,327	(3,759)	-33.9%	27,838	33,879	6,041	21.7%
2 Kakaako	2,165	1,682	(483)	-22.3%	13,856	11,845	(2,011)	-14.5%
3 Makiki	1,584	944	(640)	-40.4%	14,515	13,280	(1,235)	-8.5%
4 McCully	5,381	1,853	(3,528)	-65.6%	15,698	11,564	(4,134)	-26.3%
5 Waikiki	2,279	1,224	(1,055)	-46.3%	12,009	7,928	(4,081)	-34.0%
6 Diamond Hd	908	276	(632)	-69.6%	6,594	4,207	(2,387)	-36.2%
7 Kaimuki	624	317	(307)	-49.2%	5,278	3,360	(1,918)	-36.3%
8 Manoa	474	193	(281)	-59.3%	12,534	7,804	(4,730)	-37.7%
9 Nuuanu	782	444	(338)	-43.2%	10,623	5,758	(4,865)	-45.8%
10 Kalihi	456	441	(15)	-3.3%	5,255	4,175	(1,080)	-20.6%
11 Iwilei	2,911	2,234	(677)	-23.3%	14,253	17,066	2,813	19.7%
12 Airport PH	1,852	3,512	1,660	89.6%	11,212	27,592	16,380	146.1%
13 Salt Lake	337	2,728	2,391	709.5%	9,653	14,207	4,554	47.2%
14 PC Aiea	1,532	3,445	1,913	124.9%	11,161	14,350	3,189	28.6%
15 Waipahu	1,935	1,688	(247)	-12.8%	16,099	7,747	(8,352)	-51.9%
16 Mililani	1,860	5,157	3,297	177.3%	13,625	20,869	7,244	53.2%
17 Ewa	3,370	1,126	(2,244)	-66.6%	22,102	11,753	(10,349)	-46.8%
18 Waianae	472	1,044	572	121.2%	6,784	4,837	(1,947)	-28.7%
19 NorthShore	152	647	495	325.7%	1,269	1,997	729	57.5%
20 Koolauloa	270	691	421	155.9%	3,840	2,547	(1,293)	-33.7%
21 Kaneohe	609	3,085	2,476	406.6%	7,268	12,865	5,597	77.0%
22 Kailua	739	1,759	1,020	138.0%	8,296	7,908	(388)	-4.7%
23 E Honolulu	526	487	(39)	-7.4%	3,078	5,301	2,223	72.2%
Total	42,304	42,304	-	0.0%	252,839	252,839	-	0.0%

Table 10. Estimated 2030 Employment in Military and Government Sectors

District	Military Employment				Government Employment			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	149	319	170	114.1%	9,425	3,558	(5,867)	-62.2%
2 Kakaako	205	524	319	155.6%	1,917	1,548	(369)	-19.2%
3 Makiki	44	526	482	1095.5%	1,460	1,621	161	11.0%
4 McCully	21	439	418	1990.5%	442	2,364	1,922	434.8%
5 Waikiki	148	485	337	227.7%	425	1,403	978	230.1%
6 Diamond Hd	345	541	196	56.8%	690	2,620	1,930	279.7%
7 Kaimuki	7	508	501	7157.1%	227	1,800	1,573	693.0%
8 Manoa	82	656	574	700.0%	353	1,368	1,015	287.5%
9 Nuuanu	37	910	873	2359.5%	289	1,381	1,092	377.9%
10 Kalihi	3	771	768	25600.0%	405	1,112	707	174.6%
11 Iwilei	133	1,004	871	654.9%	1,363	2,505	1,142	83.8%
12 Airport PH	10,340	6,544	(3,796)	-36.7%	5,894	4,793	(1,101)	-18.7%
13 Salt Lake	5,924	3,763	(2,161)	-36.5%	3,930	2,072	(1,858)	-47.3%
14 PC Alea	2,675	3,381	706	26.4%	1,548	1,252	(296)	-19.1%
15 Waipahu	4	1,785	1,781	44525.0%	594	1,650	1,056	177.8%
16 Mililani	12,223	7,040	(5,183)	-42.4%	2,627	1,916	(711)	-27.1%
17 Ewa	354	2,356	2,002	565.5%	6,763	2,757	(4,006)	-59.2%
18 Waianae	45	1,043	998	2217.8%	404	620	216	53.5%
19 NorthShore	138	322	184	133.3%	62	470	408	658.1%
20 Koolauloa	20	214	194	970.0%	133	504	371	278.9%
21 Kaneohe	7,211	4,613	(2,598)	-36.0%	1,475	817	(658)	-44.6%
22 Kailua	289	1,478	1,189	411.4%	623	1,033	410	65.8%
23 E Honolulu	-	1,175	1,175	n/a	244	2,129	1,885	772.5%
Total	40,397	40,397	-	0.0%	41,293	41,293	-	0.0%

Table 11. Estimated 2030 Employment in Agriculture and Construction Sectors

District	Agricultural Employment				Construction Employment			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	310	102	(208)	-67.1%	1,641	1,998	357	21.8%
2 Kakaako	253	135	(118)	-46.6%	3,191	1,358	(1,833)	-57.4%
3 Makiki	31	94	63	203.2%	740	480	(260)	-35.1%
4 McCully	174	110	(64)	-36.8%	1,802	296	(1,506)	-83.6%
5 Waikiki	117	93	(24)	-20.5%	1,524	667	(857)	-56.2%
6 Diamond Hd	28	78	50	178.6%	390	201	(189)	-48.5%
7 Kaimuki	52	109	57	109.6%	405	187	(218)	-53.8%
8 Manoa	35	114	79	225.7%	241	162	(79)	-32.8%
9 Nuuanu	29	139	110	379.3%	519	227	(292)	-56.3%
10 Kalihi	46	121	75	163.0%	308	289	(19)	-6.2%
11 Iwilei	303	240	(63)	-20.8%	888	2,585	1,697	191.1%
12 Airport PH	77	498	421	546.8%	514	3,775	3,261	634.4%
13 Salt Lake	4	219	215	5375.0%	277	1,308	1,031	372.2%
14 PC Alea	131	382	251	191.6%	708	2,132	1,424	201.1%
15 Waipahu	142	320	178	125.4%	3,282	1,665	(1,617)	-49.3%
16 Mililani	339	532	193	56.9%	1,041	2,889	1,848	177.5%
17 Ewa	728	469	(259)	-35.6%	7,675	2,500	(5,175)	-67.4%
18 Waianae	648	321	(327)	-50.5%	560	866	306	54.6%
19 NorthShore	624	152	(472)	-75.6%	300	391	91	30.3%
20 Koolauloa	376	149	(227)	-60.4%	181	291	110	60.8%
21 Kaneohe	452	426	(26)	-5.8%	612	1,332	720	117.6%
22 Kailua	421	344	(77)	-18.3%	426	1,402	976	229.1%
23 E Honolulu	56	229	173	308.9%	245	469	224	91.4%
Total	5,376	5,376	-	0.0%	27,470	27,470	-	0.0%

Table 12. Estimated 2030 Employment in the Retail Sector

District	Resident-Oriented Retail Employment				Visitor-Oriented Retail Employment			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	5,873	10,123	4,250	72.4%	-	-	-	n/a
2 Kakaako	9,552	7,868	(1,684)	-17.6%	-	-	-	n/a
3 Makiki	2,477	3,272	795	32.1%	-	-	-	n/a
4 McCully	9,149	8,320	(829)	-9.1%	2,064	1,520	(544)	-26.4%
5 Waikiki	-	-	-	n/a	19,806	14,097	(5,709)	-28.8%
6 Diamond Hd	3,241	4,358	1,117	34.5%	-	-	-	n/a
7 Kaimuki	1,904	2,959	1,055	55.4%	-	-	-	n/a
8 Manoa	1,087	1,835	748	68.8%	-	-	-	n/a
9 Nuuanu	990	1,799	809	81.7%	-	-	-	n/a
10 Kalihi	929	1,509	580	62.4%	-	-	-	n/a
11 Iwilei	7,103	8,283	1,180	16.6%	-	-	-	n/a
12 Airport PH	8,215	10,254	2,039	24.8%	-	-	-	n/a
13 Salt Lake	2,392	3,998	1,606	67.1%	-	-	-	n/a
14 PC Alea	8,050	6,600	(1,450)	-18.0%	-	-	-	n/a
15 Waipahu	7,677	4,663	(3,014)	-39.3%	-	-	-	n/a
16 Mililani	4,448	6,460	2,012	45.2%	-	-	-	n/a
17 Ewa	12,285	5,489	(6,796)	-55.3%	-	-	-	n/a
18 Waianae	1,576	2,156	580	36.8%	-	-	-	n/a
19 NorthShore	1,106	1,533	427	38.6%	-	-	-	n/a
20 Koolauloa	1,217	1,645	428	35.2%	-	-	-	n/a
21 Kaneohe	3,148	3,939	791	25.1%	-	-	-	n/a
22 Kailua	3,291	3,652	361	11.0%	-	-	-	n/a
23 E Honolulu	1,472	2,721	1,249	84.9%	-	-	-	n/a
Total	97,182	103,436	6,254	6.4%	21,870	15,617	(6,253)	-28.6%

Table 13. Estimated 2030 Hotel Rooms and Employment in the Hotel Sector

District	Hotel Rooms		Hotel Employment				Resort Condo Units	
No. Name	Conventional	UrbanSim	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim
1 Downtown	69	1,032	1,045	527	(518)	-49.6%	77	160
2 Kakaako	-	730	1,250	375	(875)	-70.0%	-	-
3 Makiki	40	1,028	411	527	116	28.2%	21	27
4 McCully	1,164	5,164	1,930	2,650	720	37.3%	401	227
5 Waikiki	23,205	6,997	6,579	3,592	(2,987)	-45.4%	9,873	10,477
6 Diamond Hd	693	4,025	606	2,067	1,461	241.1%	3	1
7 Kaimuki	-	2,563	330	1,317	987	299.1%	-	-
8 Manoa	40	1,501	240	771	531	221.3%	11	1
9 Nuuanu	-	761	261	390	129	49.4%	-	-
10 Kalihi	-	782	231	400	169	73.2%	-	-
11 Iwilei	-	2,136	878	1,095	217	24.7%	-	-
12 Airport PH	863	2,981	1,202	1,531	329	27.4%	290	55
13 Salt Lake	-	392	362	201	(161)	-44.5%	-	-
14 PC Alea	29	890	1,056	352	(704)	-66.7%	44	99
15 Waipahu	-	970	-	497	497	n/a	-	-
16 Mililani	659	697	103	357	254	246.6%	74	22
17 Ewa	8,770	1,868	2,392	957	(1,435)	-60.0%	2	1
18 Waianae	382	231	316	118	(198)	-62.7%	1,121	702
19 NorthShore	-	551	6	282	276	4600.0%	544	24
20 Koolauloa	1,620	675	270	346	76	28.1%	116	77
21 Kaneohe	109	352	21	179	158	752.4%	147	16
22 Kailua	141	558	12	286	274	2283.3%	190	20
23 E Honolulu	-	1,336	-	684	684	n/a	-	-
Total	37,984	38,020	19,501	19,501	-	0.0%	12,714	11,909

Table 14. Estimated 2030 Public and Private College Students

District	Public College Students				Private College Students			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	-	-	-	n/a	6,315	6,766	451	7.1%
2 Kakaako	-	-	-	n/a	-	-	-	n/a
3 Makiki	-	-	-	n/a	40	44	4	10.0%
4 McCully	-	-	-	n/a	168	178	10	6.0%
5 Waikiki	-	-	-	n/a	-	-	-	n/a
6 Diamond Hd	9,879	10,582	703	7.1%	-	-	-	n/a
7 Kaimuki	-	-	-	n/a	1,075	1,151	76	7.1%
8 Manoa	26,908	28,827	1,919	7.1%	-	-	-	n/a
9 Nuuanu	-	-	-	n/a	-	-	-	n/a
10 Kalihi	-	-	-	n/a	-	-	-	n/a
11 Iwilei	6,366	6,821	455	7.1%	-	-	-	n/a
12 Airport PH	-	-	-	n/a	-	-	-	n/a
13 Salt Lake	-	-	-	n/a	-	-	-	n/a
14 PC Aiea	-	-	-	n/a	-	-	-	n/a
15 Waipahu	9,568	10,249	681	7.1%	-	-	-	n/a
16 Mililani	-	-	-	n/a	-	-	-	n/a
17 Ewa	7,600	-	(7,600)	-100.0%	-	-	-	n/a
18 Waianae	-	-	-	n/a	-	-	-	n/a
19 NorthShore	-	-	-	n/a	-	-	-	n/a
20 Koolauloa	-	-	-	n/a	2,654	2,843	189	7.1%
21 Kaneohe	2,195	2,352	157	7.2%	-	-	-	n/a
22 Kailua	-	-	-	n/a	-	-	-	n/a
23 E Honolulu	-	-	-	n/a	148	158	10	6.8%
Total	62,516	58,831	(3,685)	-5.9%	10,400	11,140	740	7.1%

Table 15. Estimated 2030 Public and Private K-12 Students

District	Public K-12 Students				Private K-12 Students			
No. Name	Conventional	UrbanSim	Difference	%+/- Diff.	Conventional	UrbanSim	Difference	%+/- Diff.
1 Downtown	2,512	2,193	(319)	-12.7%	1,175	898	(277)	-23.6%
2 Kakaako	11,692	5,221	(6,471)	-55.3%	-	-	-	n/a
3 Makiki	1,172	1,469	297	25.3%	6,643	9,254	2,611	39.3%
4 McCully	3,649	4,788	1,139	31.2%	2,451	3,217	766	31.3%
5 Waikiki	1,085	1,801	716	66.0%	255	514	259	101.6%
6 Diamond Hd	4,329	6,414	2,085	48.2%	76	123	47	61.8%
7 Kaimuki	3,111	5,144	2,033	65.3%	2,721	4,471	1,750	64.3%
8 Manoa	1,647	2,378	731	44.4%	1,989	2,869	880	44.2%
9 Nuuanu	6,735	9,500	2,765	41.1%	3,398	4,728	1,330	39.1%
10 Kalihi	5,774	6,027	253	4.4%	5,065	5,293	228	4.5%
11 Iwilei	6,506	4,311	(2,195)	-33.7%	1,082	670	(412)	-38.1%
12 Airport PH	5,671	4,010	(1,661)	-29.3%	840	594	(246)	-29.3%
13 Salt Lake	8,370	7,860	(510)	-6.1%	246	235	(11)	-4.5%
14 PC Aiea	12,836	16,156	3,320	25.9%	831	1,050	219	26.4%
15 Waipahu	12,319	7,744	(4,575)	-37.1%	680	666	(14)	-2.1%
16 Mililani	15,649	16,118	469	3.0%	1,195	1,235	40	3.3%
17 Ewa	20,845	9,916	(10,929)	-52.4%	450	507	57	12.7%
18 Waianae	13,041	10,117	(2,924)	-22.4%	119	92	(27)	-22.7%
19 NorthShore	2,887	2,934	47	1.6%	285	290	5	1.8%
20 Koolauloa	4,798	5,490	692	14.4%	-	-	-	n/a
21 Kaneohe	8,202	8,066	(136)	-1.7%	976	960	(16)	-1.6%
22 Kailua	7,825	8,822	997	12.7%	1,276	1,440	164	12.8%
23 E Honolulu	6,218	8,495	2,277	36.6%	532	727	195	36.7%
Total	166,873	154,974	(11,899)	-7.1%	32,285	39,833	7,548	23.4%

Appendix M

Conceptual Water Master Plan

Conceptual Water Master Plan for the Hoopili Project in Ewa, Oahu

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November 2007

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Introduction

The proposed Hoopili project would consist of residential, commercial, industrial, mixed uses, parks, and public facilities on 1555 acres of land in Ewa, Oahu. Figure 1 is a conceptual land use plan for the project which would be undertaken by the D.R. Horton-Schuler Division. It is the intention of the developer to use non-potable water for irrigation to limit the project's use of potable water.

This conceptual water master plan identifies the required supply and offsite water system infrastructure for both the potable and non-potable systems. Because the present land use plan is conceptual in nature and the project's interior roadways have not yet been defined, sizing and analyses of the project's interior distribution mains are not presented herein.

Delineation of Service Pressure Zones

Potable System. The potable system would be built to Honolulu Board of Water Supply (BWS) standards and dedicated to that agency. To incorporate the Hoopili system into that of BWS, two service pressure zones would be created: a lower, 228-foot zone to match existing BWS storage reservoirs in Kunia and Honouliuli; and an upper service zone, tentatively selected at 440-foot elevation. Depending on land acquisition and other issues that will be evaluated subsequently, the upper service zone may use a 395- rather than 440-foot tank spillway elevation. Figure 2 shows the boundary of the two service pressure zones. About two-thirds of the project area is in the upper service zone.

Non-Potable System. At present, BWS' regional non-potable system does not serve the Hoopili project area. As such, the Hoopili non-potable system would be privately owned and operated at least initially. However, to make future dedication to BWS possible if and when the BWS regional system is expanded, the private Hoopili system would use a compatible service zone delineation. For the purposes of this conceptual water master plan, it is assumed that the non-potable system's service zone delineation would be identical to the potable system: a lower 228-foot; and an upper 440-foot zone. It is recognized that the lower zone may ultimately be based on a 215- rather than 228-foot tank.

Projected Potable and Non-Potable Supply Requirements

Table 1 summarizes water use demand factors and infrastructure sizing criteria that are the basis of this master plan. The water use criteria are identical to those formulated by BWS and incorporated into the Ewa Water Master Plan done by the Ewa Plain Water Development Corporation (EPWDC) in 1987. These criteria allow for a difference between water use and water demand. The water use amount establishes the well supply requirement. Water demand is nominally 20 percent greater than water use and it is the basis of reservoir and pipeline sizing. The infrastucture sizing criteria reflect the fact that the non-potable system will initially be supplied by direct pumping without reservoir storage.

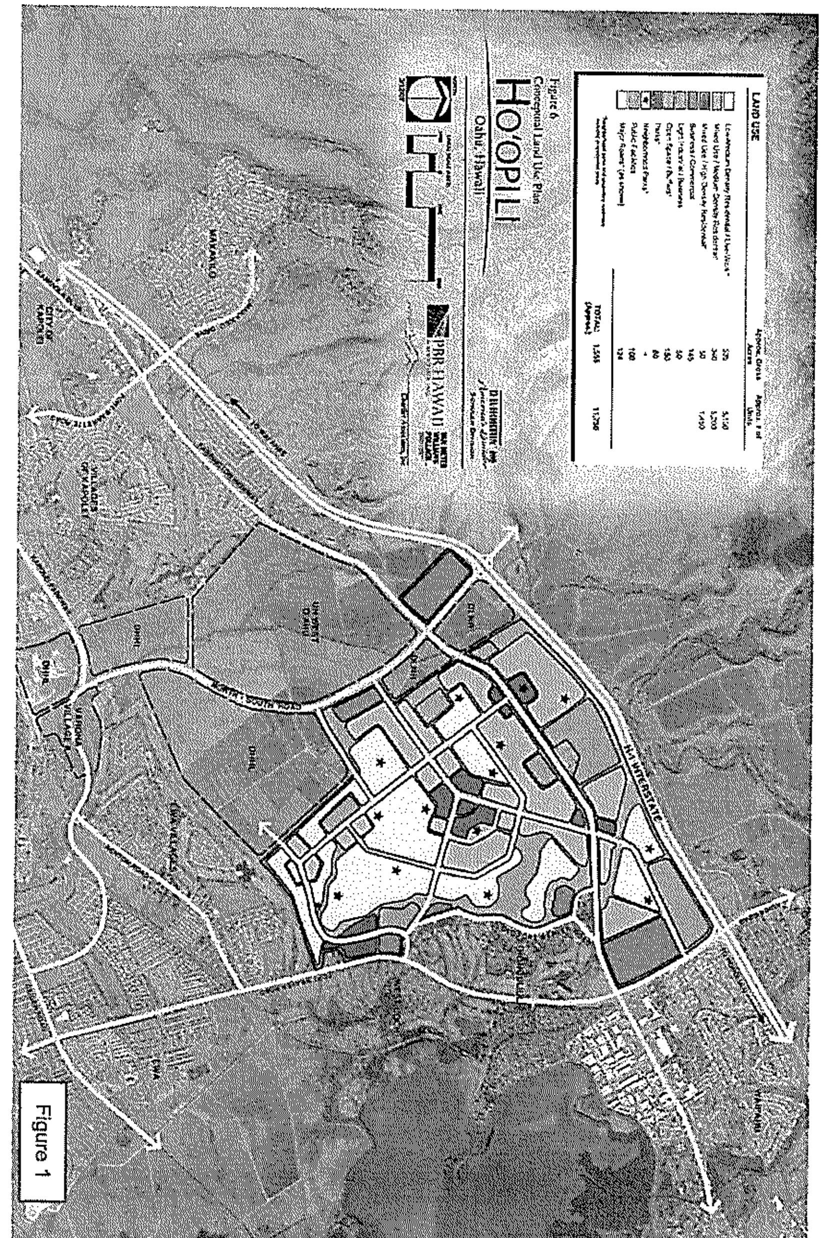


Figure 1

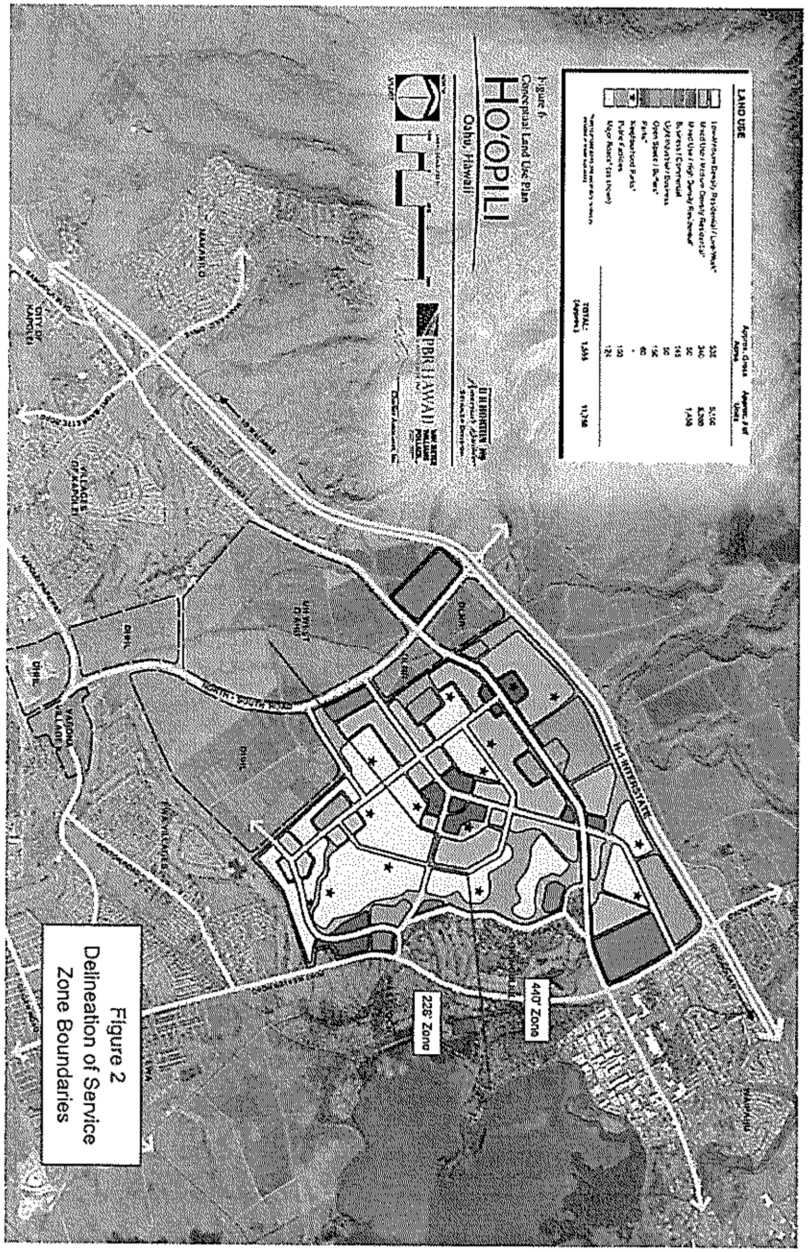


Figure 2
Delineation of Service Zone Boundaries

Table 1. Summary of Water System Design Criteria

WATER USE CRITERIA

Land Use	Unit	All Potable System	Dual System: Average Water Use – Potable	Dual System: Average Water Use – Non-Potable	Dual System: Average Daily Demand – Potable	Dual System: Average Daily Demand – Non-Potable
Residential						
Single Family	GPD / Unit	500	345	155	414	186
Multi-Family Low Rise	GPD / Unit	400	276	124	331	149
Multi-Family High Rise	GPD / Unit	300	207	93	248	112
Commercial	GPD / Acre	3,000	1,800	1,200	2,160	1,440
Resort	GPD / Unit	350	203	147	244	176
	GPD / Acre	4,000	2,320	1,680	2,784	2,016
Golf Course and Parks	GPD / Acre	4,000	600	3,400	720	4,080
School	GPD / Student	60	35	25	42	30
Industrial	GPD / Acre	4,000	1,184	2,816	1,421	3,379
Commercial / Industrial	GPD / 1,000 Ft^2	100	60	40	72	48
Commercial / Residential	GPD / 1,000 Ft^2	120	83	37	100	44

PIPELINE, STORAGE, AND WELL PUMP SIZING CRITERIA

1. Demand Factors

   a. AVERAGE DAY DEMAND. For land uses served by a dual system, a 1.2 factor is applied to the AVERAGE WATER USE rates to derive the AVERAGE DAY DEMAND. For land uses served only by the potable system, AVERAGE WATER USE and AVERAGE DAY DEMAND are identical.

   b. MAXIMUM DAY DEMAND = (1.5) AVERAGE DAY DEMAND.
   c. PEAK HOUR RATE = (3.0) AVERAGE DAY DEMAND

   (Note: Peak rate in the non-potable pipelines is defined as delivery of the Maximum Day Demand in a 12-hour period. This is equivalent to 3.0 times the Average Demand).

2. Fire protection will be provided by the potable system.

3. Reservoir Storage:

   a. The potable reservoir storage volume shall be equivalent to the maximum day demand.
   b. The private non-potable system will be supplied by direct well pumping with no reservoir storage.

4. Potable and non-potable pipelines shall be sized for PEAK HOUR flowrates with a minimum residual pressure of 40 psi and maximum velocity in the main of 6 feet per second (fps) for potable lines and 8 fps for non-potable lines. Hydraulic analyses will utilize tank spillway elevations as the initial hydraulic grade line elevations. Pipelines providing fire protection shall also be sized for MAXIMUM DAY flow plus fire flow with a residual of 20 psi at the critical fire hydrant. Hydraulic analyses will use three-quarters full tank water surface elevations as initial hydraulic grade line elevations.

5. Well pumps for potable system shall provide MAXIMUM DAY DEMAND in an operating time of 16 hours with the largest pump unit as standby. The well pumps for the private non-potable systems shall provide the MAXIMUM DAY DEMAND in a time of 12 hours with the largest pump as standby.

Based on the land use plan shown on Figure 1 and the water use criteria in Table 1, the Hoopili project's potable and non-potable water use and water demand totals are summarized below. The total potable supply requirement for both service zones is 3.87 MGD. It has been reduced by 1.75 MGD by the commitment to install a dual water system in both service zones throughout the project

Projected Average Potable Water Use and Average Potable Water Demand

Service Pressure Zone	Average Water Use (MGD)	Average Water Demand (MGD)
440-Foot	2.96	3.52
228-Foot	0.91	1.02
Both Zones	3.87	4.54

Projected Average Non-Potable Water Use and Average Non-Potable Demand

Service Pressure Zone	Average Water Use (MGD)	Average Water Demand (MGD)
440-Foot	1.44	1.74
228-Foot	0.31	0.37
Both Zones	1.75	2.11

Potable System

Well Supply. At full build-out, the Hoopili project will require an average potable well supply of 3.87 MGD. It is intended that the well supply would be provided from existing BWS sources with the developer paying the appropriate Facilities Charges. BWS' Ewa Shaft (State No. 2202-21) has a permitted use of 12.154 MGD and its entire allocation has been committed to development in the Ewa Development Plan area on a first-come, first-serve basis. Depending on the remaining unallocated supply from the Ewa Shaft at the time the Hoopili project is built-out, other BWS sources may also provide some of the supply. These other sources may include existing BWS wells in Waipahu that serve the Ewa area and/or a desalinization plant at the makai end of Campbell Industrial Park.

Reservoir Storage. Storage for the Hoopili project will be required in the 440- and 228-foot service zones. Required storage in the 440-foot zone is 5.28 million gallons (MG), the project's maximum day demand at full build-out. A 5.5 MG tank would be installed next to the existing 1.0 MG Honouliuli 440 tank to meet this requirement.

Required reservoir storage in the 228-foot service zone, again based on maximum day demand at full build-out, is 1.53 MG. BWS owns a site next to its existing 5.0 MG Honouliuli 228 tank which is large enough for a 5.5 MG tank. Ultimately, BWS will install a large storage tank at this site funded by Facilities Charges it collects. The Hoopili project will pay the applicable portion of Facilities Charges for storage as its contribution to the construction of that storage reservoir.

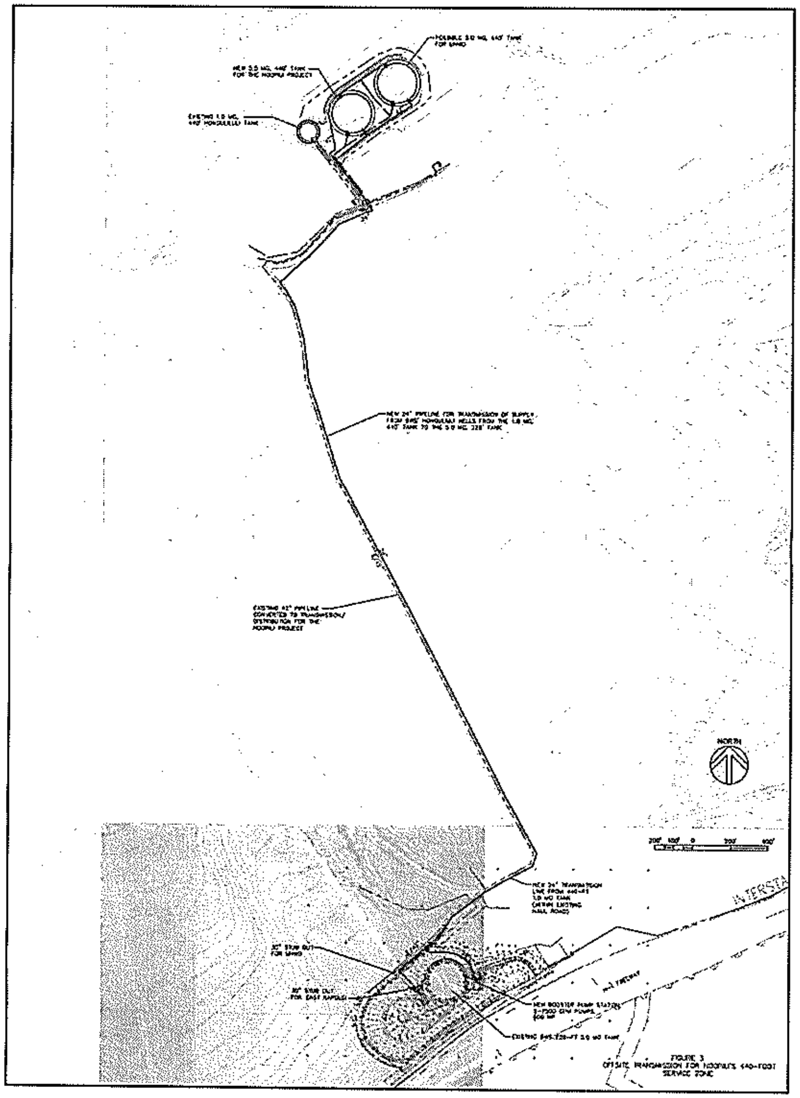
Offsite Transmission for the 440-Foot Service Zone. Figure 3 illustrates how transmission from the new 5.5 MG, 440-foot tank to the Hoopili project makai of H-1 freeway would be accomplished. It consists of the following:

- The 42-inch main between the existing Honouliuli 440 and Honouliuli 228 tanks would be converted to a transmission/distribution main for the Hoopili project. The mauka-makai transmission of water from BWS' Honouliuli wells between the 440 and 228 tanks would occur through a new 24-inch pipeline installed by the Hoopili developer. The size of the existing 42-inch pipeline was selected when it was anticipated that the Honouliuli Well Fields (Honouliuli Wells I and II) would ultimately consist of 12 wells with a combined pumping capacity of 21,000 GPM. With BWS' acquisition of the Ewa Shaft, the Honouliuli Well fields will not be expanded beyond their present six wells and combined 7875 GPM pumping capacity. A 24-inch pipeline will provide adequate capacity for these six wells.

- A new booster pump station would be installed at the existing Honouliuli 228 tank site to deliver water via the existing 42-inch pipeline up to the new Honouliuli 440 tank. As water in the 440 tank would "float" on the system, separate inflow and outflow would be installed at the tank to create positive turnover in the tank.

- Makai of the Honouliuli 228-foot tank, the transmission pipeline would be sized for the project's requirements in the 440-foot zone. Tentatively, the size of the pipeline beneath H-1 freeway to Farrington Highway would be 30-inch. Two routes for the pipeline have been preliminarily investigated, tunneling beneath the freeway or running the line back (east) to and beneath the Honouliuli Gulch Bridge. If there is insufficient space to go beneath the bridge, the tunneling option would be selected. BWS may consider oversizing the 30-inch pipe for use by other projects in the 440-foot zone.

Proposed University of Hawaii West Oahu (UHWO) 440'-System. A 440-foot service zone to serve the UHWO campus is currently in the preliminary design stage. There have been discussions between UHWO and Hoopili regarding combining the offsite elements of both 440-foot zone systems. Such a combination may include the following:



- UHWO, which has a 5.0 MG storage requirement in the 440-foot zone, would build its tank next to the existing 1.0 MG Honouliuli 440 and proposed 5.5 MG 440 tank for Hoopili.

- UHWO and Hoopili would share in the construction of the booster station at the 5.0 MG Honouliuli 228 tank and the 24-inch mauka-makai transmission pipeline described above.

- The existing 42-inch main, which will be converted for use by Hoopili, would have adequate capacity for the UHWO project as well.

- Transmission/distribution to UHWO from the site of the Honouliuli 228 tank could either run on the mauka side of H-1 freeway or participate with Hoopili in a route beneath H-1 freeway.

Offsite Transmission for the 228-Foot Service Zone. Existing transmission for the 228-foot service zone on the east side of the Ewa Plain is provided by a 42-inch pipeline which runs from the 5.0 MG Honouliuli 228 tank back to and beneath the Honouliuli Gulch Bridge. It then takes a diagonal path to the intersection of Farrington Highway and "Pipeline" Road and then goes down Pipeline Road to users. The pipeline was installed by EPWDC in the 1980s and has no available capacity for the Hoopili project. Hoopili's requirements in the 228-foot zone are relatively modest, an average demand of 1.02 MGD and peak of 3.06 MGD. A new pipeline, tentatively selected to be 20-inch, would be installed from the Honouliuli 228 tank across or beneath H-1 freeway (the pipe size is discussed in a section following). As with the pipeline from the 440-foot tank(s), the crossing of H-1 freeway would either be by a tunnel beneath the freeway or the longer route back to and beneath the Honouliuli Gulch Bridge. BWS may also elect to oversize this pipeline.

Relocation of the Existing 42-Inch, 228-Foot Service Zone Pipeline. The existing 42-inch main down Pipeline Road cuts across Hoopili development areas and is not aligned with the project's major roadways. Realignment of major sections of the 42-inch main and/or adjustments to the land use plan will be necessary.

Hydraulic Analyses. As this water master plan is based on a conceptual land use plan, the roadways and distribution pipelines within the Hoopili project are not yet defined. Service to Hoopili's 440-foot zone would essentially be a stand-alone system. As such, its hydraulic analysis can be deferred until after the land use plan is finalized. Hoopili's 228-foot zone would be incorporated into BWS' Fort Weaver Road corridor system. Even at the present conceptual land use plan level, it is important to demonstrate that the addition of the Hoopili project will not adversely impact service to present and future customers in the Fort Weaver Corridor and in Kapolei and Barbers Point. Details of these analyses are presented in Appendices A, B, and C and can be summarized as follows:

- Appendix A illustrates the hydraulic model used for the simulations, including a new 20-inch pipeline for Hoopili's 228-foot service zone.

- Appendix B is a simulation for "existing" conditions in BWS' system in the Fort Weaver corridor. It includes full build-out of the Ewa by Gentry and Ocean Pointe projects. For continuity and clarity, this computer run is identical to the simulation in Appendix A of the "November 2006 Potable and Non-Potable Water Master Plans for the Ocean Pointe Project in Ewa, Oahu". Details of the assumptions incorporated in this analysis are explained in that report.

- Appendix C is simulation with the addition of a 20-inch pipeline to and through Hoopili's 228-foot zone to BWS' Fort Weaver Corridor system.

The simulation results in Appendix C demonstrate that a 20-inch pipeline from the Honouliuli 228 tank down to and through Hoopili's 228-foot service zone, with two points of connection to the existing 42-inch pipeline, would decrease flow and velocities in the 42-inch main and increase delivery pressures to customers in the lower portion of BWS' 228-foot service zone by about two (2) psi.

Non-Potable System

Well Supply. At least until BWS' regional non-potable system is expanded to include the Hoopili project area, supply for its non-potable system would be provided from the battery of wells commonly known as EP 5 & 6 and identified as State Well Nos. 2202-03 to 14 (old Well Nos. 259 A to L). This battery consists of 12 wells which were drilled in 1896-97. All of the wells have 12-inch casing to 70-foot depths and total depths which vary between 303 and 312 feet. The lower 233 to 242 feet of the wells are open hole. Nominal ground elevation at the well battery is 50 feet.

The battery has two 36-inch pipe manifolds, each of which connects six wells to a common header which delivers water into a square-shaped and very deep concrete vault (the vault is 22 feet on a side and 48 feet deep). The two manifold pipelines enter the vault on opposite sides and each has its own isolation gate valve in the vault. At the close of plantation operations in the 1990s, a 4500 GPM end suction pump was connected to one of the manifolds (EP 5) and a 5600 GPM end suction pump was connected to the other (EP 6). Their combined pumping capacity of 10,100 GPM (14.5 MGD) is far greater than would be required for the Hoopili project.

At present, smaller-sized, end suction pumps are connected to the manifolds and these provide agricultural irrigation for Aloun Farms in the area of the Hoopili project. To convert the EP 5 & 6 facility for use by the Hoopili project, the following would be done:

- The present end-suction pumps, electrical equipment, and all piping (back to the incoming isolation valves) would be removed from the vault.

- As best as can be determined from measurements and old records, the bottom of the vault is on the order of two to three feet above sea level. The piezometric head in the volcanics tapped by the 12 wells is 17 to 18 feet above sea level. The isolation valves on both manifolds would be opened, thereby filling the vault and creating a sump with a water depth on the order of 14 to 16 feet.

- Two pump stations, one for each of Hoopili's two service pressure zones, would be installed at ground level over the vault. Each station would have multiple line shaft turbine pumps and automated start/stop operation based on service pressure. Their operation would be essentially identical to golf course pump stations.

- Based on BWS' design criteria and the fact that the system would initially have no reservoir storage, the well pumping capacity would be selected to provide the maximum day supply requirement in a 12-hour period. This conforms with BWS' Non-Potable Water System Planning Factors and Design Standards (Revised November 3, 2006). Based on this, the station pumping capacities that would be installed for the Hoopili project would be as follows:

Service Pressure Zone	Average Demand (MGD)	Station Pumping Capacity	
		Required MGD	Nominal GPM
228	1.74	5.22	3700
440	0.37	1.11	800

Water Use Permit (WUP) for EP 5 & 6. There are three former plantation well batteries along old Fort Weaver Road in lower Honouliuli. In addition to EP 5 & 6, the other two well batteries are EP 3 & 4 (State Nos. 2102-02 and 04-22) and EP 7 & 8 (State Nos. 2202-15 to 20). In January 2000, the Commission on Water Resource Management (CWRM) revoked the individual WUPs for these three batteries and reconsolidated them under one new permit, WUP No. 805. The permitted use of 7.969 MGD under WUP No. 805 can be drawn from any of the well batteries but the use is specifically limited to agriculture. Landscape irrigation of an urbanized area such as the Hoopili project does not qualify as an agricultural use. It will be necessary to modify WUP No. 805 or to obtain a new permit for Hoopili's non-potable use. CWRM's processing procedures are the same for a WUP modification as they are for obtaining a new permit. Based on the project's current concept plan, the required permitted use for Hoopili would be 1.75 MGD. The remaining amount of WUP 805 would not be needed by the project and would become available for other users in the Waipahu-Waiawa Aquifer System. Use of the EP 3 & 4 and EP 7 & 8 well batteries would also no longer be needed as all of the project's non-potable supply would be drawn from the EP 5 & 6 well battery.

Reservoir Storage. Unless and until BWS' regional non-potable system is expanded to provide service to the Hoopili project area, the non-potable system would have direct pumping from EP 5 & 6 with no reservoir storage.

Transmission/Distribution Pipelines in the Lower (215- or 228-Foot) Service Zone. BWS' (draft) Ewa Non-Potable Water Master Plan envisions the installation of a storage reservoir on the west side of the North-South Road and on the makai side of H-1 freeway. The tank would have a 215- or 228-foot spillway elevation. This possible storage tank location is on the opposite side of the Hoopili project from the EP 5 & 6 well battery (EP 5 & 6 is on the eastern edge of the project site and just off old Fort Weaver Road). To enable the initial, pumped delivery system using EP 5 & 6 to be compatible with BWS' expansion of its regional non-potable system, all pipelines would meet BWS' construction standards and their sizes would be selected for both pumped delivery from EP 5 & 6 and gravity delivery from BWS' North-South Road Reservoir.

Transmission/Distribution Pipelines in the Upper (440-Foot) Service Zone. BWS' (draft) Ewa Non-Potable Water Master Plan does not include an upper service zone above the North-South Road Reservoir. If one were to be constructed, a tank mauka of H-1 freeway and booster pumping to it would be required. In addition to Hoopili, such an upper system could also serve UH West Oahu and the State DLNR parcels adjacent to Farrington Highway. As with the lower service zone system, Hoopili's non-potable pipelines in its upper service zone would meet BWS standards and would be sized for both pumped supply from EP 5 & 6 and gravity delivery from a possible BWS reservoir on the mauka side of H-1.

Appendix A

Hydraulic Model for Simulations of BWS' 228-Foot Service Zone in the Fort Weaver Corridor

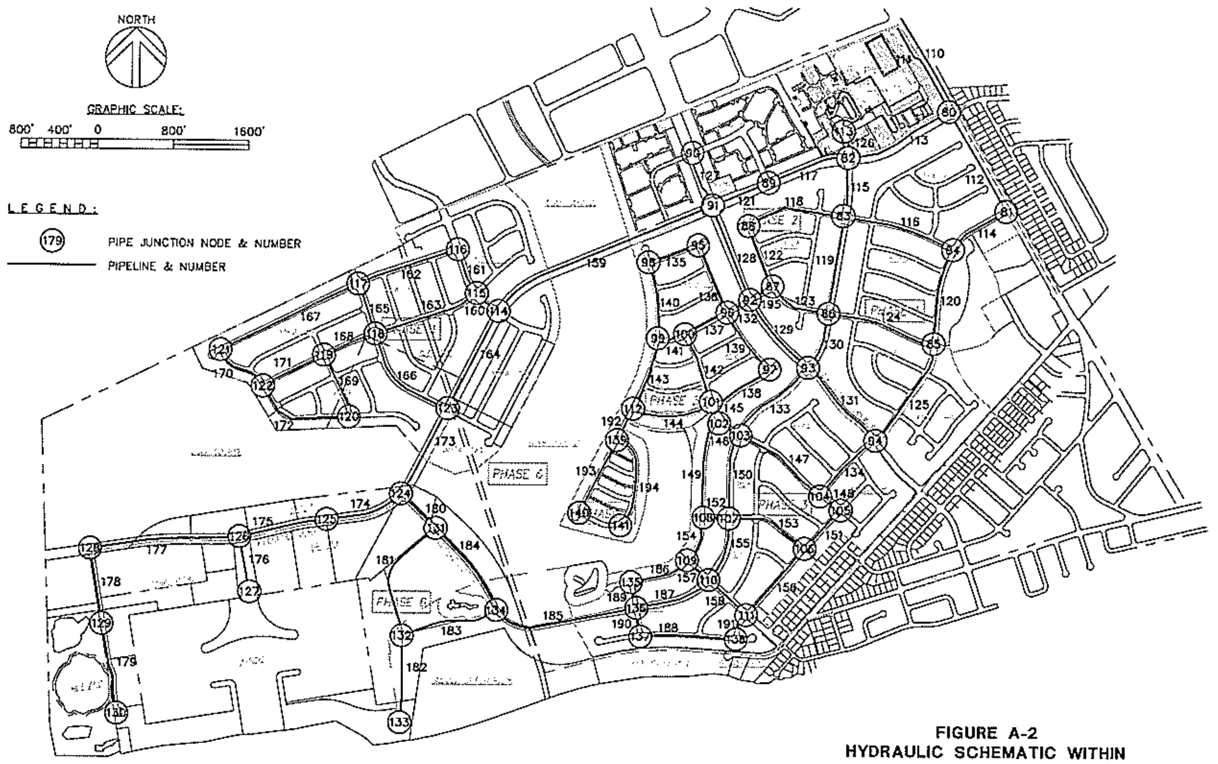


FIGURE A-2
HYDRAULIC SCHEMATIC WITHIN OCEAN POINTE

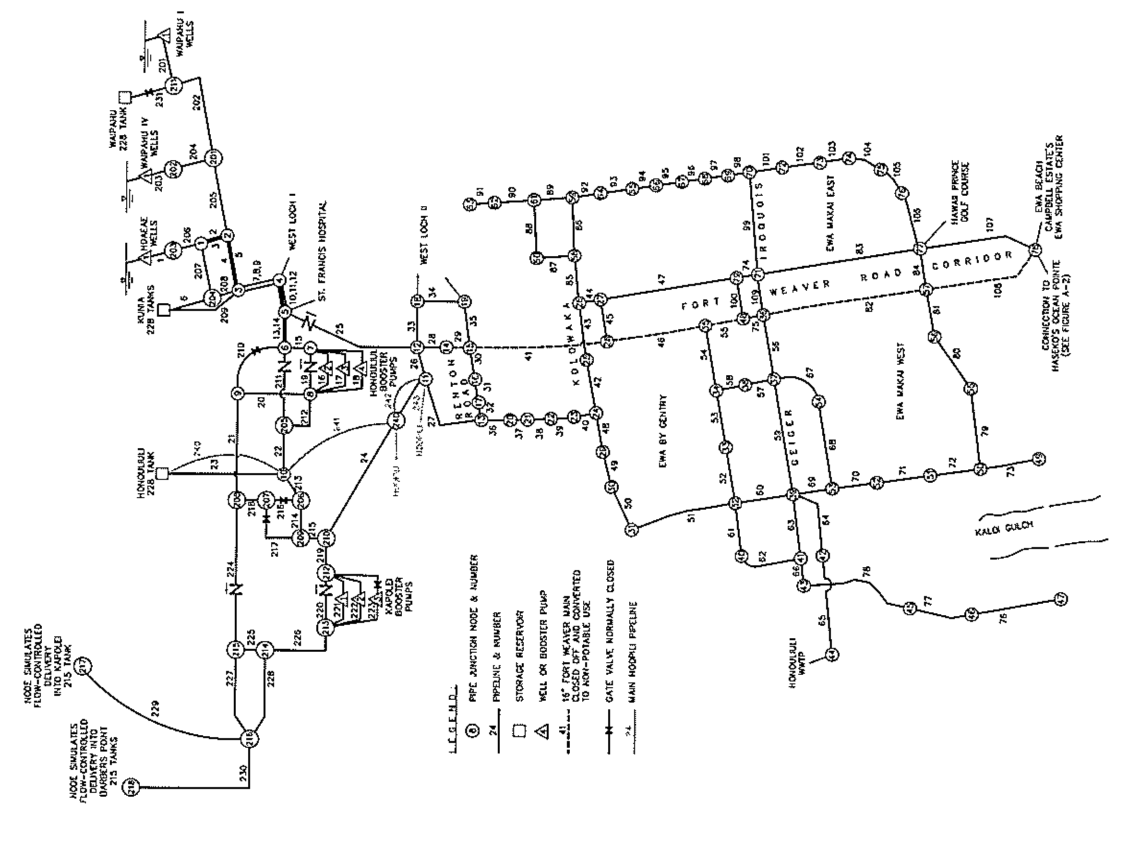


FIGURE A-1
HYDRAULIC MODEL OF THE BWS SYSTEM IN THE FORT WEAVER CORRIDOR

Appendix B

Computer Simulation of "Existing Conditions" in BWS' 228-Foot Service Zone in the Fort Weaver Corridor

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JOB NAME =

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* * * * * * * * * *   K Y P I P E 2   * * * * * * * * * *
*   University of Kentucky Hydraulic Analysis Program   *
* Distribution of Pressure and Flows in Piping Networks *
*        1000 PIPE VERSION - 1.10   (08/25/92)          *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

DATE: 3/17/2003
TIME: 10:50:11

INPUT DATA FILENAME -------------- OP2003.DAT
TABULATED OUTPUT FILENAME -------- OP2003.OUT
POSTPROCESSOR RESULTS FILENAME --- OP2003.RES

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************************************************
S U M M A R Y   O F   O R I G I N A L   D A T A
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U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (ft)
1-FGPU	0	1	30.0	36.0	130.00	.00	10.00
2	1	2	1000.0	30.0	130.00	.00	
3	1	2	1000.0	12.0	110.00	.00	
4	2	3	2500.0	36.0	130.00	.00	
5	2	3	2500.0	30.0	130.00	.00	
6-FG	0	3	2600.0	20.0	120.00	.00	223.00
7	3	4	1350.0	36.0	130.00	.00	
8	3	4	1350.0	30.0	130.00	.00	
9	3	4	1350.0	20.0	120.00	.00	
10	4	5	1650.0	36.0	130.00	.00	
11	4	5	1650.0	30.0	130.00	.00	
12	4	5	1650.0	20.0	120.00	.00	
13	5	6	1850.0	36.0	130.00	.00	
14	5	6	1850.0	30.0	130.00	.00	
15	6	7	370.0	30.0	130.00	.00	

16-PU	7	8	20.0	30.0	130.00	.00	
17-PU	7	8	20.0	30.0	130.00	.00	
18-PU	7	8	20.0	30.0	130.00	.00	
19-CV	7	8	20.0	30.0	130.00	.00	
20	8	9	70.0	30.0	130.00	.00	
21	9	10	3000.0	30.0	130.00	.00	
22	9	10	3000.0	30.0	130.00	.00	
23-FG	0	10	4530.0	42.0	130.00	.00	223.00
24	10	11	8250.0	42.0	130.00	.00	
25-CV	5	12	7150.0	16.0	120.00	.00	
26	11	12	1900.0	16.0	120.00	.00	
27	11	13	3750.0	42.0	130.00	.00	
28	12	14	2850.0	16.0	120.00	.00	
29-XX	14	15	650.0	16.0	120.00	.00	
30	16	15	1300.0	16.0	120.00	.00	
31	17	16	700.0	16.0	120.00	.00	
32	13	17	200.0	16.0	120.00	.00	
33	12	18	2000.0	12.0	110.00	.00	
34	18	19	1800.0	12.0	110.00	.00	
35	15	19	3200.0	12.0	110.00	.00	
36	13	20	1250.0	36.0	130.00	.00	
37	20	21	230.0	36.0	130.00	.00	
38	21	22	200.0	36.0	130.00	.00	
39	22	23	200.0	36.0	130.00	.00	
40	23	24	380.0	36.0	130.00	.00	
41-XX	15	28	2480.0	16.0	120.00	.00	
42	24	25	1100.0	36.0	130.00	.00	
43	25	26	180.0	30.0	130.00	.00	
44	26	27	100.0	36.0	130.00	.00	
45	28	27	150.0	16.0	120.00	.00	
46-XX	28	35	2000.0	16.0	120.00	.00	
47	27	79	2450.0	36.0	130.00	.00	
48	24	29	110.0	16.0	120.00	.00	
49	29	30	730.0	12.0	110.00	.00	
50	30	31	970.0	12.0	110.00	.00	
51	31	32	1700.0	12.0	110.00	.00	
52	33	32	570.0	12.0	110.00	.00	
53	34	33	580.0	12.0	110.00	.00	
54	35	34	800.0	12.0	110.00	.00	
55-XX	35	48	730.0	16.0	120.00	.00	
56	36	37	700.0	12.0	110.00	.00	
57	38	37	350.0	12.0	110.00	.00	
58	34	38	700.0	12.0	110.00	.00	
59	37	39	1300.0	12.0	110.00	.00	
60	32	39	870.0	12.0	110.00	.00	
61	32	40	1140.0	12.0	110.00	.00	
62	40	41	1150.0	12.0	110.00	.00	
63	39	41	1390.0	12.0	110.00	.00	
64	39	42	1480.0	12.0	110.00	.00	
65	42	44	122.0	12.0	110.00	.00	
66	41	43	890.0	16.0	120.00	.00	
67	37	54	1000.0	12.0	110.00	.00	
68	54	53	1030.0	12.0	110.00	.00	
69	53	39	730.0	12.0	110.00	.00	
70	53	52	805.0	12.0	110.00	.00	

71	52	51	400.0	12.0	110.00	.00
72	50	51	580.0	12.0	110.00	.00
73	50	49	965.0	12.0	110.00	.00
74	79	71	150.0	36.0	130.00	.00
75-XX	48	36	170.0	16.0	120.00	.00
76	46	47	1390.0	8.0	110.00	.00
77	45	46	1390.0	12.0	110.00	.00
78	43	45	1390.0	12.0	110.00	.00
79	55	50	1015.0	12.0	110.00	.00
80	56	55	1000.0	12.0	110.00	.00
81	57	56	465.0	12.0	110.00	.00
82-XX	36	57	2000.0	16.0	120.00	.00
83	71	77	2000.0	36.0	130.00	.00
84	77	57	150.0	12.0	110.00	.00
85	26	58	360.0	12.0	110.00	.00
86	58	59	630.0	12.0	110.00	.00
87	58	60	650.0	8.0	110.00	.00
88	60	61	650.0	8.0	110.00	.00
89	59	61	550.0	12.0	110.00	.00
90	61	62	720.0	12.0	110.00	.00
91	62	63	950.0	12.0	110.00	.00
92	59	64	310.0	12.0	110.00	.00
93	64	65	420.0	12.0	110.00	.00
94	65	66	320.0	12.0	110.00	.00
95	67	66	570.0	12.0	110.00	.00
96	68	67	400.0	12.0	110.00	.00
97	69	68	250.0	12.0	110.00	.00
98	70	69	330.0	12.0	110.00	.00
99	71	70	1320.0	12.0	110.00	.00
100	79	48	40.0	16.0	120.00	.00
101	70	72	410.0	12.0	110.00	.00
102	72	73	390.0	12.0	110.00	.00
103	73	74	780.0	12.0	110.00	.00
104	75	74	465.0	12.0	110.00	.00
105	76	75	810.0	12.0	110.00	.00
106	77	76	700.0	12.0	110.00	.00
107	77	78	1580.0	36.0	130.00	.00
108-XX	57	78	1580.0	16.0	120.00	.00
109	71	36	210.0	12.0	110.00	.00
110	78	80	900.0	20.0	120.00	.00
111	78	80	900.0	12.0	110.00	.00
112	80	81	1210.0	20.0	120.00	.00
113	80	82	1200.0	16.0	120.00	.00
114	81	84	710.0	16.0	120.00	.00
115	82	83	650.0	8.0	110.00	.00
116	84	83	1200.0	8.0	110.00	.00
117	82	89	1530.0	16.0	120.00	.00
118	83	85	1030.0	8.0	110.00	.00
119	84	86	1050.0	16.0	120.00	.00
120	89	90	1070.0	12.0	110.00	.00
121	90	87	950.0	12.0	110.00	.00
122	85	87	620.0	8.0	110.00	.00
123	86	85	1150.0	8.0	110.00	.00
124	87	88	1050.0	8.0	110.00	.00
125	86	88	1200.0	16.0	120.00	.00

126	90	91	790.0	8.0	110.00	.00
127	87	93	1030.0	12.0	110.00	.00
128	88	94	820.0	16.0	120.00	.00
129	91	92	810.0	8.0	110.00	.00
130	92	93	410.0	8.0	110.00	.00
131	93	94	1100.0	8.0	110.00	.00
132	94	95	280.0	16.0	110.00	.00
133	93	100	900.0	12.0	110.00	.00
134	95	101	540.0	12.0	110.00	.00
135	100	101	900.0	8.0	110.00	.00
136	100	102	720.0	12.0	110.00	.00
137	101	103	950.0	12.0	110.00	.00
138	102	103	560.0	12.0	110.00	.00
139	103	104	380.0	8.0	110.00	.00
140	102	105	840.0	16.0	120.00	.00
141	105	107	940.0	16.0	120.00	.00
142	107	109	1400.0	16.0	120.00	.00
143	109	110	620.0	16.0	120.00	.00
144	104	106	700.0	8.0	110.00	.00
145	106	108	1300.0	8.0	110.00	.00
146-XX	108	110	2050.0	8.0	110.00	.00
147	110	111	1400.0	16.0	120.00	.00
148	91	96	300.0	8.0	110.00	.00
149	96	97	780.0	8.0	110.00	.00
150	92	97	870.0	8.0	110.00	.00
151	97	98	380.0	8.0	110.00	.00
152	98	99	880.0	8.0	110.00	.00
153	98	99	1440.0	8.0	110.00	.00
154	89	112	970.0	20.0	120.00	.00
155	112	113	2420.0	20.0	120.00	.00
156	113	114	900.0	20.0	120.00	.00
157	114	115	2250.0	16.0	120.00	.00
158	115	116	1760.0	16.0	120.00	.00
159	116	117	1350.0	16.0	120.00	.00
160	117	118	1080.0	16.0	120.00	.00

P U M P D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
415.00	.00
230.00	6700.00
105.00	9450.00

THERE IS A PUMP IN LINE 16 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 17 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

THERE IS A PUMP IN LINE 18 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
150.00	.00
110.00	5000.00
45.00	8200.00

J U N C T I O N N O D E D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES					
1		.00	120.00	1	2	3			
2		.00	75.00	2	3	4	5		
3		.00	77.00	4	5	6	7	8	9
4		958.00	50.00	7	8	9	10	11	12
5		208.00	85.00	10	11	12	13	14	25
6		.00	95.00	13	14	15			
7		.00	98.00	15	16	17	18	19	
8		.00	98.00	16	17	18	19	20	
9		.00	102.00	20	21	22			
10		20830.00	175.00	21	22	23	24		
11		.00	55.00	24	26	27			
12		471.00	25.00	25	26	28	33		
13		312.00	45.00	27	32	36			
14		.00	45.00	28	29				
15		250.00	45.00	29	30	35	41		
16		334.00	45.00	30	31				
17		125.00	45.00	31	32				
18		469.00	20.00	33	34				
19		469.00	30.00	34	35				
20		243.00	38.00	36	37				
21		143.00	37.00	37	38				
22		143.00	36.00	38	39				
23		144.00	35.00	39	40				
24		.00	34.00	40	42	48			
25		.00	33.00	42	43				
26		.00	28.00	43	44	85			

27	.00	28.00	44	45	47		
28	.00	27.00	41	45	46		
29	199.00	35.00	48	49			
30	373.00	36.00	49	50			
31	429.00	37.00	50	51			
32	.00	34.00	51	52	60	61	
33	198.00	33.00	52	53			
34	183.00	31.00	53	54	58		
35	.00	34.00	46	54	55		
36	.00	34.00	56	75	82	109	
37	.00	34.00	56	57	59	67	
38	323.00	33.00	57	58			
39	.00	33.00	59	60	63	64	69
40	301.00	33.00	61	62			
41	.00	34.00	62	63	66		
42	42.00	34.00	64	65			
43	101.00	34.00	66	78			
44	1042.00	33.00	65				
45	219.00	30.00	77	78			
46	219.00	28.00	76	77			
47	198.00	25.00	76				
48	.00	35.00	55	75	100		
49	150.00	25.00	73				
50	178.00	26.00	72	73	79		
51	355.00	27.00	71	72			
52	.00	28.00	70	71			
53	70.00	29.00	68	69	70		
54	311.00	31.00	67	68			
55	199.00	27.00	79	80			
56	353.00	27.00	80	81			
57	.00	28.00	81	82	84	108	
58	.00	32.00	85	86	87		
59	.00	31.00	86	89	92		
60	166.00	31.00	87	88			
61	8.00	31.00	88	89	90		
62	127.00	32.00	90	91			
63	323.00	38.00	91				
64	180.00	30.00	92	93			
65	334.00	30.00	93	94			
66	525.00	30.00	94	95			
67	106.00	30.00	95	96			
68	106.00	30.00	96	97			
69	106.00	30.00	97	98			
70	.00	32.00	98	99	101		
71	.00	34.00	74	83	99	109	
72	422.00	32.00	101	102			
73	294.00	31.00	102	103			
74	228.00	30.00	103	104			
75	527.00	30.00	104	105			
76	193.00	29.00	105	106			
77	31.00	28.00	83	84	106	107	
78	4185.00	20.00	107	108	110	111	
79	.00	35.00	47	74	100		
80	.00	25.00	110	111	112	113	
81	29.80	25.00	112	114			

82	141.80	25.00	113	115	117	
83	274.60	25.00	115	116	118	
84	171.70	25.00	114	116	119	
85	213.80	25.00	118	122	123	
86	278.90	25.00	119	123	125	
87	197.60	25.00	121	122	124	127
88	91.50	25.00	124	125	128	
89	266.70	25.00	117	120	154	
90	229.60	25.00	120	121	126	
91	126.70	20.00	126	129	148	
92	72.80	20.00	129	130	150	
93	93.80	20.00	127	130	131	133
94	93.80	20.00	128	131	132	
95	44.60	20.00	132	134		
96	.00	20.00	148	149		
97	29.70	20.00	149	150	151	
98	68.80	20.00	151	152	153	
99	68.80	20.00	152	153		
100	85.90	20.00	133	135	136	
101	85.90	20.00	134	135	137	
102	36.70	15.00	136	138	140	
103	36.70	15.00	137	138	139	
104	.00	15.00	139	144		
105	183.30	15.00	140	141		
106	22.10	15.00	144	145		
107	170.50	15.00	141	142		
108	.00	15.00	145	146		
109	210.00	15.00	142	143		
110	121.50	15.00	143	146	147	
111	188.50	15.00	147			
112	179.20	25.00	154	155		
113	707.00	20.00	155	156		
114	527.30	20.00	156	157		
115	1059.20	15.00	157	158		
116	285.50	15.00	158	159		
117	165.70	15.00	159	160		
118	165.70	15.00	160			

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 10
MAXIMUM AND MINIMUM VELOCITIES = 10

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 160
NUMBER OF JUNCTION NODES ....(j) = 118
NUMBER OF PRIMARY LOOPS ....(l) = 40
NUMBER OF FIXED GRADE NODES ....(f) = 3
NUMBER OF SUPPLY ZONES ....(z) = 1

S I M U L A T I O N   R E S U L T S

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00302

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8647.38	.02	143.67	.00	2.73	.65
2	1	2	8036.31	1.39	.00	.00	3.65	1.39
3	1	2	611.06	1.39	.00	.00	1.73	1.39
4	2	3	5340.74	.67	.00	.00	1.68	.27
5	2	3	3306.64	.67	.00	.00	1.50	.27
6-FG	0	3	12802.12	71.41	.00	.00	13.07	27.47
7	3	4	11811.99	1.57	.00	.00	3.72	1.17
8	3	4	7313.19	1.57	.00	.00	3.32	1.17
9	3	4	2324.33	1.57	.00	.00	2.37	1.17
10	4	5	11284.43	1.77	.00	.00	3.56	1.07
11	4	5	6986.55	1.77	.00	.00	3.17	1.07
12	4	5	2220.52	1.77	.00	.00	2.27	1.07
13	5	6	12527.44	2.40	.00	.00	3.95	1.30
14	5	6	7756.07	2.40	.00	.00	3.52	1.30
15	6	7	20283.50	2.85	.00	.00	9.21	7.71
16-PU	7	8	6761.17	.02	77.94	.00	3.07	1.01
17-PU	7	8	6761.17	.02	77.94	.00	3.07	1.01
18-PU	7	8	6761.17	.02	77.94	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20283.50	.54	.00	.00	9.21	7.71
21	9	10	10141.75	6.41	.00	.00	4.60	2.14
22	9	10	10141.75	6.41	.00	.00	4.60	2.14
23-FG	0	10	23679.20	9.04	.00	.00	5.48	1.99
24	10	11	23132.70	15.76	.00	.00	5.36	1.91
25-XXCV	5	12						
26	11	12	1260.69	2.11	.00	.00	2.01	1.11
27	11	13	21872.01	6.46	.00	.00	5.06	1.72
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	398.31	.17	.00	.00	.64	.13
31	17	16	732.31	.28	.00	.00	1.17	.41
32	13	17	857.31	.11	.00	.00	1.37	.54
33	12	18	789.69	4.46	.00	.00	2.24	2.23
34	18	19	320.69	.76	.00	.00	.91	.42
35	15	19	148.31	.32	.00	.00	.42	.10

36	13	20	20702.70	4.12	.00	.00	6.53	3.29
37	20	21	20459.70	.74	.00	.00	6.45	3.22
38	21	22	20316.70	.64	.00	.00	6.40	3.18
39	22	23	20173.70	.63	.00	.00	6.36	3.14
40	23	24	20029.70	1.18	.00	.00	6.31	3.10
41-XX	15	28						
42	24	25	17955.43	2.78	.00	.00	5.66	2.53
43	25	26	17955.43	1.11	.00	.00	8.15	6.15
44	26	27	16197.92	.21	.00	.00	5.11	2.09
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	16197.92	5.12	.00	.00	5.11	2.09
48	24	29	2074.27	.31	.00	.00	3.31	2.80
49	29	30	1875.27	8.08	.00	.00	5.32	11.07
50	30	31	1502.27	7.12	.00	.00	4.26	7.34
51	31	32	1073.27	6.70	.00	.00	3.04	3.94
52	33	32	27.23	.00	.00	.00	.08	.00
53	34	33	225.23	.13	.00	.00	.64	.22
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	2004.88	8.77	.00	.00	5.69	12.53
57	38	37	-731.23	.68	.00	.00	2.07	1.94
58	34	38	-408.23	.46	.00	.00	1.16	.66
59	37	39	666.27	2.12	.00	.00	1.89	1.63
60	32	39	505.81	.85	.00	.00	1.43	.98
61	32	40	594.69	1.50	.00	.00	1.69	1.32
62	40	41	293.69	.41	.00	.00	.83	.36
63	39	41	443.31	1.06	.00	.00	1.26	.77
64	39	42	1084.00	5.94	.00	.00	3.07	4.01
65	42	44	1042.00	.45	.00	.00	2.96	3.73
66	41	43	737.00	.37	.00	.00	1.18	.41
67	37	54	607.38	1.37	.00	.00	1.72	1.37
68	54	53	296.38	.37	.00	.00	.84	.36
69	53	39	355.22	.37	.00	.00	1.01	.51
70	53	52	-128.85	.06	.00	.00	.37	.08
71	52	51	-128.85	.03	.00	.00	.37	.08
72	50	51	483.85	.52	.00	.00	1.37	.90
73	50	49	150.00	.10	.00	.00	.43	.10
74	79	71	16197.92	.31	.00	.00	5.11	2.09
75-XX	48	36						
76	46	47	198.00	1.72	.00	.00	1.26	1.24
77	45	46	417.00	.95	.00	.00	1.18	.68
78	43	45	636.00	2.08	.00	.00	1.80	1.49
79	55	50	811.85	2.38	.00	.00	2.30	2.35
80	56	55	1010.85	3.53	.00	.00	2.87	3.53
81	57	56	1363.85	2.85	.00	.00	3.87	6.14
82-XX	36	57						
83	71	77	13163.44	2.85	.00	.00	4.15	1.42
84	77	57	1363.85	.92	.00	.00	3.87	6.14
85	26	58	1757.51	3.53	.00	.00	4.99	9.82
86	58	59	1361.36	3.85	.00	.00	3.86	6.12
87	58	60	396.15	2.91	.00	.00	2.53	4.48
88	60	61	230.15	1.07	.00	.00	1.47	1.64
89	59	61	227.85	.12	.00	.00	.65	.22
90	61	62	450.00	.57	.00	.00	1.28	.79

91	62	63	323.00	.40	.00	.00	.92	.43
92	59	64	1133.51	1.35	.00	.00	3.22	4.36
93	64	65	953.51	1.33	.00	.00	2.70	3.16
94	65	66	619.51	.46	.00	.00	1.76	1.42
95	67	66	-94.51	.02	.00	.00	.27	.04
96	68	67	11.49	.00	.00	.00	.03	.00
97	69	68	117.49	.02	.00	.00	.33	.07
98	70	69	223.49	.07	.00	.00	.63	.22
99	71	70	1029.60	4.81	.00	.00	2.92	3.65
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	806.11	.95	.00	.00	2.29	2.32
102	72	73	384.11	.23	.00	.00	1.09	.59
103	73	74	90.11	.03	.00	.00	.26	.04
104	75	74	137.89	.04	.00	.00	.39	.09
105	76	75	664.89	1.31	.00	.00	1.89	1.62
106	77	76	857.89	1.82	.00	.00	2.43	2.60
107	77	78	10910.70	1.59	.00	.00	3.44	1.01
108-XX	57	78						
109	71	36	2004.88	2.63	.00	.00	5.69	12.53
110	78	80	5427.26	5.04	.00	.00	5.54	5.60
111	78	80	1298.44	5.04	.00	.00	3.68	5.60
112	80	81	3092.59	2.39	.00	.00	3.16	1.98
113	80	82	3633.11	9.48	.00	.00	5.80	7.90
114	81	84	3062.79	4.09	.00	.00	4.89	5.76
115	82	83	266.56	1.40	.00	.00	1.70	2.15
116	84	83	355.42	4.40	.00	.00	2.27	3.66
117	82	89	3224.76	9.69	.00	.00	5.15	6.34
118	83	85	347.37	3.62	.00	.00	2.22	3.51
119	84	86	2535.67	4.26	.00	.00	4.05	4.06
120	89	90	-131.54	.09	.00	.00	.37	.08
121	90	87	-472.25	.82	.00	.00	1.34	.86
122	85	87	467.44	3.77	.00	.00	2.98	6.09
123	86	85	333.86	3.75	.00	.00	2.13	3.26
124	87	88	-391.85	4.61	.00	.00	2.50	4.39
125	86	88	1922.91	2.92	.00	.00	3.07	2.43
126	90	91	111.11	.34	.00	.00	.71	.43
127	87	93	189.43	.16	.00	.00	.54	.16
128	88	94	1439.56	1.17	.00	.00	2.30	1.42
129	91	92	-78.16	.18	.00	.00	.50	.22
130	92	93	-255.69	.82	.00	.00	1.63	1.99
131	93	94	-335.07	3.61	.00	.00	2.14	3.29
132	94	95	1010.69	.24	.00	.00	1.61	.87
133	93	100	175.01	.12	.00	.00	.50	.14
134	95	101	966.09	1.75	.00	.00	2.74	3.24
135	100	101	-251.39	1.74	.00	.00	1.60	1.93
136	100	102	340.51	.34	.00	.00	.97	.47
137	101	103	628.79	1.39	.00	.00	1.78	1.46
138	102	103	-569.99	.68	.00	.00	1.62	1.22
139	103	104	22.10	.01	.00	.00	.14	.02
140	102	105	873.80	.47	.00	.00	1.39	.56
141	105	107	690.50	.34	.00	.00	1.10	.36
142	107	109	520.00	.30	.00	.00	.83	.22
143	109	110	310.00	.05	.00	.00	.49	.08
144	104	106	22.10	.01	.00	.00	.14	.02
145	106	108	.00	.00	.00	.00	.00	.00

146-XX	108	110						
147	110	111	188.50	.05	.00	.00	.30	.03
148	91	96	62.57	.04	.00	.00	.40	.15
149	96	97	62.57	.11	.00	.00	.40	.15
150	92	97	104.73	.33	.00	.00	.67	.38
151	97	98	137.60	.24	.00	.00	.88	.63
152	98	99	38.94	.05	.00	.00	.25	.06
153	98	99	29.86	.05	.00	.00	.19	.04
154	89	112	3089.60	1.92	.00	.00	3.16	1.97
155	112	113	2910.40	4.28	.00	.00	2.97	1.77
156	113	114	2203.40	.95	.00	.00	2.25	1.06
157	114	115	1676.10	4.24	.00	.00	2.67	1.89
158	115	116	616.90	.52	.00	.00	.98	.30
159	116	117	331.40	.13	.00	.00	.53	.09
160	117	118	165.70	.03	.00	.00	.26	.03

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	153.65	120.00	33.65	14.58
2		.00	152.26	75.00	77.26	33.48
3		.00	151.59	77.00	74.59	32.32
4		958.00	150.02	50.00	100.02	43.34
5		208.00	148.25	85.00	63.25	27.41
6		.00	145.84	95.00	50.84	22.03
7		.00	143.00	98.00	45.00	19.50
8		.00	220.91	98.00	122.91	53.26
9		.00	220.37	102.00	118.37	51.29
10		20830.00	213.96	175.00	38.96	16.88
11		.00	198.21	55.00	143.21	62.06
12		471.00	196.09	25.00	171.09	74.14
13		312.00	191.75	45.00	146.75	63.59
14		.00	196.09	45.00	151.09	65.47
15		250.00	191.19	45.00	146.19	63.35
16		334.00	191.36	45.00	146.36	63.42
17		125.00	191.64	45.00	146.64	63.54
18		469.00	191.63	20.00	171.63	74.37
19		469.00	190.87	30.00	160.87	69.71
20		243.00	187.63	38.00	149.63	64.84
21		143.00	186.89	37.00	149.89	64.95
22		143.00	186.25	36.00	150.25	65.11
23		144.00	185.62	35.00	150.62	65.27
24		.00	184.45	34.00	150.45	65.19
25		.00	181.66	33.00	148.66	64.42
26		.00	180.55	28.00	152.55	66.10
27		.00	180.34	28.00	152.34	66.01
28		.00	180.34	27.00	153.34	66.45
29		199.00	184.14	35.00	149.14	64.63
30		373.00	176.06	36.00	140.06	60.69
31		429.00	168.93	37.00	131.93	57.17

32	.00	162.23	34.00	128.23	55.57
33	198.00	162.23	33.00	129.23	56.00
34	183.00	162.36	31.00	131.36	56.92
35	.00	162.36	34.00	128.36	55.62
36	.00	172.27	34.00	138.27	59.92
37	.00	163.50	34.00	129.50	56.12
38	323.00	162.82	33.00	129.82	56.26
39	.00	161.38	33.00	128.38	55.63
40	301.00	160.73	33.00	127.73	55.35
41	.00	160.32	34.00	126.32	54.74
42	42.00	155.44	34.00	121.44	52.63
43	101.00	159.95	34.00	125.95	54.58
44	1042.00	154.99	33.00	121.99	52.86
45	219.00	157.87	30.00	127.87	55.41
46	219.00	156.92	28.00	128.92	55.87
47	198.00	155.20	25.00	130.20	56.42
48	.00	175.22	35.00	140.22	60.76
49	150.00	162.27	25.00	137.27	59.48
50	178.00	162.37	26.00	136.37	59.09
51	355.00	161.85	27.00	134.85	58.43
52	.00	161.81	28.00	133.81	57.99
53	70.00	161.75	29.00	132.75	57.53
54	311.00	162.13	31.00	131.13	56.82
55	199.00	164.75	27.00	137.75	59.69
56	353.00	168.28	27.00	141.28	61.22
57	.00	171.13	28.00	143.13	62.02
58	.00	177.01	32.00	145.01	62.84
59	.00	173.16	31.00	142.16	61.60
60	166.00	174.10	31.00	143.10	62.01
61	8.00	173.04	31.00	142.04	61.55
62	127.00	172.47	32.00	140.47	60.87
63	323.00	172.07	38.00	134.07	58.09
64	180.00	171.81	30.00	141.81	61.45
65	334.00	170.48	30.00	140.48	60.87
66	525.00	170.02	30.00	140.02	60.68
67	106.00	170.00	30.00	140.00	60.67
68	106.00	170.00	30.00	140.00	60.67
69	106.00	170.02	30.00	140.02	60.67
70	.00	170.09	32.00	138.09	59.84
71	.00	174.90	34.00	140.90	61.06
72	422.00	169.14	32.00	137.14	59.43
73	294.00	168.91	31.00	137.91	59.76
74	228.00	168.88	30.00	138.88	60.18
75	527.00	168.92	30.00	138.92	60.20
76	193.00	170.23	29.00	141.23	61.20
77	31.00	172.05	28.00	144.05	62.42
78	4185.00	170.46	20.00	150.46	65.20
79	.00	175.22	35.00	140.22	60.76
80	.00	165.42	25.00	140.42	60.85
81	29.80	163.03	25.00	138.03	59.81
82	141.80	155.94	25.00	130.94	56.74
83	274.60	154.54	25.00	129.54	56.13
84	171.70	158.94	25.00	133.94	58.04
85	213.80	150.92	25.00	125.92	54.57
86	278.90	154.67	25.00	129.67	56.19

87	197.60	147.15	25.00	122.15	52.93
88	91.50	151.76	25.00	126.76	54.93
89	266.70	146.24	25.00	121.24	52.54
90	229.60	146.33	25.00	121.33	52.58
91	126.70	145.99	20.00	125.99	54.60
92	72.80	146.17	20.00	126.17	54.68
93	93.80	146.98	20.00	126.98	55.03
94	93.80	150.59	20.00	130.59	56.59
95	44.60	150.35	20.00	130.35	56.48
96	.00	145.95	20.00	125.95	54.58
97	29.70	145.84	20.00	125.84	54.53
98	68.80	145.60	20.00	125.60	54.43
99	68.80	145.55	20.00	125.55	54.40
100	85.90	146.86	20.00	126.86	54.97
101	85.90	148.60	20.00	128.60	55.73
102	36.70	146.52	15.00	131.52	56.99
103	36.70	147.21	15.00	132.21	57.29
104	.00	147.20	15.00	132.20	57.29
105	183.30	146.05	15.00	131.05	56.79
106	22.10	147.18	15.00	132.18	57.28
107	170.50	145.71	15.00	130.71	56.64
108	.00	147.18	15.00	132.18	57.28
109	210.00	145.40	15.00	130.40	56.51
110	121.50	145.35	15.00	130.35	56.49
111	188.50	145.31	15.00	130.31	56.47
112	179.20	144.33	25.00	119.33	51.71
113	707.00	140.05	20.00	120.05	52.02
114	527.30	139.10	20.00	119.10	51.61
115	1059.20	134.86	15.00	119.86	51.94
116	285.50	134.34	15.00	119.34	51.71
117	165.70	134.21	15.00	119.21	51.66
118	165.70	134.18	15.00	119.18	51.65

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
18	74.37	1	14.58
12	74.14	10	16.88
19	69.71	7	19.50
28	66.45	6	22.03
26	66.10	5	27.41
27	66.01	3	32.32
14	65.47	2	33.48
23	65.27	4	43.34
78	65.20	9	51.29
24	65.19	114	51.61

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
6	13.07	96	.03
15	9.21	52	.08
20	9.21	139	.14
43	8.15	144	.14
36	6.53	153	.19
37	6.45	152	.25
38	6.40	103	.26
39	6.36	160	.26
40	6.31	95	.27
113	5.80	147	.30

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8647.38
6	12802.12
23	23679.20

NET SYSTEM INFLOW = 45128.70
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 45128.70

D A T A C H A N G E S F O R N E X T S I M U L A T I O N

D E M A N D C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
10	20833.00
111	4094.00

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S I M U L A T I O N R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00048

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8548.21	.02	148.33	.00	2.69	.64
2	1	2	7944.15	1.36	.00	.00	3.61	1.36
3	1	2	604.06	1.36	.00	.00	1.71	1.36
4	2	3	5279.49	.66	.00	.00	1.66	.26
5	2	3	3268.72	.66	.00	.00	1.48	.26
6-FG	0	3	12339.74	66.71	.00	.00	12.60	25.66
7	3	4	11502.72	1.50	.00	.00	3.63	1.11
8	3	4	7121.75	1.50	.00	.00	3.23	1.11
9	3	4	2263.48	1.50	.00	.00	2.31	1.11
10	4	5	11238.95	1.75	.00	.00	3.54	1.06
11	4	5	6958.43	1.75	.00	.00	3.16	1.06
12	4	5	2211.57	1.75	.00	.00	2.26	1.06
13	5	6	12540.61	2.41	.00	.00	3.95	1.30
14	5	6	7764.34	2.41	.00	.00	3.52	1.30
15	6	7	20304.95	2.86	.00	.00	9.22	7.72
16-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
17-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
18-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20304.95	.54	.00	.00	9.22	7.72
21	9	10	10152.48	6.42	.00	.00	4.61	2.14
22	9	10	10152.48	6.42	.00	.00	4.61	2.14
23-FG	0	10	16094.15	4.42	.00	.00	3.73	.98
24	10	11	15566.10	7.57	.00	.00	3.60	.92
25-XXCV	5	12						
26	11	12	733.57	.78	.00	.00	1.17	.41
27	11	13	14832.53	3.15	.00	.00	3.43	.84
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	95.93	.01	.00	.00	.15	.01
31	17	16	262.93	.04	.00	.00	.42	.06
32	13	17	325.43	.02	.00	.00	.52	.09
33	12	18	498.07	1.90	.00	.00	1.41	.95
34	18	19	263.57	.53	.00	.00	.75	.29
35	15	19	-29.07	.02	.00	.00	.08	.00
36	13	20	14351.10	2.09	.00	.00	4.52	1.67
37	20	21	14229.60	.38	.00	.00	4.48	1.65
38	21	22	14158.10	.33	.00	.00	4.46	1.63
39	22	23	14086.60	.32	.00	.00	4.44	1.61

40	23	24	14014.60	.61	.00	.00	4.42	1.60
41-XX	15	28						
42	24	25	12841.88	1.50	.00	.00	4.05	1.36
43	25	26	12841.88	.60	.00	.00	5.83	3.31
44	26	27	11804.22	.12	.00	.00	3.72	1.16
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	11804.22	2.85	.00	.00	3.72	1.16
48	24	29	1172.72	.11	.00	.00	1.87	.97
49	29	30	1073.22	2.88	.00	.00	3.04	3.94
50	30	31	886.72	2.68	.00	.00	2.52	2.77
51	31	32	672.22	2.82	.00	.00	1.91	1.66
52	33	32	-35.07	.00	.00	.00	.10	.01
53	34	33	63.93	.01	.00	.00	.18	.02
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	977.74	2.32	.00	.00	2.77	3.31
57	38	37	-316.93	.14	.00	.00	.90	.41
58	34	38	-155.43	.08	.00	.00	.44	.11
59	37	39	335.38	.59	.00	.00	.95	.46
60	32	39	320.13	.36	.00	.00	.91	.42
61	32	40	317.02	.47	.00	.00	.90	.41
62	40	41	166.52	.14	.00	.00	.47	.12
63	39	41	201.98	.25	.00	.00	.57	.18
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	325.43	.43	.00	.00	.92	.43
68	54	53	169.93	.13	.00	.00	.48	.13
69	53	39	88.47	.03	.00	.00	.25	.04
70	53	52	46.46	.01	.00	.00	.13	.01
71	52	51	46.46	.00	.00	.00	.13	.01
72	50	51	131.04	.05	.00	.00	.37	.08
73	50	49	75.00	.03	.00	.00	.21	.03
74	79	71	11804.22	.17	.00	.00	3.72	1.16
75-XX	48	36						
76	46	47	99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	295.04	.37	.00	.00	.84	.36
80	56	55	394.54	.62	.00	.00	1.12	.62
81	57	56	571.04	.57	.00	.00	1.62	1.22
82-XX	36	57						
83	71	77	10314.94	1.81	.00	.00	3.25	.91
84	77	57	571.04	.18	.00	.00	1.62	1.22
85	26	58	1037.66	1.33	.00	.00	2.94	3.70
86	58	59	810.09	1.47	.00	.00	2.30	2.34
87	58	60	227.57	1.04	.00	.00	1.45	1.60
88	60	61	144.57	.45	.00	.00	.92	.69
89	59	61	84.43	.02	.00	.00	.24	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	725.66	.59	.00	.00	2.06	1.91
93	64	65	635.66	.63	.00	.00	1.80	1.49
94	65	66	468.66	.27	.00	.00	1.33	.85

95	67	66	-206.16	.11	.00	.00	.58	.19
96	68	67	-153.16	.04	.00	.00	.43	.11
97	69	68	-100.16	.01	.00	.00	.28	.05
98	70	69	-47.16	.00	.00	.00	.13	.01
99	71	70	511.54	1.32	.00	.00	1.45	1.00
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	558.70	.48	.00	.00	1.58	1.18
102	72	73	347.70	.19	.00	.00	.99	.49
103	73	74	200.70	.14	.00	.00	.57	.18
104	75	74	-86.70	.02	.00	.00	.25	.04
105	76	75	176.80	.11	.00	.00	.50	.14
106	77	76	273.30	.22	.00	.00	.78	.31
107	77	78	9455.10	1.22	.00	.00	2.98	.77
108-XX	57	78						
109	71	36	977.74	.70	.00	.00	2.77	3.31
110	78	80	5941.20	5.96	.00	.00	6.07	6.63
111	78	80	1421.40	5.96	.00	.00	4.03	6.63
112	80	81	3847.34	3.59	.00	.00	3.93	2.96
113	80	82	3515.26	8.92	.00	.00	5.61	7.43
114	81	84	3832.44	6.19	.00	.00	6.12	8.72
115	82	83	405.48	3.04	.00	.00	2.59	4.68
116	84	83	243.39	2.18	.00	.00	1.55	1.82
117	82	89	3038.88	8.68	.00	.00	4.85	5.68
118	83	85	511.57	7.41	.00	.00	3.27	7.19
119	84	86	3503.20	7.76	.00	.00	5.59	7.39
120	89	90	1360.73	6.54	.00	.00	3.86	6.11
121	90	87	725.88	1.81	.00	.00	2.06	1.91
122	85	87	631.56	6.59	.00	.00	4.03	10.63
123	86	85	226.88	1.84	.00	.00	1.45	1.60
124	87	88	-191.55	1.22	.00	.00	1.22	1.17
125	86	88	3136.87	7.22	.00	.00	5.01	6.02
126	90	91	520.05	5.86	.00	.00	3.32	7.42
127	87	93	1450.19	7.08	.00	.00	4.11	6.88
128	88	94	2899.56	4.27	.00	.00	4.63	5.20
129	91	92	261.37	1.68	.00	.00	1.67	2.07
130	92	93	336.65	1.36	.00	.00	2.15	3.31
131	93	94	-354.89	4.02	.00	.00	2.27	3.65
132	94	95	2497.77	1.30	.00	.00	3.99	4.64
133	93	100	2094.83	12.23	.00	.00	5.94	13.59
134	95	101	2475.47	10.00	.00	.00	7.02	18.52
135	100	101	-442.62	4.95	.00	.00	2.82	5.50
136	100	102	2494.50	13.52	.00	.00	7.08	18.78
137	101	103	1989.90	11.74	.00	.00	5.64	12.36
138	102	103	-1960.50	6.73	.00	.00	5.56	12.02
139	103	104	11.05	.00	.00	.00	.07	.01
140	102	105	4436.65	9.61	.00	.00	7.08	11.44
141	105	107	4345.00	10.35	.00	.00	6.93	11.01
142	107	109	4259.75	14.85	.00	.00	6.80	10.61
143	109	110	4154.75	6.28	.00	.00	6.63	10.13
144	104	106	11.05	.00	.00	.00	.07	.01
145	106	108	.00	.00	.00	.00	.00	.00
146-XX	108	110						
147	110	111	4094.00	13.80	.00	.00	6.53	9.86
148	91	96	195.33	.36	.00	.00	1.25	1.21
149	96	97	195.33	.94	.00	.00	1.25	1.21

150	92	97	-111.68	.37	.00	.00	.71	.43
151	97	98	68.80	.07	.00	.00	.44	.18
152	98	99	19.47	.01	.00	.00	.12	.02
153	98	99	14.93	.01	.00	.00	.10	.01
154	89	112	1544.80	.53	.00	.00	1.58	.55
155	112	113	1455.20	1.18	.00	.00	1.49	.49
156	113	114	1101.70	.26	.00	.00	1.13	.29
157	114	115	838.05	1.18	.00	.00	1.34	.52
158	115	116	308.45	.14	.00	.00	.49	.08
159	116	117	165.70	.04	.00	.00	.26	.03
160	117	118	82.85	.01	.00	.00	.13	.01

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.31	120.00	38.31	16.60
2		.00	156.95	75.00	81.95	35.51
3		.00	156.29	77.00	79.29	34.36
4		479.00	154.79	50.00	104.79	45.41
5		104.00	153.04	85.00	68.04	29.48
6		.00	150.63	95.00	55.63	24.11
7		.00	147.77	98.00	49.77	21.57
8		.00	225.54	98.00	127.54	55.27
9		.00	225.00	102.00	123.00	53.30
10		20833.00	218.58	175.00	43.58	18.88
11		.00	211.01	55.00	156.01	67.61
12		235.50	210.24	25.00	185.24	80.27
13		156.00	207.87	45.00	162.87	70.58
14		.00	210.24	45.00	165.24	71.60
15		125.00	207.80	45.00	162.80	70.54
16		167.00	207.81	45.00	162.81	70.55
17		62.50	207.85	45.00	162.85	70.57
18		234.50	208.34	20.00	188.34	81.61
19		234.50	207.81	30.00	177.81	77.05
20		121.50	205.78	38.00	167.78	72.70
21		71.50	205.40	37.00	168.40	72.97
22		71.50	205.08	36.00	169.08	73.27
23		72.00	204.75	35.00	169.75	73.56
24		.00	204.14	34.00	170.14	73.73
25		.00	202.65	33.00	169.65	73.51
26		.00	202.05	28.00	174.05	75.42
27		.00	201.94	28.00	173.94	75.37
28		.00	201.94	27.00	174.94	75.81
29		99.50	204.04	35.00	169.04	73.25
30		186.50	201.16	36.00	165.16	71.57
31		214.50	198.48	37.00	161.48	69.97
32		.00	195.66	34.00	161.66	70.05
33		99.00	195.66	33.00	162.66	70.49
34		91.50	195.67	31.00	164.67	71.36
35		.00	195.67	34.00	161.67	70.06

36	.00	198.21	34.00	164.21	71.16
37	.00	195.89	34.00	161.89	70.15
38	161.50	195.75	33.00	162.75	70.52
39	.00	195.30	33.00	162.30	70.33
40	150.50	195.20	33.00	162.20	70.28
41	.00	195.05	34.00	161.05	69.79
42	21.00	193.66	34.00	159.66	69.18
43	50.50	194.95	34.00	160.95	69.75
44	521.00	193.53	33.00	160.53	69.56
45	109.50	194.37	30.00	164.37	71.23
46	109.50	194.11	28.00	166.11	71.98
47	99.00	193.63	25.00	168.63	73.07
48	.00	199.08	35.00	164.08	71.10
49	75.00	195.33	25.00	170.33	73.81
50	89.00	195.36	26.00	169.36	73.39
51	177.50	195.31	27.00	168.31	72.94
52	.00	195.32	28.00	167.32	72.50
53	35.00	195.33	29.00	166.33	72.08
54	155.50	195.46	31.00	164.46	71.27
55	99.50	195.73	27.00	168.73	73.11
56	176.50	196.34	27.00	169.34	73.38
57	.00	196.91	28.00	168.91	73.20
58	.00	200.72	32.00	168.72	73.11
59	.00	199.25	31.00	168.25	72.91
60	83.00	199.68	31.00	168.68	73.09
61	4.00	199.23	31.00	168.23	72.90
62	63.50	199.07	32.00	167.07	72.40
63	161.50	198.96	38.00	160.96	69.75
64	90.00	198.66	30.00	168.66	73.08
65	167.00	198.03	30.00	168.03	72.81
66	262.50	197.76	30.00	167.76	72.69
67	53.00	197.65	30.00	167.65	72.65
68	53.00	197.61	30.00	167.61	72.63
69	53.00	197.60	30.00	167.60	72.62
70	.00	197.59	32.00	165.59	71.76
71	.00	198.91	34.00	164.91	71.46
72	211.00	197.11	32.00	165.11	71.55
73	147.00	196.92	31.00	165.92	71.90
74	114.00	196.78	30.00	166.78	72.27
75	263.50	196.76	30.00	166.76	72.26
76	96.50	196.88	29.00	167.88	72.75
77	15.50	197.10	28.00	169.10	73.28
78	2092.50	195.88	20.00	175.88	76.21
79	.00	199.08	35.00	164.08	71.10
80	.00	189.91	25.00	164.91	71.46
81	14.90	186.33	25.00	161.33	69.91
82	70.90	180.99	25.00	155.99	67.60
83	137.30	177.95	25.00	152.95	66.28
84	85.85	180.13	25.00	155.13	67.22
85	106.90	170.54	25.00	145.54	63.07
86	139.45	172.38	25.00	147.38	63.86
87	98.80	163.95	25.00	138.95	60.21
88	45.75	165.15	25.00	140.15	60.73
89	133.35	172.31	25.00	147.31	63.83
90	114.80	165.77	25.00	140.77	61.00

91	63.35	159.91	20.00	139.91	60.63
92	36.40	158.23	20.00	138.23	59.90
93	46.90	156.87	20.00	136.87	59.31
94	46.90	160.89	20.00	140.89	61.05
95	22.30	159.59	20.00	139.59	60.49
96	.00	159.55	20.00	139.55	60.47
97	14.85	158.60	20.00	138.60	60.06
98	34.40	158.54	20.00	138.54	60.03
99	34.40	158.52	20.00	138.52	60.03
100	42.95	144.64	20.00	124.64	54.01
101	42.95	149.59	20.00	129.59	56.16
102	18.35	131.12	15.00	116.12	50.32
103	18.35	137.85	15.00	122.85	53.24
104	.00	137.85	15.00	122.85	53.23
105	91.65	121.51	15.00	106.51	46.15
106	11.05	137.84	15.00	122.84	53.23
107	85.25	111.16	15.00	96.16	41.67
108	.00	137.84	15.00	122.84	53.23
109	105.00	96.31	15.00	81.31	35.23
110	60.75	90.03	15.00	75.03	32.51
111	4094.00	76.23	15.00	61.23	26.53
112	89.60	171.78	25.00	146.78	63.60
113	353.50	170.59	20.00	150.59	65.26
114	263.65	170.33	20.00	150.33	65.14
115	529.60	169.15	15.00	154.15	66.80
116	142.75	169.01	15.00	154.01	66.74
117	82.85	168.98	15.00	153.98	66.72
118	82.85	168.97	15.00	153.97	66.72

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
18	81.61	1	16.60
12	80.27	10	18.88
19	77.05	7	21.57
78	76.21	6	24.11
28	75.81	111	26.53
26	75.42	5	29.48
27	75.37	110	32.51
49	73.81	3	34.36
24	73.73	109	35.23
23	73.56	2	35.51

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY	PIPE NUMBER	MINIMUM VELOCITY
	(ft/s)		(ft/s)
6	12.60	139	.07
15	9.22	144	.07
20	9.22	35	.08
140	7.08	153	.10
136	7.08	52	.10
134	7.02	152	.12
141	6.93	70	.13
142	6.80	71	.13
143	6.63	160	.13
147	6.53	98	.13

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8548.21
6	12339.74
23	16094.15

NET SYSTEM INFLOW = 36982.09
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 36982.11

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
118	4083.00
10	20833.00

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S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00288

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	1	8548.21	.02	148.33	.00	2.69	.64
2	1	2	7944.15	1.36	.00	.00	3.61	1.36
3	1	2	604.06	1.36	.00	.00	1.71	1.36
4	2	3	5279.49	.66	.00	.00	1.66	.26
5	2	3	3268.72	.66	.00	.00	1.48	.26
6-FG	0	3	12339.75	66.71	.00	.00	12.60	25.66
7	3	4	11502.73	1.50	.00	.00	3.63	1.11
8	3	4	7121.75	1.50	.00	.00	3.23	1.11
9	3	4	2263.48	1.50	.00	.00	2.31	1.11
10	4	5	11238.95	1.75	.00	.00	3.54	1.06
11	4	5	6958.44	1.75	.00	.00	3.16	1.06
12	4	5	2211.58	1.75	.00	.00	2.26	1.06
13	5	6	12540.62	2.41	.00	.00	3.95	1.30
14	5	6	7764.35	2.41	.00	.00	3.52	1.30
15	6	7	20304.97	2.86	.00	.00	9.22	7.72
16-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
17-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
18-PU	7	8	6768.32	.02	77.79	.00	3.07	1.01
19-XXCV	7	8						
20	8	9	20304.97	.54	.00	.00	9.22	7.72
21	9	10	10152.48	6.42	.00	.00	4.61	2.14
22	9	10	10152.48	6.42	.00	.00	4.61	2.14
23-FG	0	10	16094.53	4.42	.00	.00	3.73	.98
24	10	11	15566.50	7.57	.00	.00	3.60	.92
25-XXCV	5	12						
26	11	12	733.58	.78	.00	.00	1.17	.41
27	11	13	14832.92	3.15	.00	.00	3.43	.84
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	95.92	.01	.00	.00	.15	.01
31	17	16	262.92	.04	.00	.00	.42	.06
32	13	17	325.42	.02	.00	.00	.52	.09
33	12	18	498.08	1.90	.00	.00	1.41	.95
34	18	19	263.58	.53	.00	.00	.75	.29
35	15	19	-29.08	.02	.00	.00	.08	.00
36	13	20	14351.50	2.09	.00	.00	4.52	1.67
37	20	21	14230.00	.38	.00	.00	4.48	1.65
38	21	22	14158.50	.33	.00	.00	4.46	1.63
39	22	23	14087.00	.32	.00	.00	4.44	1.61
40	23	24	14015.00	.61	.00	.00	4.42	1.60
41-XX	15	28						
42	24	25	12842.26	1.50	.00	.00	4.05	1.36
43	25	26	12842.26	.60	.00	.00	5.83	3.31

44	26	27	11804.59	.12	.00	.00	3.72	1.16
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	11804.59	2.85	.00	.00	3.72	1.16
48	24	29	1172.74	.11	.00	.00	1.87	.97
49	29	30	1073.24	2.88	.00	.00	3.04	3.94
50	30	31	886.74	2.68	.00	.00	2.52	2.77
51	31	32	672.24	2.82	.00	.00	1.91	1.66
52	33	32	-35.08	.00	.00	.00	.10	.01
53	34	33	63.92	.01	.00	.00	.18	.02
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	977.74	2.32	.00	.00	2.77	3.31
57	38	37	-316.92	.14	.00	.00	.90	.41
58	34	38	-155.42	.08	.00	.00	.44	.11
59	37	39	335.38	.59	.00	.00	.95	.46
60	32	39	320.14	.36	.00	.00	.91	.42
61	32	40	317.02	.47	.00	.00	.90	.41
62	40	41	166.52	.14	.00	.00	.47	.12
63	39	41	201.98	.25	.00	.00	.57	.18
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	325.43	.43	.00	.00	.92	.43
68	54	53	169.93	.13	.00	.00	.48	.13
69	53	39	88.46	.03	.00	.00	.25	.04
70	53	52	46.48	.01	.00	.00	.13	.01
71	52	51	46.48	.00	.00	.00	.13	.01
72	50	51	131.02	.05	.00	.00	.37	.08
73	50	49	75.00	.03	.00	.00	.21	.03
74	79	71	11804.59	.17	.00	.00	3.72	1.16
75-XX	48	36						
76	46	47	99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	295.02	.37	.00	.00	.84	.36
80	56	55	394.52	.62	.00	.00	1.12	.62
81	57	56	571.02	.57	.00	.00	1.62	1.22
82-XX	36	57						
83	71	77	10315.31	1.81	.00	.00	3.25	.91
84	77	57	571.02	.18	.00	.00	1.62	1.22
85	26	58	1037.68	1.33	.00	.00	2.94	3.70
86	58	59	810.11	1.47	.00	.00	2.30	2.34
87	58	60	227.57	1.04	.00	.00	1.45	1.60
88	60	61	144.57	.45	.00	.00	.92	.69
89	59	61	84.43	.02	.00	.00	.24	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	725.68	.59	.00	.00	2.06	1.91
93	64	65	635.68	.63	.00	.00	1.80	1.49
94	65	66	468.68	.27	.00	.00	1.33	.85
95	67	66	-206.18	.11	.00	.00	.58	.19
96	68	67	-153.18	.04	.00	.00	.43	.11
97	69	68	-100.18	.01	.00	.00	.28	.05
98	70	69	-47.18	.00	.00	.00	.13	.01

99	71	70	511.54	1.32	.00	.00	1.45	1.00
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	558.71	.48	.00	.00	1.58	1.18
102	72	73	347.71	.19	.00	.00	.99	.49
103	73	74	200.71	.14	.00	.00	.57	.18
104	75	74	-86.71	.02	.00	.00	.25	.04
105	76	75	176.79	.11	.00	.00	.50	.14
106	77	76	273.29	.22	.00	.00	.78	.31
107	77	78	9455.50	1.22	.00	.00	2.98	.77
108-XX	57	78						
109	71	36	977.74	.70	.00	.00	2.77	3.31
110	78	80	5941.53	5.96	.00	.00	6.07	6.63
111	78	80	1421.47	5.96	.00	.00	4.03	6.63
112	80	81	3011.59	2.28	.00	.00	3.08	1.88
113	80	82	4351.41	13.24	.00	.00	6.94	11.04
114	81	84	2996.69	3.93	.00	.00	4.78	5.53
115	82	83	-74.06	.13	.00	.00	.47	.20
116	84	83	453.75	6.91	.00	.00	2.90	5.76
117	82	89	4354.57	16.91	.00	.00	6.95	11.05
118	83	85	242.39	1.86	.00	.00	1.55	1.80
119	84	86	2457.09	4.02	.00	.00	3.92	3.83
120	89	90	-1323.73	6.22	.00	.00	3.75	5.81
121	90	87	-1180.04	4.46	.00	.00	3.35	4.70
122	85	87	514.95	4.51	.00	.00	3.29	7.28
123	86	85	379.45	4.76	.00	.00	2.42	4.14
124	87	88	-463.94	6.30	.00	.00	2.96	6.00
125	86	88	1938.18	2.96	.00	.00	3.09	2.47
126	90	91	-258.49	1.61	.00	.00	1.65	2.03
127	87	93	-299.96	.38	.00	.00	.85	.37
128	88	94	1428.50	1.15	.00	.00	2.28	1.40
129	91	92	-226.92	1.29	.00	.00	1.45	1.60
130	92	93	-441.89	2.25	.00	.00	2.82	5.48
131	93	94	-389.64	4.78	.00	.00	2.49	4.34
132	94	95	991.96	.23	.00	.00	1.58	.84
133	93	100	-399.11	.57	.00	.00	1.13	.63
134	95	101	969.66	1.76	.00	.00	2.75	3.26
135	100	101	-290.98	2.28	.00	.00	1.86	2.53
136	100	102	-151.08	.08	.00	.00	.43	.10
137	101	103	635.73	1.42	.00	.00	1.80	1.49
138	102	103	-606.33	.77	.00	.00	1.72	1.37
139	103	104	11.05	.00	.00	.00	.07	.01
140	102	105	436.90	.13	.00	.00	.70	.16
141	105	107	345.25	.10	.00	.00	.55	.10
142	107	109	260.00	.08	.00	.00	.41	.06
143	109	110	155.00	.01	.00	.00	.25	.02
144	104	106	11.05	.00	.00	.00	.07	.01
145	106	108	.00	.00	.00	.00	.00	.00
146-XX	108	110						
147	110	111	94.25	.01	.00	.00	.15	.01
148	91	96	-94.92	.10	.00	.00	.61	.32
149	96	97	-94.92	.25	.00	.00	.61	.32
150	92	97	178.57	.89	.00	.00	1.14	1.02
151	97	98	68.80	.07	.00	.00	.44	.18
152	98	99	19.47	.01	.00	.00	.12	.02
153	98	99	14.93	.01	.00	.00	.10	.01

154	89	112	5544.95	5.66	.00	.00	5.66	5.83
155	112	113	5455.35	13.69	.00	.00	5.57	5.66
156	113	114	5101.85	4.50	.00	.00	5.21	5.00
157	114	115	4838.20	30.22	.00	.00	7.72	13.43
158	115	116	4308.60	19.07	.00	.00	6.87	10.84
159	116	117	4165.85	13.74	.00	.00	6.65	10.18
160	117	118	4083.00	10.59	.00	.00	6.51	9.81

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	158.31	120.00	38.31	16.60
2		.00	156.95	75.00	81.95	35.51
3		.00	156.29	77.00	79.29	34.36
4		479.00	154.79	50.00	104.79	45.41
5		104.00	153.04	85.00	68.04	29.48
6		.00	150.63	95.00	55.63	24.11
7		.00	147.77	98.00	49.77	21.57
8		.00	225.54	98.00	127.54	55.27
9		.00	225.00	102.00	123.00	53.30
10		20833.00	218.58	175.00	43.58	18.88
11		.00	211.01	55.00	156.01	67.61
12		235.50	210.24	25.00	185.24	80.27
13		156.00	207.87	45.00	162.87	70.58
14		.00	210.24	45.00	165.24	71.60
15		125.00	207.80	45.00	162.80	70.54
16		167.00	207.81	45.00	162.81	70.55
17		62.50	207.85	45.00	162.85	70.57
18		234.50	208.34	20.00	188.34	81.61
19		234.50	207.81	30.00	177.81	77.05
20		121.50	205.78	38.00	167.78	72.70
21		71.50	205.40	37.00	168.40	72.97
22		71.50	205.07	36.00	169.07	73.27
23		72.00	204.75	35.00	169.75	73.56
24		.00	204.14	34.00	170.14	73.73
25		.00	202.65	33.00	169.65	73.51
26		.00	202.05	28.00	174.05	75.42
27		.00	201.94	28.00	173.94	75.37
28		.00	201.94	27.00	174.94	75.81
29		99.50	204.04	35.00	169.04	73.25
30		186.50	201.16	36.00	165.16	71.57
31		214.50	198.48	37.00	161.48	69.97
32		.00	195.66	34.00	161.66	70.05
33		99.00	195.66	33.00	162.66	70.49
34		91.50	195.67	31.00	164.67	71.36
35		.00	195.67	34.00	161.67	70.06
36		.00	198.21	34.00	164.21	71.16
37		.00	195.89	34.00	161.89	70.15
38		161.50	195.75	33.00	162.75	70.52
39		.00	195.30	33.00	162.30	70.33

40	150.50	195.19	33.00	162.19	70.28
41	.00	195.05	34.00	161.05	69.79
42	21.00	193.65	34.00	159.65	69.18
43	50.50	194.95	34.00	160.95	69.74
44	521.00	193.53	33.00	160.53	69.56
45	109.50	194.37	30.00	164.37	71.23
46	109.50	194.11	28.00	166.11	71.98
47	99.00	193.63	25.00	168.63	73.07
48	.00	199.08	35.00	164.08	71.10
49	75.00	195.33	25.00	170.33	73.81
50	89.00	195.36	26.00	169.36	73.39
51	177.50	195.31	27.00	168.31	72.94
52	.00	195.32	28.00	167.32	72.50
53	35.00	195.33	29.00	166.33	72.08
54	155.50	195.46	31.00	164.46	71.27
55	99.50	195.72	27.00	168.72	73.11
56	176.50	196.34	27.00	169.34	73.38
57	.00	196.91	28.00	168.91	73.19
58	.00	200.72	32.00	168.72	73.11
59	.00	199.25	31.00	168.25	72.91
60	83.00	199.68	31.00	168.68	73.09
61	4.00	199.23	31.00	168.23	72.90
62	63.50	199.07	32.00	167.07	72.40
63	161.50	198.96	38.00	160.96	69.75
64	90.00	198.65	30.00	168.65	73.08
65	167.00	198.03	30.00	168.03	72.81
66	262.50	197.76	30.00	167.76	72.69
67	53.00	197.65	30.00	167.65	72.65
68	53.00	197.61	30.00	167.61	72.63
69	53.00	197.59	30.00	167.59	72.62
70	.00	197.59	32.00	165.59	71.76
71	.00	198.91	34.00	164.91	71.46
72	211.00	197.11	32.00	165.11	71.55
73	147.00	196.92	31.00	165.92	71.90
74	114.00	196.78	30.00	166.78	72.27
75	263.50	196.76	30.00	166.76	72.26
76	96.50	196.88	29.00	167.88	72.75
77	15.50	197.09	28.00	169.09	73.27
78	2092.50	195.88	20.00	175.88	76.21
79	.00	199.08	35.00	164.08	71.10
80	.00	189.91	25.00	164.91	71.46
81	14.90	187.63	25.00	162.63	70.47
82	70.90	176.67	25.00	151.67	65.72
83	137.30	176.80	25.00	151.80	65.78
84	85.85	183.71	25.00	158.71	68.77
85	106.90	174.94	25.00	149.94	64.97
86	139.45	179.68	25.00	154.68	67.03
87	98.80	170.43	25.00	145.43	63.02
88	45.75	176.72	25.00	151.72	65.75
89	133.35	159.76	25.00	134.76	58.40
90	114.80	165.98	25.00	140.98	61.09
91	63.35	167.58	20.00	147.58	63.95
92	36.40	168.87	20.00	148.87	64.51
93	46.90	170.81	20.00	150.81	65.35
94	46.90	175.57	20.00	155.57	67.42

95	22.30	175.34	20.00	155.34	67.31
96	.00	167.68	20.00	147.68	63.99
97	14.85	167.98	20.00	147.98	64.13
98	34.40	167.92	20.00	147.92	64.10
99	34.40	167.90	20.00	147.90	64.09
100	42.95	171.38	20.00	151.38	65.60
101	42.95	173.58	20.00	153.58	66.55
102	18.35	171.45	15.00	156.45	67.80
103	18.35	172.16	15.00	157.16	68.10
104	.00	172.15	15.00	157.15	68.10
105	91.65	171.32	15.00	156.32	67.74
106	11.05	172.15	15.00	157.15	68.10
107	85.25	171.22	15.00	156.22	67.70
108	.00	172.15	15.00	157.15	68.10
109	105.00	171.14	15.00	156.14	67.66
110	60.75	171.13	15.00	156.13	67.65
111	94.25	171.11	15.00	156.11	67.65
112	89.60	154.10	25.00	129.10	55.94
113	353.50	140.41	20.00	120.41	52.18
114	263.65	135.91	20.00	115.91	50.23
115	529.60	105.69	15.00	90.69	39.30
116	142.75	86.62	15.00	71.62	31.04
117	82.85	72.88	15.00	57.88	25.08
118	4083.00	62.29	15.00	47.29	20.49

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
18	81.61	1	16.60
12	80.27	10	18.88
19	77.05	118	20.49
78	76.21	7	21.57
28	75.81	6	24.11
26	75.42	117	25.08
27	75.37	5	29.48
49	73.81	116	31.04
24	73.73	3	34.36
23	73.56	2	35.51

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
6	12.60	139	.07
15	9.22	144	.07

20	9.22	35	.08
157	7.72	153	.10
117	6.95	52	.10
113	6.94	152	.12
158	6.87	70	.13
159	6.65	71	.13
160	6.51	98	.13
110	6.07	147	.15

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	8548.21
6	12339.75
23	16094.53

NET SYSTEM INFLOW = 36982.50
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 36982.50

**** KYPIPE SIMULATION COMPLETED ****

DATE: 3/17/2003
TIME: 10:50:12

Appendix C

Computer Simulation of BWS' 228-Foot Service Zone in the Fort Weaver Corridor With the Addition of the Hoopili Project

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* * * * * * * * * *   K Y P I P E 2   * * * * * * * * * *
*   University of Kentucky Hydraulic Analysis Program   *
* Distribution of Pressure and Flows in Piping Networks *
*        1000 PIPE VERSION - 1.10   (08/25/92)          *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
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DATE: 11/16/2006
TIME: 8:47: 0

INPUT DATA FILENAME -------------- HOOPILI.DAT
TABULATED OUTPUT FILENAME -------- HOOPILI.OUT
POSTPROCESSOR RESULTS FILENAME --- HOOPILI.RES

S U M M A R Y   O F   O R I G I N A L   D A T A

U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	FGN-HGL (ft)
1-FGPU	0	203	50.0	36.0	130.00	.00	10.00
2	1	2	980.0	30.0	130.00	.00	
3	1	2	980.0	12.0	110.00	.00	
4	2	3	2500.0	36.0	130.00	.00	
5	2	3	2500.0	30.0	130.00	.00	
6-FG	0	204	1800.0	20.0	120.00	.00	228.00
7	3	4	1350.0	36.0	130.00	.00	
8	3	4	1350.0	30.0	130.00	.00	
9	3	4	1350.0	20.0	120.00	.00	
10	4	5	1650.0	36.0	130.00	.00	
11	4	5	1650.0	30.0	130.00	.00	
12	4	5	1650.0	20.0	120.00	.00	
13	5	6	1850.0	36.0	130.00	.00	
14	5	6	1850.0	30.0	130.00	.00	
15	6	7	370.0	30.0	130.00	.00	
16-XXPU	7	8	20.0	30.0	130.00	.00	
17-XXPU	7	8	20.0	30.0	130.00	.00	
18-XXPU	7	8	20.0	30.0	130.00	.00	
19-CV	7	8	20.0	30.0	130.00	.00	
20	8	9	70.0	30.0	130.00	.00	
21	9	208	3000.0	30.0	130.00	.00	
22	205	10	3000.0	30.0	130.00	.00	
23-FG	0	10	4530.0	42.0	130.00	.00	228.00
24	210	11	8250.0	42.0	130.00	.00	
25-CV	5	12	7150.0	16.0	120.00	.00	
26	12	11	1900.0	16.0	120.00	.00	
27	11	13	3750.0	42.0	130.00	.00	
28	12	14	2850.0	16.0	120.00	.00	
29-XX	14	15	650.0	16.0	120.00	.00	
30	16	15	1300.0	16.0	120.00	.00	
31	17	16	700.0	16.0	120.00	.00	
32	13	17	200.0	16.0	120.00	.00	
33	12	18	2000.0	12.0	110.00	.00	
34	18	19	1800.0	12.0	110.00	.00	
35	15	19	3200.0	12.0	110.00	.00	
36	13	20	1250.0	36.0	130.00	.00	
37	20	21	230.0	36.0	130.00	.00	
38	21	22	200.0	36.0	130.00	.00	
39	22	23	200.0	36.0	130.00	.00	
40	23	24	380.0	36.0	130.00	.00	
41-XX	15	28	2480.0	16.0	120.00	.00	
42	24	25	1100.0	36.0	130.00	.00	
43	25	26	180.0	30.0	130.00	.00	
44	26	27	100.0	36.0	130.00	.00	
45	28	27	150.0	16.0	120.00	.00	
46-XX	28	35	2000.0	16.0	120.00	.00	
47	27	79	2450.0	36.0	130.00	.00	
48	24	29	110.0	16.0	120.00	.00	
49	29	30	730.0	12.0	110.00	.00	
50	30	31	970.0	12.0	110.00	.00	
51	31	32	1700.0	12.0	110.00	.00	
52	33	32	570.0	12.0	110.00	.00	
53	34	33	580.0	12.0	110.00	.00	
54	35	34	800.0	12.0	110.00	.00	
55-XX	35	48	730.0	16.0	120.00	.00	
56	36	37	700.0	12.0	110.00	.00	
57	37	38	350.0	12.0	110.00	.00	
58	38	34	700.0	12.0	110.00	.00	
59	37	39	1300.0	12.0	110.00	.00	
60	32	39	870.0	12.0	110.00	.00	
61	32	40	1140.0	12.0	110.00	.00	
62	40	41	1150.0	12.0	110.00	.00	
63	39	41	1390.0	12.0	110.00	.00	
64	39	42	1480.0	12.0	110.00	.00	
65	42	44	122.0	12.0	110.00	.00	
66	41	43	890.0	16.0	120.00	.00	
67	37	54	1000.0	12.0	110.00	.00	
68	54	53	1030.0	12.0	110.00	.00	
69	53	39	730.0	12.0	110.00	.00	
70	52	53	805.0	12.0	110.00	.00	
71	51	52	400.0	12.0	110.00	.00	
72	50	51	580.0	12.0	110.00	.00	
73	50	49	965.0	12.0	110.00	.00	
74	79	71	150.0	36.0	130.00	.00	
75-XX	48	36	170.0	16.0	120.00	.00	
76	46	47	1390.0	8.0	110.00	.00	

77	45	46	1390.0	12.0	110.00	.00
78	43	45	1390.0	12.0	110.00	.00
79	55	50	1015.0	12.0	110.00	.00
80	56	55	1000.0	12.0	110.00	.00
81	57	56	465.0	12.0	110.00	.00
82-XX	36	57	2000.0	16.0	120.00	.00
83	71	77	2000.0	36.0	130.00	.00
84	77	57	150.0	12.0	110.00	.00
85	26	58	360.0	12.0	110.00	.00
86	58	59	630.0	12.0	110.00	.00
87	58	60	650.0	8.0	110.00	.00
88	60	61	650.0	8.0	110.00	.00
89	59	61	550.0	12.0	110.00	.00
90	61	62	720.0	12.0	110.00	.00
91	62	63	950.0	12.0	110.00	.00
92	59	64	310.0	12.0	110.00	.00
93	64	65	420.0	12.0	110.00	.00
94	65	66	320.0	12.0	110.00	.00
95	66	67	570.0	12.0	110.00	.00
96	68	67	400.0	12.0	110.00	.00
97	69	68	250.0	12.0	110.00	.00
98	70	69	330.0	12.0	110.00	.00
99	71	70	1320.0	12.0	110.00	.00
100	79	48	40.0	16.0	120.00	.00
101	70	72	410.0	12.0	110.00	.00
102	72	73	390.0	12.0	110.00	.00
103	73	74	780.0	12.0	110.00	.00
104	75	74	465.0	12.0	110.00	.00
105	76	75	810.0	12.0	110.00	.00
106	77	76	700.0	12.0	110.00	.00
107	77	78	1580.0	36.0	130.00	.00
108-XX	57	78	1580.0	16.0	120.00	.00
109	71	36	210.0	12.0	110.00	.00
110	78	80	900.0	20.0	120.00	.00
111	78	80	900.0	12.0	110.00	.00
112	80	81	1220.0	20.0	120.00	.00
113	80	82	1170.0	16.0	120.00	.00
114	81	84	700.0	16.0	120.00	.00
115	82	83	630.0	8.0	110.00	.00
116	84	83	1200.0	8.0	110.00	.00
117	82	89	900.0	16.0	120.00	.00
118	83	85	1060.0	8.0	110.00	.00
119	83	86	1035.0	8.0	110.00	.00
120	84	85	1050.0	16.0	120.00	.00
121	89	91	650.0	16.0	120.00	.00
122	87	88	710.0	8.0	110.00	.00
123	86	87	665.0	8.0	110.00	.00
124	85	86	1150.0	8.0	110.00	.00
125	85	94	1200.0	16.0	120.00	.00
126	82	113	280.0	8.0	110.00	.00
127	91	90	620.0	12.0	110.00	.00
128	91	92	1070.0	12.0	110.00	.00
129	93	92	950.0	12.0	110.00	.00
130	86	93	600.0	8.0	110.00	.00
131	94	93	1050.0	8.0	110.00	.00
132	92	96	280.0	8.0	110.00	.00
133	93	103	1040.0	12.0	110.00	.00
134	94	104	800.0	16.0	120.00	.00

135	95	98	550.0	8.0	110.00	.00	
136	96	95	780.0	8.0	110.00	.00	
137	96	100	520.0	8.0	110.00	.00	
138	97	101	730.0	8.0	110.00	.00	
139	96	97	770.0	8.0	110.00	.00	
140	98	99	800.0	8.0	110.00	.00	
141	100	99	310.0	8.0	110.00	.00	
142	101	100	810.0	8.0	110.00	.00	
143	99	112	790.0	8.0	110.00	.00	
144	101	112	870.0	8.0	110.00	.00	
145	102	101	150.0	8.0	110.00	.00	
146	103	102	270.0	8.0	110.00	.00	
147	104	103	1120.0	8.0	110.00	.00	
148	104	105	250.0	12.0	110.00	.00	
149	102	108	1090.0	8.0	110.00	.00	
150	103	107	900.0	12.0	110.00	.00	
151	105	106	560.0	12.0	110.00	.00	
152	107	108	290.0	8.0	110.00	.00	
153	106	107	920.0	8.0	110.00	.00	
154	108	109	500.0	8.0	110.00	.00	
155	107	110	710.0	12.0	110.00	.00	
156	106	111	930.0	12.0	110.00	.00	
157	109	110	310.0	8.0	110.00	.00	
158	111	110	550.0	8.0	110.00	.00	
159	91	114	2540.0	20.0	120.00	.00	
160	114	115	300.0	8.0	110.00	.00	
201-XXPU	0	211	50.0	24.0	130.00	.00	10.00
202	211	201	6650.0	36.0	130.00	.00	
203-FGPU	0	202	50.0	24.0	130.00	.00	10.00
204-XX	202	201	1900.0	20.0	120.00	.00	
205	201	2	4830.0	36.0	130.00	.00	
206	203	1	420.0	30.0	130.00	.00	
207	1	204	2700.0	12.0	110.00	.00	
208	204	3	800.0	20.0	120.00	.00	
209-FG	0	3	2600.0	24.0	130.00	.00	228.00
210-XX	6	9	150.0	30.0	130.00	.00	
211-CV	6	205	220.0	30.0	130.00	.00	
212	8	205	240.0	30.0	130.00	.00	
213	10	206	40.0	42.0	130.00	.00	
214	206	209	20.0	42.0	130.00	.00	
215	209	210	85.0	42.0	130.00	.00	
216-XX	207	206	50.0	30.0	130.00	.00	
217-XX	207	209	70.0	30.0	130.00	.00	
218	208	207	10.0	30.0	130.00	.00	
219	210	212	150.0	42.0	130.00	.00	
220-CV	212	213	50.0	24.0	130.00	.00	
221-PU	212	213	50.0	24.0	130.00	.00	
222-PU	212	213	50.0	24.0	130.00	.00	
223-XXPU	212	213	50.0	24.0	130.00	.00	
224-CV	208	215	260.0	30.0	130.00	.00	
225	214	215	60.0	24.0	130.00	.00	
226	213	214	110.0	42.0	130.00	.00	
227	215	216	14300.0	30.0	130.00	.00	
228	214	216	14300.0	36.0	130.00	.00	
229	216	217	2430.0	36.0	130.00	.00	
230	216	218	10400.0	30.0	130.00	.00	
231-XXFG	0	211	30.0	36.0	130.00	.00	228.00
161	115	116	510.0	8.0	110.00	.00	

162	116	117	1110.0	8.0	110.00	.00	
163	115	118	1150.0	8.0	110.00	.00	
164	114	123	1160.0	20.0	120.00	.00	
165	118	117	550.0	8.0	110.00	.00	
166	123	118	1160.0	8.0	110.00	.00	
167	117	121	1600.0	8.0	110.00	.00	
168	118	119	600.0	8.0	110.00	.00	
169	119	120	700.0	8.0	110.00	.00	
170	121	122	620.0	8.0	110.00	.00	
171	119	122	720.0	8.0	110.00	.00	
172	122	120	1090.0	8.0	110.00	.00	
173	123	124	1050.0	20.0	120.00	.00	
174	124	125	880.0	16.0	120.00	.00	
175	125	126	910.0	16.0	120.00	.00	
176	126	127	620.0	16.0	120.00	.00	
177	126	128	1600.0	16.0	120.00	.00	
178	128	129	830.0	16.0	120.00	.00	
179	129	130	950.0	16.0	120.00	.00	
180	131	124	510.0	16.0	120.00	.00	
181	131	132	1340.0	12.0	110.00	.00	
182	132	133	1010.0	16.0	120.00	.00	
183	134	132	1020.0	12.0	110.00	.00	
184	134	131	1090.0	16.0	120.00	.00	
185	136	134	1570.0	16.0	120.00	.00	
186	109	135	660.0	8.0	110.00	.00	
187	110	136	830.0	16.0	120.00	.00	
188	138	137	1040.0	8.0	110.00	.00	
189	135	136	280.0	8.0	110.00	.00	
190	137	136	280.0	8.0	110.00	.00	
191	111	138	290.0	8.0	110.00	.00	
192	112	139	380.0	8.0	110.00	.00	
193	139	140	900.0	8.0	110.00	.00	
194	139	141	1030.0	8.0	110.00	.00	
240-FG	0	10	2600.0	16.0	130.00	.00	228.00
241	10	240	7115.0	16.0	130.00	.00	
242	240	11	2750.0	16.0	120.00	.00	
243	240	11	2750.0	42.0	130.00	.00	

P U M P   D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
415.00	.00
230.00	6700.00
105.00	9450.00

THERE IS A PUMP IN LINE 16 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
138.00	.00
110.00	4900.00
101.00	6000.00

THERE IS A PUMP IN LINE 17 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
138.00	.00
110.00	4900.00
101.00	6000.00

THERE IS A PUMP IN LINE 18 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
138.00	.00
110.00	4900.00
101.00	6000.00

THERE IS A PUMP IN LINE 201 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
345.00	.00
236.00	5700.00
200.00	6600.00

THERE IS A PUMP IN LINE 203 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
362.00	.00
250.00	3150.00
187.00	3900.00

THERE IS A PUMP IN LINE 221 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
85.00	.00
55.50	10500.00
48.00	11500.00

THERE IS A PUMP IN LINE 222 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
85.00	.00
55.50	10500.00
48.00	11500.00

THERE IS A PUMP IN LINE 223 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
85.00	.00
55.50	10500.00
48.00	11500.00

J U N C T I O N   N O D E   D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES
1		.00	120.00	2 3 206 207
2		.00	75.00	2 3 4 5 205
3		.00	77.00	4 5 7 8 9 208 209
4		958.00	50.00	7 8 9 10 11 12
5		208.00	85.00	10 11 12 13 14 25
6		.00	95.00	13 14 15 210 211
7		.00	98.00	15 16 17 18 19
8		.00	98.00	16 17 18 19 20 212
9		.00	102.00	20 21 210
10		.00	175.00	22 23 213 240 241
11		1063.00	55.00	24 26 27 242 243
12		471.00	25.00	25 26 28 33
13		312.00	45.00	27 32 36
14		.00	45.00	28 29
15		250.00	45.00	29 30 35 41
16		334.00	45.00	30 31
17		125.00	45.00	31 32
18		469.00	20.00	33 34
19		469.00	30.00	34 35
20		243.00	38.00	36 37
21		143.00	37.00	37 38
22		143.00	36.00	38 39
23		144.00	35.00	39 40
24		.00	34.00	40 42 48
25		.00	33.00	42 43
26		.00	28.00	43 44 85
27		.00	28.00	44 45 47
28		.00	27.00	41 45 46
29		199.00	35.00	48 49
30		373.00	36.00	49 50
31		429.00	37.00	50 51
32		.00	34.00	51 52 60 61
33		198.00	33.00	52 53
34		183.00	31.00	53 54 58
35		.00	34.00	46 54 55
36		.00	34.00	56 75 82 109
37		.00	34.00	56 57 59 67
38		323.00	33.00	57 58
39		.00	33.00	59 60 63 64 69
40		301.00	33.00	61 62
41		.00	34.00	62 63 66
42		42.00	34.00	64 65
43		101.00	34.00	66 78
44		1042.00	33.00	65
45		219.00	30.00	77 78
46		219.00	28.00	76 77
47		198.00	25.00	76

48		.00	35.00	55 75 100
49		150.00	25.00	73
50		178.00	26.00	72 73 79
51		355.00	27.00	71 72
52		.00	28.00	70 71
53		70.00	29.00	68 69 70
54		311.00	31.00	67 68
55		199.00	27.00	79 80
56		353.00	27.00	80 81
57		.00	28.00	81 82 84 108
58		.00	32.00	85 86 87
59		.00	31.00	86 89 92
60		166.00	31.00	87 88
61		8.00	31.00	88 89 90
62		127.00	32.00	90 91
63		323.00	38.00	91
64		180.00	30.00	92 93
65		334.00	30.00	93 94
66		525.00	30.00	94 95
67		106.00	30.00	95 96
68		106.00	30.00	96 97
69		106.00	30.00	97 98
70		.00	32.00	98 99 101
71		.00	34.00	74 83 99 109
72		422.00	32.00	101 102
73		294.00	31.00	102 103
74		228.00	30.00	103 104
75		527.00	30.00	104 105
76		193.00	29.00	105 106
77		31.00	28.00	83 84 106 107
78		4185.00	20.00	107 108 110 111
79		.00	35.00	47 74 100
80		53.90	25.00	110 111 112 113
81		68.80	25.00	112 114
82		.00	25.00	113 115 117 126
83		220.80	25.00	115 116 118 119
84		157.20	25.00	114 116 120
85		329.20	25.00	118 120 124 125
86		126.50	25.00	119 123 124 130
87		102.90	25.00	122 123
88		.00	25.00	122
89		126.70	25.00	117 121
90		306.70	25.00	127
91		6.50	20.00	121 127 128 159
92		.00	20.00	128 129 132
93		33.80	20.00	129 130 131 133
94		197.40	20.00	125 131 134
95		41.80	20.00	135 136
96		84.50	20.00	132 136 137 139
97		42.60	20.00	138 139
98		41.80	20.00	135 140
99		57.70	20.00	140 141 143
100		58.50	20.00	137 141 142
101		58.50	20.00	138 142 144 145
102		.00	15.00	145 146 149
103		97.80	15.00	133 146 147 150
104		97.80	15.00	134 147 148
105		40.60	15.00	148 151

106	36.50	15.00	151	153	156			
107	63.90	15.00	150	152	153	155		
108	36.50	15.00	149	152	154			
109	36.40	15.00	154	157	186			
110	.00	15.00	155	157	158	187		
111	36.40	15.00	156	158	191			
112	15.90	25.00	143	144	192			
113	281.60	20.00	126					
114	66.00	20.00	159	160	164			
115	161.70	20.00	160	161	163			
116	147.60	20.00	161	162				
117	86.00	20.00	162	165	167			
118	100.00	20.00	163	165	166	168		
119	63.70	20.00	168	169	171			
120	63.70	20.00	169	172				
121	44.80	20.00	167	170				
122	108.50	20.00	170	171	172			
123	142.00	20.00	164	166	173			
124	13.30	20.00	173	174	180			
125	441.70	20.00	174	175				
126	138.10	20.00	175	176	177			
127	190.80	20.00	176					
128	194.60	20.00	177	178				
129	38.70	20.00	178	179				
130	220.60	20.00	179					
131	276.20	20.00	180	181	184			
132	265.40	20.00	181	182	183			
133	202.80	20.00	182					
134	101.20	20.00	183	184	185			
135	63.50	20.00	186	189				
136	63.50	20.00	185	187	189	190		
137	63.50	20.00	188	190				
138	.00	20.00	188	191				
139	.00	20.00	192	193	194			
140	65.60	20.00	193					
141	65.60	20.00	194					
201	.00	70.00	202	204	205			
202	.00	135.00	203	204				
203	.00	130.00	1	206				
204	.00	80.00	6	207	208			
205	.00	102.00	22	211	212			
206	.00	175.00	213	214	216			
207	.00	175.00	216	217	218			
208	.00	175.00	21	218	224			
209	.00	175.00	214	215	217			
210	.00	175.00	24	215	219			
211	.00	208.00	201	202	231			
212	.00	175.00	219	220	221	222	223	
213	.00	175.00	220	221	222	223	226	
214	.00	175.00	225	226	228			
215	.00	175.00	224	225	227			
216	.00	130.00	227	228	229	230		
217	8333.00	215.00	229					
218	12500.00	215.00	230					
240	1063.00	95.00	241	242	243			

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 10
MAXIMUM AND MINIMUM VELOCITIES = 10

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 229
NUMBER OF JUNCTION NODES ....(j) = 160
NUMBER OF PRIMARY LOOPS ....(l) = 62
NUMBER OF FIXED GRADE NODES ....(f) = 8
NUMBER OF SUPPLY ZONES ....(z) = 1

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S I M U L A T I O N   R E S U L T S
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THE RESULTS ARE OBTAINED AFTER 5 TRIALS WITH AN ACCURACY = .00068

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	203	7032.00	.02	216.07	.00	2.22	.45
2	1	2	6440.89	.90	.00	.00	2.92	.92
3	1	2	489.75	.90	.00	.00	1.39	.92
4	2	3	4280.46	.44	.00	.00	1.35	.18
5	2	3	2650.18	.44	.00	.00	1.20	.18
6-FG	0	204	2578.04	2.54	.00	.00	2.63	1.41
7	3	4	7806.58	.73	.00	.00	2.46	.54
8	3	4	4833.33	.73	.00	.00	2.19	.54
9	3	4	1536.16	.73	.00	.00	1.57	.54
10	4	5	7279.02	.78	.00	.00	2.29	.48
11	4	5	4506.70	.78	.00	.00	2.05	.48
12	4	5	1432.35	.78	.00	.00	1.46	.48
13	5	6	6712.62	.76	.00	.00	2.12	.41
14	5	6	4156.02	.76	.00	.00	1.89	.41
15	6	7	3931.33	.14	.00	.00	1.78	.37
16-XXPU	7	8						
17-XXPU	7	8						
18-XXPU	7	8						
19-CV	7	8	3931.33	.01	.00	.00	1.78	.37
20	8	9	.00	.00	.00	.00	.00	.00
21	9	208	.00	.00	.00	.00	.00	.00
22	205	10	10868.64	7.28	.00	.00	4.93	2.43
23-FG	0	10	29461.46	13.54	.00	.00	6.82	2.99

24	210	11	20799.42	12.94	.00	.00	4.82	1.57
25-CV	5	12	2141.43	21.22	.00	.00	3.42	2.97
26	12	11	752.24	.81	.00	.00	1.20	.43
27	11	13	21266.12	6.13	.00	.00	4.92	1.63
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	269.82	.08	.00	.00	.43	.06
31	17	16	603.82	.20	.00	.00	.96	.28
32	13	17	728.82	.08	.00	.00	1.16	.40
33	12	18	918.18	5.90	.00	.00	2.60	2.95
34	18	19	449.18	1.41	.00	.00	1.27	.78
35	15	19	19.82	.01	.00	.00	.06	.00
36	13	20	20225.30	3.94	.00	.00	6.37	3.16
37	20	21	19982.30	.71	.00	.00	6.30	3.09
38	21	22	19839.30	.61	.00	.00	6.25	3.04
39	22	23	19696.30	.60	.00	.00	6.21	3.00
40	23	24	19552.30	1.13	.00	.00	6.16	2.96
41-XX	15	28						
42	24	25	17492.12	2.65	.00	.00	5.51	2.41
43	25	26	17492.12	1.05	.00	.00	7.94	5.86
44	26	27	15752.08	.20	.00	.00	4.96	1.99
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	15752.08	4.87	.00	.00	4.96	1.99
48	24	29	2060.19	.30	.00	.00	3.29	2.76
49	29	30	1861.19	7.97	.00	.00	5.28	10.92
50	30	31	1488.19	7.00	.00	.00	4.22	7.22
51	31	32	1059.19	6.53	.00	.00	3.00	3.84
52	33	32	32.37	.00	.00	.00	.09	.01
53	34	33	230.37	.13	.00	.00	.65	.23
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	2008.83	8.80	.00	.00	5.70	12.58
57	37	38	736.37	.69	.00	.00	2.09	1.96
58	38	34	413.37	.47	.00	.00	1.17	.67
59	37	39	666.95	2.12	.00	.00	1.89	1.63
60	32	39	498.73	.83	.00	.00	1.41	.95
61	32	40	592.82	1.50	.00	.00	1.68	1.31
62	40	41	291.82	.41	.00	.00	.83	.35
63	39	41	445.18	1.07	.00	.00	1.26	.77
64	39	42	1084.00	5.94	.00	.00	3.07	4.01
65	42	44	1042.00	.45	.00	.00	2.96	3.73
66	41	43	737.00	.37	.00	.00	1.18	.41
67	37	54	605.51	1.36	.00	.00	1.72	1.36
68	54	53	294.51	.37	.00	.00	.84	.36
69	53	39	363.49	.39	.00	.00	1.03	.53
70	52	53	138.98	.07	.00	.00	.39	.09
71	51	52	138.98	.04	.00	.00	.39	.09
72	50	51	493.98	.54	.00	.00	1.40	.94
73	50	49	150.00	.10	.00	.00	.43	.10
74	79	71	15752.08	.30	.00	.00	4.96	1.99
75-XX	48	36						
76	46	47	198.00	1.72	.00	.00	1.26	1.24
77	45	46	417.00	.95	.00	.00	1.18	.68
78	43	45	636.00	2.08	.00	.00	1.80	1.49
79	55	50	821.98	2.44	.00	.00	2.33	2.40
80	56	55	1020.98	3.59	.00	.00	2.90	3.59
81	57	56	1373.98	2.89	.00	.00	3.90	6.22

82-XX	36	57						
83	71	77	12712.07	2.67	.00	.00	4.01	1.34
84	77	57	1373.98	.93	.00	.00	3.90	6.22
85	26	58	1740.03	3.47	.00	.00	4.94	9.64
86	58	59	1347.11	3.78	.00	.00	3.82	6.00
87	58	60	392.92	2.87	.00	.00	2.51	4.41
88	60	61	226.92	1.04	.00	.00	1.45	1.60
89	59	61	231.08	.13	.00	.00	.66	.23
90	61	62	450.00	.57	.00	.00	1.28	.79
91	62	63	323.00	.40	.00	.00	.92	.43
92	59	64	1116.03	1.31	.00	.00	3.17	4.23
93	64	65	936.03	1.28	.00	.00	2.66	3.06
94	65	66	602.03	.43	.00	.00	1.71	1.35
95	66	67	77.03	.02	.00	.00	.22	.03
96	68	67	28.97	.00	.00	.00	.08	.00
97	69	68	134.97	.02	.00	.00	.38	.08
98	70	69	240.97	.08	.00	.00	.68	.25
99	71	70	1031.19	4.83	.00	.00	2.93	3.66
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	790.22	.92	.00	.00	2.24	2.23
102	72	73	368.22	.21	.00	.00	1.04	.54
103	73	74	74.22	.02	.00	.00	.21	.03
104	75	74	153.78	.05	.00	.00	.44	.11
105	76	75	680.78	1.37	.00	.00	1.93	1.70
106	77	76	873.78	1.88	.00	.00	2.48	2.69
107	77	78	10433.30	1.46	.00	.00	3.29	.93
108-XX	57	78						
109	71	36	2008.83	2.64	.00	.00	5.70	12.58
110	78	80	5042.03	4.40	.00	.00	5.15	4.89
111	78	80	1206.27	4.40	.00	.00	3.42	4.89
112	80	81	2884.85	2.12	.00	.00	2.95	1.74
113	80	82	3309.55	7.78	.00	.00	5.28	6.65
114	81	84	2816.05	3.45	.00	.00	4.49	4.93
115	82	83	268.83	1.38	.00	.00	1.72	2.19
116	84	83	318.18	3.58	.00	.00	2.03	2.99
117	82	89	2759.12	4.27	.00	.00	4.40	4.75
118	83	85	47.28	.09	.00	.00	.30	.09
119	83	86	318.93	3.10	.00	.00	2.04	3.00
120	84	85	2340.67	3.68	.00	.00	3.73	3.50
121	89	91	2632.42	2.83	.00	.00	4.20	4.35
122	87	88	.00	.00	.00	.00	.00	.00
123	86	87	102.90	.25	.00	.00	.66	.37
124	85	86	296.40	3.01	.00	.00	1.89	2.62
125	85	94	1762.35	2.48	.00	.00	2.81	2.07
126	82	113	281.60	.67	.00	.00	1.80	2.38
127	91	90	306.70	.24	.00	.00	.87	.39
128	91	92	160.25	.12	.00	.00	.45	.12
129	93	92	210.38	.18	.00	.00	.60	.19
130	86	93	385.94	2.56	.00	.00	2.46	4.27
131	94	93	315.66	3.09	.00	.00	2.01	2.94
132	92	96	370.63	1.11	.00	.00	2.37	3.96
133	93	103	457.41	.84	.00	.00	1.30	.81
134	94	104	1249.29	.88	.00	.00	1.99	1.09
135	95	98	56.69	.07	.00	.00	.36	.12
136	96	95	98.49	.27	.00	.00	.63	.34
137	96	100	114.83	.24	.00	.00	.73	.45
138	97	101	30.21	.03	.00	.00	.19	.04
139	96	97	72.81	.15	.00	.00	.46	.19

140	98	99	14.89	.01	.00	.00	.10	.01
141	100	99	98.62	.11	.00	.00	.63	.34
142	101	100	42.29	.06	.00	.00	.27	.07
143	99	112	55.81	.09	.00	.00	.36	.12
144	101	112	91.29	.26	.00	.00	.58	.30
145	102	101	161.87	.13	.00	.00	1.03	.85
146	103	102	245.11	.50	.00	.00	1.56	1.84
147	104	103	303.18	3.06	.00	.00	1.94	2.73
148	104	105	848.31	.64	.00	.00	2.41	2.55
149	102	108	83.24	.27	.00	.00	.53	.25
150	103	107	417.68	.62	.00	.00	1.18	.69
151	105	106	807.71	1.30	.00	.00	2.29	2.33
152	107	108	124.12	.15	.00	.00	.79	.52
153	106	107	248.30	1.74	.00	.00	1.58	1.89
154	108	109	170.86	.47	.00	.00	1.09	.94
155	107	110	477.95	.63	.00	.00	1.36	.88
156	106	111	522.91	.97	.00	.00	1.48	1.04
157	109	110	10.71	.00	.00	.00	.07	.01
158	111	110	291.15	1.39	.00	.00	1.86	2.53
159	91	114	2158.97	2.58	.00	.00	2.20	1.02
160	114	115	520.04	2.22	.00	.00	3.32	7.42
201-XXPU	0	211						
202	211	201	.00	.00	.00	.00	.00	.00
203-FGPU	0	202	.00	.00	362.00	.00	.00	.00
204-XX	202	201						
205	201	2	.00	.00	.00	.00	.00	.00
206	203	1	7032.00	.46	.00	.00	3.19	1.08
207	1	204	101.36	.13	.00	.00	.29	.05
208	204	3	2679.40	1.21	.00	.00	2.74	1.52
209-FG	0	3	4566.02	3.75	.00	.00	3.24	1.44
210-XX	6	9						
211-CV	6	205	6937.31	.23	.00	.00	3.15	1.06
212	8	205	3931.33	.09	.00	.00	1.78	.37
213	10	206	41632.42	.23	.00	.00	9.64	5.67
214	206	209	41632.42	.11	.00	.00	9.64	5.67
215	209	210	41632.42	.48	.00	.00	9.64	5.67
216-XX	207	206						
217-XX	207	209						
218	208	207	.00	.00	.00	.00	.00	.00
219	210	212	20833.00	.24	.00	.00	4.82	1.57
220-XXCV	212	213						
221-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
222-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
223-XXPU	212	213						
224-XXCV	208	215						
225	214	215	7933.44	.24	.00	.00	5.63	4.02
226	213	214	20833.00	.17	.00	.00	4.82	1.57
227	215	216	7933.44	19.38	.00	.00	3.60	1.36
228	214	216	12899.56	19.62	.00	.00	4.07	1.37
229	216	217	8333.00	1.48	.00	.00	2.63	.61
230	216	218	12500.00	32.71	.00	.00	5.67	3.15
231-XXFG	0	211						
161	115	116	218.82	.76	.00	.00	1.40	1.49
162	116	117	71.22	.21	.00	.00	.45	.19
163	115	118	139.51	.75	.00	.00	.89	.65
164	114	123	1572.93	.66	.00	.00	1.61	.57
165	118	117	108.18	.22	.00	.00	.69	.40
166	123	118	255.96	2.31	.00	.00	1.63	2.00

167	117	121	93.40	.49	.00	.00	.60	.31
168	118	119	187.30	.67	.00	.00	1.20	1.12
169	119	120	62.29	.10	.00	.00	.40	.15
170	121	122	48.60	.06	.00	.00	.31	.09
171	119	122	61.31	.10	.00	.00	.39	.14
172	122	120	1.41	.00	.00	.00	.01	.00
173	123	124	1174.97	.35	.00	.00	1.20	.33
174	124	125	1224.50	.93	.00	.00	1.95	1.05
175	125	126	782.80	.42	.00	.00	1.25	.46
176	126	127	190.80	.02	.00	.00	.30	.03
177	126	128	453.90	.27	.00	.00	.72	.17
178	128	129	259.30	.05	.00	.00	.41	.06
179	129	130	220.60	.04	.00	.00	.35	.04
180	131	124	62.83	.00	.00	.00	.10	.00
181	131	132	164.99	.16	.00	.00	.47	.12
182	132	133	202.80	.04	.00	.00	.32	.04
183	134	132	303.21	.39	.00	.00	.86	.38
184	134	131	504.02	.22	.00	.00	.80	.20
185	136	134	908.43	.95	.00	.00	1.45	.61
186	109	135	123.75	.34	.00	.00	.79	.52
187	110	136	779.81	.38	.00	.00	1.24	.46
188	138	137	195.36	1.26	.00	.00	1.25	1.21
189	135	136	60.25	.04	.00	.00	.38	.14
190	137	136	131.86	.16	.00	.00	.84	.58
191	111	138	195.36	.35	.00	.00	1.25	1.21
192	112	139	131.20	.22	.00	.00	.84	.58
193	139	140	65.60	.14	.00	.00	.42	.16
194	139	141	65.60	.17	.00	.00	.42	.16
240-FG	0	10	3142.77	13.54	.00	.00	5.01	5.21
241	10	240	1840.45	13.76	.00	.00	2.94	1.93
242	240	11	59.76	.01	.00	.00	.10	.00
243	240	11	717.69	.01	.00	.00	.17	.00

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	225.59	120.00	105.59	45.76
2		.00	224.69	75.00	149.69	64.87
3		.00	224.25	77.00	147.25	63.81
4		958.00	223.51	50.00	173.51	75.19
5		208.00	222.73	85.00	137.73	59.68
6		.00	221.97	95.00	126.97	55.02
7		.00	221.84	98.00	123.84	53.66
8		.00	221.83	98.00	123.83	53.66
9		.00	221.83	102.00	119.83	51.93
10		.00	214.46	175.00	39.46	17.10
11		1063.00	200.69	55.00	145.69	63.13
12		471.00	201.50	25.00	176.50	76.49
13		312.00	194.56	45.00	149.56	64.81
14		.00	201.50	45.00	156.50	67.82
15		250.00	194.20	45.00	149.20	64.65
16		334.00	194.28	45.00	149.28	64.69
17		125.00	194.48	45.00	149.48	64.78

18	469.00	195.60	20.00	175.60	76.09
19	469.00	194.19	30.00	164.19	71.15
20	243.00	190.62	38.00	152.62	66.13
21	143.00	189.91	37.00	152.91	66.26
22	143.00	189.30	36.00	153.30	66.43
23	144.00	188.70	35.00	153.70	66.60
24	.00	187.57	34.00	153.57	66.55
25	.00	184.92	33.00	151.92	65.83
26	.00	183.86	28.00	155.86	67.54
27	.00	183.67	28.00	155.67	67.46
28	.00	183.67	27.00	156.67	67.89
29	199.00	187.27	35.00	152.27	65.98
30	373.00	179.30	36.00	143.30	62.10
31	429.00	172.30	37.00	135.30	58.63
32	.00	165.76	34.00	131.76	57.10
33	198.00	165.77	33.00	132.77	57.53
34	183.00	165.90	31.00	134.90	58.46
35	.00	165.90	34.00	131.90	57.16
36	.00	175.86	34.00	141.86	61.47
37	.00	167.06	34.00	133.06	57.66
38	323.00	166.37	33.00	133.37	57.79
39	.00	164.94	33.00	131.94	57.17
40	301.00	164.27	33.00	131.27	56.88
41	.00	163.86	34.00	129.86	56.27
42	42.00	159.00	34.00	125.00	54.17
43	101.00	163.50	34.00	129.50	56.12
44	1042.00	158.54	33.00	125.54	54.40
45	219.00	161.42	30.00	131.42	56.95
46	219.00	160.47	28.00	132.47	57.40
47	198.00	158.74	25.00	133.74	57.96
48	.00	178.80	35.00	143.80	62.31
49	150.00	165.87	25.00	140.87	61.05
50	178.00	165.97	26.00	139.97	60.66
51	355.00	165.43	27.00	138.43	59.99
52	.00	165.39	28.00	137.39	59.54
53	70.00	165.32	29.00	136.32	59.07
54	311.00	165.69	31.00	134.69	58.37
55	199.00	168.41	27.00	141.41	61.28
56	353.00	172.00	27.00	145.00	62.83
57	.00	174.90	28.00	146.90	63.66
58	.00	180.39	32.00	148.39	64.30
59	.00	176.61	31.00	145.61	63.10
60	166.00	177.53	31.00	146.53	63.49
61	8.00	176.49	31.00	145.49	63.05
62	127.00	175.92	32.00	143.92	62.37
63	323.00	175.52	38.00	137.52	59.59
64	180.00	175.30	30.00	145.30	62.96
65	334.00	174.02	30.00	144.02	62.41
66	525.00	173.59	30.00	143.59	62.22
67	106.00	173.57	30.00	143.57	62.21
68	106.00	173.57	30.00	143.57	62.21
69	106.00	173.59	30.00	143.59	62.22
70	.00	173.67	32.00	141.67	61.39
71	.00	178.50	34.00	144.50	62.62
72	422.00	172.76	32.00	140.76	60.99
73	294.00	172.55	31.00	141.55	61.34
74	228.00	172.52	30.00	142.52	61.76
75	527.00	172.57	30.00	142.57	61.78

76	193.00	173.95	29.00	144.95	62.81
77	31.00	175.83	28.00	147.83	64.06
78	4185.00	174.37	20.00	154.37	66.89
79	.00	178.80	35.00	143.80	62.31
80	53.90	169.97	25.00	144.97	62.82
81	68.80	167.85	25.00	142.85	61.90
82	.00	162.19	25.00	137.19	59.45
83	220.80	160.81	25.00	135.81	58.85
84	157.20	164.39	25.00	139.39	60.40
85	329.20	160.72	25.00	135.72	58.81
86	126.50	157.71	25.00	132.71	57.51
87	102.90	157.46	25.00	132.46	57.40
88	.00	157.46	25.00	132.46	57.40
89	126.70	157.92	25.00	132.92	57.60
90	306.70	154.85	25.00	129.85	56.27
91	6.50	155.09	20.00	135.09	58.54
92	.00	154.96	20.00	134.96	58.48
93	33.80	155.15	20.00	135.15	58.56
94	197.40	158.24	20.00	138.24	59.90
95	41.80	153.59	20.00	133.59	57.89
96	84.50	153.86	20.00	133.86	58.00
97	42.60	153.71	20.00	133.71	57.94
98	41.80	153.52	20.00	133.52	57.86
99	57.70	153.52	20.00	133.52	57.86
100	58.50	153.62	20.00	133.62	57.90
101	58.50	153.68	20.00	133.68	57.93
102	.00	153.81	15.00	138.81	60.15
103	97.80	154.30	15.00	139.30	60.36
104	97.80	157.36	15.00	142.36	61.69
105	40.60	156.72	15.00	141.72	61.41
106	36.50	155.42	15.00	140.42	60.85
107	63.90	153.69	15.00	138.69	60.10
108	36.50	153.53	15.00	138.53	60.03
109	36.40	153.06	15.00	138.06	59.83
110	.00	153.06	15.00	138.06	59.83
111	36.40	154.45	15.00	139.45	60.43
112	15.90	153.42	25.00	128.42	55.65
113	281.60	161.52	20.00	141.52	61.33
114	66.00	152.51	20.00	132.51	57.42
115	161.70	150.28	20.00	130.28	56.46
116	147.60	149.52	20.00	129.52	56.13
117	86.00	149.31	20.00	129.31	56.04
118	100.00	149.54	20.00	129.54	56.13
119	63.70	148.87	20.00	128.87	55.84
120	63.70	148.76	20.00	128.76	55.80
121	44.80	148.82	20.00	128.82	55.82
122	108.50	148.76	20.00	128.76	55.80
123	142.00	151.85	20.00	131.85	57.14
124	13.30	151.51	20.00	131.51	56.99
125	441.70	150.58	20.00	130.58	56.58
126	138.10	150.16	20.00	130.16	56.40
127	190.80	150.14	20.00	130.14	56.39
128	194.60	149.89	20.00	129.89	56.29
129	38.70	149.84	20.00	129.84	56.26
130	220.60	149.80	20.00	129.80	56.25
131	276.20	151.51	20.00	131.51	56.99
132	265.40	151.34	20.00	131.34	56.92
133	202.80	151.30	20.00	131.30	56.90

134	101.20	151.73	20.00	131.73	57.08
135	63.50	152.72	20.00	132.72	57.51
136	63.50	152.68	20.00	132.68	57.50
137	63.50	152.85	20.00	132.85	57.57
138	.00	154.10	20.00	134.10	58.11
139	.00	153.20	20.00	133.20	57.72
140	65.60	153.06	20.00	133.06	57.66
141	65.60	153.04	20.00	133.04	57.65
201	.00	224.69	70.00	154.69	67.03
202	.00	372.00	135.00	237.00	102.70
203	.00	226.05	130.00	96.05	41.62
204	.00	225.46	80.00	145.46	63.03
205	.00	221.74	102.00	119.74	51.89
206	.00	214.23	175.00	39.23	17.00
207	.00	221.83	175.00	46.83	20.29
208	.00	221.83	175.00	46.83	20.29
209	.00	214.12	175.00	39.12	16.95
210	.00	213.64	175.00	38.64	16.74
211	.00	224.69	208.00	16.69	7.23
212	.00	213.40	175.00	38.40	16.64
213	.00	269.15	175.00	94.15	40.80
214	.00	268.97	175.00	93.97	40.72
215	.00	268.73	175.00	93.73	40.62
216	.00	249.36	130.00	119.36	51.72
217	8333.00	247.87	215.00	32.87	14.24
218	12500.00	216.65	215.00	1.65	.71
240	1063.00	200.70	95.00	105.70	45.80

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
202	102.70	218	.71
12	76.49	211	7.23
18	76.09	217	14.24
4	75.19	212	16.64
19	71.15	210	16.74
28	67.89	209	16.95
14	67.82	206	17.00
26	67.54	10	17.10
27	67.46	207	20.29
201	67.03	208	20.29

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
213	9.64	172	.01
214	9.64	35	.06

215	9.64	157	.07
43	7.94	96	.08
221	7.39	52	.09
222	7.39	140	.10
23	6.82	242	.10
36	6.37	180	.10
37	6.30	243	.17
38	6.25	138	.19

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	7032.00
6	2578.04
23	29461.46
203	.00
209	4566.02
240	3142.77

NET SYSTEM INFLOW = 46780.30
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 46780.30

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
217	8333.00
218	12500.00
130	4072.00

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S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00482

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	203	6984.69	.02	218.08	.00	2.20	.44
2	1	2	6260.22	.86	.00	.00	2.84	.87
3	1	2	476.01	.86	.00	.00	1.35	.87
4	2	3	4160.39	.42	.00	.00	1.31	.17
5	2	3	2575.84	.42	.00	.00	1.17	.17
6-FG	0	204	1607.56	1.06	.00	.00	1.64	.59
7	3	4	6357.27	.50	.00	.00	2.00	.37
8	3	4	3936.01	.50	.00	.00	1.79	.37
9	3	4	1250.97	.50	.00	.00	1.28	.37
10	4	5	6093.49	.56	.00	.00	1.92	.34
11	4	5	3772.70	.56	.00	.00	1.71	.34
12	4	5	1199.06	.56	.00	.00	1.22	.34
13	5	6	5799.55	.58	.00	.00	1.83	.31
14	5	6	3590.71	.58	.00	.00	1.63	.31
15	6	7	3396.26	.10	.00	.00	1.54	.28
16-XXPU	7	8						
17-XXPU	7	8						
18-XXPU	7	8						
19-CV	7	8	3396.26	.01	.00	.00	1.54	.28
20	8	9	.00	.00	.00	.00	.00	.00
21	9	208	.00	.00	.00	.00	.00	.00
22	205	10	9390.26	5.55	.00	.00	4.26	1.85
23-FG	0	10	23696.32	9.05	.00	.00	5.49	2.00
24	210	11	13560.59	5.86	.00	.00	3.14	.71
25-CV	5	12	1571.00	11.96	.00	.00	2.51	1.67
26	12	11	740.69	.79	.00	.00	1.18	.42
27	11	13	14459.04	3.00	.00	.00	3.35	.80
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	-.81	.00	.00	.00	.00	.00
31	17	16	166.19	.02	.00	.00	.27	.03
32	13	17	228.69	.01	.00	.00	.36	.05
33	12	18	594.81	2.64	.00	.00	1.69	1.32
34	18	19	360.31	.94	.00	.00	1.02	.52
35	15	19	-125.81	.24	.00	.00	.36	.07
36	13	20	14074.35	2.02	.00	.00	4.44	1.61
37	20	21	13952.85	.36	.00	.00	4.40	1.59
38	21	22	13881.35	.31	.00	.00	4.38	1.57
39	22	23	13809.85	.31	.00	.00	4.35	1.56
40	23	24	13737.85	.59	.00	.00	4.33	1.54
41-XX	15	28						
42	24	25	12575.39	1.44	.00	.00	3.96	1.31
43	25	26	12575.39	.57	.00	.00	5.71	3.18
44	26	27	11548.85	.11	.00	.00	3.64	1.12
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	11548.85	2.74	.00	.00	3.64	1.12
48	24	29	1162.46	.11	.00	.00	1.85	.96
49	29	30	1062.96	2.82	.00	.00	3.02	3.87

50	30	31	876.46	2.63	.00	.00	2.49	2.71
51	31	32	661.96	2.74	.00	.00	1.88	1.61
52	33	32	-31.62	.00	.00	.00	.09	.01
53	34	33	67.38	.01	.00	.00	.19	.02
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	978.65	2.32	.00	.00	2.78	3.32
57	37	38	320.38	.15	.00	.00	.91	.42
58	38	34	158.88	.08	.00	.00	.45	.11
59	37	39	334.53	.59	.00	.00	.95	.45
60	32	39	314.97	.35	.00	.00	.89	.41
61	32	40	315.37	.46	.00	.00	.89	.41
62	40	41	164.87	.14	.00	.00	.47	.12
63	39	41	203.63	.25	.00	.00	.58	.18
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	323.74	.43	.00	.00	.92	.43
68	54	53	168.24	.13	.00	.00	.48	.13
69	53	39	96.13	.03	.00	.00	.27	.05
70	52	53	-37.11	.01	.00	.00	.11	.01
71	51	52	-37.11	.00	.00	.00	.11	.01
72	50	51	140.39	.05	.00	.00	.40	.09
73	50	49	75.00	.03	.00	.00	.21	.03
74	79	71	11548.85	.17	.00	.00	3.64	1.12
75-XX	48	36						
76	46	47	99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	304.39	.39	.00	.00	.86	.38
80	56	55	403.89	.64	.00	.00	1.15	.64
81	57	56	580.39	.59	.00	.00	1.65	1.26
82-XX	36	57						
83	71	77	10059.04	1.73	.00	.00	3.17	.87
84	77	57	580.39	.19	.00	.00	1.65	1.26
85	26	58	1026.55	1.31	.00	.00	2.91	3.63
86	58	59	801.05	1.44	.00	.00	2.27	2.29
87	58	60	225.49	1.03	.00	.00	1.44	1.58
88	60	61	142.49	.44	.00	.00	.91	.67
89	59	61	86.51	.02	.00	.00	.25	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	714.55	.57	.00	.00	2.03	1.85
93	64	65	624.55	.61	.00	.00	1.77	1.45
94	65	66	457.55	.26	.00	.00	1.30	.81
95	66	67	195.05	.10	.00	.00	.55	.17
96	68	67	-142.05	.04	.00	.00	.40	.09
97	69	68	-89.05	.01	.00	.00	.25	.04
98	70	69	-36.05	.00	.00	.00	.10	.01
99	71	70	511.15	1.32	.00	.00	1.45	1.00
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	547.20	.46	.00	.00	1.55	1.13
102	72	73	336.20	.18	.00	.00	.95	.46
103	73	74	189.20	.12	.00	.00	.54	.16
104	75	74	-75.20	.01	.00	.00	.21	.03
105	76	75	188.30	.13	.00	.00	.53	.16
106	77	76	284.80	.24	.00	.00	.81	.34
107	77	78	9178.35	1.15	.00	.00	2.89	.73

108-XX	57	78						
109	71	36	978.65	.70	.00	.00	2.78	3.32
110	78	80	5717.88	5.56	.00	.00	5.84	6.17
111	78	80	1367.97	5.56	.00	.00	3.88	6.17
112	80	81	3154.47	2.50	.00	.00	3.22	2.05
113	80	82	3904.43	10.56	.00	.00	6.23	9.03
114	81	84	3120.07	4.17	.00	.00	4.98	5.96
115	82	83	183.81	.68	.00	.00	1.17	1.08
116	84	83	362.65	4.56	.00	.00	2.31	3.80
117	82	89	3579.81	6.92	.00	.00	5.71	7.69
118	83	85	62.96	.16	.00	.00	.40	.15
119	83	86	373.10	4.15	.00	.00	2.38	4.01
120	84	85	2678.82	4.72	.00	.00	4.27	4.49
121	89	91	3516.46	4.83	.00	.00	5.61	7.44
122	87	88	.00	.00	.00	.00	.00	.00
123	86	87	51.45	.07	.00	.00	.33	.10
124	85	86	345.34	4.00	.00	.00	2.20	3.47
125	85	94	2231.84	3.85	.00	.00	3.56	3.20
126	82	113	140.80	.18	.00	.00	.90	.66
127	91	90	153.35	.07	.00	.00	.43	.11
128	91	92	-218.63	.22	.00	.00	.62	.21
129	93	92	482.64	.85	.00	.00	1.37	.90
130	86	93	603.75	5.87	.00	.00	3.85	9.78
131	94	93	452.41	6.02	.00	.00	2.89	5.73
132	92	96	264.02	.59	.00	.00	1.69	2.11
133	93	103	556.61	1.21	.00	.00	1.58	1.17
134	94	104	1680.73	1.52	.00	.00	2.68	1.90
135	95	98	43.08	.04	.00	.00	.27	.07
136	96	95	63.98	.12	.00	.00	.41	.15
137	96	100	91.64	.15	.00	.00	.58	.30
138	97	101	44.84	.06	.00	.00	.29	.08
139	96	97	66.14	.13	.00	.00	.42	.16
140	98	99	22.18	.02	.00	.00	.14	.02
141	100	99	42.55	.02	.00	.00	.27	.07
142	101	100	-19.84	.01	.00	.00	.13	.02
143	99	112	35.89	.04	.00	.00	.23	.05
144	101	112	37.66	.05	.00	.00	.24	.06
145	102	101	2.23	.00	.00	.00	.01	.00
146	103	102	214.63	.39	.00	.00	1.37	1.44
147	104	103	424.85	5.71	.00	.00	2.71	5.10
148	104	105	1206.98	1.22	.00	.00	3.42	4.90
149	102	108	212.40	1.54	.00	.00	1.36	1.41
150	103	107	717.93	1.68	.00	.00	2.04	1.87
151	105	106	1186.68	2.66	.00	.00	3.37	4.74
152	107	108	148.41	.21	.00	.00	.95	.73
153	106	107	363.43	3.51	.00	.00	2.32	3.82
154	108	109	342.56	1.71	.00	.00	2.19	3.42
155	107	110	901.00	2.02	.00	.00	2.56	2.85
156	106	111	805.00	2.15	.00	.00	2.28	2.31
157	109	110	101.82	.11	.00	.00	.65	.36
158	111	110	470.18	3.38	.00	.00	3.00	6.15
159	91	114	3578.49	6.58	.00	.00	3.65	2.59
160	114	115	401.03	1.37	.00	.00	2.56	4.58
201-XXPU	0	211						
202	211	201	.00	.00	.00	.00	.00	.00
203-FGPU	0	202	.00	.00	362.00	.00	.00	.00
204-XX	202	201						
205	201	2	.00	.00	.00	.00	.00	.00

206	203	1	6984.69	.45	.00	.00	3.17	1.07
207	1	204	248.46	.71	.00	.00	.70	.26
208	204	3	1856.02	.61	.00	.00	1.90	.77
209-FG	0	3	2952.00	1.67	.00	.00	2.09	.64
210-XX	6	9						
211-CV	6	205	5994.00	.18	.00	.00	2.72	.81
212	8	205	3396.26	.07	.00	.00	1.54	.28
213	10	206	34393.59	.16	.00	.00	7.96	3.98
214	206	209	34393.59	.08	.00	.00	7.96	3.98
215	209	210	34393.59	.34	.00	.00	7.96	3.98
216-XX	207	206						
217-XX	207	209						
218	208	207	.00	.00	.00	.00	.00	.00
219	210	212	20833.00	.24	.00	.00	4.82	1.57
220-XXCV	212	213						
221-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
222-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
223-XXPU	212	213						
224-XXCV	208	215						
225	214	215	7933.44	.24	.00	.00	5.63	4.02
226	213	214	20833.00	.17	.00	.00	4.82	1.57
227	215	216	7933.44	19.38	.00	.00	3.60	1.36
228	214	216	12899.56	19.62	.00	.00	4.07	1.37
229	216	217	8333.00	1.48	.00	.00	2.63	.61
230	216	218	12500.00	32.71	.00	.00	5.67	3.15
231-XXFG	0	211						
161	115	116	169.78	.48	.00	.00	1.08	.93
162	116	117	95.98	.36	.00	.00	.61	.32
163	115	118	150.41	.86	.00	.00	.96	.75
164	114	123	3144.46	2.37	.00	.00	3.21	2.04
165	118	117	.94	.00	.00	.00	.01	.00
166	123	118	-13.03	.01	.00	.00	.08	.01
167	117	121	53.91	.18	.00	.00	.34	.11
168	118	119	86.44	.16	.00	.00	.55	.27
169	119	120	27.78	.02	.00	.00	.18	.03
170	121	122	31.51	.03	.00	.00	.20	.04
171	119	122	26.80	.02	.00	.00	.17	.03
172	122	120	4.07	.00	.00	.00	.03	.00
173	123	124	3086.49	2.07	.00	.00	3.15	1.97
174	124	125	4573.95	10.65	.00	.00	7.30	12.10
175	125	126	4353.10	10.05	.00	.00	6.95	11.04
176	126	127	95.40	.01	.00	.00	.15	.01
177	126	128	4188.65	16.45	.00	.00	6.68	10.28
178	128	129	4091.35	8.17	.00	.00	6.53	9.85
179	129	130	4072.00	9.27	.00	.00	6.50	9.76
180	131	124	1494.11	.78	.00	.00	2.38	1.52
181	131	132	-279.54	.44	.00	.00	.79	.33
182	132	133	101.40	.01	.00	.00	.16	.01
183	134	132	513.64	1.03	.00	.00	1.46	1.01
184	134	131	1352.67	1.38	.00	.00	2.16	1.27
185	136	134	1916.91	3.80	.00	.00	3.06	2.42
186	109	135	222.54	1.02	.00	.00	1.42	1.54
187	110	136	1473.00	1.23	.00	.00	2.35	1.48
188	138	137	316.62	3.08	.00	.00	2.02	2.96
189	135	136	190.79	.32	.00	.00	1.22	1.16
190	137	136	284.87	.68	.00	.00	1.82	2.43
191	111	138	316.62	.86	.00	.00	2.02	2.96
192	112	139	65.60	.06	.00	.00	.42	.16

193	139	140	32.80	.04	.00	.00	.21	.04
194	139	141	32.80	.05	.00	.00	.21	.04
240-FG	0	10	2527.78	9.05	.00	.00	4.03	3.48
241	10	240	1220.76	6.43	.00	.00	1.95	.90
242	240	11	46.88	.01	.00	.00	.07	.00
243	240	11	642.39	.01	.00	.00	.15	.00

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	227.60	120.00	107.60	46.63
2		.00	226.75	75.00	151.75	65.76
3		.00	226.33	77.00	149.33	64.71
4		479.00	225.83	50.00	175.83	76.19
5		104.00	225.26	85.00	140.26	60.78
6		.00	224.68	95.00	129.68	56.20
7		.00	224.58	98.00	126.58	54.85
8		.00	224.58	98.00	126.58	54.85
9		.00	224.58	102.00	122.58	53.12
10		.00	218.95	175.00	43.95	19.05
11		531.50	212.51	55.00	157.51	68.26
12		235.50	213.30	25.00	188.30	81.60
13		156.00	209.51	45.00	164.51	71.29
14		.00	213.30	45.00	168.30	72.93
15		125.00	209.49	45.00	164.49	71.28
16		167.00	209.49	45.00	164.49	71.28
17		62.50	209.51	45.00	164.51	71.29
18		234.50	210.66	20.00	190.66	82.62
19		234.50	209.72	30.00	179.72	77.88
20		121.50	207.50	38.00	169.50	73.45
21		71.50	207.13	37.00	170.13	73.72
22		71.50	206.82	36.00	170.82	74.02
23		72.00	206.51	35.00	171.51	74.32
24		.00	205.92	34.00	171.92	74.50
25		.00	204.48	33.00	171.48	74.31
26		.00	203.91	28.00	175.91	76.23
27		.00	203.80	28.00	175.80	76.18
28		.00	203.80	27.00	176.80	76.61
29		99.50	205.82	35.00	170.82	74.02
30		186.50	202.99	36.00	166.99	72.36
31		214.50	200.37	37.00	163.37	70.79
32		.00	197.63	34.00	163.63	70.91
33		99.00	197.63	33.00	164.63	71.34
34		91.50	197.64	31.00	166.64	72.21
35		.00	197.64	34.00	163.64	70.91
36		.00	200.20	34.00	166.20	72.02
37		.00	197.87	34.00	163.87	71.01
38		161.50	197.72	33.00	164.72	71.38
39		.00	197.28	33.00	164.28	71.19
40		150.50	197.17	33.00	164.17	71.14
41		.00	197.03	34.00	163.03	70.65
42		21.00	195.64	34.00	161.64	70.04
43		50.50	196.93	34.00	162.93	70.60

44	521.00	195.51	33.00	162.51	70.42
45	109.50	196.35	30.00	166.35	72.09
46	109.50	196.09	28.00	168.09	72.84
47	99.00	195.61	25.00	170.61	73.93
48	.00	201.06	35.00	166.06	71.96
49	75.00	197.33	25.00	172.33	74.67
50	89.00	197.35	26.00	171.35	74.25
51	177.50	197.30	27.00	170.30	73.80
52	.00	197.31	28.00	169.31	73.37
53	35.00	197.31	29.00	168.31	72.94
54	155.50	197.44	31.00	166.44	72.13
55	99.50	197.74	27.00	170.74	73.99
56	176.50	198.39	27.00	171.39	74.27
57	.00	198.97	28.00	170.97	74.09
58	.00	202.61	32.00	170.61	73.93
59	.00	201.16	31.00	170.16	73.74
60	83.00	201.58	31.00	170.58	73.92
61	4.00	201.14	31.00	170.14	73.73
62	63.50	200.98	32.00	168.98	73.23
63	161.50	200.87	38.00	162.87	70.58
64	90.00	200.59	30.00	170.59	73.92
65	167.00	199.98	30.00	169.98	73.66
66	262.50	199.72	30.00	169.72	73.55
67	53.00	199.63	30.00	169.63	73.50
68	53.00	199.59	30.00	169.59	73.49
69	53.00	199.58	30.00	169.58	73.48
70	.00	199.58	32.00	167.58	72.62
71	.00	200.89	34.00	166.89	72.32
72	211.00	199.11	32.00	167.11	72.42
73	147.00	198.93	31.00	167.93	72.77
74	114.00	198.81	30.00	168.81	73.15
75	263.50	198.80	30.00	168.80	73.15
76	96.50	198.93	29.00	169.93	73.63
77	15.50	199.16	28.00	171.16	74.17
78	2092.50	198.01	20.00	178.01	77.14
79	.00	201.06	35.00	166.06	71.96
80	26.95	192.45	25.00	167.45	72.56
81	34.40	189.95	25.00	164.95	71.48
82	.00	181.89	25.00	156.89	67.98
83	110.40	181.21	25.00	156.21	67.69
84	78.60	185.78	25.00	160.78	69.67
85	164.60	181.06	25.00	156.06	67.63
86	63.25	177.06	25.00	152.06	65.89
87	51.45	176.99	25.00	151.99	65.86
88	.00	176.99	25.00	151.99	65.86
89	63.35	174.97	25.00	149.97	64.99
90	153.35	170.07	25.00	145.07	62.86
91	3.25	170.13	20.00	150.13	65.06
92	.00	170.36	20.00	150.36	65.15
93	16.90	171.19	20.00	151.19	65.52
94	98.70	177.21	20.00	157.21	68.13
95	20.90	169.64	20.00	149.64	64.85
96	42.25	169.76	20.00	149.76	64.90
97	21.30	169.64	20.00	149.64	64.84
98	20.90	169.60	20.00	149.60	64.83
99	28.85	169.59	20.00	149.59	64.82
100	29.25	169.61	20.00	149.61	64.83
101	29.25	169.59	20.00	149.59	64.82

102	.00	169.59	15.00	154.59	66.99
103	48.90	169.98	15.00	154.98	67.16
104	48.90	175.70	15.00	160.70	69.64
105	20.30	174.47	15.00	159.47	69.10
106	18.25	171.82	15.00	156.82	67.95
107	31.95	168.29	15.00	153.29	66.43
108	18.25	168.05	15.00	153.05	66.32
109	18.20	166.34	15.00	151.34	65.58
110	.00	166.27	15.00	151.27	65.55
111	18.20	169.67	15.00	154.67	67.02
112	7.95	169.54	25.00	144.54	62.63
113	140.80	181.70	20.00	161.70	70.07
114	33.00	163.55	20.00	143.55	62.21
115	80.85	162.18	20.00	142.18	61.61
116	73.80	161.70	20.00	141.70	61.40
117	43.00	161.34	20.00	141.34	61.25
118	50.00	161.32	20.00	141.32	61.24
119	31.85	161.16	20.00	141.16	61.17
120	31.85	161.14	20.00	141.14	61.16
121	22.40	161.16	20.00	141.16	61.17
122	54.25	161.14	20.00	141.14	61.16
123	71.00	161.19	20.00	141.19	61.18
124	6.65	159.12	20.00	139.12	60.28
125	220.85	148.47	20.00	128.47	55.67
126	69.05	138.42	20.00	118.42	51.31
127	95.40	138.41	20.00	118.41	51.31
128	97.30	121.96	20.00	101.96	44.18
129	19.35	113.79	20.00	93.79	40.64
130	4072.00	104.52	20.00	84.52	36.63
131	138.10	159.89	20.00	139.89	60.62
132	132.70	160.33	20.00	140.33	60.81
133	101.40	160.32	20.00	140.32	60.81
134	50.60	161.28	20.00	141.28	61.22
135	31.75	165.32	20.00	145.32	62.97
136	31.75	165.04	20.00	145.04	62.85
137	31.75	165.72	20.00	145.72	63.15
138	.00	168.81	20.00	148.81	64.48
139	.00	169.48	20.00	149.48	64.77
140	32.80	169.44	20.00	149.44	64.76
141	32.80	169.43	20.00	149.43	64.75
201	.00	226.75	70.00	156.75	67.92
202	.00	372.00	135.00	237.00	102.70
203	.00	228.05	130.00	98.05	42.49
204	.00	226.94	80.00	146.94	63.67
205	.00	224.51	102.00	122.51	53.09
206	.00	218.79	175.00	43.79	18.98
207	.00	224.58	175.00	49.58	21.48
208	.00	224.58	175.00	49.58	21.48
209	.00	218.71	175.00	43.71	18.94
210	.00	218.38	175.00	43.38	18.80
211	.00	226.75	208.00	18.75	8.12
212	.00	218.14	175.00	43.14	18.69
213	.00	273.89	175.00	98.89	42.85
214	.00	273.71	175.00	98.71	42.78
215	.00	273.47	175.00	98.47	42.67
216	.00	254.10	130.00	124.10	53.77
217	8333.00	252.61	215.00	37.61	16.30
218	12500.00	221.39	215.00	6.39	2.77

240	531.50	212.52	95.00	117.52	50.93

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
202	102.70	218	2.77
18	82.62	211	8.12
12	81.60	217	16.30
19	77.88	212	18.69
78	77.14	210	18.80
28	76.61	209	18.94
26	76.23	206	18.98
4	76.19	10	19.05
27	76.18	207	21.48
49	74.67	208	21.48

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
213	7.96	30	.00
214	7.96	165	.01
215	7.96	145	.01
221	7.39	172	.03
222	7.39	242	.07
174	7.30	166	.08
175	6.95	52	.09
177	6.68	98	.10
178	6.53	70	.11
179	6.50	71	.11

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	6984.69
6	1607.56
23	23696.32
203	.00
209	2952.00
240	2527.78

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NET SYSTEM INFLOW  =  37768.35
NET SYSTEM OUTFLOW =       .00
NET SYSTEM DEMAND  =  37768.35
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D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
217	8333.00
218	12500.00
133	4073.00

****
S I M U L A T I O N   R E S U L T S
****

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00386

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE FG -FIXED GRADE NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	203	6984.64	.02	218.08	.00	2.20	.44
2	1	2	6267.06	.86	.00	.00	2.84	.88
3	1	2	476.53	.86	.00	.00	1.35	.88
4	2	3	4164.93	.42	.00	.00	1.31	.17
5	2	3	2578.66	.42	.00	.00	1.17	.17
6-FG	0	204	1610.12	1.06	.00	.00	1.64	.59
7	3	4	6358.96	.50	.00	.00	2.00	.37
8	3	4	3937.06	.50	.00	.00	1.79	.37
9	3	4	1251.30	.50	.00	.00	1.28	.37
10	4	5	6095.18	.56	.00	.00	1.92	.34
11	4	5	3773.74	.56	.00	.00	1.71	.34
12	4	5	1199.39	.56	.00	.00	1.22	.34
13	5	6	5801.04	.58	.00	.00	1.83	.31
14	5	6	3591.63	.58	.00	.00	1.63	.31
15	6	7	3397.13	.10	.00	.00	1.54	.28
16-XXPU	7	8						
17-XXPU	7	8						

18-XXPU	7	8						
19-CV	7	8	3397.13	.01	.00	.00	1.54	.28
20	8	9	.00	.00	.00	.00	.00	.00
21	9	208	.00	.00	.00	.00	.00	.00
22	205	10	9392.67	5.56	.00	.00	4.26	1.85
23-FG	0	10	23702.50	9.05	.00	.00	5.49	2.00
24	210	11	13569.12	5.87	.00	.00	3.14	.71
25-CV	5	12	1571.64	11.97	.00	.00	2.51	1.67
26	12	11	741.08	.79	.00	.00	1.18	.42
27	11	13	14468.69	3.00	.00	.00	3.35	.80
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	-1.07	.00	.00	.00	.00	.00
31	17	16	165.93	.02	.00	.00	.26	.03
32	13	17	228.43	.01	.00	.00	.36	.05
33	12	18	595.07	2.64	.00	.00	1.69	1.32
34	18	19	360.57	.94	.00	.00	1.02	.52
35	15	19	-126.07	.24	.00	.00	.36	.07
36	13	20	14084.25	2.02	.00	.00	4.44	1.61
37	20	21	13962.75	.37	.00	.00	4.40	1.59
38	21	22	13891.25	.31	.00	.00	4.38	1.57
39	22	23	13819.75	.31	.00	.00	4.36	1.56
40	23	24	13747.75	.59	.00	.00	4.33	1.54
41-XX	15	28						
42	24	25	12584.97	1.44	.00	.00	3.97	1.31
43	25	26	12584.97	.57	.00	.00	5.71	3.18
44	26	27	11558.16	.11	.00	.00	3.64	1.12
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	11558.16	2.74	.00	.00	3.64	1.12
48	24	29	1162.78	.11	.00	.00	1.86	.96
49	29	30	1063.28	2.83	.00	.00	3.02	3.87
50	30	31	876.78	2.63	.00	.00	2.49	2.71
51	31	32	662.28	2.74	.00	.00	1.88	1.61
52	33	32	-31.62	.00	.00	.00	.09	.01
53	34	33	67.38	.01	.00	.00	.19	.02
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	978.81	2.32	.00	.00	2.78	3.32
57	37	38	320.38	.15	.00	.00	.91	.42
58	38	34	158.88	.08	.00	.00	.45	.11
59	37	39	334.70	.59	.00	.00	.95	.46
60	32	39	315.20	.35	.00	.00	.89	.41
61	32	40	315.46	.46	.00	.00	.89	.41
62	40	41	164.96	.14	.00	.00	.47	.12
63	39	41	203.54	.25	.00	.00	.58	.18
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	323.73	.43	.00	.00	.92	.43
68	54	53	168.23	.13	.00	.00	.48	.13
69	53	39	95.64	.03	.00	.00	.27	.04
70	52	53	-37.59	.01	.00	.00	.11	.01
71	51	52	-37.59	.00	.00	.00	.11	.01
72	50	51	139.91	.05	.00	.00	.40	.09
73	50	49	75.00	.03	.00	.00	.21	.03
74	79	71	11558.16	.17	.00	.00	3.64	1.12
75-XX	48	36						

76	46	47	99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	303.91	.39	.00	.00	.86	.38
80	56	55	403.41	.64	.00	.00	1.14	.64
81	57	56	579.91	.59	.00	.00	1.64	1.26
82-XX	36	57						
83	71	77	10068.21	1.73	.00	.00	3.17	.87
84	77	57	579.91	.19	.00	.00	1.64	1.26
85	26	58	1026.81	1.31	.00	.00	2.91	3.63
86	58	59	801.27	1.44	.00	.00	2.27	2.29
87	58	60	225.54	1.03	.00	.00	1.44	1.58
88	60	61	142.54	.44	.00	.00	.91	.67
89	59	61	86.46	.02	.00	.00	.25	.04
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	714.81	.58	.00	.00	2.03	1.86
93	64	65	624.81	.61	.00	.00	1.77	1.45
94	65	66	457.81	.26	.00	.00	1.30	.81
95	66	67	195.31	.10	.00	.00	.55	.17
96	68	67	-142.31	.04	.00	.00	.40	.09
97	69	68	-89.31	.01	.00	.00	.25	.04
98	70	69	-36.31	.00	.00	.00	.10	.01
99	71	70	511.14	1.32	.00	.00	1.45	1.00
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	547.45	.46	.00	.00	1.55	1.13
102	72	73	336.45	.18	.00	.00	.95	.46
103	73	74	189.45	.12	.00	.00	.54	.16
104	75	74	-75.45	.01	.00	.00	.21	.03
105	76	75	188.05	.13	.00	.00	.53	.16
106	77	76	284.55	.24	.00	.00	.81	.34
107	77	78	9188.25	1.16	.00	.00	2.90	.73
108-XX	57	78						
109	71	36	978.81	.70	.00	.00	2.78	3.32
110	78	80	5725.87	5.57	.00	.00	5.85	6.19
111	78	80	1369.88	5.57	.00	.00	3.89	6.19
112	80	81	3181.14	2.54	.00	.00	3.25	2.08
113	80	82	3887.66	10.48	.00	.00	6.20	8.96
114	81	84	3146.74	4.24	.00	.00	5.02	6.05
115	82	83	207.42	.85	.00	.00	1.32	1.35
116	84	83	361.92	4.55	.00	.00	2.31	3.79
117	82	89	3539.44	6.78	.00	.00	5.65	7.53
118	83	85	83.28	.26	.00	.00	.53	.25
119	83	86	375.65	4.20	.00	.00	2.40	4.06
120	84	85	2706.23	4.81	.00	.00	4.32	4.58
121	89	91	3476.09	4.73	.00	.00	5.55	7.28
122	87	88	.00	.00	.00	.00	.00	.00
123	86	87	51.45	.07	.00	.00	.33	.10
124	85	86	342.82	3.94	.00	.00	2.19	3.43
125	85	94	2282.09	4.01	.00	.00	3.64	3.34
126	82	113	140.80	.18	.00	.00	.90	.66
127	91	90	153.35	.07	.00	.00	.43	.11
128	91	92	-64.37	.02	.00	.00	.18	.02
129	93	92	396.38	.59	.00	.00	1.12	.62
130	86	93	603.77	5.87	.00	.00	3.85	9.78
131	94	93	443.62	5.80	.00	.00	2.83	5.52
132	92	96	332.01	.90	.00	.00	2.12	3.23
133	93	103	634.12	1.55	.00	.00	1.80	1.49

134	94	104	1739.76	1.62	.00	.00	2.78	2.02
135	95	98	57.42	.07	.00	.00	.37	.13
136	96	95	78.32	.17	.00	.00	.50	.22
137	96	100	122.51	.27	.00	.00	.78	.51
138	97	101	67.62	.12	.00	.00	.43	.17
139	96	97	88.92	.22	.00	.00	.57	.28
140	98	99	36.52	.04	.00	.00	.23	.05
141	100	99	41.57	.02	.00	.00	.27	.07
142	101	100	-51.69	.08	.00	.00	.33	.10
143	99	112	49.24	.07	.00	.00	.31	.09
144	101	112	24.31	.02	.00	.00	.16	.03
145	102	101	-65.76	.02	.00	.00	.42	.16
146	103	102	185.88	.30	.00	.00	1.19	1.10
147	104	103	425.52	5.73	.00	.00	2.72	5.11
148	104	105	1265.35	1.34	.00	.00	3.59	5.34
149	102	108	251.64	2.11	.00	.00	1.61	1.93
150	103	107	824.85	2.18	.00	.00	2.34	2.42
151	105	106	1245.05	2.90	.00	.00	3.53	5.19
152	107	108	152.50	.22	.00	.00	.97	.76
153	106	107	371.64	3.66	.00	.00	2.37	3.98
154	108	109	385.89	2.13	.00	.00	2.46	4.27
155	107	110	1012.04	2.51	.00	.00	2.87	3.53
156	106	111	855.16	2.41	.00	.00	2.43	2.59
157	109	110	120.52	.15	.00	.00	.77	.49
158	111	110	497.91	3.76	.00	.00	3.18	6.84
159	91	114	3383.86	5.93	.00	.00	3.46	2.34
160	114	115	391.66	1.32	.00	.00	2.50	4.39
201-XXPU	0	211						
202	211	201	.00	.00	.00	.00	.00	.00
203-FGPU	0	202	.00	.00	362.00	.00	.00	.00
204-XX	202	201						
205	201	2	.00	.00	.00	.00	.00	.00
206	203	1	6984.64	.45	.00	.00	3.17	1.07
207	1	204	241.05	.67	.00	.00	.68	.25
208	204	3	1851.17	.61	.00	.00	1.89	.76
209-FG	0	3	2952.55	1.67	.00	.00	2.09	.64
210-XX	6	9						
211-CV	6	205	5995.54	.18	.00	.00	2.72	.81
212	8	205	3397.13	.07	.00	.00	1.54	.28
213	10	206	34402.13	.16	.00	.00	7.97	3.98
214	206	209	34402.13	.08	.00	.00	7.97	3.98
215	209	210	34402.13	.34	.00	.00	7.97	3.98
216-XX	207	206						
217-XX	207	209						
218	208	207	.00	.00	.00	.00	.00	.00
219	210	212	20833.00	.24	.00	.00	4.82	1.57
220-XXCV	212	213						
221-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
222-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
223-XXPU	212	213						
224-XXCV	208	215						
225	214	215	7933.44	.24	.00	.00	5.63	4.02
226	213	214	20833.00	.17	.00	.00	4.82	1.57
227	215	216	7933.44	19.38	.00	.00	3.60	1.36
228	214	216	12899.56	19.62	.00	.00	4.07	1.37
229	216	217	8333.00	1.48	.00	.00	2.63	.61
230	216	218	12500.00	32.71	.00	.00	5.67	3.15
231-XXFG	0	211						

161	115	116	166.38	.46	.00	.00	1.06	.90
162	116	117	92.58	.34	.00	.00	.59	.30
163	115	118	144.43	.80	.00	.00	.92	.69
164	114	123	2959.21	2.11	.00	.00	3.02	1.82
165	118	117	2.51	.00	.00	.00	.02	.00
166	123	118	-3.66	.00	.00	.00	.02	.00
167	117	121	52.09	.17	.00	.00	.33	.10
168	118	119	88.26	.17	.00	.00	.56	.28
169	119	120	28.63	.02	.00	.00	.18	.03
170	121	122	29.69	.02	.00	.00	.19	.04
171	119	122	27.78	.02	.00	.00	.18	.03
172	122	120	3.22	.00	.00	.00	.02	.00
173	123	124	2891.86	1.83	.00	.00	2.95	1.75
174	124	125	612.25	.26	.00	.00	.98	.29
175	125	126	391.40	.12	.00	.00	.62	.13
176	126	127	95.40	.01	.00	.00	.15	.01
177	126	128	226.95	.07	.00	.00	.36	.05
178	128	129	129.65	.01	.00	.00	.21	.02
179	129	130	110.30	.01	.00	.00	.18	.01
180	131	124	-2272.96	1.69	.00	.00	3.63	3.31
181	131	132	1955.40	16.03	.00	.00	5.55	11.96
182	132	133	4073.00	9.86	.00	.00	6.50	9.76
183	134	132	2250.30	15.83	.00	.00	6.38	15.52
184	134	131	-179.46	.03	.00	.00	.29	.03
185	136	134	2121.44	4.58	.00	.00	3.38	2.92
186	109	135	247.17	1.23	.00	.00	1.58	1.87
187	110	136	1630.47	1.49	.00	.00	2.60	1.79
188	138	137	339.04	3.49	.00	.00	2.16	3.36
189	135	136	215.42	.41	.00	.00	1.37	1.45
190	137	136	307.29	.78	.00	.00	1.96	2.80
191	111	138	339.04	.97	.00	.00	2.16	3.36
192	112	139	65.60	.06	.00	.00	.42	.16
193	139	140	32.80	.04	.00	.00	.21	.04
194	139	141	32.80	.05	.00	.00	.21	.04
240-FG	0	10	2528.44	9.05	.00	.00	4.03	3.48
241	10	240	1221.49	6.44	.00	.00	1.95	.90
242	240	11	46.92	.01	.00	.00	.07	.00
243	240	11	643.07	.01	.00	.00	.15	.00

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	227.61	120.00	107.61	46.63
2		.00	226.75	75.00	151.75	65.76
3		.00	226.33	77.00	149.33	64.71
4		479.00	225.83	50.00	175.83	76.19
5		104.00	225.26	85.00	140.26	60.78
6		.00	224.68	95.00	129.68	56.20
7		.00	224.58	98.00	126.58	54.85
8		.00	224.57	98.00	126.57	54.85
9		.00	224.57	102.00	122.57	53.12
10		.00	218.95	175.00	43.95	19.04
11		531.50	212.50	55.00	157.50	68.25

12		235.50	213.29	25.00	188.29	81.59
13		156.00	209.50	45.00	164.50	71.28
14		.00	213.29	45.00	168.29	72.93
15		125.00	209.47	45.00	164.47	71.27
16		167.00	209.47	45.00	164.47	71.27
17		62.50	209.49	45.00	164.49	71.28
18		234.50	210.65	20.00	190.65	82.62
19		234.50	209.71	30.00	179.71	77.87
20		121.50	207.48	38.00	169.48	73.44
21		71.50	207.12	37.00	170.12	73.72
22		71.50	206.80	36.00	170.80	74.01
23		72.00	206.49	35.00	171.49	74.31
24		.00	205.90	34.00	171.90	74.49
25		.00	204.46	33.00	171.46	74.30
26		.00	203.89	28.00	175.89	76.22
27		.00	203.78	28.00	175.78	76.17
28		.00	203.78	27.00	176.78	76.60
29		99.50	205.80	35.00	170.80	74.01
30		186.50	202.97	36.00	166.97	72.35
31		214.50	200.34	37.00	163.34	70.78
32		.00	197.61	34.00	163.61	70.90
33		99.00	197.60	33.00	164.60	71.33
34		91.50	197.62	31.00	166.62	72.20
35		.00	197.62	34.00	163.62	70.90
36		.00	200.17	34.00	166.17	72.01
37		.00	197.84	34.00	163.84	71.00
38		161.50	197.70	33.00	164.70	71.37
39		.00	197.25	33.00	164.25	71.18
40		150.50	197.14	33.00	164.14	71.13
41		.00	197.00	34.00	163.00	70.63
42		21.00	195.61	34.00	161.61	70.03
43		50.50	196.90	34.00	162.90	70.59
44		521.00	195.48	33.00	162.48	70.41
45		109.50	196.32	30.00	166.32	72.07
46		109.50	196.06	28.00	168.06	72.83
47		99.00	195.58	25.00	170.58	73.92
48		.00	201.03	35.00	166.03	71.95
49		75.00	197.30	25.00	172.30	74.66
50		89.00	197.33	26.00	171.33	74.24
51		177.50	197.27	27.00	170.27	73.79
52		.00	197.28	28.00	169.28	73.35
53		35.00	197.28	29.00	168.28	72.92
54		155.50	197.42	31.00	166.42	72.11
55		99.50	197.71	27.00	170.71	73.98
56		176.50	198.36	27.00	171.36	74.25
57		.00	198.94	28.00	170.94	74.08
58		.00	202.58	32.00	170.58	73.92
59		.00	201.14	31.00	170.14	73.73
60		83.00	201.56	31.00	170.56	73.91
61		4.00	201.12	31.00	170.12	73.72
62		63.50	200.96	32.00	168.96	73.22
63		161.50	200.85	38.00	162.85	70.57
64		90.00	200.56	30.00	170.56	73.91
65		167.00	199.95	30.00	169.95	73.65
66		262.50	199.69	30.00	169.69	73.53
67		53.00	199.60	30.00	169.60	73.49
68		53.00	199.56	30.00	169.56	73.48
69		53.00	199.55	30.00	169.55	73.47

70	.00	199.55	32.00	167.55	72.60
71	.00	200.87	34.00	166.87	72.31
72	211.00	199.09	32.00	167.09	72.40
73	147.00	198.91	31.00	167.91	72.76
74	114.00	198.78	30.00	168.78	73.14
75	263.50	198.77	30.00	168.77	73.13
76	96.50	198.90	29.00	169.90	73.62
77	15.50	199.13	28.00	171.13	74.16
78	2092.50	197.97	20.00	177.97	77.12
79	.00	201.03	35.00	166.03	71.95
80	26.95	192.40	25.00	167.40	72.54
81	34.40	189.86	25.00	164.86	71.44
82	.00	181.93	25.00	156.93	68.00
83	110.40	181.07	25.00	156.07	67.63
84	78.60	185.62	25.00	160.62	69.60
85	164.60	180.82	25.00	155.82	67.52
86	63.25	176.87	25.00	151.87	65.81
87	51.45	176.80	25.00	151.80	65.78
88	.00	176.80	25.00	151.80	65.78
89	63.35	175.15	25.00	150.15	65.06
90	153.35	170.35	25.00	145.35	62.99
91	3.25	170.42	20.00	150.42	65.18
92	.00	170.44	20.00	150.44	65.19
93	16.90	171.00	20.00	151.00	65.44
94	98.70	176.81	20.00	156.81	67.95
95	20.90	169.36	20.00	149.36	64.72
96	42.25	169.54	20.00	149.54	64.80
97	21.30	169.32	20.00	149.32	64.71
98	20.90	169.29	20.00	149.29	64.69
99	28.85	169.25	20.00	149.25	64.67
100	29.25	169.27	20.00	149.27	64.68
101	29.25	169.19	20.00	149.19	64.65
102	.00	169.16	15.00	154.16	66.80
103	48.90	169.46	15.00	154.46	66.93
104	48.90	175.19	15.00	160.19	69.42
105	20.30	173.86	15.00	158.86	68.84
106	18.25	170.95	15.00	155.95	67.58
107	31.95	167.28	15.00	152.28	65.99
108	18.25	167.05	15.00	152.05	65.89
109	18.20	164.92	15.00	149.92	64.97
110	.00	164.77	15.00	149.77	64.90
111	18.20	168.55	15.00	153.55	66.54
112	7.95	169.16	25.00	144.16	62.47
113	140.80	181.74	20.00	161.74	70.09
114	33.00	164.48	20.00	144.48	62.61
115	80.85	163.17	20.00	143.17	62.04
116	73.80	162.71	20.00	142.71	61.84
117	43.00	162.37	20.00	142.37	61.69
118	50.00	162.37	20.00	142.37	61.69
119	31.85	162.21	20.00	142.21	61.62
120	31.85	162.18	20.00	142.18	61.61
121	22.40	162.20	20.00	142.20	61.62
122	54.25	162.18	20.00	142.18	61.61
123	71.00	162.37	20.00	142.37	61.69
124	6.65	160.53	20.00	140.53	60.90
125	220.85	160.28	20.00	140.28	60.79
126	69.05	160.16	20.00	140.16	60.74
127	95.40	160.16	20.00	140.16	60.73

128	97.30	160.09	20.00	140.09	60.70
129	19.35	160.07	20.00	140.07	60.70
130	110.30	160.06	20.00	140.06	60.69
131	138.10	158.84	20.00	138.84	60.17
132	132.70	142.81	20.00	122.81	53.22
133	4073.00	132.95	20.00	112.95	48.95
134	50.60	158.81	20.00	138.81	60.15
135	31.75	163.69	20.00	143.69	62.26
136	31.75	163.29	20.00	143.29	62.09
137	31.75	164.07	20.00	144.07	62.43
138	.00	167.57	20.00	147.57	63.95
139	.00	169.10	20.00	149.10	64.61
140	32.80	169.06	20.00	149.06	64.59
141	32.80	169.06	20.00	149.06	64.59
201	.00	226.75	70.00	156.75	67.92
202	.00	372.00	135.00	237.00	102.70
203	.00	228.06	130.00	98.06	42.49
204	.00	226.94	80.00	146.94	63.67
205	.00	224.51	102.00	122.51	53.09
206	.00	218.79	175.00	43.79	18.98
207	.00	224.57	175.00	49.57	21.48
208	.00	224.57	175.00	49.57	21.48
209	.00	218.71	175.00	43.71	18.94
210	.00	218.37	175.00	43.37	18.79
211	.00	226.75	208.00	18.75	8.12
212	.00	218.13	175.00	43.13	18.69
213	.00	273.88	175.00	98.88	42.85
214	.00	273.71	175.00	98.71	42.77
215	.00	273.47	175.00	98.47	42.67
216	.00	254.09	130.00	124.09	53.77
217	8333.00	252.61	215.00	37.61	16.30
218	12500.00	221.38	215.00	6.38	2.77
240	531.50	212.51	95.00	117.51	50.92

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
202	102.70	218	2.77
18	82.62	211	8.12
12	81.59	217	16.30
19	77.87	212	18.69
78	77.12	210	18.79
28	76.60	209	18.94
26	76.22	206	18.98
4	76.19	10	19.04
27	76.17	207	21.48
49	74.66	208	21.48

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
213	7.97	30	.00
214	7.97	165	.02
215	7.97	172	.02
221	7.39	166	.02
222	7.39	242	.07
182	6.50	52	.09
183	6.38	98	.10
113	6.20	70	.11
110	5.85	71	.11
43	5.71	243	.15

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	6984.64
6	1610.12
23	23702.50
203	.00
209	2952.55
240	2528.44

NET SYSTEM INFLOW = 37778.26
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 37778.25

D A T A   C H A N G E S   F O R   N E X T   S I M U L A T I O N

D E M A N D   C H A N G E S

DEMAND TYPE = 1 - GDF = .500

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND (gpm)
217	8333.00
218	12500.00
141	1033.00

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S I M U L A T I O N   R E S U L T S

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THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00116

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   FG -FIXED GRADE NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1-FGPU	0	203	6973.67	.02	218.54	.00	2.20	.44
2	1	2	6232.88	.85	.00	.00	2.83	.87
3	1	2	473.94	.85	.00	.00	1.34	.87
4	2	3	4142.22	.42	.00	.00	1.31	.17
5	2	3	2564.60	.42	.00	.00	1.16	.17
6-FG	0	204	1320.45	.74	.00	.00	1.35	.41
7	3	4	5923.32	.44	.00	.00	1.87	.32
8	3	4	3667.34	.44	.00	.00	1.66	.32
9	3	4	1165.58	.44	.00	.00	1.19	.32
10	4	5	5659.54	.49	.00	.00	1.78	.30
11	4	5	3504.02	.49	.00	.00	1.59	.30
12	4	5	1113.67	.49	.00	.00	1.14	.30
13	5	6	5427.83	.51	.00	.00	1.71	.28
14	5	6	3360.56	.51	.00	.00	1.53	.28
15	6	7	3178.58	.09	.00	.00	1.44	.25
16-XXPU	7	8						
17-XXPU	7	8						
18-XXPU	7	8						
19-CV	7	8	3178.58	.00	.00	.00	1.44	.25
20	8	9	.00	.00	.00	.00	.00	.00
21	9	208	.00	.00	.00	.00	.00	.00
22	205	10	8788.39	4.91	.00	.00	3.99	1.64
23-FG	0	10	21732.33	7.71	.00	.00	5.03	1.70
24	210	11	11002.21	3.98	.00	.00	2.55	.48
25-CV	5	12	1384.85	9.47	.00	.00	2.21	1.32
26	12	11	634.78	.59	.00	.00	1.01	.31
27	11	13	11577.78	1.99	.00	.00	2.68	.53
28	12	14	.00	.00	.00	.00	.00	.00
29-XX	14	15						
30	16	15	79.43	.01	.00	.00	.13	.01
31	17	16	246.43	.04	.00	.00	.39	.05
32	13	17	308.93	.02	.00	.00	.49	.08
33	12	18	514.57	2.02	.00	.00	1.46	1.01
34	18	19	280.07	.59	.00	.00	.79	.33
35	15	19	-45.57	.04	.00	.00	.13	.01
36	13	20	11112.85	1.30	.00	.00	3.50	1.04
37	20	21	10991.35	.23	.00	.00	3.46	1.02
38	21	22	10919.85	.20	.00	.00	3.44	1.01
39	22	23	10848.35	.20	.00	.00	3.42	1.00
40	23	24	10776.35	.37	.00	.00	3.40	.98
41-XX	15	28						
42	24	25	9715.90	.89	.00	.00	3.06	.81
43	25	26	9715.90	.36	.00	.00	4.41	1.97

44	26	27	8808.38	.07	.00	.00	2.78	.68
45	28	27	.00	.00	.00	.00	.00	.00
46-XX	28	35						
47	27	79	8808.38	1.66	.00	.00	2.78	.68
48	24	29	1060.45	.09	.00	.00	1.69	.81
49	29	30	960.95	2.34	.00	.00	2.73	3.21
50	30	31	774.45	2.09	.00	.00	2.20	2.15
51	31	32	559.95	2.01	.00	.00	1.59	1.18
52	33	32	5.08	.00	.00	.00	.01	.00
53	34	33	104.08	.03	.00	.00	.30	.05
54	35	34	.00	.00	.00	.00	.00	.00
55-XX	35	48						
56	36	37	996.37	2.40	.00	.00	2.83	3.43
57	37	38	357.08	.18	.00	.00	1.01	.51
58	38	34	195.58	.12	.00	.00	.55	.17
59	37	39	332.34	.58	.00	.00	.94	.45
60	32	39	264.54	.26	.00	.00	.75	.29
61	32	40	300.49	.42	.00	.00	.85	.37
62	40	41	149.99	.12	.00	.00	.43	.10
63	39	41	218.51	.29	.00	.00	.62	.21
64	39	42	542.00	1.64	.00	.00	1.54	1.11
65	42	44	521.00	.13	.00	.00	1.48	1.03
66	41	43	368.50	.10	.00	.00	.59	.11
67	37	54	306.95	.39	.00	.00	.87	.39
68	54	53	151.45	.11	.00	.00	.43	.10
69	53	39	163.63	.09	.00	.00	.46	.12
70	52	53	47.18	.01	.00	.00	.13	.01
71	51	52	47.18	.00	.00	.00	.13	.01
72	50	51	224.68	.13	.00	.00	.64	.22
73	50	49	75.00	.03	.00	.00	.21	.03
74	79	71	8808.38	.10	.00	.00	2.78	.68
75-XX	48	36						
76	46	47	99.00	.48	.00	.00	.63	.34
77	45	46	208.50	.26	.00	.00	.59	.19
78	43	45	318.00	.58	.00	.00	.90	.41
79	55	50	388.68	.61	.00	.00	1.10	.60
80	56	55	488.18	.92	.00	.00	1.38	.92
81	57	56	664.68	.75	.00	.00	1.89	1.62
82-XX	36	57						
83	71	77	7299.40	.96	.00	.00	2.30	.48
84	77	57	664.68	.24	.00	.00	1.89	1.62
85	26	58	907.52	1.04	.00	.00	2.57	2.89
86	58	59	704.14	1.14	.00	.00	2.00	1.80
87	58	60	203.39	.85	.00	.00	1.30	1.30
88	60	61	120.39	.32	.00	.00	.77	.49
89	59	61	108.61	.03	.00	.00	.31	.06
90	61	62	225.00	.16	.00	.00	.64	.22
91	62	63	161.50	.11	.00	.00	.46	.12
92	59	64	595.52	.41	.00	.00	1.69	1.32
93	64	65	505.52	.41	.00	.00	1.43	.98
94	65	66	338.52	.15	.00	.00	.96	.46
95	66	67	76.02	.02	.00	.00	.22	.03
96	68	67	-23.02	.00	.00	.00	.07	.00
97	69	68	29.98	.00	.00	.00	.09	.01
98	70	69	82.98	.01	.00	.00	.24	.03
99	71	70	512.61	1.32	.00	.00	1.45	1.00
100	79	48	.00	.00	.00	.00	.00	.00
101	70	72	429.63	.30	.00	.00	1.22	.72

102	72	73	218.63	.08	.00	.00	.62	.21
103	73	74	71.63	.02	.00	.00	.20	.03
104	75	74	42.37	.00	.00	.00	.12	.01
105	76	75	305.87	.31	.00	.00	.87	.39
106	77	76	402.37	.45	.00	.00	1.14	.64
107	77	78	6216.85	.56	.00	.00	1.96	.36
108-XX	57	78						
109	71	36	996.37	.72	.00	.00	2.83	3.43
110	78	80	3328.12	2.04	.00	.00	3.40	2.27
111	78	80	796.23	2.04	.00	.00	2.26	2.27
112	80	81	1898.19	.98	.00	.00	1.94	.80
113	80	82	2199.21	3.65	.00	.00	3.51	3.12
114	81	84	1863.79	1.61	.00	.00	2.97	2.30
115	82	83	173.15	.61	.00	.00	1.11	.97
116	84	83	211.00	1.67	.00	.00	1.35	1.40
117	82	89	1885.27	2.11	.00	.00	3.01	2.34
118	83	85	46.15	.09	.00	.00	.29	.08
119	83	86	227.59	1.66	.00	.00	1.45	1.61
120	84	85	1574.19	1.76	.00	.00	2.51	1.68
121	89	91	1821.92	1.43	.00	.00	2.91	2.20
122	87	88	.00	.00	.00	.00	.00	.00
123	86	87	51.45	.07	.00	.00	.33	.10
124	85	86	208.74	1.57	.00	.00	1.33	1.37
125	85	94	1247.00	1.31	.00	.00	1.99	1.09
126	82	113	140.80	.18	.00	.00	.90	.66
127	91	90	153.35	.07	.00	.00	.43	.11
128	91	92	418.04	.74	.00	.00	1.19	.69
129	93	92	207.53	.18	.00	.00	.59	.19
130	86	93	321.63	1.83	.00	.00	2.05	3.05
131	94	93	255.74	2.09	.00	.00	1.63	1.99
132	92	96	625.57	2.92	.00	.00	3.99	10.44
133	93	103	352.94	.52	.00	.00	1.00	.50
134	94	104	892.56	.47	.00	.00	1.42	.59
135	95	98	184.93	.60	.00	.00	1.18	1.09
136	96	95	205.83	1.04	.00	.00	1.31	1.33
137	96	100	262.22	1.08	.00	.00	1.67	2.09
138	97	101	93.97	.23	.00	.00	.60	.31
139	96	97	115.27	.35	.00	.00	.74	.46
140	98	99	164.03	.70	.00	.00	1.05	.88
141	100	99	376.48	1.26	.00	.00	2.40	4.08
142	101	100	143.51	.55	.00	.00	.92	.68
143	99	112	511.66	5.68	.00	.00	3.27	7.20
144	101	112	562.09	7.45	.00	.00	3.59	8.56
145	102	101	640.88	1.64	.00	.00	4.09	10.92
146	103	102	446.65	1.51	.00	.00	2.85	5.60
147	104	103	250.26	2.14	.00	.00	1.60	1.91
148	104	105	593.40	.33	.00	.00	1.68	1.31
149	102	108	-194.22	1.30	.00	.00	1.24	1.20
150	103	107	107.65	.05	.00	.00	.31	.06
151	105	106	573.10	.69	.00	.00	1.63	1.23
152	107	108	147.10	.21	.00	.00	.94	.72
153	106	107	200.83	1.17	.00	.00	1.28	1.27
154	108	109	-65.37	.08	.00	.00	.42	.16
155	107	110	129.43	.06	.00	.00	.37	.08
156	106	111	354.02	.47	.00	.00	1.00	.50
157	109	110	-81.58	.07	.00	.00	.52	.24
158	111	110	209.52	.76	.00	.00	1.34	1.38
159	91	114	1247.27	.93	.00	.00	1.27	.37

160	114	115	264.52	.64	.00	.00	1.69	2.12
201-XXPU	0	211						
202	211	201	.00	.00	.00	.00	.00	.00
203-FGPU	0	202	.00	.00	362.00	.00	.00	.00
204-XX	202	201						
205	201	2	.00	.00	.00	.00	.00	.00
206	203	1	6973.67	.45	.00	.00	3.17	1.07
207	1	204	266.85	.81	.00	.00	.76	.30
208	204	3	1587.30	.46	.00	.00	1.62	.58
209-FG	0	3	2462.12	1.20	.00	.00	1.75	.46
210-XX	6	9						
211-CV	6	205	5609.81	.16	.00	.00	2.55	.71
212	8	205	3178.58	.06	.00	.00	1.44	.25
213	10	206	31835.21	.14	.00	.00	7.37	3.45
214	206	209	31835.21	.07	.00	.00	7.37	3.45
215	209	210	31835.21	.29	.00	.00	7.37	3.45
216-XX	207	206						
217-XX	207	209						
218	208	207	.00	.00	.00	.00	.00	.00
219	210	212	20833.00	.24	.00	.00	4.82	1.57
220-XXCV	212	213						
221-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
222-PU	212	213	10416.50	.33	56.08	.00	7.39	6.65
223-XXPU	212	213						
224-XXCV	208	215						
225	214	215	7933.44	.24	.00	.00	5.63	4.02
226	213	214	20833.00	.17	.00	.00	4.82	1.57
227	215	216	7933.44	19.38	.00	.00	3.60	1.36
228	214	216	12899.56	19.62	.00	.00	4.07	1.37
229	216	217	8333.00	1.48	.00	.00	2.63	.61
230	216	218	12500.00	32.71	.00	.00	5.67	3.15
231-XXFG	0	211						
161	115	116	111.36	.22	.00	.00	.71	.43
162	116	117	37.56	.06	.00	.00	.24	.06
163	115	118	72.31	.22	.00	.00	.46	.19
164	114	123	949.76	.26	.00	.00	.97	.22
165	118	117	52.54	.06	.00	.00	.34	.11
166	123	118	123.48	.60	.00	.00	.79	.52
167	117	121	47.10	.14	.00	.00	.30	.09
168	118	119	93.25	.18	.00	.00	.60	.31
169	119	120	30.95	.03	.00	.00	.20	.04
170	121	122	24.70	.02	.00	.00	.16	.03
171	119	122	30.45	.03	.00	.00	.19	.04
172	122	120	.90	.00	.00	.00	.01	.00
173	123	124	755.27	.15	.00	.00	.77	.15
174	124	125	612.25	.26	.00	.00	.98	.29
175	125	126	391.40	.12	.00	.00	.62	.13
176	126	127	95.40	.01	.00	.00	.15	.01
177	126	128	226.95	.07	.00	.00	.36	.05
178	128	129	129.65	.01	.00	.00	.21	.02
179	129	130	110.30	.01	.00	.00	.18	.01
180	131	124	-136.37	.01	.00	.00	.22	.02
181	131	132	103.38	.07	.00	.00	.29	.05
182	132	133	101.40	.01	.00	.00	.16	.01
183	134	132	130.72	.08	.00	.00	.37	.08
184	134	131	105.11	.01	.00	.00	.17	.01
185	136	134	286.43	.11	.00	.00	.46	.07
186	109	135	-1.99	.00	.00	.00	.01	.00

187	110	136	257.36	.05	.00	.00	.41	.06
188	138	137	126.30	.56	.00	.00	.81	.54
189	135	136	-33.74	.01	.00	.00	.22	.05
190	137	136	94.55	.09	.00	.00	.60	.32
191	111	138	126.30	.16	.00	.00	.81	.54
192	112	139	1065.80	10.64	.00	.00	6.80	28.01
193	139	140	32.80	.04	.00	.00	.21	.04
194	139	141	1033.00	27.23	.00	.00	6.59	26.43
240-FG	0	10	2318.29	7.71	.00	.00	3.70	2.96
241	10	240	1003.80	4.48	.00	.00	1.60	.63
242	240	11	32.12	.00	.00	.00	.05	.00
243	240	11	440.18	.00	.00	.00	.10	.00

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
1		.00	228.07	120.00	108.07	46.83
2		.00	227.22	75.00	152.22	65.96
3		.00	226.80	77.00	149.80	64.91
4		479.00	226.37	50.00	176.37	76.43
5		104.00	225.87	85.00	140.87	61.05
6		.00	225.36	95.00	130.36	56.49
7		.00	225.27	98.00	127.27	55.15
8		.00	225.27	98.00	127.27	55.15
9		.00	225.27	102.00	123.27	53.42
10		.00	220.29	175.00	45.29	19.63
11		531.50	215.81	55.00	160.81	69.69
12		235.50	216.41	25.00	191.41	82.94
13		156.00	213.82	45.00	168.82	73.16
14		.00	216.41	45.00	171.41	74.28
15		125.00	213.76	45.00	168.76	73.13
16		167.00	213.77	45.00	168.77	73.13
17		62.50	213.81	45.00	168.81	73.15
18		234.50	214.39	20.00	194.39	84.23
19		234.50	213.80	30.00	183.80	79.65
20		121.50	212.52	38.00	174.52	75.63
21		71.50	212.29	37.00	175.29	75.96
22		71.50	212.09	36.00	176.09	76.30
23		72.00	211.89	35.00	176.89	76.65
24		.00	211.51	34.00	177.51	76.92
25		.00	210.62	33.00	177.62	76.97
26		.00	210.27	28.00	182.27	78.98
27		.00	210.20	28.00	182.20	78.95
28		.00	210.20	27.00	183.20	79.39
29		99.50	211.43	35.00	176.43	76.45
30		186.50	209.08	36.00	173.08	75.00
31		214.50	207.00	37.00	170.00	73.66
32		.00	204.99	34.00	170.99	74.09
33		99.00	204.99	33.00	171.99	74.53
34		91.50	205.02	31.00	174.02	75.41
35		.00	205.02	34.00	171.02	74.11
36		.00	207.72	34.00	173.72	75.28
37		.00	205.32	34.00	171.32	74.24

38	161.50	205.14	33.00	172.14	74.59
39	.00	204.73	33.00	171.73	74.42
40	150.50	204.56	33.00	171.56	74.34
41	.00	204.44	34.00	170.44	73.86
42	21.00	203.09	34.00	169.09	73.27
43	50.50	204.34	34.00	170.34	73.82
44	521.00	202.96	33.00	169.96	73.65
45	109.50	203.77	30.00	173.77	75.30
46	109.50	203.50	28.00	175.50	76.05
47	99.00	203.03	25.00	178.03	77.15
48	.00	208.54	35.00	173.54	75.20
49	75.00	204.93	25.00	179.93	77.97
50	89.00	204.96	26.00	178.96	77.55
51	177.50	204.83	27.00	177.83	77.06
52	.00	204.83	28.00	176.83	76.63
53	35.00	204.82	29.00	175.82	76.19
54	155.50	204.93	31.00	173.93	75.37
55	99.50	205.57	27.00	178.57	77.38
56	176.50	206.49	27.00	179.49	77.78
57	.00	207.24	28.00	179.24	77.67
58	.00	209.23	32.00	177.23	76.80
59	.00	208.09	31.00	177.09	76.74
60	83.00	208.38	31.00	177.38	76.86
61	4.00	208.06	31.00	177.06	76.73
62	63.50	207.90	32.00	175.90	76.22
63	161.50	207.79	38.00	169.79	73.58
64	90.00	207.68	30.00	177.68	76.99
65	167.00	207.27	30.00	177.27	76.82
66	262.50	207.12	30.00	177.12	76.75
67	53.00	207.10	30.00	177.10	76.75
68	53.00	207.10	30.00	177.10	76.74
69	53.00	207.10	30.00	177.10	76.75
70	.00	207.12	32.00	175.12	75.88
71	.00	208.44	34.00	174.44	75.59
72	211.00	206.82	32.00	174.82	75.76
73	147.00	206.74	31.00	175.74	76.15
74	114.00	206.72	30.00	176.72	76.58
75	263.50	206.72	30.00	176.72	76.58
76	96.50	207.04	29.00	178.04	77.15
77	15.50	207.48	28.00	179.48	77.78
78	2092.50	206.92	20.00	186.92	81.00
79	.00	208.54	35.00	173.54	75.20
80	26.95	204.88	25.00	179.88	77.95
81	34.40	203.91	25.00	178.91	77.53
82	.00	201.23	25.00	176.23	76.37
83	110.40	200.63	25.00	175.63	76.10
84	78.60	202.30	25.00	177.30	76.83
85	164.60	200.54	25.00	175.54	76.07
86	63.25	198.96	25.00	173.96	75.38
87	51.45	198.90	25.00	173.90	75.35
88	.00	198.90	25.00	173.90	75.35
89	63.35	199.12	25.00	174.12	75.45
90	153.35	197.63	25.00	172.63	74.81
91	3.25	197.69	20.00	177.69	77.00
92	.00	196.96	20.00	176.96	76.68
93	16.90	197.14	20.00	177.14	76.76
94	98.70	199.23	20.00	179.23	77.67
95	20.90	193.00	20.00	173.00	74.97

96	42.25	194.04	20.00	174.04	75.42
97	21.30	193.68	20.00	173.68	75.26
98	20.90	192.40	20.00	172.40	74.70
99	28.85	191.69	20.00	171.69	74.40
100	29.25	192.95	20.00	172.95	74.95
101	29.25	193.47	20.00	173.47	75.17
102	.00	195.10	15.00	180.10	78.04
103	48.90	196.61	15.00	181.61	78.70
104	48.90	198.76	15.00	183.76	79.63
105	20.30	198.43	15.00	183.43	79.49
106	18.25	197.74	15.00	182.74	79.19
107	31.95	196.56	15.00	181.56	78.68
108	18.25	196.41	15.00	181.41	78.61
109	18.20	196.49	15.00	181.49	78.64
110	.00	196.51	15.00	181.51	78.65
111	18.20	197.27	15.00	182.27	78.98
112	7.95	186.01	25.00	161.01	69.77
113	140.80	201.05	20.00	181.05	78.46
114	33.00	196.76	20.00	176.76	76.60
115	80.85	196.12	20.00	176.12	76.32
116	73.80	195.91	20.00	175.91	76.23
117	43.00	195.84	20.00	175.84	76.20
118	50.00	195.90	20.00	175.90	76.22
119	31.85	195.72	20.00	175.72	76.14
120	31.85	195.69	20.00	175.69	76.13
121	22.40	195.70	20.00	175.70	76.14
122	54.25	195.69	20.00	175.69	76.13
123	71.00	196.50	20.00	176.50	76.48
124	6.65	196.35	20.00	176.35	76.42
125	220.85	196.09	20.00	176.09	76.31
126	69.05	195.98	20.00	175.98	76.26
127	95.40	195.97	20.00	175.97	76.25
128	97.30	195.90	20.00	175.90	76.22
129	19.35	195.89	20.00	175.89	76.22
130	110.30	195.88	20.00	175.88	76.21
131	138.10	196.34	20.00	176.34	76.41
132	132.70	196.27	20.00	176.27	76.38
133	101.40	196.26	20.00	176.26	76.38
134	50.60	196.35	20.00	176.35	76.42
135	31.75	196.49	20.00	176.49	76.48
136	31.75	196.46	20.00	176.46	76.47
137	31.75	196.55	20.00	176.55	76.50
138	.00	197.11	20.00	177.11	76.75
139	.00	175.37	20.00	155.37	67.33
140	32.80	175.33	20.00	155.33	67.31
141	1033.00	148.14	20.00	128.14	55.53
201	.00	227.22	70.00	157.22	68.13
202	.00	372.00	135.00	237.00	102.70
203	.00	228.52	130.00	98.52	42.69
204	.00	227.26	80.00	147.26	63.81
205	.00	225.21	102.00	123.21	53.39
206	.00	220.15	175.00	45.15	19.57
207	.00	225.27	175.00	50.27	21.78
208	.00	225.27	175.00	50.27	21.78
209	.00	220.08	175.00	45.08	19.54
210	.00	219.79	175.00	44.79	19.41
211	.00	227.22	208.00	19.22	8.33
212	.00	219.56	175.00	44.56	19.31

213	.00	275.30	175.00	100.30	43.46
214	.00	275.13	175.00	100.13	43.39
215	.00	274.89	175.00	99.89	43.29
216	.00	255.51	130.00	125.51	54.39
217	8333.00	254.03	215.00	39.03	16.91
218	12500.00	222.80	215.00	7.80	3.38
240	531.50	215.82	95.00	120.82	52.35

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES (psi)	JUNCTION NUMBER	MINIMUM PRESSURES (psi)
202	102.70	218	3.38
18	84.23	211	8.33
12	82.94	217	16.91
78	81.00	212	19.31
19	79.65	210	19.41
104	79.63	209	19.54
105	79.49	206	19.57
28	79.39	10	19.63
106	79.19	207	21.78
111	78.98	208	21.78

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
221	7.39	172	.01
222	7.39	186	.01
213	7.37	52	.01
214	7.37	242	.05
215	7.37	96	.07
192	6.80	97	.09
194	6.59	243	.10
230	5.67	104	.12
225	5.63	30	.13
23	5.03	35	.13

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM FIXED GRADE NODES
(-) OUTFLOWS FROM THE SYSTEM INTO FIXED GRADE NODES

PIPE NUMBER	FLOWRATE (gpm)
1	6973.67

6	1320.45
23	21732.33
203	.00
209	2462.12
240	2318.29

NET SYSTEM INFLOW = 34806.85
NET SYSTEM OUTFLOW = .00
NET SYSTEM DEMAND = 34806.85

**** KYPIPE SIMULATION COMPLETED ****

DATE: 11/16/2006
TIME: 8:47: 0

Appendix D

Water Line Tunnel Under H-1 Freeway
For the
Hoopili Project

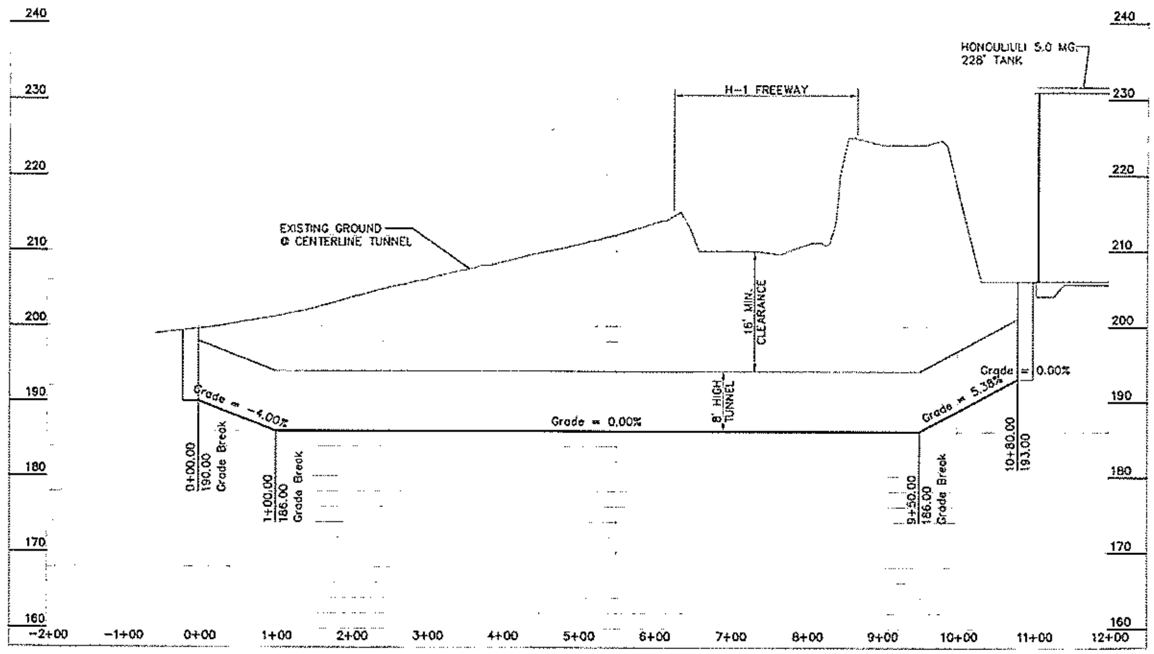
The Hoopili project proposes to construct a tunnel under the H-1 Freeway to deliver water from both the 228 and 440 storage systems to the Hoopili project boundaries. This corridor will be used if there is insufficient space within the Honouliuli Gulch crossing. The Honouliuli Gulch crossing contains BWS water lines delivering water from the existing BWS 228 and 440 storage systems.

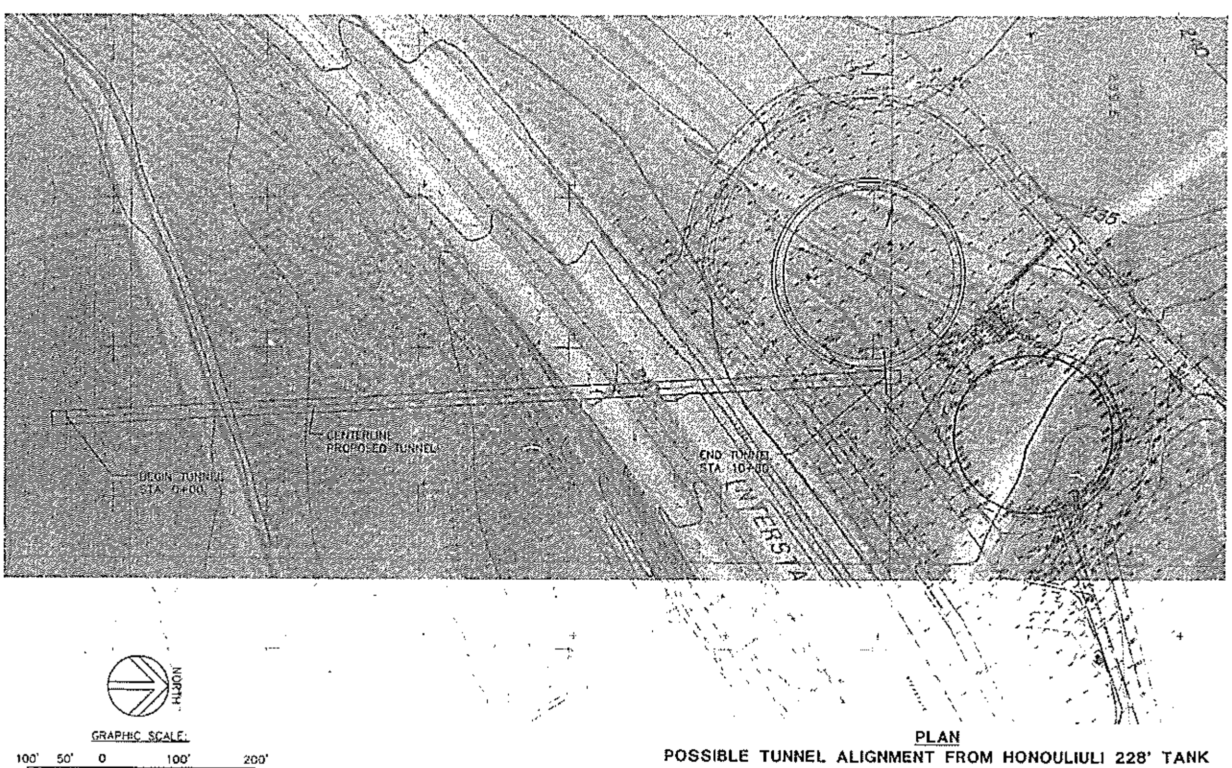
A plan and profile of the tunnel is contained on the exhibits within this appendix. The tunnel will have a mauka terminus in the existing Honouliuli 228 Reservoir site and the makai terminus in the mixed use industrial area of the Hoopili project. A typical section is also shown.

Two options exist for construction. One would be micro-tunneling and the other would be conventional well construction.

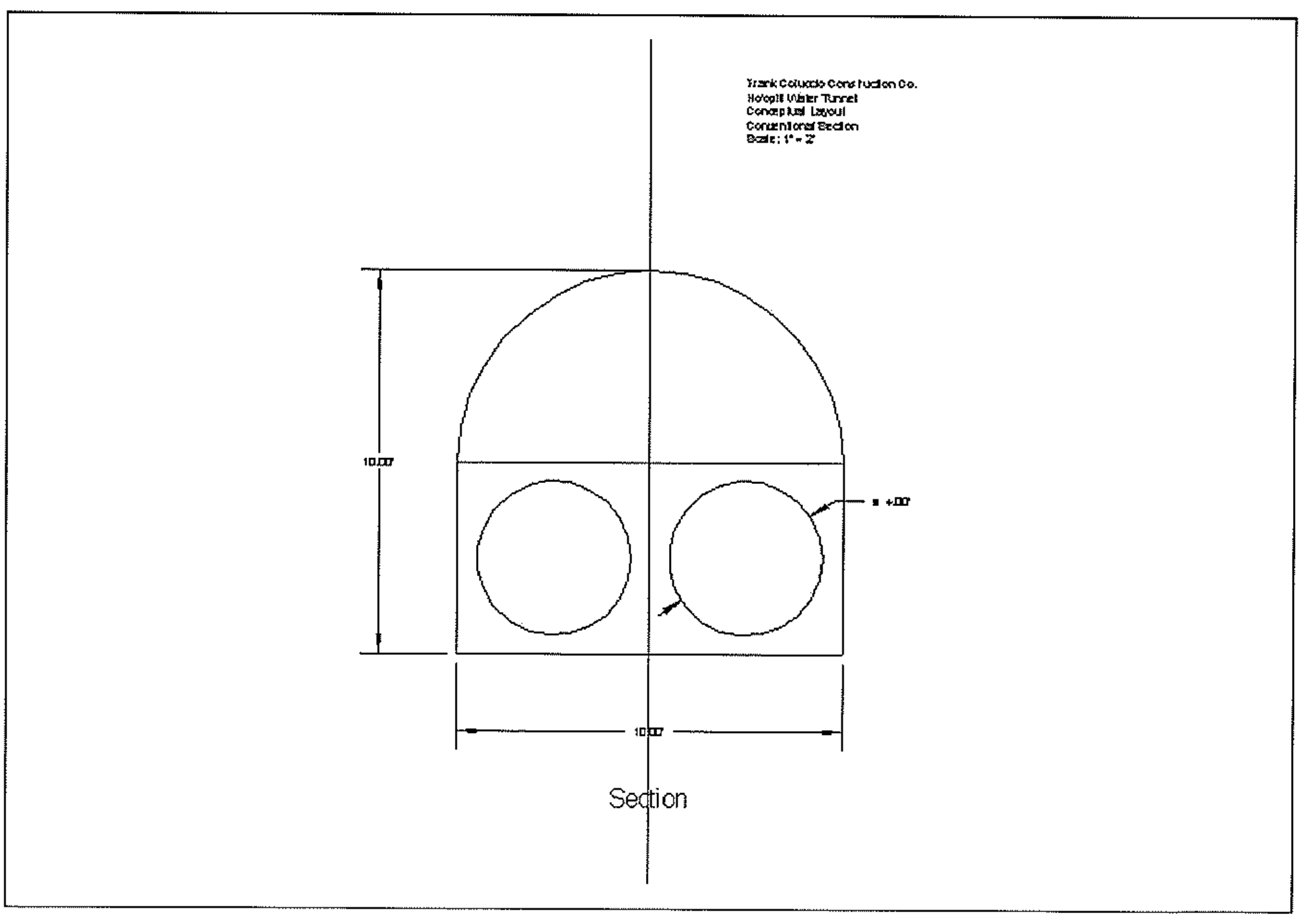
Once constructed, the water system (including the tunnel) would be dedicated to the Board of Water Supply.

An easement or access permitted designation would be required form the State of Hawaii Department of Transportation. Ongoing discussions exploring the easement/access permitted designation have been occurring.





PLAN
POSSIBLE TUNNEL ALIGNMENT FROM HONOULIULI 228' TANK BENEATH H-1 FREEWAY


Frank Coluccio Construction Co.
Conceptual Layout
Conventional Section
Scale: 1" = 2'
10.00'
10.00'
Section

Appendix N

Preliminary Wastewater Collection System Master Plan

PRELIMINARY WASTEWATER COLLECTION SYSTEM MASTER PLAN

FOR

HO'OPILI

HONOULIULI, 'EWA, O'AHU, HAWAI'I
TMK: (1)9-1-017: POR. 004, 059, 072;
(1)9-1-018: 001, 004

NOVEMBER 2007

BILLS ENGINEERING INC.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, Hawai'i 96813-2715
Telephone No: 808.792.2022
Fax No: 808.792.2033
General Email: info@BillsEngineering.com
www.BillsEngineering.com

PRELIMINARY WASTEWATER COLLECTION SYSTEM MASTER PLAN

FOR

HO'OPILI

TMK: (1) 9-1-017: POR. 004, 059, 072;
(1)9-1-018: 001, 004
HONOULIULI, 'EWA, O'AHU, HAWAI'I

NOVEMBER 2007

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE
Expiration Date: 4-30-08

PREPARED BY:

BILLS ENGINEERING INC.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, Hawai'i 96813

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APPENDICES

SECTION 1. BACKGROUND INFORMATION

D. R. Horton-Schuler Division ("Schuler") intends to develop approximately 1,555 acres of land in 'Ewa over the next 25 to 30 years. The project will be called Ho'opili. The Ho'opili project is generally bound by the H-1 Freeway to the north, proposed North-South Road to the west, Ewa Villages to the south and Old Fort Weaver Road/Fort Weaver Road to the east. Figure 1 - Ho'opili Site Plan illustrates the project and how it is situated on the Ewa plain. The other notable projects being developed in the immediate vicinity are Department of Hawaiian Homeland ("DHHL") properties and the University of Hawai'i West Oahu ("UHWO") campus. Ho'opili and other neighboring projects in the area are shown on Figure 1.

The Ho'opili project is anticipated to provide housing and commercial space as listed below:

Housing Units:	11,750 (Single Family, Multi-Family and Apartment)
Commercial Space:	
Retail	2,240,000 Square Feet
Office	720,000 Square Feet
Industrial	800,000 Square Feet
Developable Acres (Minus Schools/Parks/ Roads/Open Space)	1,130 Acres

The Ho'opili project is at the beginning of the development path. The current State land use designation is agricultural and a petition will be processed with the State Land Use Commission to change the designation of the land from agricultural to urban. Subsequent steps in the development process will be the submittal and processing of a change of zone application with the City and County of Honolulu. Upon successful completion of the State Land Use petition process and change of zoning, actual development (subdivision work and physical improvements) could commence. A general time frame for the project is outlined below:

State Land Use Petition and City Change of Zone	3-5 years (Starting in 4th Quarter 2006 ending 2010)
Incremental Development initiated through subdivision actions	20-25 years (Starting 2010 and ending 2035)

This wastewater collection system master plan has been prepared for the Ho'opili project in order to support the development process and to assist reviewing technical agencies (Department of Planning and Permitting and the Department of Wastewater Management).

SECTION 2. EXISTING CONDITIONS

The major municipal sewage system features that exist in the project area are the Honouliuli Wastewater Treatment Plant (WWTP) and trunk sewers transmitting sewage from points farther west to the Honouliuli WWTP. The existing treatment plant capacity is 35 MGD. The current average daily flows are approximately 27 MGD. The trunk sewer system is made up of the Makakilo Interceptor Sewer and the recently completed Kapolei Interceptor Sewer. Figure 2 - Existing Sewer System Plan shows these municipal sewage system features in relation to the project site and proposed development in the immediate vicinity.

It should be pointed out that development in the immediate project area has been contemplated in various forms over the past decade. This portion of the Ewa Plain has long been the designated site for the University of Hawai'i West Oahu campus as well as for DHHL property development. In the mid 1990's Schuler explored development of 660 acres of the Ho'opili property (East Kapolei Project) and prepared an EIS to support a Land Use petition.

Because of that earlier planning, the existing conditions plan, as shown on Figure 2, shows a sewer stub on the recently completed Kapolei Interceptor at the proposed North/South Road intersection. This stub was to accommodate future growth to the north and, particularly, DHHL and UHWO lands. The Kapolei Interceptor was designed to accept a "future" flow having an equivalent population of 38,975 people, encompassing an area of 1,409 acres and a peak flow of 9.45 million gallons per day (MGD).

There are other existing municipal sewage collection features in the area. These include trunk sewers in Fort Weaver Road/Geiger Road delivering sewage from properties to the east and south into the Honouliuli WWTP. However, since there are no planned connections to this part of the existing sewage collection infrastructure, these systems have been omitted from the existing conditions plan (Figure 2).

SECTION 3. PROPOSED CONDITIONS

Ho'opili, UHWO and DHHL plan to develop a sewer corridor extending from the existing sewer stub on the Kapolei Interceptor at North/South Road (see Figure 2) and extending the gravity sewer system in a northerly direction generally following North/South Road to collect sewage from all three projects and deliver the sewage to the Honouliuli WWTP. The proposed system is shown on Figure 3 - DHHL Sewer System.

Transmission to the Honouliuli WWTP will require one of two upgrades to the existing sewer corridor:

1. Construct a third interceptor, alongside the 30" Makakilo Interceptor and 42" Kapolei Interceptor. Figure 4 - Sewer Corridor Typical Section shows a preliminary location for the new interceptor. The three lines will be connected to create a manifold system capable of distributing flow between the lines. Size and actual location of the line will be determined as planning progresses.

2. Construct a third interceptor, alongside the 30" Makakilo Interceptor and 42" Kapolei Interceptor, with the intention of abandoning the 30" Makakilo Interceptor. This line would be larger than that proposed in option 1 above, and would be sized to accommodate the additional flows from DHHL, UHWO, Ho'opili and other future projects, such as Makaiwa Hills. Size of the line will be determined as planning progresses.

The Ho'opili project is made up of three sewer zones as shown on Figure 5 - Ho'opili Sewer Zones. Sewer Zone 1 is approximately 925 acres and is located on the site's west side. Zone 2 is approximately 375 acres and borders the east side of Zone 1 and Old Fort Weaver Road. Zone 3 is located on the project's northeastern corner, east of Honouliuli Stream and is approximately 205 acres. See Appendix A - Preliminary Wastewater Calculations for computed flows for each of the three zones.

Zone 1 will gravity flow to the Main Trunk Sewer to Honouliuli WWTP with a design peak flow of 9.2 MGD. This main trunk sewer is a part of the DHHL sewer system shown on Figure 3. See Appendix B - Wastewater Calculations from "Wastewater Master Plan for East Kapolei" dated June 2006.

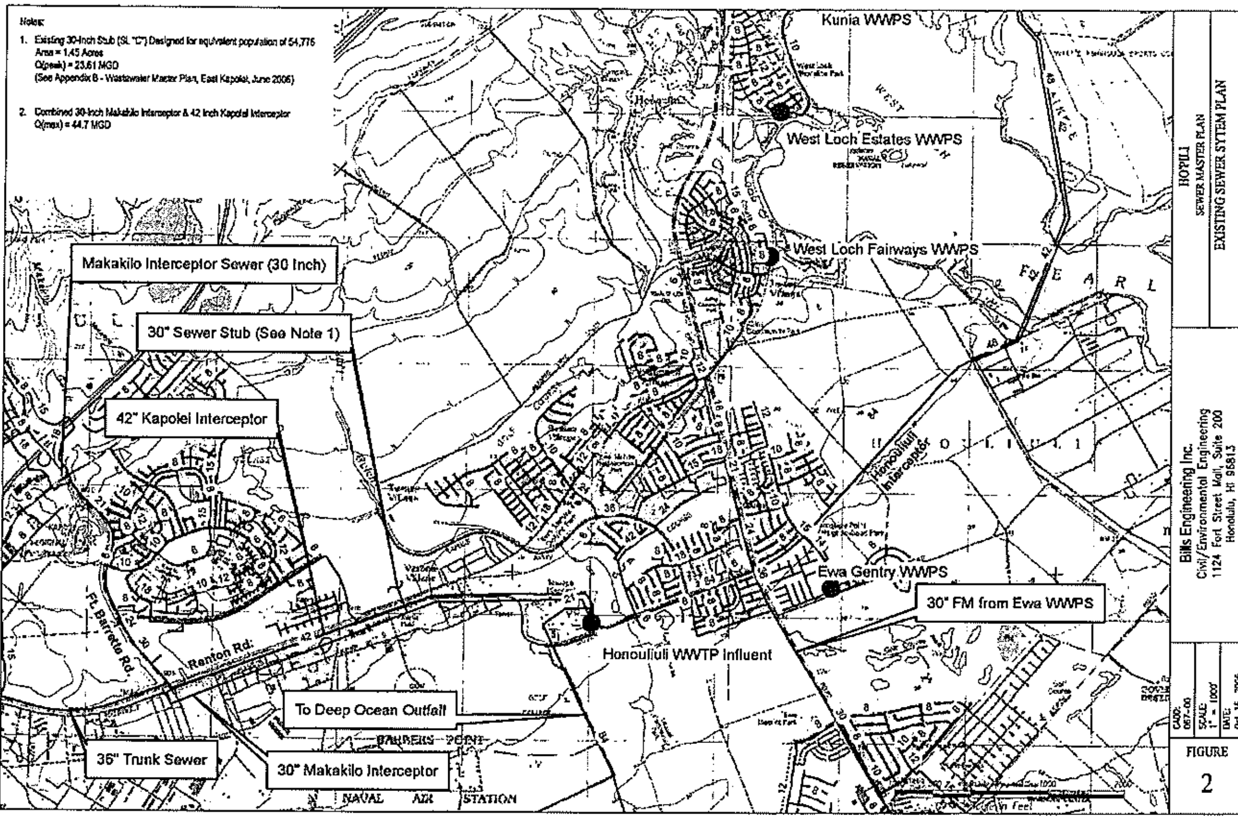
Zone 2 sewage will gravity flow to the proposed Ho'opili SPS, where it will then be lifted to Zone 1. Peak design flow is approximately 2.0 MGD.

Zone 3 has a design peak flow of 1.6 MGD. This area will gravity flow to the Kunia SPS, eventually connecting to the Waipahu SPS. Adequacy of the existing infrastructure will be determined as planning progresses.

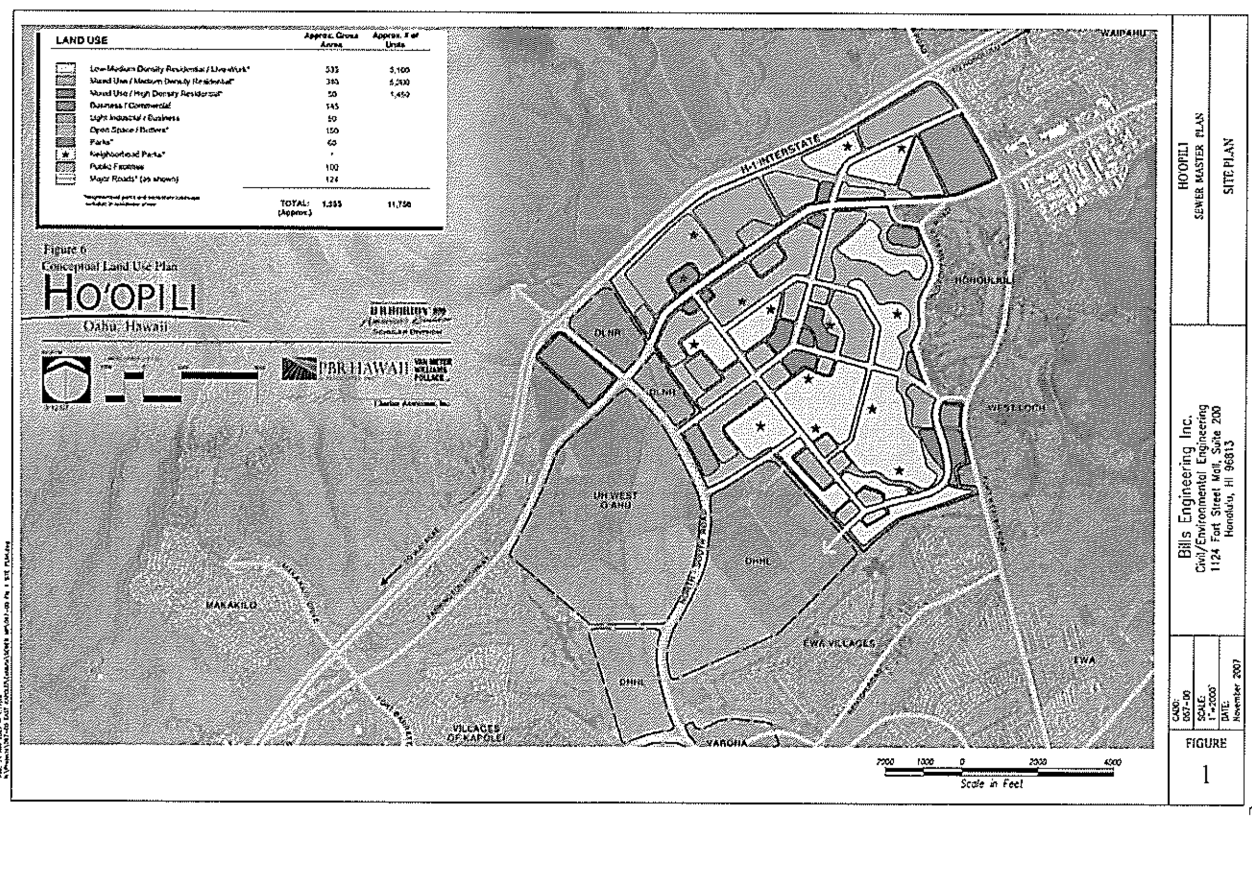
An alternative option to provide sewer service for Zone 3 is to install a sewage pump station and lift sewage to the mauka end of Zone 2. The Zone 2 gravity system would be sized to transport all sewage to the Zone 2 sewage pump station and subsequently lifted to the main trunk sewer in Zone 1.

SECTION 4. ULTIMATE TREATMENT AND DISPOSAL

The project area is within the service limits of the City's Honouliuli Wastewater Treatment Plant service (WWTP) area. The "West Mamala Bay Facilities Plan" prepared for the City and County of Honolulu (Wilson Okamoto and Associates, Inc. and Brown and Caldwell Consultants, 2001) identifies the future flows from the total service area identified in Figure 1. The 2020 capacity of the Honoluluuli is anticipated to be 51 MGD. The project will be contributing funds towards planned expansions to the treatment plant facilities by payment of Sewer Facility Charges.

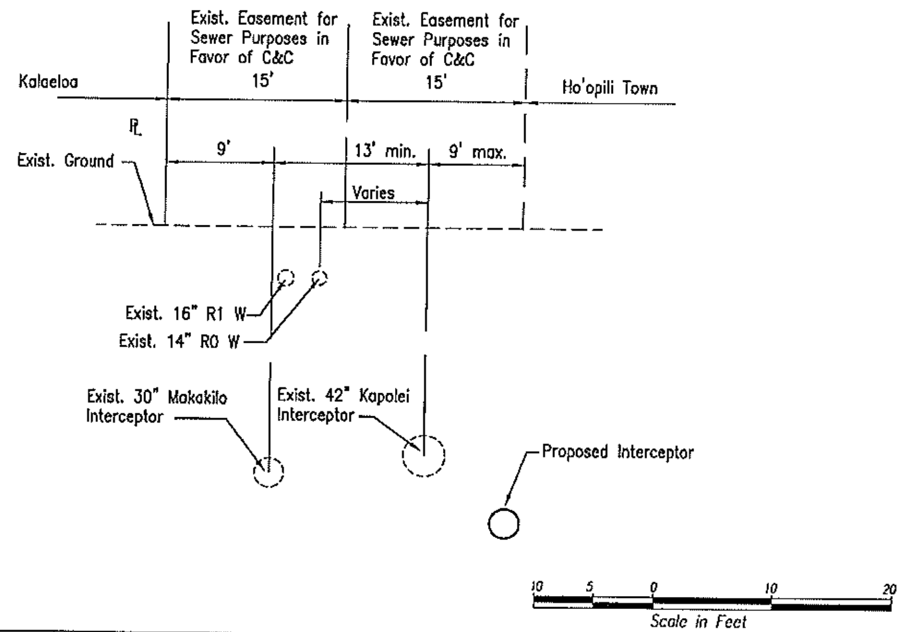


Notes:
1. Existing 30-Inch Stub (SL "C") Designed for equivalent population of 54,776
Area = 1.45 Acres
Q(peak) = 23.61 MGD
(See Appendix B - Wastewater Master Plan, East Kapolei, June 2006)
2. Combined 30-Inch Makakilo Interceptor & 42 Inch Kapolei Interceptor
Q(max) = 44.7 MGD
Kunia WWPS
West Loch Estates WWPS
West Loch Fairways WWPS
Makakilo Interceptor Sewer (30 Inch)
30" Sewer Stub (See Note 1)
42" Kapolei Interceptor
Honouliuli Interceptor
Ewa Gentry WWPS
30" FM from Ewa WWPS
Honouliuli WWTP Influent
Ft. Barrette Rd
Renton Rd.
To Deep Ocean Outfall
36" Trunk Sewer
30" Makakilo Interceptor
BARBERS POINT
NAVAL AIR STATION
HO'PILI
SEWER MASTER PLAN
EXISTING SEWER SYTEM PLAN
Bills Engineering Inc.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, HI 96813
CADD: 067-00
SCALE: 1" = 1000'
DATE: Oct 16, 2006
FIGURE
2

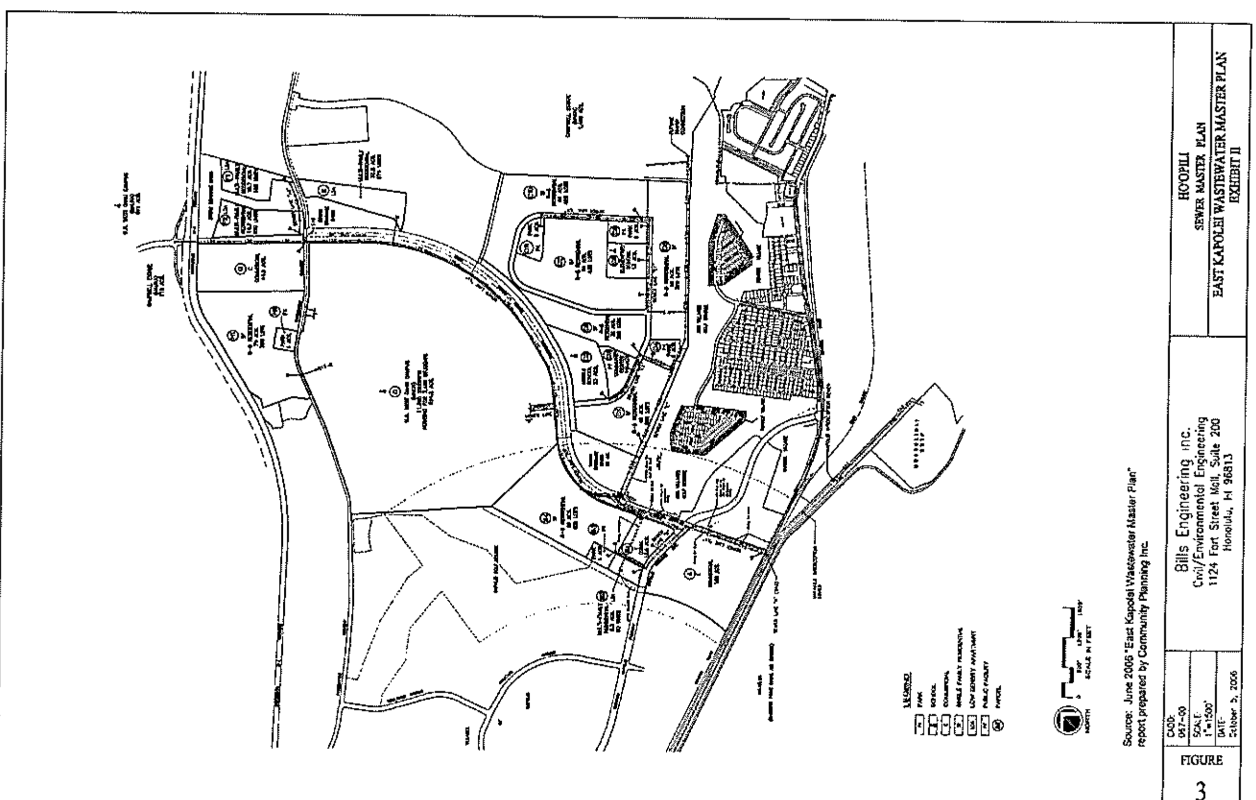


LAND USE
Low-Medium Density Residential / Live-Work*
Mixed Use / Medium Density Residential*
Mixed Use / High Density Residential*
Business / Commercial
Light Industrial / Business
Open Space / Buffers*
Parks*
Neighborhood Parks*
Public Facilities
Major Roads* (as shown)
TOTAL: (Approx.)
Figure 6
Conceptual Land Use Plan
HO'OPILI
Oahu, Hawaii
PBR HAWAII
WAIPAHU
H-1 INTERSTATE
HONOULIULI
DLNR
WEST LOCH
UH WEST O'AHU
DHHL
MAKAKILO
EWA VILLAGES
EWA
VILLAGES OF KAPOLEI
VARONA
Scale in Feet
HO'OPILI
SEWER MASTER PLAN
SITE PLAN
Bills Engineering Inc.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, HI 96813
CADD: 067-00
SCALE: 1"=2000'
DATE: November 2007
FIGURE
1

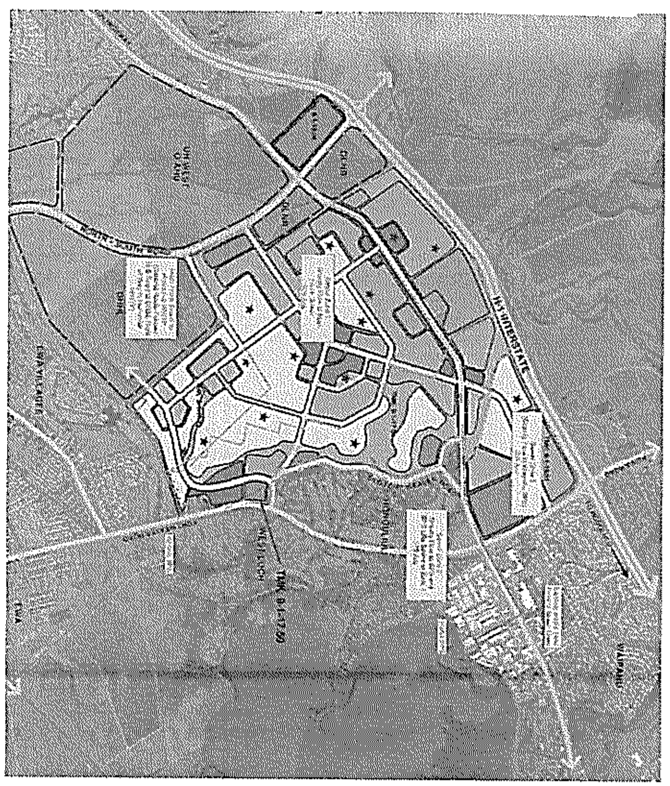
Fri, 27 Oct 2006 - 9:21am
H:\Projects\067-00 EAST KAPOLEI\Exhibits\SEWER MP\067-00 FIG 4 SEWER CORRIDOR.dwg



CADD: 067-00 SCALE: 1"=10' DATE: Oct. 5, 2006	Bills Engineering Inc. Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HO'OPILI SEWER MASTER PLAN SEWER CORRIDOR TYPICAL SECTION	FIGURE 4



APPENDIX A
Preliminary Wastewater Calculations



Scale in Feet: 2000 1000 0 2000 4000

FIGURE 5	CADD: 067-00	Bills Engineering Inc. Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HO'OPILI SEWER MASTER PLAN
	SCALE: AS NOTED		SEWER ZONES
	DATE: November 2007		

Sewer Location				Tributary Area (Acres)		Tributary Equivalent Population						Wastewater Flow Computation								
						Residential 1/		Other 2/ 3/		Total										
District Zone or Street	Point	Unit	Multiplier	Incr.	Total	Incr.	Total	Incr.	Total	Incr.	Total	Ave. WWF (MGD)	Maximum Flow Factor	Maximum Flow (mgd)	Dry Weather Infiltration (mgd)	Design Average Flow (mgd)	Design Maximum Flow (mgd)	Wet Weather Infiltration (mgd)	Design Peak Flow (mgd)	Design Peak Flow (cfs)
ZONE 2	RESIDENTIAL (1,243 UNITS)	1,243	4			4972	4,972					0.398								
	RETAIL (327,034 SF)	327,934	0.007					2,186				0.055								
	OFFICE (215,285 SF)	215,285	0.007					1,435				0.036								
	INDUSTRIAL (0 SF)	-	0.005					-				-								
				317.00	317.00	4,972	4,972	3,621	3,621	8,593	8,593	0.488	3.2519	1.5879	0.0430	0.5313	1.6309	0.3963	2.0271	3.1362

1. RESIDENTIAL - 4 PN/UNIT * 80 GPCD
2. RETAIL/OFFICE - 150 SF/PN 25 GPCD
3. INDUSTRIAL - 200 SF/PN 25 GPCD

Sewer Location				Tributary Area (Acres)		Tributary Equivalent Population						Wastewater Flow Computation								
						Residential 1/		Other 2/ 3/		Total										
District Zone or Street	Point	Unit	Multiplier	Incr.	Total	Incr.	Total	Incr.	Total	Incr.	Total	Ave. WWF (MGD)	Maximum Flow Factor	Maximum Flow (mgd)	Dry Weather Infiltration (mgd)	Design Average Flow (mgd)	Design Maximum Flow (mgd)	Wet Weather Infiltration (mgd)	Design Peak Flow (mgd)	Design Peak Flow (cfs)
ZONE 1	RESIDENTIAL (9,747 UNITS)	9,747	4			38988	38,988					3.119								
	RETAIL (1,249,136 SF)	1,249,136	0.007					8,328				0.208								
	OFFICE (81,437 SF)	81,437	0.007					543				0.014								
	INDUSTRIAL (800,000 SF)	800,000	0.005					4,000				0.100								
				906.00	906.00	38,988	38,988	12,870	12,870	51,858	51,858	3.441	2.2699	7.8103	0.2593	3.7001	8.0696	1.1325	9.2021	14.2367

1. RESIDENTIAL - 4 PN/UNIT * 80 GPCD
2. RETAIL/OFFICE - 150 SF/PN 25 GPCD
3. INDUSTRIAL - 200 SF/PN 25 GPCD

APPENDIX B
Wastewater Calculations from "Wastewater Master Plan for East Kapolei" dated June 2006

Sewer Location				Tributary Area (Acres)		Tributary Equivalent Population						Wastewater Flow Computation								
						Residential 1/		Other 2/ 3/		Total										
District Zone or Street	Point	Unit	Multiplier	Incr.	Total	Incr.	Total	Incr.	Total	Incr.	Total	Ave. WWF (MGD)	Maximum Flow Factor	Maximum Flow (mgd)	Dry Weather Infiltration (mgd)	Design Average Flow (mgd)	Design Maximum Flow (mgd)	Wet Weather Infiltration (mgd)	Design Peak Flow (mgd)	Design Peak Flow (cfs)
ZONE 3	RESIDENTIAL (760 UNITS)	760	4			3040	3,040					0.243								
	RETAIL (642,930 SF)	642,930	0.007					4,286				0.107								
	OFFICE (423,278 SF)	423,278	0.007					2,822				0.071								
	INDUSTRIAL (0 SF)	-	0.005					-				-								
				187.00	187.00	3,040	3,040	7,108	7,108	10,148	10,148	0.421	3.1455	1.3240	0.0507	0.4716	1.3747	0.2330	1.6084	2.4685
	1. RESIDENTIAL - 4 PN/UNIT * 80 GPCD																			
	2. RETAIL/OFFICE - 150 SF/PN 25 GPCD																			
	3. INDUSTRIAL - 200 SF/PN 25 GPCD																			

COMPUTATION OF WASTEWATER FLOW

SEWER: EAST KAPOLEI
DISTRICT: SEWERLINE "B" AND "C"
REFERENCE MAPS:

PAGE: 2 OF 3
COMPUTED BY: DKM
DATE: 5/18/2005

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								AVERAGE FLOW			MAXIMUM FLOW		SEWER STUDY — EXISTING / X ULTIMATE					
				RESIDENTIAL		OTHER		TOTAL																				
DISTRICT ZONE OR STREET	PARCEL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT *	TOTAL	INCREMENT	TOTAL	AVERAGE WWF @ 80 GPCD (MGD)	MAXIMUM FLOW FACTOR	MAXIMUM FLOW (MGD)	DRY WEATHER INFIL (MGD)	DESIGN AVERAGE FLOW (MGD)	DESIGN MAXIMUM FLOW (MGD)	WET WEATHER INFIL (MGD)	DESIGN PEAK FLOW (MGD)	VELOCITY (FPS)	DEPTH (IN)	% FULL	VELOCITY (FPS)	DEPTH (IN)	PIPE DIA. (IN.)	ROUGHNESS	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)	PEAK FLOW CAPACITY (%)
SEWERLINE "B"																												
Single-Family Res.	B4	69	69	1,600	1,600			1,600	1,600	0.128	4.55	0.582	0.008	0.136	0.591	0.066	0.66	1.45	2.86	24%	2.16	6.36	12	0.015	0.28	2.1	1.06	64%
Park	B3	4	73		1,600	20/6		6	1,606	0.128	4.55	0.584	0.008	0.137	0.592	0.091	0.68	1.46	2.88	24%	2.14	6.42	12	0.015	0.28	2.1	1.06	65%
Low-Density Res.	B2	5.3	78.3	168	1,768			168	1,774	0.142	4.46	0.633	0.009	0.151	0.642	0.098	0.74	1.48	3.06	26%	2.19	6.72	12	0.015	0.28	2.1	1.06	70%
Community/Business	B1	13.8	92.1		1,768	1932		1,932	3,706	0.296	3.85	1.141	0.019	0.315	1.159	0.115	1.27	2.46	3.60	30%	3.38	7.68	12	0.015	0.61	3.1	1.56	82%
Sewer "B"			92.1		1,768				3,706	0.296	3.85	1.141	0.019	0.315	1.159	0.115	1.27	2.46	3.60	30%	3.38	7.68	12	0.015	0.61	3.1	1.56	82%
SEWERLINE "C"																												
Single-Family Res.	C6	58	58	1,460	1,460			1,460	1,460	0.118	4.62	0.547	0.007	0.126	0.555	0.073	0.63	1.43	2.78	23%	2.10	6.18	12	0.015	0.28	2.1	1.06	59%
"1" carry over		167	225	3,400	4,860			3,787	5,247	0.421	3.59	1.511	0.026	0.448	1.537	0.281	1.82	1.75	4.95	28%	2.41	9.81	18	0.015	0.20	2.3	2.63	69%
"C2" carry over		73	298	800	5,660			1,261	6,528	0.522	3.44	1.794	0.033	0.555	1.827	0.373	2.20	1.84	5.58	31%	2.50	10.56	18	0.015	0.20	2.3	2.63	84%
Single-Family Res.	C1	45	343	1,120	6,900			1,120	7,648	0.612	3.33	2.037	0.038	0.650	2.075	0.429	2.50	2.26	5.40	30%	3.02	10.44	18	0.015	0.30	2.8	3.22	78%
Campbell+Makai (FUTURE)		1485	1828	54,775	61,575			54,776	62,423	4.994	2.19	10.923	0.312	5.306	11.235	2.285	13.52	4.21	11.52	32%	5.11	17.46	36	0.013	0.30	5.2	23.81	57%
Sewer "C"			1828		61,575			-	62,423	4.994	2.19	10.923	0.312	5.306	11.235	2.285	13.52	4.21	11.52	32%	5.11	17.46	36	0.013	0.30	5.2	23.81	57%
Park	C11	6	6		-	20/6		6	6	0.000	5.00	0.002	0.000	0.001	0.002	0.010	0.01	0.33	0.20	3%	0.50	0.44	6	0.015	0.28	1.6	0.36	3%
Single-Family Res.	C10	69	77	1,680	1,680			1,680	1,686	0.135	4.50	0.607	0.008	0.143	0.616	0.098	0.71	1.49	2.94	25%	2.18	6.54	12	0.015	0.28	2.1	1.06	67%
Park	C9	8	85		1,680	20/6		6	1,692	0.135	4.50	0.609	0.008	0.144	0.618	0.108	0.73	1.49	2.94	25%	2.18	6.54	12	0.015	0.28	2.1	1.06	69%
Elementary School	C8	13	98		1,680	1200/375		375	2,067	0.165	4.32	0.715	0.010	0.178	0.725	0.123	0.85	1.56	3.30	28%	2.26	7.26	12	0.015	0.28	2.1	1.06	80%
Single-Family Res.	C7	69	167	1,720	3,400			1,720	3,787	0.303	3.83	1.161	0.019	0.322	1.180	0.209	1.39	1.82	4.13	28%	2.55	8.48	15	0.015	0.28	2.4	1.91	73%
Sewer "C1"			167		3,400				3,787	0.303	3.83	1.161	0.019	0.322	1.180	0.209	1.39	1.82	4.13	28%	2.55	8.48	15	0.015	0.28	2.4	1.91	73%
Middle School	C2	23	23		-	1200/375		375	375	0.030	5.00	0.150	0.002	0.032	0.152	0.023	0.18	1.31	1.32	17%	2.04	2.52	8	0.015	0.60	2.3	0.52	34%
Community Center	C3	10	33		-	256/80		80	455	0.036	5.00	0.182	0.002	0.039	0.184	0.041	0.23	1.40	1.44	15%	2.15	3.24	8	0.015	0.60	2.3	0.52	43%
Single-Family Res.	C5	32	65	800	800			800	1,255	0.100	4.78	0.480	0.006	0.107	0.486	0.081	0.57	1.45	2.60	26%	2.14	6.15	10	0.015	0.32	2.0	0.69	82%
Park	C4	8	73		800	20/6		6	1,261	0.101	4.77	0.482	0.006	0.107	0.488	0.091	0.58	1.43	2.65	27%	2.14	6.15	10	0.015	0.32	2.0	0.69	83%
Sewer "C2"			73		800				1,261	0.101	4.77	0.482	0.006	0.107	0.488	0.091	0.58	1.43	2.65	27%	2.14	6.15	10	0.015	0.32	2.0	0.69	83%

REMARKS: * Design criteria population (generating 25 gpcd) converted to an equivalent population (generating 80 gpcd) by multiplying too number in the column by 0.3125
(Example: 1200/375 => 1200 x 0.3125 = 375 equivalent population)

APPENDIX O
Drainage Master Plan

DRAINAGE MASTER PLAN

FOR

HO'OPILI

HONOULIULI, 'EWA, O'AHU, HAWAI'I
TMK: (1)9-1-017: POR. 004, 059, 072;
9-1-018: 001, 004

NOVEMBER 2007

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DRAINAGE MASTER PLAN

FOR

HO'OPILI

TMK: (1)9-1-017: POR. 004, 059, 072;
9-1-018: 001, 004
HONOULIULI, 'EWA, O'AHU, HAWAI'I

NOVEMBER 2007

DAVID B. BILLS
LICENSED PROFESSIONAL ENGINEER
No. 4516-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED
BY ME OR UNDER MY SUPERVISION.

SIGNATURE
Expiration Date: 4-30-08

PREPARED BY:

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067-00

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SECTION 1. INTRODUCTION

1.1 Project Location

The Ho'opili project by D. R. Horton-Schuler Division ("Schuler") is located in Honouliuli, 'Ewa, O'ahu. The project site is between 'Ewa Villages and H-1 Freeway, west of Fort Weaver Road, and east of the proposed North-South Road. The development includes TMK: (1)9-1-017: por. 004, 059, 072 and 9-1-018: 001, 004, for a total area of approximately 1,586 acres. (See Figure 1 - Location Map & Project Site Plan.)

The proposed Ho'opili project is a master-planned community with approximately 11,750 residential units. The project will also include commercial and medical office space, parks, and schools.

1.2 Purpose

The purpose of this report is to present the existing and proposed hydrology affecting the project site and to develop a conceptual drainage plan that will demonstrate that storm water can adequately be accommodated to pass through the project site, in conformance with the City and County of Honolulu Drainage Standards.

The second purpose of this report is to present a conceptual plan for compliance with the Water Quality component of the City and County of Honolulu Drainage Standards. All projects in excess of 10 acres must demonstrate that it has reduced the discharge of pollutants to the "maximum extent practicable". Physical methods to demonstrate compliance (detention based water quality control) are proposed.

More detailed drainage studies will be done, as appropriate, to support the various stages of project planning and development.

SECTION 2. EXISTING CONDITIONS

2.1 Existing Topography

The project site is located within the 'Ewa Plain of Leeward O'ahu. The land is presently in agricultural production. The property is relatively flat with elevations ranging from 220 feet above Mean Sea Level (MSL) at the mauka boundary at H-1, to elevation 55 MSL at Fort Weaver Road. The site has an average slope of 1.6% from mauka to makai.

2.2 Flood Insurance Rate Map

The majority of the project site is located in an area designated as Zone D on the Flood Insurance Rate Map (Map No. 15003C220 & 310 F, effective September 30, 2004), where flood hazards are undetermined but possible. Portions of the site are subject to flooding from Honouliuli Stream and are within Zones A, AE and X. (See Figure 2 - Flood Insurance Rate Map.)

2.3 Existing Drainage

The Ho'opili project is within three drainage basins - West Loch, Kalo'i Gulch and Honouliuli. The "Ewa District Runoff Map - Drainage Areas and Peak Flows" prepared by Engineering Concepts, Inc. dated April 3, 1991, identifies the extent of each of these drainage basins. Figure 3 – Ho'opili/'Ewa District Runoff Map shows the map with the proposed Ho'opili project limits superimposed. Figure 4 – Project Drainage Areas, shows how the site is divided between these basins.

West Loch

Approximately 849 acres of the project area lies within the West Loch drainage basin, extending from H-1 Freeway, across Farrington Highway, and down toward the northeast boundary with 'Ewa Village. Runoff within the basin flows along the cane haul road, crossing under Fort Weaver Road, or over Fort Weaver Road in the vicinity just mauka of the Elderly Housing Project (see Figure 4).

The cane haul road is within Easement "2680" and runs through the Asing Park owned by the City and County of Honolulu (TMK: 9-1-17:66). A 54" inlet, located at the low-point takes water through the West Loch Fairways project (design area, A = 31 acres, design discharge, Q = 93 cfs) and discharges through an 84" outlet into the West Loch Fairways golf course (A = 80 acres, Q = 239 cfs). Runoff in excess of the 93 cfs is forced out toward West Loch along the cane haul road. The cane haul road terminates at an existing detention basin built in Schuler's 31-acre parcel (TMK: (1)9-1-010: 002).

The basin was built just southeast of the West Loch subdivision in conjunction with the 'Ewa by Gentry – East project. The basin collects runoff from the Elderly Housing site, a portion of 'Ewa Villages (via two- 54" pipe culverts under Fort Weaver Road), and the site of the future Ho'opili project. The basin is owned and maintained by the City and County of Honolulu. Overflow from the basin sheet-flows toward the West Loch basin of Pearl Harbor.

Onsite storm water basins have been defined from H-1 Freeway as the mauka extent and the basins have been drawn to the exit point of the proposed project (see Figure 4). Basins W1 and W2 represent the drainage areas contributing to West Loch via the Cane Haul Road. The City and County of Honolulu Drainage Standard (Plate 6) was used for this basin since it is over 100 acres. The basins listed as W1A and W1B represent subareas of basin W1 used in the analysis of developed conditions.

Kalo'i Gulch

The entire Kalo'i basin extends from the Wai'anae Range above H-1 Freeway and terminates at the coast in the vicinity of the Ocean Pointe marina. Approximately 102 acres of the project area (areas K8 and K9, on Figure 4) lie within the Kalo'i drainage basin. The areas are adjacent to the proposed North-South Road (TMK: (1)9-1-018: 004 and portion of TMK: (1)9-1-017: 004). Runoff flows in a mauka to makai direction from H-1 Freeway.

Honouliuli

The entire Honouliuli drainage basin is approximately 12.13 square miles in area. It extends from the south slopes of the Wai'anae Range above H-1 Freeway and drains into West Loch, Pearl Harbor. The Honouliuli Stream system is made up of two main branches, the East and West forks, with a confluence just above H-1 Freeway. Below H-1, the flow is confined to Honouliuli Stream.

The "Honouliuli Stream Flood Study for the West Loch Development" dated May 1992, prepared by the R. M. Towill Corporation, established flood boundaries and elevations along the lower Honouliuli Stream floodplain. The study mentioned that the area is prone to relatively frequent flooding due to an accumulation of debris along the stream's narrow and winding course. Channel improvements and clearing done in conjunction with the development of the golf course increased capacity of Honouliuli Stream to carry the 10-year flood. The Fort Weaver Road twin bridges have a 100-year design capacity. (See Figure 2 – Flood Insurance Rate Map.)

Approximately 632 acres of the Ho'opili project (portion of TMK: (1)9-1-018: 001 and portion of (1)9-1-017: 004) are within the Honouliuli drainage basin. The majority of the area is within Zone D, where flood hazards are undetermined but possible. Within TMK: (1)9-1-018: 001 (portions of areas H3 and H4), a strip along Honouliuli Stream is within Zone A and Zone X, areas where no base flood elevations have been determined, and areas of 0.2% annual chance of flood or with 1% annual chance of flood with average depths less than 1 foot, respectively.

The offsite drainage basin, mauka of H-1 Freeway, entering the site is approximately 6,896 acres with a Plate 6 design discharge of 11,200 cfs. The Flood Insurance Study lists a Q_{100} of 7,730 cfs at Farrington Highway.

The onsite basins are shown as H3 – H7 on Figure 4. Areas H5A, H5B, H7A and H7B are subareas used in the analysis of developed conditions.

2.4 Existing Hydrology

The following table summarizes the hydrologic calculations for each onsite basin shown on Figure 4.

TABLE 1. ONSITE DRAINAGE BASIN SUMMARY

Basin	*Area (acres)*	*Q (cfs)*	*Method/comments*
West Loch			
W1	809.5	2,400	Plate 6, Q_{peak}/A = 3 cfs/ac
W2	9.1	11.2	Rational Method Q_{50}/A = 1.2 cfs/ac
	30.8		Detention area (TMK: 9-1-10:02)
	849.4		
Honouliuli			
H3	94.8	83.4	Rational Method Q_{50}/A = 0.9 cfs/ac
H4	78.1	82.5	Rational Method Q_{50}/A = 1.1 cfs/ac
H5	137.8	750	Plate 6, Q_{peak}/A = 5.4 cfs/ac
H6	173.5	750	Plate 6, Q_{peak}/A = 4.3 cfs/ac
H7	148.2	700	Plate 6, Q_{peak}/A = 4.7 cfs/ac
	632.4		
Kalo'i			
K8	50.5	48	Rational Method Q_{50}/A = 0.92 cfs/ac
K9	52.0	48.9	Rational Method Q_{50}/A = 0.97 cfs/ac
	102.5		
Totals	1,584.3*	4,874	*Drainage area exceeds project area due to area contributed by Farrington Hwy.

Rational Method
(See Appendix A – Rational Method, for Tables and Plates)

Basin W2 – 9.1 Acres

Q_{50} = CIA, where
C = 0.2 (Table 1, Band 4, flat farmlands)
I = TM_{50} x Correction Factor for Time of Concentration
TM_{50} = 2.2 in/hr (Plate 2)

Correction Factor = Use Plate 5 for Small Agricultural Basins, where:

Length (L) = 450 Feet
H (Height) = Elevation 62- Elevation 58 = 4 Feet
Slope (S) = 4/450 = 0.89 Ft/Ft

$K = L/S^{1/2}$ = $450/0.0089^{1/2}$ = 4,770

For K = 4,770 and Upper Curve Plate 5,
Time of Concentration = 5.3 Minutes
Correction Factor = 2.8 (Plate 4)

Q_{50} /A = (0.2)(2.8 In/Hr.)(2.2) = 1.2 cfs/ac
Q_{50} = (9.1 ac)(1.2) = 11 cfs

Basin H3 – 94.8 Acres

Q_{50} = CIA, where
C = 0.2 (Table 1, Band 4, flat farmlands)
I = TM_{50} x Correction Factor for Time of Concentration
TM_{50} = 2.2 in/hr (Plate 2)

Correction Factor = Use Plate 5 for Small Agricultural Basins, where:

Length (L) = 3,200 Feet
H (Height) = Elevation 212 - Elevation 107 = 105 Feet
Slope (S) = 105/3,200 = 3.28 Ft/Ft

$K = L/S^{1/2}$ = $3,200/0.0328^{1/2}$ = 17,669

For K = 17,669 and Upper Curve, Plate 5
Time of Concentration = 14.5 Minutes
Correction Factor = 2.0 (Plate 4)

Q_{50}/A = (0.2) (2.0 in/hr)(2.2)/(A) = 0.88 cfs/ac
Q_{50} = (94.8 ac)(0.88) = 83.4 cfs

Basin H4 – 78.1 Acres

Q_{50} = CIA, where
C = 0.2 (Table 1, Band 4, flat farmlands)
I = TM_{50} x Correction Factor for Time of Concentration
TM_{50} = 2.2 in/hr (Plate 2)

Correction Factor = Use Plate 5 for Small Agricultural Basins, where:

Length (L) = 2,100 Feet
H (Height) = Elevation 189.6 - Elevation 96 = 93.6 Feet
Slope (S) = 93.6/2,100 = 4.46 Ft/Ft

$K = L/S^{1/2}$ = $2,100/0.0446^{/2}$ = 9,947

For K = 9,947 and Upper Curve, Plate 5
Time of Concentration = 9.3 Minutes
Correction Factor = 2.4 (Plate 4)

Q_{50}/A = (0.2) (2.2 in/hr)(2.4)/(A) = 1.06 cfs/ac
Q_{50} = (78.1 ac)(1.06) = 82.8 cfs

Basin K8 – 50.5 Acres

Q_{50} = CIA, where
C = 0.2 (Table 1, Band 4, flat farmlands)
I = TM_{50} x Correction Factor for Time of Concentration
TM_{50} = 2.2 in/hr (Plate 2)

Correction Factor = Use Plate 5 for Small Agricultural Basins, where:

Length (L) = 2,200 Feet
H (Height) = Elevation 200 - Elevation 150 = 50 Feet
Slope (S) = 50/2,200 = .0227 Ft/Ft

$K = L/S^{1/2}$ = $2,200/0.0227^{/2}$ = 14,602

For K = 14,602 and Upper Curve, Plate 5
Time of Concentration = 12.6 Minutes
Correction Factor = 2.1 (Plate 4)

Q_{50}/A = (0.2) (2.2 in/hr)(2.1)/(A) = 0.92 cfs/ac
Q_{50} = (50.5 ac)(0.92) = 46.5 cfs

SECTION 3. PROPOSED CONDITIONS

3.1 Increased Runoff from Development

The master plan for the proposed "Ho'opili" project is shown on Figure 5 – Ho'opili Master Plan. The individual basins and sub-basins that were analyzed to create the Master Plan are identified on Figure 4 - Project Drainage Areas. Figure 5 - Drainage Master Plan summarizes the total "after development" conditions. Increased runoff resulting from development has been determined for all areas using the NRCS Method TR-20. Existing and peak flows were calculated for each drainage basin assuming 24-hour rainfall. (See Table 2 - Runoff Increase Summary.)

Runoff will "be limited to predevelopment conditions", in accordance with Section 1-4.1B.3 of the City and County of Honolulu Drainage Standards. Individual developments will be required to provide detention/retention facilities to address both peak storm water runoff rates as well as water quality requirements of the Drainage Standards. The location of the retention/detention basin facilities will be determined during the site planning stage for each area. The one exception to this design criteria will be that runoff that can be directly routed to West Loch and not cause downstream aggravation to property will be allowed to pass at a "fully developed" discharge flow with detention for water quality requirements only. See Table 2 for comparison of runoff for existing and developed conditions. Figure 5 shows preliminary locations for detention/retention areas discussed below.

<u>Kalo'i Basin</u>
For Kalo'i drainage basins (Areas K8 and K9), any increase in runoff will be collected in retention/detention facilities within the two development areas. The retention/detention basin for the K-8 area will discharge to Farrington Highway and the UHWO campus areas at pre-development rates. The discharge from the retention/detention basin for the K9 area will be connected to the North-South Road drainage channel system.

<u>Honouliuli Stream Basin</u>
Area H5 at the corner of Farrington Highway and Fort Weaver Road presently drains to a low point at the southeast corner of TMK: (1)9-1-018: 001. It appears that the runoff ponds within this area until it rises and eventually crosses Fort Weaver Road towards West Loch, Pearl Harbor. Under developed conditions, portions of the Honouliuli drainage basin will be diverted to Honouliuli Stream to alleviate this potential problem, resulting in a decrease in runoff for area H5B. Area H5B is identified as the Waipahu Drainage Basin on the Master Plan (Figure 5).

Under existing and proposed conditions, runoff from Areas H3 and H4 drain towards Honouliuli Stream. Any increase in runoff will need to be addressed by providing onsite detention/retention facilities, with overflow going into Honouliuli Stream.

Runoff from area H6 flows along an existing gully and then sheet flows across existing lots along the West Loch Golf Course (Mauka Phase 1). The runoff gets into Honouliuli Stream once it reaches the golf course. It is proposed that a detention/retention area be created within the existing gully. Overflow will be released at a rate not to exceed the 10-year recurrence interval storm. (This is the recognized capacity of the Honouliuli Stream channel.)

Under existing conditions, the majority of the runoff from area H7 sheet flows across Fort Weaver Road, with a portion of the runoff allowed to pass under Fort Weaver Road via a 48-inch pipe culvert to West Loch Estates. Under developed conditions, runoff from Area H7A (approximately 148 acres) will be collected within the roadway drainage system and piped to the Cane Haul Road, eventually discharging into West Loch. Runoff from Area H7B (approximately 23 acres) will continue to sheet flow across Fort Weaver Road. The net result of drainage improvements proposed by Ho'opili will be a reduction in storm water flow (46 cfs) crossing Fort Weaver Road, passing through West Loch Estates and crossing the Golf Course before ultimately entering the West Loch.

<u>West Loch</u>
Runoff from the West Loch areas (Areas H7A, W1A and W1B) will flow from the project's onsite drainage system into the Cane Haul Road drainage ditch and then into an enlarged detention area near West Loch Fairways Subdivision. The existing detention basin will need to be expanded to cover the 31-acre site to accept flow from the "developed" Ho'opili project. Discharge from the detention basin facilities would then be routed across Navy property to ultimately discharge into the West Loch of Pearl Harbor. The stormwater routing from the detention basin to West Loch would consist of an earth lined trapezoidal channel approximately 80 to 100 feet wide. The channel (from the detention basin to West Loch) would have a maintenance roadway and security fencing.

A plan was developed by Gentry in the mid 1990's to allow a similar detention basin and overflow channel to West Loch. Gentry entered discussions with the Navy but no agreements were made. The Gentry 1990's plan is shown on Figure 6 – Proposed West Loch Detention Area as the background of the current plan. The current plan minimizes the amount of Navy land potentially impacted. A Figure 6A is also presented that provides for a concrete channel overflow. The concrete channel overflow is being considered as a "lowest maintenance" option that would be more attractive to the City for dedication purposes.

The plan presented in this drainage analysis shows storm water runoff from the West Loch drainage basin entering the makai detention area with an overflow to West Loch across Navy property. The concept can readily be expanded to also include Gentry properties to the west of Fort Weaver Road by adding detention on Gentry property adjacent to the 31 acre makai detention area and widening the overflow channel. Consultation with Gentry has confirmed this option may be explored. The current Gentry plan to meet City and County of Honolulu Drainage standards for their properties west of Fort Weaver Road is to excavate depressions capable of storing 100-year 24-hour rainfall events. This plan reduces the land Gentry's land area available for development and encumbers it with large depressions.

Crossing Navy property will require approval of the U. S. Navy. Resolving issues regarding security and maintenance (private vs. City and County) will be paramount. The alternative to the concept shown on Figure 6 is complete retention of a 100-year 24-hour storm on the Ho'opili project property. This would include the 31-acre detention site shown on Figure 6 as well as a portion of the project currently planned for residential housing. The volume required to retain a 100-year 24-hour storm is 34 acre-feet.

TABLE 2. RUNOFF INCREASE SUMMARY

Basin	Area (acres)	Developed Area (acres)	Existing Peak Runoff (cfs)	Developed Peak Runoff (cfs)	Change (cfs)	Storm Water Quality Requirement WQDV = C(1")A(3,630) (Acre-ft)	Preliminary Basin Design Dimensions/ Peak flow /Vol (cfs/Acre-ft)
West Loch							
W1							
W1 (Exist.)	809.5		306.52				
W1A & W1B		809.5		1201.53	895.01	33.7	
W2	9.1	9.1	11.0	21.35	10.35	0.4	
TMK: 9-1-010:2	30.8	30.8	-	-	-	Detention area	700'x400'x8.4'/ 195 cfs/57 AF
Total (West Loch)	849.4	849.4	317.52	1222.88	905.36	35.4	
Honouliuli							
H3	94.8	94.8	83.81	217.59	133.78	4.0	140'x100'x9.3'/ 68 cfs/8 AF
H4							
H4 (Exist.)	78.1		91.12				
H4 & H5A		183.1		357.19	266.07	7.6	300'x300'x7.8'/ 74 cfs/18 AF
H5							
H5A & H5B (Exist.)	137.8		114.4				
H5B		32.8		75.48	-38.92	1.4	100'x100'x7.9'/ 36 cfs/3 AF
H6	173.5	173.5	144.92	217.07	72.15	7.2	250'x250'x7.8'/ 142 cfs/13 AF
H7							
H7 (Exist.)	148.2		99.05				
H7A		125.2		236.87		5.2	250'x250'x7.8'/ 71 cfs/11 AF
H7B		23		52.93	190.75	1.0	100'x100'x6.3'/ 23 cfs/2 AF
Total (Honouliuli)	632.4	632.4	533.3	1134.59	601.29	26.4	
Kalo'i							
K8	50.5	50.5	49.31	108.13	58.62	2.2	150'x150'x6.9'/ 45 cfs/4 AF
K9	52.0	52.0	48.36	110.32	61.96	2.1	150'x150'x6.7'/ 48 cfs/4 AF
Total (Kalo'i)	102.5	102.5			120.78	4.3	
Totals	1,584.3	1,584.3					

3.2 Onsite Drainage System

All runoff from the project lots and roadway system will be collected by swales and roadway catch basins. The drainage system will include catch basins, drain manholes and drain lines. All improvements will be designed and constructed in accordance with City and County of Honolulu "Rules Relating to Storm Drainage Standards" dated January 2000.

Hydraulic calculations for the onsite drainage system will be submitted with the construction plans.

3.3 Retention/Detention Facility

The project's detention/retention facilities have two purposes: to reduce the project's peak flow to predevelopment conditions and to provide water quality detention.

The size of the water quality detention facilities will be based on Section 1-5.1C of the Storm Drainage Standards the required volume of runoff to be detained through the water quality detention basin is calculated as follows:

WQDV = C x 1" x A x 3,630

Where, C = 0.05 + (0.009) x (IMP)

Where, IMP = Impervious Area of project expressed as percentage where little or no infiltration occurs. For the purpose of this study, a paved percentage factor of 50 has been used.

C = 0.05 + (0.009) x 50 = 0.50

WQVD = 0.5 x 1" x Area x 3,630 = 1,815 Cubic Feet/Acre (.0417 Acre-feet/Acre)
Table 2 - Runoff Increase Summary identifies the water quality storage requirement for each of the development areas shown of Figure 4.

In addition to the water quality aspect of the project's retention/detention facility, the facility utilizes storage to dampen the project's peak flow. Inflow and outflow hydrographs have been created to size both the basin and the basin's outflow structure, to demonstrate that the basin adequately dampens the peak flow to predevelopment conditions. (See Appendix B – Preliminary TR-20 Calculations.)

3.4 Maintenance of Drainage Facilities

<u>Piped Systems</u>
Piped systems (i.e., drain pipes, catch basins, concrete drainage structures, etc.) will be constructed to meet the requirements of the Drainage Standards and will be dedicated to the City and County oh Honolulu. Drainage features within roadways will be part of the dedicated roadway system. Piped drainage systems created outside the roadway area will be constructed to City and County standards and easements will be created for the piped systems as a part of dedication.

Retention/Detention Basins
Retention/detention basins will be constructed to meet hydraulic requirements of the Drainage Standards. It is the project's intention to dedicate the facilities to the City and County of Honolulu. However, it is recognized that the City may require maintenance of these facilities to be retained by the homeowners or property owner associations. Flowage easements will be created for the basins.

The West Loch drainage basin and the makai detention facility may require special consideration. The discharge from the basin is proposed to cross Navy property and the Navy will be particularly concerned about the entity responsible for maintenance. Maintenance by a private company or a property owner association may be unacceptable to the Navy.

Commercial lots, such as Areas K8 and K9, will most likely have their own property owner association(s) and these retention/detention basins will be privately maintained.

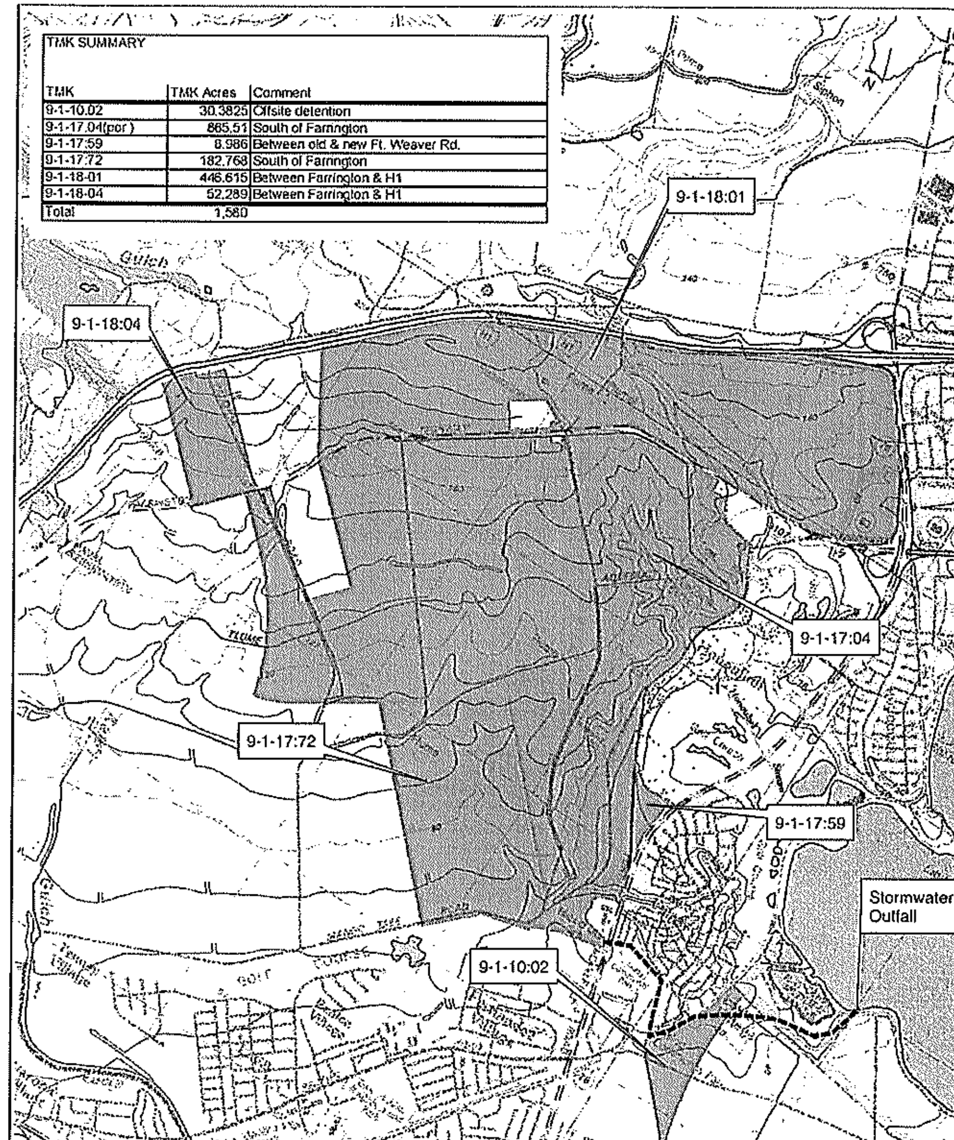
SECTION 4. SUMMARY & CONCLUSIONS

1. The Drainage Master Plan for the Ho'opili project demonstrates that proposed development will not adversely affect adjacent property owners and/or existing or proposed downstream development in accordance with the City and County of Honolulu Drainage Standards.

2. This Drainage Master Plan identifies the major components of the overall Ho'opili drainage system with emphasis on the methods and means to address downstream runoff created through urbanization. The master plan will evolve to add more detailed site specific analysis of on-site piping structures at a later date as the plan becomes more developed. However, the methods to address increased runoff will not change significantly.

3. There will be no adverse drainage impacts resulting from development if the principles in this Drainage Master Plan are followed.

4. The Navy has been consulted with respect to the preferred option of having the ultimate discharge enter West Loch. As of this date the Navy has rejected the plan. Therefore, unless the Navy's position can be altered, the primary ultimate drainage solution will be the creation of on-site retention basins capable of storing the 100-year, 24-hour rainfall event.



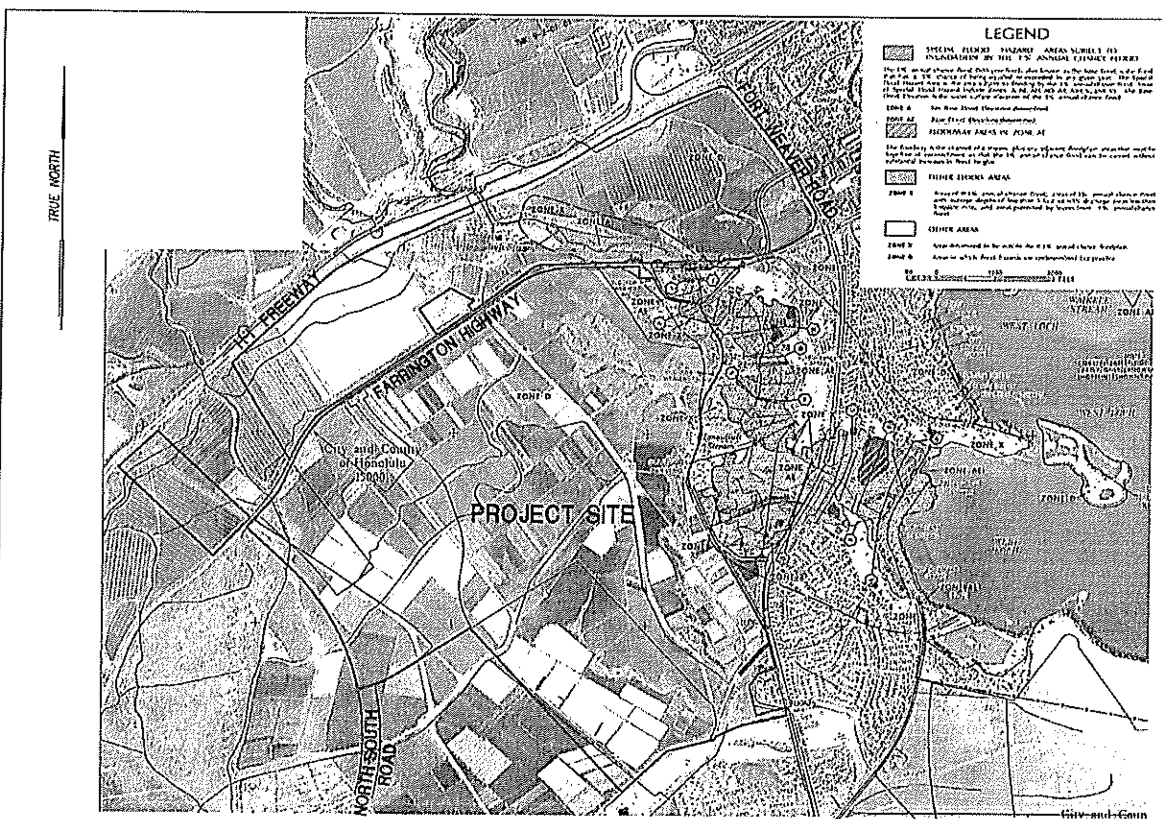
TMK SUMMARY

TMK	TMK Acres	Comment
9-1-10:02	30.3825	Offsite detention
9-1-17:04(por)	865.51	South of Farrington
9-1-17:59	8.986	Between old & new Ft. Weaver Rd.
9-1-17:72	182.768	South of Farrington
9-1-18-01	446.615	Between Farrington & H1
9-1-18-04	52.289	Between Farrington & H1
Total	1,580	

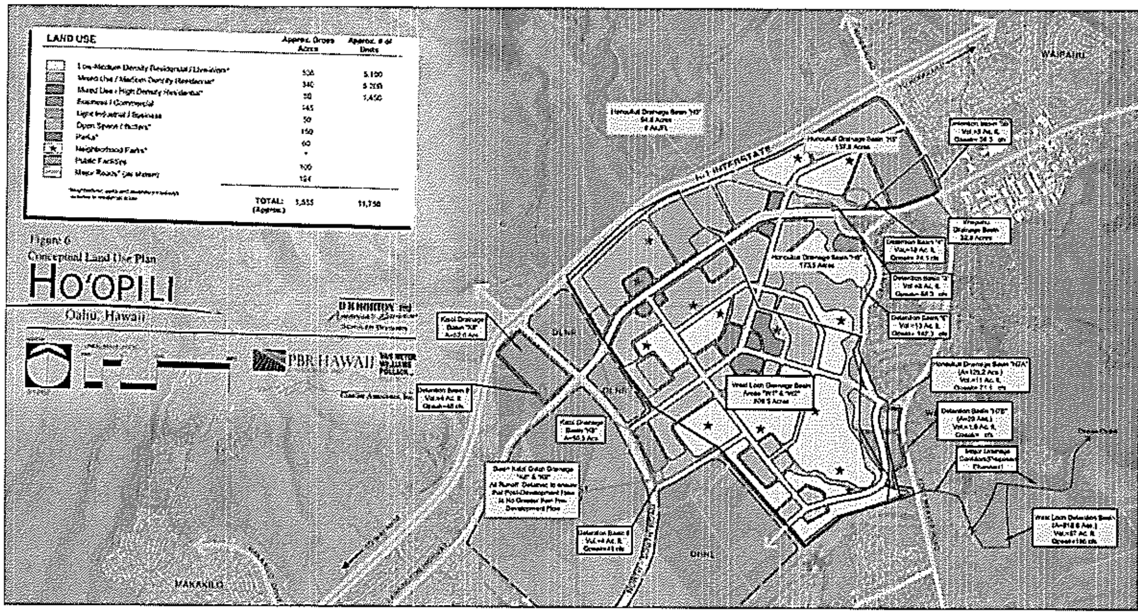
CADD: 067-00	Bills Engineering Inc.	Ho'opili Drainage Master Plan	FIGURE
SCALE: 1" = 2000'	Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813		1
DATE: 8/9/6		Location Map	

CADD: 067-Figure 3 SCALE: SCALE AS SHOWN DATE: Aug 31, 2006	Bills Engineering Inc. Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HO'OPILI DRAINAGE MASTER PLAN HO'OPILI/EWA DISTRICT RUNOFF MAP	FIGURE 3

Fri. 27 Oct 2006 - 10:57am
K:\Projects\067-00 EAST KAPOLEI\Exhibits\DRAINAGE MP\FIG 3 Runoff Map.dwg



CADD: 067-00 FIRM SCALE: 1" = 2000' DATE: Oct. 27, 2006	Bills Engineering Inc. Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HO'OPILI FLOOD INSURANCE RATE MAP (FIRM)	FIGURE 2



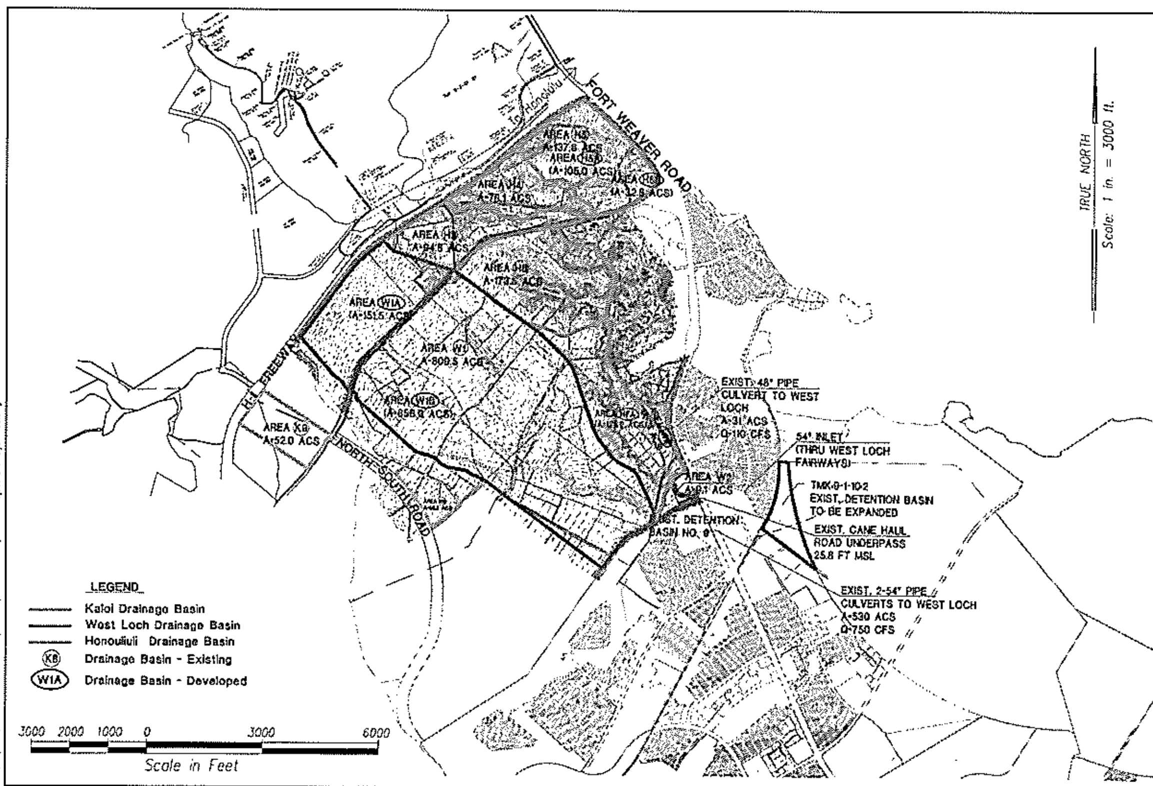
HO'OPILI
DRAINAGE MASTER PLAN

DRAINAGE MASTER PLAN

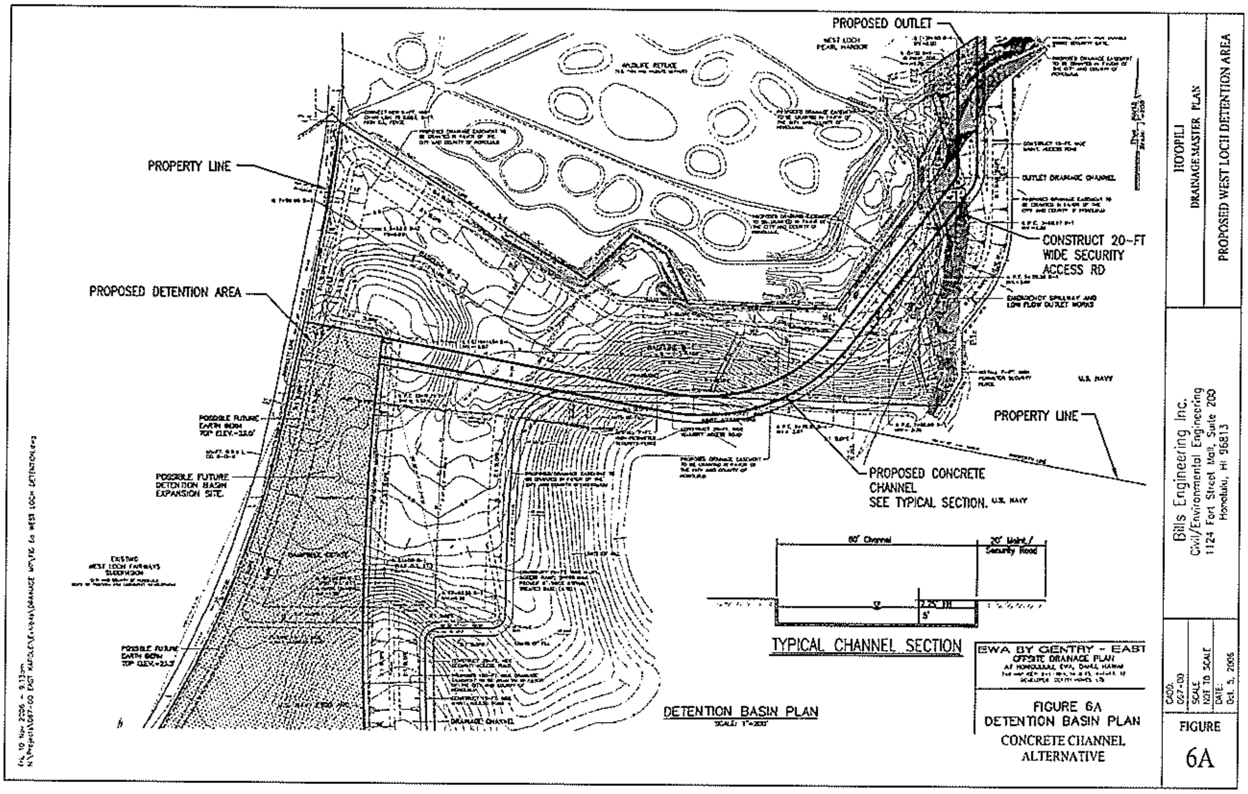
Bills Engineering Inc.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, HI 96813

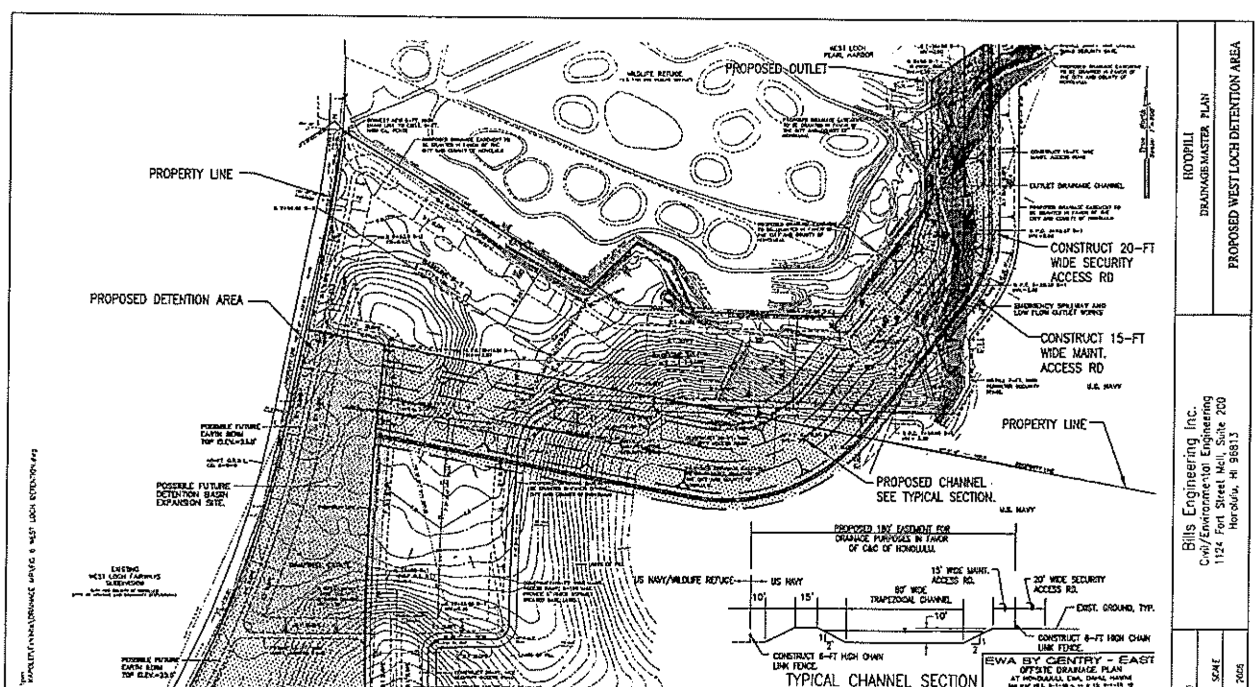
CADD: 067-00
SCALE: AS NOTED
DATE: November 2007

FIGURE
5



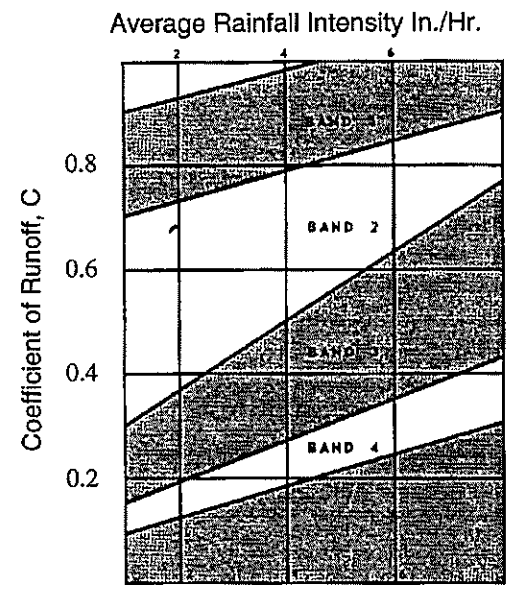
CADD:	Bills Engineering Inc.	HO'OPILI DRAINAGE MASTER PLAN	FIGURE
SCALE: 1" = 3000'	Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	PROJECT DRAINAGE AREAS	4
DATE: NOVEMBER 2007			


PROPOSED OUTLET
PROPERTY LINE
PROPOSED DETENTION AREA
CONSTRUCT 20-FT WIDE SECURITY ACCESS RD
PROPERTY LINE
PROPOSED CONCRETE CHANNEL SEE TYPICAL SECTION.
POSSIBLE FUTURE EARTH BERM
POSSIBLE FUTURE DETENTION BASIN EXPANSION SITE.
U.S. NAVY
80' Channel
20' Maint./ Security Road
TYPICAL CHANNEL SECTION
DETENTION BASIN PLAN
EWA BY GENTRY - EAST
OFFSITE DRAINAGE PLAN
FIGURE 6A
DETENTION BASIN PLAN
CONCRETE CHANNEL ALTERNATIVE
HO'OPILI
DRAINAGE MASTER PLAN
PROPOSED WEST LOCH DETENTION AREA
Bills Engineering Inc.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, HI 96813
SCALE: NOT TO SCALE
DATE: Oct. 5, 2005
FIGURE
6A

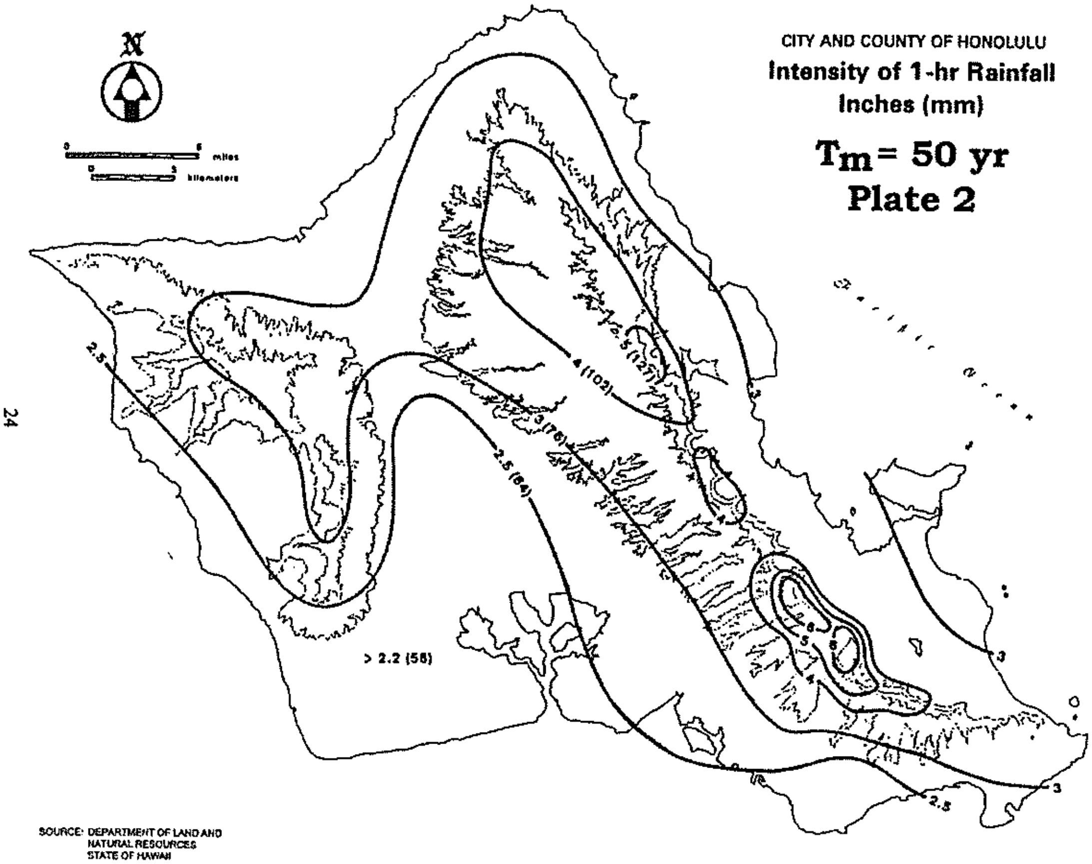

PROPOSED OUTLET
PROPERTY LINE
PROPOSED DETENTION AREA
CONSTRUCT 20-FT WIDE SECURITY ACCESS RD
CONSTRUCT 15-FT WIDE MAINT. ACCESS RD
U.S. NAVY
PROPERTY LINE
PROPOSED CHANNEL SEE TYPICAL SECTION.
POSSIBLE FUTURE EARTH BERM
POSSIBLE FUTURE DETENTION BASIN EXPANSION SITE.
PROPOSED 180' EASEMENT FOR DRAINAGE PURPOSES IN FAVOR OF C&C OF HONOLULU
US NAVY/WILDLIFE REFUGE
US NAVY
15' WIDE MAINT. ACCESS RD.
80' WIDE TRAPEZOIDAL CHANNEL
20' WIDE SECURITY ACCESS RD.
EXIST. GROUND, TYP.
CONSTRUCT 6-FT HIGH CHAIN LINK FENCE.
TYPICAL CHANNEL SECTION
DETENTION BASIN PLAN
EWA BY GENTRY - EAST
OFFSITE DRAINAGE PLAN
FIGURE 6
DETENTION BASIN PLAN
HO'OPILI
DRAINAGE MASTER PLAN
PROPOSED WEST LOCH DETENTION AREA
Bills Engineering Inc.
Civil/Environmental Engineering
1124 Fort Street Mall, Suite 200
Honolulu, HI 96813
SCALE: NOT TO SCALE
DATE: Oct. 5, 2005
FIGURE
6

APPENDIX A
Rational Method Tables and Plates

Table 1
RUNOFF COEFFICIENT FOR AGRICULTRUAL AND OPEN AREAS

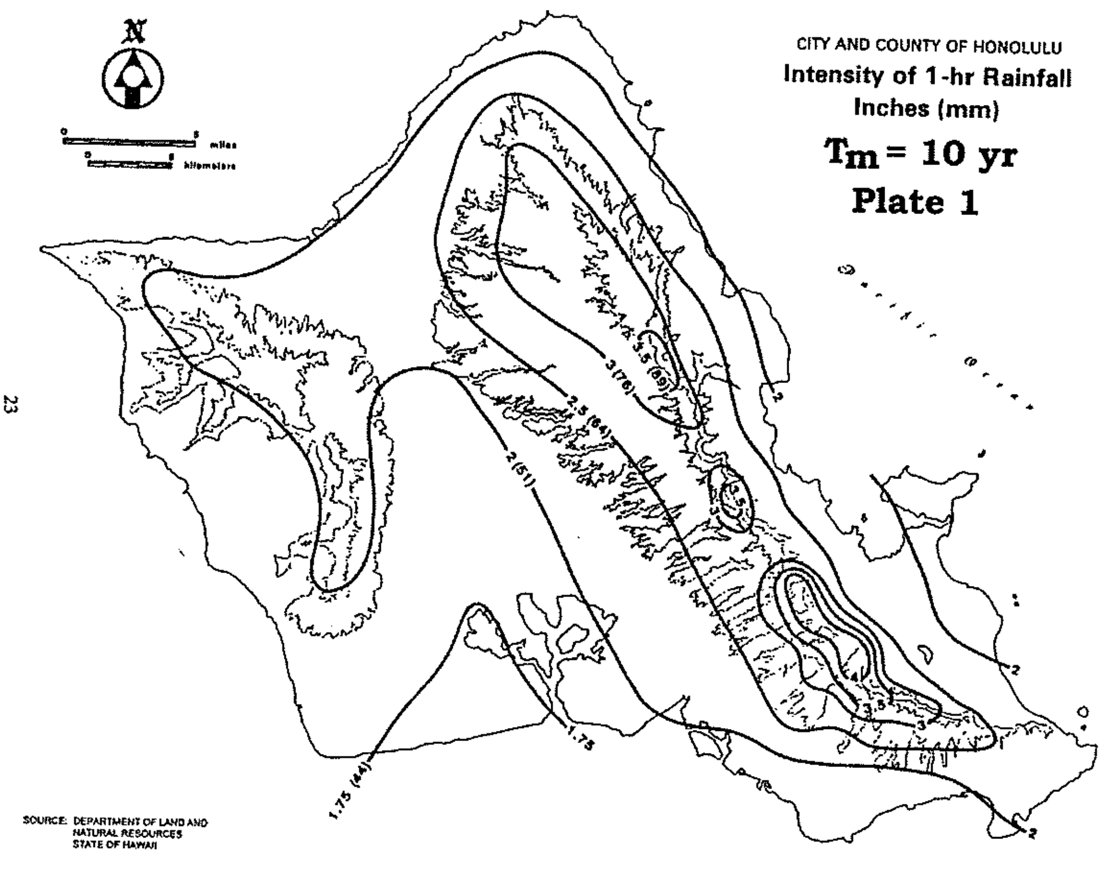


Band 1	Steep, barren, impervious surfaces
Band 2	Rolling barren in upper band values, flat barren in lower part of band, steep forested and steep grass meadows
Band 3	Timber lands of moderate to steep slopes, mountainous, farming
Band 4	Flat pervious surface, flat farmlands, wooded areas and meadows



CITY AND COUNTY OF HONOLULU
Intensity of 1-hr Rainfall
Inches (mm)
Tm = 50 yr
Plate 2
4 (102)
3 (76)
2.5 (64)
> 2.2 (56)
2.5
3
SOURCE: DEPARTMENT OF LAND AND NATURAL RESOURCES STATE OF HAWAII

24

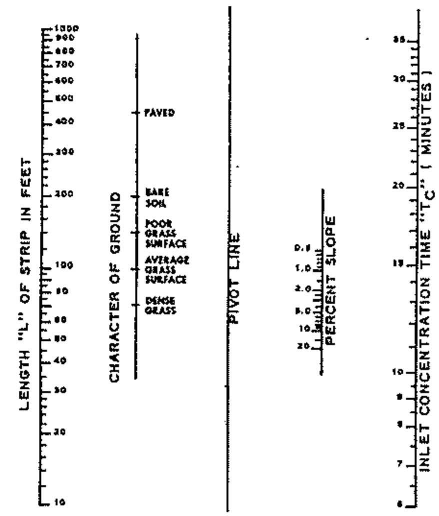


CITY AND COUNTY OF HONOLULU
Intensity of 1-hr Rainfall
Inches (mm)
Tm = 10 yr
Plate 1
3 (76)
2.5 (64)
2 (51)
1.75 (44)
1.75
2
SOURCE: DEPARTMENT OF LAND AND NATURAL RESOURCES STATE OF HAWAII

23

Plate 3

Overland Flow Chart



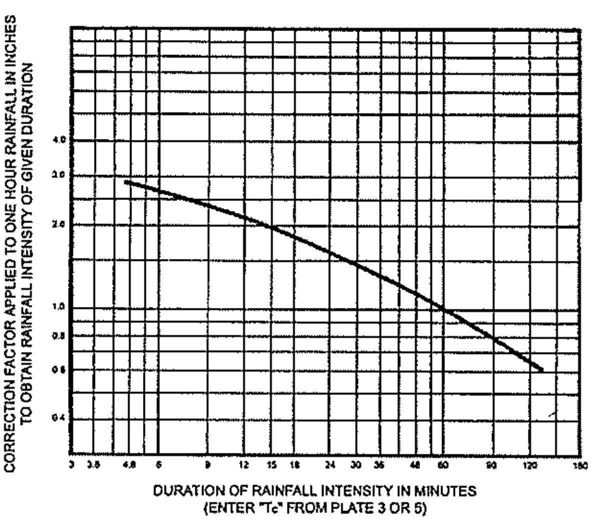
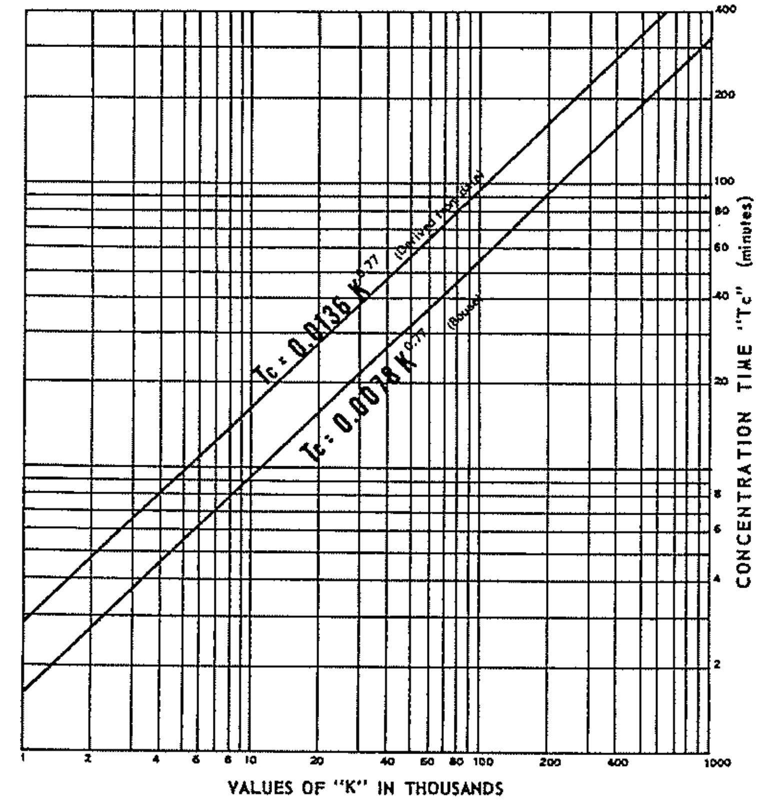


Plate 4

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

(See Plate 6 for area more than 100 acres)



L = Maximum length of travel in feet
H = Difference in elevation between most remote point and outlet in feet.
S = Slope H/L

$K = \frac{L}{\sqrt{S}} = \sqrt{\frac{L^3}{H}}$

Use upper curve for well forested areas
Use lower curve for areas with little or no cover.

SOURCE: CITY PLANNING COMMISSION
graph from Hunter Rouse "Engineering Hydraulics."

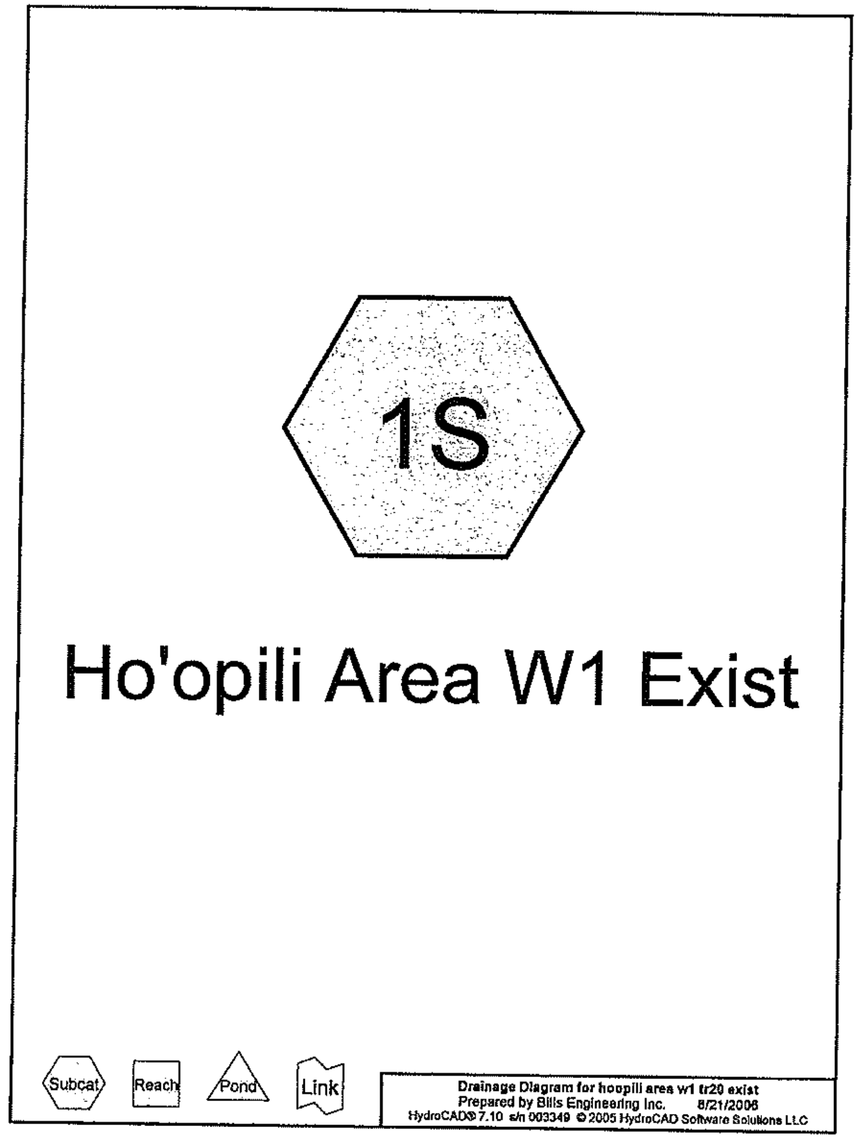
NOTE: Use 5 minutes if Tc is 5 minutes or less.

Plate 5

Time of Concentration

(OF SMALL AGRICULTURAL DRAINAGE BASIN)

APPENDIX B
Preliminary TR-20 Calculations



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W1 Exist Runoff Area=809.500 ac Runoff Depth=2.46"
Flow Length=11,000' Tc=176.7 min CN=80 Runoff=306.52 cfs 166.051 af

Total Runoff Area = 809.500 ac Runoff Volume = 166.051 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area W1 Exist

Subcatchment area W1 east of NS Rd

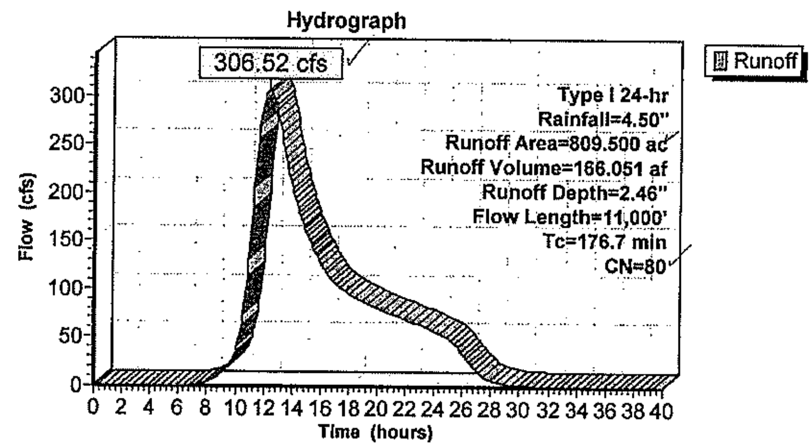
Runoff = 306.52 cfs @ 12.36 hrs, Volume= 166.051 af, Depth= 2.46"

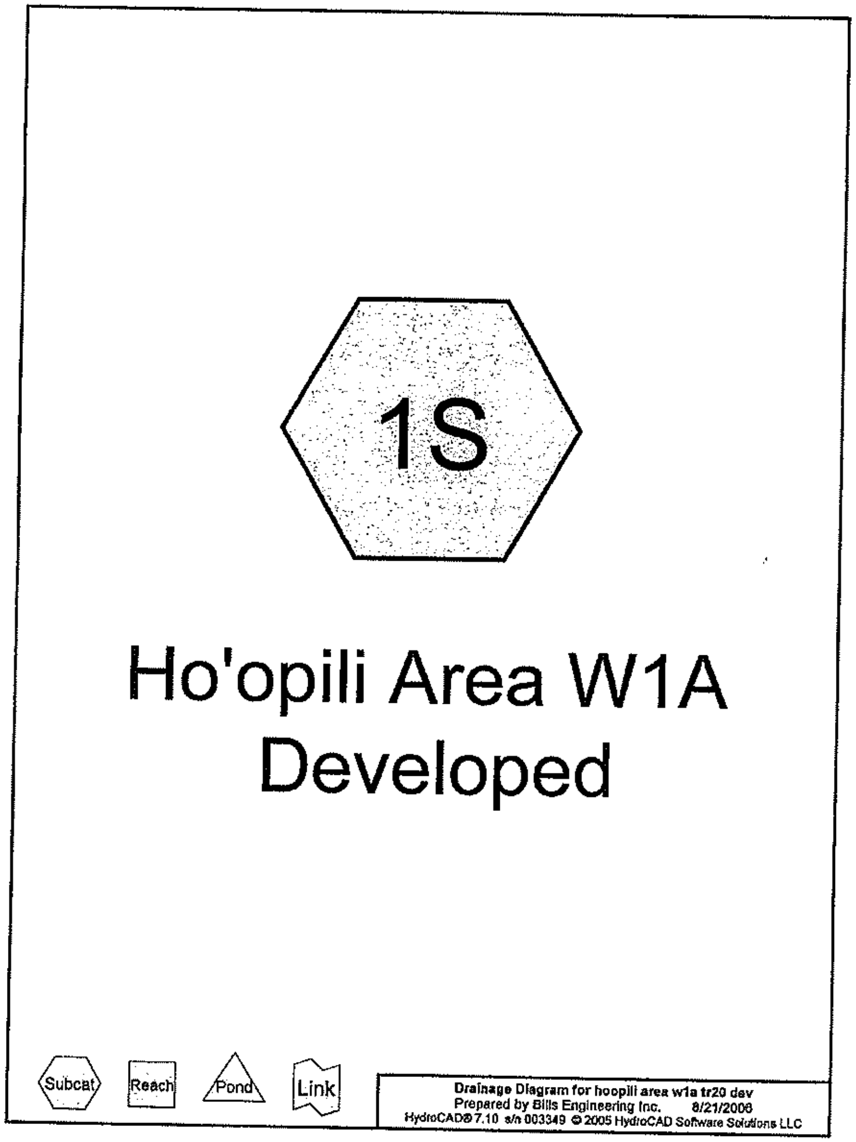
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
809.500	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
176.7	11,000	0.0150	1.0		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area W1 Exist





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W1A Developed Runoff Area=151.500 ac Runoff Depth=3.10"
Flow Length=5,400' Tc=17.7 min CN=87 Runoff=281.85 cfs 39.124 af

Total Runoff Area = 151.500 ac Runoff Volume = 39.124 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area W1A Developed

Subcatchment area W1A east of NS Rd above Farrington

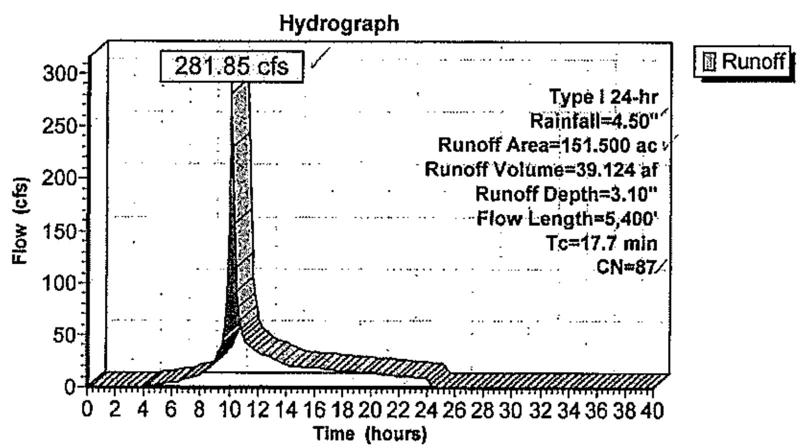
Runoff = 281.85 cfs @ 10.10 hrs, Volume= 39.124 af, Depth= 3.10"

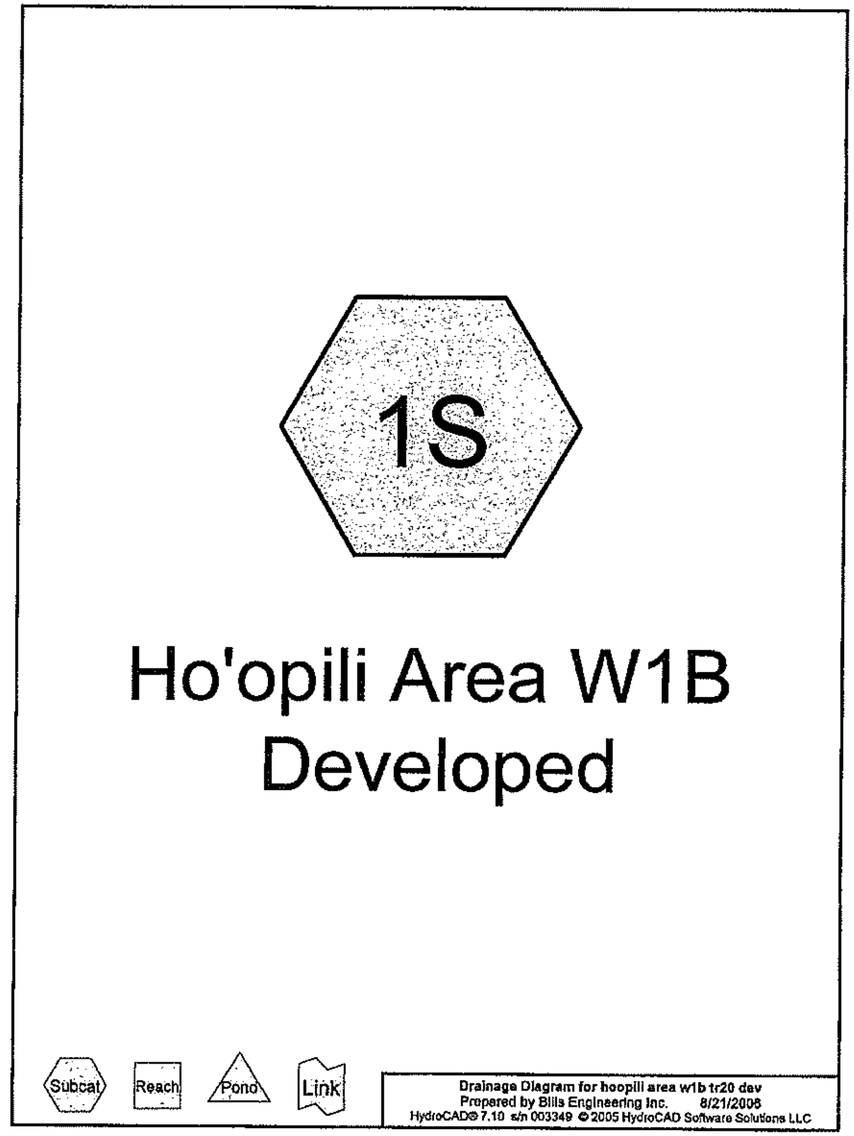
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
151.500	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
2.9	1,800	0.0200	10.2	31.99	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
7.9	3,400	0.0100	7.2	22.62	Circular Channel (pipe), Piped within Farrington Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
17.7	5,400	Total			

Subcatchment 1S: Ho'opili Area W1A Developed





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W1B Developed Runoff Area=658.000 ac Runoff Depth=3.10"
Flow Length=12,000' Tc=31.4 min CN=87 Runoff=919.68 cfs 169.925 af

Total Runoff Area = 658.000 ac Runoff Volume = 169.925 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area W1B Developed

Subcatchment area W1B east of NS Rd belowFarrington

Runoff = 919.68 cfs @ 10.27 hrs, Volume= 169.925 af, Depth= 3.10"

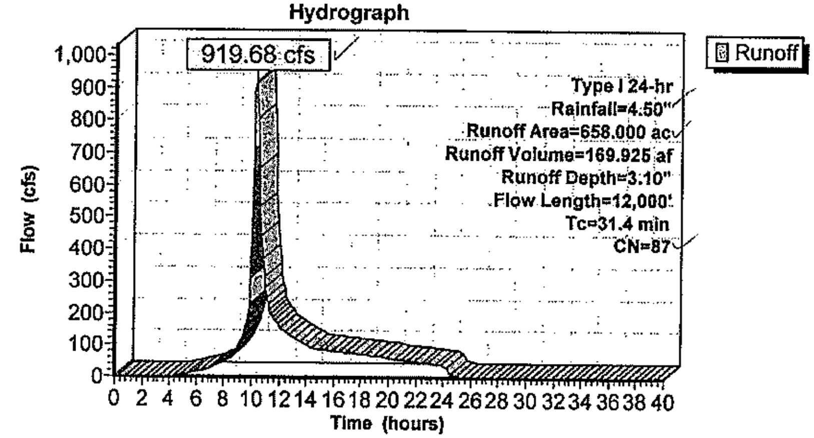
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

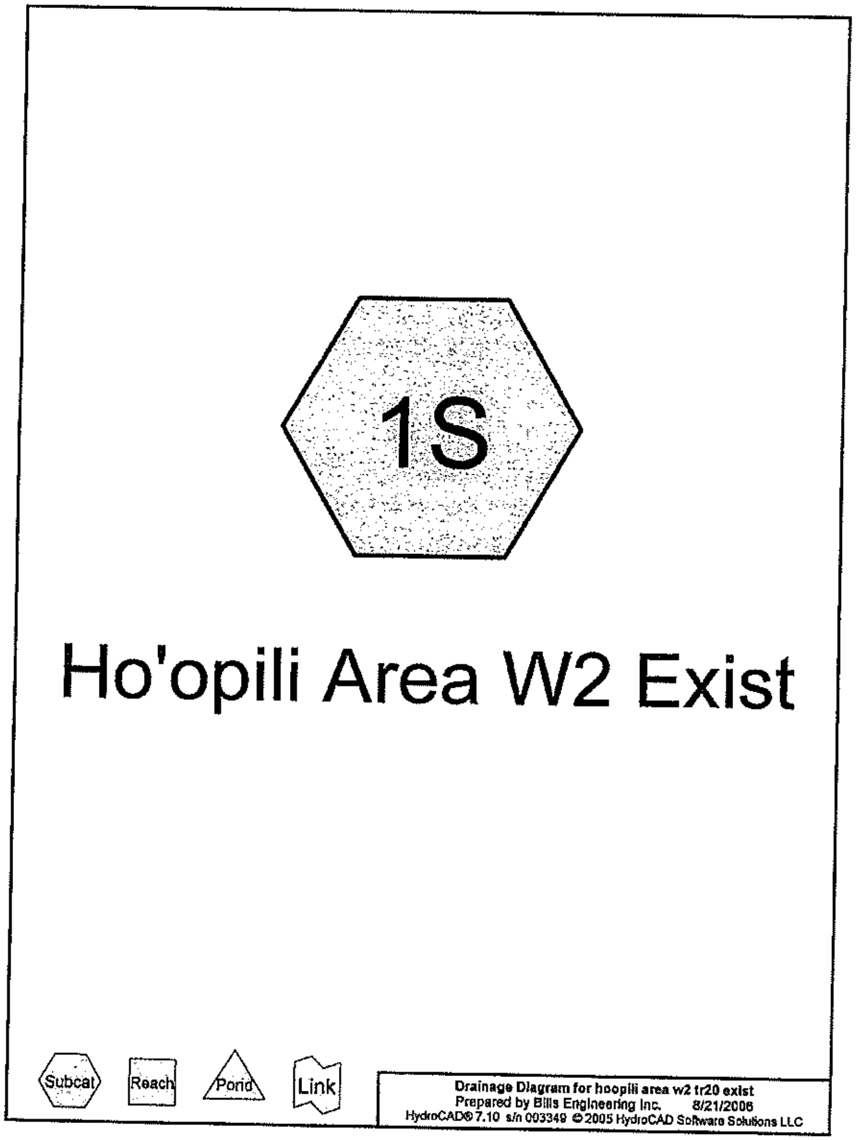
Area (ac)	CN	Description
658.000	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		**Lag/CN Method, Overland**
19.9	9,800	0.0130	8.2	25.79	**Circular Channel (pipe), Piped** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
4.6	2,000	0.0100	7.2	22.62	**Circular Channel (pipe), Piped** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
31.4	12,000	Total			

Subcatchment 1S: Ho'opili Area W1B Developed

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W2 Exist Runoff Area=9.100 ac Runoff Depth=2.46"
Flow Length=600' Tc=25.2 min CN=80 Runoff=11.00 cfs 1.867 af

Total Runoff Area = 9.100 ac Runoff Volume = 1.867 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area W2 Exist

Subcatchment area W2 north of Cane Haul Rd.

Runoff = 11.00 cfs @ 10.20 hrs, Volume= 1.867 af, Depth= 2.46"

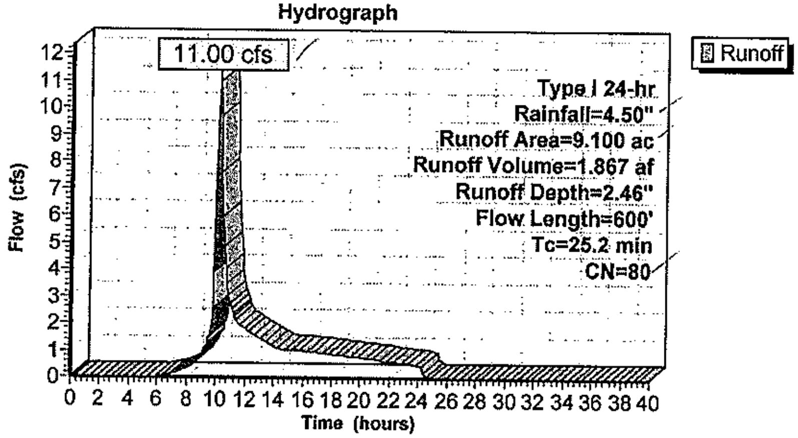
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

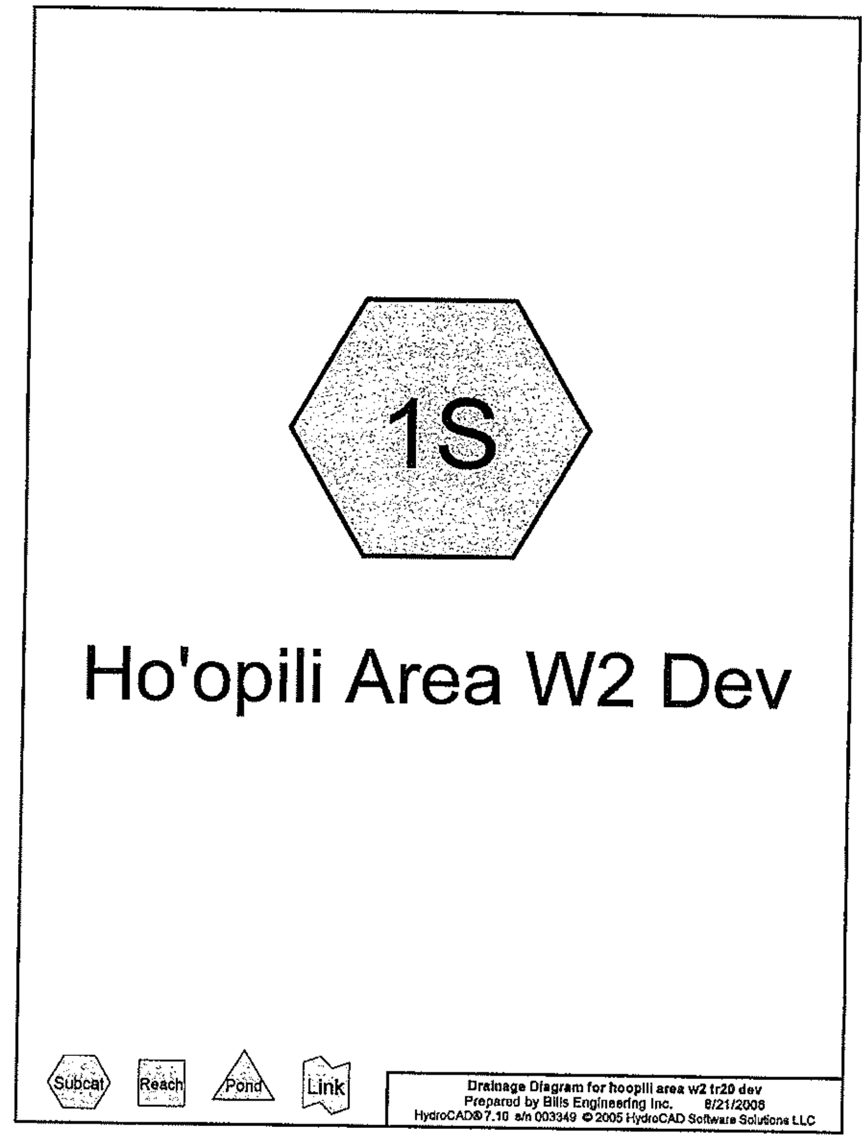
Area (ac)	CN	Description
9.100	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.2	600	0.0070	0.4		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area W2 Exist

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W2 Dev Runoff Area=9.100 ac Runoff Depth=3.10"
Flow Length=800' Tc=8.3 min CN=87 Runoff=21.35 cfs 2.350 af

Total Runoff Area = 9.100 ac Runoff Volume = 2.350 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area W2 Dev

Subcatchment area W2 north of Cane Haul Rd.

[49] Hint: Tc<2dt may require smaller dt

Runoff = 21.35 cfs @ 9.99 hrs, Volume= 2.350 af, Depth= 3.10"

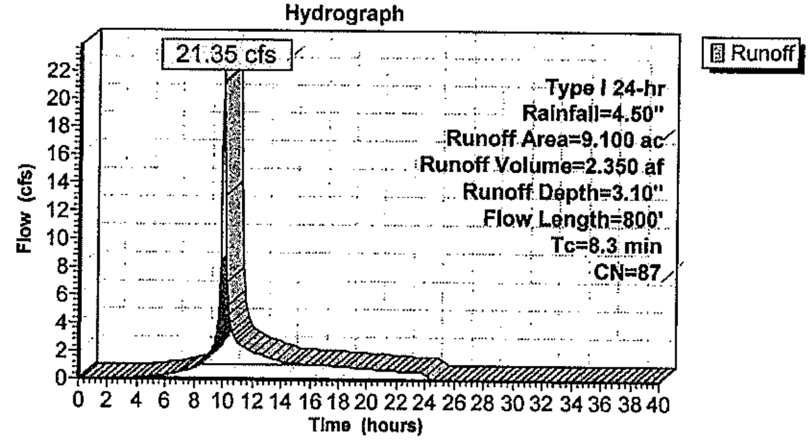
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

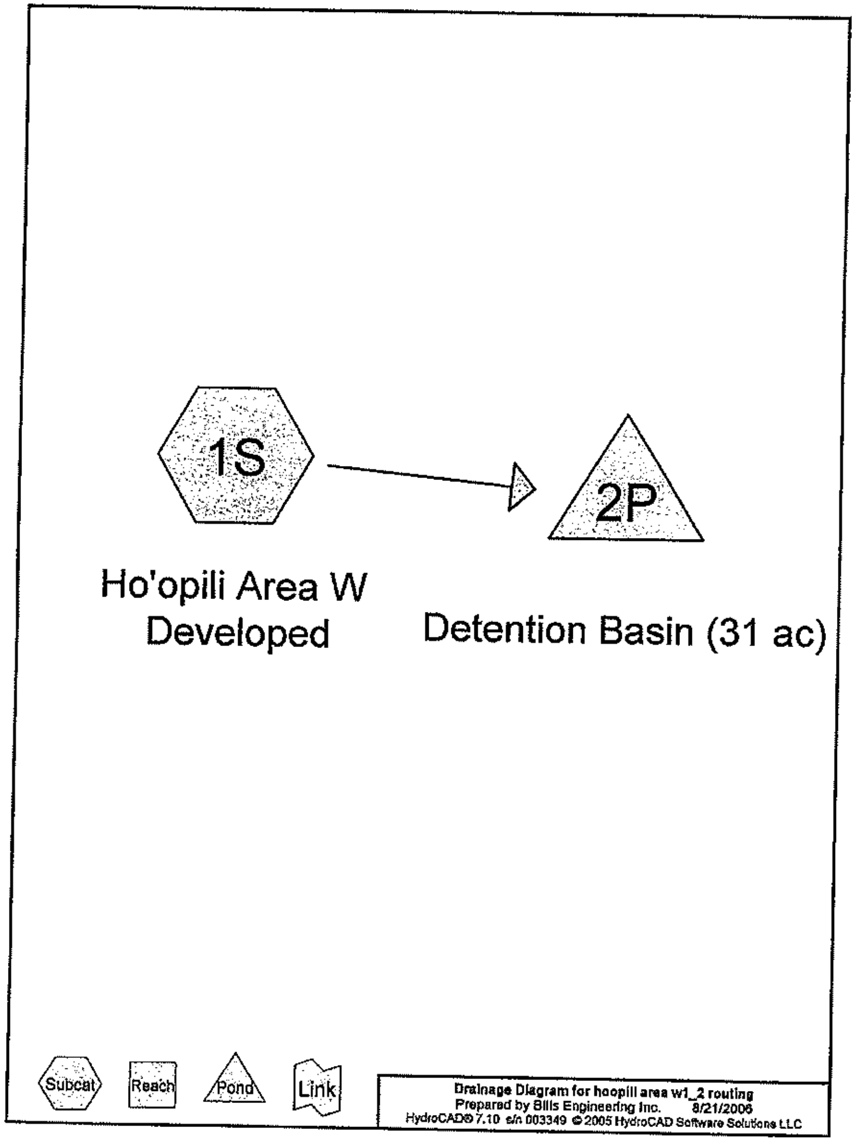
Area (ac)	CN	Description
9.100	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
1.4	600	0.0100	7.2	22.62	Circular Channel (pipe), Piped within rd Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
8.3	800	Total			

Subcatchment 1S: Ho'opili Area W2 Dev

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area W Developed Runoff Area=818.600 ac Runoff Depth=2.18"
Flow Length=12,000' Tc=31.4 min CN=87 Runoff=796.88 cfs 148.878 af

Pond 2P: Detention Basin (31 ac) Peak Elev=8.35' Storage=57.243 af Inflow=796.88 cfs 148.878 af
48.0" x 20.0' Culvert Outflow=195.01 cfs 113.468 af

Total Runoff Area = 818.600 ac Runoff Volume = 148.878 af Average Runoff Depth = 2.18"

Subcatchment 1S: Ho'opili Area W Developed

West Loch drainage basins W1 and W2

Runoff = 796.88 cfs @ 10.27 hrs, Volume= 148.878 af, Depth= 2.18"

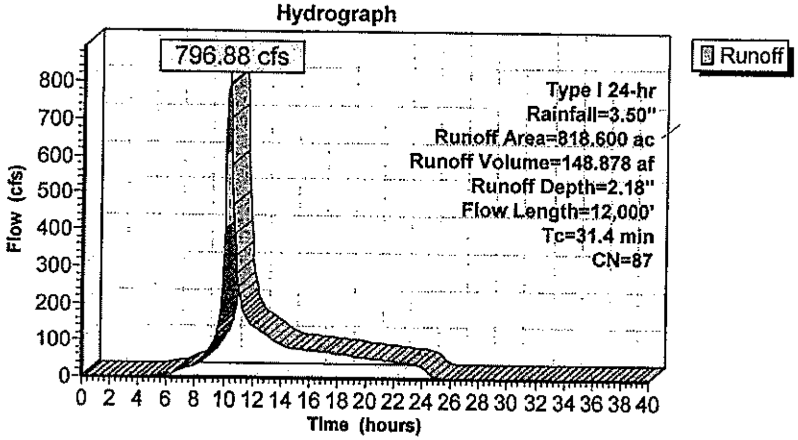
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=3.50"

Area (ac)	CN	Description
818.600	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
19.9	9,800	0.0130	8.2	25.79	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
4.6	2,000	0.0100	7.2	22.62	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
31.4	12,000	Total			

Subcatchment 1S: Ho'opili Area W Developed

Hydrograph



Pond 2P: Detention Basin (31 ac)

Inflow Area = 818.600 ac, Inflow Depth = 2.18"
Inflow = 796.88 cfs @ 10.27 hrs, Volume= 148.878 af
Outflow = 195.01 cfs @ 11.26 hrs, Volume= 113.468 af, Atten= 76%, Lag= 59.6 min
Primary = 195.01 cfs @ 11.26 hrs, Volume= 113.468 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 8.35' @ 11.26 hrs Surf.Area= 7.297 ac Storage= 57.243 af
Plug-Flow detention time=307.1 min calculated for 113.185 af (76% of inflow)
Center-of-Mass det. time= 187.2 min (994.4 - 807.2)

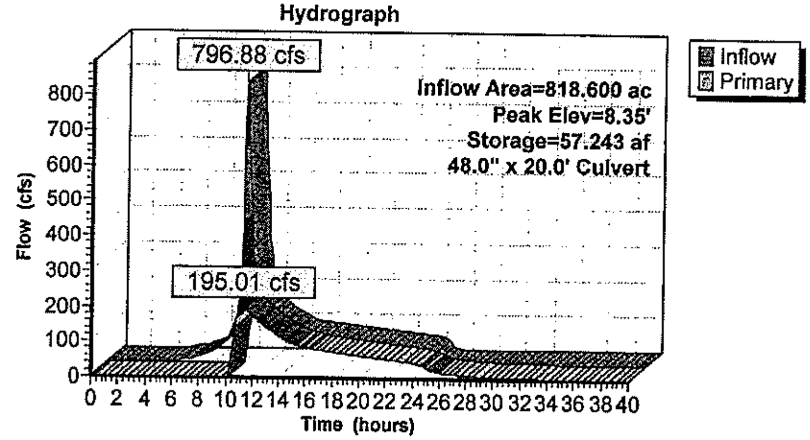
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	84.619 af	700.00'W x 400.00'L x 12.00'H Prismatoid Z=2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	5.10'	48.0" x 20.0' long Culvert X 4.00 RCP, square edge headwall, Ke= 0.500 Outlet Invert= 5.00' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=194.83 cfs @ 11.26 hrs HW=8.35' (Free Discharge)
1=Culvert (Barrel Controls 194.83 cfs @ 6.1 fps)

Pond 2P: Detention Basin (31 ac)

Hydrograph



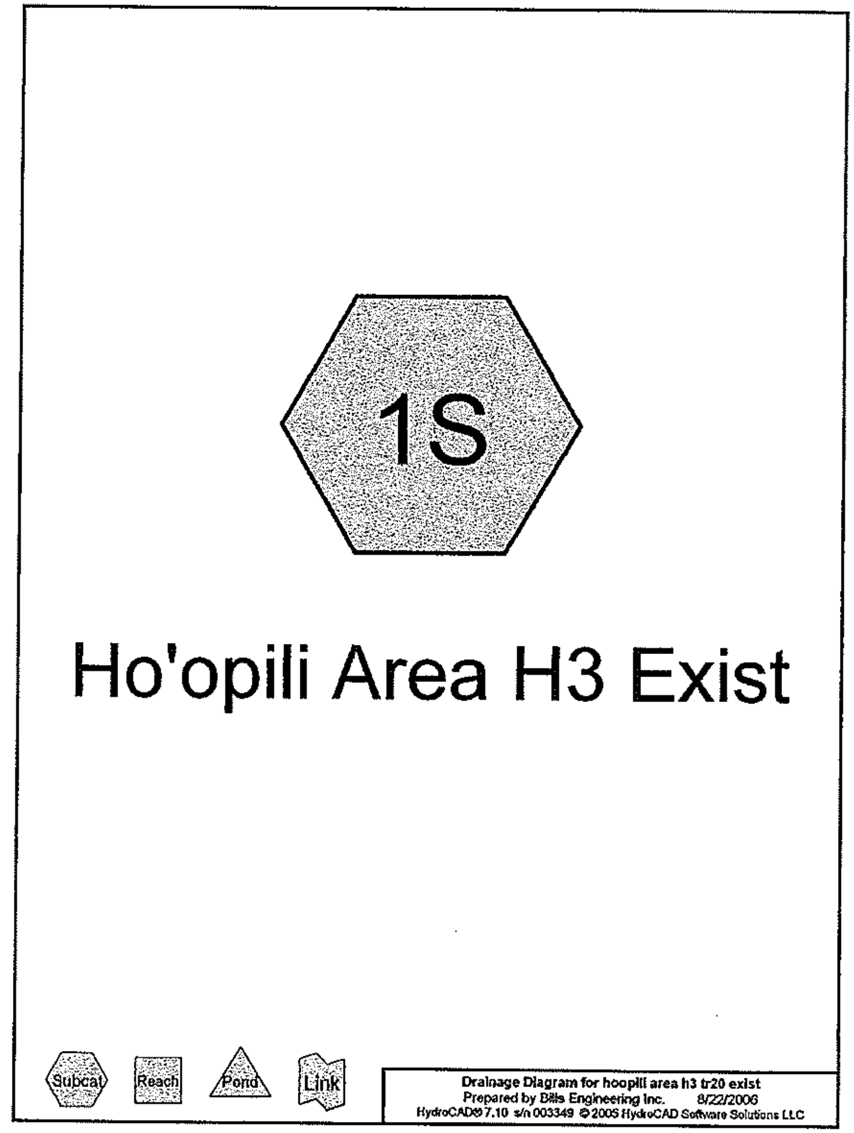
Stage-Discharge for Pond 2P: Detention Basin (31 ac)

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	3.18	0.00	6.36	35.81	9.54	314.43
0.06	0.00	3.24	0.00	6.42	39.06	9.60	320.11
0.12	0.00	3.30	0.00	6.48	42.43	9.66	325.70
0.18	0.00	3.36	0.00	6.54	45.92	9.72	331.21
0.24	0.00	3.42	0.00	6.60	49.52	9.78	336.61
0.30	0.00	3.48	0.00	6.66	53.24	9.84	341.89
0.36	0.00	3.54	0.00	6.72	57.08	9.90	347.04
0.42	0.00	3.60	0.00	6.78	61.02	9.96	352.04
0.48	0.00	3.66	0.00	6.84	65.08	10.02	356.88
0.54	0.00	3.72	0.00	6.90	69.23	10.08	361.53
0.60	0.00	3.78	0.00	6.96	73.50	10.14	365.96
0.66	0.00	3.84	0.00	7.02	77.86	10.20	370.14
0.72	0.00	3.90	0.00	7.08	82.33	10.26	374.01
0.78	0.00	3.96	0.00	7.14	86.89	10.32	377.51
0.84	0.00	4.02	0.00	7.20	91.54	10.38	380.46
0.90	0.00	4.08	0.00	7.26	96.29	10.44	382.81
0.96	0.00	4.14	0.00	7.32	101.12	10.50	390.70
1.02	0.00	4.20	0.00	7.38	106.04	10.56	398.44
1.08	0.00	4.26	0.00	7.44	111.05	10.62	406.03
1.14	0.00	4.32	0.00	7.50	116.13	10.68	413.48
1.20	0.00	4.38	0.00	7.56	121.30	10.74	420.80
1.26	0.00	4.44	0.00	7.62	126.54	10.80	427.99
1.32	0.00	4.50	0.00	7.68	131.86	10.86	435.06
1.38	0.00	4.56	0.00	7.74	137.24	10.92	442.03
1.44	0.00	4.62	0.00	7.80	142.70	10.98	448.88
1.50	0.00	4.68	0.00	7.86	148.21	11.04	455.63
1.56	0.00	4.74	0.00	7.92	153.79	11.10	462.28
1.62	0.00	4.80	0.00	7.98	159.43	11.16	468.84
1.68	0.00	4.86	0.00	8.04	165.13	11.22	475.31
1.74	0.00	4.92	0.00	8.10	170.87	11.28	481.69
1.80	0.00	4.98	0.00	8.16	176.67	11.34	487.98
1.86	0.00	5.04	0.00	8.22	182.51	11.40	494.20
1.92	0.00	5.10	0.00	8.28	188.39	11.46	500.34
1.98	0.00	5.16	0.08	8.34	194.31	11.52	506.40
2.04	0.00	5.22	0.34	8.40	200.27	11.58	512.27
2.10	0.00	5.28	0.80	8.46	206.26	11.64	515.69
2.16	0.00	5.34	1.44	8.52	212.28	11.70	519.09
2.22	0.00	5.40	2.25	8.58	218.32	11.76	522.46
2.28	0.00	5.46	3.23	8.64	224.38	11.82	525.82
2.34	0.00	5.52	4.38	8.70	230.45	11.88	529.15
2.40	0.00	5.58	5.68	8.76	236.54	11.94	532.46
2.46	0.00	5.64	7.14	8.82	242.64	12.00	**535.75**
2.52	0.00	5.70	8.76	8.88	248.73		
2.58	0.00	5.76	10.52	8.94	254.83		
2.64	0.00	5.82	12.43	9.00	260.91		
2.70	0.00	5.88	14.48	9.06	266.99		
2.76	0.00	5.94	16.67	9.12	273.05		
2.82	0.00	6.00	19.01	9.18	279.08		
2.88	0.00	6.06	21.48	9.24	285.08		
2.94	0.00	6.12	24.08	9.30	291.05		
3.00	0.00	6.18	26.82	9.36	296.98		
3.06	0.00	6.24	29.69	9.42	302.85		
3.12	0.00	6.30	32.69	9.48	308.67		

Stage-Area-Storage for Pond 2P: Detention Basin (31 ac)

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	3.18	20.955	6.36	42.956	9.54	66.025
0.06	0.386	3.24	21.361	6.42	43.381	9.60	66.471
0.12	0.772	3.30	21.767	6.48	43.807	9.66	66.917
0.18	1.159	3.36	22.173	6.54	44.233	9.72	67.363
0.24	1.546	3.42	22.579	6.60	44.659	9.78	67.810
0.30	1.933	3.48	22.986	6.66	45.086	9.84	68.258
0.36	2.321	3.54	23.393	6.72	45.513	9.90	68.705
0.42	2.709	3.60	23.801	6.78	45.941	9.96	69.153
0.48	3.097	3.66	24.209	6.84	46.369	10.02	69.602
0.54	3.486	3.72	24.617	6.90	46.797	10.08	70.050
0.60	3.875	3.78	25.026	6.96	47.226	10.14	70.500
0.66	4.264	3.84	25.435	7.02	47.655	10.20	70.949
0.72	4.654	3.90	25.844	7.08	48.085	10.26	71.399
0.78	5.045	3.96	26.254	7.14	48.515	10.32	71.850
0.84	5.435	4.02	26.664	7.20	48.945	10.38	72.300
0.90	5.826	4.08	27.075	7.26	49.376	10.44	72.751
0.96	6.217	4.14	27.486	7.32	49.807	10.50	73.203
1.02	6.609	4.20	27.897	7.38	50.238	10.56	73.655
1.08	7.001	4.26	28.309	7.44	50.670	10.62	74.107
1.14	7.394	4.32	28.721	7.50	51.102	10.68	74.560
1.20	7.786	4.38	29.133	7.56	51.534	10.74	75.013
1.26	8.180	4.44	29.546	7.62	51.967	10.80	75.467
1.32	8.573	4.50	29.960	7.68	52.401	10.86	75.921
1.38	8.967	4.56	30.373	7.74	52.834	10.92	76.375
1.44	9.361	4.62	30.787	7.80	53.269	10.98	76.829
1.50	9.756	4.68	31.201	7.86	53.703	11.04	77.285
1.56	10.151	4.74	31.616	7.92	54.138	11.10	77.740
1.62	10.546	4.80	32.031	7.98	54.573	11.16	78.196
1.68	10.942	4.86	32.447	8.04	55.009	11.22	78.652
1.74	11.338	4.92	32.862	8.10	55.445	11.28	79.109
1.80	11.735	4.98	33.279	8.16	55.881	11.34	79.566
1.86	12.131	5.04	33.695	8.22	56.318	11.40	80.023
1.92	12.529	5.10	34.112	8.28	56.755	11.46	80.481
1.98	12.926	5.16	34.530	8.34	57.193	11.52	80.939
2.04	13.324	5.22	34.947	8.40	57.631	11.58	81.398
2.10	13.722	5.28	35.365	8.46	58.069	11.64	81.857
2.16	14.121	5.34	35.784	8.52	58.508	11.70	82.316
2.22	14.520	5.40	36.203	8.58	58.947	11.76	82.776
2.28	14.920	5.46	36.622	8.64	59.386	11.82	83.236
2.34	15.319	5.52	37.042	8.70	59.826	11.88	83.697
2.40	15.720	5.58	37.462	8.76	60.266	11.94	84.158
2.46	16.120	5.64	37.882	8.82	60.707	12.00	**84.619**
2.52	16.521	5.70	38.303	8.88	61.148		
2.58	16.922	5.76	38.724	8.94	61.590		
2.64	17.324	5.82	39.145	9.00	62.031		
2.70	17.726	5.88	39.567	9.06	62.474		
2.76	18.128	5.94	39.989	9.12	62.916		
2.82	18.531	6.00	40.412	9.18	63.359		
2.88	18.934	6.06	40.835	9.24	63.803		
2.94	19.338	6.12	41.259	9.30	64.246		
3.00	19.742	6.18	41.682	9.36	64.690		
3.06	20.146	6.24	42.106	9.42	65.135		
3.12	20.550	6.30	42.531	9.48	65.580		

Q = 1.486 AR^2/3 S^1/2 N^(-1)				Cane Haul Rd Channel	
SECTION	Rectangular	Input width		30	
DESIRED Q	2600				
ASSUMED D	5.1		R =		3.81
INPUT S	0.005		Q =		2614.49
INPUT N	0.015				
A	153	TOTAL REQ'D DEPTH			7.84
P	40.2				
V	17.08818				
FB*	2.73535				



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H3 Exist Runoff Area=94.800 ac Runoff Depth=2.46"
Flow Length=3,200' Tc=44.4 min CN=80 Runoff=83.81 cfs 19.446 af

Total Runoff Area = 94.800 ac Runoff Volume = 19.446 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area H3 Exist

Subcatchment area 3 west of Honouliuli Stream

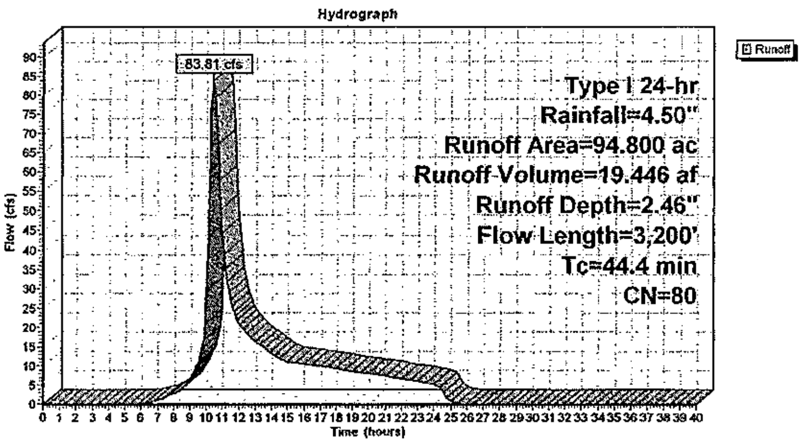
Runoff = 83.81 cfs @ 10.44 hrs, Volume= 19.446 af, Depth= 2.46"

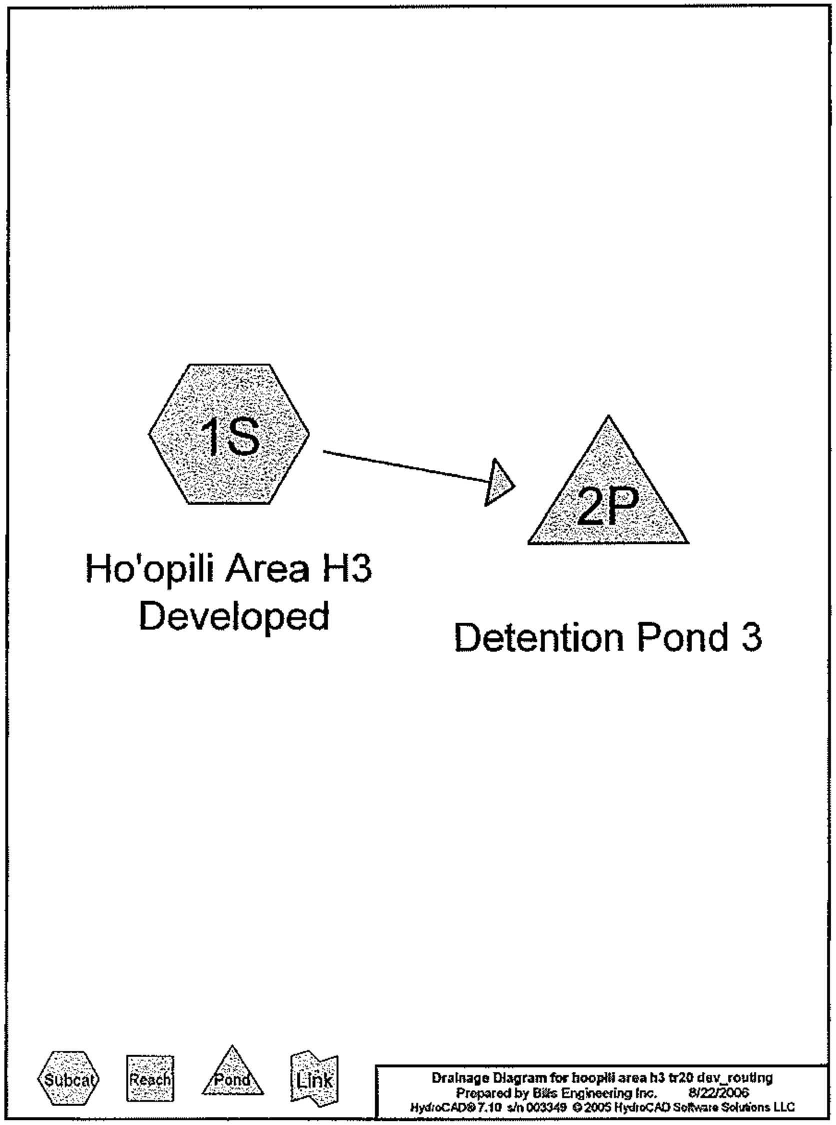
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
94.800	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.4	3,200	0.0330	1.2		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area H3 Exist





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H3 Developed Runoff Area=94.800 ac Runoff Depth=3.10"
Flow Length=2,000' Tc=9.3 min CN=87 Runoff=217.59 cfs 24.482 af

Pond 2P: Detention Pond 3 Peak Elev=90.32' Storage=8.108 af Inflow=217.59 cfs 24.482 af
30.0" x 100.0' Culvert Outflow=68.33 cfs 20.187 af

Total Runoff Area = 94.800 ac Runoff Volume = 24.482 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H3 Developed

Subcatchment area 3 Honouliuli Stream

[49] Hint: Tc<2dt may require smaller dt

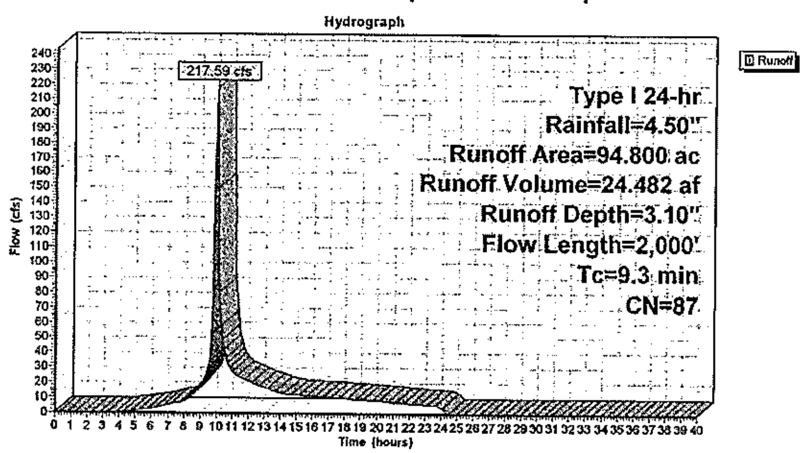
Runoff = 217.59 cfs @ 10.00 hrs, Volume= 24.482 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
94.800	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		**Lag/CN Method, OVERLAND**
2.4	1,800	0.0300	12.5	39.18	**Circular Channel (pipe), PIPED DRAIN SYSTEM** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, bends & connections
9.3	2,000	Total			

Subcatchment 1S: Ho'opili Area H3 Developed



Pond 2P: Detention Pond 3

Inflow Area =	94.800 ac, Inflow Depth = 3.10"		
Inflow =	217.59 cfs @	10.00 hrs, Volume=	24.482 af
Outflow =	68.33 cfs @	10.26 hrs, Volume=	20.187 af, Atten= 69%, Lag= 15.6 min
Primary =	68.33 cfs @	10.26 hrs, Volume=	20.187 af

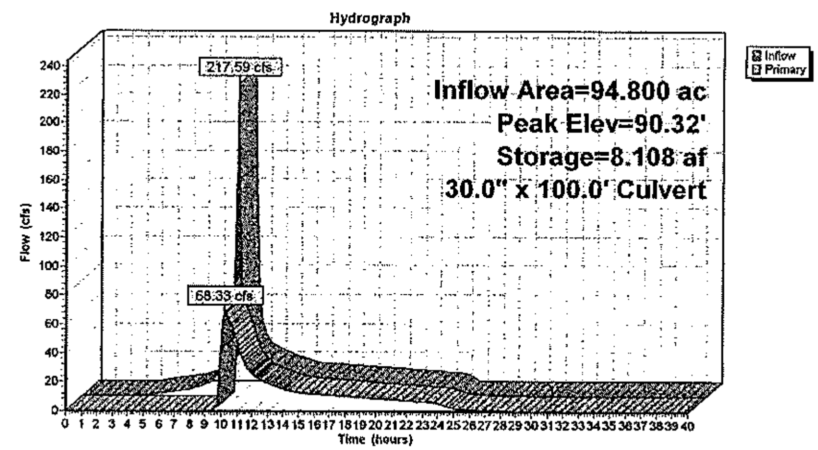
Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 90.32' @ 10.26 hrs Surf.Area= 1.118 ac Storage= 8.108 af
Plug-Flow detention time= 204.9 min calculated for 20.137 af (82% of inflow)
Center-of-Mass det. time= 110.7 min (882.5 - 771.8)

Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	8.877 af	**140.00'W x 100.00'L x 10.00'H Prismatoid Z=2.0** x 2

Device	Routing	Invert	Outlet Devices
#1	Primary	86.50'	**30.0" x 100.0' long Culvert X 2.00** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 86.00' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=68.08 cfs @ 10.26 hrs HW=90.31' (Free Discharge)
└─**1=Culvert** (Barrel Controls 68.08 cfs @ 6.9 fps)

Pond 2P: Detention Pond 3

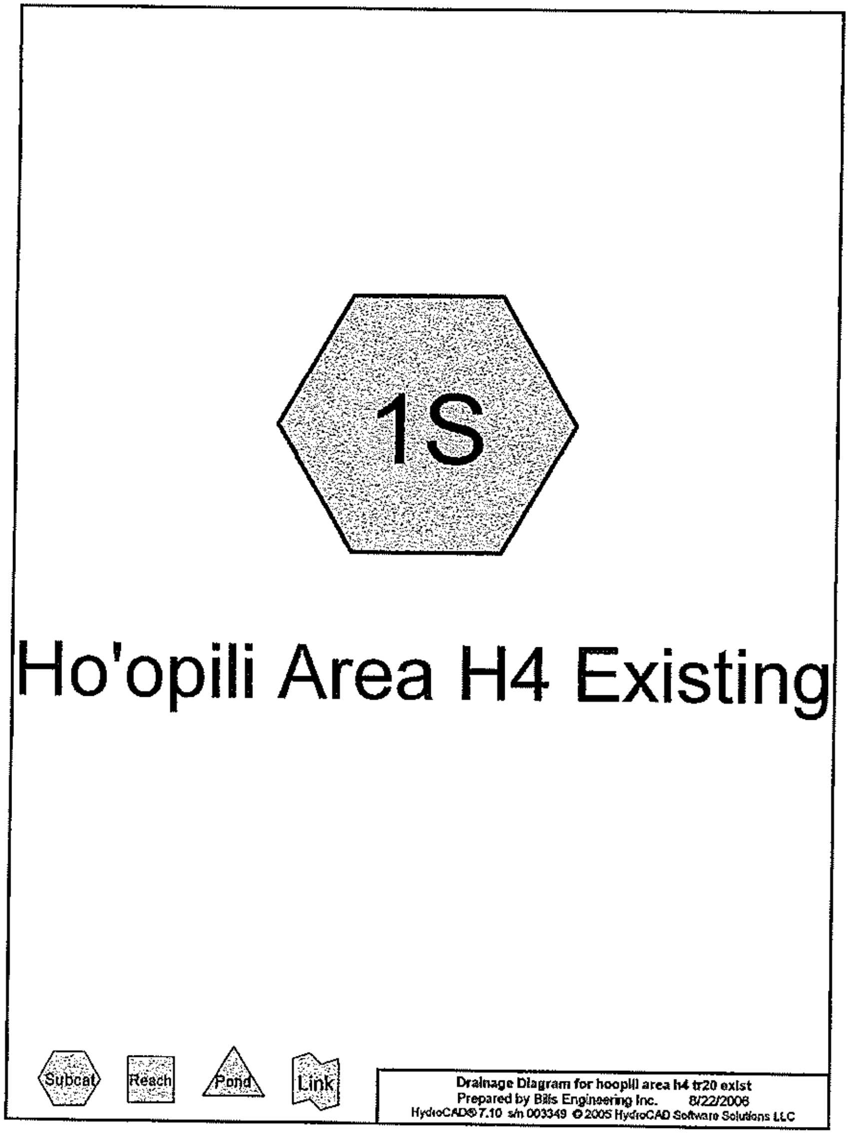


Stage-Discharge for Pond 2P: Detention Pond 3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
81.00	0.00	86.40	0.00
81.10	0.00	86.50	0.00
81.20	0.00	86.60	0.09
81.30	0.00	86.70	0.40
81.40	0.00	86.80	0.94
81.50	0.00	86.90	1.68
81.60	0.00	87.00	2.63
81.70	0.00	87.10	3.76
81.80	0.00	87.20	5.06
81.90	0.00	87.30	6.53
82.00	0.00	87.40	8.13
82.10	0.00	87.50	9.88
82.20	0.00	87.60	11.75
82.30	0.00	87.70	13.74
82.40	0.00	87.80	15.82
82.50	0.00	87.90	18.01
82.60	0.00	88.00	20.28
82.70	0.00	88.10	22.62
82.80	0.00	88.20	25.02
82.90	0.00	88.30	27.48
83.00	0.00	88.40	29.98
83.10	0.00	88.50	32.51
83.20	0.00	88.60	35.06
83.30	0.00	88.70	37.60
83.40	0.00	88.80	40.14
83.50	0.00	88.90	42.65
83.60	0.00	89.00	45.11
83.70	0.00	89.10	47.51
83.80	0.00	89.20	49.82
83.90	0.00	89.30	52.01
84.00	0.00	89.40	54.05
84.10	0.00	89.50	55.89
84.20	0.00	89.60	57.45
84.30	0.00	89.70	58.63
84.40	0.00	89.80	59.06
84.50	0.00	89.90	59.85
84.60	0.00	90.00	61.95
84.70	0.00	90.10	63.99
84.80	0.00	90.20	65.96
84.90	0.00	90.30	67.87
85.00	0.00	90.40	69.73
85.10	0.00	90.50	71.54
85.20	0.00	90.60	73.31
85.30	0.00	90.70	75.03
85.40	0.00	90.80	76.72
85.50	0.00	90.90	78.37
85.60	0.00	91.00	79.98
85.70	0.00		
85.80	0.00		
85.90	0.00		
86.00	0.00		
86.10	0.00		
86.20	0.00		
86.30	0.00		

Stage-Area-Storage for Pond 2P: Detention Pond 3

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
81.00	0.000	86.40	4.152
81.10	0.064	86.50	4.243
81.20	0.129	86.60	4.334
81.30	0.195	86.70	4.425
81.40	0.261	86.80	4.517
81.50	0.327	86.90	4.610
81.60	0.394	87.00	4.703
81.70	0.461	87.10	4.797
81.80	0.528	87.20	4.891
81.90	0.597	87.30	4.986
82.00	0.665	87.40	5.081
82.10	0.734	87.50	5.177
82.20	0.804	87.60	5.273
82.30	0.873	87.70	5.370
82.40	0.944	87.80	5.467
82.50	1.015	87.90	5.565
82.60	1.086	88.00	5.663
82.70	1.158	88.10	5.762
82.80	1.230	88.20	5.862
82.90	1.303	88.30	5.962
83.00	1.376	88.40	6.063
83.10	1.449	88.50	6.164
83.20	1.523	88.60	6.266
83.30	1.598	88.70	6.368
83.40	1.673	88.80	6.471
83.50	1.749	88.90	6.574
83.60	1.825	89.00	6.678
83.70	1.901	89.10	6.783
83.80	1.978	89.20	6.888
83.90	2.055	89.30	6.993
84.00	2.133	89.40	7.100
84.10	2.212	89.50	7.206
84.20	2.291	89.60	7.314
84.30	2.370	89.70	7.422
84.40	2.450	89.80	7.530
84.50	2.530	89.90	7.639
84.60	2.611	90.00	7.749
84.70	2.692	90.10	7.859
84.80	2.774	90.20	7.970
84.90	2.857	90.30	8.081
85.00	2.939	90.40	8.193
85.10	3.023	90.50	8.305
85.20	3.107	90.60	8.419
85.30	3.191	90.70	8.532
85.40	3.276	90.80	8.646
85.50	3.361	90.90	8.761
85.60	3.447	91.00	8.877
85.70	3.533		
85.80	3.620		
85.90	3.708		
86.00	3.796		
86.10	3.884		
86.20	3.973		
86.30	4.062		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H4 Existing Runoff Area=78.100 ac Runoff Depth=2.46"
Flow Length=2,100' Tc=27.1 min CN=80 Runoff=91.12 cfs 16.021 af

Total Runoff Area = 78.100 ac Runoff Volume = 16.021 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area H4 Existing

Subcatchment area 4 Honouliuli Stream

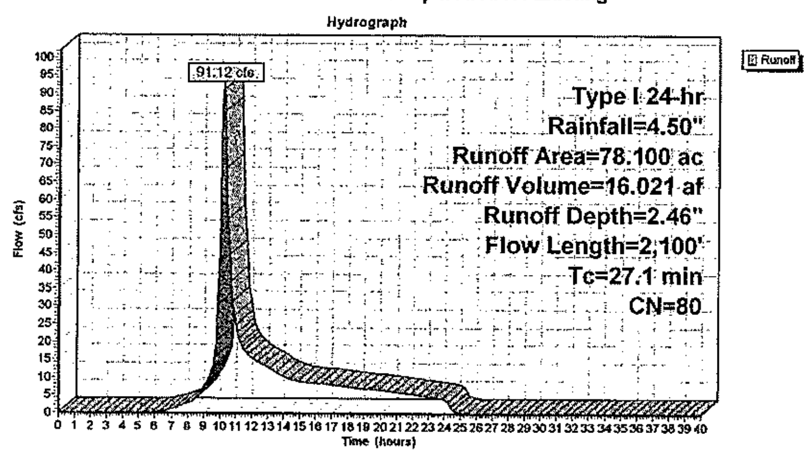
Runoff = 91.12 cfs @ 10.22 hrs, Volume= 16.021 af, Depth= 2.46"

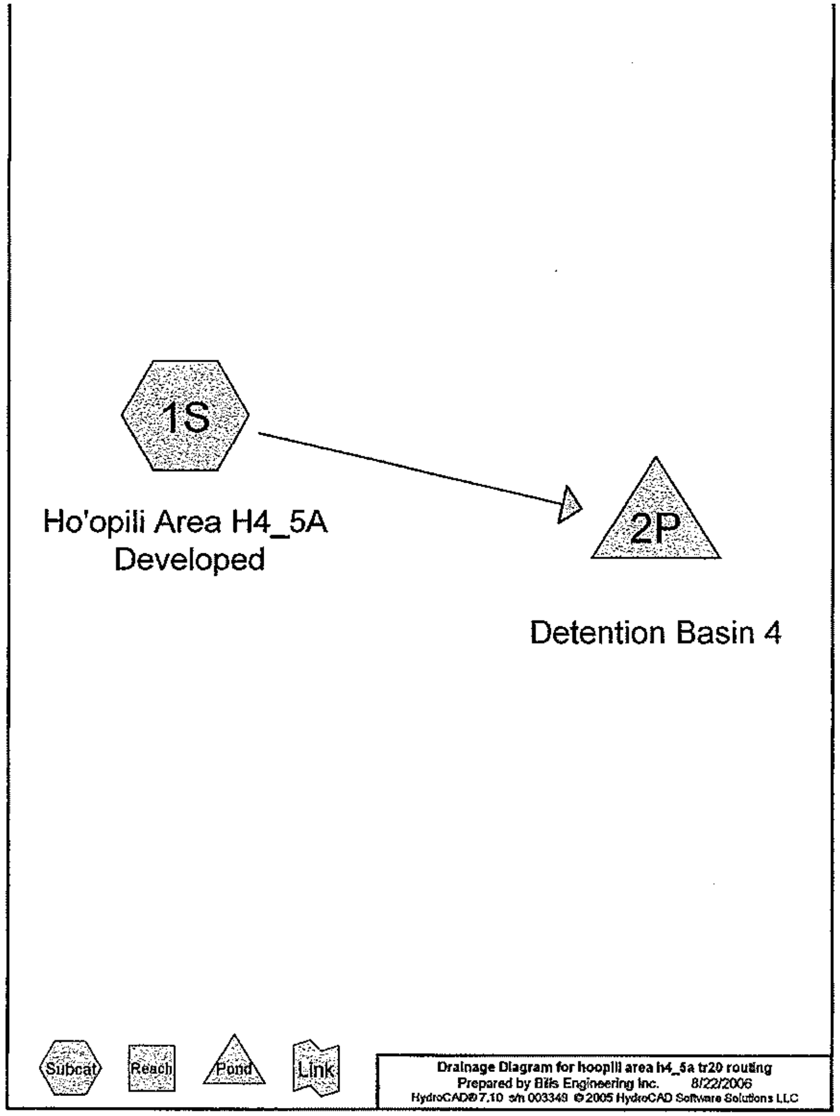
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
78.100	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.1	2,100	0.0450	1.3		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area H4 Existing





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H4_5A Developed Runoff Area=183.100 ac Runoff Depth=3.10"
Flow Length=3,800' Tc=15.2 min CN=87 Runoff=357.19 cfs 47.285 af

Pond 2P: Detention Basin 4 Peak Elev=87.75' Storage=17.715 af Inflow=357.19 cfs 47.285 af
30.0" x 100.0' Culvert Outflow=74.10 cfs 39.155 af

Total Runoff Area = 183.100 ac Runoff Volume = 47.285 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H4_5A Developed

Subcatchment area 4 Honouliuli Stream, including area 5A (105 acs).

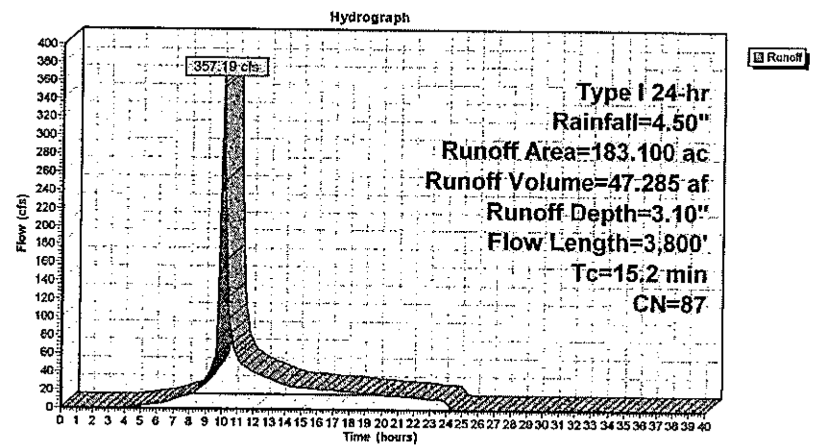
Runoff = 357.19 cfs @ 10.07 hrs, Volume= 47.285 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
183.100	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
8.3	3,600	0.0100	7.2	22.62	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
15.2	3,800	Total			

Subcatchment 1S: Ho'opili Area H4_5A Developed



Pond 2P: Detention Basin 4

Inflow Area = 183.100 ac, Inflow Depth = 3.10"
Inflow = 357.19 cfs @ 10.07 hrs, Volume= 47.285 af
Outflow = 74.10 cfs @ 10.69 hrs, Volume= 39.155 af, Atten= 79%, Lag= 36.8 min
Primary = 74.10 cfs @ 10.69 hrs, Volume= 39.155 af

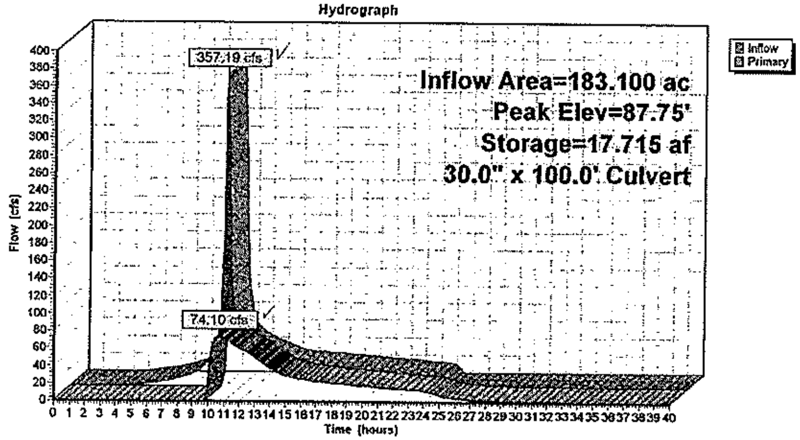
Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 87.75' @ 10.69 hrs Surf.Area= 2.515 ac Storage= 17.715 af
Plug-Flow detention time= 255.5 min calculated for 39.155 af (83% of inflow)
Center-of-Mass det. time= 160.6 min (937.9 - 777.3)

Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	23.538 af	**300.00'W x 300.00'L x 10.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	83.60'	**30.0" x 100.0' long Culvert X 2.00** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 83.10' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=74.08 cfs @ 10.69 hrs HW=87.74' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 74.08 cfs @ 7.5 fps)

Pond 2P: Detention Basin 4

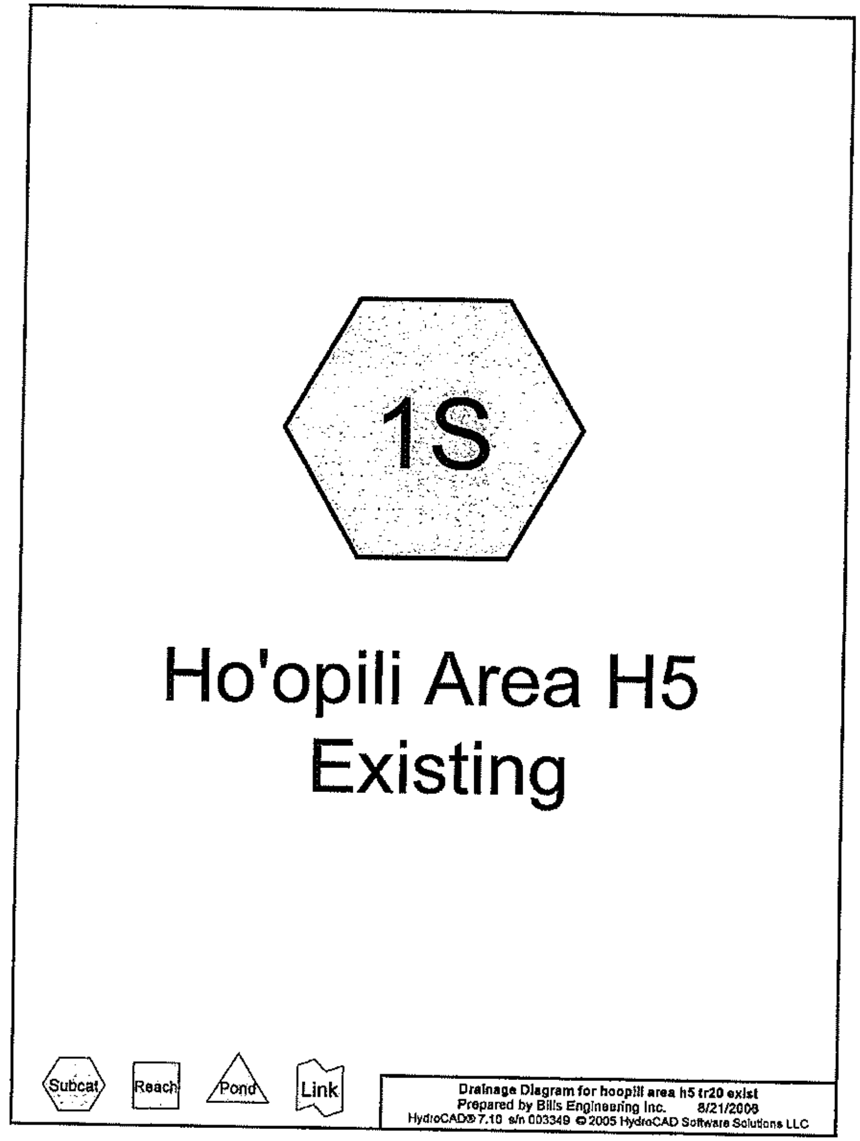


Stage-Discharge for Pond 2P: Detention Basin 4

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
80.00	0.00	85.40	27.48
80.10	0.00	85.50	29.98
80.20	0.00	85.60	32.51
80.30	0.00	85.70	35.06
80.40	0.00	85.80	37.60
80.50	0.00	85.90	40.14
80.60	0.00	86.00	42.65
80.70	0.00	86.10	45.11
80.80	0.00	86.20	47.51
80.90	0.00	86.30	49.82
81.00	0.00	86.40	52.01
81.10	0.00	86.50	54.05
81.20	0.00	86.60	55.89
81.30	0.00	86.70	57.45
81.40	0.00	86.80	58.63
81.50	0.00	86.90	59.06
81.60	0.00	87.00	59.85
81.70	0.00	87.10	61.95
81.80	0.00	87.20	63.99
81.90	0.00	87.30	65.96
82.00	0.00	87.40	67.87
82.10	0.00	87.50	69.73
82.20	0.00	87.60	71.54
82.30	0.00	87.70	73.31
82.40	0.00	87.80	75.03
82.50	0.00	87.90	76.72
82.60	0.00	88.00	78.37
82.70	0.00	88.10	79.98
82.80	0.00	88.20	81.57
82.90	0.00	88.30	83.12
83.00	0.00	88.40	84.65
83.10	0.00	88.50	86.14
83.20	0.00	88.60	87.62
83.30	0.00	88.70	89.07
83.40	0.00	88.80	90.49
83.50	0.00	88.90	91.89
83.60	0.00	89.00	93.28
83.70	0.09	89.10	94.64
83.80	0.40	89.20	95.98
83.90	0.94	89.30	97.30
84.00	1.68	89.40	98.61
84.10	2.63	89.50	99.90
84.20	3.76	89.60	101.17
84.30	5.06	89.70	102.43
84.40	6.53	89.80	103.67
84.50	8.13	89.90	104.90
84.60	9.88	90.00	106.11
84.70	11.75		
84.80	13.74		
84.90	15.82		
85.00	18.01		
85.10	20.28		
85.20	22.62		
85.30	25.02		

Stage-Area-Storage for Pond 2P: Detention Basin 4

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
80.00	0.000	85.40	11.980
80.10	0.207	85.50	12.217
80.20	0.414	85.60	12.456
80.30	0.622	85.70	12.695
80.40	0.831	85.80	12.934
80.50	1.040	85.90	13.174
80.60	1.250	86.00	13.415
80.70	1.460	86.10	13.656
80.80	1.671	86.20	13.898
80.90	1.882	86.30	14.141
81.00	2.094	86.40	14.384
81.10	2.306	86.50	14.627
81.20	2.519	86.60	14.872
81.30	2.733	86.70	15.116
81.40	2.947	86.80	15.362
81.50	3.162	86.90	15.608
81.60	3.377	87.00	15.855
81.70	3.593	87.10	16.102
81.80	3.809	87.20	16.350
81.90	4.026	87.30	16.598
82.00	4.243	87.40	16.847
82.10	4.461	87.50	17.097
82.20	4.680	87.60	17.347
82.30	4.899	87.70	17.598
82.40	5.119	87.80	17.850 ✓
82.50	5.339	87.90	18.102
82.60	5.560	88.00	18.355
82.70	5.782	88.10	18.608
82.80	6.004	88.20	18.862
82.90	6.226	88.30	19.117
83.00	6.450	88.40	19.372
83.10	6.673	88.50	19.628
83.20	6.898	88.60	19.884
83.30	7.123	88.70	20.141
83.40	7.348	88.80	20.399
83.50	7.574	88.90	20.657
83.60 ✓	7.801 ✓	89.00	20.916
83.70	8.028	89.10	21.175
83.80	8.256	89.20	21.435
83.90	8.484	89.30	21.696
84.00	8.713	89.40	21.957
84.10	8.943	89.50	22.219
84.20	9.173	89.60	22.482
84.30	9.403	89.70	22.745
84.40	9.635	89.80	23.009
84.50	9.867	89.90	23.273
84.60	10.099	90.00	23.538
84.70	10.332		
84.80	10.566		
84.90	10.800		
85.00	11.035		
85.10	11.270		
85.20	11.506		
85.30	11.742		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H5 Existing Runoff Area=137.800 ac Runoff Depth=2.46"
Flow Length=3,800' Tc=49.4 min CN=80 Runoff=114.40 cfs 28.267 af

Total Runoff Area = 137.800 ac Runoff Volume = 28.267 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area H5 Existing

Subcatchment area 5 Honouliuli Stream

Runoff = 114.40 cfs @ 10.51 hrs, Volume= 28.267 af, Depth= 2.46"

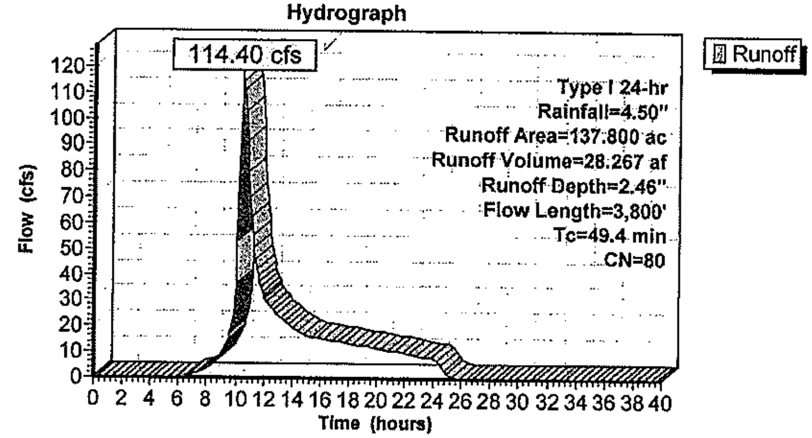
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

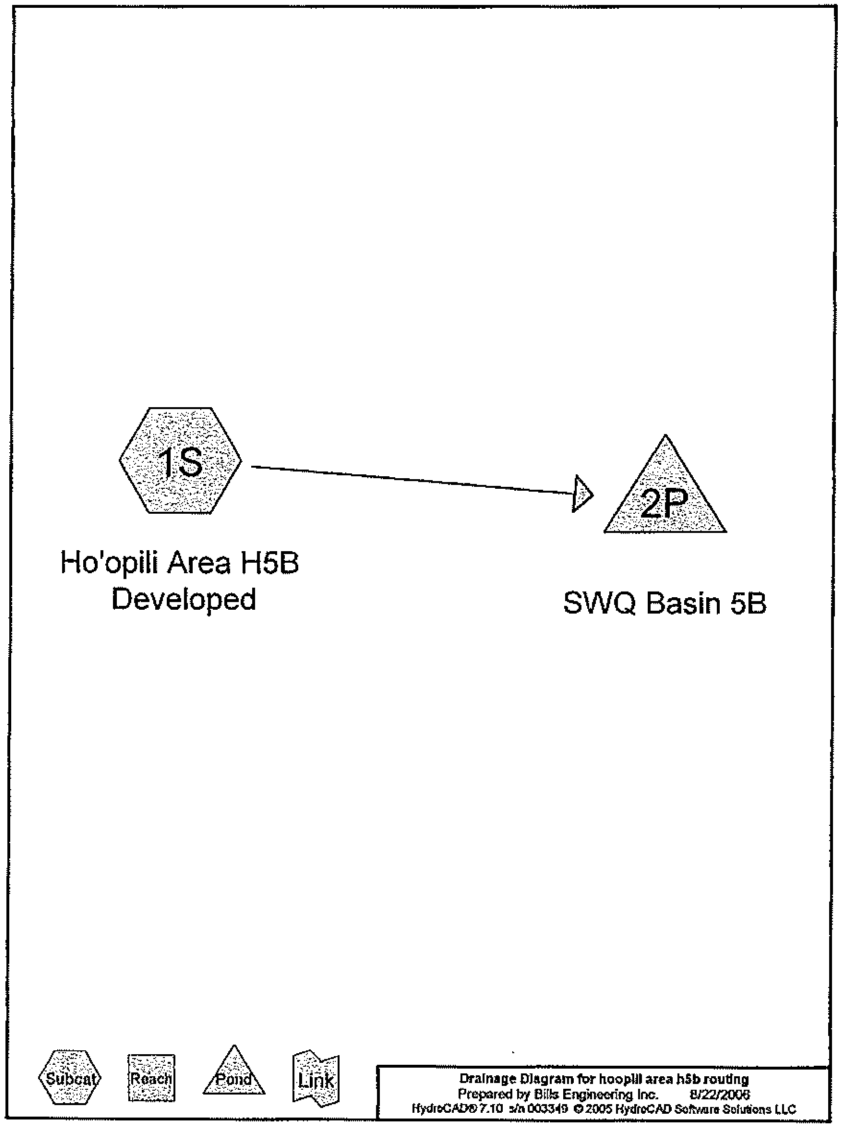
Area (ac)	CN	Description
137.800	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
49.4	3,800	0.0350	1.3		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area H5 Existing

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H5B Developed Runoff Area=32.800 ac Runoff Depth=3.10"
Flow Length=1,200' Tc=9.2 min CN=87 Runoff=75.48 cfs 8.470 af

Pond 2P: SWQ Basin 5B Peak Elev=7.93' Storage=2.458 af Inflow=75.48 cfs 8.470 af
24.0" x 100.0' Culvert Outflow=36.33 cfs 7.075 af

Total Runoff Area = 32.800 ac Runoff Volume = 8.470 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H5B Developed

Subcatchment area 5B Honouliuli Stream

[49] Hint: Tc<2dt may require smaller dt

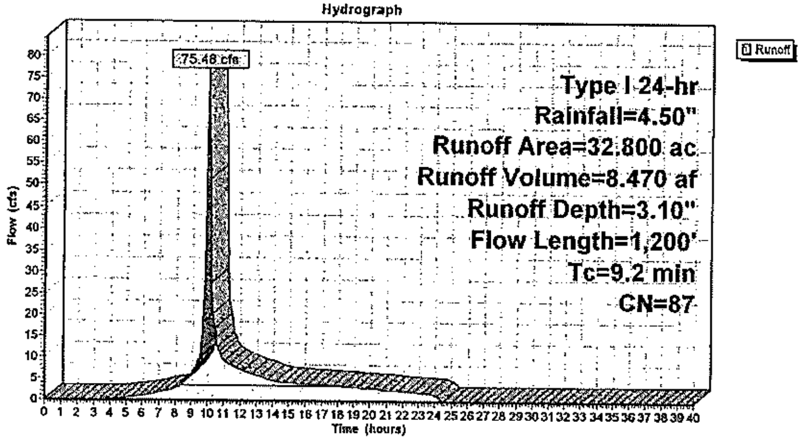
Runoff = 75.48 cfs @ 10.00 hrs, Volume= 8.470 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
32.800	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
2.3	1,000	0.0100	7.2	22.62	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
9.2	1,200	Total			

Subcatchment 1S: Ho'opili Area H5B Developed



Pond 2P: SWQ Basin 5B

Inflow Area = 32.800 ac, Inflow Depth = 3.10"
Inflow = 75.48 cfs @ 10.00 hrs, Volume= 8.470 af
Outflow = 36.33 cfs @ 10.18 hrs, Volume= 7.075 af, Atten= 52%, Lag= 10.7 min
Primary = 36.33 cfs @ 10.18 hrs, Volume= 7.075 af

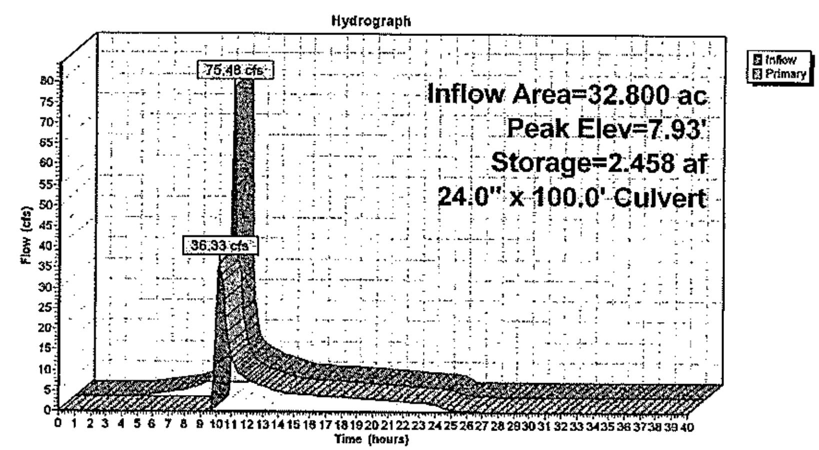
Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 7.93' @ 10.18 hrs Surf.Area= 0.398 ac Storage= 2.458 af
Plug-Flow detention time= 179.0 min calculated for 7.075 af (84% of Inflow)
Center-of-Mass det. time= 87.2 min (858.9 - 771.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3.336 af	100.00'W x 100.00'L x 10.00'H Prismatoid Z=2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	24.0" x 100.0' long Culvert X 2.00 RCP, square edge headwall, Ke= 0.500 Outlet Invert= 4.50' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=35.98 cfs @ 10.18 hrs HW=7.90' (Free Discharge)
↑—1=Culvert (Barrel Controls 35.98 cfs @ 5.7 fps)

Pond 2P: SWQ Basin 5B

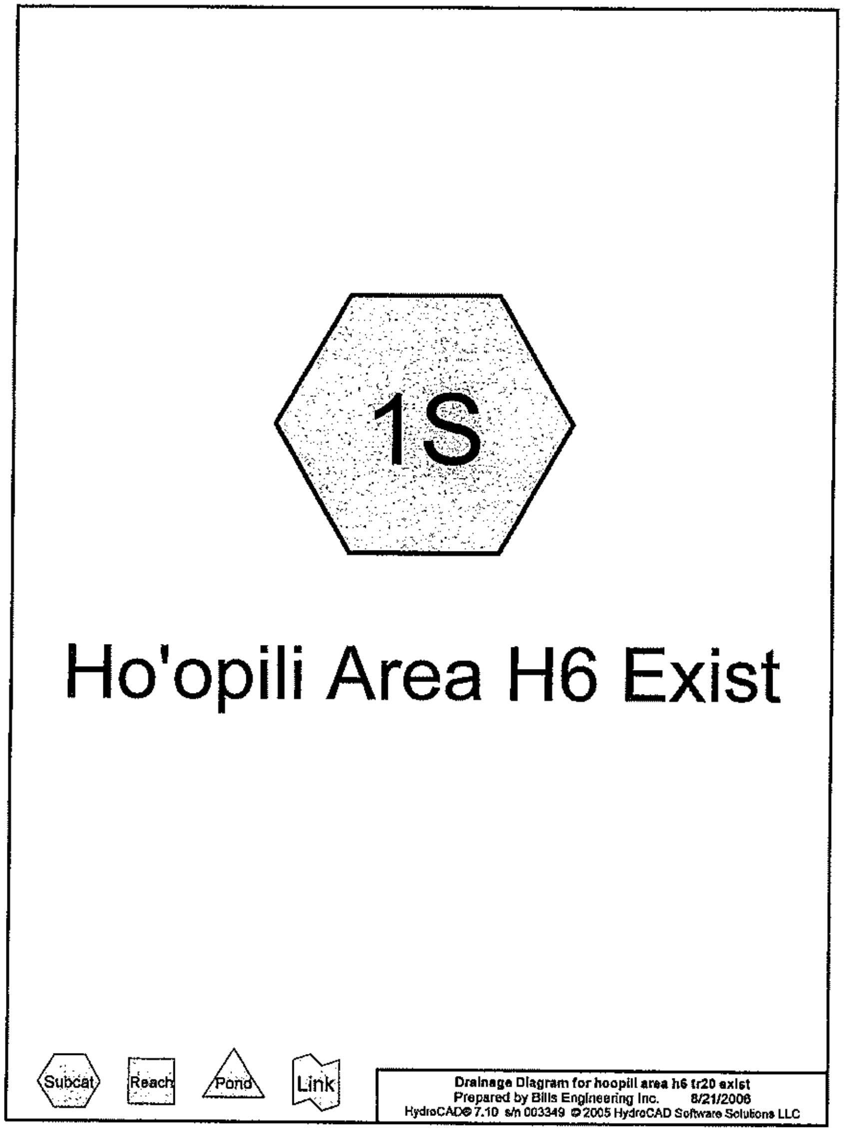


Stage-Discharge for Pond 2P: SWQ Basin 5B

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	5.40	1.48
0.10	0.00	5.50	2.30
0.20	0.00	5.60	3.28
0.30	0.00	5.70	4.39
0.40	0.00	5.80	5.63
0.50	0.00	5.90	6.99
0.60	0.00	6.00	8.45
0.70	0.00	6.10	10.00
0.80	0.00	6.20	11.62
0.90	0.00	6.30	13.31
1.00	0.00	6.40	15.05
1.10	0.00	6.50	16.84
1.20	0.00	6.60	18.64
1.30	0.00	6.70	20.46
1.40	0.00	6.80	22.27
1.50	0.00	6.90	24.06
1.60	0.00	7.00	25.81
1.70	0.00	7.10	27.49
1.80	0.00	7.20	29.07
1.90	0.00	7.30	30.53
2.00	0.00	7.40	31.79
2.10	0.00	7.50	32.80
2.20	0.00	7.60	33.37
2.30	0.00	7.70	33.33
2.40	0.00	7.80	34.69
2.50	0.00	7.90	36.00
2.60	0.00	8.00	37.26
2.70	0.00	8.10	38.49
2.80	0.00	8.20	39.67
2.90	0.00	8.30	40.82
3.00	0.00	8.40	41.94
3.10	0.00	8.50	43.03
3.20	0.00	8.60	44.09
3.30	0.00	8.70	45.13
3.40	0.00	8.80	46.14
3.50	0.00	8.90	47.14
3.60	0.00	9.00	48.11
3.70	0.00	9.10	49.06
3.80	0.00	9.20	50.00
3.90	0.00	9.30	50.91
4.00	0.00	9.40	51.81
4.10	0.00	9.50	52.70
4.20	0.00	9.60	53.57
4.30	0.00	9.70	54.43
4.40	0.00	9.80	55.27
4.50	0.00	9.90	56.10
4.60	0.00	10.00	56.92
4.70	0.00		
4.80	0.00		
4.90	0.00		
5.00	0.00		
5.10	0.08		
5.20	0.36		
5.30	0.83		

Stage-Area-Storage for Pond 2P: SWQ Basin 5B

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	5.40	1.527
0.10	0.023	5.50	1.561
0.20	0.046	5.60	1.595
0.30	0.070	5.70	1.630
0.40	0.093	5.80	1.664
0.50	0.117	5.90	1.699
0.60	0.141	6.00	1.734
0.70	0.165	6.10	1.770
0.80	0.190	6.20	1.805
0.90	0.214	6.30	1.841
1.00	0.239	6.40	1.877
1.10	0.264	6.50	1.914
1.20	0.289	6.60	1.950
1.30	0.314	6.70	1.987
1.40	0.340	6.80	2.024
1.50	0.365	6.90	2.061
1.60	0.391	7.00	2.099
1.70	0.417	7.10	2.137
1.80	0.444	7.20	2.175
1.90	0.470	7.30	2.213
2.00	0.497	7.40	2.251
2.10	0.524	7.50	2.290
2.20	0.551	7.60	2.329
2.30	0.578	7.70	2.368
2.40	0.606	7.80	2.407
2.50	0.633	7.90	2.447
2.60	0.661	8.00	2.487
2.70	0.689	8.10	2.527
2.80	0.717	8.20	2.567
2.90	0.746	8.30	2.608
3.00	0.775	8.40	2.649
3.10	0.804	8.50	2.690
3.20	0.833	8.60	2.731
3.30	0.862	8.70	2.773
3.40	0.891	8.80	2.815
3.50	0.921	8.90	2.857
3.60	0.951	9.00	2.899
3.70	0.981	9.10	2.942
3.80	1.012	9.20	2.985
3.90	1.042	9.30	3.028
4.00	1.073	9.40	3.071
4.10	1.104	9.50	3.115
4.20	1.135	9.60	3.158
4.30	1.167	9.70	3.203
4.40	1.198	9.80	3.247
4.50	1.230	9.90	3.292
4.60	1.262	10.00	3.336
4.70	1.295		
4.80	1.327		
4.90	1.360		
5.00	1.393		
5.10	1.426		
5.20	1.459		
5.30	1.493		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H6 Exist Runoff Area=173.500 ac Runoff Depth=2.46"
Flow Length=3,800' Tc=48.7 min CN=80 Runoff=144.92 cfs 35.590 af

Total Runoff Area = 173.500 ac Runoff Volume = 35.590 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area H6 Exist

Subcatchment area 6 west of Honouliuli Stream

Runoff = 144.92 cfs @ 10.50 hrs, Volume= 35.590 af, Depth= 2.46"

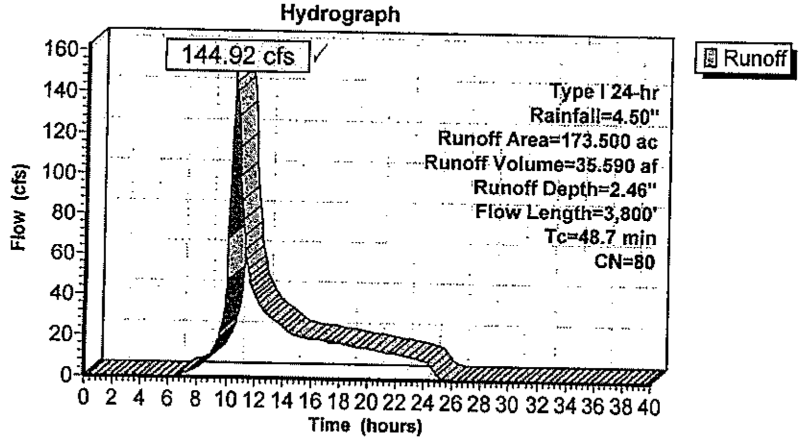
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

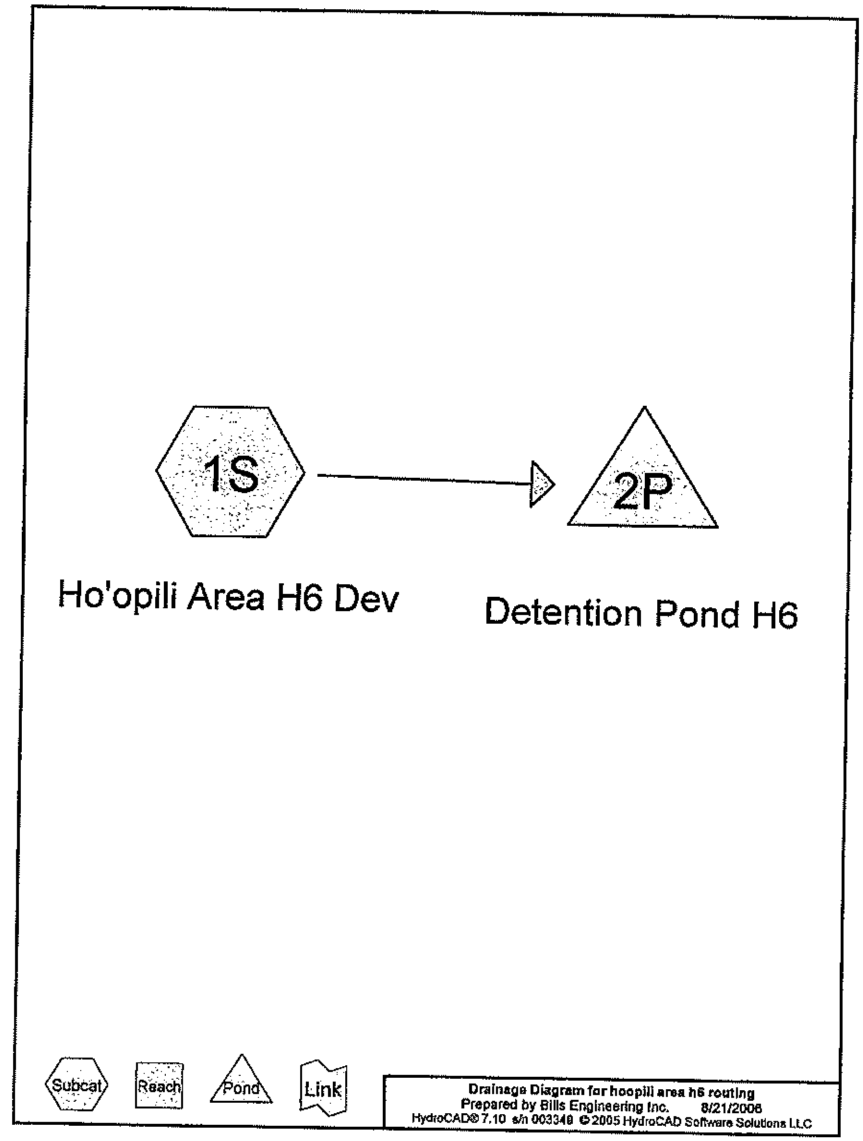
Area (ac)	CN	Description
173.500	80✓	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.7	3,800	0.0360	1.3		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area H6 Exist

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H6 Dev Runoff Area=173.500 ac Runoff Depth=3.10"
Flow Length=3,800' Tc=38.4 min CN=87 Runoff=217.07 cfs 44.805 af

Pond 2P: Detention Pond H6 Peak Elev=7.83' Storage=12.693 af Inflow=217.07 cfs 44.805 af
48.0" x 100.0' Culvert Outflow=142.26 cfs 37.285 af

Total Runoff Area = 173.500 ac Runoff Volume = 44.805 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H6 Dev

Subcatchment area 6 west of Honouliuli Stream

Runoff = 217.07 cfs @ 10.35 hrs, Volume= 44.805 af, Depth= 3.10"

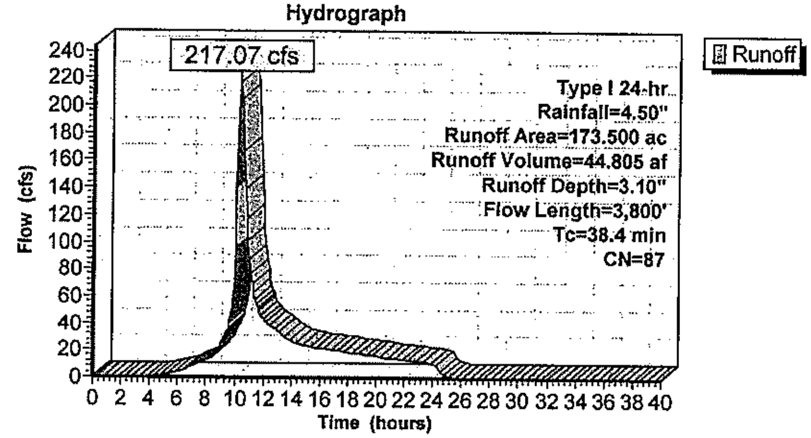
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
173.500	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
38.4	3,800	0.0360	1.6		Lag/CN Method, Developed condition

Subcatchment 1S: Ho'opili Area H6 Dev

Hydrograph



Pond 2P: Detention Pond H6

Inflow Area =	173.500 ac, Inflow Depth = 3.10"		
Inflow =	217.07 cfs @ 10.35 hrs, Volume=	44.805 af	
Outflow =	142.26 cfs @ 10.70 hrs, Volume=	37.285 af,	Atten= 34%, Lag= 20.9 min
Primary =	142.26 cfs @ 10.70 hrs, Volume=	37.285 af	

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 7.83' @ 10.70 hrs Surf.Area= 1.817 ac Storage= 12.693 af
Plug-Flow detention time= 193.7 min calculated for 37.192 af (83% of inflow)
Center-of-Mass det. time= 102.7 min (901.5 - 798.8)

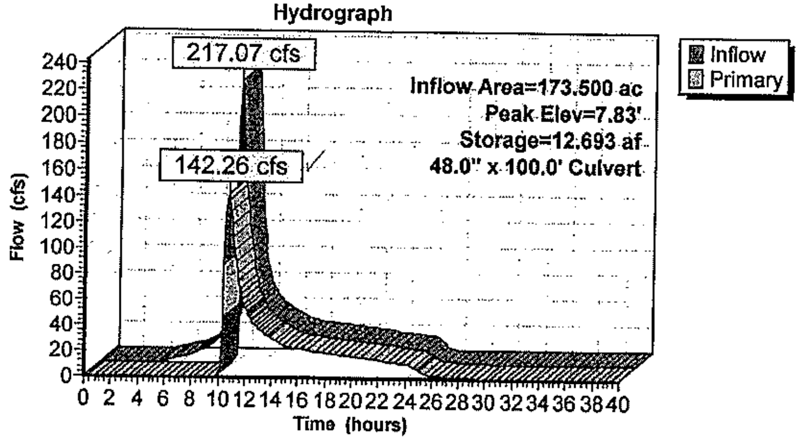
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	16.766 af	**250.00'W x 250.00'L x 10.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	4.80'	**48.0" x 100.0' long Culvert X 3.00** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 4.30' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=142.24 cfs @ 10.70 hrs HW=7.83' (Free Discharge)
↑**1=Culvert** (Barrel Controls 142.24 cfs @ 6.4 fps)

Pond 2P: Detention Pond H6

Hydrograph

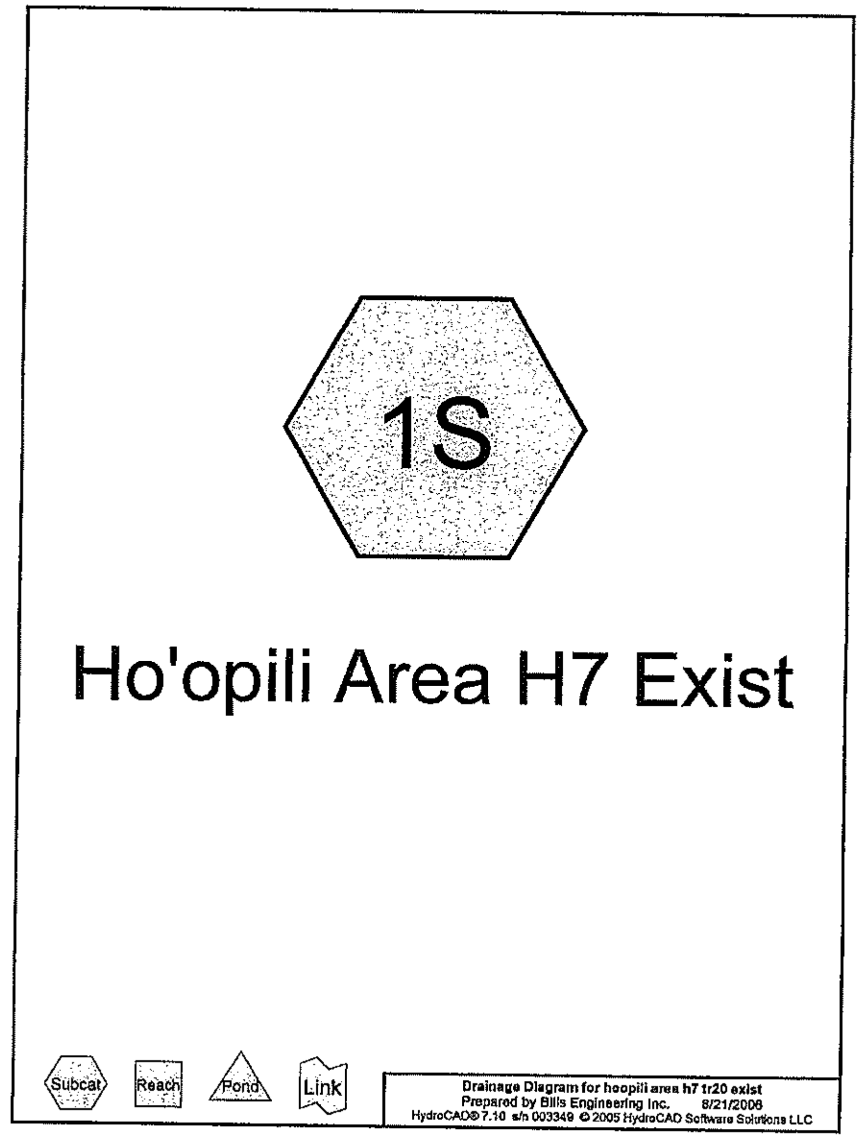


Stage-Discharge for Pond 2P: Detention Pond H6

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	5.30	5.15
0.10	0.00	5.40	7.41
0.20	0.00	5.50	10.03
0.30	0.00	5.60	13.00
0.40	0.00	5.70	16.31
0.50	0.00	5.80	19.93
0.60	0.00	5.90	23.85
0.70	0.00	6.00	28.06
0.80	0.00	6.10	32.54
0.90	0.00	6.20	37.29
1.00	0.00	6.30	42.29
1.10	0.00	6.40	47.53
1.20	0.00	6.50	53.00
1.30	0.00	6.60	58.70
1.40	0.00	6.70	64.60
1.50	0.00	6.80	70.70
1.60	0.00	6.90	76.99
1.70	0.00	7.00	83.45
1.80	0.00	7.10	90.09
1.90	0.00	7.20	96.88
2.00	0.00	7.30	103.82
2.10	0.00	7.40	110.90
2.20	0.00	7.50	118.10
2.30	0.00	7.60	125.41
2.40	0.00	7.70	132.82
2.50	0.00	7.80	140.32
2.60	0.00	7.90	147.90
2.70	0.00	8.00	155.54
2.80	0.00	8.10	163.23
2.90	0.00	8.20	170.95
3.00	0.00	8.30	178.70
3.10	0.00	8.40	186.44
3.20	0.00	8.50	194.18
3.30	0.00	8.60	201.88
3.40	0.00	8.70	209.53
3.50	0.00	8.80	217.11
3.60	0.00	8.90	224.60
3.70	0.00	9.00	231.97
3.80	0.00	9.10	239.19
3.90	0.00	9.20	246.24
4.00	0.00	9.30	253.08
4.10	0.00	9.40	259.66
4.20	0.00	9.50	265.96
4.30	0.00	9.60	271.89
4.40	0.00	9.70	277.40
4.50	0.00	9.80	282.38
4.60	0.00	9.90	286.67
4.70	0.00	10.00	289.99
4.80	0.00		
4.90	0.18		
5.00	0.78		
5.10	1.81		
5.20	3.28		

Stage-Area-Storage for Pond 2P: Detention Pond H6

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	5.30	8.268
0.10	0.144	5.40	8.437
0.20	0.288	5.50	8.606
0.30	0.433	5.60	8.776
0.40	0.578	5.70	8.947
0.50	0.723	5.80	9.118
0.60	0.869	5.90	9.290
0.70	1.016	6.00	9.462
0.80	1.163	6.10	9.634
0.90	1.310	6.20	9.807
1.00	1.458	6.30	9.981
1.10	1.606	6.40	10.155
1.20	1.755	6.50	10.330
1.30	1.904	6.60	10.505
1.40	2.054	6.70	10.681
1.50	2.204	6.80	10.857
1.60	2.355	6.90	11.033
1.70	2.506	7.00	11.210
1.80	2.658	7.10	11.388
1.90	2.810	7.20	11.566
2.00	2.962	7.30	11.745
2.10	3.115	7.40	11.924
2.20	3.269	7.50	12.104
2.30	3.423	7.60	12.284
2.40	3.577	7.70	12.465
2.50	3.732	7.80	12.646
2.60	3.888	7.90	12.828
2.70	4.044	8.00	13.010
2.80	4.200	8.10	13.193
2.90	4.357	8.20	13.377
3.00	4.514	8.30	13.560
3.10	4.672	8.40	13.745
3.20	4.830	8.50	13.930
3.30	4.989	8.60	14.115
3.40	5.149	8.70	14.301
3.50	5.308	8.80	14.487
3.60	5.469	8.90	14.674
3.70	5.629	9.00	14.862
3.80	5.790	9.10	15.050
3.90	5.952	9.20	15.239
4.00	6.114	9.30	15.428
4.10	6.277	9.40	15.617
4.20	6.440	9.50	15.807
4.30	6.604	9.60	15.998
4.40	6.768	9.70	16.189
4.50	6.933	9.80	16.381
4.60	7.098	9.90	16.573
4.70	7.263	10.00	**16.766**
4.80	7.430		
4.90	7.596		
5.00	7.763		
5.10	7.931		
5.20	8.099		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H7 Exist Runoff Area=148.200 ac Runoff Depth=2.46"
Flow Length=4,800' Tc=70.5 min CN=80 Runoff=99.05 cfs 30.400 af

Total Runoff Area = 148.200 ac Runoff Volume = 30.400 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area H7 Exist

Subcatchment area 7 west of Honouliuli Stream

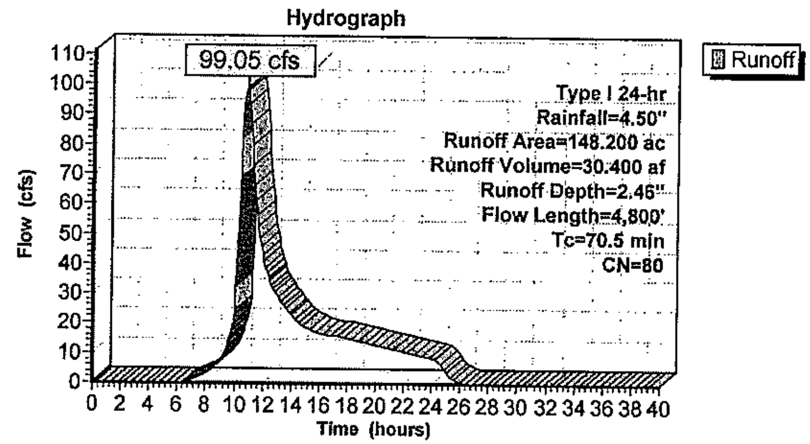
Runoff = 99.05 cfs @ 10.80 hrs, Volume= 30.400 af, Depth= 2.46"

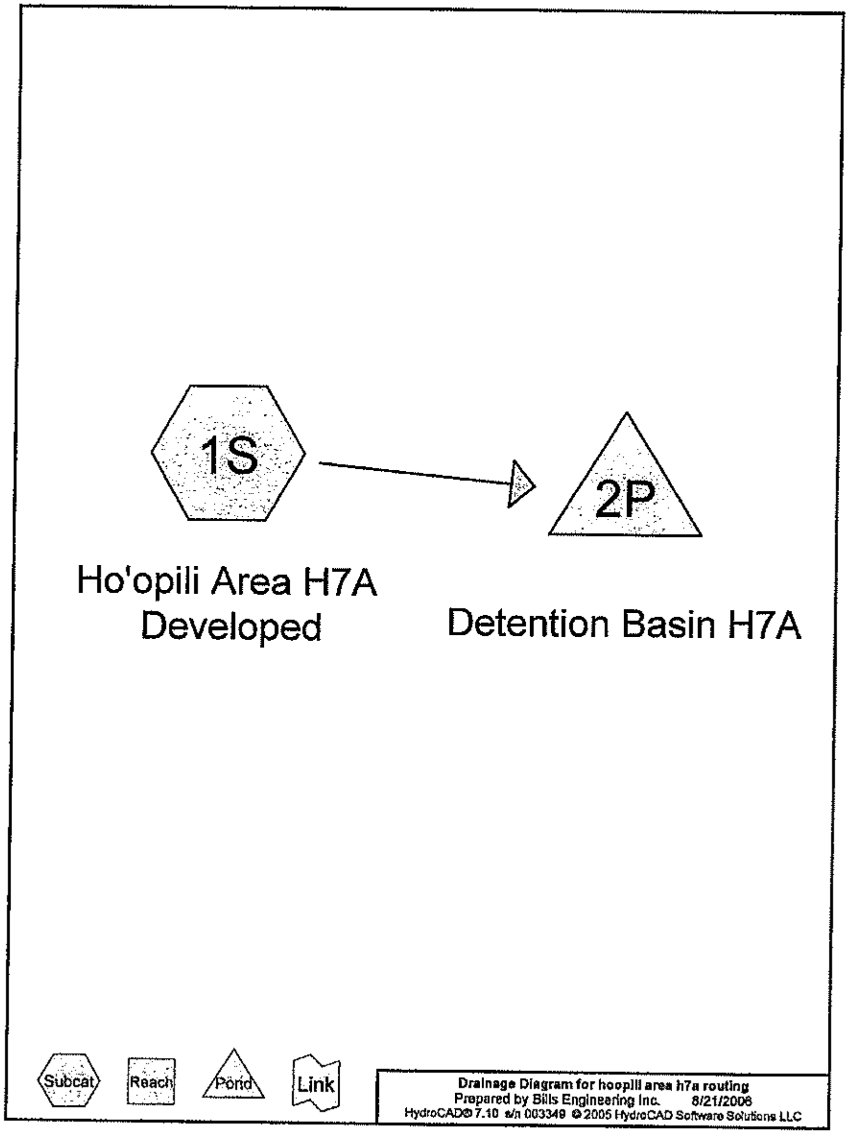
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
148.200	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
70.5	4,800	0.0250	1.1		**Lag/CN Method, Existing condition**

Subcatchment 1S: Ho'opili Area H7 Exist





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H7A Developed Runoff Area=125.200 ac Runoff Depth=3.10"
Flow Length=4,000' Tc=16.9 min CN=87 Runoff=236.87 cfs 32.332 af

Pond 2P: Detention Basin H7A Peak Elev=7.78' Storage=11.157 af Inflow=236.87 cfs 32.332 af
30.0" x 100.0' Culvert Outflow=71.10 cfs 26.745 af

Total Runoff Area = 125.200 ac Runoff Volume = 32.332 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H7A Developed

Subcatchment area 7 west of Honouliuli Stream

Runoff = 236.87 cfs @ 10.09 hrs, Volume= 32.332 af, Depth= 3.10"

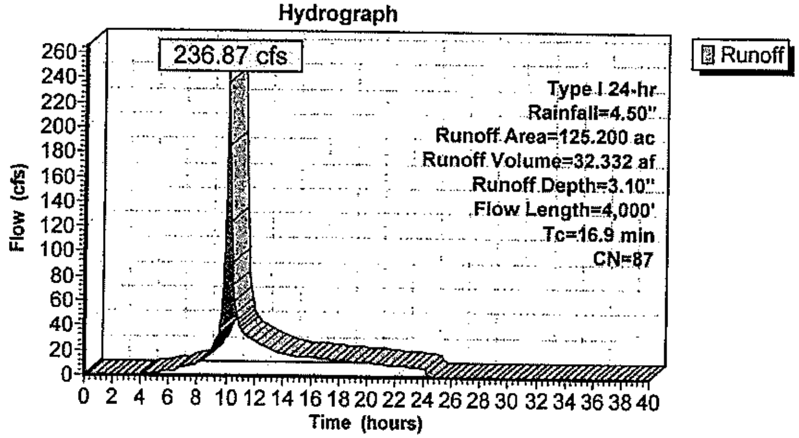
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
125.200	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		**Lag/CN Method, Overland**
2.5	1,500	0.0200	10.2	31.99	**Circular Channel (pipe), Piped** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
7.5	2,300	0.0050	5.1	16.00	**Circular Channel (pipe), Piped-in road** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
16.9	4,000	Total			

Subcatchment 1S: Ho'opili Area H7A Developed

Hydrograph



Pond 2P: Detention Basin H7A

Inflow Area = 125.200 ac, Inflow Depth = 3.10"
Inflow = 236.87 cfs @ 10.09 hrs, Volume= 32.332 af
Outflow = 71.10 cfs @ 10.52 hrs, Volume= 26.745 af, Atten= 70%, Lag= 25.9 min
Primary = 71.10 cfs @ 10.52 hrs, Volume= 26.745 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 7.78' @ 10.52 hrs Surf.Area= 1.435 ac Storage= 11.157 af
Plug-Flow detention time=222.0 min calculated for 26.679 af (83% of inflow)
Center-of-Mass det. time= 129.0 min (907.9 - 778.9)

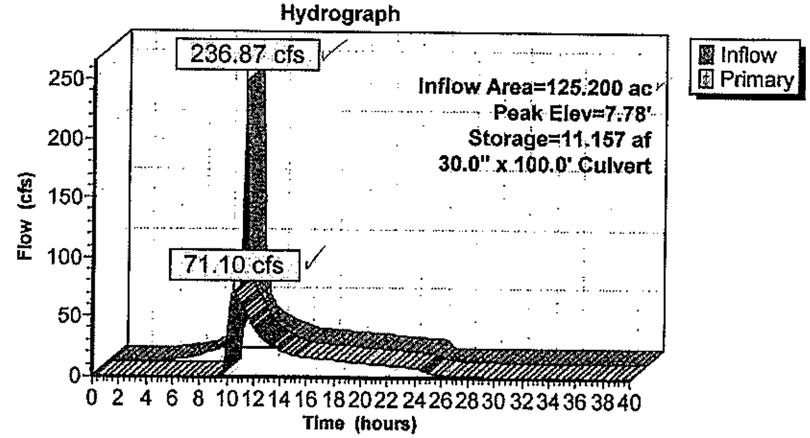
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	14.348 af	**250.00'W x 250.00'L x 10.00'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	3.80'	**30.0" x 100.0' long Culvert X 2.00** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 3.30' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=70.95 cfs @ 10.52 hrs HW=7.77' (Free Discharge)
↳1=Culvert (Barrel Controls 70.95 cfs @ 7.2 fps)

Pond 2P: Detention Basin H7A

Hydrograph

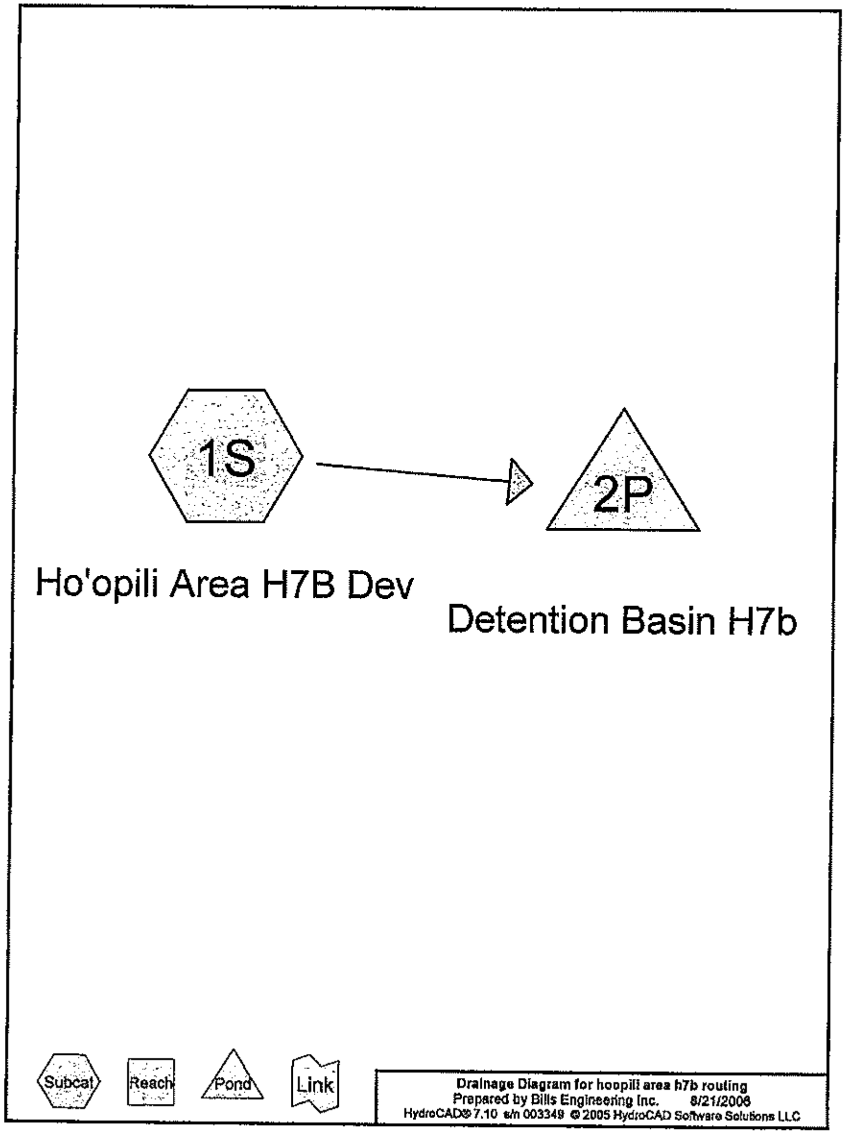


Stage-Discharge for Pond 2P: Detention Basin H7A

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	5.30	20.28
0.10	0.00	5.40	22.62
0.20	0.00	5.50	25.02
0.30	0.00	5.60	27.48
0.40	0.00	5.70	29.98
0.50	0.00	5.80	32.51
0.60	0.00	5.90	35.06
0.70	0.00	6.00	37.60
0.80	0.00	6.10	40.14
0.90	0.00	6.20	42.65
1.00	0.00	6.30	45.11
1.10	0.00	6.40	47.51
1.20	0.00	6.50	49.82
1.30	0.00	6.60	52.01
1.40	0.00	6.70	54.05
1.50	0.00	6.80	55.89
1.60	0.00	6.90	57.45
1.70	0.00	7.00	58.63
1.80	0.00	7.10	59.06
1.90	0.00	7.20	59.85
2.00	0.00	7.30	61.95
2.10	0.00	7.40	63.99
2.20	0.00	7.50	65.96
2.30	0.00	7.60	67.87
2.40	0.00	7.70	69.73
2.50	0.00	7.80	71.54
2.60	0.00	7.90	73.31
2.70	0.00	8.00	75.03
2.80	0.00	8.10	76.72
2.90	0.00	8.20	78.37
3.00	0.00	8.30	79.98
3.10	0.00	8.40	81.57
3.20	0.00	8.50	83.12
3.30	0.00	8.60	84.65
3.40	0.00	8.70	86.14
3.50	0.00	8.80	87.62
3.60	0.00	8.90	89.07
3.70	0.00	9.00	90.49
3.80	0.00	9.10	91.89
3.90	0.09	9.20	93.28
4.00	0.40	9.30	94.64
4.10	0.94	9.40	95.98
4.20	1.68	9.50	97.30
4.30	2.63	9.60	98.61
4.40	3.76	9.70	99.90
4.50	5.06	9.80	101.17
4.60	6.53	9.90	102.43
4.70	8.13	10.00	**103.67**
4.80	9.88		
4.90	11.75		
5.00	13.74		
5.10	15.82		
5.20	18.01		

Stage-Area-Storage for Pond 2P: Detention Basin H7A

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	5.30	7.604
0.10	0.143	5.40	7.748
0.20	0.287	5.50	7.891
0.30	0.430	5.60	8.035
0.40	0.574	5.70	8.178
0.50	0.717	5.80	8.322
0.60	0.861	5.90	8.465
0.70	1.004	6.00	8.609
0.80	1.148	6.10	8.752
0.90	1.291	6.20	8.896
1.00	1.435	6.30	9.039
1.10	1.578	6.40	9.183
1.20	1.722	6.50	9.326
1.30	1.865	6.60	9.470
1.40	2.009	6.70	9.613
1.50	2.152	6.80	9.757
1.60	2.296	6.90	9.900
1.70	2.439	7.00	10.044
1.80	2.583	7.10	10.187
1.90	2.728	7.20	10.331
2.00	2.870	7.30	10.474
2.10	3.013	7.40	10.618
2.20	3.157	7.50	10.761
2.30	3.300	7.60	10.904
2.40	3.444	7.70	11.048
2.50	3.587	7.80	11.191
2.60	3.730	7.90	11.335
2.70	3.874	8.00	11.478
2.80	4.017	8.10	11.622
2.90	4.161	8.20	11.765
3.00	4.304	8.30	11.909
3.10	4.448	8.40	12.052
3.20	4.591	8.50	12.196
3.30	4.735	8.60	12.339
3.40	4.878	8.70	12.483
3.50	5.022	8.80	12.626
3.60	5.165	8.90	12.770
3.70	5.309	9.00	12.913
3.80 ✓	5.452 ✓	9.10	13.057
3.90	5.596	9.20	13.200
4.00	5.739	9.30	13.344
4.10	5.883	9.40	13.487
4.20	6.026	9.50	13.631
4.30	6.170	9.60	13.774
4.40	6.313	9.70	13.918
4.50	6.457	9.80	14.061
4.60	6.600	9.90	14.205
4.70	6.744	10.00	**14.348**
4.80	6.887		
4.90	7.031		
5.00	7.174		
5.10	7.317		
5.20	7.461		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area H7B Dev Runoff Area=23.000 ac Runoff Depth=3.10"
Flow Length=1,200' Tc=9.2 min CN=87 Runoff=52.93 cfs 5.940 af

Pond 2P: Detention Basin H7b Peak Elev=6.33' Storage=1.852 af Inflow=52.93 cfs 5.940 af
30.0" x 100.0' Culvert Outflow=22.91 cfs 4.919 af

Total Runoff Area = 23.000 ac Runoff Volume = 5.940 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area H7B Dev

Subcatchment area 7B west of Honouliuli Stream

[49] Hint: Tc<2dt may require smaller dt

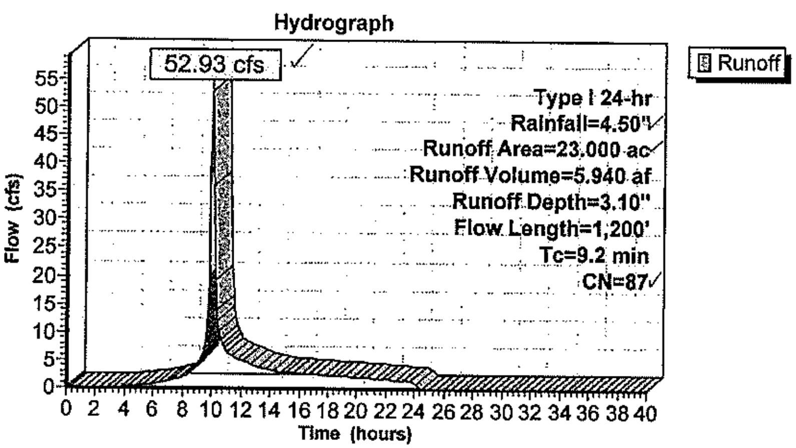
Runoff = 52.93 cfs @ 10.00 hrs, Volume= 5.940 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
23.000	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, Overland
2.3	1,000	0.0100	7.2	22.62	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
9.2	1,200	Total			

Subcatchment 1S: Ho'opili Area H7B Dev



Pond 2P: Detention Basin H7b

Inflow Area = 23.000 ac, Inflow Depth = 3.10"
Inflow = 52.93 cfs @ 10.00 hrs, Volume= 5.940 af
Outflow = 22.91 cfs @ 10.20 hrs, Volume= 4.919 af, Atten= 57%, Lag= 12.2 min
Primary = 22.91 cfs @ 10.20 hrs, Volume= 4.919 af

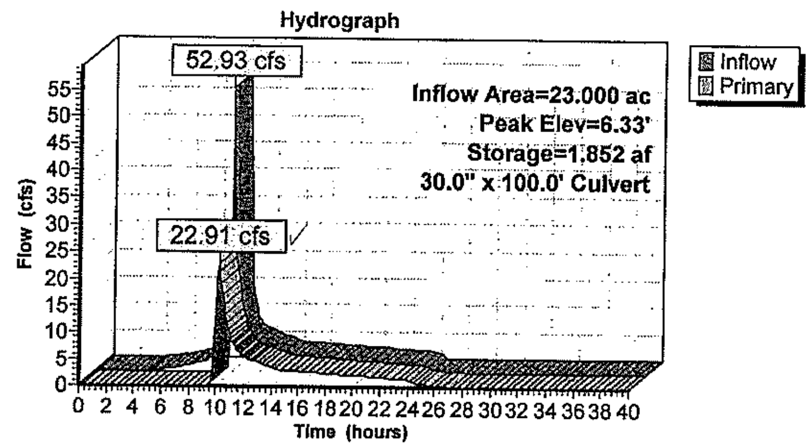
Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 6.33' @ 10.20 hrs Surf.Area= 0.361 ac Storage= 1.852 af
Plug-Flow detention time=199.3 min calculated for 4.919 af (83% of inflow)
Center-of-Mass det. time= 104.4 min (876.1 - 771.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3.336 af	100.00'W x 100.00'L x 10.00'H Prismatoid Z=2.0

Device	Routing	Invert	Outlet Devices
#1	Primary	3.80'	30.0" x 100.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 3.30' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=22.91 cfs @ 10.20 hrs HW=6.33' (Free Discharge)
└─1=Culvert (Barrel Controls 22.91 cfs @ 5.7 fps)

Pond 2P: Detention Basin H7b

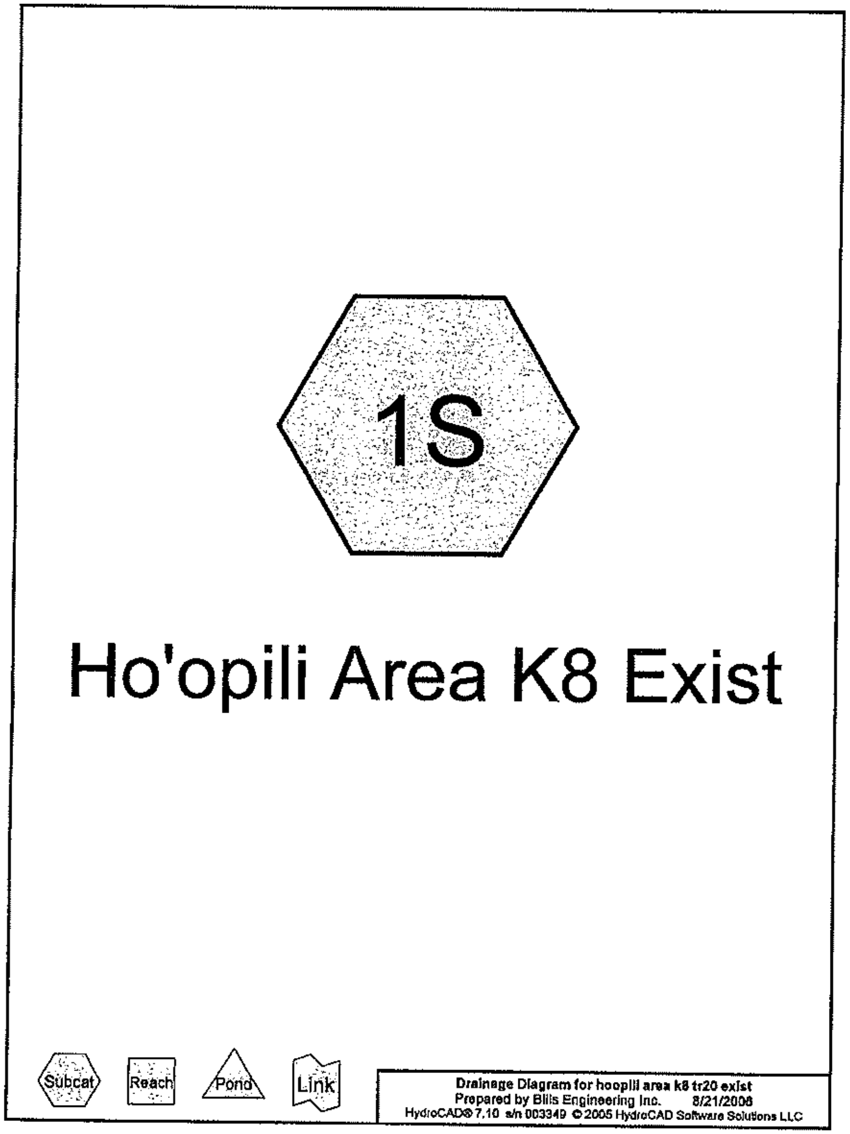


Stage-Discharge for Pond 2P: Detention Basin H7b

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	5.30	10.14
0.10	0.00	5.40	11.31
0.20	0.00	5.50	12.51
0.30	0.00	5.60	13.74
0.40	0.00	5.70	14.99
0.50	0.00	5.80	16.26
0.60	0.00	5.90	17.53
0.70	0.00	6.00	18.80
0.80	0.00	6.10	20.07
0.90	0.00	6.20	21.33
1.00	0.00	6.30	22.56
1.10	0.00	6.40	23.76
1.20	0.00	6.50	24.91
1.30	0.00	6.60	26.01
1.40	0.00	6.70	27.02
1.50	0.00	6.80	27.94
1.60	0.00	6.90	28.73
1.70	0.00	7.00	29.31
1.80	0.00	7.10	29.53
1.90	0.00	7.20	29.93
2.00	0.00	7.30	30.98
2.10	0.00	7.40	31.99
2.20	0.00	7.50	32.98
2.30	0.00	7.60	33.93
2.40	0.00	7.70	34.86
2.50	0.00	7.80	35.77
2.60	0.00	7.90	36.65
2.70	0.00	8.00	37.52
2.80	0.00	8.10	38.36
2.90	0.00	8.20	39.18
3.00	0.00	8.30	39.99
3.10	0.00	8.40	40.78
3.20	0.00	8.50	41.56
3.30	0.00	8.60	42.32
3.40	0.00	8.70	43.07
3.50	0.00	8.80	43.81
3.60	0.00	8.90	44.53
3.70	0.00	9.00	45.25
3.80	0.00	9.10	45.95
3.90	0.05	9.20	46.64
4.00	0.20	9.30	47.32
4.10	0.47	9.40	47.99
4.20	0.84	9.50	48.65
4.30	1.31	9.60	49.31
4.40	1.88	9.70	49.95
4.50	2.53	9.80	50.59
4.60	3.26	9.90	51.21
4.70	4.07	10.00	**51.84**
4.80	4.94		
4.90	5.87		
5.00	6.87		
5.10	7.91		
5.20	9.00		

Stage-Area-Storage for Pond 2P: Detention Basin H7b

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	5.30	1.493
0.10	0.023	5.40	1.527
0.20	0.046	5.50	1.561
0.30	0.070	5.60	1.595
0.40	0.093	5.70	1.630
0.50	0.117	5.80	1.664
0.60	0.141	5.90	1.699
0.70	0.165	6.00	1.734
0.80	0.190	6.10	1.770
0.90	0.214	6.20	1.805
1.00	0.239	6.30	1.841
1.10	0.264	6.40	1.877
1.20	0.289	6.50	1.914
1.30	0.314	6.60	1.950
1.40	0.340	6.70	1.987
1.50	0.365	6.80	2.024
1.60	0.391	6.90	2.061
1.70	0.417	7.00	2.099
1.80	0.444	7.10	2.137
1.90	0.470	7.20	2.175
2.00	0.497	7.30	2.213
2.10	0.524	7.40	2.251
2.20	0.551	7.50	2.290
2.30	0.578	7.60	2.329
2.40	0.606	7.70	2.368
2.50	0.633	7.80	2.407
2.60	0.661	7.90	2.447
2.70	0.689	8.00	2.487
2.80	0.717	8.10	2.527
2.90	0.746	8.20	2.567
3.00	0.775	8.30	2.608
3.10	0.804	8.40	2.649
3.20	0.833	8.50	2.690
3.30	0.862	8.60	2.731
3.40	0.891	8.70	2.773
3.50	0.921	8.80	2.815
3.60	0.951	8.90	2.857
3.70	0.981	9.00	2.899
3.80	1.012	9.10	2.942
3.90	1.042	9.20	2.985
4.00	1.073	9.30	3.028
4.10	1.104	9.40	3.071
4.20	1.135	9.50	3.115
4.30	1.167	9.60	3.158
4.40	1.198	9.70	3.203
4.50	1.230	9.80	3.247
4.60	1.262	9.90	3.292
4.70	1.295	10.00	**3.338**
4.80	1.327		
4.90	1.360		
5.00	1.393		
5.10	1.426		
5.20	1.459		



Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area K8 Exist Runoff Area=52.000 ac Runoff Depth=2.46"
Flow Length=2,000' Tc=39.1 min CN=80 Runoff=49.31 cfs 10.667 af

Total Runoff Area = 52.000 ac Runoff Volume = 10.667 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area K8 Exist

Subcatchment area K8 west of NS Rd above Farrington

Runoff = 49.31 cfs @ 10.38 hrs, Volume= 10.667 af, Depth= 2.46"

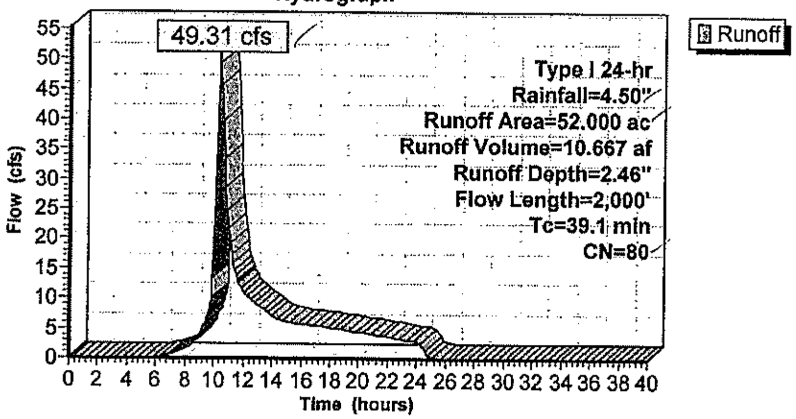
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

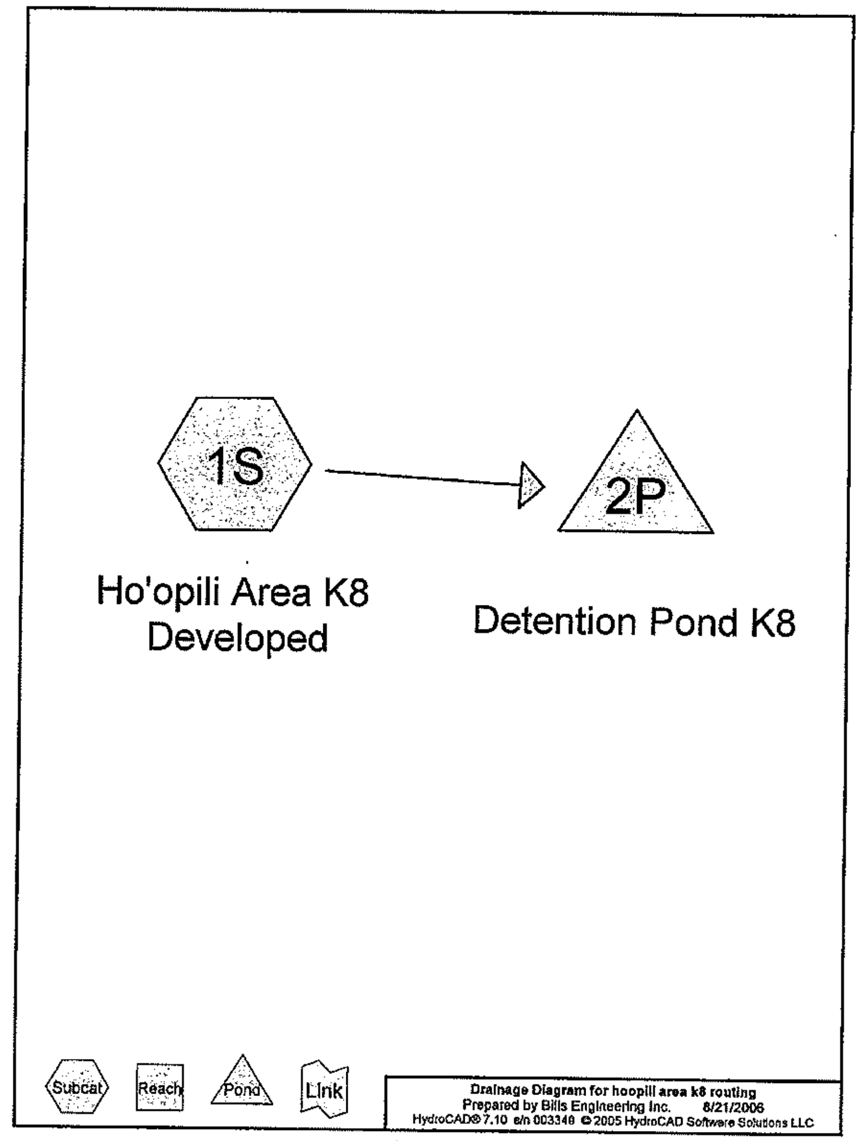
Area (ac)	CN	Description
52.000	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.1	2,000	0.0200	0.9		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area K8 Exist

Hydrograph





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area K8 Developed Runoff Area=52.000 ac Runoff Depth=3.10"
Flow Length=3,200' Tc=12.5 min CN=87 Runoff=108.13 cfs 13.429 af

Pond 2P: Detention Pond K8 Peak Elev=6.94' Storage=4.291 af Inflow=108.13 cfs 13.429 af
48.0" x 100.0' Culvert Outflow=45.35 cfs 11.092 af

Total Runoff Area = 52.000 ac Runoff Volume = 13.429 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area K8 Developed

Subcatchment area K8 west of NS Rd above Farrington

Runoff = 108.13 cfs @ 10.03 hrs, Volume= 13.429 af, Depth= 3.10"

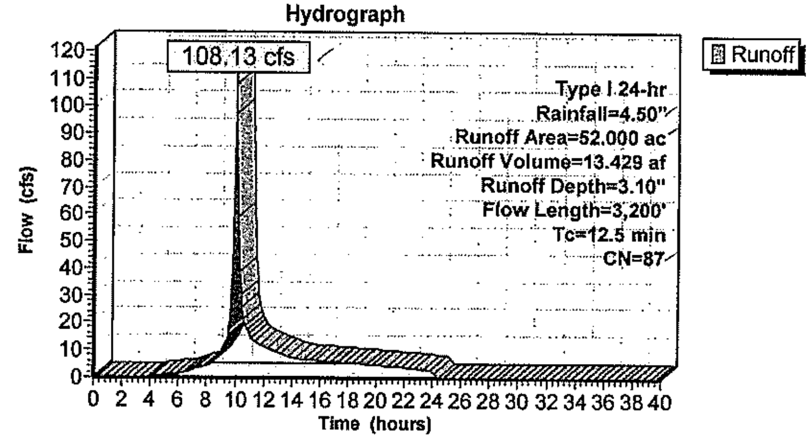
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
52.000	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		Lag/CN Method, overland
2.3	1,000	0.0100	7.2	22.62	Circular Channel (pipe), Piped Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
3.3	2,000	0.0200	10.2	31.99	Circular Channel (pipe), Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
12.5	3,200	Total			

Subcatchment 1S: Ho'opili Area K8 Developed

Hydrograph



Pond 2P: Detention Pond K8

Inflow Area = 52.000 ac, Inflow Depth = 3.10"
Inflow = 108.13 cfs @ 10.03 hrs, Volume= 13.429 af
Outflow = 45.35 cfs @ 10.28 hrs, Volume= 11.092 af, Atten= 58%, Lag= 15.0 min
Primary = 45.35 cfs @ 10.28 hrs, Volume= 11.092 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 6.94' @ 10.28 hrs Surf.Area= 0.726 ac Storage= 4.291 af
Plug-Flow detention time=209.7 min calculated for 11.092 af (83% of inflow)
Center-of-Mass det. time= 113.8 min (888.5 - 774.8)

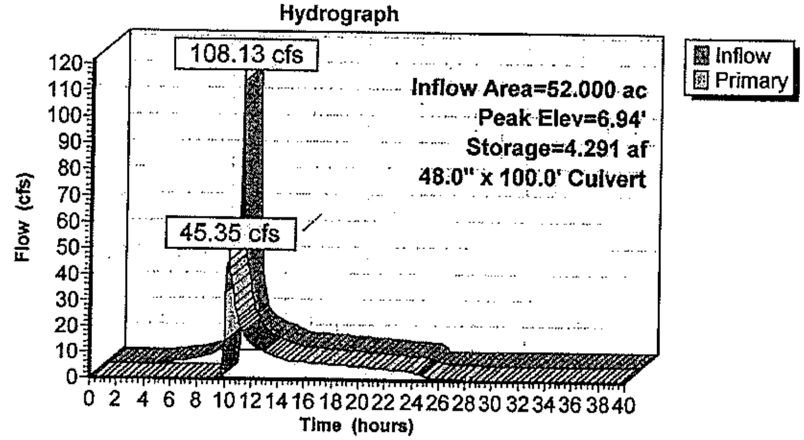
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	5.076 af	**150.00'W x 150.00'L x 8.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**48.0" x 100.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 3.50' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=45.07 cfs @ 10.28 hrs HW=6.93' (Free Discharge)
└─**1=Culvert** (Barrel Controls 45.07 cfs @ 6.4 fps)

Pond 2P: Detention Pond K8

Hydrograph

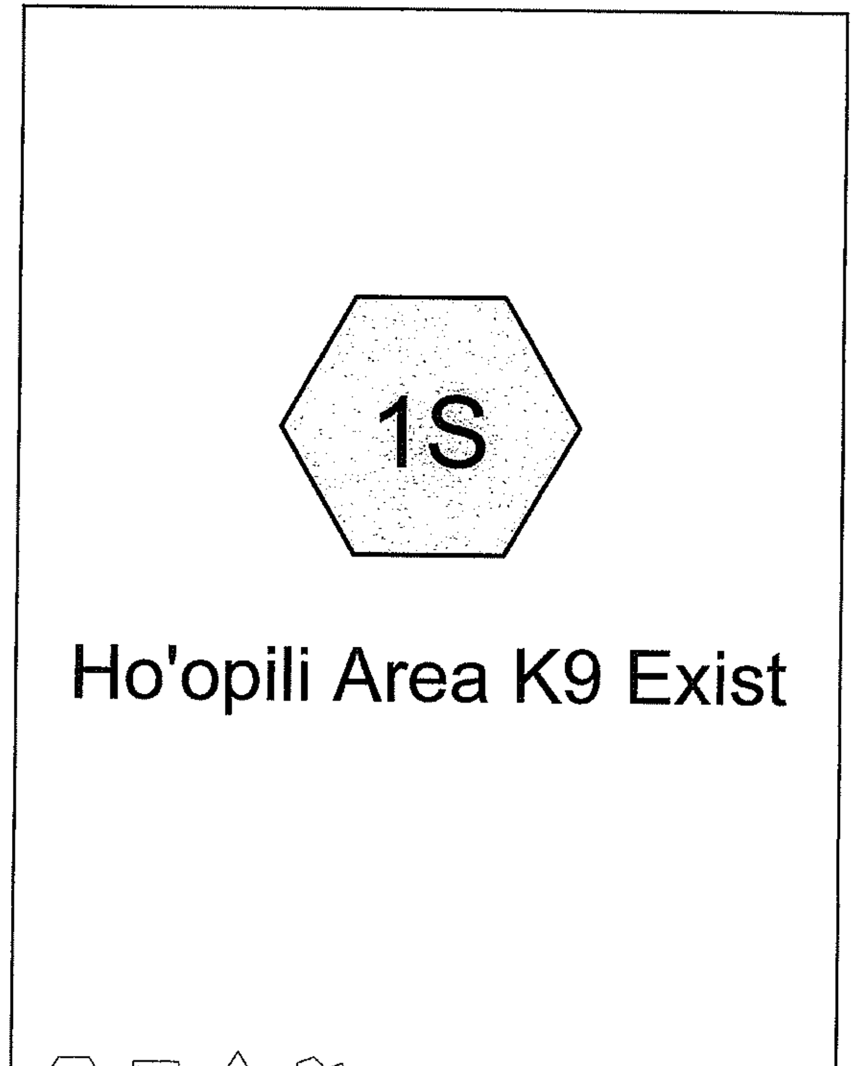


Stage-Discharge for Pond 2P: Detention Pond K8

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	2.12	0.00	4.24	0.38	6.36	31.38
0.04	0.00	2.16	0.00	4.28	0.52	6.40	32.29
0.08	0.00	2.20	0.00	4.32	0.69	6.44	33.21
0.12	0.00	2.24	0.00	4.36	0.88	6.48	34.14
0.16	0.00	2.28	0.00	4.40	1.09	6.52	35.08
0.20	0.00	2.32	0.00	4.44	1.33	6.56	36.02
0.24	0.00	2.36	0.00	4.48	1.58	6.60	36.97
0.28	0.00	2.40	0.00	4.52	1.86	6.64	37.92
0.32	0.00	2.44	0.00	4.56	2.15	6.68	38.88
0.36	0.00	2.48	0.00	4.60	2.47	6.72	39.85
0.40	0.00	2.52	0.00	4.64	2.80	6.76	40.82
0.44	0.00	2.56	0.00	4.68	3.16	6.80	41.80
0.48	0.00	2.60	0.00	4.72	3.53	6.84	42.79
0.52	0.00	2.64	0.00	4.76	3.92	6.88	43.78
0.56	0.00	2.68	0.00	4.80	4.33	6.92	44.77
0.60	0.00	2.72	0.00	4.84	4.76	6.96	45.77
0.64	0.00	2.76	0.00	4.88	5.21	7.00	46.77
0.68	0.00	2.80	0.00	4.92	5.67	7.04	47.78
0.72	0.00	2.84	0.00	4.96	6.15	7.08	48.79
0.76	0.00	2.88	0.00	5.00	6.64	7.12	49.81
0.80	0.00	2.92	0.00	5.04	7.15	7.16	50.83
0.84	0.00	2.96	0.00	5.08	7.68	7.20	51.85
0.88	0.00	3.00	0.00	5.12	8.22	7.24	52.87
0.92	0.00	3.04	0.00	5.16	8.78	7.28	53.90
0.96	0.00	3.08	0.00	5.20	9.35	7.32	54.92
1.00	0.00	3.12	0.00	5.24	9.94	7.36	55.95
1.04	0.00	3.16	0.00	5.28	10.54	7.40	56.98
1.08	0.00	3.20	0.00	5.32	11.16	7.44	58.02
1.12	0.00	3.24	0.00	5.36	11.79	7.48	59.05
1.16	0.00	3.28	0.00	5.40	12.43	7.52	60.08
1.20	0.00	3.32	0.00	5.44	13.09	7.56	61.12
1.24	0.00	3.36	0.00	5.48	13.76	7.60	62.15
1.28	0.00	3.40	0.00	5.52	14.44	7.64	63.18
1.32	0.00	3.44	0.00	5.56	15.14	7.68	64.21
1.36	0.00	3.48	0.00	5.60	15.84	7.72	65.24
1.40	0.00	3.52	0.00	5.64	16.56	7.76	66.27
1.44	0.00	3.56	0.00	5.68	17.30	7.80	67.29
1.48	0.00	3.60	0.00	5.72	18.04	7.84	68.32
1.52	0.00	3.64	0.00	5.76	18.80	7.88	69.33
1.56	0.00	3.68	0.00	5.80	19.57	7.92	70.35
1.60	0.00	3.72	0.00	5.84	20.34	7.96	71.36
1.64	0.00	3.76	0.00	5.88	21.13	8.00	**72.37**
1.68	0.00	3.80	0.00	5.92	21.93		
1.72	0.00	3.84	0.00	5.96	22.74		
1.76	0.00	3.88	0.00	6.00	23.57		
1.80	0.00	3.92	0.00	6.04	24.40		
1.84	0.00	3.96	0.00	6.08	25.24		
1.88	0.00	4.00	0.00	6.12	26.09		
1.92	0.00	4.04	0.01	6.16	26.95		
1.96	0.00	4.08	0.04	6.20	27.82		
2.00	0.00	4.12	0.09	6.24	28.70		
2.04	0.00	4.16	0.16	6.28	29.58		
2.08	0.00	4.20	0.26	6.32	30.48		

Stage-Area-Storage for Pond 2P: Detention Pond K8

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	2.12	1.158	4.24	2.447	6.36	3.874
0.04	0.021	2.16	1.181	4.28	2.473	6.40	3.902
0.08	0.041	2.20	1.204	4.32	2.498	6.44	3.930
0.12	0.062	2.24	1.228	4.36	2.524	6.48	3.959
0.16	0.083	2.28	1.251	4.40	2.550	6.52	3.987
0.20	0.104	2.32	1.274	4.44	2.576	6.56	4.016
0.24	0.125	2.36	1.297	4.48	2.602	6.60	4.044
0.28	0.146	2.40	1.321	4.52	2.627	6.64	4.073
0.32	0.167	2.44	1.344	4.56	2.653	6.68	4.102
0.36	0.188	2.48	1.368	4.60	2.679	6.72	4.130
0.40	0.209	2.52	1.391	4.64	2.705	6.76	4.159
0.44	0.230	2.56	1.415	4.68	2.732	6.80	4.188
0.48	0.251	2.60	1.438	4.72	2.758	6.84	4.217
0.52	0.272	2.64	1.462	4.76	2.784	6.88	4.246
0.56	0.294	2.68	1.486	4.80	2.810	6.92	4.275
0.60	0.315	2.72	1.509	4.84	2.837	6.96	4.304
0.64	0.336	2.76	1.533	4.88	2.863	7.00	4.333
0.68	0.358	2.80	1.557	4.92	2.889	7.04	4.362
0.72	0.379	2.84	1.581	4.96	2.916	7.08	4.391
0.76	0.401	2.88	1.605	5.00	2.942	7.12	4.420
0.80	0.422	2.92	1.629	5.04	2.969	7.16	4.449
0.84	0.444	2.96	1.653	5.08	2.995	7.20	4.479
0.88	0.465	3.00	1.677	5.12	3.022	7.24	4.508
0.92	0.487	3.04	1.701	5.16	3.049	7.28	4.538
0.96	0.509	3.08	1.725	5.20	3.076	7.32	4.567
1.00	0.530	3.12	1.749	5.24	3.102	7.36	4.597
1.04	0.552	3.16	1.774	5.28	3.129	7.40	4.626
1.08	0.574	3.20	1.798	5.32	3.156	7.44	4.656
1.12	0.596	3.24	1.822	5.36	3.183	7.48	4.686
1.16	0.618	3.28	1.847	5.40	3.210	7.52	4.715
1.20	0.640	3.32	1.871	5.44	3.237	7.56	4.745
1.24	0.662	3.36	1.896	5.48	3.264	7.60	4.775
1.28	0.684	3.40	1.920	5.52	3.292	7.64	4.805
1.32	0.706	3.44	1.945	5.56	3.319	7.68	4.835
1.36	0.728	3.48	1.969	5.60	3.346	7.72	4.865
1.40	0.750	3.52	1.994	5.64	3.373	7.76	4.895
1.44	0.773	3.56	2.019	5.68	3.401	7.80	4.925
1.48	0.795	3.60	2.044	5.72	3.428	7.84	4.955
1.52	0.817	3.64	2.069	5.76	3.456	7.88	4.985
1.56	0.840	3.68	2.093	5.80	3.483	7.92	5.016
1.60	0.862	3.72	2.118	5.84	3.511	7.96	5.046
1.64	0.885	3.76	2.143	5.88	3.538	8.00	5.076
1.68	0.907	3.80	2.168	5.92	3.566		
1.72	0.930	3.84	2.194	5.96	3.594		
1.76	0.952	3.88	2.219	6.00	3.621		
1.80	0.975	3.92	2.244	6.04	3.649		
1.84	0.998	3.96	2.269	6.08	3.677		
1.88	1.021	4.00✓	2.294✓	6.12	3.705		
1.92	1.043	4.04	2.320	6.16	3.733		
1.96	1.066	4.08	2.345	6.20	3.761		
2.00	1.089	4.12	2.370	6.24	3.789		
2.04	1.112	4.16	2.396	6.28	3.817		
2.08	1.135	4.20	2.421	6.32	3.848		



Drainage Diagram for hoopili area k9 tr20 exist
Prepared by Bills Engineering Inc. 8/21/2006
HydroCAD® 7.10 s/n 003349 © 2005 HydroCAD Software Solutions LLC

Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area K9 Exist Runoff Area=50.500 ac Runoff Depth=2.46"
Flow Length=1,700' Tc=38.4 min CN=80 Runoff=48.36 cfs 10.359 af

Total Runoff Area = 50.500 ac Runoff Volume = 10.359 af Average Runoff Depth = 2.46"

Subcatchment 1S: Ho'opili Area K9 Exist

Subcatchment area K9 east of NS Rd below Farrington

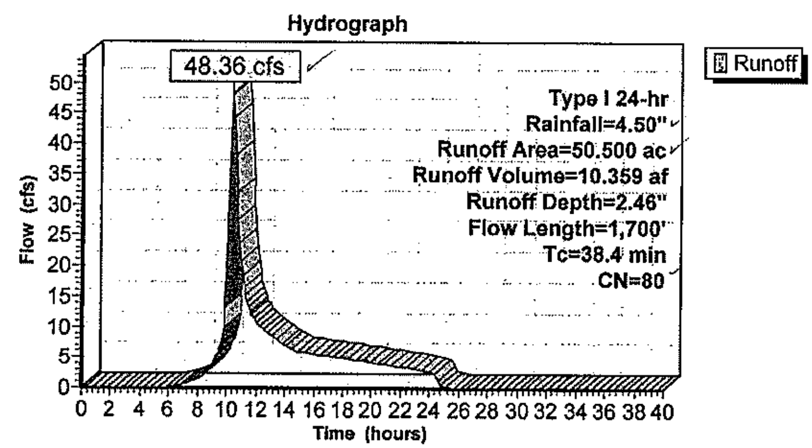
Runoff = 48.36 cfs @ 10.37 hrs, Volume= 10.359 af, Depth= 2.46"

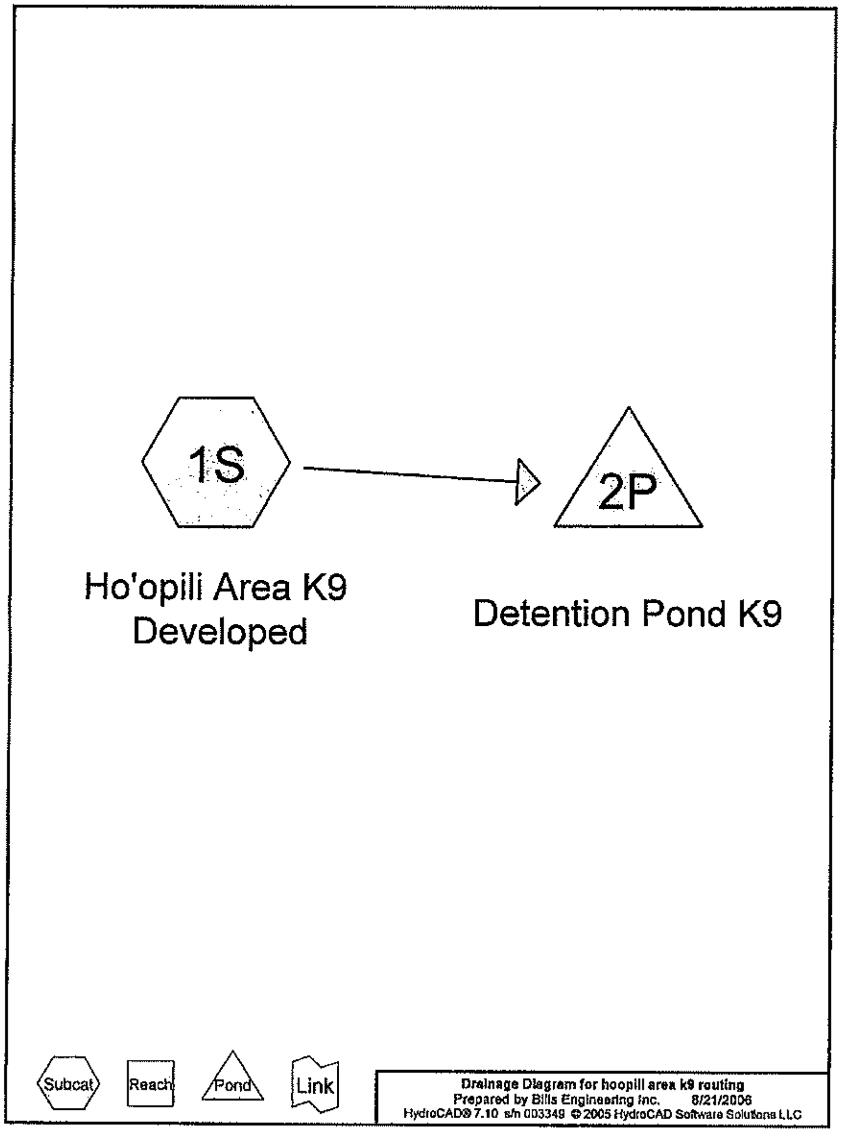
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
50.500	80	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
38.4	1,700	0.0160	0.7		Lag/CN Method, Existing condition

Subcatchment 1S: Ho'opili Area K9 Exist





Time span=0.00-40.00 hrs, dt=0.10 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Ho'opili Area K9 Developed Runoff Area=50.500 ac Runoff Depth=3.10"
Flow Length=2,300' Tc=11.0 min CN=87 Runoff=110.32 cfs 13.041 af

Pond 2P: Detention Pond K9 Peak Elev=6.66' Storage=4.084 af Inflow=110.32 cfs 13.041 af
48.0" x 100.0' Culvert Outflow=48.16 cfs 10.960 af

Total Runoff Area = 50.500 ac Runoff Volume = 13.041 af Average Runoff Depth = 3.10"

Subcatchment 1S: Ho'opili Area K9 Developed

Subcatchment area K9 east of NS Rd below Farrington

[49] Hint: Tc<2dt may require smaller dt

Runoff = 110.32 cfs @ 10.01 hrs, Volume= 13.041 af, Depth= 3.10"

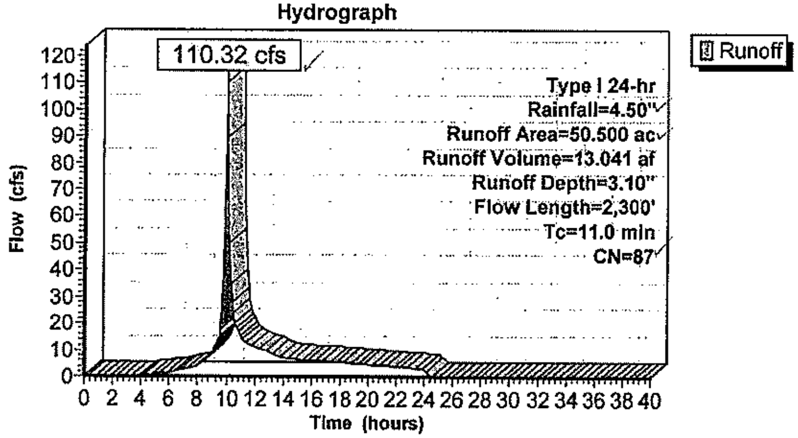
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Type I 24-hr Rainfall=4.50"

Area (ac)	CN	Description
50.500	87	CN entered directly

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	200	0.0100	0.5		**Lag/CN Method, Overland**
3.2	1,700	0.0150	8.8	27.71	**Circular Channel (pipe), Piped in road** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.9	400	0.0100	7.2	22.62	**Circular Channel (pipe), Piped** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
11.0	2,300	Total			

Subcatchment 1S: Ho'opili Area K9 Developed

Hydrograph



Pond 2P: Detention Pond K9

Inflow Area = 50.500 ac, Inflow Depth = 3.10"
Inflow = 110.32 cfs @ 10.01 hrs, Volume= 13.041 af
Outflow = 48.16 cfs @ 10.23 hrs, Volume= 10.960 af, Atten= 56%, Lag= 13.2 min
Primary = 48.16 cfs @ 10.23 hrs, Volume= 10.960 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.10 hrs
Peak Elev= 6.66' @ 10.23 hrs Surf.Area= 0.716 ac Storage= 4.084 af
Plug-Flow detention time= 196.0 min calculated for 10.933 af (84% of inflow)
Center-of-Mass det. time= 109.1 min (882.5 - 773.4)

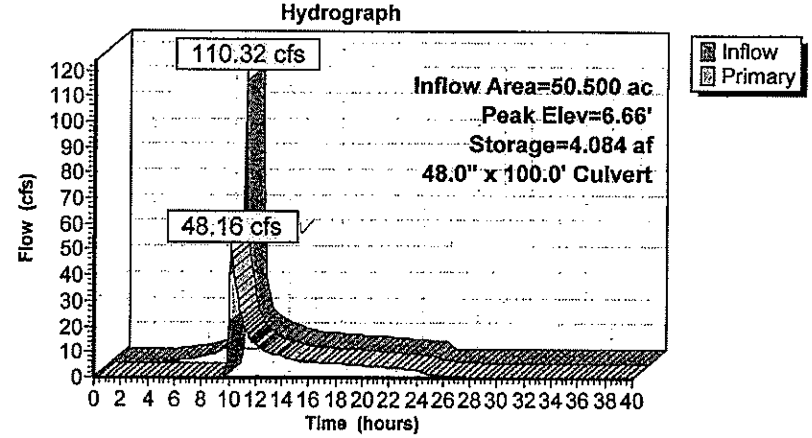
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6.665 af	**150.00'W x 150.00'L x 10.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	3.60'	**48.0" x 100.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 3.10' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=47.16 cfs @ 10.23 hrs HW=6.62' (Free Discharge)
↑**1=Culvert** (Barrel Controls 47.16 cfs @ 6.4 fps)

Pond 2P: Detention Pond K9

Hydrograph



Stage-Discharge for Pond 2P: Detention Pond K9

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	5.30	17.67
0.10	0.00	5.40	19.57
0.20	0.00	5.50	21.53
0.30	0.00	5.60	23.57
0.40	0.00	5.70	25.66
0.50	0.00	5.80	27.82
0.60	0.00	5.90	30.03
0.70	0.00	6.00	32.29
0.80	0.00	6.10	34.61
0.90	0.00	6.20	36.97
1.00	0.00	6.30	39.37
1.10	0.00	6.40	41.80
1.20	0.00	6.50	44.27
1.30	0.00	6.60	46.77
1.40	0.00	6.70	49.30
1.50	0.00	6.80	51.85
1.60	0.00	6.90	54.41
1.70	0.00	7.00	56.98
1.80	0.00	7.10	59.57
1.90	0.00	7.20	62.15
2.00	0.00	7.30	64.73
2.10	0.00	7.40	67.29
2.20	0.00	7.50	69.84
2.30	0.00	7.60	72.37
2.40	0.00	7.70	74.87
2.50	0.00	7.80	77.32
2.60	0.00	7.90	79.73
2.70	0.00	8.00	82.08
2.80	0.00	8.10	84.36
2.90	0.00	8.20	86.55
3.00	0.00	8.30	88.65
3.10	0.00	8.40	90.63
3.20	0.00	8.50	92.47
3.30	0.00	8.60	94.13
3.40	0.00	8.70	95.56
3.50	0.00	8.80	96.66
3.60	0.00	8.90	97.17
3.70	0.08	9.00	98.42
3.80	0.26	9.10	100.98
3.90	0.60	9.20	103.47
4.00	1.09	9.30	105.91
4.10	1.72	9.40	108.29
4.20	2.47	9.50	110.62
4.30	3.34	9.60	112.90
4.40	4.33	9.70	115.13
4.50	5.44	9.80	117.33
4.60	6.64	9.90	119.48
4.70	7.95	10.00	**121.59**
4.80	9.35		
4.90	10.85		
5.00	12.43		
5.10	14.10		
5.20	15.84		

Stage-Area-Storage for Pond 2P: Detention Pond K9

Elevation (feet)	Storage (acre-feet)	Elevation (feet)	Storage (acre-feet)
0.00	0.000	5.30	3.143
0.10	0.052	5.40	3.210
0.20	0.104	5.50	3.278
0.30	0.156	5.60	3.346
0.40	0.209	5.70	3.414
0.50	0.262	5.80	3.483
0.60	0.315	5.90	3.552
0.70	0.368	6.00	3.621
0.80	0.422	6.10	3.691
0.90	0.476	6.20	3.761
1.00	0.530	6.30	3.831
1.10	0.585	6.40	3.902
1.20	0.640	6.50	3.973
1.30	0.695	6.60	4.044
1.40	0.750	6.70	4.116
1.50	0.806	6.80	4.188
1.60	0.862	6.90	4.260
1.70	0.919	7.00	4.333
1.80	0.975	7.10	4.406
1.90	1.032	7.20	4.479
2.00	1.089	7.30	4.552
2.10	1.147	7.40	4.626
2.20	1.204	7.50	4.700
2.30	1.262	7.60	4.775
2.40	1.321	7.70	4.850
2.50	1.379	7.80	4.925
2.60	1.438	7.90	5.001
2.70	1.497	8.00	5.076
2.80	1.557	8.10	5.153
2.90	1.617	8.20	5.229
3.00	1.677	8.30	5.306
3.10	1.737	8.40	5.383
3.20	1.798	8.50	5.461
3.30	1.859	8.60	5.539
3.40	1.920	8.70	5.617
3.50	1.982	8.80	5.696
3.60	2.044	8.90	5.774
3.70	2.106	9.00	5.854
3.80	2.168	9.10	5.933
3.90	2.231	9.20	6.013
4.00	2.294	9.30	6.094
4.10	2.358	9.40	6.174
4.20	2.421	9.50	6.255
4.30	2.485	9.60	6.336
4.40	2.550	9.70	6.418
4.50	2.614	9.80	6.500
4.60	2.679	9.90	6.582
4.70	2.745	10.00	**6.665**
4.80	2.810		
4.90	2.876		
5.00	2.942		
5.10	3.009		
5.20	3.076		

Appendix P

Preliminary Electrical & Communications Master Plan

PRELIMINARY ELECTRICAL AND COMMUNICATIONS MASTER PLAN

FOR

HO'OPILI

EWA, OAHU, HAWAII

Prepared for:

D.R. Horton - Schuler Homes, LLC

Honolulu, Hawaii

Prepared by:

MK Engineers, Ltd.
286 Kalihi Street
Honolulu, Hawaii 96819

February, 2008

HO'OPILI

PRELIMINARY ELECTRICAL AND COMMUNICATIONS MASTER PLAN
Prepared by MK Engineers, Ltd. for
D.R. Horton – Schuler Homes, LLC
November, 2007

I. INTRODUCTION

D.R. Horton – Schuler Homes, LLC is preparing conceptual plans for the Ho'opili project that will provide residential homes, schools, parks, commercial, and light industrial facilities on about 1,555 acres in an area approximately bounded by the H-1 Freeway to the north, the new North-South Road to the west, Fort Weaver Road to the east, and Ewa Villages Golf Course to the south. This preliminary master plan document provides the results of meetings with the various electrical and communication utilities who have facilities being impacted by the development, what efforts will be required to relocate or remove the existing utilities, and what will be required to provide new electrical and communication services to the development.

II. HAWAIIAN ELECTRIC COMPANY (HECO)

A meeting was held with several HECO representatives on May 3, 2006 (see Attachment A for the meeting minutes). At the meeting and with follow-up correspondence, the following items were determined:

A. Existing Facilities (see Attachment B)

HECO's facilities currently consist of a major transmission steel pole line supporting two 138 kV circuits following the North-South Road alignment to Farrington Highway, then along the mauka side of Farrington Highway with a 12.47 kV circuit below to its Ewa Nui Transmission Substation. From the Ewa Nui Transmission Substation, two 138 kV circuits and a 46 kV circuit on a steel pole line, and a 12.47 kV circuit traverse the property mauka towards the H-1 Freeway on a perpetual easement with no relocation clause. From the Ewa Nui Transmission Substation, a 46 kV circuit on wood poles with 12.47 kV underbuild traverses east along Farrington Highway to the Waipahu Interchange and up Fort Weaver Road to the Kunia Interchange. The 46 kV and 12.47 kV lines also continue down the Old Fort Weaver Road to the intersection with the new Fort Weaver Road. Finally, a 12.47 kV line traverses the property in the makai direction on an easement to the Old Fort Weaver Road that serves the West Loch area as well as some irrigation wells that used to belong to the Oahu Sugar Company. This easement has a relocation clause. HECO also provided all the easement documents and maps for existing HECO facilities that currently encumber the properties within the project boundary.

Each of these easements will need to be researched during the preliminary engineering phase of the project to determine whether the existing facility can remain or must be relocated, and if so, to where, at what cost, at who's expense, and when required.

B. Proposed Substation Sites and 46 kV Subtransmission Lines

Three distribution substations will be required for the development at a minimum. The existing transmission substation is mainly for transmission and subtransmission switching, with expansion plans for only transmission and subtransmission. There is currently one distribution transformer in the transmission substation that serves as a backup to nearby distribution substations, as well as to provide station power for the transmission substation. The requirements for the new distribution substations are as follows:

1. The first new distribution substation will be located on the mauka side of Farrington Highway between the Ewa Nui Transmission Substation and Fort Weaver Road; the second new distribution substation will be located near the main road running through Ho'opili and perpendicular to the North-South Road; and the third new distribution substation will be located between the North-South Road and the Ewa Nui Transmission Substation. See Attachment C for tentative areas that these new distribution substations may be located. Other factors such as proximity to existing 46 kV subtransmission lines, use of open spaces, etc., should be taken into consideration in locating these substation sites.
2. The new substation sites will likely be low profile type and may be square or rectangular with a size of about 20,000 SF. This size lot will be suitable for a four-unit substation. See Attachment D (four sheets) for various substation layouts based on different lot configurations.
3. Substation land will be owned by HECO. HECO does not want the substations located in flood zone areas.
4. Each substation will require the 46 kV feeders to be underground. There will initially be two 46 kV feeders to each substation and one or two transformers, with a third 46 kV feeder required for full build-out of the substation (four transformers).
5. Since there is no ordinance mandating that the 46 kV lines within a subdivision be placed underground, any 46 kV underground lines within the subdivision will need to be paid for by the developer. The developer would be required to install the underground infrastructure at his cost and the developer's share of 46 kV line extension costs will be the difference between the underground cable installation cost and an equivalent overhead line cost.
6. HECO will have two 46 kV lines running overhead on the 138 kV steel poles along the new North-South Road. If substations are placed near North-South Road, the cost of the underground 46 kV line extensions may be minimized.

C. Proposed Distribution Lines

By City ordinance, all new primary and secondary distribution lines within Ho'opili must be placed underground.

1. The distribution system voltage will be 12.47 kV and the distribution system will include primary and secondary cables in a concrete-encased duct system within the streets and sidewalks and with handholes in the sidewalk area, primary padmounted switchgears, and padmounted transformers.
2. Easements will be required for the padmounted switchgears, padmounted transformers, and cables crossing private property to serve other customers.
3. Service tails will be provided at the property line for service to the individual property owners.
4. Each substation will require the 46 kV feeders to be underground. There will initially be two 46 kV feeders to each substation and one or two transformers, with a third 46 kV feeder required for full build-out of the substation (four transformers).

D. Miscellaneous

1. The new North-South Road will be constructed of concrete and any future trenching across the roadway will not be allowed. Accordingly, D.R. Horton – Schuler Homes, LLC is coordinating duct requirements with R.M. Towill along North-South Road.
2. The final alignment of the Honolulu High Capacity Transit Corridor (HHCTC) project has not yet been determined. An Environmental Impact Statement (EIS) will be prepared for the HHCTC project that will address impacts on existing and new electrical and communication facilities within the new Ho'opili project.
3. There is a 30-foot wide Energy Corridor along the mauka side of Farrington Highway that contains a 10-inch Hawaiian Independent Refinery, Inc. fuel oil pipeline and a 16-inch Gas Company gas pipeline. This Energy Corridor is currently under the jurisdiction of the State Department of Transportation (Harbors Division). Any utility lines crossing this Energy Corridor will require a permit from the Harbors Division and construction plans must satisfy the requirements of the Harbors Division and of its tenants.

III. HAWAIIAN TELCOM (HTCOM)

A meeting was held with several HTCOM representatives on April 25, 2006 (see Attachment E for the meeting minutes). At the meeting and with follow-up correspondence, the following items were determined:

A. Existing Facilities (see Attachment B)

HTCOM's facilities currently consist of a several major telephone cables on overhead wooden poles along Farrington Highway, Old Fort Weaver Road, and Kunia Road.

B. Proposed HTCOM Lines

1. One source of telephone service may be from Kapolei.
2. North-South Road design is underway and there are 6-way ducts on the mauka side and 8-way ducts on the makai side of the North-South Road. Service to Ho'opili could be routed along the North-South Road. Coordination should be done with Ron Ho and Associates, the electrical design consultant for the North-South Road.
3. HTCOM has not been contacted about the UH West Oahu Campus. They would like to know what the timing of that project is.
4. The size of the Ho'opili project suggests that multiple hubs may be required for telephone service. HTCOM would prefer to have a lot near the center of area served for the hub.
5. The telephone distribution system from the hubs will include copper or fiber optic cables in a concrete-encased duct system within the streets and sidewalks and with handholes in the sidewalk area.
6. Easements will be required for the cables crossing private property to serve other customers.
7. Service tails will be provided at the property line for service to the individual property owners.
8. HTCOM requested the electronic file of the subdivision plan so that they can begin planning and engineering.

IV. OCEANIC TIME WARNER CABLE (TW)

The following items were determined:

A. Existing Facilities (see Attachment B)

TW's facilities currently consist of fiber optic cables on overhead wooden poles along Farrington Highway, Old Fort Weaver Road, and Kunia Road.

B. Proposed TW Lines

1. The project will need to provide 6'x6' easements for TW's cable television (CATV) Power Supply Pedestal Equipment cabinets adjacent to HECO's padmounted switchgear (see Attachment F).
2. The CATV distribution system will include fiber optic cables in a concrete-encased duct system within the streets and sidewalks and with handholes in the

sidewalk area.

3. Easements will be required for the power supply cabinets and for cables crossing private property to serve other customers.
4. Service tails will be provided at the property line for service to the individual property owners.

V. OTHER COMMUNICATION FACILITIES

There may be other private or governmental communication facilities within the Ho'opili project such as Pacific LightNet, Inc., Sandwich Isles Communication, Inc, and Army Signal Corps. These entities will need to be contacted as part of the infrastructure design phase of the project to coordinate any relocation of existing facilities.

Attachment A

HECO Conference Memo

MK Engineers, Ltd.

Consulting Electrical Engineers
286 Kalihi St. $ Honolulu, Hawaii 96819
Telephone # (808) 848-8622 $ Fax # (808) 848-5574
e-mail address: ron@mkhawaii.com

CONFERENCE MEMORANDUM

Project:	Ho'opili Development (East Kapolei) for D. R. Horton, Schuler Division
Project No.:	06040
Location:	HECO Ward Avenue Conf Rm 300
Date of Conf:	5-3-06
Prepared By:	Ron Katahara
Attenders:	See attendance sheet

Items of Discussion

1. See Agenda. Mr. Hirakami described the project and displayed phasing drawings.
2. Discussion:
   a. The new development will have all-electric residential units (SF and MF), schools, medical facilities, commercial and light industrial facilities, and parks. Overall project development is expected to span 25 to 30 years. Developer needs to seek land rezoning and permitting from both the State and City governments. Construction of the first phase is expected to start within 4 to 5 years, with first home projected to be sold in 2012. The second, third and fourth phases of the project will be approximately 5 years each thereafter. A spreadsheet showing tentative zoning calculations of acreage and number of units within each Land Use Ordinance zone was provided.
   b. There are several other design projects that may impact this project.
      i. North South Road designs are underway. Ron Ho & Associates is doing the electrical design for the State DOT.
      ii. The UH West Oahu Campus will be on the western boundary of this project. HECO is working with the consultant on the location of a new substation to serve this development.
      iii. The Dept. of Hawaiian Home Lands is developing a parcel of land just below the UH West Oahu Campus. HECO is in contact with the DHHL, but haven't received definite plans to date.
      iv. The City's High-Capacity Transit project has two alternative routes that may impact this project: one along the North-South Road and Farrington Highway; and the other along Fort Weaver Road. MKE previously met with HECO engineers on the City's transit project and requested information on HECO's facilities along each of the alternative routes.
      v. The State DOT is widening Fort Weaver Road from about the Waipahu Interchange down to Geiger Road. MKE previously informed HECO on the DOT's project and requested information on HECO's existing facilities.
   c. There is an existing energy corridor along the mauka side of Farrington Highway.
   d. HECO's facilities currently consist of a major transmission steel pole line supporting two 138 kV circuits following the North-South Road alignment to Farrington Highway, then along the

mauka side of Farrington Highway to its Ewa Nui Transmission Substation. From the Ewa Nui Transmission Substation, two 138 kV circuits and a 46 kV circuit on a steel pole line traverses the property mauka towards the H-1 Freeway on an perpetual easement with no relocation clause. From the Ewa Nui Transmission Substation, a 46 kV circuit on wood poles with 12 kV underbuild traverses east along Farrington Highway to the Waipahu Interchange and up Kunia Road to the Kunia Interchange. The 46 kV and 12 kV lines also continue down the Old Fort Weaver Road to the intersection with the new Fort Weaver Road. Finally, a 12 kV line traverses the property in the makai direction on an easement to the Old Fort Weaver Road that serves the West Loch area as well as some irrigation wells that used to belong to the Oahu Sugar Company. This easement may have a relocation clause.

e. Two distribution substations will probably be required for the development as a minimum. The existing transmission substation is mainly for transmission and subtransmission switching, with expansion plans for only transmission and subtransmission. There is currently one distribution transformer in the transmission substation that serves as a backup to nearby distribution substations as well as to provide station power for the transmission substation.
   i. The new substation sites may be square or rectangular with size of about 20,000 SF. This size lot will be suitable for a four-unit substation.
   ii. Substation land will be owned by HECO. HECO does not want the substations located in flood zone areas.
   iii. The substation will likely be low profile type and will require 46 kV in-feed to be underground. There will initially be two 46 kV feeders to each substation and one or two transformers, with a third 46 kV feeder required for full build-out of the substation (four transformers).
   iv. Since there is no ordinance mandating that the 46 kV lines within a subdivision be placed underground, any 46 kV underground lines within the subdivision will need to be paid for by the developer. The developer would be required to install the underground infrastructure at his cost and the developer's share of 46 kV line extension costs will be the difference between the underground cable installation cost and an equivalent overhead line cost.
   v. HECO will have two 46 kV lines running overhead on the 138 kV steel poles along the new North-South Road. If substations are placed near North-South Road, the cost of the underground 46 kV line extensions may be minimized.

f. The distribution system voltage will be 12 kV and will be all underground.

g. The new North-South Road will be constructed of concrete and any future trenching across the roadway will not be allowed. Accordingly, HECO suggested that MKE contact D.R. Horton and ask them to see if the State would be willing to provide North-South Road duct crossings for HECO at the West Oahu UH main roadway that will extend into the Phase 1B portion of the Ho'opili Town Development. This will provide some flexibility in the event that the new substation in the UH West Oahu Campus might have some spare capacity to initially serve Phase 1B.

h. It is uncertain whether the High Capacity Transit project or the new Ho'opili Town Development project will provide for the widening of Farrington Highway. It is currently a two-lane highway, but there is room for widening on the makai side. Distribution duct requirements will need to be coordinated with whichever project initiates the widening of Farrington Highway.

3. MKE will provide a load estimate based on the planned uses of the land. This information will be used by HECO to determine the number of substations required for the development and their suggested locations.
4. ACTION ITEMS:
   a. HECO will request that MKE sign a waiver and hold harmless agreement form for copies of HECO documents (easement maps and documents, transmission and distribution line maps, and preliminary substation layout plans).
   b. Upon receipt of signed waiver and hold harmless agreement form, HECO will provide the requested documents.
   c. MKE will provide estimated loads for each of the planned zoning parcels so that the total number of substations and potential substation sites can be determined.
   d. Upon receipt of the estimated loads, HECO will provide the number of substations required to serve the development and potential substation sites within the development.

END

MK Engineers, Ltd.
Consulting Electrical Engineers
286 Kalihi St. • Honolulu, Hawaii 96819
Telephone # (808) 848-8622 • Fax # (808) 848-5574
e-mail address: info@mkhawaii.com

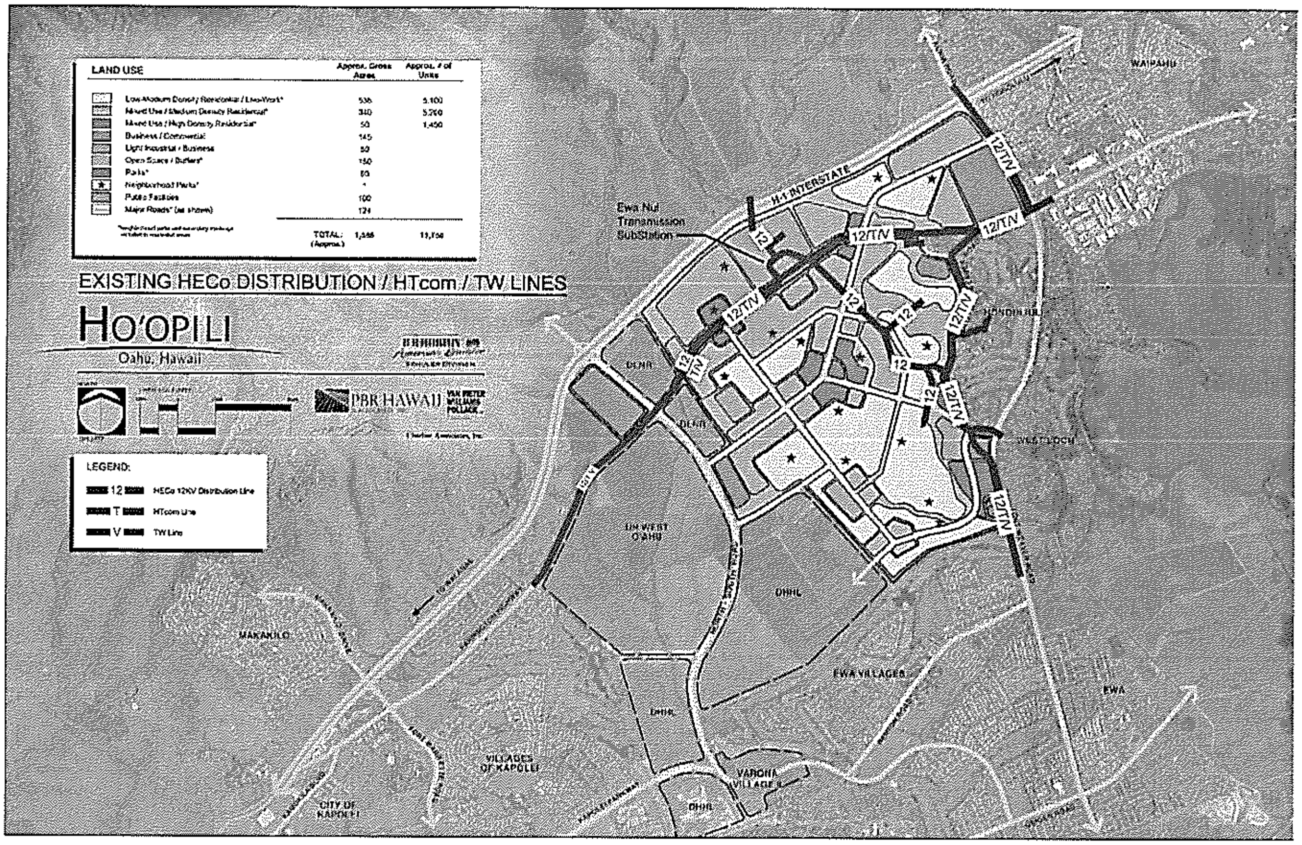
ATTENDANCE SHEET

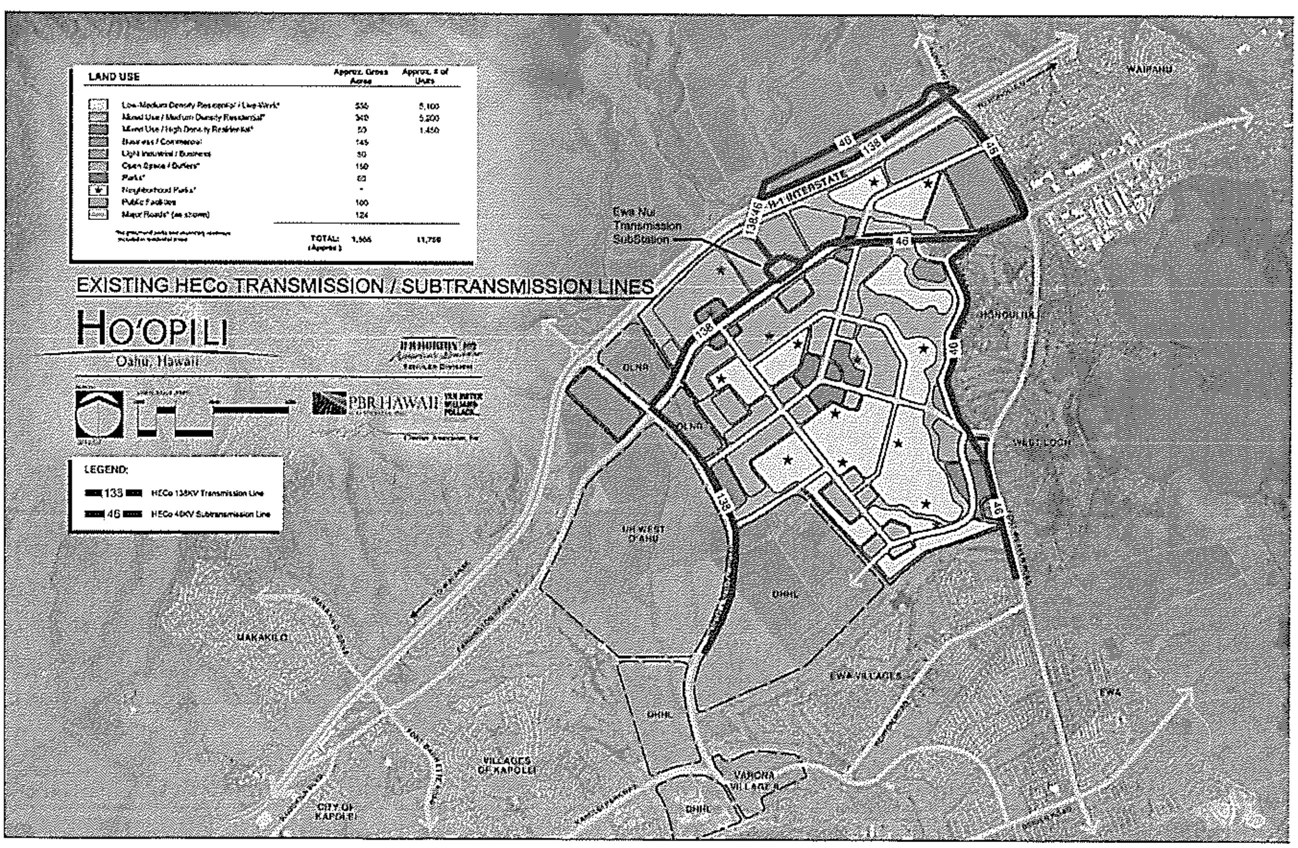
PROJECT: HO'OPILI TOWN DEVELOPMENT
DATE: 5/3/06
LOCATION OF CONFERENCE: HECO CONF RM 300

NAME	COMPANY/ACTIVITY	PHONE/FAX/E-MAIL
Francis Hirakami	MK Engineers, Ltd.	(808)848-8622/(808) 848-5574 francis@mkhawaii.com
RON KATAHARA	"	" RON@mkhawaii.com
Phil Hauret	HECO	543-4735/4726 phil.hauret@heco.com
Ruby Shimabukuro	"	543-4617 Ruby.Shimabukuro@heco.com
Jimmy Lum	✓	543-7553 jimmy.lum@heco.com
Susan Chow	HECO	543-7766 susan.chow@heco.com
Rudy Tamayo	HECO	543-7999 rudy.Tamayo@heco.com
Nathan Liang	HECO	543-7978 NATHAN, LIANG@HECO.com
PAUL NAKAGAWA	HECO	543-7062 paul.nakagawa@heco.com

Attachment B

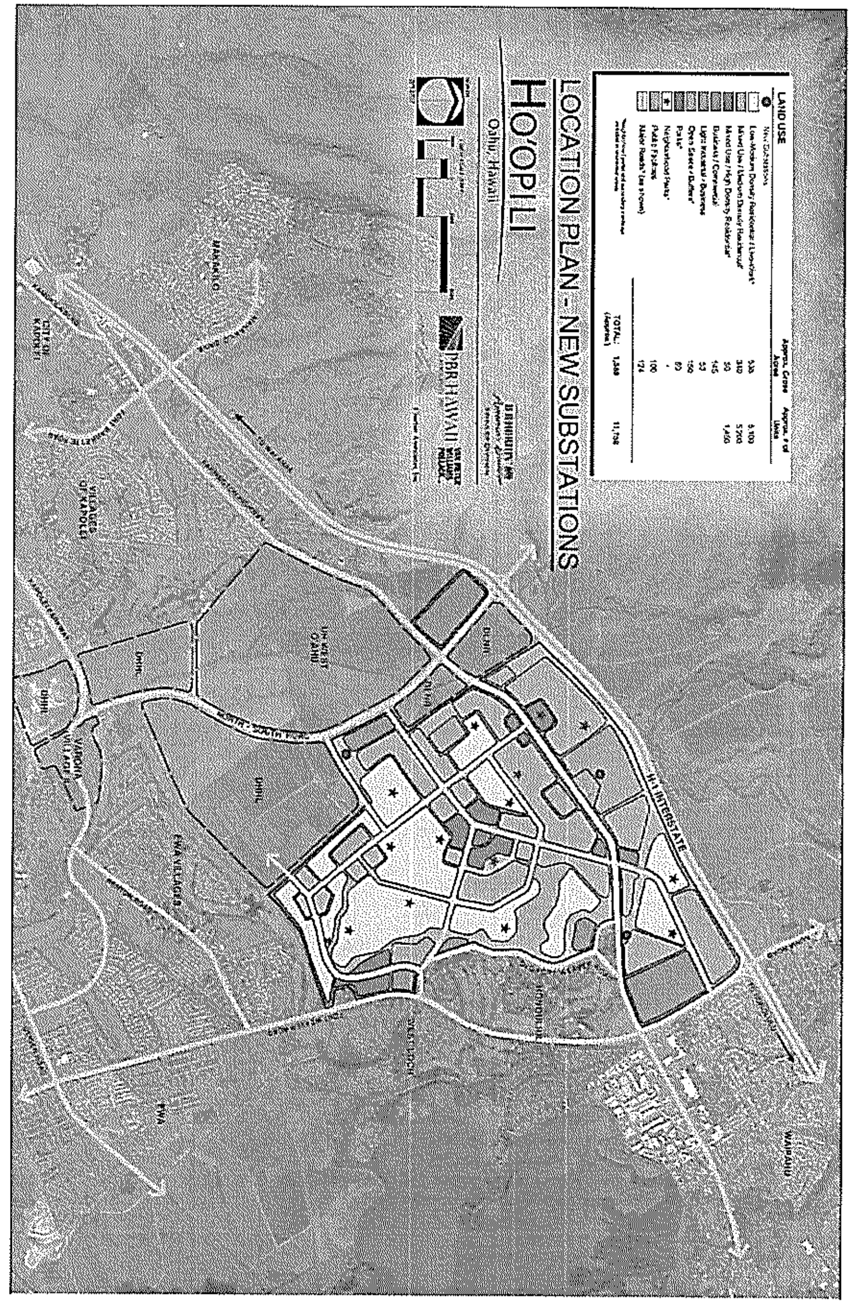
Maps of Existing Utility Lines


LAND USE
TOTAL:
EXISTING HECo DISTRIBUTION / HTcom / TW LINES
HO'OPILI
Oahu, Hawaii
PBR HAWAII
LEGEND:
12 HECo 12KV Distribution Line
T HTcom Line
V TW Line
Ewa Nui Transmission SubStation
H-1 INTERSTATE
WAIPAHU
HONOULIULI
WEST LOCH
UH WEST O'AHU
DHHL
DLNR
MAKAKILO
EWA VILLAGES
EWA
VILLAGES OF KAPOLEI
VARONA VILLAGE
CITY OF KAPOLEI
12/T/V
12


LAND USE
TOTAL:
EXISTING HECo TRANSMISSION / SUBTRANSMISSION LINES
HO'OPILI
Oahu, Hawaii
PBR HAWAII
LEGEND:
138 HECo 138KV Transmission Line
46 HECo 46KV Subtransmission Line
Ewa Nui Transmission SubStation
H-1 INTERSTATE
WAIPAHU
HONOULIULI
WEST LOCH
UH WEST O'AHU
DHHL
DLNR
MAKAKILO
EWA VILLAGES
EWA
VILLAGES OF KAPOLEI
VARONA VILLAGE
CITY OF KAPOLEI
138
46
138/46

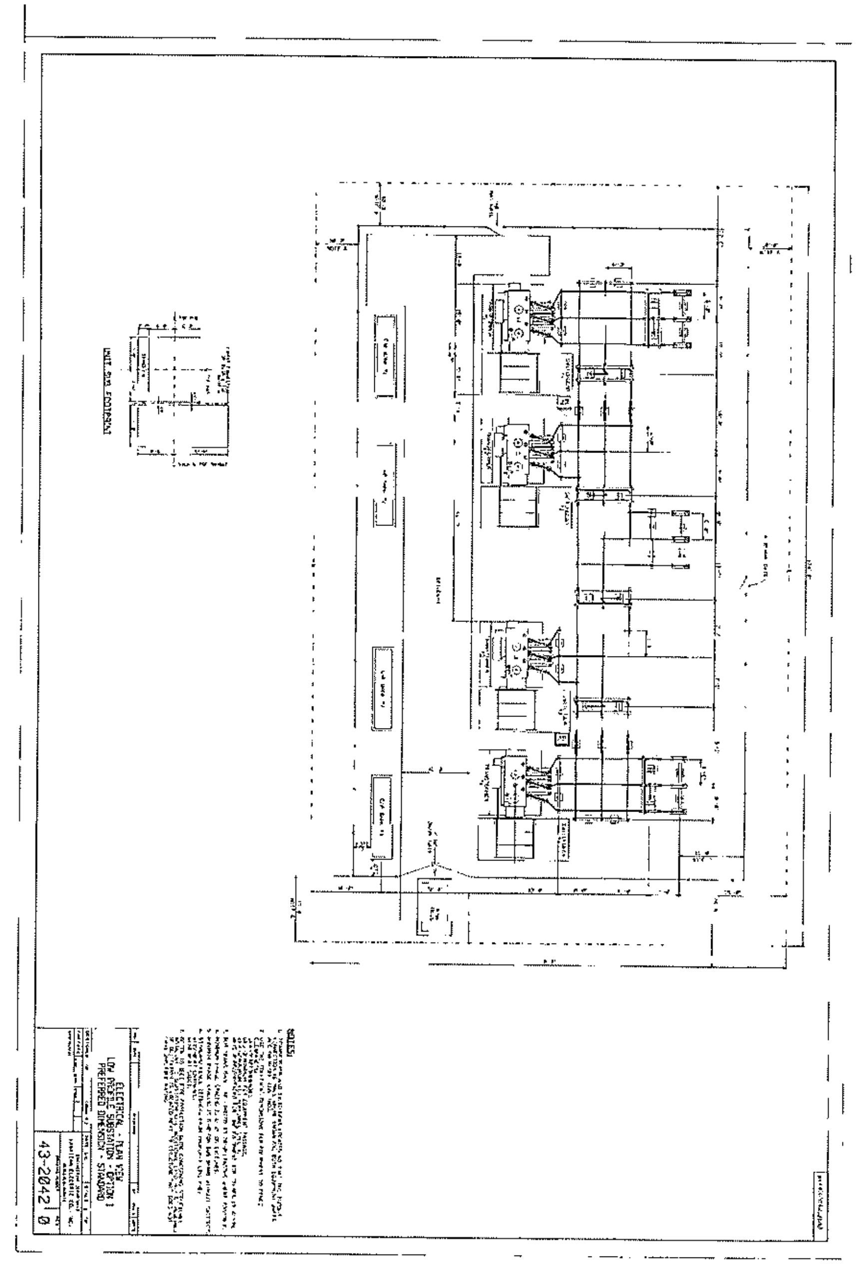
Attachment C

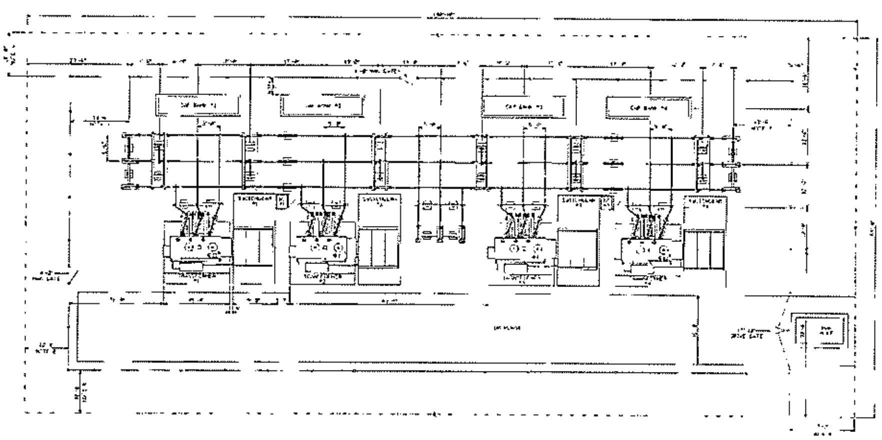
New Distribution Substation Sites

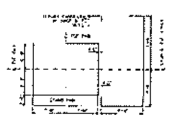


Attachment D

Distribution Substation Layouts







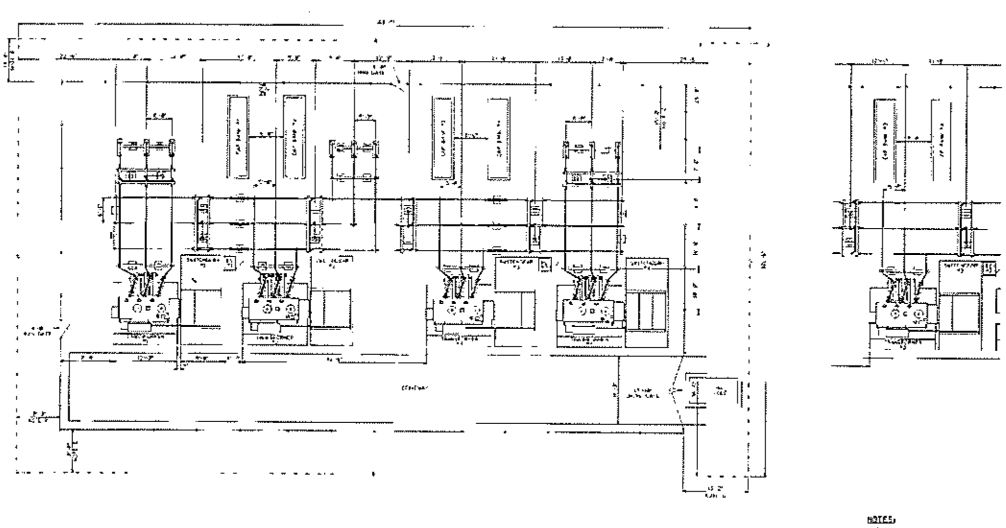
UNIT SUB FOOTPRINT

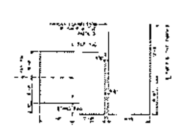
NOTES:

ELECTRICAL - PLAN VIEW
LOW PROFILE SUBSTATION - OPTION 3
MINIMUM DIMENSION - STANDARD

HAWAIIAN ELECTRIC CO., INC.

43-2046 | 0





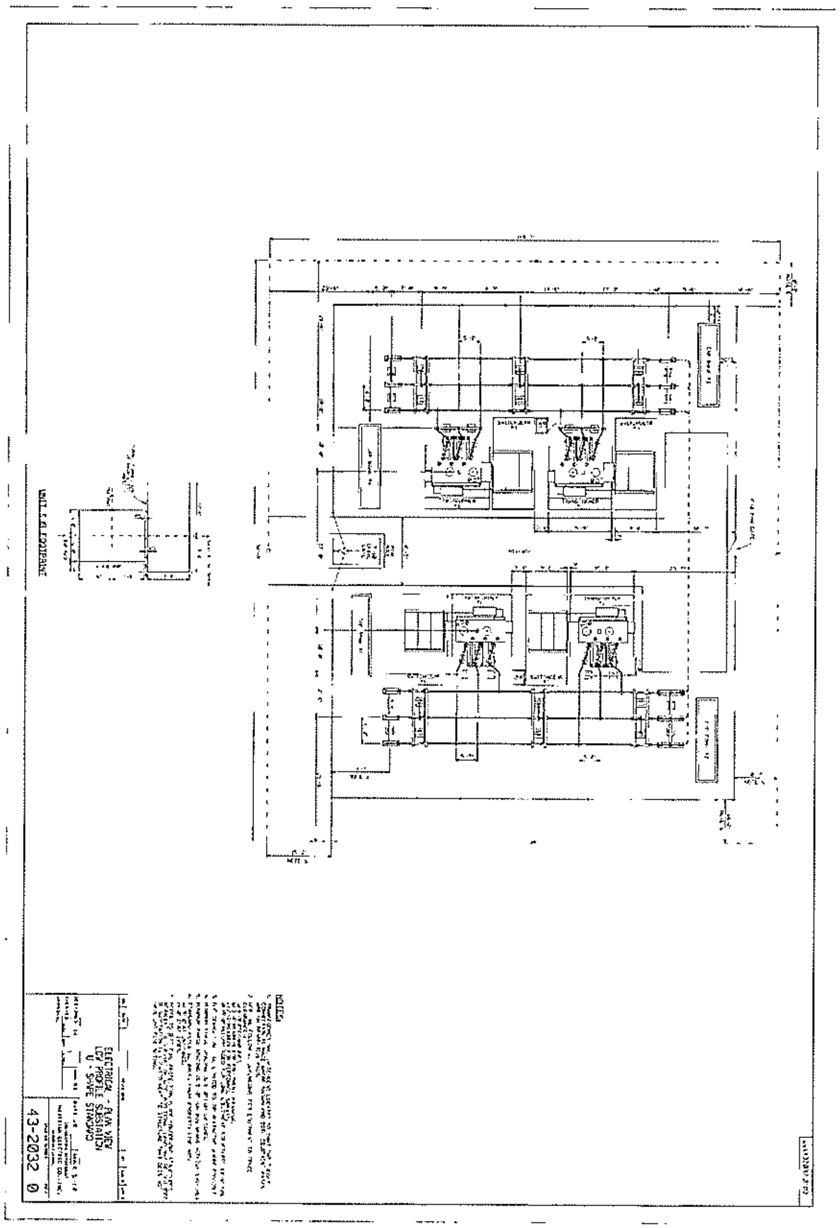
UNIT SUB FOOTPRINT

NOTES:

ELECTRICAL - PLAN VIEW
LOW PROFILE SUBSTATION - OPTION 2
MINIMUM DIMENSION - STANDARD

HAWAIIAN ELECTRIC CO., INC.

43-2044 | 0



Attachment E

HTCOM
Conference Memo

MK Engineers, Ltd.

Consulting Electrical Engineers
286 Kalihi St. $ Honolulu, Hawaii 96819
Telephone # (808) 848-8622 $ Fax # (808) 848-5574
e-mail address: ron@mkhawaii.com

CONFERENCE MEMORANDUM

Project:	Ho'opili Development, East Kapolei – D. R. Horton Schuler Division
Project No.:	06040
Location:	Hawaiian Telcom Airport Baseyard
Date:	4-25-06
Prepared By:	Ron Katahara
Attenders:	Messrs. Les Loo, Gary Sumida, Paul Hanohano, Cliff Onguay, Clay Tang, Kevin Choan of HT and Ron Katahara of MKE

Items of Discussion

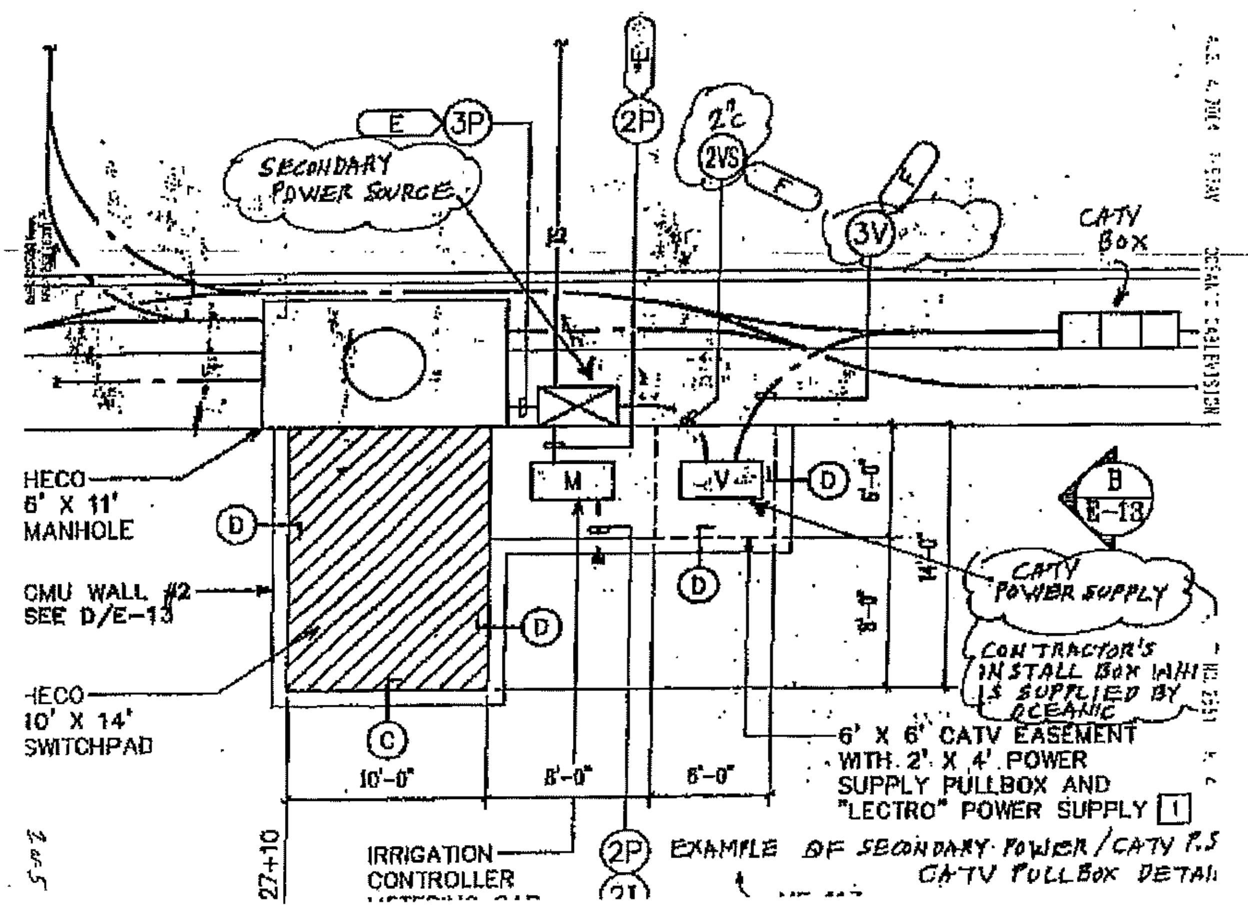
1. Katahara gave a brief overview of the project with reference to the overall colored map sent earlier with the letter to HT:
    a. 16000 single family homes
    b. Retail, commercial, industrial, schools
    c. HECO switching station/substation will stay in same location
    d. First home will be finished in 2012
    e. Development will span about 25 years and include 5 phases, each about 5 years in length
    f. Some data is available on the map – i.e.

2. Katahara requested information on existing easements and facilities in the area, where HT will bring service from and what their infrastructure requirements will be. The telephone systems engineers will study the project and make recommendations. Katahara requested desired location of facilities (hubs) and size of lot be provide while in this preliminary planning stage.
3. HT comments:
    a. Once source of service may be from Kapolei
    b. North South Road design is underway and there are 6 way ducts on the mauka side and 8 way ducts on the makai side. Service to Ho'opili might be from NS road. Ron Ho and Associates is doing the design of NS Road (Gary Funasaki).
    c. HT has not been contacted about the West Oahu Campus. They would like to know what the timing of that project is.
    d. The size of the Ho'opili development suggests that multiple hubs may be required for telephone service. Desire would be to have a lot near the center of area served for the hub.
    e. HT requested the electronic file of the subdivision plan so that they can begin planning and engineering.

END

Attachment F

CATV Power Supply Layout


E
3P
2P
2VS
F
3V
SECONDARY POWER SOURCE
CATV BOX
HECO 6' X 11' MANHOLE
CMU WALL #2 SEE D/E-13
HECO 10' X 14' SWITCHPAD
D
C
M
V
B
E-13
CATV POWER SUPPLY
CONTRACTOR'S INSTALL BOX WHI IS SUPPLIED BY OCEANIC
6' X 6' CATV EASEMENT WITH 2' X 4' POWER SUPPLY PULLBOX AND "LECTRO" POWER SUPPLY 1
10'-0"
8'-0"
6'-0"
14'-0"
27+10
IRRIGATION CONTROLLER
EXAMPLE OF SECONDARY POWER/CATV P.S
CATV PULLBOX DETAI

Appendix Q
Draft Project Master Plan

HO'OPILI

Draft Master Plan

February, 2008

Prepared by

PBR HAWAII & ASSOCIATES, INC.

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PLANNING AND PERMITTING'S
PROJECT MASTER PLAN
DETAILED REQUIREMENTS

The proposed Ho'opili project is located in the 'Ewa District and will require a zone change. According to the City and County of Honolulu, Department of Planning and Permitting (DPP) criteria, the proposed Ho'opili project would be considered a "significant" zone change. According to DPP, a Project Master Plan must be included as part of the Environmental Assessment (EA) or Environmental Impact Statement (EIS) for significant zone changes which are larger than a specified project size (any significant zone change involving 25 acres or more of land).

According to DPP, "the Project Master Plan is intended solely as a guide to help describe in words and illustrations how a project promotes the vision, policies, principles and guidelines for the Development Plan (DP) or Sustainable Communities Plan (SCP) area...The Project Master Plan should be based on the best information available to the applicant at the time the Environmental Assessment or Environmental Impact Statement is submitted [emphasis added]..."

The following is a Draft Master Plan for the proposed Ho'opili project, which will be finalized when resubmitted with the zone change application.

LIST OF FIGURES

(i) Statement of Consistency with the Development Plan or Sustainable Communities Plan

The Ho'opili Master Plan will be consistent with the vision, policies, and guidelines stated in the *Ewa Development Plan* (Ewa DP), as described in *Section 5.3.2 Ewa Development Plan* of the EIS.

(ii) Site Analysis

The following is a description of prominent site features and their relationship to the proposed development of the property.

Topography. The approximately 1,600.265-acre Project Area consists of 10 distinct parcels of land (See Figure 1: Parcels Map). Parcels A, B, C, D1, D2 and G are situated makai of the H-1 Freeway while Parcels E1, E2, E3, and F are situated mauka of the H-1 Freeway. The topography of each of the 10 parcels is described below.

The topography of Parcel A ranges from approximately 150 feet above mean sea level (MSL) at Farrington Highway to approximately 210 feet MSL at the H-1 Freeway. The slope of Parcel A is 3 percent.

The topography of Parcel B ranges from approximately 170 feet MSL at the southwestern boundary (at Farrington Highway) to approximately 205 feet MSL at its northwestern boundary (at the H-1 Freeway). The topography of Parcel B at the southeastern boundary (at Farrington Highway) is approximately 75 feet MSL and approximately 175 feet MSL at the northeastern boundary (at the H-1 Freeway). The slope of Parcel B is between 1.9 percent and 3.2 percent.

The topography of Parcel C ranges from approximately 65 feet MSL at its southern boundary to approximately 175 feet MSL at Farrington Highway. The slope of Parcel C is 1.4 percent. A ravine and steep, east-facing slope are located on the eastern boundary of the Parcel C, along Old Fort Weaver Road.

The topography of Parcel D1 ranges from approximately 10 feet MSL at its northern boundary to approximately 40 feet MSL at its northern boundary. The central portion of Parcel D1 is 25 feet MSL. The slope of Parcel D1 is 1.2 percent. Parcel D2 ranges from 0 feet at its northern boundary to 35 feet MSL at its southern boundary with a slope of 1.1 percent.

The topography of Parcels E1, E2 and E3 ranges from approximately 410 feet MSL at their southern boundaries to 415, 430 and 415, respectively at their northern

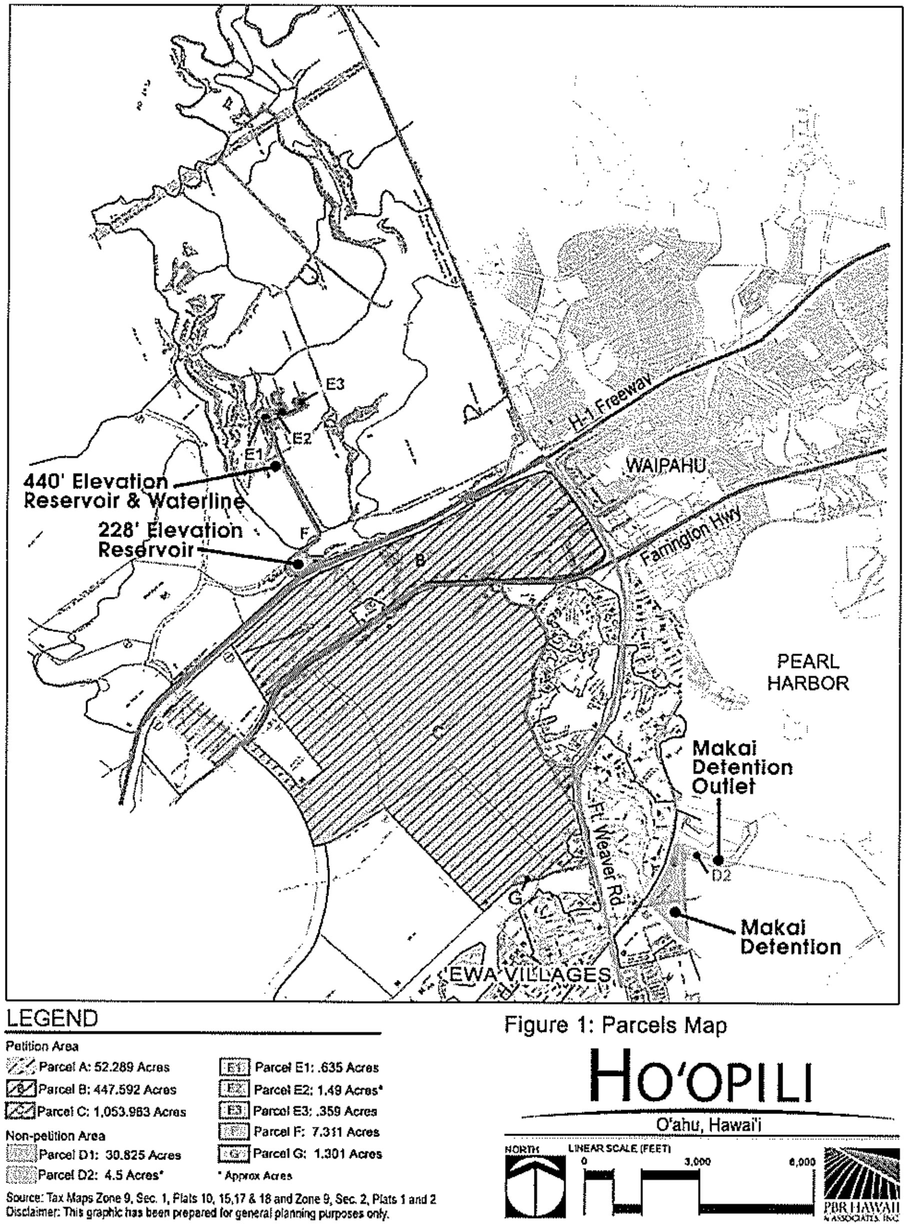


Figure 1: Parcels Map

boundaries. The slope of parcel E1 is 2.8 percent, the slope of E2 is 3.5 percent, and the slope of E3 is 3.9 percent.

The topography of Parcel F runs with an east-west slope with an elevation of 240 feet MSL on the western boundary and an elevation of 205 on the eastern edge. The center of the parcel is at an elevation of 220 feet. Parcel F has a slope of 3.49 percent on the east-west axis.

Parcel G is very small and located along the makai edge of Parcel C, bordering the 'Ewa Villages Golf Course. The slope of Parcel G is approximately 1.4 percent.

The entire Project Area has been historically utilized for sugarcane cultivation and large portions are currently utilized for agricultural production. As such, the Project Area has been extensively modified with dirt roadways, various irrigation systems, and other appurtenant agricultural structures.

The topography of the Project Area is mostly gently sloping (and highly accessible) and provides adequate slope for drainage. The Project Area will be modified with infrastructure improvements and urban structures for residential, commercial, industrial, recreational and educational uses. The Project Area will include drainage detention basins, open space buffers, parks and some undeveloped areas. Most of the developed areas will be extensively landscaped, which will minimize the potential for soil erosion.

Soils. Three soil suitability studies have been prepared for lands in Hawai'i. The principal focus of these studies is to describe the physical attributes and relative productivity of different land types for agricultural production within the State of Hawai'i. The three studies are the U.S. Department of Agriculture (USDA) *Natural Resources Conservation Service Soil Survey*, the University of Hawai'i Land Study Bureau *Detailed Land Classification*, and the State of Hawai'i, Department of Agriculture's *Agricultural Lands of Importance to the State of Hawaii* (ALISH).

Natural Resources Conservation Service Soil Survey. The U.S. Department of Agriculture Natural Resources Conservation Service identified sixteen general soil types within the property (See Figure 2: Natural Resources Conservation Services Soil Survey Map). The soil types include:

- 'Ewa Silty Clay Loam, 3 to 6 percent slopes (EaB);
- Honouliuli Clay, 0 to 2 percent slopes (HxA);
- Honouliuli Clay, 2 to 6 percent slopes (HxB);
- Kaloko Clay, Noncalcareous Variant (Kfa);
- Kawaihāpai Clay Loam, 0 to 2 percent slopes (KlB);

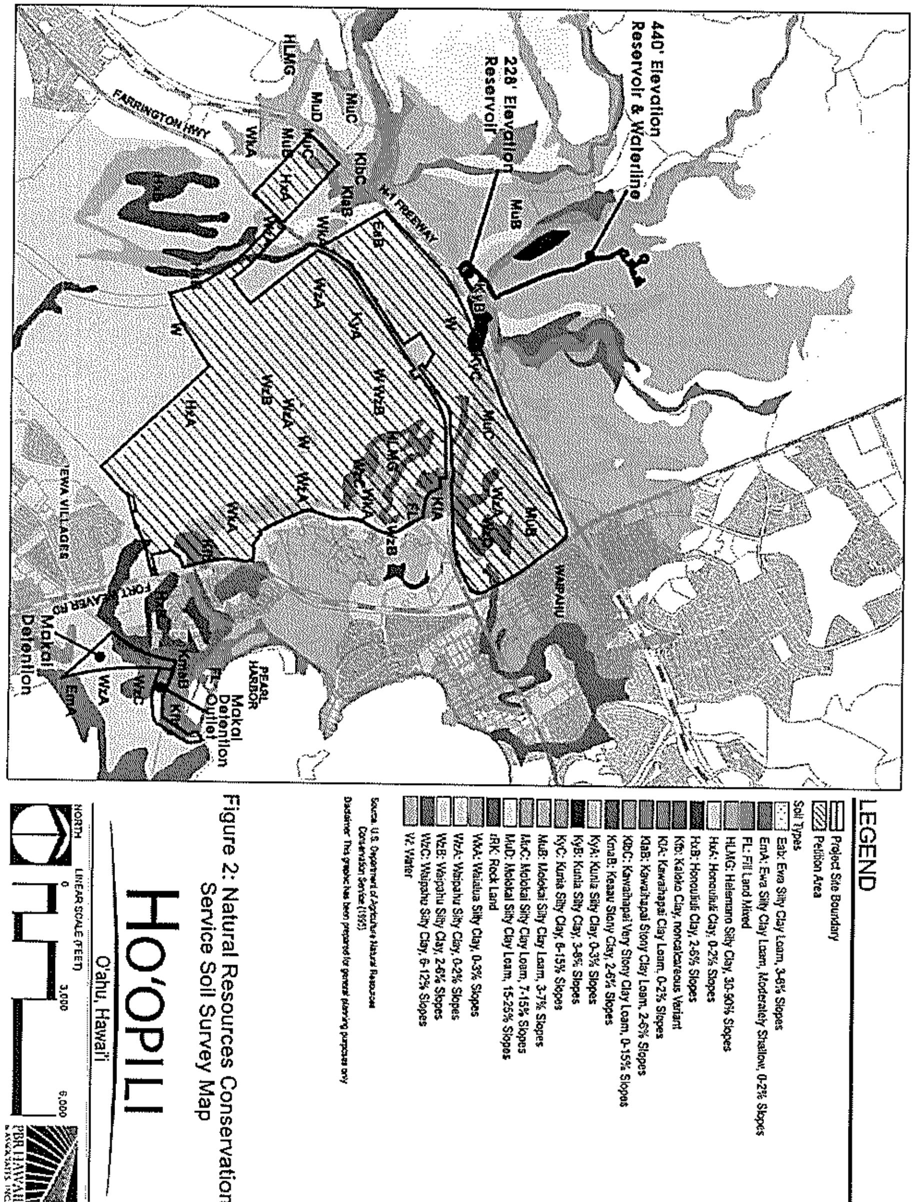


Figure 2: Natural Resources Conservation Service Soil Survey Map

HO'OPILI

O'ahu, Hawai'i

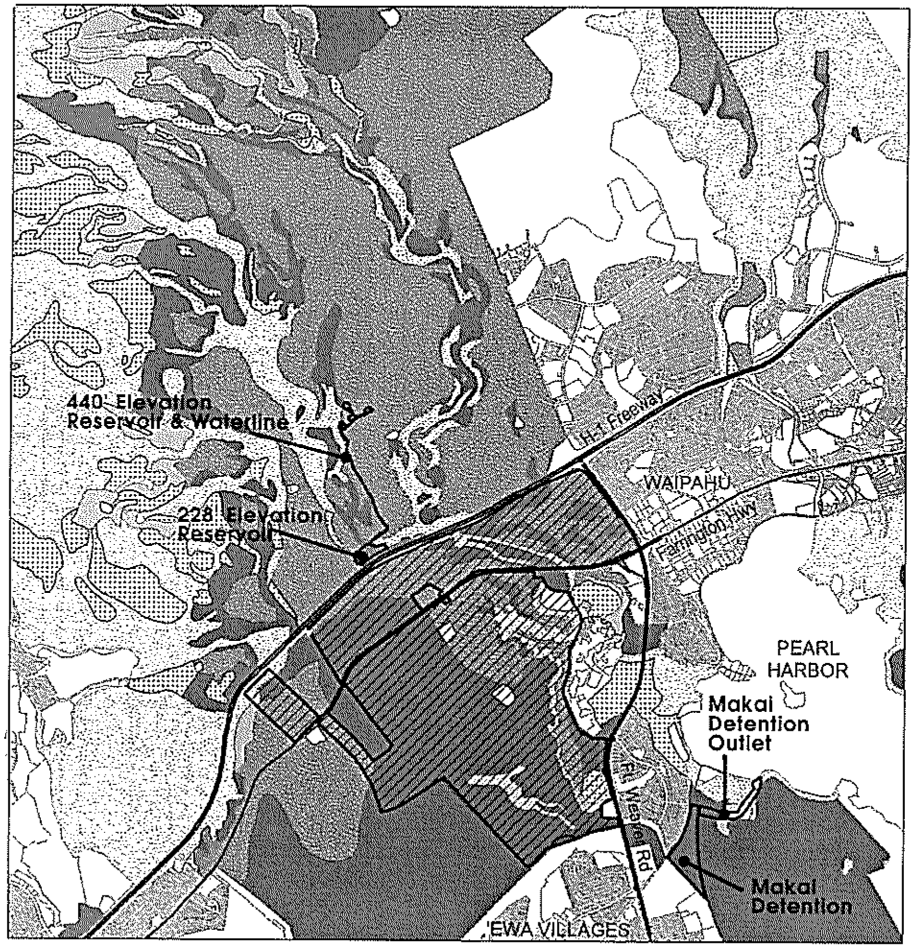
- Kolekole Silty Clay Loam, 6 to 12 percent slopes (KuC);
- Kolekole Silty Clay Loam, 12 to 25 percent slopes (KuD);
- Kunia Silty Clay, 0 to 3 percent slopes (KyA);
- Kunia Silty Clay, 3 to 8 percent slopes (KyB);
- Kunia Silty Clay, 8 to 15 percent slopes (KyC);
- Moloka'i Silty Clay Loam, 3 to 7 percent slopes (MuB);
- Moloka'i Silty Clay Loam, 7 to 15 percent slopes (MuC);
- Waialua Silty Clay, 0 to 3 percent slopes (WkA);
- Waipahu Silty Clay, 0 to 2 percent slopes (WzA);
- Waipahu Silty Clay, 2 to 6 percent slopes (WzB); and
- Wahiawā Silty Clay Loam, 0 to 3 percent slopes (WaA).

Land Study Bureau Detailed Land Classification. The *Detailed Land Classification* (1965 through 1972) series was produced for each island by the Land Study Bureau (LSB) of the University of Hawai'i. The intent of this series of reports was to develop a land inventory and productivity evaluation based on statewide standards of crop yields and levels of management.

A five-class productivity rating is applied using the letters A, B, C, D and E, with A representing the class of highest productivity and E the lowest. Most of the soils within the Project Area are rated B (See Figure 3: Land Study Bureau Land Classification). Other soils are rated A, with fewer soils rated C, D and E. These soil ratings reflect the Project Area's past and present use for agricultural production under irrigated conditions.

Agricultural Lands of Importance to the State of Hawaii. *The Agricultural Lands of Importance to the State of Hawaii* (ALISH) (1977) system classifies lands that are important to agriculture in Hawai'i as Prime, Unique, or Other Agricultural Land, with Prime Agricultural Land representing the class of greatest importance and Other Agricultural Land the least. Most of the Project Area includes soils identified as Prime Agricultural Land, which is defined as "land best suited for the production of food, feed, forage, and fiber crops." The remaining lands are identified as Other Agricultural Land (which is important to agriculture in Hawai'i but exhibits properties that exclude it from the Prime or Unique Agricultural Land classifications) or are not classified by the ALISH system (See Figure 4: Agricultural Lands of Importance to the State of Hawaii).

While the Project Area contains soil with good agricultural productivity, State and County land use policy has directed growth towards 'Ewa, makai of the H-1 Freeway.



LEGEND

- Project Site Boundary
- Petition Area

Soil Classification

- A (Excellent)
- B (Good)
- C (Fair)
- D (Poor)
- E (Very Poor)
- Not Classified

Source: Land Study Bureau (1967)
Disclaimer: This graphic has been prepared for general planning purposes only.

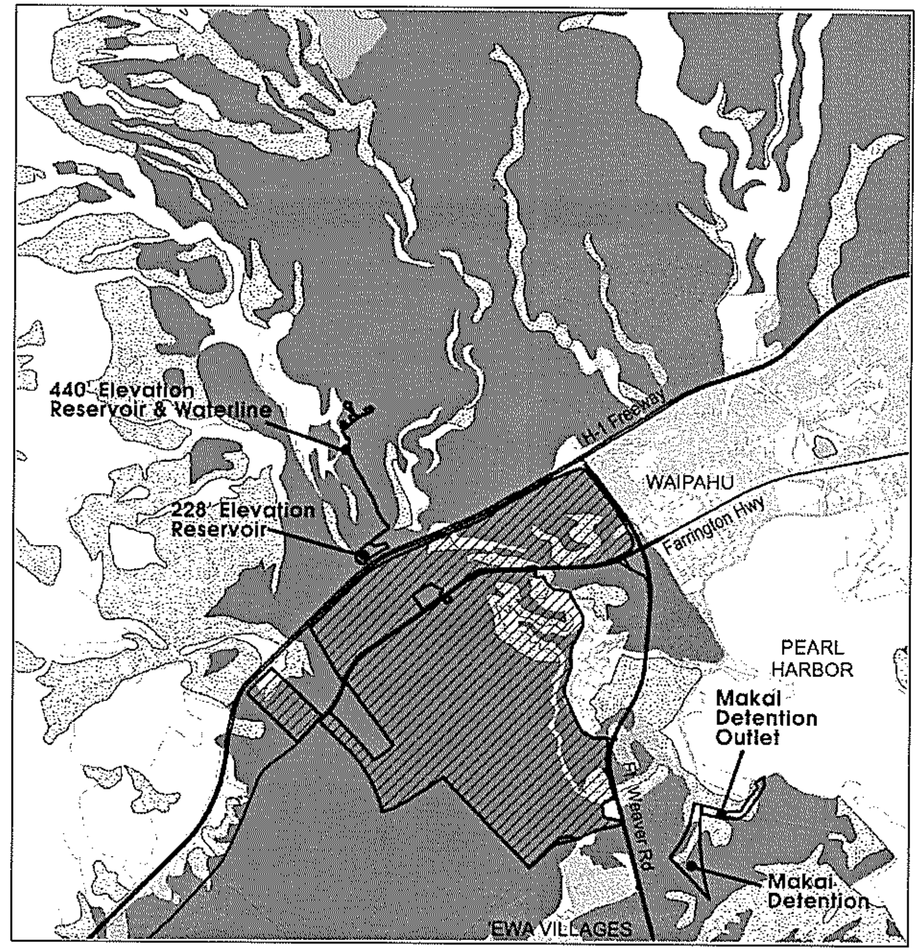
Figure 3: Land Study Bureau Land Classification

HO'OPILI

O'ahu, Hawai'i

NORTH LINEAR SCALE (FEET) 0 3,500 7,000

PBR HAWAII & ASSOCIATES, INC.



LEGEND

- Project Site Boundary
- Petition Area
- Prime Agricultural Lands
- Unique Agricultural Lands
- Other Agricultural Lands
- Unclassified Agricultural Lands

Source: State Dept. of Agriculture (1977).
Disclaimer: This graphic has been prepared for general planning purposes only.

Figure 4: Agricultural Lands of Importance to the State of Hawaii (ALISH)

HO'OPILI

O'ahu, Hawai'i

NORTH LINEAR SCALE (FEET) 0 3,500 7,000

PBR HAWAII & ASSOCIATES, INC.

Drainage. The Project Area is within three distinct drainage basins. These are the Kalo'i drainage basin, the Honouliuli Stream drainage basin and the West Loch drainage basin.

Kalo'i Drainage Basin. The Kalo'i Basin stretches to the top of the eastern slopes of the Wai'anae mountain range and terminates near the ocean in the vicinity of Haseko's Ocean Pointe development. The drainage basin mauka of the H-1 Freeway is 3,000 acres and generates a peak flow of 5,000 cubic feet per second (CFS). The drainage basin size increases to 4,330 acres and carries a peak flow of 8,900 CFS at the entrance to 'Ewa Villages. Approximately 100 acres of the Ho'opili project are within this watershed.

With respect to the portion of the project within the Kalo'i drainage basin, the project will be creating on-site detention basins to collect all storm water runoff and discharge the flow at a rate that will not exceed pre-development conditions. The project will also be providing storage and detention to meet the City and County of Honolulu Drainage Standards with respect to water quality standards. The basin size could be decreased at some time in the future when the terminus of Kalo'i basin is finalized. All developed projects discharging to the Kalo'i basin currently have discharge restrictions and these restrictions will continue until the Kalo'i basin terminus is finalized. The portions of the project within the Kalo'i drainage basin are Parcels A and the western most part of Parcel C adjacent to the North-South Roadway alignment. The D.R. Horton - Schuler Division will continue to coordinate with County and State agencies to discuss issues within the Kalo'i Gulch Watershed.

Honouliuli Stream Drainage Basin. The Honouliuli Stream drainage basin also stretches to the top of the eastern slopes of the Wai'anae mountain range. This basin contains 6,600 acres (11,200 CFS – peak flow) of drainage area mauka of the H-1 Freeway and expands to 7,880 acres (12,300 CFS – peak flow) at its connection with the West Loch of Pearl Harbor. The terminus location is in the vicinity of the West Loch Golf Course. Approximately 635 acres of the Ho'opili project are in the Honouliuli Stream drainage basin. The portions of the project within the Honouliuli Stream drainage basin are Parcels B and the northeastern part of Parcel C adjacent to Old Fort Weaver Road.

With respect to the Honouliuli Stream drainage basin, the project will provide detention basins to collect all storm water runoff and discharge the flow at a rate that will not exceed the 10-year recurrence flow rate. This is the recognized capacity of the Honouliuli Stream channel.

West Loch Drainage Basin. The West Loch drainage basin is the smallest drainage basin affecting the project. The basin upper reaches begin at the makai side of the H-1 Freeway and generally terminates at two locations at the West Loch of Pearl Harbor. One terminus is through West Loch Estates and the other is an overflow from an existing detention basin located east of Fort Weaver Road and just south of the OR&L railroad tracks (See Parcel D1 on Figure 1: Parcels Map). This basin contains approximately 937 acres and generates a peak flow of 2,500 CFS. The total basin is within lands that are part of the Ho'opili project.

With respect to the West Loch drainage basin, the project intends to collect all storm water and route it to the existing detention basin located on the east side of Fort Weaver Road and south of the OR&L railroad tracks. The routing would require the installation of a concrete channel from the southeastern end of Parcel C, under Fort Weaver Road (using the existing cane haul underpass) and connecting to the existing detention basin. The basin would be expanded to ensure that the water quality storage component of the City and County of Honolulu Standards was achieved. An overflow from the detention basin would discharge to the West Loch of Pearl Harbor (See Parcel D2 on Figure 1: Parcels Map). The portion of the project within the West Loch drainage basin is the bulk of Parcel C (See Figure 5: Drainage Basins).

The overflow from the detention basin would have to cross Navy property. Permission of the Navy would be required. Initial inquiries have been made to the Navy to see if the overflow can be negotiated. Issues with the Navy include security and access in a post- "9/11" environment, Navy plans for development in the overflow corridor, and the acquisition of a maintenance commitment by the City and County of Honolulu. The concept of the overflow across Navy property is not new and was approved in concept back in the early- to mid- 1990's. Lack of action and the issues cited above are points that need to be resolved for the overflow option to move forward.

If permitted, the overflow option across Navy property will solve drainage problems occurring on Fort Weaver Road, within West Loch Estates and within portions of 'Ewa Villages by effectively collecting the storm water that currently is misdirected across these properties.

The alternative drainage solution if the overflow across Navy property cannot be resolved is to construct retention basins on site holding back the total volume of a 100 year- 24 hour storm. These basins would be located on the southern portion of Parcel C.

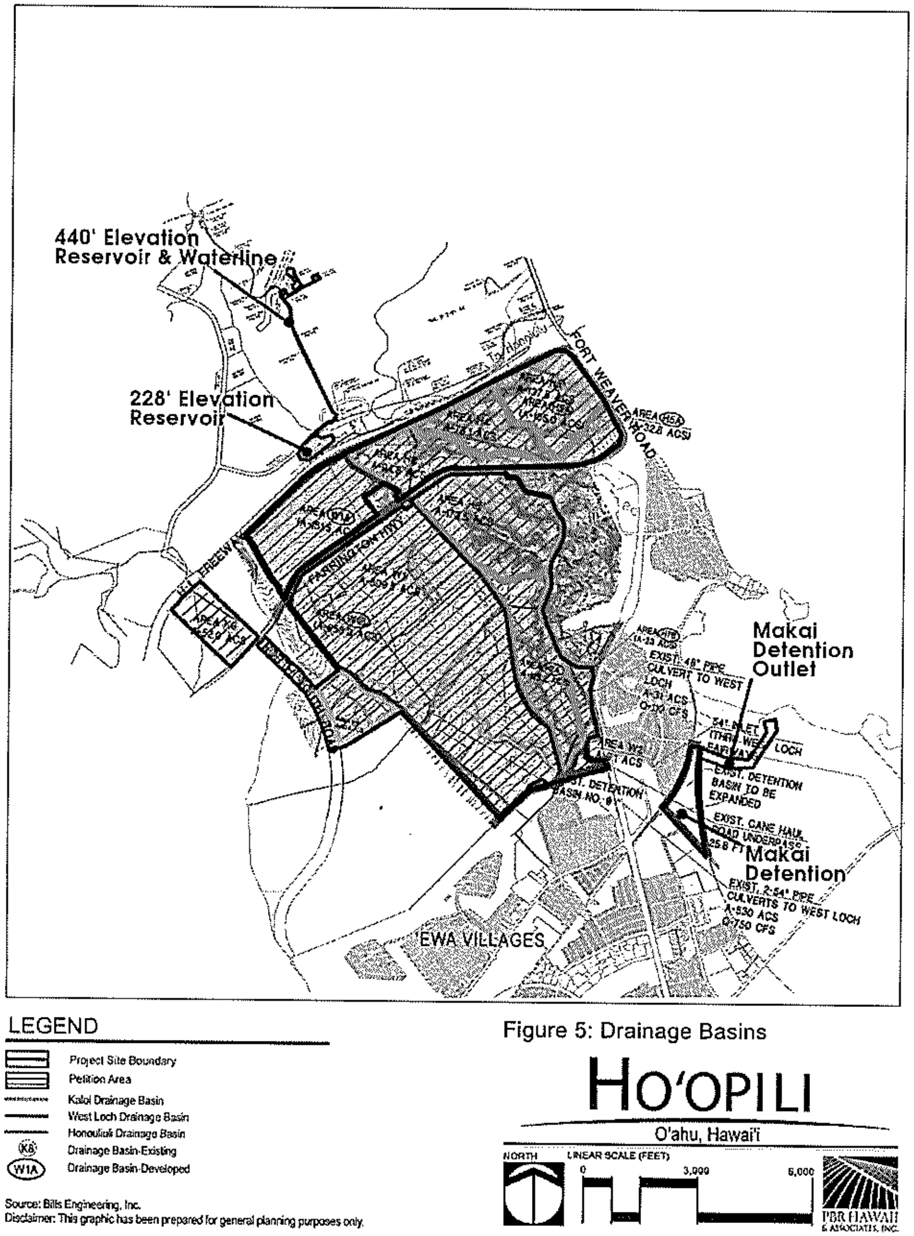


Figure 5: Drainage Basins

Grading. The Project Area will be modified with infrastructure improvements and urban structures for residential, commercial, industrial, recreational and educational uses. The Project Area will include drainage detention basins, open space buffers, parks and some undeveloped areas. Most of the developed areas will be extensively landscaped, which will minimize the potential for soil erosion.

Geotechnical Considerations. No significant geological and/or geotechnical constraints that would preclude the proposed development are expected to be encountered. The primary geotechnical considerations for the development of this property appear to be site drainage, abandoned agricultural infrastructure, (assumed to be) expansive soil conditions, and possible backfilled, undocumented ditches or reservoirs associated with past use of the land. Due to the relatively dry climatic conditions of the 'Ewa Plain, it is important that proper site drainage and landscaping, along with a permanent irrigation system, be developed to help control the (assumed) expansive soils and reduce the potential for significant erosion of soil materials.

Flora. According to the botanical survey reports, conducted by LeGrande Biological Surveys, Inc., in August 2006, most of the Project Area is currently plowed and devoid of trees and brush. Other lands within the Project Area are uncultivated brushland or pastureland. The vegetation is typical of agriculturally cultivated cropland or highly disturbed weedy areas. Little of the original native vegetation remains after over a century of intensive sugarcane agriculture and periodic burning. Native species have been replaced by aggressive non-native plant species. No federally listed endangered or threatened native plants, or candidate endangered species, were encountered on the property. Additionally, no wetlands occur on the property.

None of the plant species which occurred on the Project Area are considered a threatened and endangered species or a species of concern. Although a concerted effort was made in surveying for ko'oloa'ula (*Abutilon menziesii*), no plants were observed on the property. As such, the proposed project is not expected to have a significant negative impact on the botanical resources in this part of O'ahu.

Fauna. According to the biological survey reports prepared by Rana Productions, Ltd., in February 2008, the mammalian and avian species currently found within the Project Area are by and large alien species. All of the mammalian species identified are alien and only three of the avian species present are indigenous. A variety of rats and mice are present in some locations, and are strongly suspected to be present in other areas. Although presence of the endangered Hawaiian Hoary bat (*Lasiurus cinereus semotus*) was suspected, none were observed during the surveys.

The majority of the sites surveyed within the Project Area are lands formerly cultivated in sugarcane or pineapple, having led to high degrees of disturbance or destruction of native habitat. Current habitats are deemed "depauperate" (severely diminished) by the biological consultant. Some of the sites are currently under partial cultivation, but those habitats likewise have been severely degraded.

The notable exceptions to the above are the four endangered waterbird species which currently inhabit the National Wildlife Refuge located north of Parcels D1 and D2 (See Figure 1: Parcels Map). The Pearl Harbor National Wildlife Refuge was established in 1972 as mitigation for construction of the Honolulu International Airport Reef Runway. The refuge is primarily devoted to the recovery of four endemic and endangered waterbirds [Hawaiian Duck x Mallard hybrids (*Anas wyvilliana x platyrhynchos*), Common Moorhen (*Gallinula choropus sandvicensis*), Hawaiian Coot (*Fulica alai*) and Black-necked Stilt (*Himantopus mexicanus knudseni*)]. The refuge is composed of two units, the 37-acre Honouliuli Unit bordering West Loch and the 25-acre Waiawa Unit bordering Middle Loch.

These waterbirds are likely to utilize the detention basin once sufficient water collects to allow ponding. There may be periodic disturbance to the waterbird species if temporary construction occurs within the detention basin (to enlarge it) or if an outlet is allowed. As previously noted, the waterbirds breed in the Honouliuli Unit of the National Wildlife Refuge, less than a sixth of a mile (250 meters) north of Parcels D1 and D2.

Impacts to the other existing mammalian and avian species and their habitats are expected to be minimal. Displacement of alien species is likely to occur as construction and development infill takes place, but these species will re-inhabit any un- or underutilized locations once development is complete. No other mitigation measures are planned for the remaining faunal species.

Historic Sites. An archaeological inventory survey report for the Project Area was conducted in February 2006 by Cultural Surveys Hawai'i Inc. This report is included in Appendix D of the EIS. Five historic properties (SIHP Nos. 50-80-12-4344, 4345, 4346, 4347, and 4348) were documented during Cultural Surveys Hawai'i's (CSH) archaeological inventory survey of the Petition Area. All five historic properties have been assessed as eligible for the State Register of Historic Places under Criteria C and D, except for Site 4344, which is only eligible under criterion D. The State of Hawai'i, Department of Land and Natural Resources, Historic Preservation Division (SHPD) concurs with these significance assessments. All five historic properties are located in the vicinity of Old Fort Weaver Road).

SIHP Nos. 50-80-12-4344. A survey conducted by CSH in 1990 identified three iron pipe features, including a tall metal post and two welded pipe constructions, located in the vicinity of the Drivers/Stable Villages. The age and function of these features elucidate out record of plantation life in 'Ewa. A more recent inventory study conducted by CSH in 2005 could not locate the previously identified features as the area had been bulldozed and the features destroyed. However, four additional plantation infrastructure features adjacent to Honouliuli Gulch were identified. These features were added to the site description, and will not affect the significance and recommendation for this site ("no preservation").

SIHP Nos. 50-80-12-4345 ('Ewa Plantation Railroad Berm). The 'Ewa Plantation Company operated an approximately 30-mile private railroad from 1890 – 1947 for the primary purpose of the transport of sugar cane. While the railroad runs throughout the Petition Area, a particularly good section of railroad can be found in the northeastern portion of the Petition Area in the mouth of a dry stream valley. A railroad berm runs on both sides of the valley access road with well-preserved facings approximately 2 meters in height. The archaeological consultant recommended that the railroad berm be preserved through incorporating the feature into the development of the project where feasible.

SIHP Nos. 50-80-12-4346 (Northern Pumping Station). A survey conducted by CSH in 1990 previously determined the site's significance under Criteria C and D. The site consists of a pumping station with a deep rectangular basalt block, faced wall. The site is believed to pre-date 1928. An adjacent single pump house, which has an exterior or corrugated sheet metal panel construction, is located nearby. The archaeological consultant recommended that the well be preserved and that issues of significance and proper historic documentation be resolved with the SHPD office in advance of any development in the area to avoid adverse impacts. A preservation plan has been drafted and will be submitted to SHPD for review and comments.

SIHP Nos. 50-80-12-4347 (Central Pumping Station). A survey conducted by CSH in 1990 previously determined the site's significance under Criteria C and D. The site consists of a pumping station with a deep rectangular basalt block, faced wall. The site is believed to pre-date 1928. Eight features related to and in the immediate vicinity of the well include a number of small architectural and/or industrial features. The archaeological consultant recommended that the well and portions of the site be preserved. The significance of the site would be evaluated after an assessment of the significance of the architectural features and the assessment of the significance of the 'Ewa Village area. A preservation plan has been drafted and will be submitted to SHPD for review and comments.

SIHP Nos. 50-80-12-4348 (Southern Pumping Station). A survey conducted by CSH in 1990 previously determined the site's significance under Criteria C and D. The site consists of a pumping station with a deep rectangular basalt block, faced wall. The site is believed to be constructed shortly after 1928. An adjacent single pump house, which has an exterior or corrugated sheet metal panel construction, is located nearby. The archaeological consultant recommended that the well be preserved and that issues of significance and proper historic documentation be resolved with SHPD in advance of any development in the area to avoid adverse impacts. A preservation plan has been drafted and will be submitted to SHPD for review and comments.

Research of earlier maps indicates four areas of interest: the Honouliuli taro lands, Kapalani Church, Pipe Line Village and Drivers/Stable Villages. All are located in the vicinity of Old Fort Weaver Road, well below from the main development area.

The Honouliuli taro lands were probably nineteenth century (and earlier) Hawaiian habitation and agricultural area. However, no surface or subsurface remains were found during the 2005 inventory survey. CSH has determined that no additional testing is necessary. However, CSH is recommending on-call/on-site archaeological monitoring during any future development in this area. SHPD concurs with this recommendation.

The Kapalani Church was a nineteenth century Hawaiian Catholic Church, schoolhouse and possible cemetery area. Pipeline Village and the Drivers/Stable Villages were early twentieth century immigrant plantation habitation camps. No surface or subsurface remains were found during the 2005 inventory survey. CSH has determined that no additional inventory survey is necessary. However, CSH is recommending on-call/on-site archaeological monitoring during any future development in this area. SHPD concurs with this recommendation.

SHPD concurs with the consulting archaeologist's (Cultural Surveys Hawai'i) mitigation recommendations, which include: (1) no further archaeological work at Site 4344, (2) preservation of Sites 4345, 4346, 4347, and 4348, and (3) archaeological monitoring in the vicinity of the four areas of historic habitation (Honouliuli taro lands, Kapalani Catholic Church, Pipeline Village, and Drivers/Stable Village).

According to SHPD, the archaeological inventory survey report is now accepted in fulfillment of *Hawaii Administrative Rules* 13-284 and 13-276 (See EIS Appendix E). A preservation plan and archaeological monitoring plan will be prepared and submitted to SHPD for their review and approval. All five sites are located near

Old Fort Weaver Road and well away (and below the bluff) from the main Petition Area. Should any archaeologically significant artifacts, bones, or other indicators of previous on-site activity be uncovered during construction, work will stop immediately and the will be notified in accordance with applicable regulations.

View Analysis. The Petition Area is located in 'Ewa (the area roughly bounded by the H-1 Freeway to the north, Kapolei Golf Course, Kapolei Middle School and the Villages of Kapolei to the west, 'Ewa Villages to the south, and Honouliuli and Fort Weaver Road to the east). Most of 'Ewa is mostly open and is being cultivated. The major man-made features in 'Ewa besides roads (such as Farrington Highway and the North-South Road – under construction) are HECO's transformer station along Farrington Highway and its overhead 138kV powerlines and supporting tower structures crossing the H-1 Freeway, and running along Farrington Highway and North-South Road.

As is the case with the rest of 'Ewa, Parcels A, B and C of the Petition Area are presently undergoing various forms of diversified agriculture. A portion of the Petition Area is being developed during the construction of North-South Road (construction on-going). Views of the Wai'anae Mountains and Diamond Head are offered from certain locations of the project site. However, since most of the Petition Area is being actively cultivated, the public does not have the opportunity to experience these views. The most heavily traveled roadways in the vicinity of the site are the H-1 Freeway and Fort Weaver Road. In fact, as DPP noted in their comments on the EISPN, the *Ewa Development Plan* Open Space Map shows that "panoramic views" of the property are available from these roadways. While nearly all of the Petition Area is lower in elevation than the H-1 Freeway, views makai from H-1 Freeway are infrequent along the stretch of the Freeway between where Kunia Road and Palehua Road cross the Freeway. In some sections of the H-1 Freeway, it appears that the Freeway was cut across slopes and/or the makai shoulder of the Freeway was graded with berms. At posted Freeway speeds of 60 miles per hour, viewing the Petition Area while driving is hazardous.

Most of the Petition Area is higher in elevation than Fort Weaver Road, but lower in elevation than the H-1 Freeway.

The most visible portion of the Petition Area from either the H-1 Freeway and/or Kunia Road/Fort Weaver Road is located near the intersection of the H-1 Freeway and Kunia Road or from Farrington Highway.

The visual appearance of the Petition Area as well as the rest of 'Ewa (including the Kroc Center, UHWO and DHHL East Kapolei Development Parcel 2) will change from vacant scrub and cultivated vegetation to a landscaped mixed-use community with parks and open space. The HHCTC project, a possible transit maintenance and storage facility, transit-oriented development, project landscaping, and the project's architectural design will set the visual character of the Petition Area. .

Analysis of Surrounding Uses. The Project Area consists of 1,553.844 acres of the 1,600.265 acres in the Project Area. The Project Area consists of 10 distinct parcels of land situated within the Agricultural District. For purposes of this EIS, the parcels have been labeled as A, B, C, D1, D2, E1, E2, E3, F and G (See Figure 1: Parcels Map). The Project Area parcels are A, B and C. The remaining Project Area parcels, D1, D2, E1, E2, E3, F and G, do not need to be reclassified to urban.

Parcel A is located west of Parcels B and C, and north of the UHWO. It is bordered by State land to the west, Farrington Highway to the south, the proposed North-South Road (under construction) to the east, and the H-1 Freeway to the north.

Parcel B is located north (mauka) of Parcel C and Farrington Highway. It is the second largest of the 10 parcels. Parcel B is bordered to the west by land proposed for multi-family residential use by the Housing and Community Development Corporation of Hawai'i (HCDCH), to the south by Farrington Highway, to the east by Kunia Road, and to the north by the H-1 Freeway. An out-parcel along Farrington Highway is used by HECO.

Parcel C is located south (makai) of Farrington Highway. It is the largest of the 10 parcels. Parcel C is bordered by the proposed North-South Road to the west; State of Hawai'i, Department of Hawaiian Home Lands (DHHL) landholdings, 'Ewa Villages, and the 'Ewa Villages Golf Course to the south; Old Fort Weaver Road and (new) Fort Weaver Road to the east; and Farrington Highway to the north. There are two out-parcels along Farrington Highway. One out-parcel of land near the planned University of Hawai'i West O'ahu (UHWO) campus and North-South Road is proposed for multi-family residential use by HCDCH. The other out-parcel of land is used by the City and County of Honolulu, Board of Water Supply (BWS).

Parcel D1 is located east of the other four parcels and Fort Weaver Road. Pearl Harbor National Wildlife Refuge is located to the north, West Loch Estates is located to the northwest, 'Ewa by Gentry is located to the south and southwest, and Waipahu and Pearl Harbor are located to the east.

Parcel D2 functions as an outlet, connecting Parcel D1 to Pearl Harbor and its use would require approval from the United States Navy.

Parcels E1, E2 and E3 are located north (mauka) of the H-1 Freeway. The parcels are numbered from west to east, with E1 on the west and E3 on the east. All are surrounded by open space, and are connected to Parcel F via narrow parcel of land which will serve as a waterline.

Parcel F is located north (mauka) near to the H-1 Freeway. It is linked to Parcels E1, E2 and E3 by a narrow band of land. It is bordered by the H-1 Freeway on the southern boundary and by open space on its north, east and western sides.

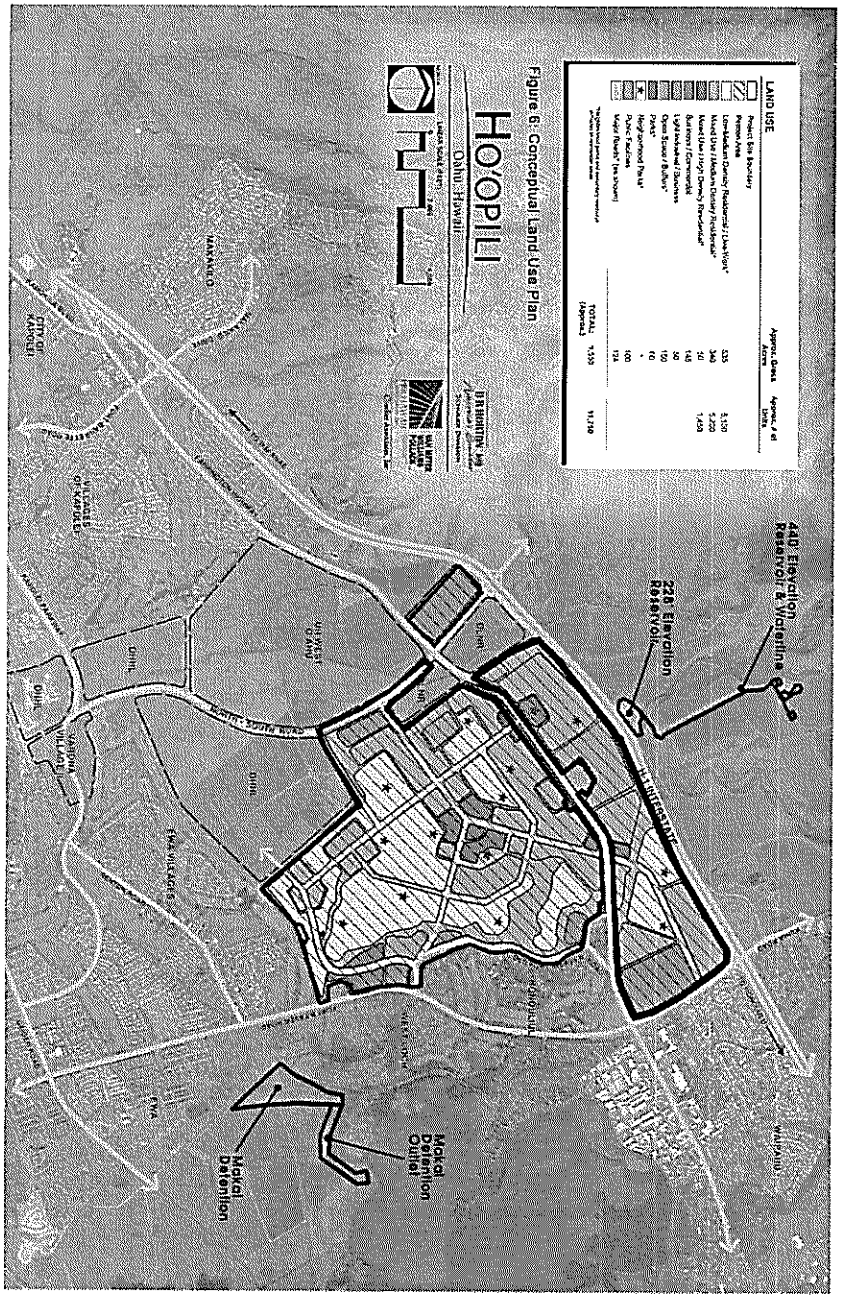
Parcel G is adjacent to the makai boundary of Parcel C and is located north (mauka) of the 'Ewa Villages Golf Course, and is already located within the State Urban Land Use District boundaries.

(iii)Land Use

The Proposed Action involves the reclassification of approximately 1,553.844 acres from the Agricultural District to the Urban District. Urbanization of the Project Area will enable The D.R. Horton - Schuler Division to develop its proposed Conceptual Land Use Plan (See Figure 6: Conceptual Land Use Plan). The proposed Ho'opili Conceptual Land Use Plan will be a community where residents can live, work, learn, play, and shop.

To achieve the communities' vision for Ho'opili, a Conceptual Land Use Plan has been formulated that illustrates a mixed-use community that would complete and connect 'Ewa with the surrounding communities. Originating from the common vision and values of a community-driven planning effort, the conceptual plan contains a series of neighborhoods with a mix of uses including residential, retail, office and light industrial. Included in this mix are a series of parks, schools, public buildings and community centers which act as a focus and help define the identity of each neighborhood.

Ho'opili will be connected to the surrounding 'Ewa District by a network of streets and bicycle paths which allow a variety of circulation options for residents and visitors. Wider tree-lined boulevards create a distinct axis running north-south and east-west across the site. Ho'opili is being designed to be transit-ready, and the land use plan, while subject to change, has been designed to accommodate a high-capacity transit corridor either along Farrington Highway or diagonally through the project site, with either one or two transit station locations. While the proposed residential unit count will not change, the land use plan will need to be adjusted depending on the final alignment of the high-capacity transit corridor, as the potential for noise impact from an elevated high-capacity transit alignment would likely require taller, higher density residential or industrial uses along the



alignment. The final siting of the transit station location(s) will also provide transit-oriented development potentials, which will also cause the plan to be refined, as higher intensity development (and density) will probably be concentrated around the transit station(s). Also possible is a site for a transit maintenance and storage facility.

In the geographical center of the site there is a public square or Civic Plaza that is surrounded by higher density housing development and mixed-use buildings. Housing intensity transitions to lower-density small-lot single family homes along the eastern and southern peripheries of the site. A significant open space and pedestrian/bicycle trail network provides a wide variety of recreational opportunities for residents and other members of the 'Ewa community. Ho'opili will incorporate traditional Hawaiian building styles with a modern, contemporary aesthetic and will reflect the landscape and climate.

The general land use allocation illustrated on the Conceptual Land Use Plan is summarized in Table 3 of the EIS and described below:

Low-Medium Density Residential/Live-Work
Ranging from traditional single family detached homes on varying lot sizes to multifamily dwellings with a variety of live-work opportunities, there are approximately 535 gross acres (which includes secondary roads and mini-"neighborhood" parks) planned to accommodate approximately 5,100 residential units at densities of 5 to 14 units per acre. These areas would include mini-parks located as focal points and activity centers of the community.

Mixed-Use/Medium Density Residential
Planned to be oriented along future high-capacity transit and major roadway alignments, these medium density mixed use districts would include live-work residential units or residential uses over ground floor commercial and office uses. Within these districts that comprise approximately 340 acres (all of which will not be developed for housing because the acreage includes secondary roads, off-street parking and mini-"neighborhood" parks), there are approximately 5,200 dwelling units planned at densities of 15 to 29 units per acre along with retail and office use.

Mixed-Use/High Density Residential
Planned to be located near major transportation junctions, these higher density mixed use districts would include commercial, office space, and higher density live-work residential units or residential uses above ground floor businesses. Within these districts that comprise approximately 50 gross acres (which includes secondary roads, off-street parking and mini-"neighborhood" parks) would be approximately 40 net developable acres that would accommodate approximately 1,450 dwelling units planned at densities of 30 to 50 units per acre along with retail and office use.

Business / Commercial
To serve the neighborhoods and surrounding communities and to provide a variety of employment opportunities within Ho'opili, the business/commercial uses are located to be conveniently accessed from the major transportation corridors of the region. The approximately 145 gross acres illustrated (which includes secondary roads and off-street parking) are estimated to yield a net development area of approximately 130 acres that are projected to accommodate retail and office use. These areas would be significant employment generators for Ho'opili and the region.

Light Industrial / Business Mixed-Use
To meet regional demands and to provide for an additional employment center for Ho'opili, approximately 50 gross acres (which includes secondary roads and off-street parking) are planned to provide an area for larger light industrial type users and businesses. It is estimated that there would be a net development area of approximately 40 acres industrial mixed-use.

Open Spaces / Buffers
Integral to the connectivity of Ho'opili to the surrounding neighborhoods, a variety of open space buffers and drainage detention areas are planned. Some of the key open space buffers include along the H-1 Freeway, Honouliuli Gulch and along Old Fort Weaver Road.

Parks
Some of the key parks being planned include a district park along Fort Weaver Road and a downtown civic square to serve as the community gathering area.

Mini-Parks
Integral to the establishment and identity of neighborhoods, a variety of smaller parks of approximately one to two acres in size are planned. Properly planned and located, most residents will be within walking distance of one of these mini-parks.

Public Facilities
The proposed project could include as many as five public school sites. The Conceptual Land Use Plan shows the possible locations for five State of Hawai'i, Department of Education (DOE) school sites planned to be as accessible to the neighborhoods of Ho'opili as the community is developed; one high school, one middle school and three elementary schools. The plan can also accommodate private schools as the need is determined. In addition, area is set aside along the western end of Farrington Highway fronting the Project Area for either a fire station or a police substation. In total, approximately 100 acres are allocated to meet public facility needs.

Major Roads and the Honolulu High-Capacity Transit Corridor (HHCTC) Project
To provide for improved regional circulation and to define and serve the various neighborhoods of Ho'opili, the major boulevards planned within the community are illustrated. In addition, there will be a well planned network of local streets to provide connectivity and alternate routes throughout the community in a safe and pedestrian friendly manner. This land use category includes the portion of the property that will be utilized for 1) the widening of Farrington Highway fronting the Project Area, 2) a portion of North-South Road between Farrington Highway and Kapolei Parkway, 3) portions of the intersections of North-South Road with Farrington Highway and the H-1 Freeway, and 4) the segment of the East-West Connector through the Project Area. As previously mentioned, a significant portion of the project site will be taken for a segment of the HHCTC project, including a possible transit maintenance and storage facility.

Proposed land uses are shown in the Conceptual Land Use Plan (See Figure 6: Conceptual Land Use Plan) and generally described below. The approximate land use areas may be adjusted as the proposed Ho'opili Conceptual Land Use Plan is refined through the land use review and approval process, as well as when the HHCTC alignment is finalized within Ho'opili. During the EISPN public review period, the City and County of Honolulu, Department of Design and Construction recommended that "the developer meet with City officials from the Department of Planning and Permitting, Department of Design and Construction, and Department of Parks and Recreation (DPR) at an early stage in the development's planning process to develop a conceptual plan for overall development which is acceptable and appropriate." As such, D.R. Horton - Schuler Division will continue to coordinate with City and County of Honolulu agencies to develop a conceptual plan for overall development which is acceptable and appropriate.

Conceptual Land Use Plan – Land Use Summary for Project Area

Land Use	Approx. Gross Acreage	Approx. Developable Net Acres	Approx. Number of Units	General Land Use Density Range (Dwellings/Units per Acre)	Proposed Zoning District****
Project Area					
Low-Medium Density Residential/Live-Work*	535	400-475	5,100	5-14	R-5/AMX-2
Mixed Use/Medium Density Residential*	340	250-300	5,200	15-29	AMX-3
Mixed Use/High Density Residential*	50	40	1,450	30-50	BMX-3
Business/Commercial	145	130	-	-	B1
Light Industrial/Business Mixed Use	50	40	-	-	IMX-1
Open Space/Buffers*,**	150	N/A	-	-	P-2
Parks*	60	N/A	-	-	P-2
Mini-"Neighborhood" Parks*	*	N/A	-	-	P-2
Public Facilities	100	N/A	-	-	AMX-3
Major Roads (as shown)**	124	N/A	-	-	Varies
TOTAL (approx.)	1,554***	-	11,750	-	-

* - Mini-"Neighborhood" parks and secondary roadways included in residential areas
** - May increase as developable areas decrease in residential and commercial categories
*** - Total acreage to be rezoned is approximately 1,555.145 acres
**** - Zoning designation may vary depending whether a Transit-Oriented Development overlay district is adopted

(iv)Open Space

Assuming an average of three residents per each of the proposed 11,750 households (estimated 35,250 future residents), and the Ewa DP's minimum requirement of two acres of park space per 1,000 residents, the proposed project, would require 70.5 acres of park space. The Ho'opili project is consistent with the Ewa DP's objectives and policies to protect and preserve open space. As many as 210 acres of parks and open space will be provided within the Project Area. An additional 30 acres will be maintained as open space and will be used for off-site drainage. Open space buffers are proposed to be located along the H-1 Freeway and Old Fort Weaver Road. In addition, linear parks and open space will encircle the Ho'opili project with walking/biking paths to create a separate but welcoming identity for the Ho'opili community.

(v) Circulation

Prior to rezoning, a Circulation Plan delineating the hierarchy of streets within the Ho'opili project and its relationship to the surrounding transportation network will be developed. Ho'opili is being designed to maximize connectivity within and to/from surrounding properties. To provide multiple routes for traveling through Ho'opili, a fine grid of closely-spaced blocks is envisioned over most of the site and where topography allows. Major planned and proposed regional connectors have been considered in the planning of the proposed project. These include: setting aside additional right-of-way for the City and County of Honolulu's widening of Farrington Highway; multiple connections to Farrington Highway; setting aside land for the proposed East-West Road; connection to the proposed North-South Road (under construction); and construction of a mauka-makai "North-South Bypass" road.

As shown on Figure 7: Proposed Circulation Plan, the Circulation Plan will also indicate:

- The currently proposed HHCTC alignment; existing and proposed bus routes; and specific measures, such as a "circulator shuttle" (local bus route connecting Ho'opili and UHWO) to accommodate efficient transit service for as many households as possible.
- Any principal pedestrian and bicycle paths that are physically separated from roadways. Within the proposed fine network of gridded streets, it is envisioned that most streets will include on-street parking and sidewalks and/or grade-separated multi-modal bike/pedestrian paths. This will allow experienced bicyclists to travel on most roadways and inexperienced bicyclists to stay off roads, except at intersections.

Not shown on Figure 7: Proposed Circulation Plan, but will be addressed in the Circulation Plan are:

- That street intersections along principal pedestrian and bicycle paths should have a narrow curb radius and include special signage and paving to encourage safe and convenient pedestrian and bicycle crossings; and
- A five-minute walking radius from proposed bus and transit routes (unless localized topographic conditions make such a requirement impractical).

(vi)Design Theme and Character

Ho'opili will be highly consistent with the goals and objectives of two primary recognized long-range development plans for the area, the City and County of Honolulu's directed growth policy for the area, the *Ewa Development Plan* and the *Kapolei Area Long Range Master Plan*, which was adopted by the City and County

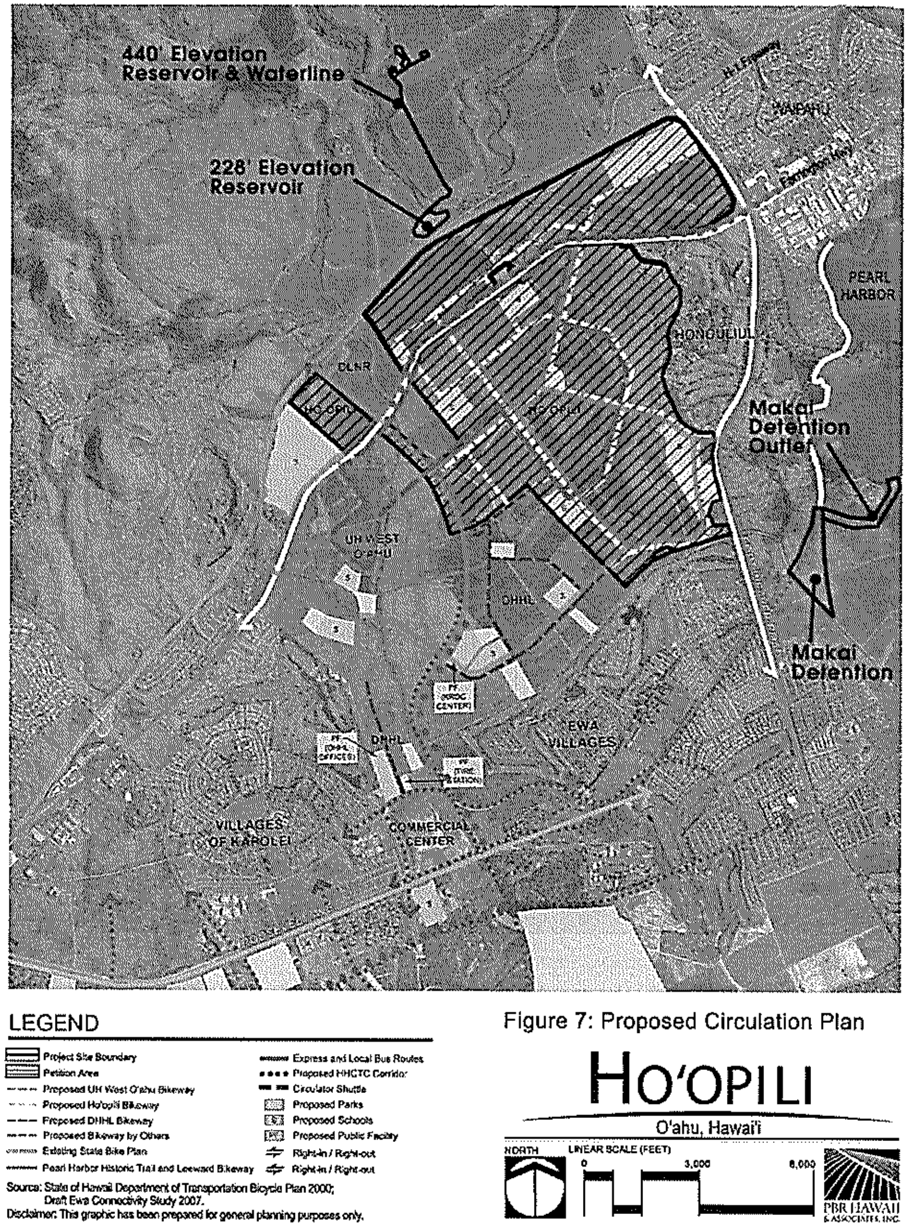


Figure 7: Proposed Circulation Plan

of Honolulu as part of Resolution 91-34. The Ewa DP states that growth in the area will include community building, not just project development, with communities designed to enhance lives, reduce automobile dependency, and be connected via a network of greenways ('Ewa will be built around a regional system of open space and greenways so that it has the feel of a network of communities "within a garden").

Ho'opili will adhere to the best intentions of the area's long-range master plans and the possibilities for a better 'Ewa with its proposed:

- concentrated mixed-use development pattern;
- embrace of "Traditional Neighborhood Design" and "Transit-Oriented Development" principles so that the entire project is walkable, connected and transit-ready; and
- earmarking of large areas for community gathering places, schools, parks and open space and a comprehensive bicycle/pedestrian network.

Ho'opili can play a key role in actualizing the community's vision for 'Ewa and enhancing the desirability of living on the 'Ewa Plain. Ho'opili, or "coming together," is part of the bridge where Honolulu's existing central corridor that reaches to Waipahu meets the urban core of the 'Ewa Plain, the City of Kapolei. It is where neighboring towns from Waipahu to Ko 'Olina and from Makakilo to 'Ewa Beach will be welcome and can gather.

Ho'opili will be connected to the surrounding 'Ewa District by a network of streets and bicycle paths which allow a variety of circulation options for residents and visitors. Wider tree-lined boulevards create a distinct axis running north-south and east-west across the site. Ho'opili is being designed to be transit-ready, and the land use plan, while subject to change, has been designed to accommodate a high-capacity transit corridor either along Farrington Highway or diagonally through the project site, with either one or two transit station locations. While the proposed residential unit count will not change, the land use plan will need to be adjusted depending on the final alignment of the high-capacity transit corridor, as the potential for noise impact from an elevated high-capacity transit alignment would likely require taller, higher density residential or industrial uses along the alignment. The final siting of the transit station location(s) will also provide transit-oriented development potentials, which will also cause the plan to be refined, as higher intensity development (and density) will probably be concentrated around the transit station(s). Also possible is a site for a transit maintenance and storage facility.

Residents should celebrate the benefits of this connected community for generations to come. Ho'opili will be a community that will:

- Be innovative, incorporating principles of "transit-oriented development" and "Traditional Neighborhood Design";
- Be highly liveable with a range of housing options – including affordable, workforce, and senior housing – plus parks, community facilities, schools, and a diversity of jobs and retail options;
- Be based on a healthy, walkable, live-work environment;
- Enhance living in 'Ewa: fewer vehicle trips to for commuting to work or school outside of the District, more time spent with families, less auto emissions, and greater community gathering opportunities; and
- Be sustainable, "green" requiring fewer car trips with its bicycle and pedestrian paths, and using renewable resources for energy consumption and recycling other resources, such as wastewater and solid waste.

Sustainability options are being considered for the Ho'opili project. Where feasible, project buildings, activities, and site grounds are intended to be designed with energy-saving considerations. Given the natural climate, the project may be suited for the use of renewable energy technologies including photovoltaics.

(vii) Telecommunications

Hawaiian Telcom, which provides telephone service to the area, owns and maintains a pole line along Farrington Highway, Old Fort Weaver Road and Kunia Road. This pole line is substandard; however, Oceanic Time Warner Cable and Pacific Lightnet have an agreement with Hawaiian Telcom for use of its poles and have attached cables to extend their facilities to Kapolei. AT&T has a fiber cable buried within the southern shoulder of the existing Farrington Highway right-of-way. In addition, the Federal government owns a buried joint tactical support cable within the Farrington Highway right-of-way.

Due to the substandard location of the existing telephone pole line along Farrington Highway; Hawaiian Telcom, Oceanic Time Warner Cable, and Pacific Lightnet will have to relocate their lines to new poles along Farrington Highway in the future. These telephone and communication lines will require easements within and the use of State and County road right-of-ways.

Appendix R

Arthropod Survey and Assessment

ARTHROPOD SURVEY AND ASSESSMENT

HO'OPILI PROJECT

'EWA DISTRICT, O'AHU, HAWAI'I

May 2008

Prepared for

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D.R. HORTON - SCHULER DIVISION
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INTRODUCTION

A survey of arthropods on the Ho'opili Project Site was conducted on May 09, 2008 by Dr. Gregory Brenner of Pacific Analytics, LLC. The primary objectives of the survey were to provide a general description of the arthropod fauna of the Ho'opili Project Site, evaluate the habitats, and search and assess the potential for threatened and endangered arthropod species as well as species of concern (DLNR 1997, Federal Register 1999, 2005).

GENERAL SITE DESCRIPTION

The approximately 1,550 acre (627 hectares) Ho'opili Project Site in the 'Ewa District on the Island of O'ahu includes three main parcels, Parcels A, B, and C, and seven smaller parcels, Parcels D1, D2, E1, E2, E3, F, and G (see Figure 1.5, DEIS page 4). The Ho'opili Project Site ranges in elevation from near sea level to about 430 ft (131 m). The Ho'opili Project Site was cultivated in sugarcane from the late 1800s to 1995, and currently contains cultivated fields for diversified agriculture, pasturage, and agricultural research, and some small gulches and cliffs. The edges of the fields and the small gulches and cliffs on the site are weedy areas dominated by alien plant species (LeGrande 2006).

There are neither unique floral habitats nor unique avian and mammalian faunal habitats on the Ho'opili Project Site and a survey for botanical, avian, and mammalian resources found no threatened endangered, or species endemic to Hawai'i at the site (LeGrande 2006, David 2008).

SURVEY METHODS

Prior to the site visit a search of literature pertaining to arthropods found in the 'Ewa District was conducted. Maps and aerial photographs of the Ho'opili Project Site were examined to familiarize the principal investigator with the general area and locate potential arthropod habitats. After examining the maps and aerial photographs it was determined that special attention should be given to the gulch and the cliff areas where the botanical survey identified scrub vegetation with native plant elements (LeGrande 2006). These areas were determined to have the best potential as native arthropod habitats.

The areas selected as requiring special attention include Honouliuli Gulch running through Parcel B, two flumes that run east-west through Parcel C, and the cliffs along the eastern boundary of Parcel C.

The arthropod survey was conducted on May 9, 2008. Roads were driven on the Ho'opili Project Site to locate potential arthropod habitats previously identified from maps and aerial photographs. A Staged Random-Walk survey method was used in these areas. Vegetation was sampled on foot along roads and between cultivated fields where arthropods would likely be found using the following methods.

Aerial Netting - Flying insects were captured in aerial nets and placed into vials for immediate identification in the field. Species present were recorded in a field notebook with annotations about relative abundance and other ecological information. Specimens were released after identification.

Sweep Netting - Grasses, small shrubs and other low-lying vegetation was sampled with a sweep net. An insect net was brushed along the top of the vegetation or grass to capture insects. Specimens were released after identification.

Foliage Beating -Foliage was sampled using a beating sheet. An insect net was placed under a branch and the stem was struck with a short stick. Arthropods on the foliage were dislodged and fell onto the sheet where they were collected with an aspirator into vials for identification. Specimens were released after identification.

Visual Inspection – Plants were visually inspected for arthropods that were not collected by other methods. Time was also spent observing larger flying insects that could be identified on the wing. The Honouliuli Gulch was also visually inspected for aquatic insects after water began flowing, apparently released from the state flood control detention pond upstream of the site.

Sampling Transects – The length of sampling transects varied with location. Staged Random-Walk sampling transects were used to survey each area. Sampling transects were selected at random to represent at least twenty percent of the vegetation on each Parcel. Sampling intensity was increased to at least fifty percent in those areas identified from maps and aerial photographs as requiring special attention.

DESCRIPTION OF THE ARTHROPOD FAUNA

Twenty-seven species of insects representing eight orders and at eighteen families were observed at the site. In additional three species of spiders were also recognized.

The entire site is disturbed by agriculture and related activities, and the vegetation is composed of non-indigenous, weedy species. This is reflective of the overall arthropod community which is almost entirely non-indigenous. Only one indigenous species, *Pantala flavescens*, a common dragonfly, was observed. No endemic native Hawaiian arthropods were detected.

Plants that were in bloom attracted pollen and nectar feeders, especially bees and butterflies. Other insects were found feeding on plant juices, under leaves and on stems. Ants were the most abundant insect on the ground.

There have been no previous arthropod surveys at the Ho'opili Project Site and a search of literature revealed only one reference of an arthropod study in the Barbers Point vicinity. The nearest and most complete comparative survey was one conducted in 2006 by the principal investigator for the proposed development of the Kapolei Harborside Center (Pacific Analytics 2006). In that study one hundred and ninety-five species of insects representing sixteen orders and at least seventy-five families were collected with an additional nineteen species of spiders, three species of other arthropods, and five species of fossilized snail.

More than ninety percent of the species collected in the Kapolei Harborside Center Project Site survey were non-indigenous. Many are cosmopolitan, weedy species found throughout the Pacific and the World. The few indigenous and endemic species observed at the Project Site are common and no rare, endangered, threatened, or species of concern were detected. The large proportion of non-indigenous species was an indication of the amount of habitat degradation that resulted from the various agricultural and mining operations that have occurred at the site.

Similar degradation has occurred at the Ho'opili Project Site as a result of the more than one hundred years of agricultural use. The vegetation at the Ho'opili Project Site is similar to but less diverse than that at Kapolei Harborside Center Project Site. In my judgment, the arthropod fauna at the Ho'opili Project Site is not substantially different from that found at the Kapolei Harborside Center Project Site and it is unlikely that an intensive inventory of the site would yield significantly different findings from the 2006 study.

Despite particular attention to gulches, flumes, and water detention areas, no native Hawaiian damselflies of other endemic aquatic arthropod species were detected. Given the intermittent nature of the water flow in these some of these areas it is unlikely that aquatic species would persist there. Only one species of native Hawaiian damselfly is historically known from this area, *Megalagrion xanthomeles*, and that species is nearly extirpated from Oahu, known recently from only one locality above Honolulu (BPBM 2008).

SUMMARY OF THE ARTHROPOD FAUNA

The arthropods species that were collected during this study would be considered typical of what would be found in lowland sites with little or no native vegetation and disturbed by agricultural operations. No species were found that are locally unique to the site. Nor were any species found whose habitat would be threatened by the proposed development at the site.

The results of this arthropod survey at the Ho'opili Project Site indicate there are no special concerns or legal constraints related to invertebrate resources in the project area. Although several species of Hawaiian endemic arthropods may occur on the 'Ewa plain, these species are not likely to be abundant in the highly disturbed agriculture lands that comprise the Ho'opili site. No invertebrate species listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai'i endangered species statutes are known to exist at the Project Site (DLNR 1997, Federal Register 1999, 2005).

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