Exhibit 5-30

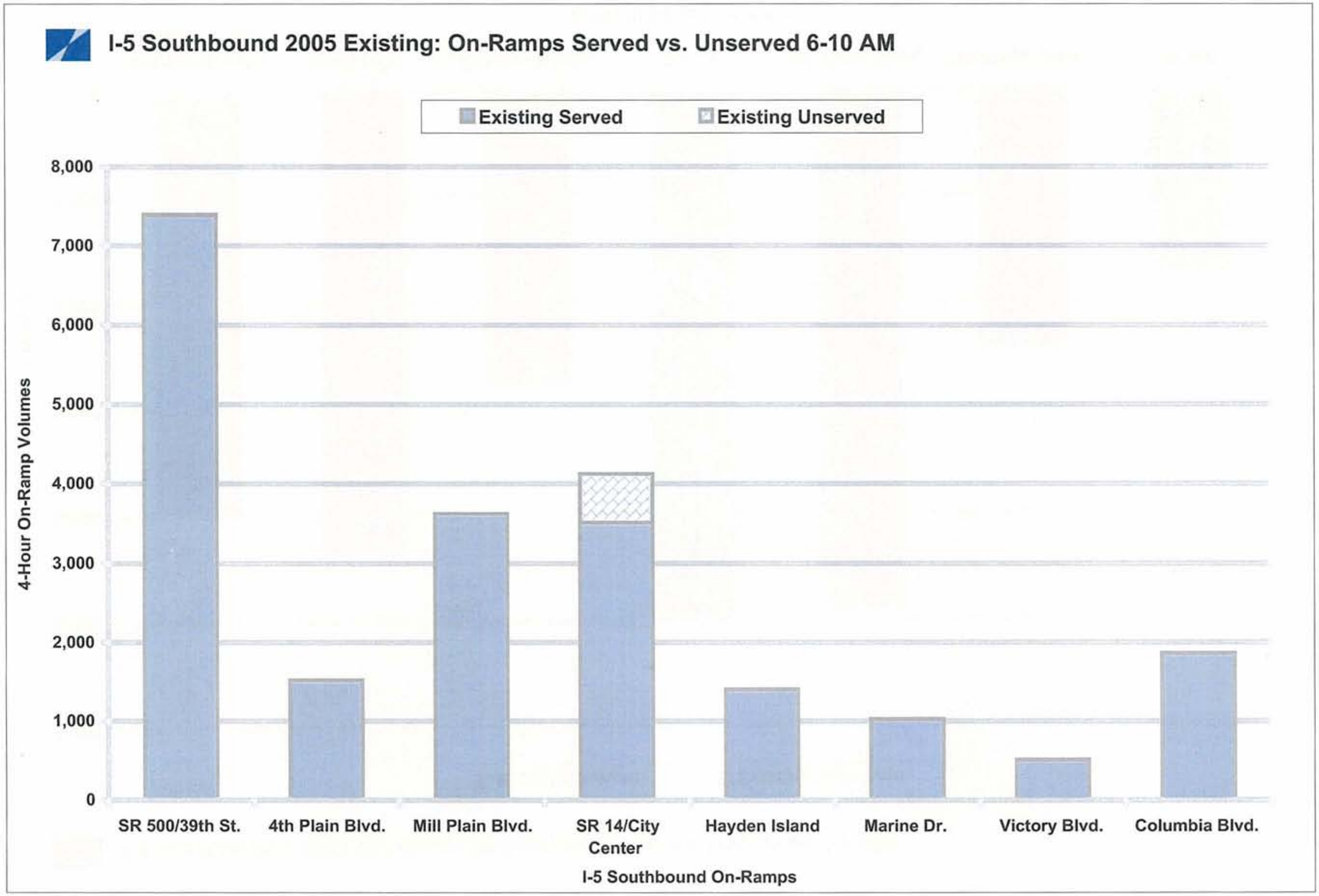
I-5 Southbound 2005 Existing: On-Ramps Served vs. Unserved 6-10 AM
Existing Served
Existing Unserved
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
4-Hour On-Ramp Volumes
SR 500/39th St.
4th Plain Blvd.
Mill Plain Blvd.
SR 14/City Center
Hayden Island
Marine Dr.
Victory Blvd.
Columbia Blvd.
I-5 Southbound On-Ramps

Exhibit 5-31

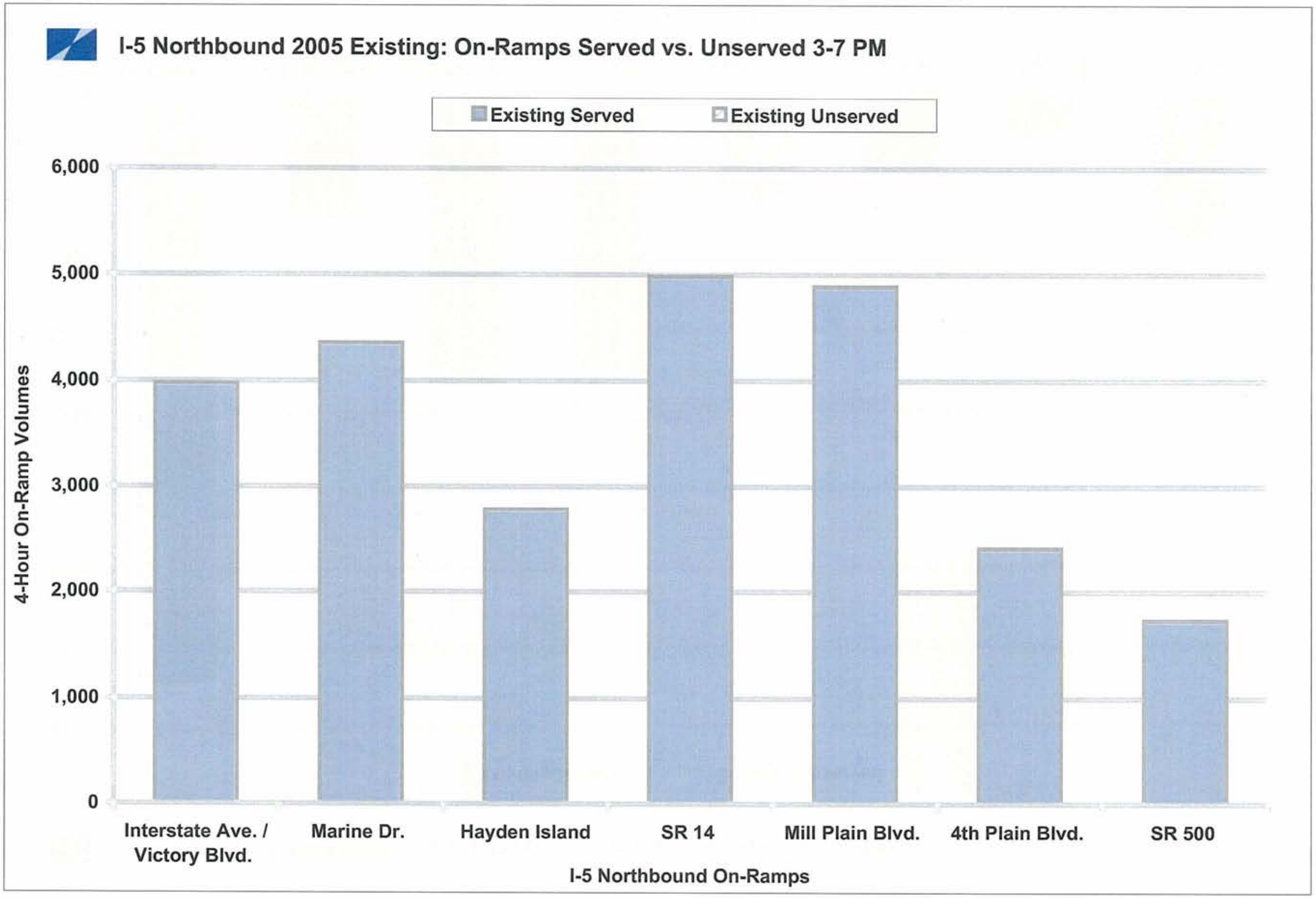
I-5 Northbound 2005 Existing: On-Ramps Served vs. Unserved 3-7 PM
Existing Served
Existing Unserved
6,000
5,000
4,000
3,000
2,000
1,000
0
4-Hour On-Ramp Volumes
Interstate Ave. / Victory Blvd.
Marine Dr.
Hayden Island
SR 14
Mill Plain Blvd.
4th Plain Blvd.
SR 500
I-5 Northbound On-Ramps

Exhibit 5-32

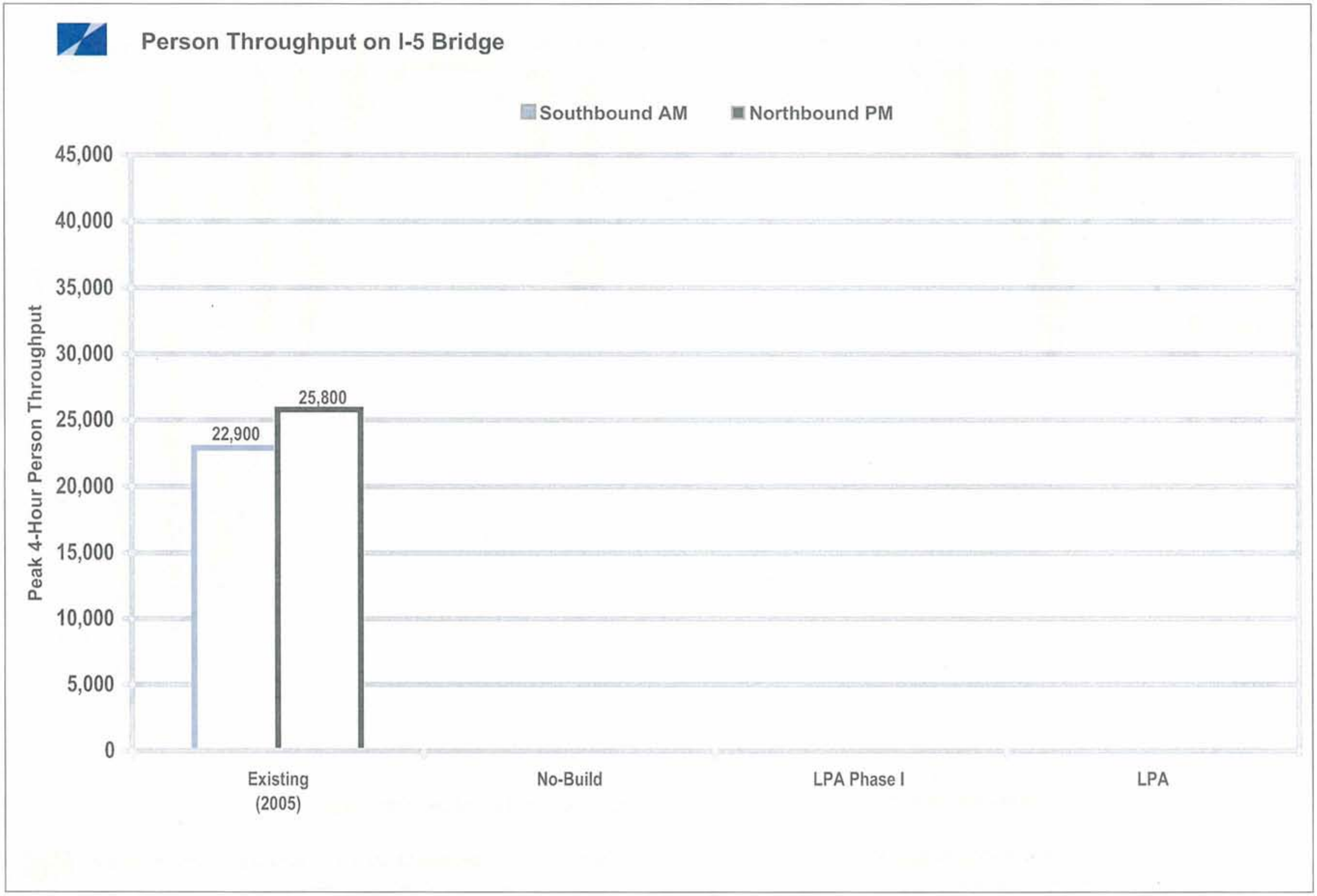
Person Throughput on I-5 Bridge
Southbound AM
Northbound PM
Peak 4-Hour Person Throughput
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
22,900
25,800
Existing (2005)
No-Build
LPA Phase I
LPA

Exhibit 5-33

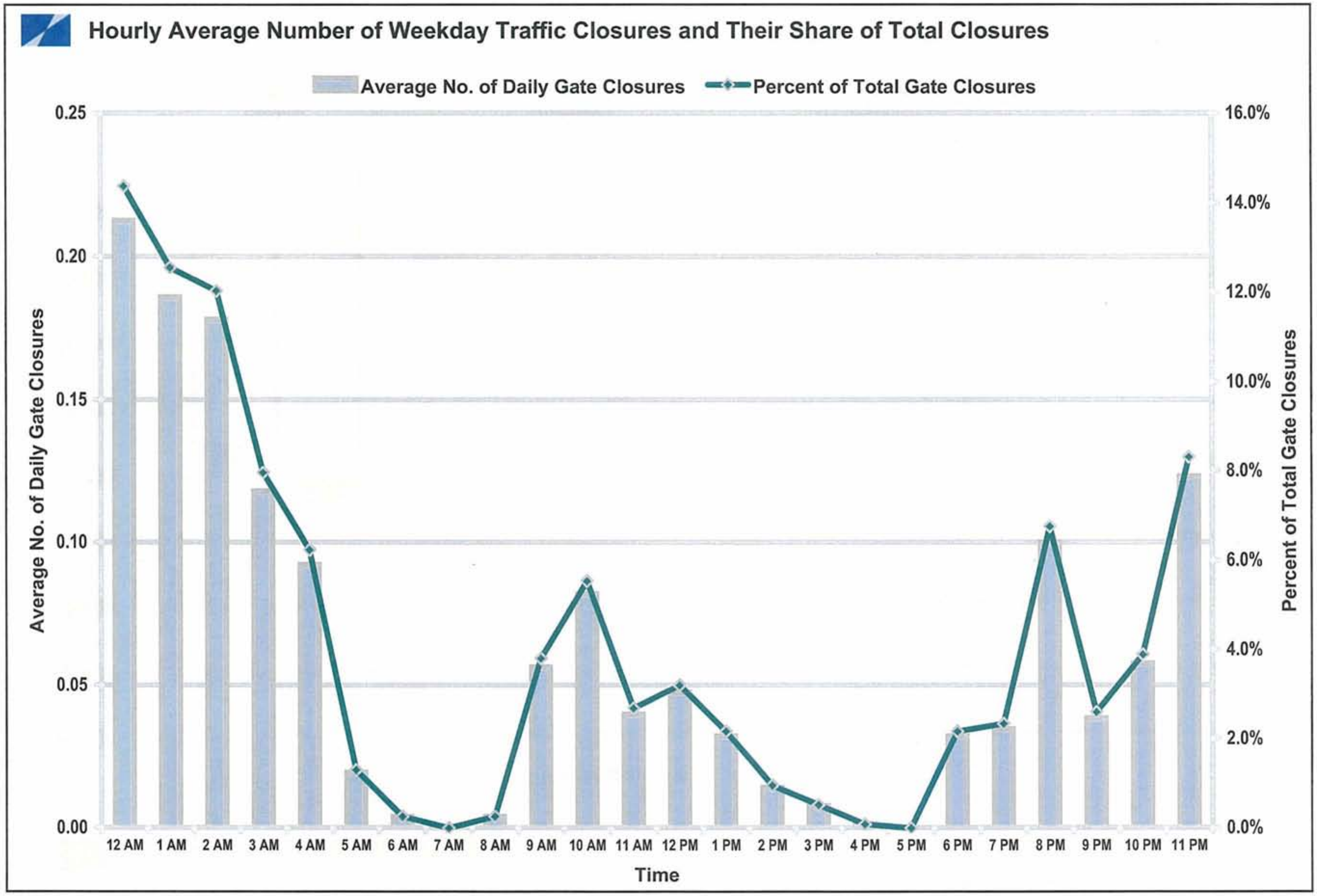
Hourly Average Number of Weekday Traffic Closures and Their Share of Total Closures
Average No. of Daily Gate Closures
Percent of Total Gate Closures
0.25
0.20
0.15
0.10
0.05
0.00
Average No. of Daily Gate Closures
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
Percent of Total Gate Closures
12 AM 1 AM 2 AM 3 AM 4 AM 5 AM 6 AM 7 AM 8 AM 9 AM 10 AM 11 AM 12 PM 1 PM 2 PM 3 PM 4 PM 5 PM 6 PM 7 PM 8 PM 9 PM 10 PM 11 PM
Time

Exhibit 5-34


Hourly Average Duration of Weekday Traffic Closure
Average Duration
Average Closure Duration (minutes)
20
18
16
14
12
10
8
6
4
2
0
10.7
10.9
10.9
12.3
11.3
10.2
9.0
0.0
13.3
10.6
9.8
10.2
9.9
10.2
8.5
10.5
19.0
0.0
11.8
9.2
4.6
5.9
12.6
12.9
12 AM
1 AM
2 AM
3 AM
4 AM
5 AM
6 AM
7 AM
8 AM
9 AM
10 AM
11 AM
12 PM
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
9 PM
10 PM
11 PM
Time

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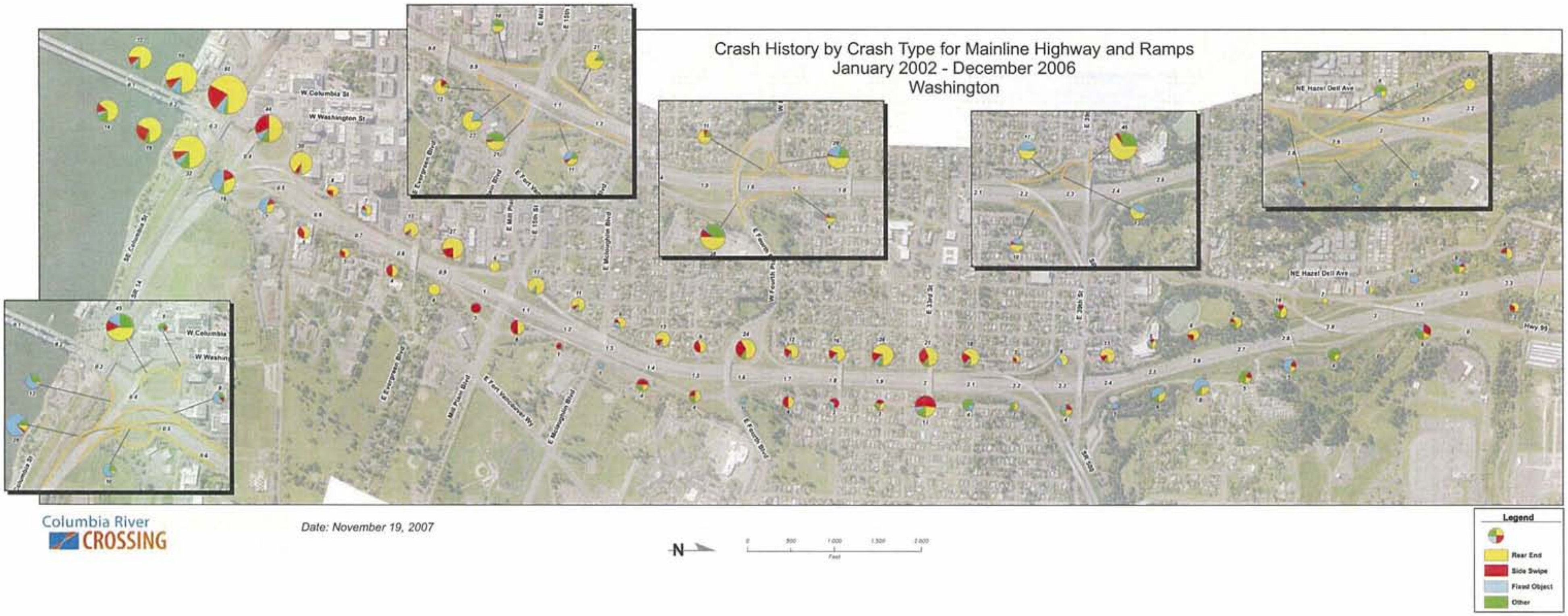
PRELIMINARY

Exhibit 5-35

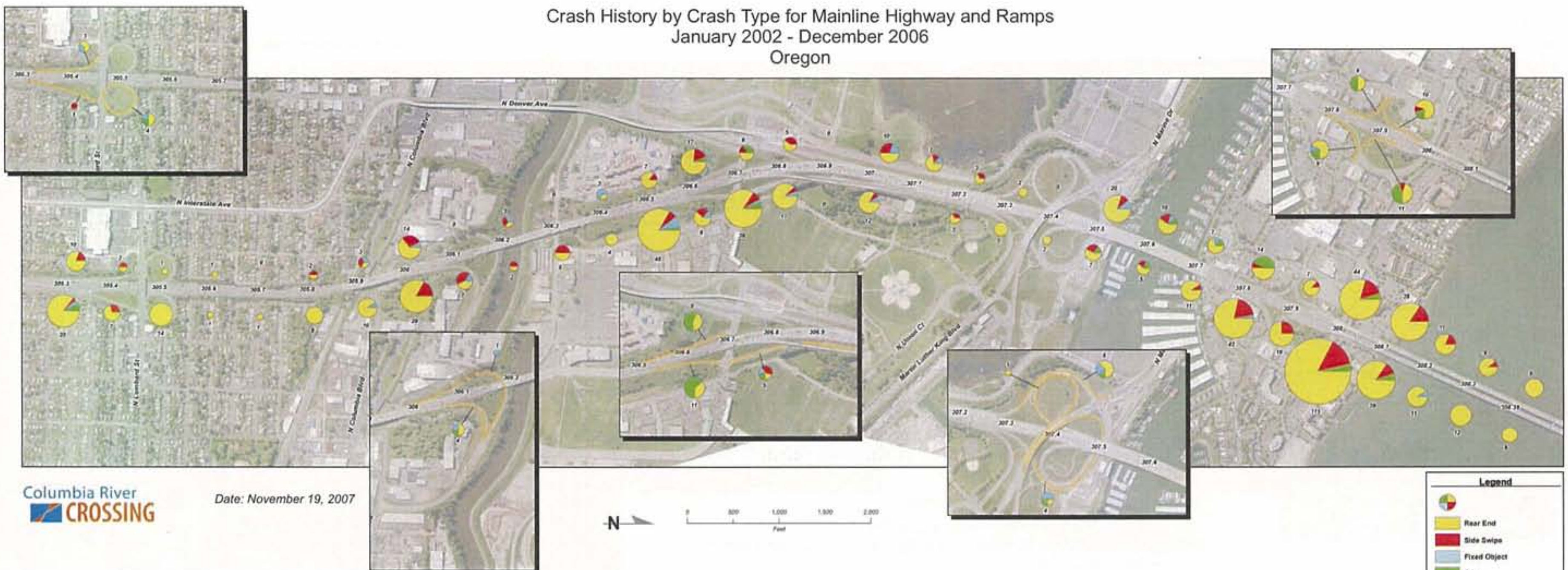


7507

7508

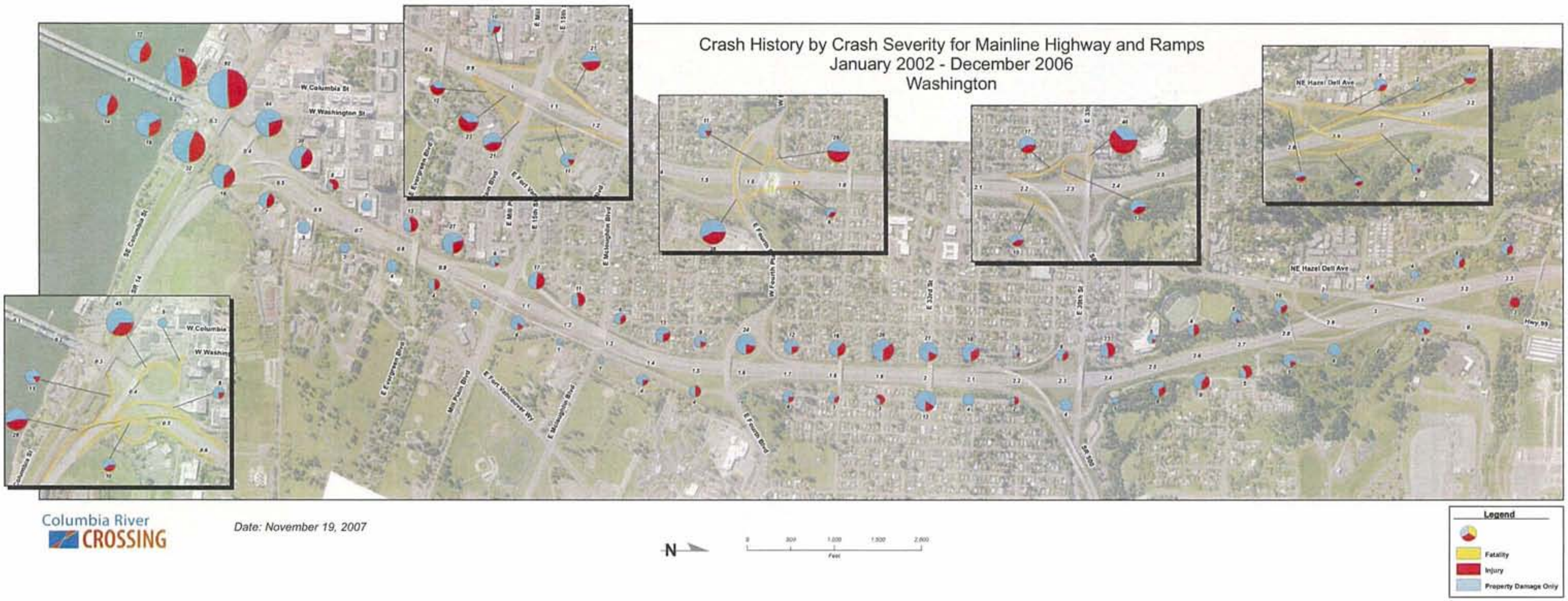
PRELIMINARY

Exhibit 5-36



PRELIMINARY

Exhibit 5-37



7510

PRELIMINARY

Exhibit 5-38

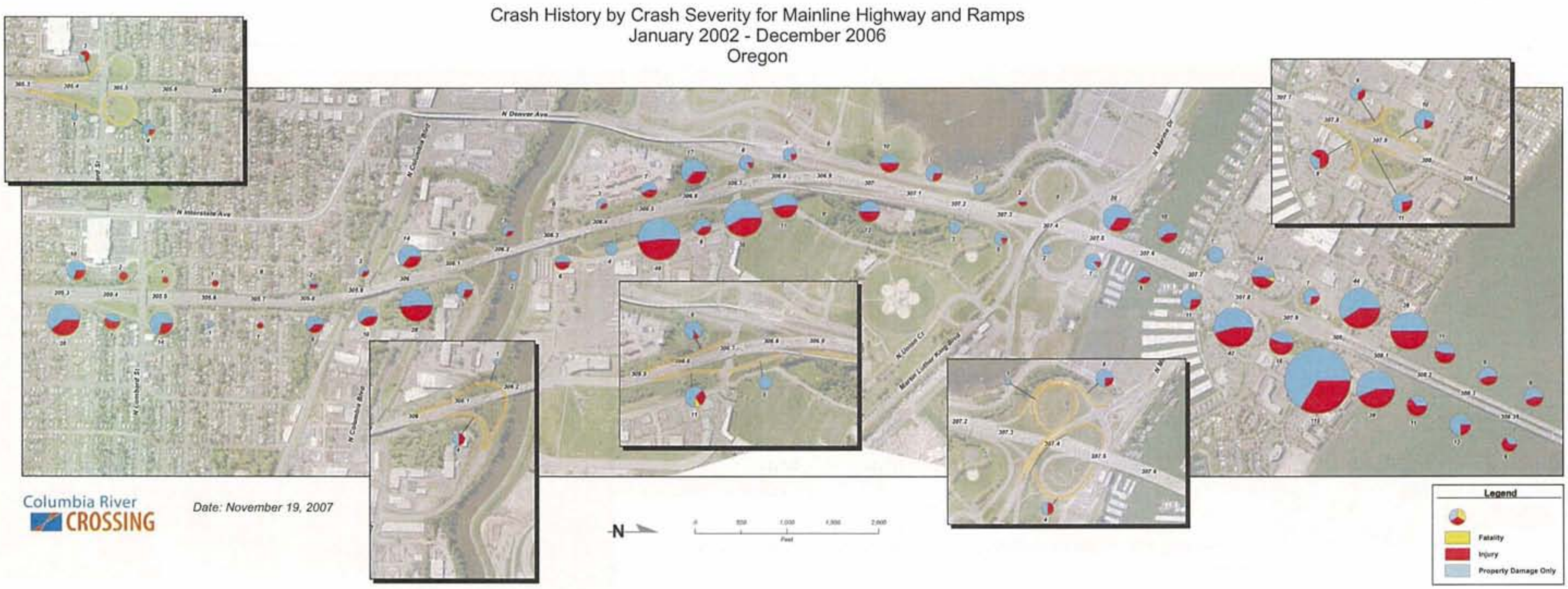


Exhibit 5-39 PRELIMINARY

#	State	Milepost Location	Direction	Description	Existing Dimension (ft)	Minimum Dimension (ft)	% of standard
Identified Deficiencies in Highway Geometrics							
Ramp-to-highway acceleration lane length							
1	WA	1.62	SB	Fourth Plain Blvd to I-5	1,250	1,420	88%
2	WA	0.47	SB	SR 14 WB to I-5	450	1,020	44%
3	OR	307.97	NB	Hayden Island on-ramp	211	2,201	10%
4	OR	307.76	SB	Hayden Island on-ramp	367	1,420	26%
5	OR	307.49	NB	Marine Drive on-ramp	367	1,420	26%
6	OR	306.51	SB	Victory Blvd on-ramp	437	750	58%
Highway-to-ramp deceleration lane length							
7	WA	0.39	NB	I-5 to 7th St/Downtown	385	460	84%
8	WA	0.28	NB	I-5 to SR 14 EB	170	430	40%
9	OR	307.99	SB	Hayden Island off-ramp	447	660	68%
10	OR	307.77	NB	Hayden Island off-ramp	289	520	56%
11	OR	307.47	SB	Marine Drive off-ramp	637	1,229	52%
Ramp-to-ramp separation length							
12	WA	0.30	NB	I-5 to SR 14 EB to I-5 to 7th St/Downtown	633	1,000	63%
Turning roadway - ramp merge							
13	WA	2.12	NB	I-5 39th St off-ramp to SR 500 off-ramp	528	800	66%
14	WA	0.87	NB	I-5 Mill Plain off-ramp to 4th Plain off-ramp	53	600	9%
Turning roadway - ramp split							
15	WA	2.20	SB	I-5 39th St on-ramp to SR 500 on-ramp	370	800	46%
Highway vertical alignment							
16	WA	0.30-0.47	Both	I-5 mainline sag vertical curve	400	533	75%
17	WA	0.00-0.30	Both	I-5 mainline sag vertical curve	400	963	42%
18	Both	308.10 to 0.20	Both	I-5 Bridge crest vertical curve	531	3,796	14%
Highway weaving area lane length							
19	WA	1.72-2.02	SB	SR 500 on-ramp to 4th Plain off-ramp	1,901	2,000	95%
20	WA	0.66-0.95	SB	Mill Plain on-ramp to SR 14 East	1,267	2,000	63%
21	OR	307.50-307.78	SB	Hayden Island on-ramp to Marine Drive off-ramp	1,855	2,000	93%
22	OR	307.49-307.76	NB	Marine Drive on-ramp to Hayden Island off-ramp	1,820	2,000	91%
23	OR	306-93-307.19	SB	Marine Drive on-ramp to Denver off-ramp	1,245	2,000	62%
Highway shoulder width							
24	WA	0.00-0.38	Both	inside and outside shoulders	0.5-6	10	5-60%
25	OR	307.90-308.38	NB	outside shoulder	0.5-2	12	4-17%
26	OR	307.86-308.38	SB	inside and outside shoulders	0.5-9.5	12	4-79%
27	OR	307.69-308.38	NB	inside shoulder	0.5-9.5	12	4-79%
28	OR	307.31-307.74	SB	inside and outside shoulders	0.5-6	12	4-50%
29	OR	307.03-307.29	NB	outside shoulder	1-4	12	8-33%
30	OR	306.59-307.45	NB	inside shoulder	0.5-6	12	4-50%
31	OR	305.22-307.31	SB	inside shoulder	0.5-6	12	4-50%
32	OR	305.82-306.65	SB	outside shoulder	0.5-9.5	12	4-79%
33	OR	306.54-306.59	NB	inside shoulder	0.5	12	4%
34	OR	306.10-306.53	NB	inside and outside shoulders	0.5-4	12	4-33%
35	OR	306.04-306.09	NB	outside shoulder	0.5-6	12	4-50%
36	OR	305.84-306.04	NB	inside shoulder	0.5	12	4%
37	OR	305.69-305.84	NB	outside shoulder taper	0.5-10	12	4-83%
38	OR	305.69-305.84	NB	inside shoulder taper	0.5-2	12	4-17%
39	OR	305.22-305.78	Both	Inside shoulder	2	12	17%
40	OR	305.22-305.47	SB	outside shoulder	1-4	12	8-33%

Exhibit 5-40

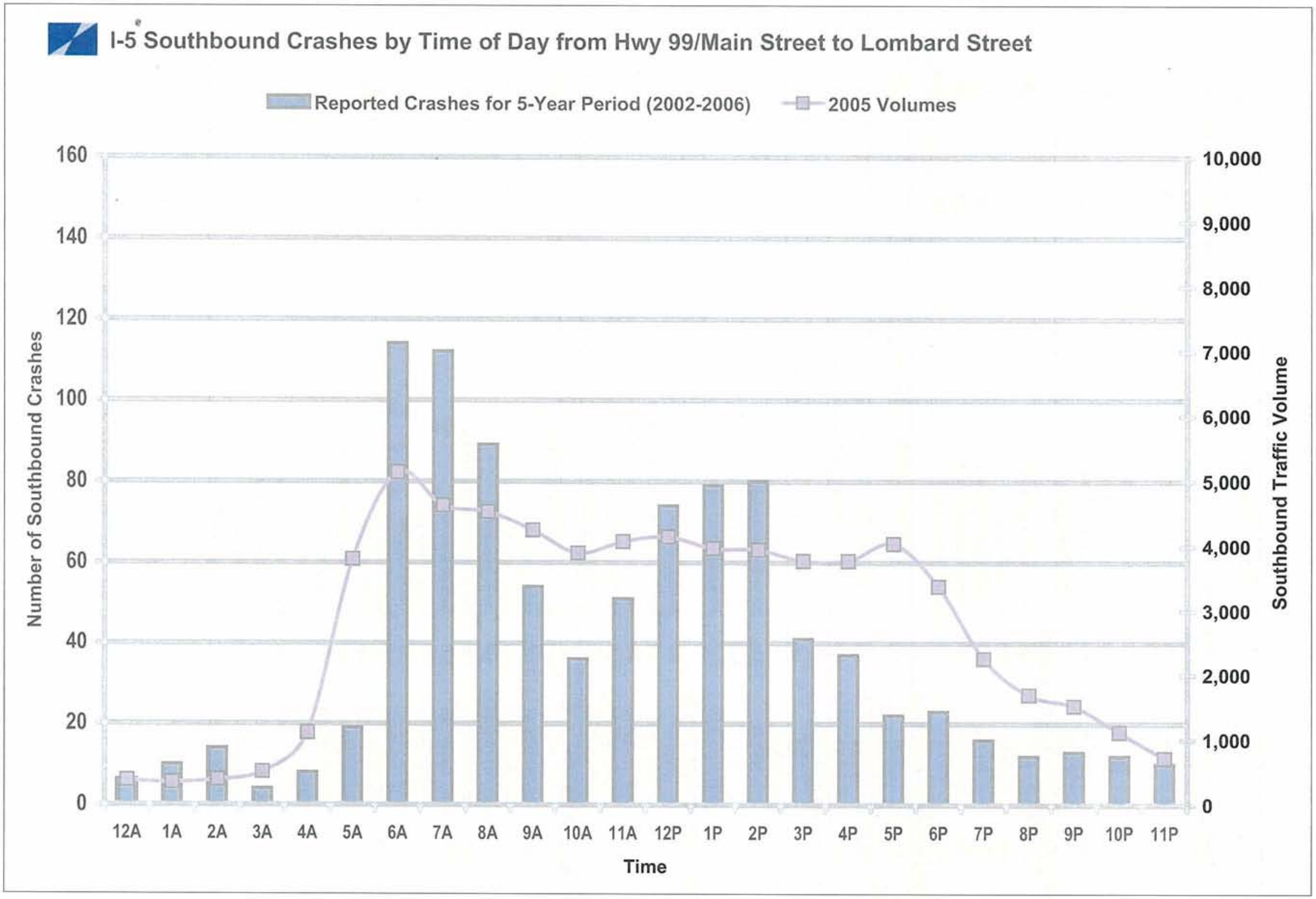

I-5 Southbound Crashes by Time of Day from Hwy 99/Main Street to Lombard Street
Reported Crashes for 5-Year Period (2002-2006)
2005 Volumes
Number of Southbound Crashes
160
140
120
100
80
60
40
20
0
Southbound Traffic Volume
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
12A 1A 2A 3A 4A 5A 6A 7A 8A 9A 10A 11A 12P 1P 2P 3P 4P 5P 6P 7P 8P 9P 10P 11P
Time

Exhibit 5-41


I-5 Northbound Crashes by Time of Day from Lombard Street to Hwy 99/Main Street
Reported Crashes for 5-Year Period (2002-2006)
2005 Volumes
Number of Northbound Crashes
160
140
120
100
80
60
40
20
0
Northbound Traffic Volume
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
12A 1A 2A 3A 4A 5A 6A 7A 8A 9A 10A 11A 12P 1P 2P 3P 4P 5P 6P 7P 8P 9P 10P 11P
Time

Exhibit 5-42

ODOT SPIS Locations 2006-2008				
Location	Mileposts	Number of Crashes	2009 SPIS Index	SPIS Rank
Columbia Boulevard interchange	305.90 to 306.09	29	69.48	top 5%
Hayden Island interchange	307.72 to 307.82	24	48.92	top 10%
Hayden Island interchange	307.81 to 307.90	12	53.25	top 10%
Hayden Island interchange	307.87 to 308.09	62	74.99	top 5%
Interstate Bridge bridgehead	308.06 to 308.17	16	46.60	top 10%
Interstate Bridge	308.10 to 308.19	17	47.12	top 10%
Interstate Bridge	308.28 to 308.38	19	49.64	top 10%

Source: Oregon Department of Transportation, 2009 Top 10% SPIS Groups for Region 1

Exhibit 5-43

Truck Collision Summary on I-5 from Lombard Street to Main Street/SR 99 (Jan. 1, 2002 - Dec. 31, 2006)							
Direction	Number of Fatalities	Number of Injuries	Collision Type				Number of Collisions
			Rear-end	Sideswipe	Fixed Object	Other	
Northbound	0	28	39	33	4	20	96
Southbound	1	49	69	67	4	19	159
Total	**1**	**77**	**108**	**100**	**8**	**39**	**255**
% of Total	0.4%	30%	42%	39%	3%	15%	

Source: *Crash Analysis Study Summary Working Paper*, Draft, 2007 CRC Project

Exhibit 5-44

Vancouver North-South Screenlines - AM Peak Hour Volumes	
Screenline	**Existing**
West of Franklin St	
Westbound Total	1,350
Eastbound Total	1,400
West of I-5	
Westbound Total	3,100
Eastbound Total	2,750
East of I-5	
Westbound Total	2,550
Eastbound Total	2,300

Vancouver East-West Screenlines - AM Peak Hour Volumes	
Screenline	**Existing**
North of Evergreen Blvd	
Southbound Total	950
Northbound Total	800
North of 15th St	
Southbound Total	1,300
Northbound Total	450
North of 4th Plain Blvd	
Southbound Total	1,500
Northbound Total	350
North of 39th St	
Southbound Total	800
Northbound Total	250

PRELIMINARY

Exhibit 5-45

Vancouver North-South Screenlines - PM Peak Hour Volumes	
Screenline	**Existing**
West of Franklin St	
Westbound Total	1,550
Eastbound Total	1,750
West of I-5	
Westbound Total	2,900
Eastbound Total	4,200
East of I-5	
Westbound Total	2,550
Eastbound Total	4,050

Vancouver East-West Screenlines - PM Peak Hour Volumes	
Screenline	**Existing**
North of Evergreen Blvd	
Southbound Total	950
Northbound Total	1,200
North of 15th St	
Southbound Total	850
Northbound Total	950
North of 4th Plain Blvd	
Southbound Total	600
Northbound Total	950
North of 39th St	
Southbound Total	500
Northbound Total	650

Exhibit 5-46

Portland North-South Screenlines - AM Peak Hour Volumes	
Screenline	**Existing**
West of Interstate	
Westbound Total	3,050
Eastbound Total	2,500
East of I-5	
Westbound Total	2,700
Eastbound Total	2,100
East of MLK Jr Blvd	
Westbound Total	3,350
Eastbound Total	2,250

Portland East-West Screenlines - AM Peak Hour Volumes	
Screenline	**Existing**
Columbia Slough	
Southbound Total	1,200
Northbound Total	950
North of Rosa Parks	
Southbound Total	1,100
Northbound Total	600
South of Alberta St	
Southbound Total	1,600
Northbound Total	700

PRELIMINARY

Exhibit 5-47

Portland North-South Screenlines - PM Peak Hour Volumes	
Screenline	**Existing**
West of Interstate	
Westbound Total	2,350
Eastbound Total	3,450
East of I-5	
Westbound Total	2,600
Eastbound Total	2,950
East of MLK Jr Blvd	
Westbound Total	2,650
Eastbound Total	3,350

Portland East-West Screenlines - PM Peak Hour Volumes	
Screenline	**Existing**
Columbia Slough	
Southbound Total	1,200
Northbound Total	1,350
North of Rosa Parks	
Southbound Total	1,100
Northbound Total	1,600
South of Alberta St	
Southbound Total	1,250
Northbound Total	2,100

Exhibit 5-48

24th St
Lincoln
Columbia
Washington
Main
Broadway
C St
F St
E Fourth Plain Blvd
Waterworks Park
20th St
W McLoughlin Blvd
501
W Mill Plain Blvd
15th
WASHINGTON
Marshall Community Park
Fort Vancouver Way
E McLoughlin Blvd
Port
13th
E Mill Plain Blvd
E Reserve St
Evergreen Blvd
E Evergreen Blvd
8th St
Esther Short
6th St
BNSF Rail
Fort Vancouver National Historic Site
Grand Blvd
SR 14
Vancouver
5thSt
Pearson Field
Columbia River
14
SE Columbia Way
Principal Arterial
Minor Arterial
Collector

Vancouver Intersection Performance Results

AM Peak Hour		2005 Existing Conditions							
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
01	3rd/4th St. @ Columbia St[3]	Westbound Left/Right	3.7	A	0.03	LOS E	Y	-	-
02	4th St. @ Columbia St.	Eastbound Left/Thru/Right	4.4	A	0.03	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	1.1	A	0.01	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	12.6	B	0.15	LOS E	Y	90	100 (SBL)
05	5th St. @ Washington St.	***Overall Intersection***	39.6	D	0.42	LOS E	Y	180 215	200 (EBR to I-5) 225 (SBL)
06	6th St. @ Columbia St.	***Overall Intersection***	7.8	A	0.42	LOS E	Y	-	-
07	6th St. @ Washington St.	***Overall Intersection***	20.3	C	0.39	LOS E	Y	-	-
08	6th St. @ Main St.	***Overall Intersection***	6.5	A	0.38	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	1.8	A	0.02	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	5.7	A	-	LOS E	Y	-	-
11	8th St. @ Esther St.	Southbound Left/Thru/Right	6.0	A	0.08	LOS E	Y	-	-
12	8th St. @ Columbia St.	***Overall Intersection***	10.8	B	0.51	LOS E	Y	-	-
13	8th St. @ Washington St.	***Overall Intersection***	5.4	A	0.55	LOS E	Y	-	-
14	8th St. @ Main St.	***Overall Intersection***	11.3	B	0.55	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Left	6.6	A	0.22	LOS E	Y	-	-
16	8th St. @ C St.	***Overall Intersection***	10.0	A	0.48	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	5.6	A	0.08	LOS E	Y	-	-
18	9th St. @ Columbia St.	Eastbound Left/Thru/Right	5.4	A	0.05	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Left	6.4	A	0.01	LOS E	Y	-	-
20	9th St. @ Main St.	Northbound Left	6.2	A	0.05	LOS E	Y	50	75 (NBL)
21	9th St. @ Broadway	Southbound Thru/Right	5.6	A	0.27	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	4.7	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	***Overall Intersection***	13.4	B	0.49	LOS E	Y	-	-
24	Evergreen Blvd. @ Washington St.	***Overall Intersection***	9.1	A	0.53	LOS E	Y	-	-
25	Evergreen Blvd. @ Main St.	***Overall Intersection***	7.9	A	0.53	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	***Overall Intersection***	18.7	B	0.83	LOS E	Y	75 100 210	75 (WBL) 100 (SBL) 225 (SBTR)
27	Evergreen Blvd. @ C St.	***Overall Intersection***	11.9	B	0.83	LOS E	Y	-	-
28	11th St. @ Esther St.	Southbound Left/Thru/Right	4.3	A	0.03	LOS E	Y	-	-
29	11th St. @ Columbia St.	Westbound Left/Thru/Right	6.9	A	0.14	LOS E	Y	-	-
30	11th St. @ Washington St.	Eastbound Thru/Right	6.0	A	0.07	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Thru/Right	4.7	A	0.08	LOS E	Y	-	-
32	11th St. @ Broadway	Eastbound Thru/Right	6.1	A	0.06	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	4.2	A	0.08	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	***Overall Intersection***	12.8	B	0.66	LOS E	Y	-	-
35	Mill Plain Blvd. @ Washington St.	***Overall Intersection***	7.2	A	0.40	LOS E	Y	-	-
36	Mill Plain Blvd. @ Main St.	***Overall Intersection***	4.7	A	0.57	LOS E	Y	-	-
37	Mill Plain Blvd. @ Broadway	***Overall Intersection***	12.2	B	0.51	LOS E	Y	190	200 (SBLT)
38	Mill Plain Blvd. @ C St.	***Overall Intersection***	8.3	A	0.34	LOS E	Y	-	-
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	18.6	B	0.58	LOS E	Y	350 275	375 (EBR) 350 (WBL)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	21.8	C	0.54	LOS E	Y	75	100 (WBR)
41	15th St. @ Columbia St.	***Overall Intersection***	10.1	B	0.53	LOS E	Y	-	-
42	15th St. @ Washington St.	***Overall Intersection***	4.9	A	0.44	LOS E	Y	-	-
43	15th St. @ Main St.	***Overall Intersection***	7.5	A	0.48	LOS E	Y	-	-
44	15th St. @ Broadway	***Overall Intersection***	18.2	B	0.47	LOS E	Y	-	-
45	15th St. @ C St.	***Overall Intersection***	8.8	A	0.48	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	***Overall Intersection***	7.3	A	0.52	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	***Overall Intersection***	11.0	B	0.55	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	***Overall Intersection***	10.1	B	0.46	LOS E	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	***Overall Intersection***	9.1	A	0.36	LOS D	Y	-	-
50	24th St. @ Columbia St.	Westbound Left/Thru/Right	8.4	A	0.12	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	6.6	A	0.06	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	18.8	B	0.61	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	35.7	D	0.66	LOS D	Y	125 200 75 470	150 (WBL) 200 (WBTR) 100 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	18.4	B	0.65	LOS D	Y	-	-
55	4th Plain Blvd. @ F St.	***Overall Intersection***	12.5	B	0.50	LOS D	Y	150	200 (EBL)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	8.8	A	0.46	LOS D	Y	-	-
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	12.3	B	0.51	LOS D	Y	75	150 (WBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	6.5	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	13.2	B	0.41	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	> 100	F	0.07	LOS E	N	215	225 (SBTR)
61	28th St. @ Broadway	Northbound Thru/Right	1.0	A	-	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Eastbound Left/Thru/Right	23.8	C	-	LOS E	Y	-	-
63	33rd St. @ Main St.	***Overall Intersection***	18.3	B	0.54	LOS D	Y	50 75	75 (WBL) 100 (SBL)
64	39th St. @ Main St.	***Overall Intersection***	28.5	C	0.69	LOS D	Y	75 75 215 125	125 (EBL) 125 (WBL) 225 (WBTR) 175 (SBL)
65	39th St. @ F St.	Southbound Left/Thru/Right	22.6	C	0.12	LOS E	Y	50	75 (WBL)
66	39th St. @ H St.	***Overall Intersection***	8.2	A	0.54	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Northbound Left	68.0	F	1.55	LOS E	N	1660 125	600 (NBL) 200 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	11.9	B	0.59	LOS D	Y	-	-
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	4.5	A	0.44	LOS D	Y	-	-
70	45th St. @ Main St.	***Overall Intersection***	7.4	A	0.44	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	9.7	A	0.50	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	4.6	A	0.29	LOS D	Y	-	-
73	Ross St. @ North Rd.	Northbound Left/Thru	6.0	A	0.24	LOS E	Y	-	-

Delay / LOS affected by freeway congestion

Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.

Note 2 The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersections.

Note 3 2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis

* Intersection not modeled in existing conditions scenario

Y* Intersection does not meet standard in the Build scenario, but meets the "do no worse" criteria as compared to the No Build.

Y** Intersection operations are no worse than No Build, and no mitigation is required.

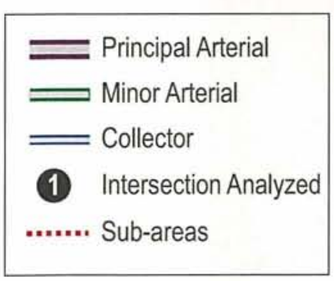
Vancouver Intersection Performance Results

PM Peak Hour		2005 Existing Conditions							
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
01	3rd/4th St. @ Columbia St[3]	Westbound Left/Right	4.7	A	0.05	LOS E	Y	-	-
02	4th St. @ Columbia St.	Westbound Left/Thru/Right	4.8	A	0.05	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	1.6	A	0.01	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	3.6	A	0.22	LOS E	Y	-	-
05	5th St. @ Washington St.	***Overall Intersection***	8.1	A	0.34	LOS E	Y	-	-
06	6th St. @ Columbia St.	***Overall Intersection***	10.7	B	0.42	LOS E	Y	-	-
07	6th St. @ Washington St.	***Overall Intersection***	11.6	B	0.36	LOS E	Y	-	-
08	6th St. @ Main St.	***Overall Intersection***	5.3	A	0.43	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	4.6	A	0.22	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	2.1	A	-	LOS E	Y	-	-
11	8th St. @ Esther St.	Northbound Left/Thru/Right	8.0	A	0.31	LOS E	Y	-	-
12	8th St. @ Columbia St.	***Overall Intersection***	15.1	B	0.74	LOS E	Y	-	-
13	8th St. @ Washington St.	***Overall Intersection***	9.5	A	0.58	LOS E	Y	75	125 (WBL)
14	8th St. @ Main St.	***Overall Intersection***	17.0	B	0.58	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Thru/Right	10.2	B	0.13	LOS E	Y	-	-
16	8th St. @ C St.	***Overall Intersection***	14.3	B	0.34	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	4.5	A	0.07	LOS E	Y	-	-
18	9th St. @ Columbia St.	Westbound Left/Thru/Right	6.3	A	0.18	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Thru	8.5	A	0.08	LOS E	Y	-	-
20	9th St. @ Main St.	Northbound Thru	6.7	A	0.34	LOS E	Y	50	50 (NBL)
21	9th St. @ Broadway	Southbound Thru/Right	6.2	A	0.24	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Southbound Left/Thru/Right	6.6	A	0.14	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	***Overall Intersection***	10.9	B	0.53	LOS E	Y	-	-
24	Evergreen Blvd. @ Washington St.	***Overall Intersection***	10.5	B	0.56	LOS E	Y	-	-
25	Evergreen Blvd. @ Main St.	***Overall Intersection***	9.7	A	0.56	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	***Overall Intersection***	12.7	B	0.56	LOS E	Y	210	225 (SBTR)
27	Evergreen Blvd. @ C St.	***Overall Intersection***	13.0	B	0.56	LOS E	Y	-	-
28	11th St. @ Esther St.	Northbound Left/Thru/Right	6.3	A	0.11	LOS E	Y	-	-
29	11th St. @ Columbia St.	Eastbound Left/Thru/Right	8.9	A	0.34	LOS E	Y	-	-
30	11th St. @ Washington St.	Eastbound Thru/Right	7.0	A	0.21	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Thru/Right	7.5	A	0.41	LOS E	Y	-	-
32	11th St. @ Broadway	Eastbound Thru/Right	6.2	A	0.19	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	7.8	A	0.18	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	***Overall Intersection***	14.7	B	0.75	LOS E	Y	-	-
35	Mill Plain Blvd. @ Washington St.	***Overall Intersection***	8.2	A	0.45	LOS E	Y	-	-
36	Mill Plain Blvd. @ Main St.	***Overall Intersection***	12.4	B	0.62	LOS E	Y	100	150 (NBR)
37	Mill Plain Blvd. @ Broadway	***Overall Intersection***	16.6	B	0.70	LOS E	Y	-	-
38	Mill Plain Blvd. @ C St.	***Overall Intersection***	14.1	B	0.60	LOS E	Y	-	-
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	37.5	D	0.72	LOS E	Y	275	350 (WBL)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	26.8	C	0.86	LOS E	Y	610 610 75	725 (EBL) 625 (EBT) 125 (WBR)
41	15th St. @ Columbia St.	***Overall Intersection***	9.0	A	0.54	LOS E	Y	-	-
42	15th St. @ Washington St.	***Overall Intersection***	5.6	A	0.37	LOS E	Y	-	-
43	15th St. @ Main St.	***Overall Intersection***	9.0	A	0.59	LOS E	Y	-	-
44	15th St. @ Broadway	***Overall Intersection***	24.8	C	0.43	LOS E	Y	210	250 (WBL)
45	15th St. @ C St.	***Overall Intersection***	6.7	A	0.41	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	***Overall Intersection***	6.4	A	0.42	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	***Overall Intersection***	11.6	B	0.67	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	***Overall Intersection***	7.8	A	0.39	LOS E	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	***Overall Intersection***	12.6	B	0.43	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	5.4	A	-	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	7.7	A	0.07	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	15.8	B	0.50	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	28.3	C	0.66	LOS D	Y	125 200 75 75 75	150 (WBL) 200 (WBTR) 100 (NBL) 125 (NBR) 125 (SBL)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	24.0	C	0.94	LOS D	Y	125 495	150 (WBL) 500 (WBTR)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	7.1	A	0.57	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	11.3	B	0.54	LOS D	Y	-	-
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	16.0	B	0.63	LOS D	Y	75	150 (WBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	7.0	A	-	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	16.6	B	0.54	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	6.8	A	0.03	LOS E	Y	-	-
61	28th St. @ Broadway	Northbound Thru/Right	1.9	A	-	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Eastbound Left/Thru/Right	12.5	B	-	LOS E	Y	-	-
63	33rd St. @ Main St.	***Overall Intersection***	18.3	B	0.45	LOS D	Y	50 50	75 (EBL) 75 (WBL)
64	39th St. @ Main St.	***Overall Intersection***	38.3	D	0.71	LOS D	Y	75 490 75 215 75 125	125 (EBL) 500 (EBTR) 100 (WBL) 225 (WBTR) 125 (NBL) 175 (SBL)
65	39th St. @ F St.	Northbound Left/Thru/Right	> 100	F	0.16	LOS E	N	- 50 430	- 75 (WBL) 450 (WBTR)
66	39th St. @ H St.	***Overall Intersection***	8.3	A	0.57	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Northbound Left	30.0	D	-	LOS E	Y	- 55 125	- 100 (EBR) 175 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	23.1	C	0.76	LOS D	Y	75	125 (NBR)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	4.9	A	0.33	LOS D	Y	-	-
70	45th St. @ Main St.	***Overall Intersection***	9.1	A	0.44	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	8.5	A	0.45	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	8.5	A	0.46	LOS D	Y	60 60	75 (WBL) 75 (WBR)
73	Ross St. @ North Rd.	Southbound Thru/Right	5.0	A	0.18	LOS E	Y	-	-

Delay / LOS affected by freeway congestion
Intersection queuing spills back into upstream intersection
Note 1 The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.
Note 2 The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersectio
Note 3 2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis
* Intersection not modeled in existing conditions scenario
Y* Intersection does not meet standard in the Build scenario, but meets the "do no worse" criteria as compared to the No Build.
Y** Intersection operations are no worse than No Build, and no mitigation is required.

Exhibit 5-51

PRELIMINARY



Existing
Mill Plain Interchange Sub-area

Columbia River CROSSING

Exhibit 5-52


Principal Arterial
Minor Arterial
Collector
500
5
Fourth Plain
33rd St
29th St
28th St
24th St
Kauffman
Columbia
Main St
P St
W Fourth Plain Blvd
E Fourth Plain Blvd
St Johns Blvd
Fort Vancouver Way
Waterworks Park
Washington
Broadway
C St
F St
McLoughlin Blvd
50
51
52
53
54
55
56
57
58
59
60
61
62
63

Exhibit 5-53


Principal Arterial
Minor Arterial
Collector
SR 500/
Main Street
NE Ross St
NE HazelDell Ave
NE 15th Ave
45th St
Main St
45th St
39th St
5
Leverich
Park
72
73
71
70
69
64
65
66
67
68

Exhibit 5-54

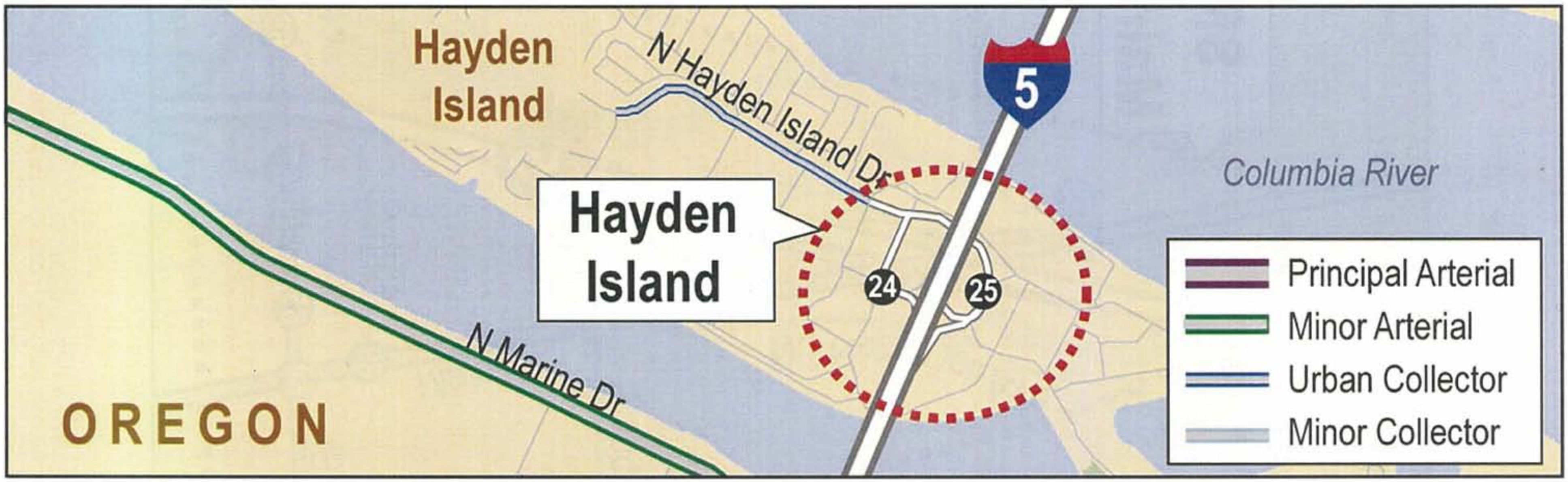

Hayden Island
N Hayden Island Dr
5
Columbia River
Hayden Island
24
25
N Marine Dr
OREGON
Principal Arterial
Minor Arterial
Urban Collector
Minor Collector

Exhibit 5-55

Portland Intersection Performance Results

AM Peak Hour		2005 Existing Conditions							
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr.	***Overall Intersection***	24.2	C	0.83	LOS D	Y	125	200 (WBL)
02	Going and Interstate	***Overall Intersection***	31.7	C	0.75	LOS D	Y	125	250 (WBL)
								125	150 (NBL)
03	Alberta and Interstate	***Overall Intersection***	18.0	B	0.72	LOS D	Y	100	125 (SBL)
04	Alberta and SB I-5 Off-Ramp	***Overall Intersection***	13.6	B	0.67	0.85	Y	175	175 (WBLT)
05	Alberta and NB I-5 Off-Ramp	***Overall Intersection***	10.1	B	0.49	0.85	Y	-	-
06	Alberta and MLK Jr.	***Overall Intersection***	20.3	C	0.78	LOS D	Y	75	125 (WBR)
								100	125 (NBL)
07	Rosa Parks and Interstate	***Overall Intersection***	18.2	B	0.54	LOS D	Y	-	-
08	Rosa Parks and I-5 SB On-/Off Ramps	***Overall Intersection***	18.3	B	0.52	0.85	Y	190	225 (WBL)
09	Rosa Parks and I-5 NB On-/Off Ramps	***Overall Intersection***	11.8	B	0.39	0.85	Y	-	-
10	Rosa Parks and MLK Jr.	***Overall Intersection***	17.5	B	0.66	LOS D	Y	-	-
11	Lombard and Interstate	***Overall Intersection***	27.8	C	0.72	0.99	Y	150	175 (WBL)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.31	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	8.5	A	0.48	0.85	Y	-	-
14	Lombard and MLK Jr.	***Overall Intersection***	61.4	E	0.79	0.99	Y	100	125 (EBL)
								100	175 (WBL)
								100	175 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	***Overall Intersection***	22.2	C	0.61	LOS D	Y	75	125 (EBR)
								50	75 (NBL)
16	Columbia Blvd and I-5 Ramps	***Overall Intersection***	17.6	B	0.62	0.85	Y	150	200 (WBR)
17	Columbia Blvd and MLK Jr.	***Overall Intersection***	32.7	C	0.72	0.99	Y	100	200 (NBL)
								225	250 (SBL)
18	Victory and Expo Road	***Overall Intersection***	2.2	A	0.22	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On-Ramp	Westbound Left/Thru	1.1	A	0.17	0.85	Y	-	-
20	Victory Blvd and NB On-/Off-Ramps	***Overall Intersection***	4.0	A	0.10	0.85	Y	-	-
21	Union Ct and I-5 NB Off-Ramp	Eastbound Left	7.1	A	0.24	0.85	Y	-	-
22	Union Ct/Marine Way and Vancouver Way	***Overall Intersection***	5.8	A	0.36	LOS E	Y	-	-
23	Marine Dr and I-5 On-/Off-Ramps	***Overall Intersection***	32.8	C	0.66	0.85	Y	200	275 (NBL)
								125	200 (SBR)
24	Center Ave and I-5 SB On-/Off Ramps	***Overall Intersection***	11.0	B	0.35	0.85	Y	-	-
25	Hayden Island Dr and Hayden Island Dr South	***Overall Intersection***	8.2	A	0.35	0.85	Y	-	-

Delay / LOS affected by freeway congestion

Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.

Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1)

Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR-99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).

Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.

PRELIMINARY

Portland Intersection Performance Results

PM Peak Hour		2005 Existing Conditions							
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr.	***Overall Intersection***	30.5	C	0.89	LOS D	Y	125	150 (EBL)
								125	175 (NBL)
								125	150 (SBL)
02	Going and Interstate	***Overall Intersection***	33.8	C	0.72	LOS D	Y	125	150 (NBL)
03	Alberta and Interstate	***Overall Intersection***	25.1	C	0.76	LOS D	Y	125	175 (NBL)
04	Alberta and SB I-5 Off-Ramp	***Overall Intersection***	10.4	B	0.63	0.85	Y	-	-
05	Alberta and NB I-5 Off-Ramp	***Overall Intersection***	10.1	B	0.70	0.85	Y	-	-
06	Alberta and MLK Jr.	***Overall Intersection***	38.0	D	0.88	LOS D	Y	75	150 (WBR)
								100	150 (NBL)
								100	150 (SBL)
07	Rosa Parks and Interstate	***Overall Intersection***	32.0	C	0.71	LOS D	Y	100	150 (WBL)
								175	225 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	***Overall Intersection***	15.0	B	0.48	0.85	Y	-	-
09	Rosa Parks and I-5 NB On-/Off Ramps	***Overall Intersection***	12.7	B	0.42	0.85	Y	-	-
10	Rosa Parks and MLK Jr.	***Overall Intersection***	16.5	B	0.75	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	***Overall Intersection***	32.4	C	0.76	0.99	Y	100	175 (NBR)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	3.7	A	0.36	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	10.7	B	0.42	0.85	Y	-	-
14	Lombard and MLK Jr.	***Overall Intersection***	74.0	E	0.85	0.99	Y	100	150 (EBL)
								100	175 (WBL)
								100	225 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	***Overall Intersection***	17.6	B	0.61	LOS D	Y	75	125 (EBR)
								50	75 (NBL)
16	Columbia Blvd and I-5 Ramps	***Overall Intersection***	12.6	B	0.58	0.85	Y	150	175 (WBR)
17	Columbia Blvd and MLK Jr.	***Overall Intersection***	39.3	D	0.71	0.99	Y	150	175 (WBL)
								100	225 (NBL)
								225	300 (SBL)
18	Victory and Expo Road	***Overall Intersection***	4.4	A	0.32	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On-Ramp	Eastbound Thru	5.5	A	0.27	0.85	Y	-	-
20	Victory Blvd and NB On-/Off-Ramps	***Overall Intersection***	56.9	E	0.32	0.85	Y	290	325 (EBL)
								200	250 (WBTR)
21	Union Ct and I-5 NB Off-Ramp	Eastbound Left/Thru	33.1	D	0.30	0.85	Y	200	250 (EBL)
22	Union Ct/Marine Way and Vancouver Way	***Overall Intersection***	28.3	D	0.66	LOS E	Y	75	100 (SBLTR)
								370	500 (NBLT)
								370	400 (NBR)
								55	75 (SWL)
								55	75 (SWTR)
23	Marine Dr and I-5 On-/Off-Ramps	***Overall Intersection***	55.7	E	0.69	0.85	Y	275	325 (EBL)
								375	1150 (WBR)
24	Center Ave and I-5 SB On-/Off Ramps	***Overall Intersection***	20.2	C	0.61	0.85	Y	115	225 (WBLT)
25	Hayden Island Dr and Hayden Island Dr South	***Overall Intersection***	12.9	B	0.44	0.85	Y	-	-

Delay / LOS affected by freeway congestion

Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.

Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1)

Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR-99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).

Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.

Exhibit 5-57


OREGON
Portland
Marine Drive
N Marine Dr
Columbia River
North Portland Harbor
N Marine Dr
23
22
21
5
Delta Park
MLK Jr Blvd
Vancouver Way
Union Ct
99E
Principal Arterial
Minor Arterial
Urban Collector
Minor Collector

Exhibit 5-58


Principal Arterial
Minor Arterial
Urban Collector
Minor Collector
Victory Blvd
18
19
20
15
Denver
Whitaker Rd
Columbia Slough
Schmeer Rd
N Columbia Blvd
Kilpatrick St
5

Exhibit 5-59

Principal Arterial
Minor Arterial
Urban Collector
Minor Collector
North Portland
Portland
Lombard
Portland Blvd
Albina Ave
Vancouver Ave
Killingsworth
Martin Luther King Jr Blvd
99E
Alberta Ave
Going
Interstate Ave
Vancouver Ave
Williams Ave
Greeley
OREGON
Fremont
5
1
2
3
4
5
6
7
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13
14
16
17

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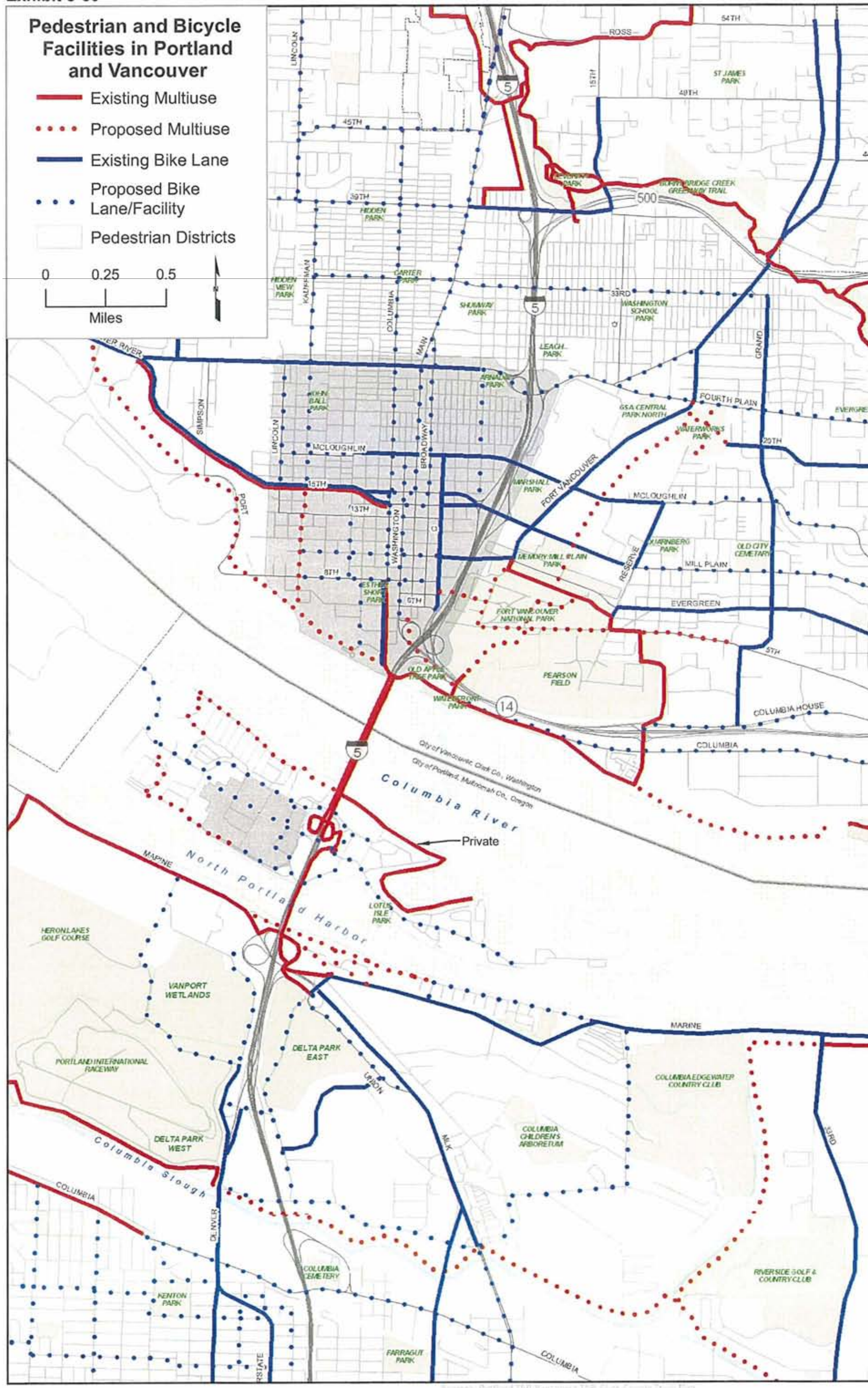
Exhibit 5-60


Pedestrian and Bicycle Facilities in Portland and Vancouver
Existing Multiuse
Proposed Multiuse
Existing Bike Lane
Proposed Bike Lane/Facility
Pedestrian Districts
0
0.25
0.5
Miles
Columbia River
North Portland Harbor
Columbia Slough
Private
City of Vancouver, Clark Co., Washington
City of Portland, Multnomah Co., Oregon
HERON LAKES GOLF COURSE
VANPORT WETLANDS
PORTLAND INTERNATIONAL RACEWAY
DELTA PARK EAST
DELTA PARK WEST
COLUMBIA EDGEWATER COUNTRY CLUB
COLUMBIA CHILDREN'S ARBORETUM
RIVERSIDE GOLF & COUNTRY CLUB
COLUMBIA CEMETERY
KENTON PARK
FARRAGUT PARK
LOTUS ISLE PARK
PEARSON FIELD
FORT VANCOUVER NATIONAL PARK
MARSHALL PARK
ST JAMES PARK
SHUMWAY PARK
LEACH PARK
WASHINGTON SCHOOL PARK
GSA CENTRAL PARK NORTH
WATERWORKS PARK
OLD CITY CEMETARY
MARINE
COLUMBIA
MCLOUGHLIN
MILL PLAIN
EVERGREEN
FOURTH PLAIN
COLUMBIA HOUSE
FORT VANCOUVER
RESERVE
GRAND
BROADWAY
WASHINGTON
LINCOLN
MAIN
COLUMBIA
KAUFFMAN
SIMPSON
PORT
UNION
MLK
DENVER
33RD
45TH
39TH
54TH
ROSS
49TH
500
5
14

PRELIMINARY

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PRELIMINARY

Exhibit 5-61

Count Locations: All three river crossings
Count Date: Tuesday, September 11, 2007
Count Time: 6 AM to 8 PM
Weather: Sunny and clear

I-5 and I-205 Columbia River Crossing Bicycle and Pedestrian Volumes (September 11, 2007)									
		NB			SB			Hourly Totals	
Hour	**Bike**	**Ped**	**Total**	**Bike**	**Ped**	**Total**	**Bikes**	**Peds**	**Volume**
6:00 AM	14	3	17	16	1	17	30	4	34
7:00 AM	30	0	30	36	0	36	66	0	66
8:00 AM	21	2	23	13	2	15	34	4	38
9:00 AM	14	1	15	31	4	35	45	5	50
10:00 AM	5	3	8	12	3	15	17	6	23
11:00 AM	6	1	7	10	1	11	16	2	18
12:00 PM	10	2	12	8	0	8	18	2	20
1:00 PM	16	2	18	5	3	8	21	5	26
2:00 PM	4	6	10	5	7	12	9	13	22
3:00 PM	23	0	23	12	2	14	35	2	37
4:00 PM	22	5	27	16	3	19	38	8	46
5:00 PM	46	7	53	20	2	22	66	9	75
6:00 PM	42	9	51	27	0	27	69	9	78
7:00 PM	12	4	16	16	1	17	28	5	33
14-Hour Totals	**265**	**45**	**310**	**227**	**29**	**256**	**492**	**74**	**566**

PRELIMINARY

Exhibit 5-62

Count Location: South end of Glenn Jackson Bridge shared-use path @ Airport Way
Count Date: Tuesday, September 11, 2007
Count Time: 6 AM to 8 PM
Weather: Sunny and clear

I-205 Glenn Jackson Bridge Bicycle and Pedestrian Volumes (September 11, 2007)

	NB			SB			Hourly Totals		
Hour	**Bike**	**Ped**	**Total**	**Bike**	**Ped**	**Total**	**Bikes**	**Peds**	**Volume**
6:00 AM	1	0	1	11	0	11	12	0	12
7:00 AM	14	0	14	11	0	11	25	0	25
8:00 AM	13	0	13	5	0	5	18	0	18
9:00 AM	10	0	10	9	0	9	19	0	19
10:00 AM	1	0	1	5	0	5	6	0	6
11:00 AM	1	0	1	6	0	6	7	0	7
12:00 PM	4	2	6	2	0	2	6	2	8
1:00 PM	6	0	6	1	1	2	7	1	8
2:00 PM	1	2	3	2	2	4	3	4	7
3:00 PM	9	0	9	8	0	8	17	0	17
4:00 PM	5	1	6	8	1	9	13	2	15
5:00 PM	6	1	7	14	0	14	20	1	21
6:00 PM	13	0	13	10	0	10	23	0	23
7:00 PM	6	0	6	6	0	6	12	0	12
14-Hour Totals	**90**	**6**	**96**	**98**	**4**	**102**	**188**	**10**	**198**

Exhibit 5-63

PRELIMINARY

Count Location: West pathway entrance at I-5 Interstate Bridge bridgehead on Hayden Island
Count Date: Tuesday, September 11, 2007
Count Time: 6 AM to 8 PM
Weather: Sunny and clear

I-5 Interstate Bridge West Pathway Bicycle and Pedestrian Volumes (September 11, 2007)

	NB			SB			Hourly Totals		
Hour	**Bike**	**Ped**	**Total**	**Bike**	**Ped**	**Total**	**Bikes**	**Peds**	**Volume**
6:00 AM	11	3	14	2	1	3	13	4	17
7:00 AM	15	0	15	5	0	5	20	0	20
8:00 AM	6	1	7	4	0	4	10	1	11
9:00 AM	4	1	5	17	4	21	21	5	26
10:00 AM	4	1	5	4	3	7	8	4	12
11:00 AM	5	1	6	4	1	5	9	2	11
12:00 PM	6	0	6	5	0	5	11	0	11
1:00 PM	9	2	11	1	2	3	10	4	14
2:00 PM	3	4	7	2	2	4	5	6	11
3:00 PM	5	0	5	3	2	5	8	2	10
4:00 PM	9	4	13	7	0	7	16	4	20
5:00 PM	25	1	26	6	2	8	31	3	34
6:00 PM	19	2	21	11	0	11	30	2	32
7:00 PM	2	1	3	4	1	5	6	2	8
14-Hour Totals	**123**	**21**	**144**	**75**	**18**	**93**	**198**	**39**	**237**

Exhibit 5-64

Count Location: East pathway entrance at I-5 Interstate Bridge bridgehead on Hayden Island
Count Date: Tuesday, September 11, 2007
Count Time: 6 AM to 8 PM
Weather: Sunny and clear

I-5 Interstate Bridge East Pathway Bicycle and Pedestrian Volumes (September 11, 2007)

	NB			SB			Hourly Totals		
Hour	Bike	Ped	Total	Bike	Ped	Total	Bikes	Peds	Volume
6:00 AM	2	0	2	3	0	3	5	0	5
7:00 AM	1	0	1	20	0	20	21	0	21
8:00 AM	2	1	3	4	2	6	6	3	9
9:00 AM	0	0	0	5	0	5	5	0	5
10:00 AM	0	2	2	3	0	3	3	2	5
11:00 AM	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	1	0	1	1	0	1
1:00 PM	1	0	1	3	0	3	4	0	4
2:00 PM	0	0	0	1	3	4	1	3	4
3:00 PM	9	0	9	1	0	1	10	0	10
4:00 PM	8	0	8	1	2	3	9	2	11
5:00 PM	15	5	20	0	0	0	15	5	20
6:00 PM	10	7	17	6	0	6	16	7	23
7:00 PM	4	3	7	6	0	6	10	3	13
14-Hour Totals	**52**	**18**	**70**	**54**	**7**	**61**	**106**	**25**	**131**

Exhibit 5-65

Bicycle and Pedestrian Existing Conditions

Annotations

1. The approach to the bridge is narrow, has limited signage and no crosswalk.
2. The bridge pathway access point is only 41" wide, and is separated from traffic by a 26" barrier.
3. The east pathway access point pavement is broken and uneven. The path is separated from traffic by a 26" barrier. A telephone pole is placed in the middle of the bike path.
4. Access to/from the bridge is via a steep path with inadequate height railings. SE Columbia Way has no crosswalks or bike lanes. Signage is minimal.
5. The bridge path narrows to 42" at the lift gate. Fixed objects such as protruding cables and chain link gates pose a hazard.
6. The bridge pathway is 4 feet wide. The railing is low – 41". Lighting is poor. Debris and bird dropping litter the path. Noise and emissions from passing traffic make the trip uncomfortable. Heavy trucks make the bridge vibrate. There is not enough separation from the traffic stream. There is a general perception that conditions are unsafe and substandard. There is no safe place to stop and enjoy the view.
7. Railing is 44" high, but there is an open space between the bottom of the railing and the path.
8. Bridge access point is narrow, with a 24" barrier separating the path from traffic. The turn-off onto Hayden Island is sharp. Landscaping has overgrown and narrowed the path.
9. Directional signage is missing, confusing or contradictory. The tunnel underneath the freeway can be intimidating at night and needs lighting improvements.
10. The barrier separating the path from traffic stream is only 26". Pathway is too narrow for two bikes to pass.
11. Path is overgrown. Signage points bikers and pedestrians to the less safe bridge east pathway.
12. Pedestrian push button is inaccessible for wheelchair users. Little to no room on curb for multiple bicyclists and walkers. Signal cycle is overly long.
13. Lack of safety at Tomahawk Drive crosswalk. Exiting vehicles have poor visibility and short sight distances. There is no crosswalk signal.
14. Path from Harbor Bridge to Interstate Bridge is circuitous and confusing and lacks a direct connection. There are a high number of vehicle and pedestrian/bicyclist conflicts. High heavy vehicle percentage creates a less comfortable environment.
15. The Portland Harbor Bridge traffic barrier ranges from a standard height of 54" to a low of 39". Headlight glare from oncoming vehicles making biking southbound at night difficult. Expansion joints and poorly patched utility work make for uneven obstacle-laden path.
16. Paths and grassy areas littered with trash – no garbage cans in the area. Circuitous paths and poor accessibility.
17. Narrow, cracked sidewalks at Marine Drive intersection. Long signal cycles. Number of heavy trucks and high traffic speeds make area intimidating.
18. Sidewalk to Expo Center MAX station is narrow and roadway has no shoulder. Path to MAX station is too narrow and has too many sharp curves. The MAX station lacks curb cutouts. Lack of signage pointing toward station.
19. Path alongside northbound on-ramp has poor sight-distances and needs re-striping. Directional signage is damaged and confusing.
20. Access to Delta Park has no crosswalk. Stop bar is located too close to intersection.
21. Delta Park pavement is bumpy, poorly patched, and makes riding uncomfortable.
22. Intersection near Union 76 lacks crosswalks, bike lanes and is difficult for bicyclists to access Delta Park without taking a long circuitous path.

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6. No-Build Alternative

6.1 Description of Transportation System

The No-Build Alternative was developed to quantify the transportation impacts in the Bridge Influence Area for the year 2030 of not building a project. As such, it serves as the basis of comparison for transportation performance of the build alternatives.

The CRC project uses 2030 as the horizon year for all alternatives. The No-Build Alternative includes planned improvements up to the year 2030 for which need, commitment, financing, and public and political support are identified and are reasonably expected to be implemented. All transportation improvements included in the No-Build Alternative are included in either Metro's 2025 RTC (including amendments) or the RTC's 2030 Metropolitan Transportation Plan (MTP).

The No-Build Alternative assumes one major capacity projects on Interstate 5 within the Bridge Influence Area: the southbound I-5 widening to three lanes from Lombard Street to Victory Boulevard, a project that was in the planning stages when the CRC project began, but which was completed in 2010. Outside the Bridge Influence Area, a major capacity improvement is planned for the Rose Quarter area that involves braiding the I-84 and Broadway/Weidler on- and off-ramps in both the northbound and southbound directions. In addition, there are some minor I-5 capacity enhancements and several major maintenance projects, specifically identified in the financially constrained regional transportation plans of both Metro and RTC. In Vancouver, additional ramp meters would be added to I-5 within the Bridge Influence Area at several locations.

Metro's adopted 2025 Regional Transportation Plan (RTP) was used to develop the No-Build Alternative. Metro has compiled a list of projects for the years 2026-2030, which have been approved by Metro's Transportation Policy Alternatives Committee (TPAC).

RTC's MTP has been updated to reflect a 2030 horizon year. The plan was adopted by the RTC in December 2007. In July 2008, RTC amended the MTP to include the Columbia River Crossing project's Locally Preferred Alternative.

Annual system-wide increases in TriMet's transit service hours are forecast to be between 1.0 percent and 1.5 percent per year, consistent with the RTP 2025 financially constrained transit network.

C-TRAN fixed route service hours will remain constant through 2010, based on the current funding that preserves existing levels of service for the foreseeable future (Preservation Plan through 2011). However, C-TRAN will experience a 2.0 percent average annual decrease in fixed route service hours from 2011 to 2030, although commuter service across the Columbia River is expected to remain relatively constant.

6.2 I-5 and I-205 Performance

This section summarizes highway performance for the No-Build Alternative. It explains how existing transportation conditions would change by the year 2030 without the improvements proposed by this project.

6.2.1 Daily Traffic Levels

By 2030, the average weekday traffic across the I-5 bridge is forecast to reach 184,000 vehicles per day, an increase of 37 percent over current conditions. Daily traffic levels on the I-205 bridge are projected to rise to 210,000 vehicles per day, an increase of 44 percent over current volumes. For the I-5 and I-205 bridges together, daily auto traffic volumes would increase by 41 percent over existing levels, while truck traffic would increase 77 percent over existing conditions. **Exhibit 6-1** summarizes ADT volumes on the I-5 bridge, the I-205 bridge, and the total river crossing.

6.2.2 Traffic Demand – Vehicles

This section compares traffic conditions in 2030 with the No-Build Alternative to existing conditions for the four-hour morning and four-hour afternoon/evening peaks.

Freeway traffic volumes were developed using the following seven-step process:

1. Summarize 2005 existing count data.
2. Summarize year 2005 and 2030 four-hour VISUM volumes.
3. Convert four-hour VISUM volumes into four, one-hour volumes, based on the percentage that each of the four one-hour periods consists of the total four-hour VISUM volume.
4. Calculate the 25-year forecast peak hour volume difference between 2005 and 2030 VISUM model.
5. Calculate the percentage of the 2030 total "screenline" segment on- and off-ramp volumes for each individual on- and off-ramp in the "screenline" segment.
6. Multiply the individual ramp percentages calculated in step 5 by the total on- or off-ramp volume difference calculated from step 4, and add this to the existing 2005 ramp volume.
7. Adjust the calculated ramp volumes in step 6 for the effects of adding or removing new on- and off-ramps, tolling, and increased development on Hayden Island.

The local roadway traffic volumes were developed using the following steps:

1. Summarize 2005 existing count data.
2. Summarize year 2005 and 2030 VISUM volumes.

3. Calculate the 25-year growth rate between 2005 and 2030 VISUM model.
4. Grow existing volumes using the growth rates from the regional model.
5. Adjust the calculated volumes in step 4 for consistency with adopted plans and policies including the adopted Vancouver Central City Vision (VCCV) plan.

6.2.2.1 Vehicle Demands on I-5

Exhibit 6-2 compares forecast four-hour morning peak traffic demand for southbound I-5 to existing traffic volumes. Southbound traffic demand on the I-5 bridge would increase by 5,200 vehicles during the four-hour morning peak, a 26 percent increase over existing demand. Traffic demand would continue to be well in excess of I-5's available capacity, resulting in substantially increased congestion. Corridor-wide, the highest growth is projected to occur in northern Clark County (100 percent) and the lowest growth projected for North Portland (less than five percent). The growth projected within the Bridge Influence Area ranges from 20 to 35 percent.

Slightly higher growth is forecast for northbound I-5 during the four-hour morning peak as shown in **Exhibit 6-3**. Under the No-Build Alternative, northbound traffic demand at the Interstate Bridge is expected to increase by 5,700 vehicles, or 51 percent. Corridor-wide, the highest growth in traffic demand is projected to occur in northern Clark County (60 to 145 percent over existing conditions) and the lowest growth in North Portland (20 to 35 percent over existing conditions). The Bridge Influence Area growth forecasts range from 45 percent to 65 percent over existing conditions.

During the four-hour afternoon/evening peak, southbound I-5 traffic demand is forecast to increase by 4,000 vehicles at the Interstate Bridge, a 27 percent increase over existing conditions. Growth rates for southbound I-5 traffic demand during the four-hour afternoon/evening peak is forecast to range from 10 to 20 percent over existing conditions in North Portland, 20 to 40 percent within the Bridge Influence Area, and from 40 to over 100 percent in northern Clark County as shown in **Exhibit 6-4**.

Northbound traffic demand is forecast to increase by 6,900 vehicles at the Interstate Bridge, or 32 percent, during the four-hour afternoon/evening peak. The resulting traffic demand will continue to be well above I-5's available capacity, resulting in increased congestion. The highest growth in the I-5 corridor is forecast in northern Clark County (from 30 to 100 percent over existing conditions) and the lowest increases are projected in North Portland (from 10 to 30 percent over existing conditions) as shown in **Exhibit 6-5**. The Bridge Influence Area growth forecasts range from 30 to 35 percent over existing conditions.

6.2.2.2 Vehicle Demands on I-205

Exhibit 6-6 compares existing and No-Build traffic demand for southbound I-205. Weekday southbound I-5 two-hour morning peak traffic demand is projected to increase through the corridor by between 10 and 90 percent over existing conditions, with the highest growth in Vancouver.

Slightly higher growth is forecast for northbound I-205 during the two-hour morning peak, as shown in **Exhibit 6-7**. Growth is expected to range from 15 to 140 percent over existing conditions, with the highest growth forecast for Vancouver.

Growth rates for southbound I-205 two-hour afternoon/evening peak traffic demand are forecast to range from 15 to 95 percent along the I-205 corridor. These trends are shown in **Exhibit 6-8**. Forecast growth rates for northbound I-205 two-hour afternoon/evening peak traffic demands shown in **Exhibit 6-9** are estimated to range from remaining flat to 95 percent over existing conditions.

6.2.3 Traffic Demand – Truck Freight

Truck volume forecasts for 2030 are based on the *Portland/Vancouver International and Domestic Trade Capacity Analysis* growth forecasts for cargo. **Exhibit 6-10** presents the regional cargo forecasts by mode, and the resulting growth for each mode. All cargo is estimated to increase by 2.0 percent per year, and truck transport as a mode share of all cargo transport is expected to increase from 67 percent in 2000 to 73 percent in 2030. The compound annual growth rate (CAGR) for truck traffic, calculated for the period 2000 to 2030, is estimated at 2.3 percent per year.

Previous analysis showed that rail does not have the capacity to accommodate a meaningful shift of freight from truck to rail, nor would the type of freight generally carried by truck be expected to shift to rail (*Feasibility of Diverting Truck Freight to Rail in the Columbia River Corridor,* Draft Technical Memorandum, CRC, April 2005). The conclusions in the technical memorandum support the assumption that freight traffic in the I-5 corridor cannot easily shift modes, and that growth in truck volumes would continue to increase.

With more severe peak period congestion expected, more truck drivers may avoid the peak periods and travel during midday or nighttime hours to increase travel time reliability. At the same time, trucks would be required to move more freight volume each day to meet customer schedules and operating hours. The daily truck volume forecast to cross the I-5 bridge would increase from 11,000 under existing conditions to 19,400 under No-Build conditions (9,800 southbound and 9,600 northbound), an increase of over 8,400 trucks or 77 percent. The forecasted increase in truck volume means that not all trucks would be able to shift their travel outside of the peak congestion periods, which would result in increased travel times, wasted fuel and costs to customers.

Exhibit 6-11 illustrates total truck throughput during the morning and afternoon/evening peaks, the midday period (10 a.m. to 3 p.m.), and nighttime hours (7 p.m. to 6 a.m.) across the Interstate Bridge. It is expected that truck volumes would continue to increase during congested periods, but at a slower rate than overall growth in truck volumes; more trucks would move to midday or nighttime hours to avoid congested conditions. With approximately 7.75 hours of congestion northbound and 7.25 hours of congestion southbound, the No-Build Alternative would have a significant impact on truck travel time and reliability. Approximately 7,400 trucks are projected to travel daily across the Interstate Bridge during congested conditions with the No-Build Alternative.

6.2.3.1 Truck Operating Characteristics

As discussed, the rate of growth for truck traffic is expected to be significantly greater than for general-purpose traffic; this would have the effect of increasing the proportion of trucks in the traffic stream. Trucks consume approximately 2.5 times the highway capacity compared to passenger cars; therefore, in the future, the proportion of capacity used by trucks will be greater than today. The degradation in highway operations caused by slow-moving trucks at interchanges and on the I-5 mainline due to geometric conditions (uphill ramp grades, super-elevation, and merge distances) would be exacerbated in the future due to the increase in truck traffic relative to auto traffic.

6.2.3.2 Oversized Loads

The number of oversized truck loads is expected to increase in the future; the actual number of oversized trucks loads depends on the quantity and type of products that would be shipped in the future. For example, there are a number of wind turbine parts shipments that travel through the Bridge Influence Area today and require oversized truck loads. In the future, the number of oversized loads would be expected to increase as the volume of wind turbine parts shipments increase, or other specialized products begin to be transported through the project corridor. Oversize loads would generally experience the same level of congestion and reduction in travel speed as all trucks. Oversize loads attempt to avoid peak period conditions more than general truck traffic (and transportation permit conditions may require that they avoid peak commute periods). With the No-Build Alternative, there would be an additional nine hours of congestion near the Interstate Bridge to avoid.

6.2.4 Effect of Congestion

This section compares conditions in 2030 under the No-Build Alternative with existing conditions.

6.2.4.1 Duration of Congestion on Southbound I-5

Southbound congestion on the Interstate Bridge is expected to increase from two hours to 7.25 hours (see **Exhibit 6-12**). One of these hours would develop during the afternoon/evening peak in the reverse commute direction.

The Delta Park project (which was completed in 2010 and which widened I-5 southbound from two to three lanes between Victory Boulevard and Columbia Boulevard) eliminated the Delta Park lane drop bottleneck that existed in 2005 and was reflected in the Existing Conditions analysis. However, congestion and vehicular queuing would still exist through this portion of highway from the existing capacity constraint north of the I-405 split.

Southbound congestion north of the I-405 split would increase from 2.5 to 11 hours, with 3.75 hours of this forecast to occur during the afternoon/evening peak. The southbound bottleneck located near I-5's lane drop in the Rose Quarter is forecast to increase from under three hours to 4.75 hours despite the planned I-84/Broadway/Weidler ramp improvements.

6.2.4.2 Duration of Congestion on Northbound I-5

Northbound congestion on the Interstate Bridge is expected to increase from four hours to almost eight hours (see **Exhibit 6-13**) from an increase in traffic volume trying to utilize the existing limited capacity across the Interstate Bridge.

Northbound congestion near the I-405/Rose Quarter weaving area would increase from just over two hours today to more than seven hours. Almost half of the congestion would occur during the morning peak. Northbound congestion in the weaving area located on the Marquam Bridge upstream from the off-ramp to I-84 would increase from five hours to approximately seven hours.

6.2.5 Travel Times

This section compares forecast travel times for the No-Build Alternative in 2030 with existing conditions using the two-hour morning and two-hour afternoon/evening peaks.

6.2.5.1 Travel Time along I-5

During the two-hour morning peak, southbound I-5 travel times are forecast to increase by three minutes (19 percent) for a vehicle trip along I-5 from SR 500 to Columbia Boulevard, and by 15 minutes (48 percent) for a vehicle trip from 179th Street to I-84 as shown in **Exhibit 6-14**. The 48 percent increase in travel time for the longer segment is due to the increase in congestion levels along I-5. Travel times for trips entering I-5 from SR 500, SR 14 and Mill Plain and crossing the Interstate Bridge would be longer under the No-Build Alternative than under existing conditions.

During the two-hour afternoon/evening peak, northbound I-5 travel times are forecast to increase by two minutes (17 percent) for a trip from Columbia Boulevard to SR 500 and by six minutes (16 percent) for a vehicle trip from I-84 to 179th Street, as shown in **Exhibit 6-15**. Northbound travel times are forecast to increase due to increased congestion in the two existing bottleneck locations (Interstate Bridge and I-405/Rose Quarter weave) and along the entire I-5 corridor between the two bottleneck locations.

6.2.5.2 Travel Time along I-205

During the two-hour morning peak, southbound I-205 travel times are forecast to increase by 21 minutes (almost 200 percent) for a vehicle trip along I-205 from SR 500 to I-84, as shown in **Exhibit 6-16**. The substantial increase in travel times would be due to the increased congestion forecast for southbound I-205 during the morning peak.

During the two-hour afternoon/evening peak, northbound I-205 travel times are forecast to increase by five minutes (36 percent) for a vehicle-trip from I-84 to SR 500, as shown in **Exhibit 6-17**. The increase in travel times would be caused by increase in volume and resulting congestion for northbound I-205 during the afternoon/evening peak.

6.2.6 Service Volumes

This section compares forecast service volumes for the No-Build Alternative in 2030 with existing conditions using the four-hour morning and four-hour afternoon/evening peaks.

6.2.6.1 Vehicle Throughput (Served Volume) on Southbound I-5

During the four-hour morning peak, southbound vehicle throughput along I-5 near the Pioneer Street interchange is expected to double from 9,000 vehicles to over 18,000 vehicles (see **Exhibit 6-18**). The 100 percent increase in vehicle throughput would result primarily due to forecast land use changes identified for northern Clark County and is consistent with the growth seen in the regional travel demand model.

Vehicle throughput near the SR 500 interchange is forecast to increase by 3,500 vehicles (20 percent) for 2030 No-Build conditions compared to existing conditions. Although the 2030 No-Build Alternative would serve more volume, it would not serve the actual forecast demand due to downstream bottlenecks located at the Interstate Bridge and north of the I-405 split.

Similarly, the southbound vehicle throughput across the Interstate Bridge is forecast to increase by 3,000 vehicles (16 percent). However, the entire forecast demand would not be served due to the southbound bottlenecks on I-5 at the Interstate Bridge and north of the I-405 split.

Four-hour peak period vehicle throughput along I-5 near I-405 is forecast to be similar under both 2030 No-Build conditions and existing conditions, and serve about 20,000 vehicles. Similar to I-5 near SR 500 and the Interstate Bridge, I-5 north of the I-405 split would not serve all of its forecast demand due to the two identified southbound bottlenecks.

6.2.6.2 Vehicle Throughput (Served Volume) on Northbound I-5

During the four-hour afternoon/evening peak, northbound vehicle throughput along I-5 near I-405 is forecast to be slightly less compared to existing conditions (see **Exhibit 6-19**). The vehicle throughput is forecast to decrease by 2,000 vehicles (a decrease of 15 percent) due to increased downstream congestion at the Interstate Bridge, which would be present over the entire four-hour afternoon/evening peak, compared with only two hours of congestion under existing conditions.

Vehicle throughput across the Interstate Bridge is forecast to be similar under both No-Build and existing conditions. Under both scenarios, around 21,000 vehicles would be served during the four-hour peak. The Interstate Bridge would not serve all of its forecast demand (served volume would be 72 percent of total demand) due to the Interstate Bridge bottleneck.

Vehicle throughput near the SR 500 interchange is forecast to increase by 1,700 vehicles (70 percent) during the four-hour peak. Although the No-Build Alternative would serve more volume than existing conditions, it would not serve the entire forecast demand due to upstream bottlenecks located at the Interstate Bridge, I-405 and the Rose Quarter.

Northbound vehicle throughput near the Pioneer Street interchange is forecast to nearly double from 9,900 to over 18,000 vehicles over the four-hour afternoon/evening peak. The 85 percent increase in vehicle throughput would result primarily from forecast land use changes for northern Clark County and is consistent with the growth seen in the regional travel demand model.

6.2.7 Served vs. Unserved Ramp Volumes

This section compares ramp service levels for the No-Build Alternative in 2030 with existing conditions, using the four-hour morning and four-hour afternoon/evening peaks.

6.2.7.1 Southbound I-5

During the four-hour morning peak, the number of southbound on-ramps within the I-5 Bridge Influence Area unable to serve their traffic demands would increase from one (SR 14/City Center) under existing conditions to three (SR 500/39th Street, Mill Plain Boulevard, and SR 14/City Center) under No-Build conditions, as shown in **Exhibit 6-20**. During the four-hour morning peak, 2,600 vehicles at SR 500, 450 vehicles at Mill Plain Boulevard and 900 vehicles at SR 14/City Center would not be served, resulting in ramp back-ups and local street congestion. This increase would result primarily because of increased congestion forecast for southbound I-5 during the four-hour morning peak.

6.2.7.2 Northbound I-5

During the four-hour afternoon/evening peak, the number of northbound on-ramps unable to serve their traffic demands would increase from none under existing conditions to five (Interstate Avenue/Victory Boulevard, Marine Drive, Hayden Island, Mill Plain Boulevard and Fourth Plain Boulevard) under No-Build conditions, as shown in **Exhibit 6-21**. During the afternoon/evening peak, 1,700 vehicles at Interstate Avenue/Victory Boulevard, 650 vehicles at Marine Drive, 1,150 vehicles at Hayden Island, 1,350 vehicles at Mill Plain Boulevard, and 100 vehicles at Fourth Plain Boulevard would not be served, resulting in ramp back-ups and local street congestion. This increase would result primarily because of the increased congestion forecast for northbound I-5 during the four-hour afternoon/evening peak.

6.2.8 Person Throughput

Under No-Build conditions, about 24,800 persons in southbound vehicles would cross the I-5 bridge during the four-hour morning peak, an increase of 15 percent over existing conditions. About 3,050 persons in buses are also forecast to cross during this period.

About 26,500 persons in northbound vehicles would cross the I-5 bridge during the four-hour afternoon/evening peak. This is similar to how many cross during existing conditions. About 2,200 persons in buses are also forecast to cross during this period. **Exhibit 6-22** shows person-throughput data.

6.2.9 Interstate Bridge Gate Closures

A typical gate closure on the Interstate Bridge was simulated using the VISSIM microsimulation model for the 2030 No-Build Alternative. The typical gate closure simulated in VISSIM was based on bridge gate closure data collected for the years 2005-2007 as discussed under **Section 5.2.10** of this report.

The existing conditions data reveals that the most typical time for a gate closure on the Interstate Bridge during both the four-hour morning and four-hour afternoon/evening peak periods is during the first full hour (9 a.m. to 10 a.m.) after the end of the morning gate closure restriction. During this hour, the average start time for a gate closure is 9:25 a.m., and the average length of time traffic was stopped was 11 minutes. These typical conditions therefore became the basis for the No-Build Alternative gate closure analysis. The simulation covered the morning peak and included both the northbound and southbound directions of traffic.

The simulation results presented in **Exhibit 6-23** showed that an average bridge gate closure occurring after 9 a.m. would cause an additional 1.25 hours of congestion at the bridge in year 2030, raising the amount of daily southbound congestion from 7.25 to 8.5 hours, an increase of 17 percent. For the northbound direction results, shown in **Exhibit 6-24**, a typical gate closure would increase daily congestion by one hour, from 7.75 to 8.75 hours, a rise of 13 percent.

A typical gate closure during the hour between 9 a.m. and 10 a.m. would increase the extent of the southbound traffic queue from the 39th Street/SR 500 interchange to the 79th Street interchange, a distance of over 1.5 miles. In the northbound direction, a typical gate closure during the hour between 9 a.m. and 10 a.m. would create a traffic queue where none would otherwise exist. The extent of the traffic queue would reach the Victory Boulevard interchange.

6.2.10 Safety

6.2.10.1 Prediction of Future Collision Potential

The existence of non-standard geometric design features, the presence and duration of current congested traffic conditions, and the occurrence of I-5 bridge gate closures all contribute to the high number of vehicular collisions and the high collision rate currently experienced in the Bridge Influence Area.

Collision rates are highest during the hours where highway volumes simultaneously approach the observed maximums on I-5 *and* when a breakdown in traffic flow occurs. For example, in **Exhibit 6-25**, traffic volumes on I-5 northbound between 1 and 2 p.m. and between 3 and 4 p.m. are similar and close to the observed I-5 maximum capacity, however, as seen in **Exhibit 6-13,** congestion during the 1 to 2 p.m. hour is not as intense as between 3 and 4 p.m. The difference in traffic flow conditions between these two periods, despite the fact that similar traffic volumes are served, results in a lower crash rate (1.69 MVMT) for the 1 to 2 p.m. period, and a higher crash rate (2.82 MVMT) for the 3 to 4 p.m. period.

To estimate the potential number of collisions in the No-Build scenario, hourly collisions rates from existing conditions of peak volumes and congestion were applied to similar periods of peak volumes and congestion in the No-Build scenario. Collision rates for other hours in the No-Build were assigned based upon collision rates for hours with similar traffic volumes under existing conditions. Collision rates were then used to calculate the number of crashes over a five-year period using forecasted ADTs in the five-mile corridor.

Based upon the analysis, the number of collisions is likely to increase, potentially up to approximately 80 percent over existing conditions, as the existing non-standard features would remain on I-5 and its ramps, traffic levels would increase, the duration of congestion lengthens, and I-5 bridge gate closures would continue at their current rate or increase in the future.

Exhibit 6-25 shows predicted future collisions along northbound I-5 assuming no improvements are made within the Bridge Influence Area (existing non-standard geometric features remain and no traffic capacity is added) and traffic demands increase to forecast 2030 levels.

Exhibit 6-25 illustrates collisions would mostly increase during the additional hours of congestion experienced on I-5 northbound in 2030. The primary hours of additional congestion would be from 10 a.m. to 2 p.m. and from 6 p.m. to 9 p.m. During those two time periods traffic volumes will be at or near highway capacity and it would be expected that the collision rates observed during those two time periods would be roughly equivalent to the collision rate measured during the peak hours of travel in 2005. Collisions would also be expected to increase during the peak morning hours between 6 a.m. and 9 a.m. as northbound traffic volumes would increase by approximately 30 percent. Similar results are expected southbound on I-5 within the Bridge Influence Area.

6.3 Local Streets

6.3.1 Travel Demand

This section compares existing and future local street travel demand under the No-Build Alternative, using the morning and afternoon/evening peak one-hour period.

6.3.1.1 Vancouver Screenlines – Morning Peak Hour

During the morning peak hour, westbound traffic west of I-5 is forecast to increase between 40 and 115 percent, with the largest growth forecast for western Vancouver as shown in **Exhibit 6-26**. Eastbound traffic west of I-5 is forecast to increase between 20 and 45 percent, with the largest increase for western Vancouver due to large population and growth increases forecast for this part of the city from the regional model. Eastbound and westbound traffic just east of I-5 is forecast to increase by about 30 to 35 percent over existing conditions.

During the morning peak, southbound traffic in Vancouver is forecast to increase between 45 and 65 percent. Northbound traffic in Vancouver is forecast to increase by up to 30 percent, with the highest growth forecast for downtown Vancouver.

6.3.1.2 Vancouver Screenlines – Afternoon/Evening Peak Hour

During the afternoon/evening peak, westbound traffic west of I-5 is forecast to increase between 35 and 60 percent, with the largest growth also forecast for western Vancouver as shown in **Exhibit 6-27**. Eastbound traffic west of I-5 is forecast to increase between 40 and 100 percent, again with the largest increase for western Vancouver due to large population and growth increases forecast for this part of the city. East of I-5, eastbound traffic is forecast to increase more (45 percent) compared to westbound traffic (20 percent) over existing conditions.

During the afternoon/evening peak, southbound traffic in Vancouver is forecast to increase between five and 20 percent, with the highest growth forecast near the Mill Plain couplet. Northbound traffic in Vancouver is forecast to increase between 35 and 55 percent, with the highest growth forecast for downtown Vancouver.

6.3.1.3 Portland Screenlines – Morning Peak Hour

During the morning peak hour, eastbound and westbound traffic west of I-5 is forecast to increase between 25 and 40 percent over existing conditions, as shown in **Exhibit 6-28**. East of I-5, eastbound and westbound traffic is forecast to increase between 20 and 30 percent over existing conditions.

During the morning peak, southbound traffic in Portland is forecast to increase between 15 and 20 percent. Northbound traffic in Portland is forecast to increase between 30 and 70 percent, with the highest growth forecast near Alberta Street.

6.3.1.4 Portland Screenlines – Afternoon/Evening Peak Hour

During the afternoon/evening peak, eastbound and westbound traffic west of I-5 is forecast to increase between 25 and 40 percent over existing conditions, as shown in **Exhibit 6-29**. East of I-5, eastbound and westbound traffic is forecast to increase between 20 and 25 percent over existing conditions.

During the morning peak, southbound traffic in Portland is forecast to increase between 25 and 40 percent, with the highest growth forecast near Rosa Parks Way and Alberta Street. Northbound traffic in Portland is forecast to increase between 15 and 20 percent.

6.3.2 Intersection Operational Performance

This section compares intersection LOS under existing conditions and future No-Build Alternative, using the morning and afternoon/evening peak one-hour period.

6.3.2.1 Vancouver Service Levels – Morning and Afternoon/Evening Peak Hours

6.3.2.2 SR 14/City Center Interchange Area Operational Performance

The No-Build roadway network includes projects from RTC's MTP. Projects in the SR 14/City Center area include converting Broadway and Main Streets from one-way to two-way streets. In addition, the expansion of Third/Fourth Street and Columbia Way will add new intersections. As shown in **Exhibit 6-30**, the SR 14/City Center interchange area has 36 study intersections, of which three would be new intersections that do not currently exist. New or revised intersections are labeled with single letters instead of numbers to help with the identification.

As shown in **Exhibit 6-31**, during the morning peak, all 36 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the existing conditions. The three new intersections would operate acceptably. As shown in **Exhibit 6-32**, during the afternoon/evening peak, all 36 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the existing conditions. The three new intersections would operate acceptably.

As shown in **Exhibit 6-31**, during the morning peak, 33 of the study intersections would operate with acceptable vehicle queuing when compared to the existing conditions. All three of the new intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, 31 of the study intersections would operate with acceptable vehicle queuing. All three of the new intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, five intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

6.3.2.3 Mill Plain Boulevard Interchange Area Operational Performance

The No-Build roadway network includes projects from RTC's MTP. In addition the No-Build roadway network assumes signal pre-emption along Mill Plain Boulevard and 15th Street benefitting truck progression east and west along those two corridors. As shown in **Exhibit 6-33**, the Mill Plain Boulevard interchange area consists of 26 study intersections, all of which currently exist. Revised intersections are labeled with single letters instead of numbers to help with the identification.

As shown in **Exhibit 6-31**, during the morning peak, all 26 study intersections would operate acceptably with improved, similar, or slightly degraded conditions compared to existing conditions. No intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, 24 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. Two intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations.

As shown in **Exhibit 6-31**, during the morning peak, 16 of the study intersections would operate with acceptable vehicle queuing when compared to the existing conditions. Based on 95% queuing analysis, 10 intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, 18 of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, eight intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

6.3.2.4 Fourth Plain Boulevard Interchange Area Operational Performance

The No-Build roadway network includes projects from RTC's MTP. Fourth Plain Boulevard would be widened to a five-lane cross section from the southbound on-/off-ramps to the west. As shown in **Exhibit 6-34**, the Fourth Plain Boulevard interchange area consists of 14 study intersections, all of which currently exist.

As shown in **Exhibit 6-31**, during the morning peak, 11 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the existing conditions. Three intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, 13 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. One intersection would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-31**, during the morning peak, eight of the study intersections would operate with acceptable vehicle queuing when compared to the existing conditions. Based on 95% queuing analysis, six intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, nine of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, five intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

6.3.2.5 SR 500/Main Street/39th Street Interchange Area Operational Performance

The No-Build roadway network includes projects from RTC's MTP. As shown in **Exhibit 6-35**, SR 500/Main Street/39th Street interchange area consists of 10 study intersections, all of which currently exist.

As shown in **Exhibit 6-31**, during the morning peak, six of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the existing conditions. Four intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, six of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the existing conditions. Four intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations.

As shown in **Exhibit 6-31**, during the morning peak, five of the study intersections would operate with acceptable vehicle queuing when compared to the existing conditions. Based on 95% queuing analysis, five of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

As shown in **Exhibit 6-32**, during the afternoon/evening peak, three of the study intersections would operate with acceptable vehicle queuing when compared to the existing conditions. Based on 95% queuing analysis, seven intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under the existing conditions.

6.3.2.6 Portland Service Levels – Morning and Afternoon/Evening Peak Hours

6.3.2.7 Hayden Island Interchange Area Operational Performance

Under the No-Build scenario, the Hayden Island interchange area roadway network would remain in the same configuration as existing conditions. As shown in **Exhibit 6-36**, the interchange area consists of two study intersections.

As shown in **Exhibit 6-37**, during the morning peak hour, both of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, both of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions.

As shown in **Exhibit 6-37**, during the morning peak, both intersections would operate with acceptable vehicle queuing. As shown in **Exhibit 6-38**, during the afternoon/evening peak, based on 95% queuing analysis, both of the intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.3.2.8 Marine Drive Interchange Area Operational Performance

Under the No-Build scenario, the Marine Drive interchange area would remain in the same configuration as existing conditions. As shown in **Exhibit 6-39**, the interchange area consists of three study intersections.

As shown in **Exhibit 6-37**, during the morning peak, all three of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, two of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. One intersection would degrade from acceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-37**, during the morning peak, two of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, one intersection would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, based on 95% queuing analysis, all three of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.3.2.9 Victory Boulevard Interchange Area Operational Performance

Under the No-Build scenario, the Victory Boulevard interchange area would remain in the same configuration as existing conditions. As shown in **Exhibit 6-40**, the interchange area consists of four study intersections.

As shown in **Exhibit 6-37**, during the morning peak, all four of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, three of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions. The intersection of Interstate Avenue and Argyle Street would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations under the No-Build Alternative. This is caused because of the downstream congestion from I-5 in the vicinity of the Denver/Victory northbound on-ramp. The vehicle queue extends back from the Denver/Victory on-ramp merge with I-5, through the ramp meter, along Interstate Avenue and back into the intersection with Argyle Street, which results in LOS ‘F’ at that intersection.

As shown in **Exhibit 6-37**, during the morning peak, three of the study intersections would operate with acceptable vehicle queuing as compared to existing conditions. Based on 95% queuing analysis, one intersection would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, one of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.3.2.10 Interstate Avenue Analysis Area Operational Performance

Under the No-Build scenario, the Interstate Avenue analysis area would remain in the same configuration as existing conditions. As shown in **Exhibit 6-41**, the interchange area consists of four study intersections.

As shown in **Exhibit 6-37**, during the morning peak, all four of study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, three of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. One intersection would degrade from acceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-37**, during the morning peak, one study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, one of the study intersections would operate with acceptable vehicle queuing as compared to existing conditions. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.3.2.11 Martin Luther King Jr. Boulevard Analysis Area Operational Performance

Under the No-Build scenario, the Martin Luther King Jr. Boulevard analysis area would remain in the same configuration as existing conditions. As shown in **Exhibit 6-41**, the interchange area consists of five study intersections.

As shown in **Exhibit 6-37**, during the morning peak, four of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. One intersection would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations under the No-Build Alternative.

As shown in **Exhibit 6-38**, during the afternoon/evening peak, three of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions, and two intersections would degrade from acceptable or unacceptable operations under existing conditions to unacceptable operations.

As shown in **Exhibit 6-37**, during the morning peak, three of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, two intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

As shown in **Exhibit 6-38**, during the afternoon/evening peak two of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.3.2.12 I-5 Ramp Terminals Analysis Area Operational Performance

Under the No-Build scenario, the I-5 Ramp Terminals analysis area would remain in the same configuration as existing conditions, with the exception of the Alberta Street southbound and northbound ramp terminals. These ramp terminals would be signalized and have a westbound left-turn lane at the southbound terminal, and an eastbound left-turn lane at the northbound terminal. As shown in **Exhibit 6-41**, the interchange area would continue to consist of seven study intersections.

As shown in **Exhibits 6-37 and 6-38**, during the morning and afternoon/evening peaks, all seven of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to existing conditions. During the morning peak, all seven study intersections would operate with acceptable vehicle queuing.

As shown in **Exhibit 6-37**, during the morning peak, five of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, two intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

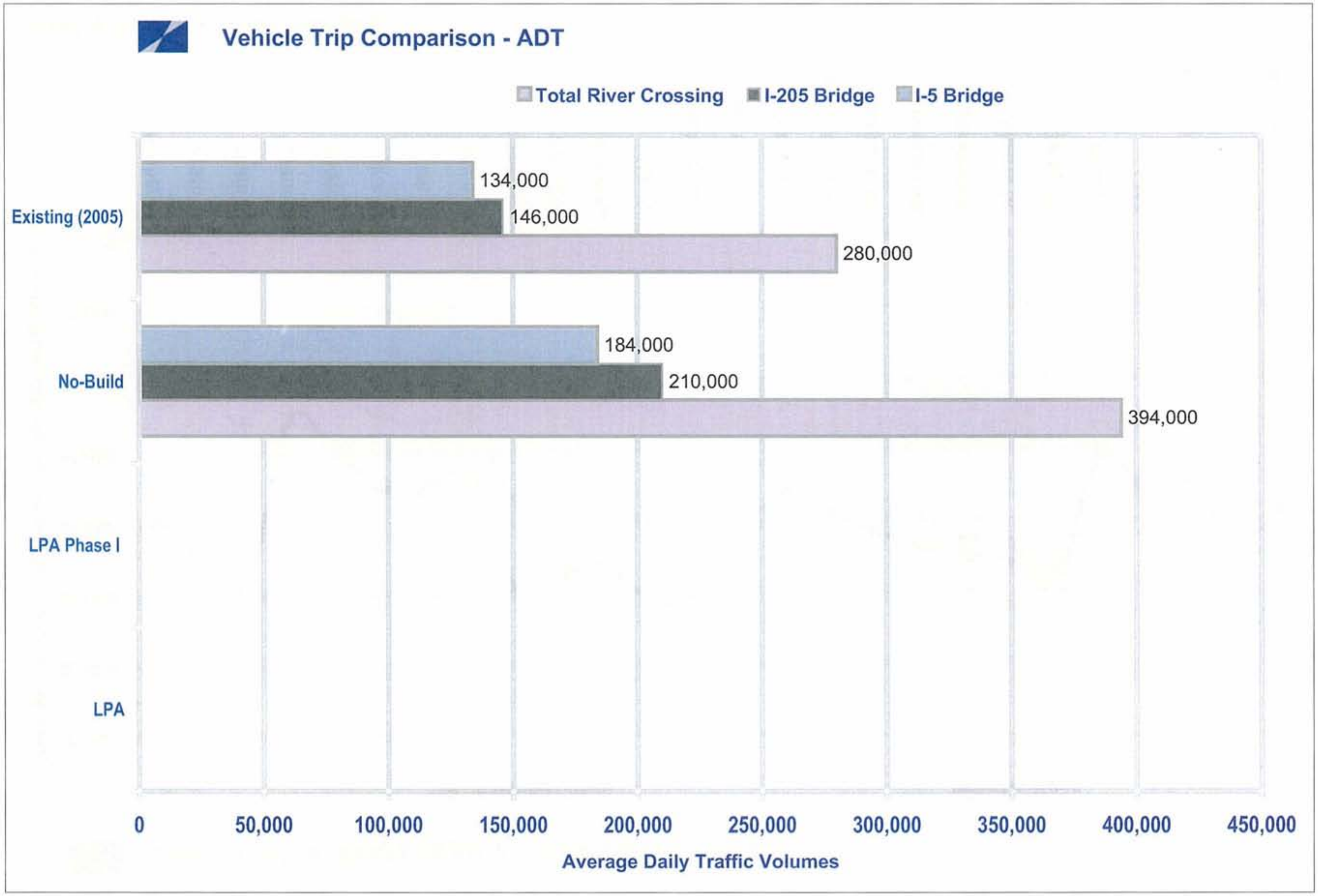
As shown in **Exhibit 6-38**, during the afternoon/evening peak, four of the study intersections would operate with acceptable vehicle queuing as compared to existing conditions. Based on 95% queuing analysis, three intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which does not occur under existing conditions.

6.4 Pedestrian and Bicycle Circulation

Although pedestrian and bicycle use for the 2030 No-Build Alternative has not been estimated, pedestrian and bicycle trips across the Columbia River are expected to increase as traffic congestion worsens and only limited transit service improvements are provided.

Under the No-Build Alternative, an increased number of pedestrians and bicyclists would face the same or more difficult conditions when crossing the Columbia River. Along the narrow sidewalks, increased conflicts would arise between pedestrians and other pedestrians, pedestrians and bicyclists, and bicyclists and other bicyclists. In addition, increased conflicts would result when pedestrians and bicyclists interact with motor vehicles, such as when accessing the Interstate Bridge or Portland Harbor Bridge in Vancouver, on Hayden Island, or in the Marine Drive interchange area.

Exhibit 6-1



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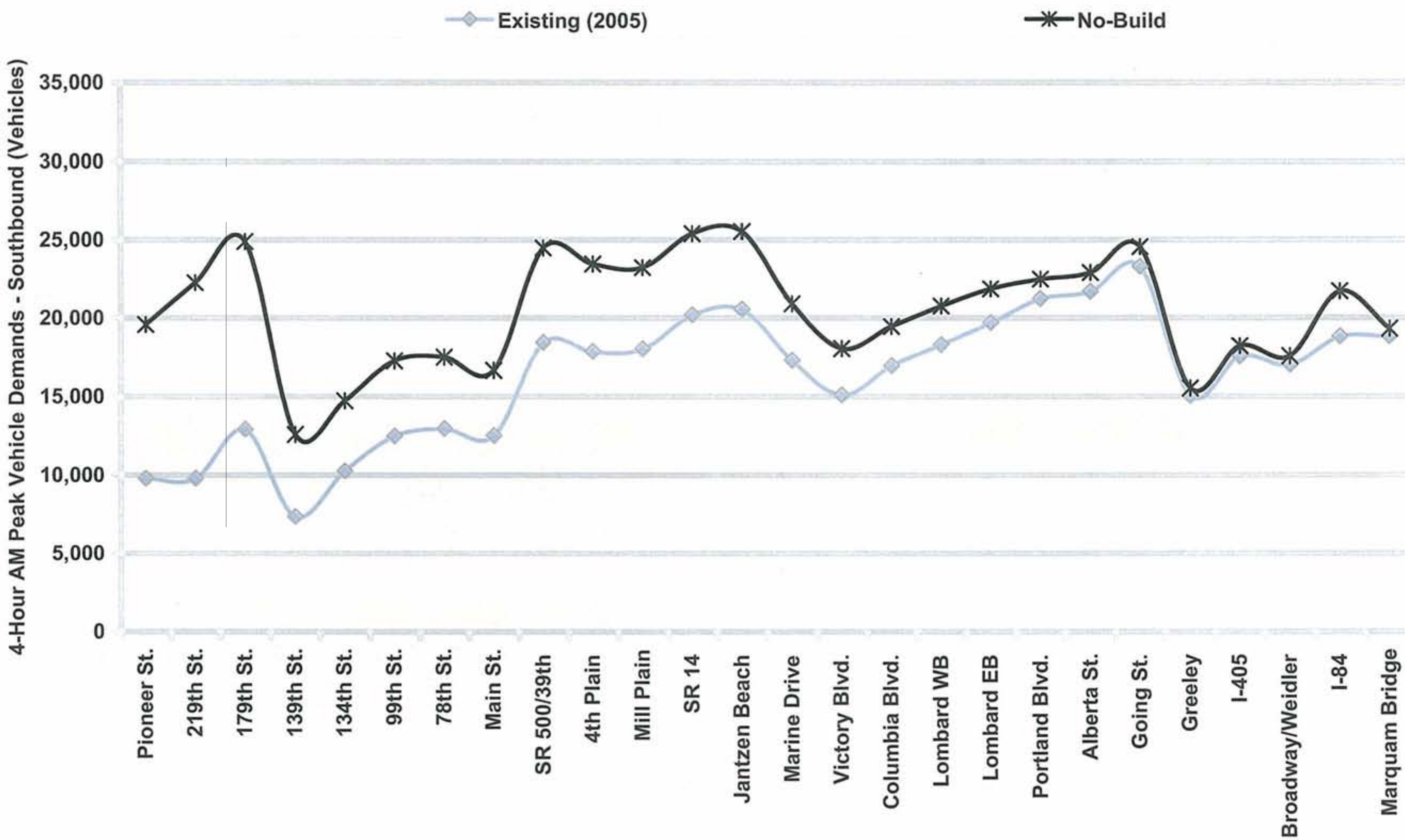
PRELIMINARY

Exhibit 6-2

Southbound I-5 Vehicle Demands - AM Peak (Year 2030*)



*Except for Existing Conditions (Year 2005)

Exhibit 6-3

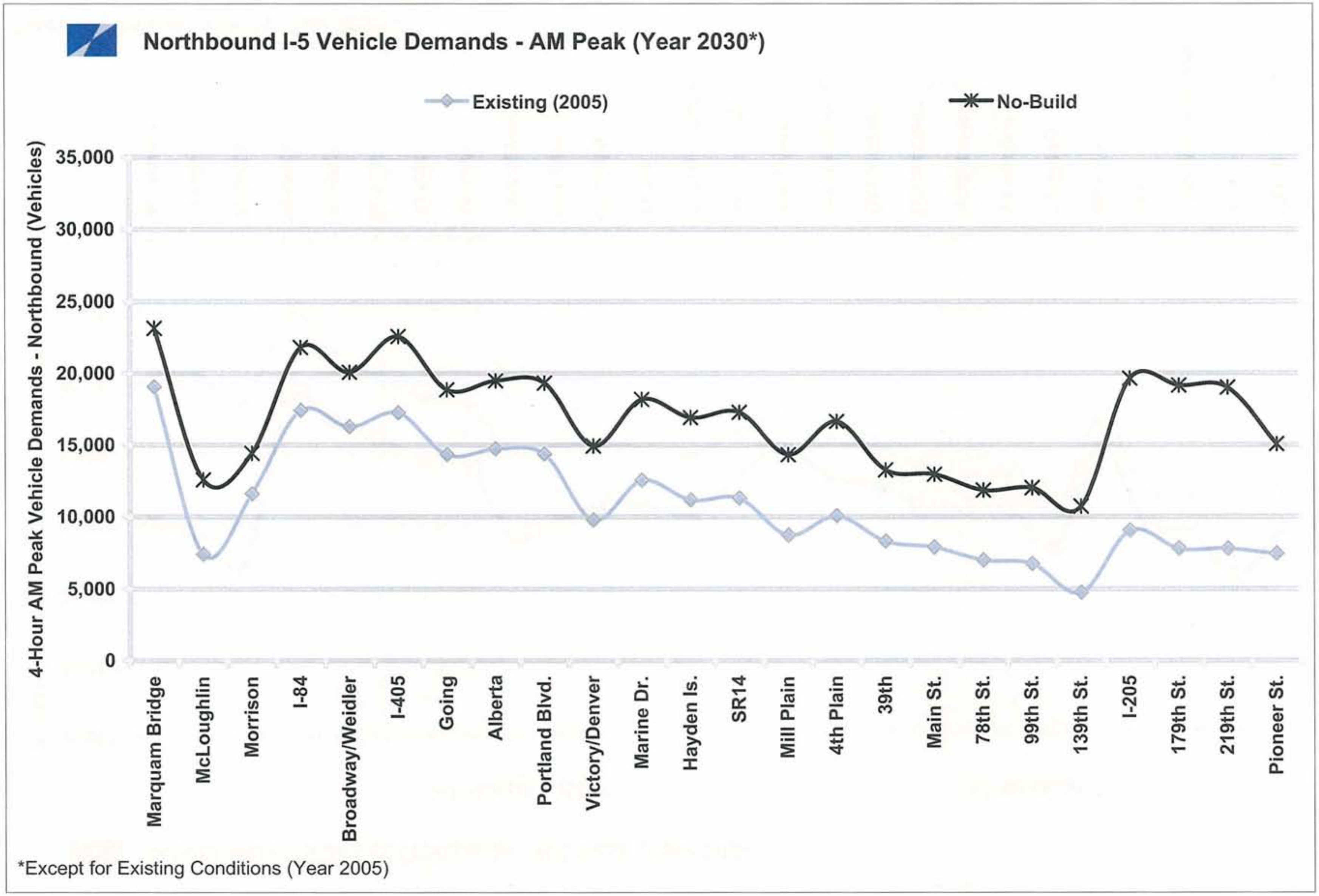

Northbound I-5 Vehicle Demands - AM Peak (Year 2030*)
Existing (2005)
No-Build
4-Hour AM Peak Vehicle Demands - Northbound (Vehicles)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Marquam Bridge
McLoughlin
Morrison
I-84
Broadway/Weidler
I-405
Going
Alberta
Portland Blvd.
Victory/Denver
Marine Dr.
Hayden Is.
SR14
Mill Plain
4th Plain
39th
Main St.
78th St.
99th St.
139th St.
I-205
179th St.
219th St.
Pioneer St.
*Except for Existing Conditions (Year 2005)

Exhibit 6-4

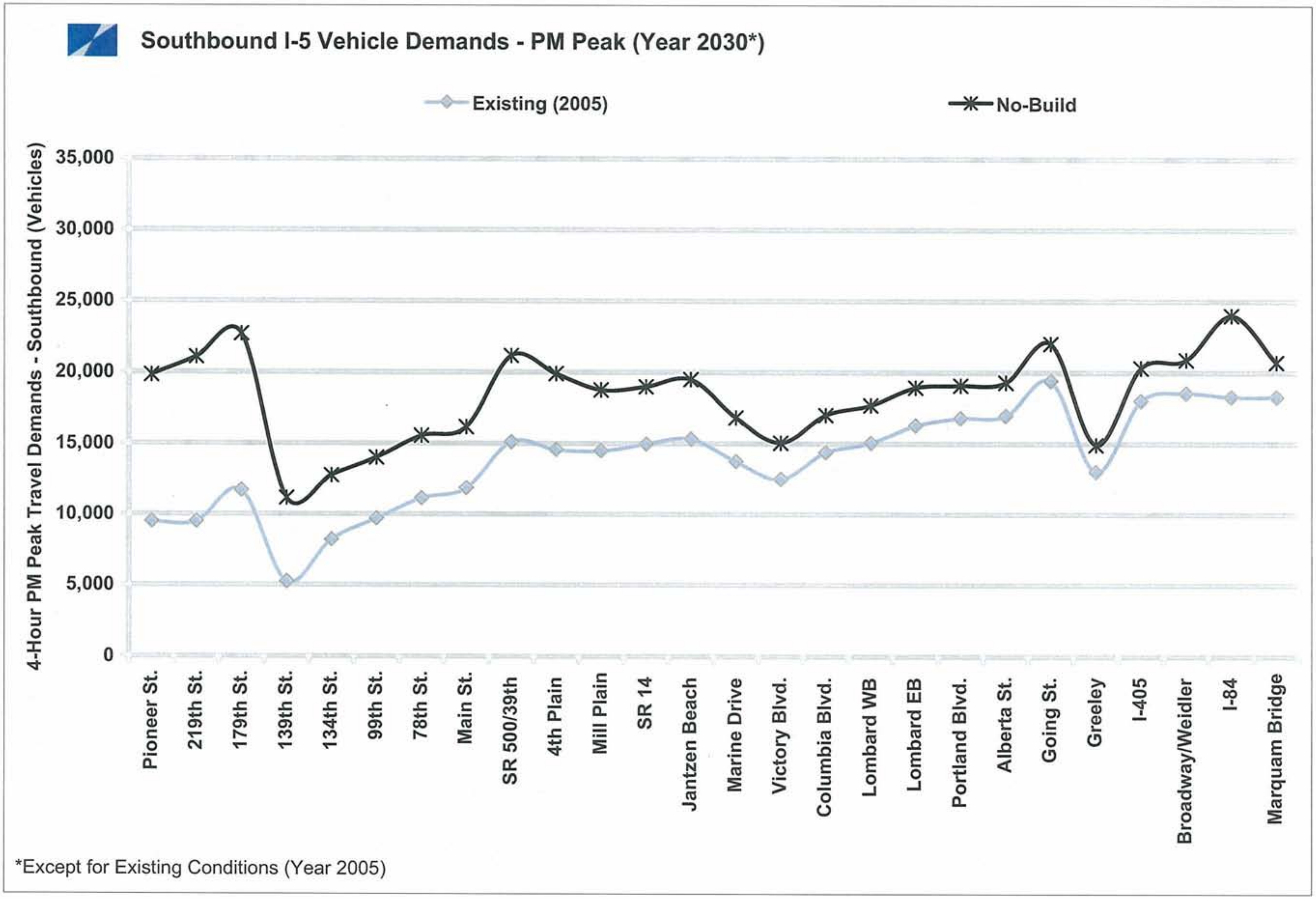
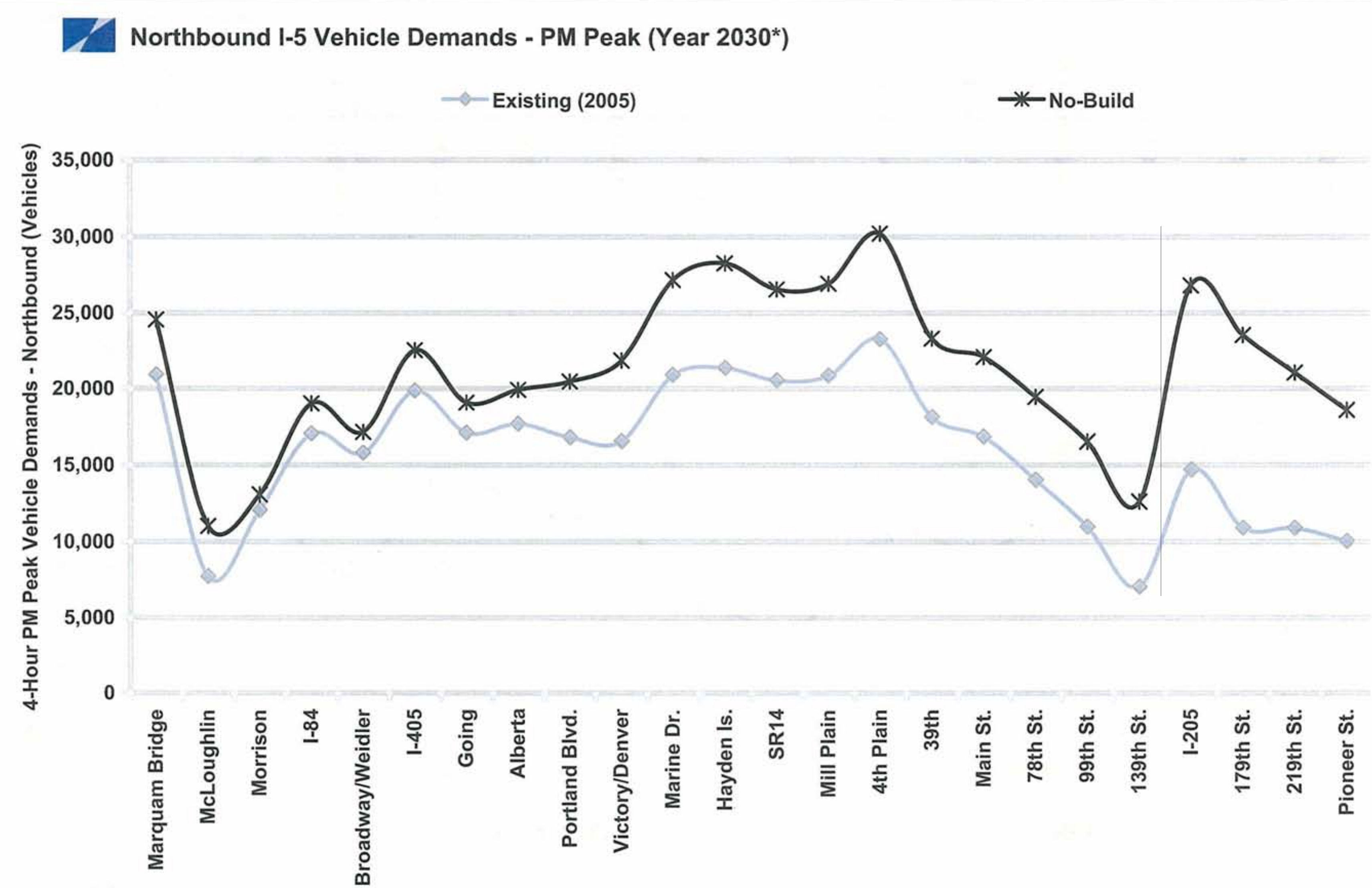

Southbound I-5 Vehicle Demands - PM Peak (Year 2030*)
Existing (2005)
No-Build
4-Hour PM Peak Travel Demands - Southbound (Vehicles)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Pioneer St.
219th St.
179th St.
139th St.
134th St.
99th St.
78th St.
Main St.
SR 500/39th
4th Plain
Mill Plain
SR 14
Jantzen Beach
Marine Drive
Victory Blvd.
Columbia Blvd.
Lombard WB
Lombard EB
Portland Blvd.
Alberta St.
Going St.
Greeley
I-405
Broadway/Weidler
I-84
Marquam Bridge
*Except for Existing Conditions (Year 2005)

Exhibit 6-5



*Except for Existing Conditions (Year 2005)

7564

Exhibit 6-6

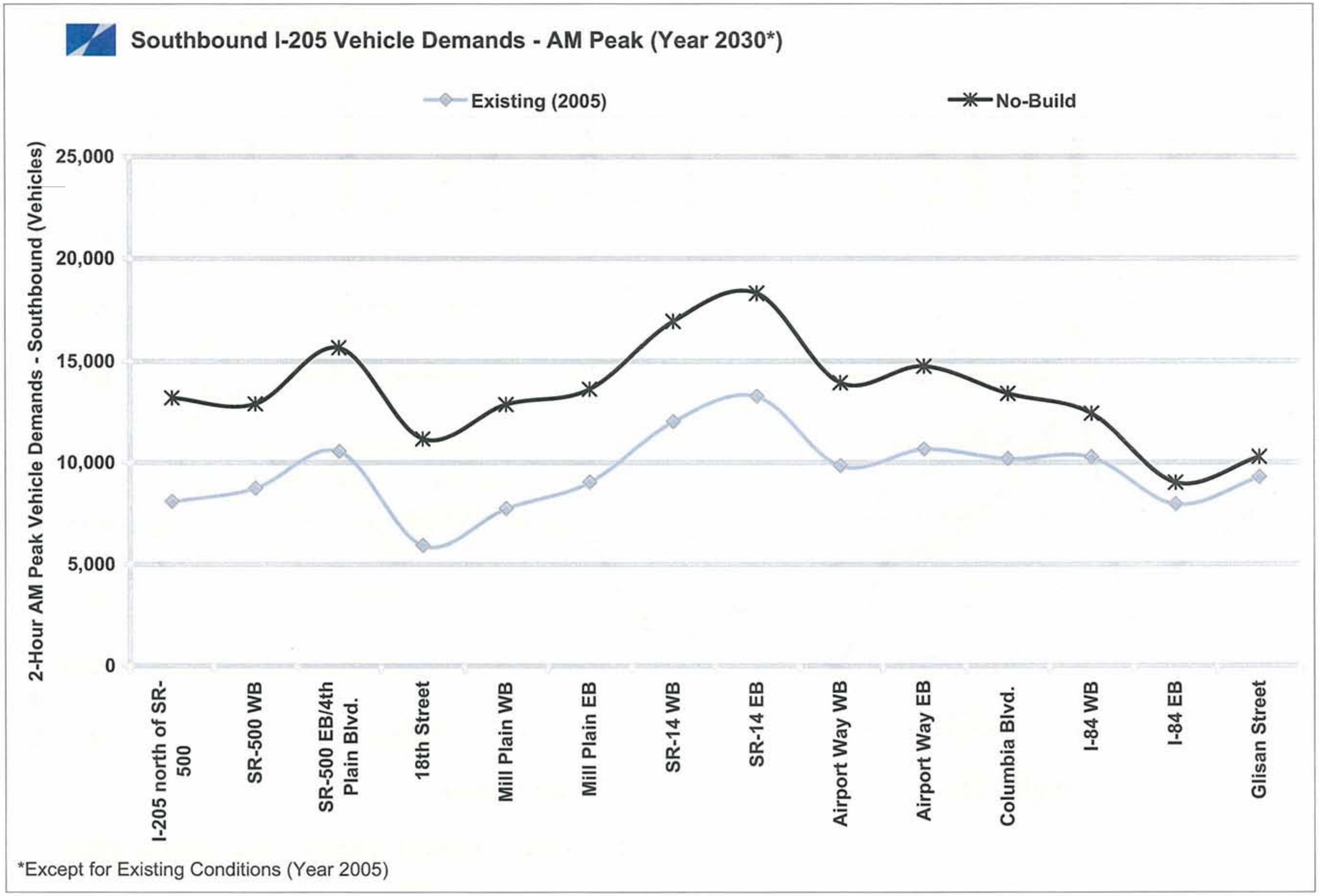


Exhibit 6-7

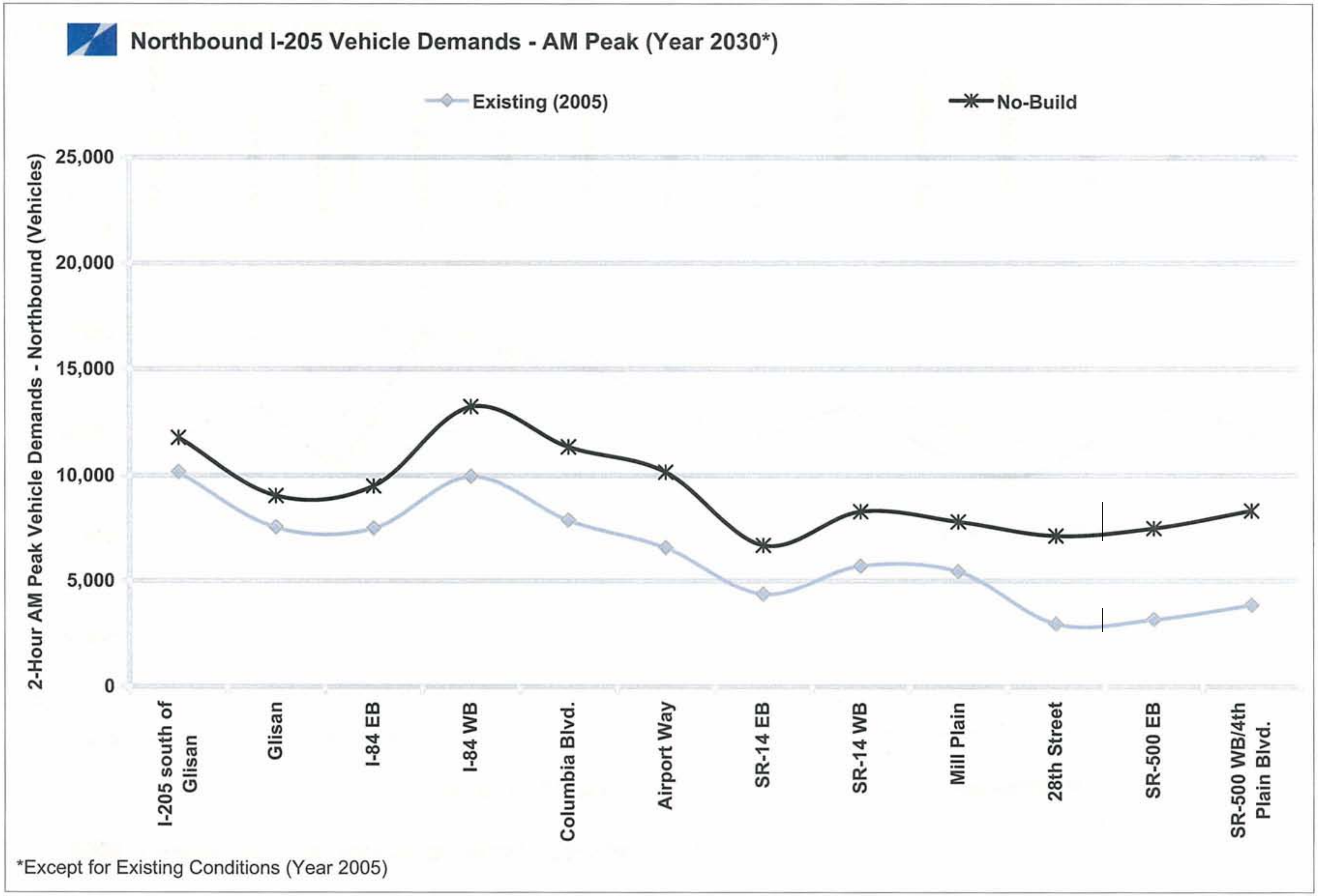

Northbound I-205 Vehicle Demands - AM Peak (Year 2030*)
Existing (2005)
No-Build
2-Hour AM Peak Vehicle Demands - Northbound (Vehicles)
25,000
20,000
15,000
10,000
5,000
0
I-205 south of Glisan
Glisan
I-84 EB
I-84 WB
Columbia Blvd.
Airport Way
SR-14 EB
SR-14 WB
Mill Plain
28th Street
SR-500 EB
SR-500 WB/4th Plain Blvd.
*Except for Existing Conditions (Year 2005)

Exhibit 6-8

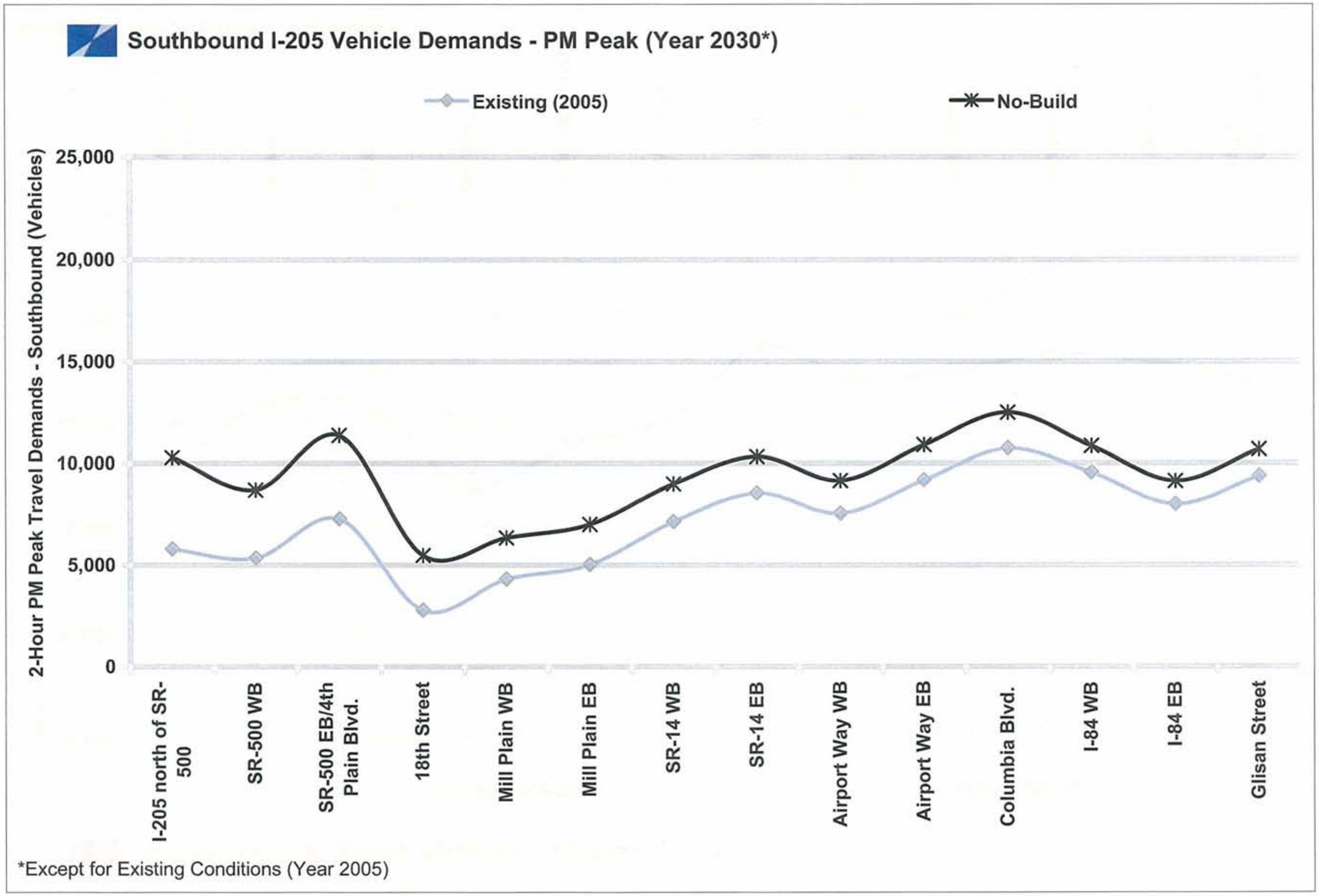
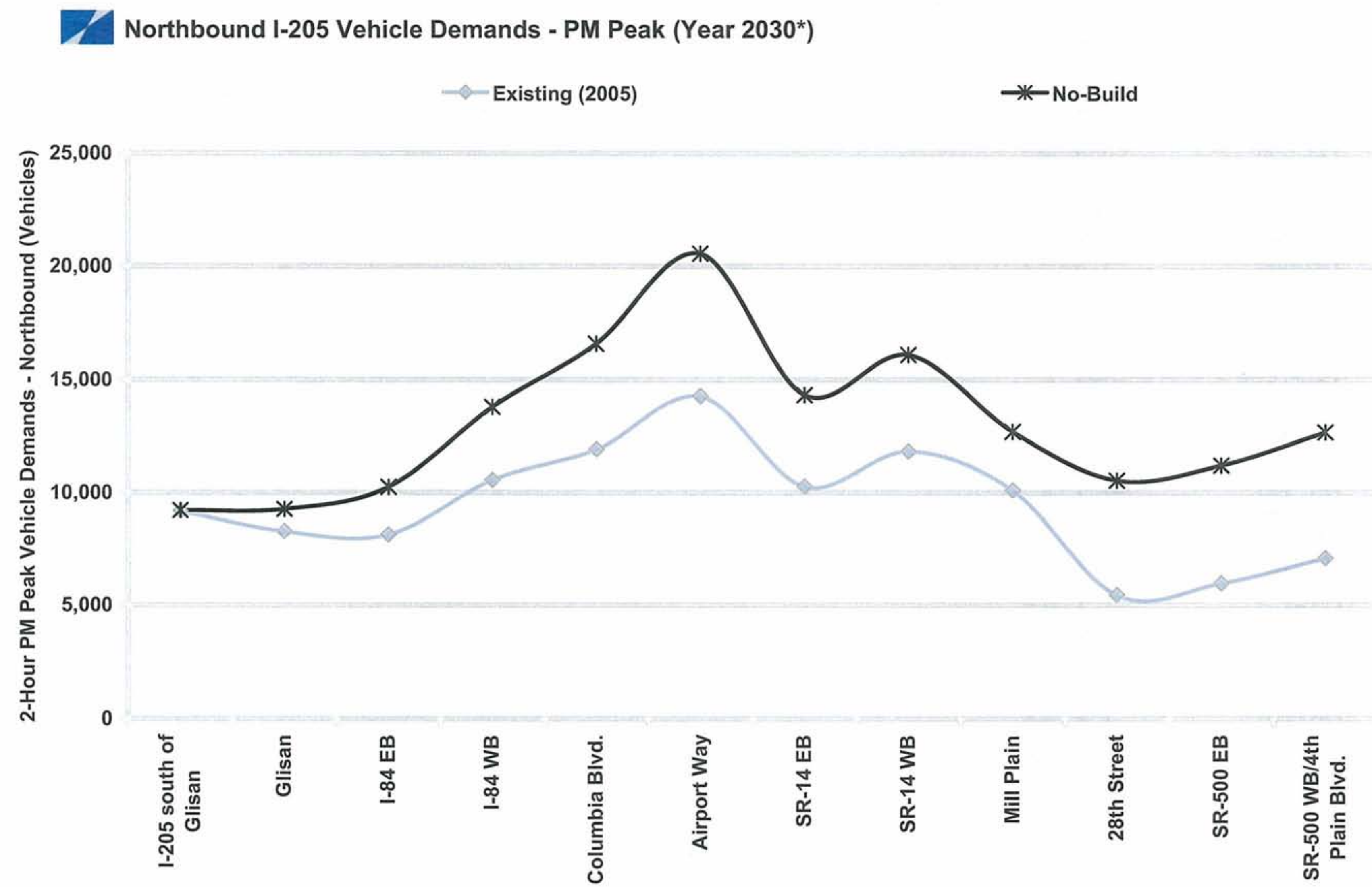

Southbound I-205 Vehicle Demands - PM Peak (Year 2030*)
Existing (2005)
No-Build
2-Hour PM Peak Travel Demands - Southbound (Vehicles)
25,000
20,000
15,000
10,000
5,000
0
I-205 north of SR-500
SR-500 WB
SR-500 EB/4th Plain Blvd.
18th Street
Mill Plain WB
Mill Plain EB
SR-14 WB
SR-14 EB
Airport Way WB
Airport Way EB
Columbia Blvd.
I-84 WB
I-84 EB
Glisan Street
*Except for Existing Conditions (Year 2005)

Exhibit 6-9



*Except for Existing Conditions (Year 2005)

PRELIMINARY

Exhibit 6-10

Portland-Vancouver Region Freight Cargo Forecasts by Mode					
	Year 2000 Volume		Year 2030 Volume		2000-2030
Mode	**Tons (millions)**	**Market Share**	**Tons (millions)**	**Market Share**	**Growth Rate**
Truck	197.2	67%	390.5	73%	2.3% / year
Rail	32.9	11%	50.9	10%	1.5% / year
Ocean	28.4	10%	40.3	8%	1.2% / year
Barge	15.1	5%	19.8	4%	0.9% / year
Pipeline	22.2	7%	28.8	5%	0.9% / year
Air	0.4	< 1 percent	1.3	< 1 percent	4.0% / year
TOTAL	**296.2**	**100%**	**531.6**	**100%**	**2.0% / year**

Source: Portland/Vancouver International and Domestic Trade Capacity Analysis 2006. Provided by Metro Planning Department, Deena Platman, Senior Transportation Planner, August 22, 2007.

Exhibit 6-11

Peak Period 2030 I-5 Truck Volume - 2030 No-Build				
	Existing 2005		2030 No-Build	
Hours	Southbound	Northbound	Southbound	Northbound
AM Peak Period 6 AM - 10 AM	1,015	1,120	1,140	2,195
Midday Peak Period 10 AM - 3 PM	1,945	1,880	3,525	2,900
PM Peak Period 3 PM - 7 PM	1,020	925	2,350	1,635
Night 7 PM - 6 AM	1,570	1,500	2,790	2,870
Daily Total	**5,550**	**5,425**	**9,805**	**9,600**

Source: Portland/Vancouver International and Domestic Trade Capacity Analysis, 2006 and CRC Project, September 2007

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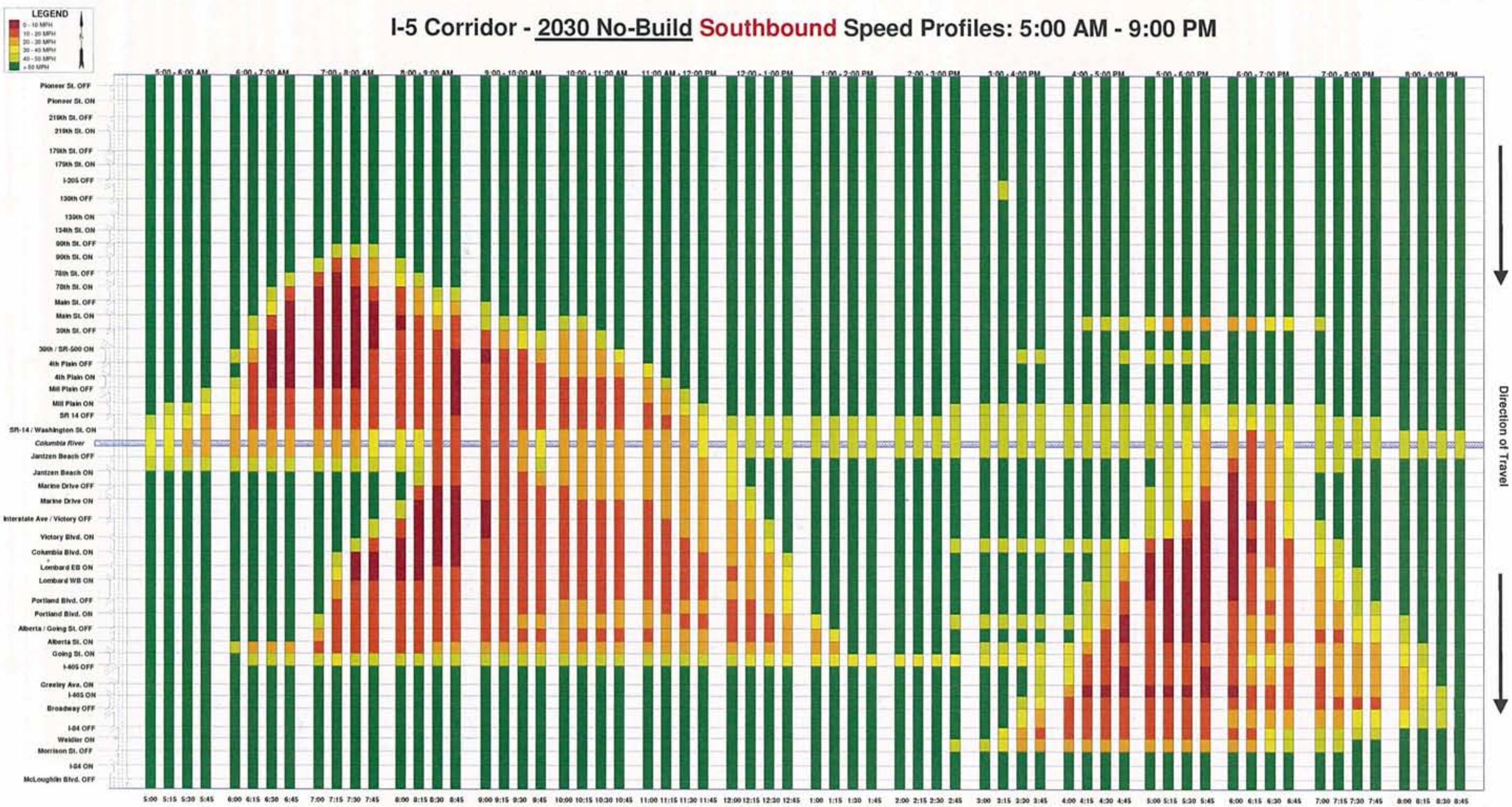
Exhibit 6-12

I-5 Corridor - 2030 No-Build Southbound Speed Profiles: 5:00 AM - 9:00 PM



PRELIMINARY

Exhibit 6-13

I-5 Corridor - 2030 No Build Northbound Speed Profiles: 5:00 AM - 9:00 PM

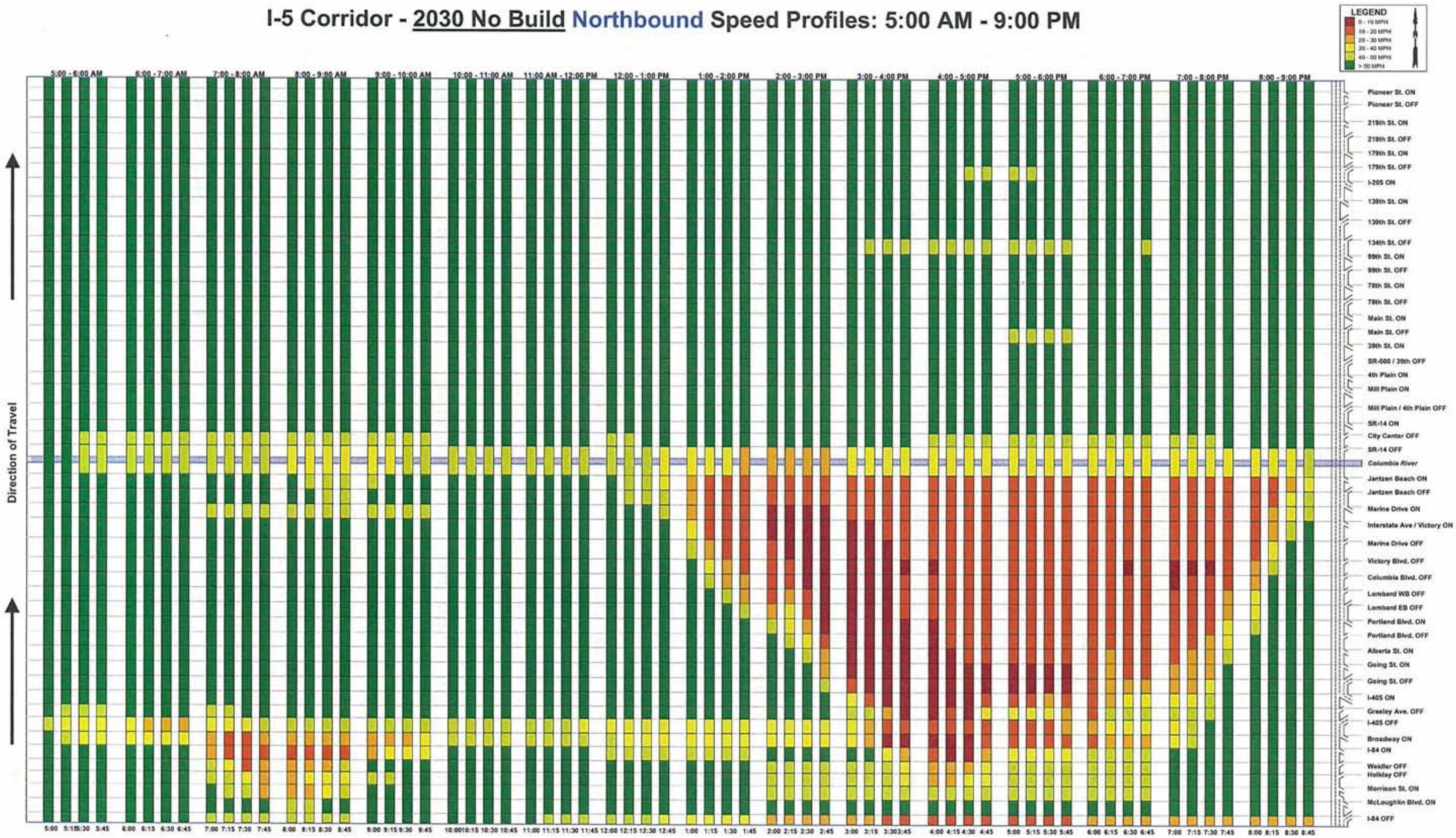
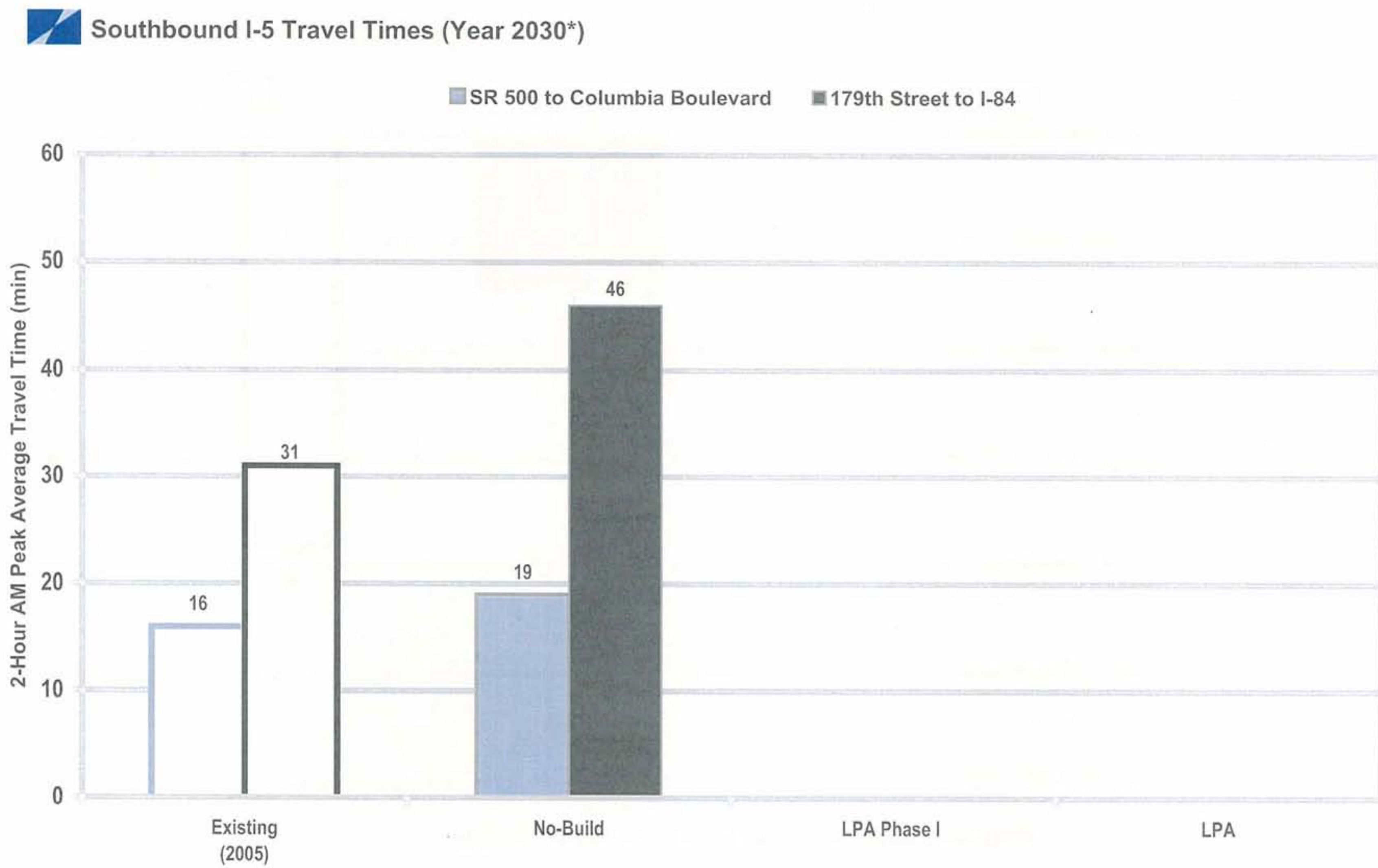


Exhibit 6-14



*Except for Existing Conditions (Year 2005)

Exhibit 6-15

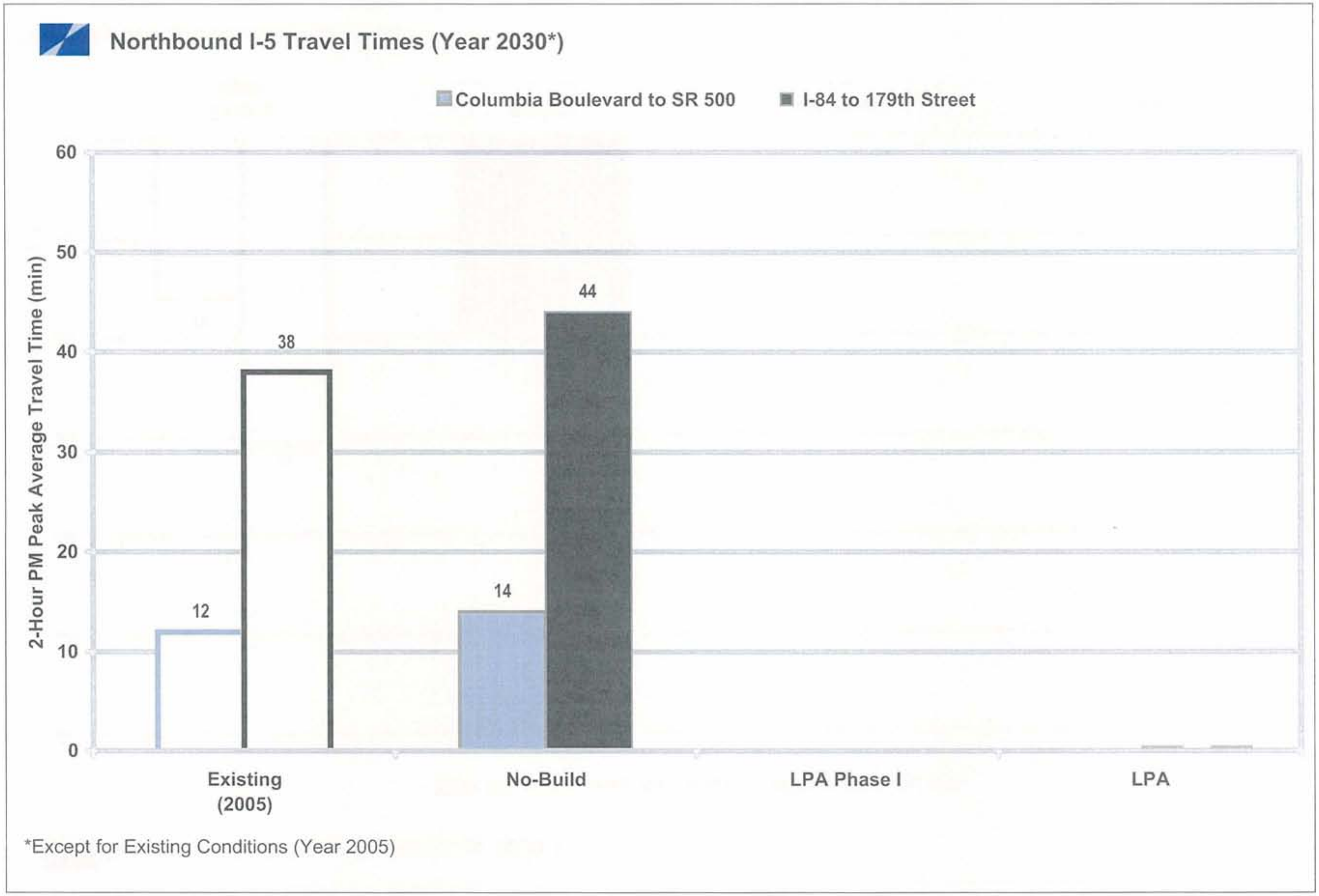
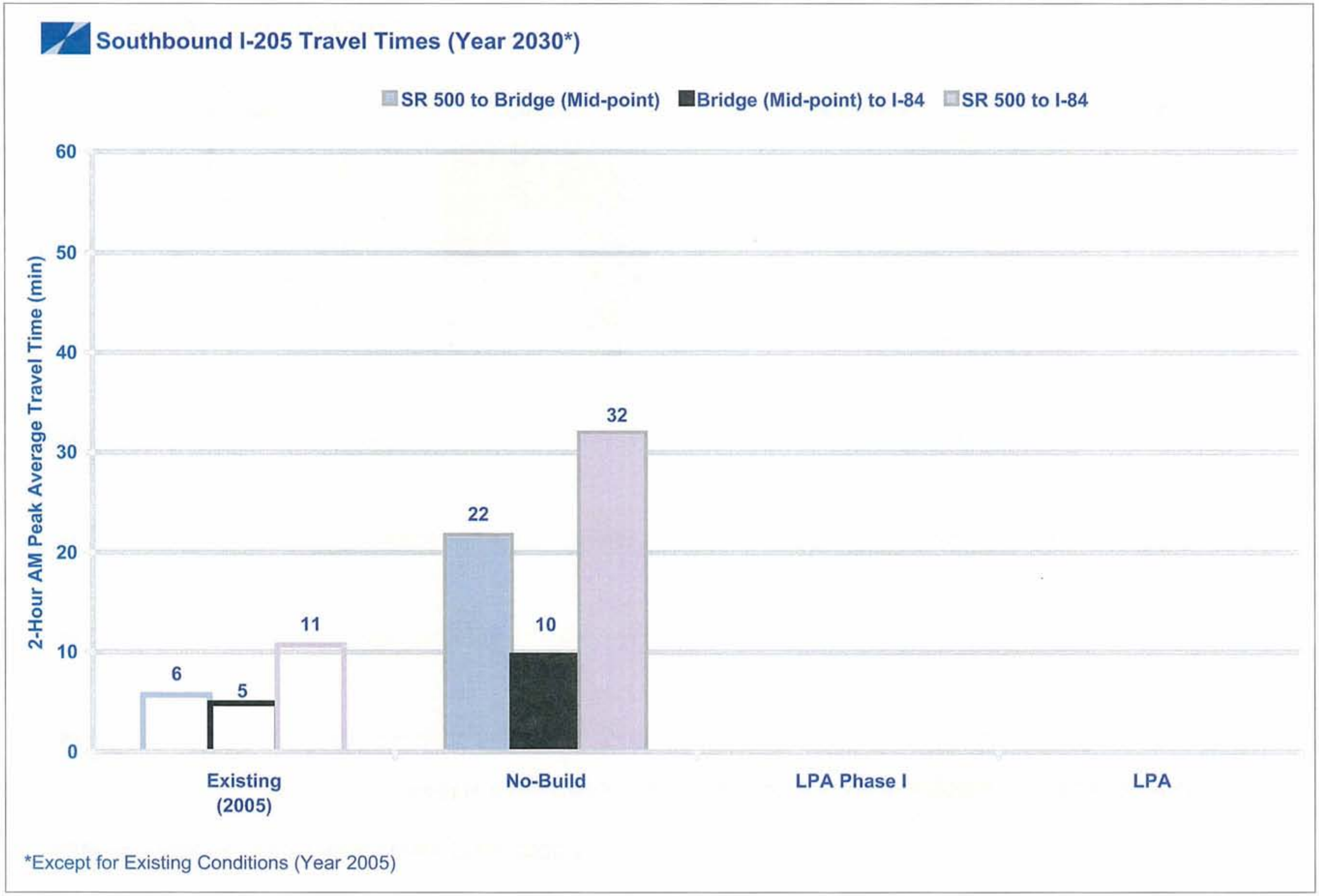

Northbound I-5 Travel Times (Year 2030*)
Columbia Boulevard to SR 500
I-84 to 179th Street
2-Hour PM Peak Average Travel Time (min)
60
50
40
30
20
10
0
12
38
14
44
Existing (2005)
No-Build
LPA Phase I
LPA
*Except for Existing Conditions (Year 2005)

Exhibit 6-16


Southbound I-205 Travel Times (Year 2030*)
SR 500 to Bridge (Mid-point)
Bridge (Mid-point) to I-84
SR 500 to I-84
2-Hour AM Peak Average Travel Time (min)
60
50
40
30
20
10
0
6
5
11
22
10
32
Existing (2005)
No-Build
LPA Phase I
LPA
*Except for Existing Conditions (Year 2005)

PRELIMINARY

Exhibit 6-17

Exhibit 6-18

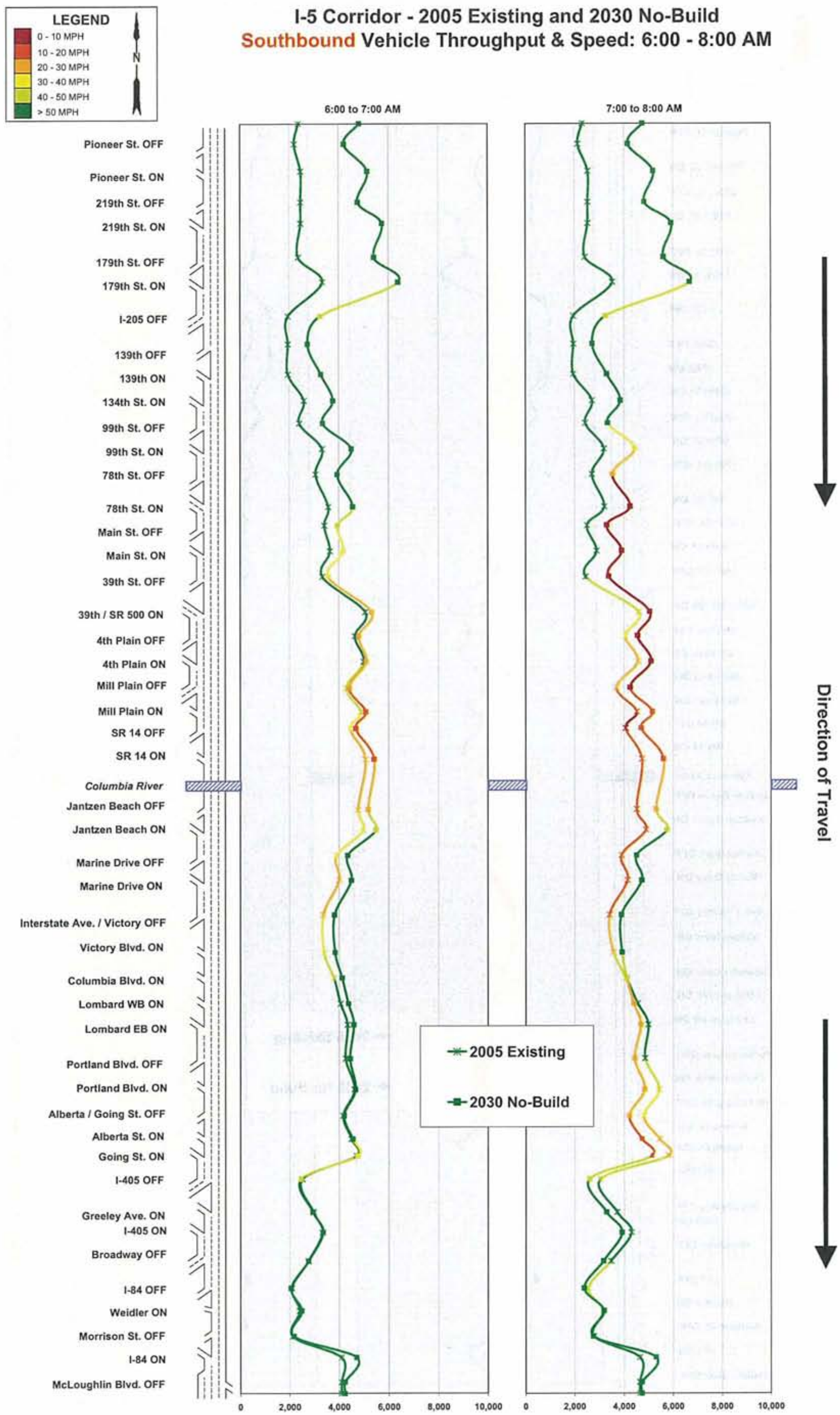


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Exhibit 6-18 - Continued

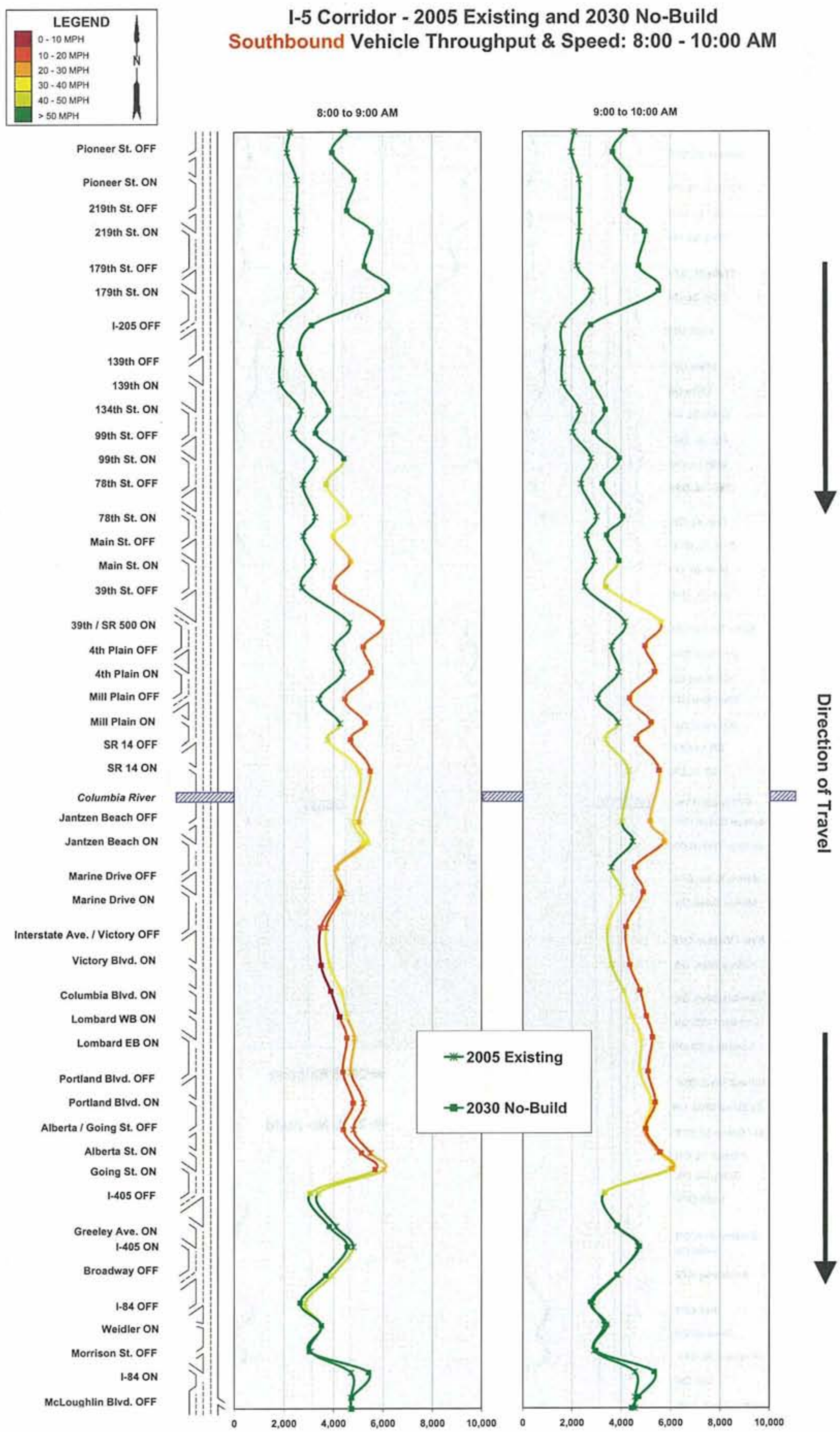

Exhibit 6-19

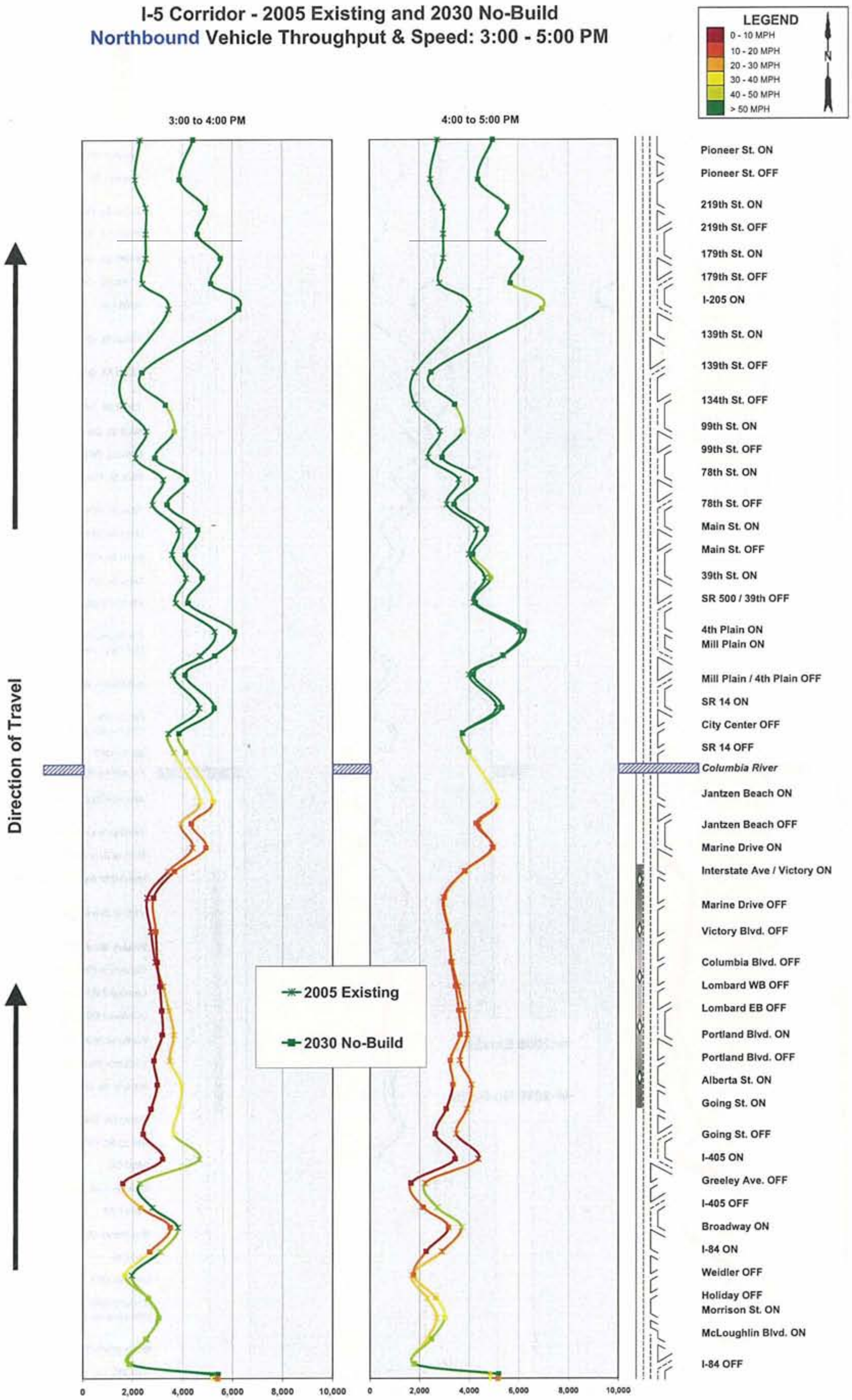

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Exhibit 6-19 - Continued

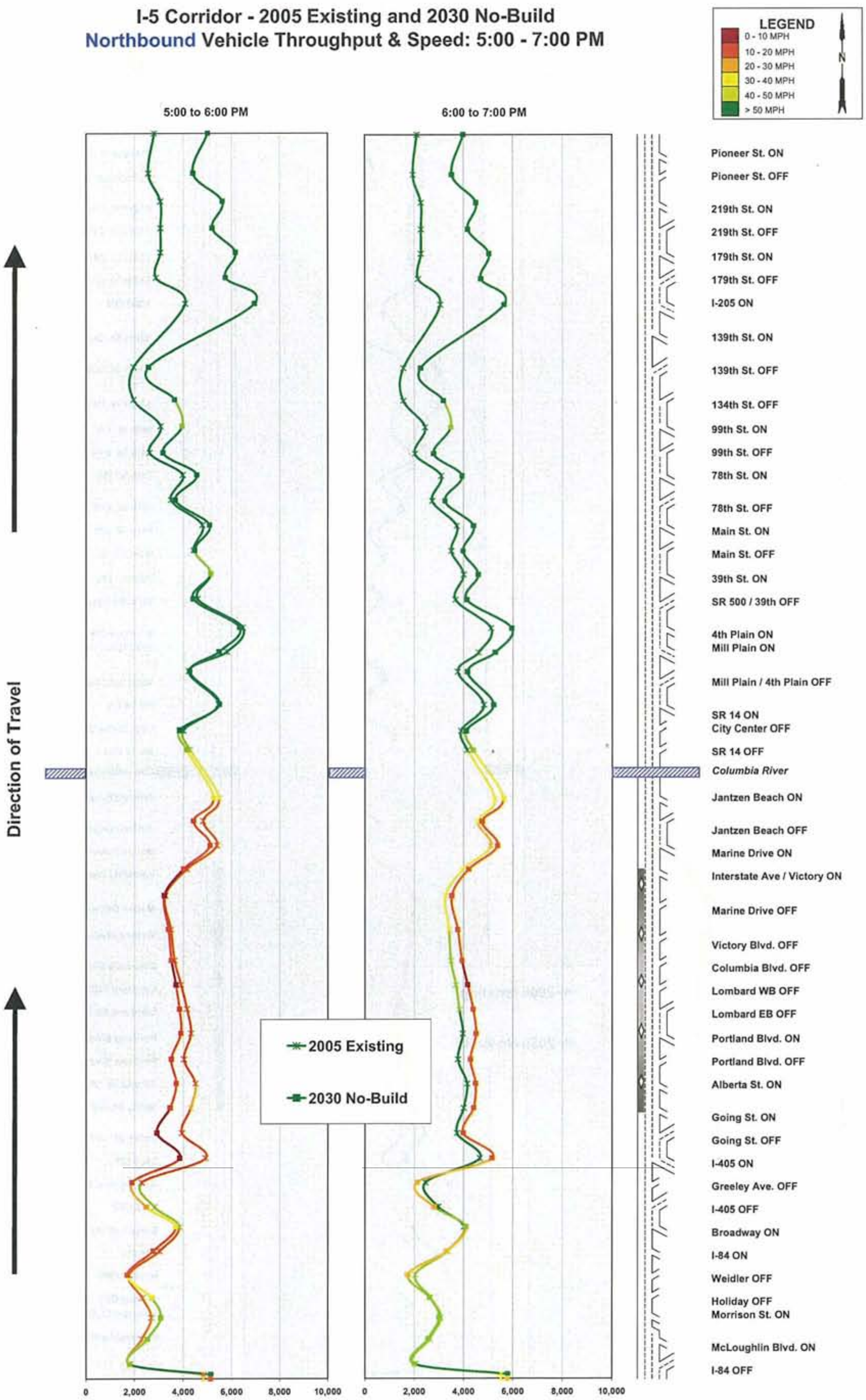


Exhibit 6-20

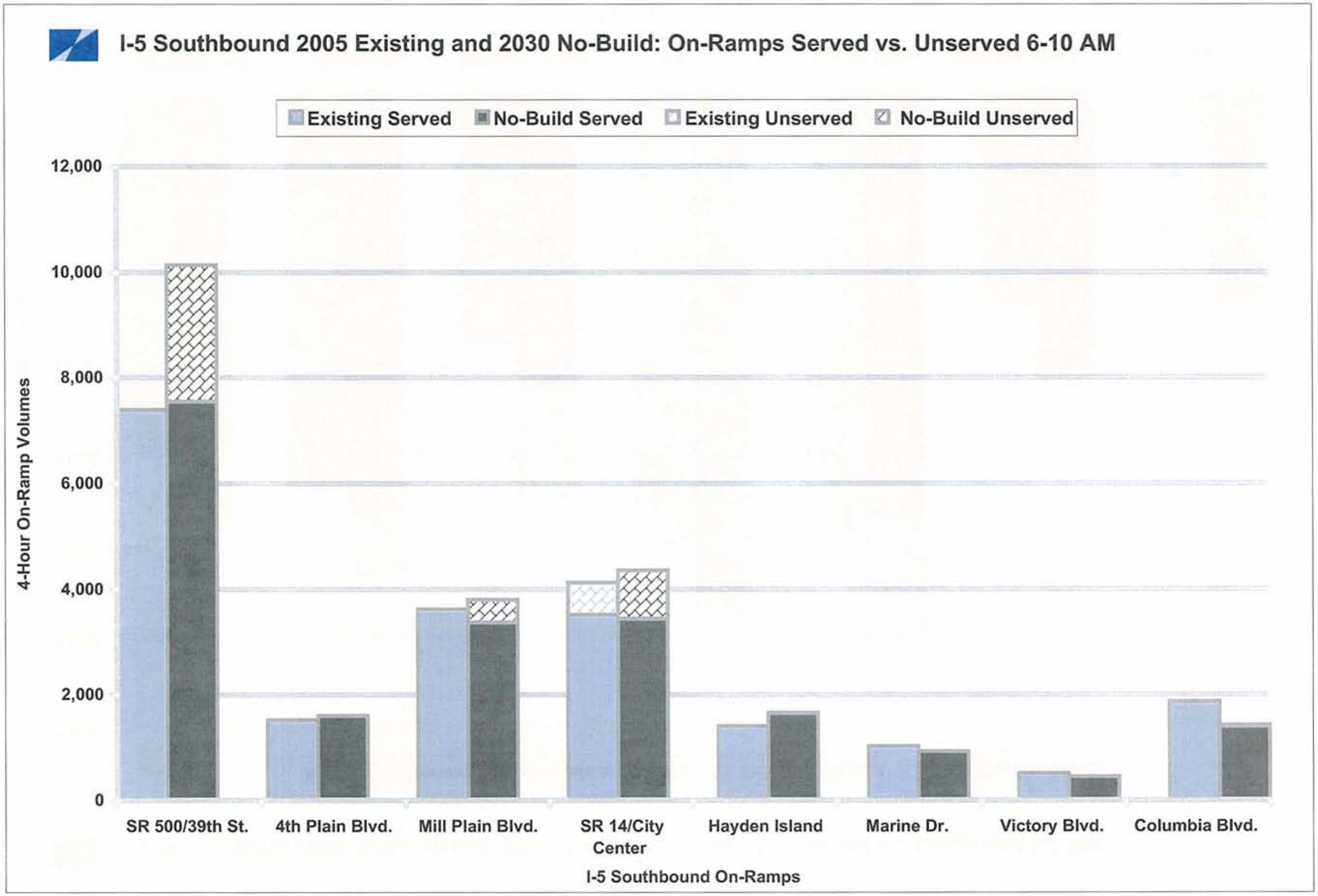

I-5 Southbound 2005 Existing and 2030 No-Build: On-Ramps Served vs. Unserved 6-10 AM
Existing Served
No-Build Served
Existing Unserved
No-Build Unserved
12,000
10,000
8,000
6,000
4,000
2,000
0
4-Hour On-Ramp Volumes
SR 500/39th St.
4th Plain Blvd.
Mill Plain Blvd.
SR 14/City Center
Hayden Island
Marine Dr.
Victory Blvd.
Columbia Blvd.
I-5 Southbound On-Ramps

Exhibit 6-21

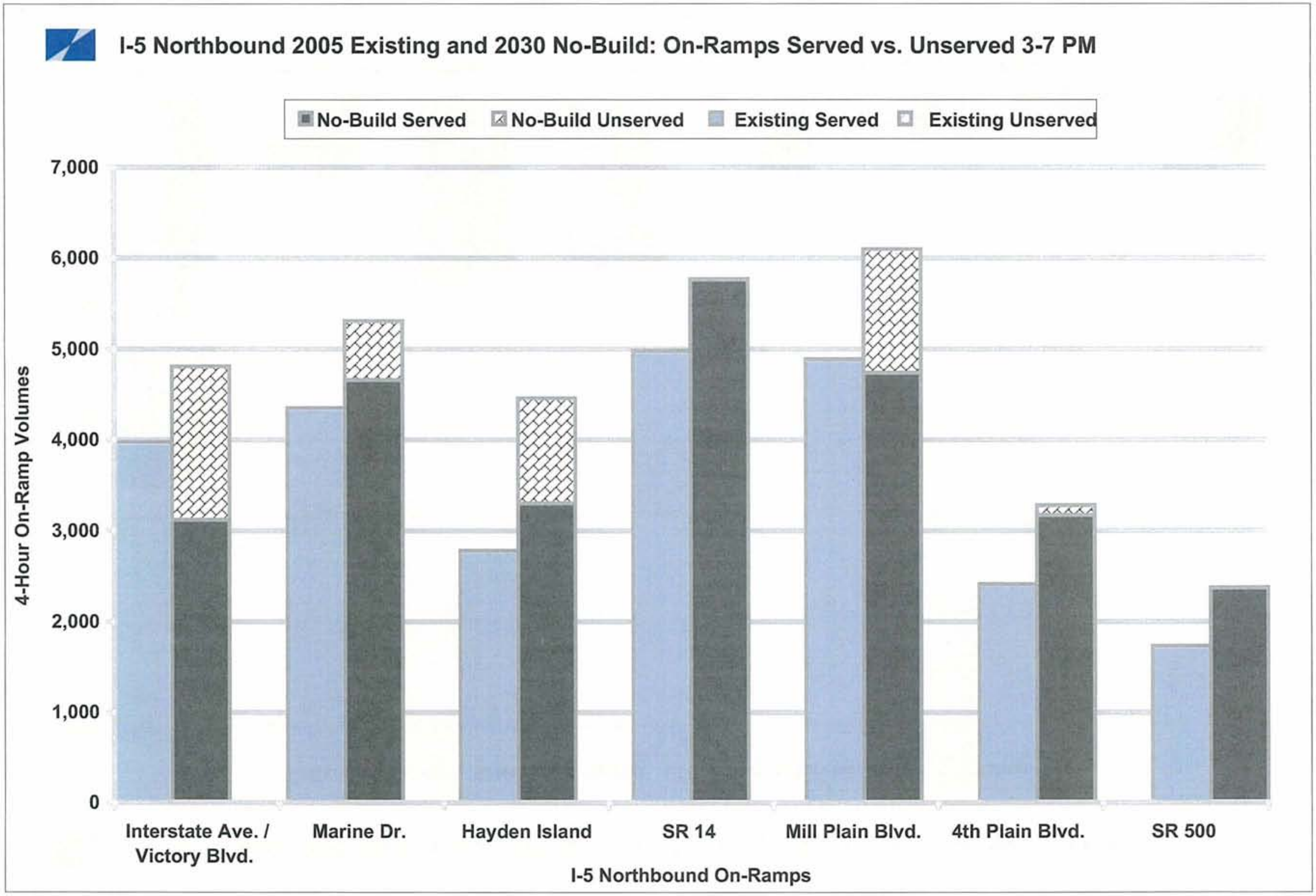
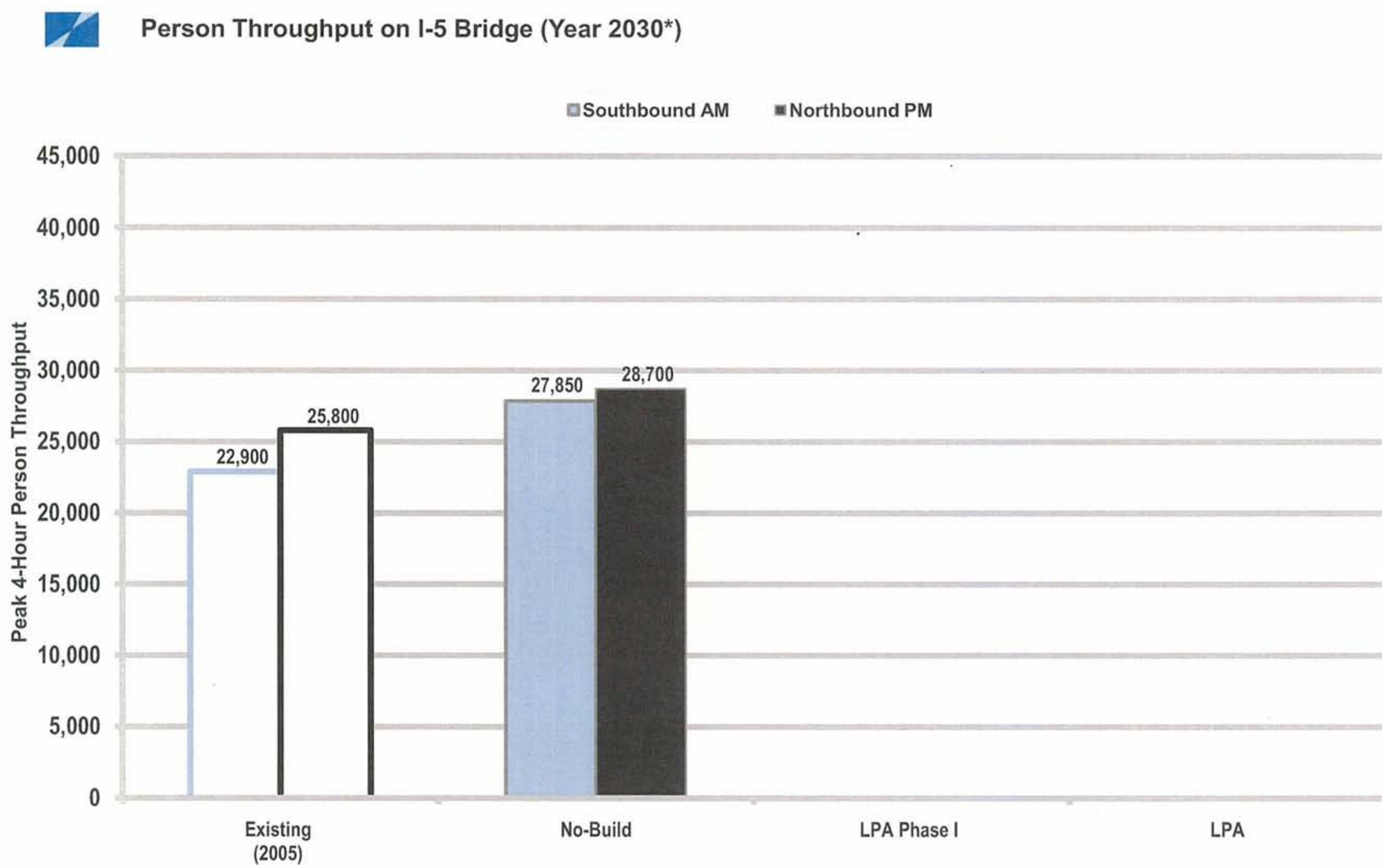

I-5 Northbound 2005 Existing and 2030 No-Build: On-Ramps Served vs. Unserved 3-7 PM
No-Build Served
No-Build Unserved
Existing Served
Existing Unserved
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
4-Hour On-Ramp Volumes
Interstate Ave. / Victory Blvd.
Marine Dr.
Hayden Island
SR 14
Mill Plain Blvd.
4th Plain Blvd.
SR 500
I-5 Northbound On-Ramps

Exhibit 6-22



*Except for Existing Conditions (Year 2005)

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PRELIMINARY

Exhibit 6-23

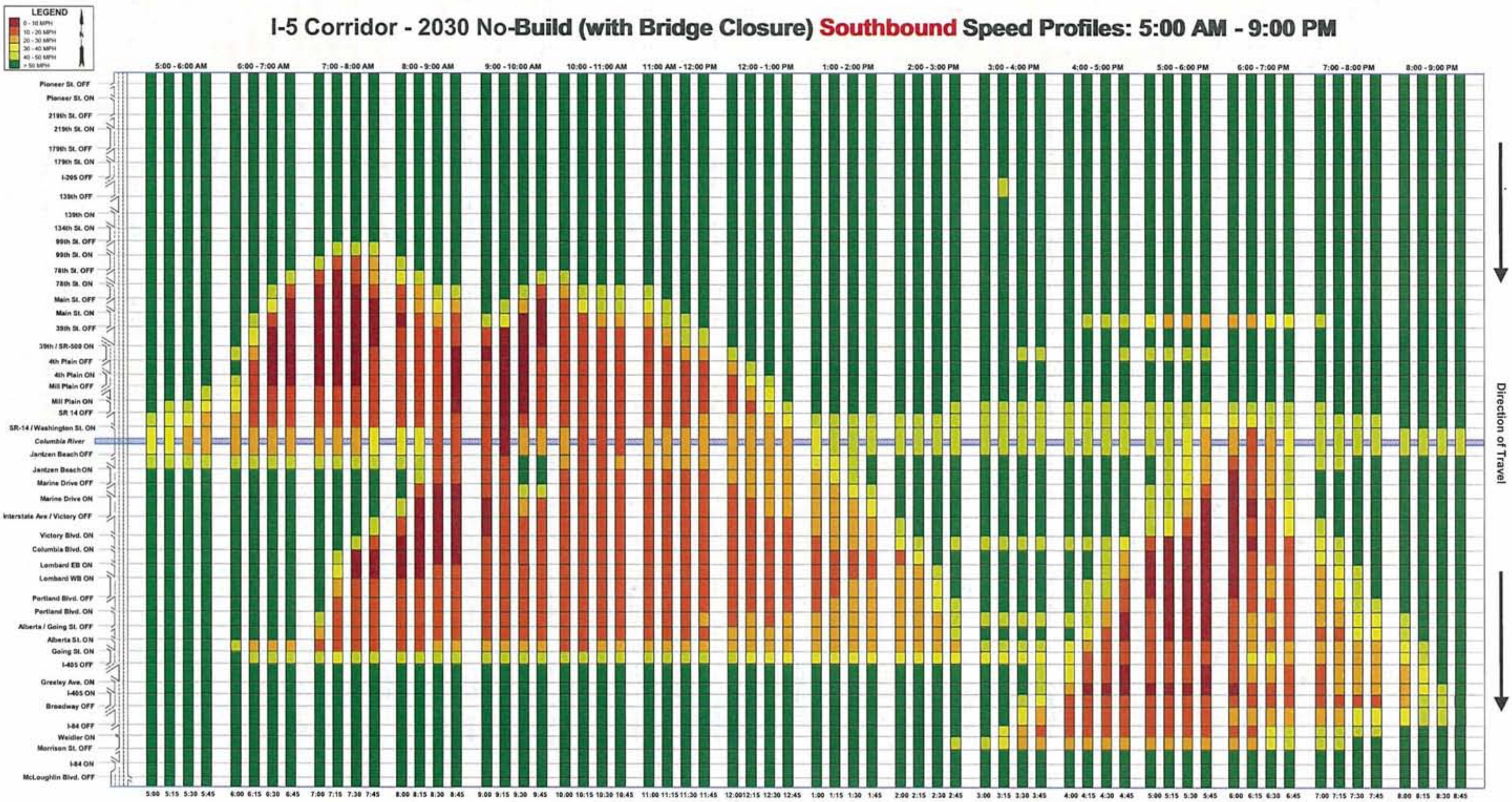

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Exhibit 6-24

PRELIMINARY

I-5 Corridor - 2030 No-Build (with Bridge Closure) Northbound Speed Profiles: 5:00 AM - 9:00 PM

PRELIMINARY

Exhibit 6-25

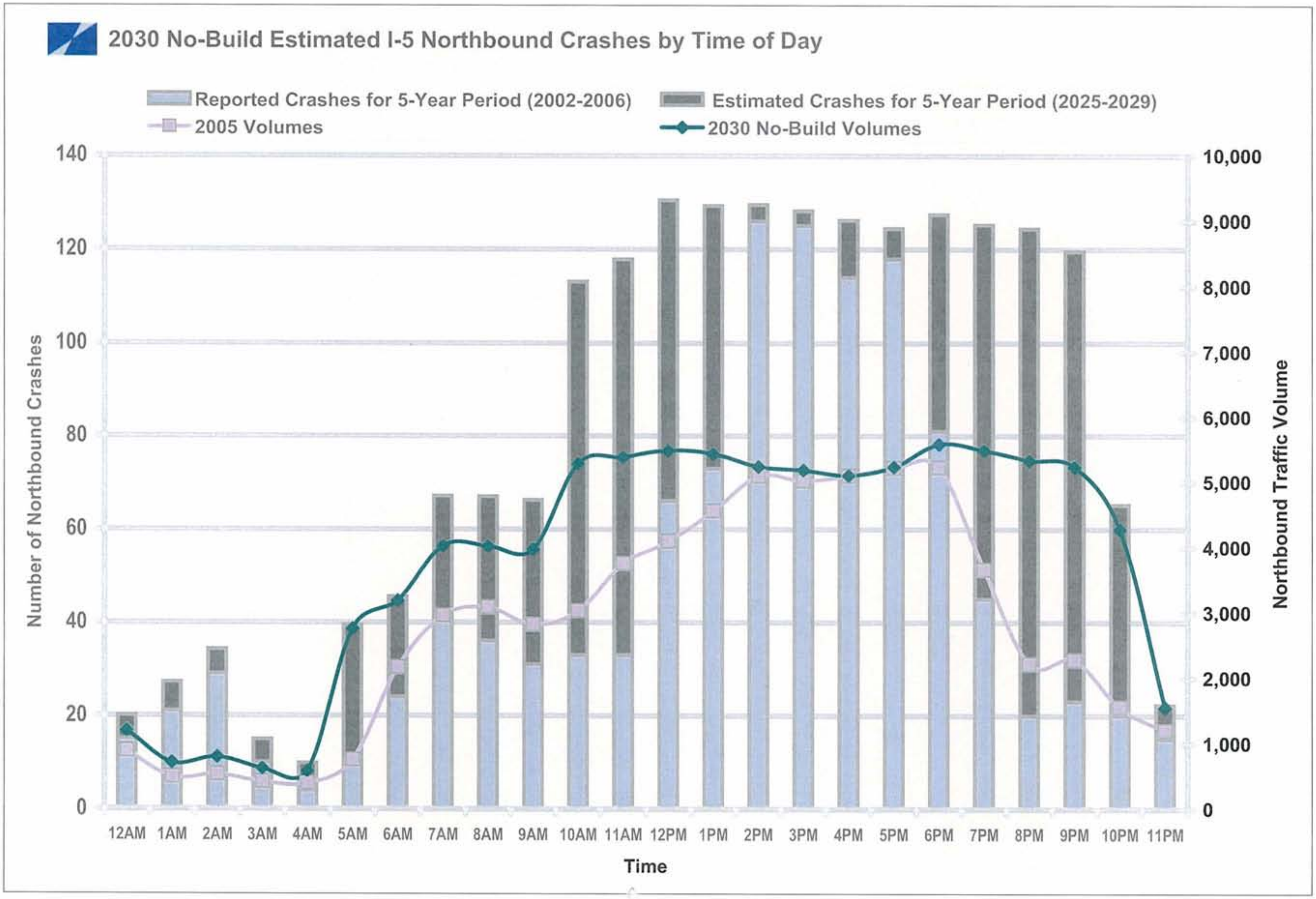

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Exhibit 6-26

Vancouver North-South Screenlines - AM Peak Hour Volumes			
Screenline	Existing	No-Build	Difference
West of Franklin St			
Westbound Total	1,350	2,850	111%
Eastbound Total	1,400	2,000	43%
West of I-5			
Westbound Total	3,100	4,450	44%
Eastbound Total	2,750	3,350	22%
East of I-5			
Westbound Total	2,550	3,450	35%
Eastbound Total	2,300	3,000	30%

Vancouver East-West Screenlines - AM Peak Hour Volumes			
Screenline	Existing	No-Build	Difference
North of Evergreen Blvd			
Southbound Total	950	1,450	53%
Northbound Total	800	1,050	31%
North of 15th St			
Southbound Total	1,300	2,100	62%
Northbound Total	450	500	11%
North of 4th Plain Blvd			
Southbound Total	1,500	2,200	47%
Northbound Total	350	350	0%
North of 39th St			
Southbound Total	800	1,250	56%
Northbound Total	250	250	0%

PRELIMINARY

Exhibit 6-27

Vancouver North-South Screenlines - PM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
West of Franklin St			
Westbound Total	1,550	2,500	61%
Eastbound Total	1,750	3,500	100%
West of I-5			
Westbound Total	2,900	3,950	36%
Eastbound Total	4,200	5,950	42%
East of I-5			
Westbound Total	2,550	3,050	20%
Eastbound Total	4,050	5,800	43%

Vancouver East-West Screenlines - PM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
North of Evergreen Blvd			
Southbound Total	950	1,050	11%
Northbound Total	1,200	1,850	54%
North of 15th St			
Southbound Total	850	1,000	18%
Northbound Total	950	1,350	42%
North of 4th Plain Blvd			
Southbound Total	600	650	8%
Northbound Total	950	1,300	37%
North of 39th St			
Southbound Total	500	550	10%
Northbound Total	650	950	46%

PRELIMINARY

Exhibit 6-28

Portland North-South Screenlines - AM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
West of Interstate			
Westbound Total	3,050	4,250	39%
Eastbound Total	2,500	3,200	28%
East of I-5			
Westbound Total	2,700	3,450	28%
Eastbound Total	2,100	2,950	40%
East of MLK Jr Blvd			
Westbound Total	3,350	3,950	18%
Eastbound Total	2,250	2,850	27%

Portland East-West Screenlines - AM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
Columbia Slough			
Southbound Total	1,200	1,400	17%
Northbound Total	950	1,150	21%
North of Rosa Parks			
Southbound Total	1,100	1,150	5%
Northbound Total	600	750	25%
South of Alberta St			
Southbound Total	1,600	1,800	13%
Northbound Total	700	1,250	79%

Exhibit 6-29

PRELIMINARY

Portland North-South Screenlines - PM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
West of Interstate			
Westbound Total	2,350	3,100	32%
Eastbound Total	3,450	4,950	43%
East of I-5			
Westbound Total	2,600	3,300	27%
Eastbound Total	2,950	3,850	31%
East of MLK Jr Blvd			
Westbound Total	2,650	3,300	25%
Eastbound Total	3,350	4,050	21%

Portland East-West Screenlines - PM Peak Hour Volumes			
Screenline	**Existing**	**No-Build**	**Difference**
Columbia Slough			
Southbound Total	1,200	1,450	21%
Northbound Total	1,350	1,550	15%
North of Rosa Parks			
Southbound Total	1,100	1,550	41%
Northbound Total	1,600	1,850	16%
South of Alberta St			
Southbound Total	1,250	1,750	40%
Northbound Total	2,100	2,550	21%

Exhibit 6-30

- Principal Arterial
- Minor Arterial
- Collector
- Intersection Analyzed
- Sub-areas

No-Build
SR 14 Interchange Sub-area

Columbia River CROSSING

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Vancouver Intersection Performance Results

AM Peak Hour

2005 Existing Conditions

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way								
B	Columbia St. @ Columbia Way[2]								
01	3rd/4th St. @ Columbia St[3]	Westbound Left/Right	3.7	A	0.03	LOS E	Y	-	-
C	3rd/4th St. @ Esther St.								
02	4th St. @ Columbia St.	Eastbound Left/Thru/Right	4.4	A	0.03	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	1.1	A	0.01	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	12.6	B	0.15	LOS E	Y	90	100 (SBL)
05	5th St. @ Washington St.	***Overall Intersection***	39.6	D	0.42	LOS E	Y	180 215	200 (EBR to I-5) 225 (SBL)
06	6th St. @ Columbia St.	***Overall Intersection***	7.8	A	0.42	LOS E	Y	-	-
07	6th St. @ Washington St.	***Overall Intersection***	20.3	C	0.39	LOS E	Y	-	-
08	6th St. @ Main St.	***Overall Intersection***	6.5	A	0.38	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	1.8	A	0.02	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	5.7	A	-	LOS E	Y	-	-
11	8th St. @ Esther St.	Southbound Left/Thru/Right	6.0	A	0.08	LOS E	Y	-	-
12	8th St. @ Columbia St.	***Overall Intersection***	10.8	B	0.51	LOS E	Y	-	-
13	8th St. @ Washington St.	***Overall Intersection***	5.4	A	0.55	LOS E	Y	-	-
14	8th St. @ Main St.	***Overall Intersection***	11.3	B	0.55	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Left	6.6	A	0.22	LOS E	Y	-	-
16	8th St. @ C St.	***Overall Intersection***	10.0	A	0.48	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	5.6	A	0.08	LOS E	Y	-	-
18	9th St. @ Columbia St.	Eastbound Left/Thru/Right	5.4	A	0.05	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Left	6.4	A	0.01	LOS E	Y	-	-
20	9th St. @ Main St.	Northbound Left	6.2	A	0.05	LOS E	Y	50	75 (NBL)
21	9th St. @ Broadway	Southbound Thru/Right	5.6	A	0.27	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	4.7	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	***Overall Intersection***	13.4	B	0.49	LOS E	Y	-	-
24	Evergreen Blvd. @ Washington St.	***Overall Intersection***	9.1	A	0.53	LOS E	Y	-	-
25	Evergreen Blvd. @ Main St.	***Overall Intersection***	7.9	A	0.53	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	***Overall Intersection***	18.7	B	0.83	LOS E	Y	75 100 210	75 (WBL) 100 (SBL) 225 (SBTR)
27	Evergreen Blvd. @ C St.	***Overall Intersection***	11.9	B	0.83	LOS E	Y	-	-
28	11th St. @ Esther St.	Southbound Left/Thru/Right	4.3	A	0.03	LOS E	Y	-	-
29	11th St. @ Columbia St.	Westbound Left/Thru/Right	6.9	A	0.14	LOS E	Y	-	-
30	11th St. @ Washington St.	Eastbound Thru/Right	6.0	A	0.07	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Thru/Right	4.7	A	0.08	LOS E	Y	-	-
32	11th St. @ Broadway	Eastbound Thru/Right	6.1	A	0.06	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	4.2	A	0.08	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	***Overall Intersection***	12.8	B	0.66	LOS E	Y	-	-
35	Mill Plain Blvd. @ Washington St.	***Overall Intersection***	7.2	A	0.40	LOS E	Y	-	-
36	Mill Plain Blvd. @ Main St.	***Overall Intersection***	4.7	A	0.57	LOS E	Y	-	-
37	Mill Plain Blvd. @ Broadway	***Overall Intersection***	12.2	B	0.51	LOS E	Y	190	200 (SBLT)
38	Mill Plain Blvd. @ C St.	***Overall Intersection***	8.3	A	0.34	LOS E	Y	-	-
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	18.6	B	0.58	LOS E	Y	350 275	375 (EBR) 350 (WBL)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	21.8	C	0.54	LOS E	Y	75	100 (WBR)
41	15th St. @ Columbia St.	***Overall Intersection***	10.1	B	0.53	LOS E	Y	-	-
42	15th St. @ Washington St.	***Overall Intersection***	4.9	A	0.44	LOS E	Y	-	-
43	15th St. @ Main St.	***Overall Intersection***	7.5	A	0.48	LOS E	Y	-	-
44	15th St. @ Broadway	***Overall Intersection***	18.2	B	0.47	LOS E	Y	-	-
45	15th St. @ C St.	***Overall Intersection***	8.8	A	0.48	LOS E	Y	-	-
D	16th St. @ Washington St.								
E	16th St. @ Main St.								
F	17th Street & Washington								
G	17th Street & Main								
H	17th Street & Broadway								
I	17th Street & C Street								
J	17th Street & G Street								
46	McLoughlin Blvd. @ Columbia St.	***Overall Intersection***	7.3	A	0.52	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.								
47	McLoughlin Blvd. @ Main St.	***Overall Intersection***	11.0	B	0.55	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	***Overall Intersection***	10.1	B	0.46	LOS E	Y	-	-
L	McLoughlin Blvd. @ C St.								
M	McLoughlin Blvd. @ G St.								
49	McLoughlin Blvd. @ Fort Vancouver Way	***Overall Intersection***	9.1	A	0.36	LOS D	Y	-	-
50	24th St. @ Columbia St.	Westbound Left/Thru/Right	8.4	A	0.12	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	6.6	A	0.06	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	18.8	B	0.61	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	35.7	D	0.66	LOS D	Y	125 200 75 470	150 (WBL) 200 (WBTR) 100 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	18.4	B	0.65	LOS D	Y	-	-
55	4th Plain Blvd. @ F St.	***Overall Intersection***	12.5	B	0.50	LOS D	Y	150	200 (EBL)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	8.8	A	0.46	LOS D	Y	-	-
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	12.3	B	0.51	LOS D	Y	75	150 (WBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	6.5	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	13.2	B	0.41	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	> 100	F	0.07	LOS E	N	215	225 (SBTR)
61	28th St. @ Broadway	Northbound Thru/Right	1.0	A	-	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Eastbound Left/Thru/Right	23.8	C	-	LOS E	Y	-	-
63	33rd St. @ Main St.	***Overall Intersection***	18.3	B	0.54	LOS D	Y	50 75	75 (WBL) 100 (SBL)
64	39th St. @ Main St.	***Overall Intersection***	28.5	C	0.69	LOS D	Y	75 75 215 125	125 (EBL) 125 (WBL) 225 (WBTR) 175 (SBL)
65	39th St. @ F St.	Southbound Left/Thru/Right	22.6	C	0.12	LOS E	Y	50	75 (WBL)
66	39th St. @ H St.	***Overall Intersection***	8.2	A	0.54	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Northbound Left	68.0	F	1.55	LOS E	N	1660 125	600 (NBL) 200 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	11.9	B	0.59	LOS D	Y	-	-
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	4.5	A	0.44	LOS D	Y	-	-
70	45th St. @ Main St.	***Overall Intersection***	7.4	A	0.44	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	9.7	A	0.50	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	4.6	A	0.29	LOS D	Y	-	-
73	Ross St. @ North Rd.	Northbound Left/Thru	6.0	A	0.24	LOS E	Y	-	-

2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way	Eastbound Left	5.6	A	0.01	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[2]	Eastbound Left	4.5	A	0.05	LOS E	Y	-	-
01	3rd/4th St. @ Columbia St[3]	Eastbound Left/Right	4.8	A	0.04	LOS E	Y	-	-
C	3rd/4th St. @ Esther St.	Westbound Left/Right	3.6	A	0.09	LOS E	Y	-	-
02	4th St. @ Columbia St.	Northbound Thru/Right	0.2	A	0.08	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	2.7	A	0.03	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	3.0	A	0.12	LOS E	Y	-	-
05	5th St. @ Washington St.	***Overall Intersection***	9.5	A	0.44	LOS E	Y	-	-
06	6th St. @ Columbia St.	***Overall Intersection***	7.9	A	0.45	LOS E	Y	-	-
07	6th St. @ Washington St.	***Overall Intersection***	11.8	B	0.48	LOS E	Y	-	-
08	6th St. @ Main St.	***Overall Intersection***	7.6	A	0.53	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	4.7	A	0.36	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	16.7	C	-	LOS E	Y	850	850 (NBLT)
11	8th St. @ Esther St.	Southbound Left/Thru/Right	8.8	A	0.19	LOS E	Y	-	-
12	8th St. @ Columbia St.	***Overall Intersection***	12.2	B	0.85	LOS E	Y	-	-
13	8th St. @ Washington St.	***Overall Intersection***	11.5	B	0.59	LOS E	Y	-	-
14	8th St. @ Main St.	***Overall Intersection***	12.2	B	0.58	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Left/Thru/Right	10.3	B	0.65	LOS E	Y	-	-
16	8th St. @ C St.	***Overall Intersection***	16.2	B	0.58	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	4.2	A	6.00	LOS E	Y	-	-
18	9th St. @ Columbia St.	Westbound Left/Thru/Right	7.0	A	0.13	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Left	5.4	A	0.04	LOS E	Y	-	-
20	9th St. @ Main St.	Eastbound Left/Thru/Right	4.6	A	0.06	LOS E	Y	-	-
21	9th St. @ Broadway	Eastbound Left/Right	3.9	A	0.04	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	7.6	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	***Overall Intersection***	13.0	B	0.63	LOS E	Y	-	-
24	Evergreen Blvd. @ Washington St.	***Overall Intersection***	17.2	B	0.60	LOS E	Y	75	100 (WBL)
25	Evergreen Blvd. @ Main St.	***Overall Intersection***	14.8	B	0.68	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	***Overall Intersection***	14.9	B	0.70	LOS E	Y	75 210	125 (WBL) 225 (WBTR)
27	Evergreen Blvd. @ C St.	***Overall Intersection***	14.3	B	0.64	LOS E	Y	-	-
28	11th St. @ Esther St.	Southbound Left/Thru/Right	4.6	A	0.05	LOS E	Y	-	-
29	11th St. @ Columbia St.	Westbound Left/Thru/Right	8.1	A	0.29	LOS E	Y	-	-
30	11th St. @ Washington St.	Westbound Left/Thru	7.9	A	0.23	LOS E	Y	-	-
31	11th St. @ Main St.	Westbound Left/Thru/Right	6.3	A	0.16	LOS E	Y	-	-
32	11th St. @ Broadway	Westbound Left/Thru/Right	6.9	A	0.22	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	6.3	A	0.17	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	***Overall Intersection***	18.4	B	0.77	LOS E	Y	75 210	150 (SBL) 225 (SBT)
35	Mill Plain Blvd. @ Washington St.	***Overall Intersection***	7.0	A	0.43	LOS E	Y	-	-
36	Mill Plain Blvd. @ Main St.	***Overall Intersection***	11.5	B	1.01	LOS E	Y	70	150 (SBL)
37	Mill Plain Blvd. @ Broadway	***Overall Intersection***	10.3	B	0.68	LOS E	Y	70	150 (SBL)
38	Mill Plain Blvd. @ C St.	***Overall Intersection***	8.0	A	0.38	LOS E	Y	-	-
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	20.4	C	0.75	LOS E	Y	800 350 275	800 (EBT) 500 (EBR) 350 (WBL)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	36.0	D	0.88	LOS E	Y	590 325	600 (NBLT) 500 (NBR)
41	15th St. @ Columbia St.	***Overall Intersection***	17.4	B	0.77	LOS E	Y	220	225 (WBLT)
42	15th St. @ Washington St.	***Overall Intersection***	12.3	B	0.54	LOS E	Y	210 210	250 (WBL) 225 (WBT)
43	15th St. @ Main St.	***Overall Intersection***	14.7	B	1.01	LOS E	Y	195	200 (WBLT)
44	15th St. @ Broadway	***Overall Intersection***	14.2	B	0.68	LOS E	Y	205	225 (WBLT)
45	15th St. @ C St.	***Overall Intersection***	8.3	A	0.58	LOS E	Y	-	-
D	16th St. @ Washington St.	Westbound Left/Thru	6.1	A	0.18	LOS E	Y	-	-
E	16th St. @ Main St.	Eastbound Left/Thru/Right	9.6	A	0.17	LOS E	Y	-	-
F	17th Street & Washington	Westbound Left/Thru	6.6	A	0.14	LOS E	Y	-	-
G	17th Street & Main	Eastbound Thru/Right	10.5	B	0.14	LOS E	Y	-	-
H	17th Street & Broadway	Westbound Left/Thru/Right	9.5	A	0.11	LOS E	Y	-	-
I	17th Street & C Street	Eastbound Left/Thru	5.7	A	0.09	LOS E	Y	-	-
J	17th Street & G Street	Eastbound Left/Thru/Right	2.7	A	0.04	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	***Overall Intersection***	12.2	B	0.64	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.	***Overall Intersection***	5.5	A	0.39	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	***Overall Intersection***	16.1	B	0.70	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	***Overall Intersection***	18.0	B	0.59	LOS E	Y	75	100 (WBL)
L	McLoughlin Blvd. @ C St.	***Overall Intersection***	5.9	A	0.30	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.	Northbound Left/Thru/Right	6.2	A	-	LOS E	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	***Overall Intersection***	11.7	B	0.42	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	9.0	A	0.04	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	9.8	A	0.05	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	20.4	C	0.74	LOS D	Y	235	250 (SBTR)
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	36.1	D	0.76	LOS D	Y	170 195 75 470	200 (WBL) 200 (WBT) 125 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	> 100	F	0.67	LOS D	N	195 495	200 (EBLT) 500 (WBT)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	11.2	B	0.53	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	17.5	B	0.64	LOS D	Y	200	275 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	16.2	B	0.58	LOS D	Y	75	125 (WBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	7.4	A	0.00	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	16.8	B	0.42	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	> 100	F	0.10	LOS E	N	215	225 (SBTR)
61	28th St. @ Broadway	Westbound Left	5.4	A	0.24	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	74.8	F	-	LOS E	N	1000	1000 (SBTR)
63	33rd St. @ Main St.	***Overall Intersection***	34.8	C	0.70	LOS D	Y	50 50 75	50 (EBL) 75 (WBL) 100 (NBL)
64	39th St. @ Main St.	***Overall Intersection***	> 100	F	0.93	LOS D	N	75 1310 75 215 75 125 360	125 (EBL) 1325 (EBTR) 125 (WBL) 225 (WBTR) 125 (NBL) 200 (SBL) 375 (SBT)
65	39th St. @ F St.	Northbound Left/Thru/Right	> 100	F	0.12	LOS E	N	50 430	75 (WBL) 450 (WBTR)
66	39th St. @ H St.	***Overall Intersection***	26.0	C	0.66	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	64.4	E	0.60	LOS D	N	135 55 275 715 1660 125	150 (EBT) 100 (EBR) 375 (WBL) 725 (WBT) 1675 (NBL) 275 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	> 100	F	0.80	LOS D	N	300 715 1170 790 75	325 (EBL) 725 (EBT) 1175 (WBTR) 800 (NBLT) 75 (NBR)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	21.5	C	0.57	LOS D	Y	-	-
70	45th St. @ Main St.	***Overall Intersection***	9.4	A	0.64	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	13.9	B	0.71	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	6.7	A	0.47	LOS D	Y	60	75 (WBL)
73	Ross St. @ North Rd.	Northbound Left/Thru	7.2	A	0.39	LOS E	Y	-	-

(yellow)	Delay / LOS affected by freeway congestion
(blue)	Intersection queuing spills back into upstream intersection
Note 1	The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.
Note 2	The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersections.
Note 3	2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis.
*	Intersection not modeled in existing conditions scenario
Y*	Intersection does not meet standard in the Build scenario; but meets the "do no worse" criteria as compared to the No Build.
Y**	Intersection operations are no worse than No Build, and no mitigation is required.

Exhibit 6-32

PRELIMINARY

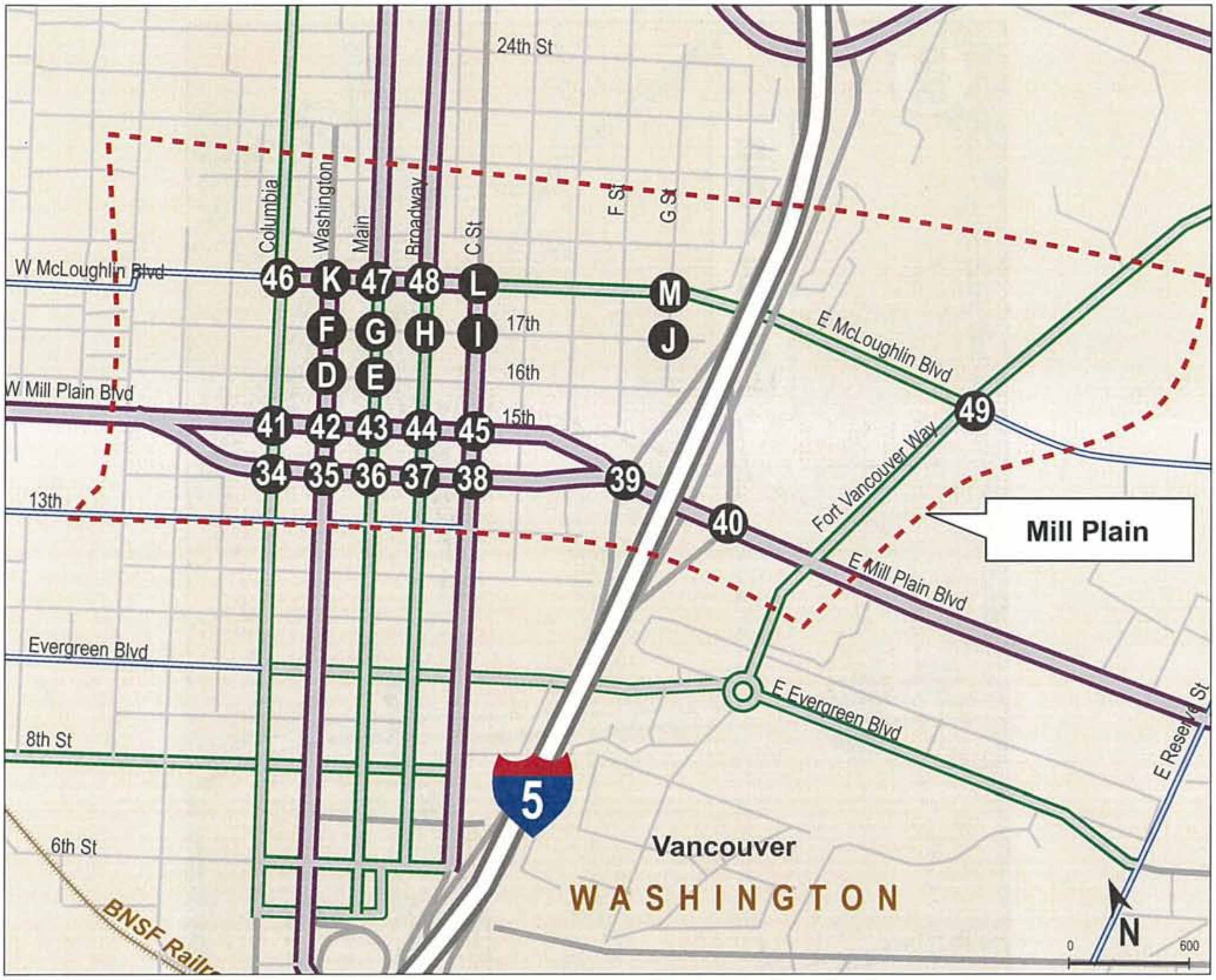
Vancouver Intersection Performance Results

PM Peak Hour

#	Intersection	2005 Existing Conditions: Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)	2030 No-Build: Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way									Eastbound Left	6.2	A	0.08	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[3]									Eastbound Left	6.0	A	0.07	LOS E	Y	-	-
01	3rd/4th St. @ Columbia St[3]	Westbound Left/Right	4.7	A	0.05	LOS E	Y	-	-	Eastbound Left/Right	6.7	A	0.16	LOS E	Y	-	-
C	3rd/4th St. @ Esther St.									Westbound Left/Right	3.1	A	0.01	LOS E	Y	-	-
02	4th St. @ Columbia St.	Westbound Left/Thru/Right	4.8	A	0.05	LOS E	Y	-	-	Northbound Thru/Right	0.4	A	0.21	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	1.6	A	0.01	LOS E	Y	-	-	Eastbound Right	2.7	A	0.01	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	3.6	A	0.22	LOS E	Y	-	-	Southbound Left	9.1	A	0.41	LOS E	Y	90	125 (SBL)
05	5th St. @ Washington St.	***Overall Intersection***	8.1	A	0.34	LOS E	Y	-	-	***Overall Intersection***	13.4	B	0.54	LOS E	Y	180 210	200 (EBR to SR-14) 225 (SBT)
06	6th St. @ Columbia St.	***Overall Intersection***	10.7	B	0.42	LOS E	Y	-	-	***Overall Intersection***	13.1	B	0.69	LOS E	Y	-	-
07	6th St. @ Washington St.	***Overall Intersection***	11.6	B	0.36	LOS E	Y	-	-	***Overall Intersection***	15.2	B	0.57	LOS E	Y	-	-
08	6th St. @ Main St.	***Overall Intersection***	5.3	A	0.43	LOS E	Y	-	-	***Overall Intersection***	6.5	A	0.60	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	4.6	A	0.22	LOS E	Y	-	-	Southbound Right	4.7	A	0.22	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	2.1	A	-	LOS E	Y	-	-	Northbound Left/Thru	2.9	A	0.30	LOS E	Y	-	-
11	8th St. @ Esther St.	Northbound Left/Thru/Right	8.0	A	0.31	LOS E	Y	-	-	Northbound Left/Thru/Right	14.6	B	0.50	LOS E	Y	-	-
12	8th St. @ Columbia St.	***Overall Intersection***	15.1	B	0.74	LOS E	Y	-	-	***Overall Intersection***	21.6	C	1.10	LOS E	Y	215	225 (SBLTR)
13	8th St. @ Washington St.	***Overall Intersection***	9.5	A	0.58	LOS E	Y	75	125 (WBL)	***Overall Intersection***	10.2	B	0.56	LOS E	Y	-	-
14	8th St. @ Main St.	***Overall Intersection***	17.0	B	0.58	LOS E	Y	-	-	***Overall Intersection***	13.5	B	0.58	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Thru/Right	10.2	B	0.13	LOS E	Y	-	-	Southbound Left/Thru/Right	8.1	A	0.38	LOS E	Y	-	-
16	8th St. @ C St.	***Overall Intersection***	14.3	B	0.34	LOS E	Y	-	-	***Overall Intersection***	15.3	B	0.42	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	4.5	A	0.07	LOS E	Y	-	-	Eastbound Left/Thru/Right	3.7	A	0.02	LOS E	Y	-	-
18	9th St. @ Columbia St.	Westbound Left/Thru/Right	6.3	A	0.18	LOS E	Y	-	-	Eastbound Left/Thru/Right	13.8	B	0.14	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Thru	8.5	A	0.08	LOS E	Y	-	-	Westbound Thru	7.2	A	0.08	LOS E	Y	-	-
20	9th St. @ Main St.	Northbound Thru	6.7	A	0.34	LOS E	Y	50	50 (NBL)	Eastbound Left/Thru/Right	6.0	A	0.06	LOS E	Y	-	-
21	9th St. @ Broadway	Southbound Thru/Right	6.2	A	0.24	LOS E	Y	-	-	Eastbound Left/Right	4.0	A	0.04	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Southbound Left/Thru/Right	6.6	A	0.14	LOS E	Y	-	-	Southbound Left/Thru/Right	6.4	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	***Overall Intersection***	10.9	B	0.53	LOS E	Y	-	-	***Overall Intersection***	18.4	B	0.59	LOS E	Y	225	225 (NBTR)
24	Evergreen Blvd. @ Washington St.	***Overall Intersection***	10.5	B	0.56	LOS E	Y	-	-	***Overall Intersection***	13.2	B	0.55	LOS E	Y	-	-
25	Evergreen Blvd. @ Main St.	***Overall Intersection***	9.7	A	0.56	LOS E	Y	-	-	***Overall Intersection***	13.1	B	0.55	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	***Overall Intersection***	12.7	B	0.56	LOS E	Y	210	225 (SBTR)	***Overall Intersection***	10.0	A	0.54	LOS E	Y	-	-
27	Evergreen Blvd. @ C St.	***Overall Intersection***	13.0	B	0.56	LOS E	Y	-	-	***Overall Intersection***	16.8	B	0.63	LOS E	Y	75	100 (EBL)
28	11th St. @ Esther St.	Northbound Left/Thru/Right	6.3	A	0.11	LOS E	Y	-	-	Northbound Left/Thru/Right	5.8	A	0.11	LOS E	Y	-	-
29	11th St. @ Columbia St.	Eastbound Left/Thru/Right	8.9	A	0.34	LOS E	Y	-	-	Eastbound Left/Thru/Right	11.6	B	0.34	LOS E	Y	-	-
30	11th St. @ Washington St.	Eastbound Thru/Right	7.0	A	0.21	LOS E	Y	-	-	Eastbound Thru/Right	7.4	A	0.17	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Thru/Right	7.5	A	0.41	LOS E	Y	-	-	Eastbound Left/Thru/Right	15.6	C	0.31	LOS E	Y	-	-
32	11th St. @ Broadway	Eastbound Thru/Right	6.2	A	0.19	LOS E	Y	-	-	Westbound Left/Thru/Right	6.7	A	0.30	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	7.8	A	0.18	LOS E	Y	-	-	Westbound Right	11.1	B	0.19	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	***Overall Intersection***	14.7	B	0.75	LOS E	Y	-	-	***Overall Intersection***	> 100	F	0.75	LOS E	N	810 150 75	825 (EBLTR) 225 (NBR) 100 (SBL)
35	Mill Plain Blvd. @ Washington St.	***Overall Intersection***	8.2	A	0.45	LOS E	Y	-	-	***Overall Intersection***	54.6	D	0.57	LOS E	Y	215	225 (EBTR)
36	Mill Plain Blvd. @ Main St.	***Overall Intersection***	12.4	B	0.62	LOS E	Y	100	150 (NBR)	***Overall Intersection***	78.5	E	0.79	LOS E	Y	210 765 70	225 (EBT) 775 (NBTR) 100 (SBL)
37	Mill Plain Blvd. @ Broadway	***Overall Intersection***	16.6	B	0.70	LOS E	Y	-	-	***Overall Intersection***	39.9	D	0.77	LOS E	Y	210 70	225 (EBT) 100 (SBL)
38	Mill Plain Blvd. @ C St.	***Overall Intersection***	14.1	B	0.60	LOS E	Y	-	-	***Overall Intersection***	51.9	D	0.78	LOS E	Y	205	225 (EBT)
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	37.5	D	0.72	LOS E	Y	275	350 (WBL)	***Overall Intersection***	94.4	F	0.87	LOS E	N	795 350 275 610	800 (EBT) 525 (EBR) 400 (WBL) 625 (WBT)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	26.8	C	0.86	LOS E	Y	610 610 75	725 (EBL) 625 (EBT) 125 (WBR)	***Overall Intersection***	36.5	D	0.97	LOS E	Y	450 75	450 (WBT) 150 (WBR)
41	15th St. @ Columbia St.	***Overall Intersection***	9.0	A	0.54	LOS E	Y	-	-	***Overall Intersection***	8.3	A	0.75	LOS E	Y	-	-
42	15th St. @ Washington St.	***Overall Intersection***	5.6	A	0.37	LOS E	Y	-	-	***Overall Intersection***	10.1	B	0.43	LOS E	Y	-	-
43	15th St. @ Main St.	***Overall Intersection***	9.0	A	0.59	LOS E	Y	-	-	***Overall Intersection***	8.8	A	0.79	LOS E	Y	-	-
44	15th St. @ Broadway	***Overall Intersection***	24.8	C	0.43	LOS E	Y	210	250 (WBL)	***Overall Intersection***	8.3	A	0.77	LOS E	Y	70 25	100 (NBL) 75 (SBR)
45	15th St. @ C St.	***Overall Intersection***	6.7	A	0.41	LOS E	Y	-	-	***Overall Intersection***	12.1	B	0.50	LOS E	Y	-	-
D	16th St. @ Washington St.									Westbound Left/Thru	6.1	A	0.19	LOS E	Y	-	-
E	16th St. @ Main St.									Eastbound Left/Thru/Right	8.1	A	0.24	LOS E	Y	-	-
F	17th Street & Washington									Westbound Left/Thru	5.6	A	0.06	LOS E	Y	-	-
G	17th Street & Main									Westbound Left/Thru/Right	8.6	A	0.15	LOS E	Y	-	-
H	17th Street & Broadway									Eastbound Left/Thru/Right	7.1	A	0.14	LOS E	Y	-	-
I	17th Street & C Street									Eastbound Left/Thru	6.1	A	0.14	LOS E	Y	-	-
J	17th Street & G Street									Southbound Left/Thru/Right	3.4	A	0.03	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	***Overall Intersection***	6.4	A	0.42	LOS E	Y	-	-	***Overall Intersection***	12.1	B	0.61	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.									***Overall Intersection***	5.9	A	0.50	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	***Overall Intersection***	11.6	B	0.67	LOS E	Y	-	-	***Overall Intersection***	15.7	B	0.76	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	***Overall Intersection***	7.8	A	0.39	LOS E	Y	-	-	***Overall Intersection***	12.0	B	0.50	LOS E	Y	-	-
L	McLoughlin Blvd. @ C St.									***Overall Intersection***	9.0	A	0.30	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.									Northbound Left/Thru/Right	5.8	A	-	LOS E	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	***Overall Intersection***	12.6	B	0.43	LOS D	Y	-	-	***Overall Intersection***	12.5	B	0.42	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	5.4	A	-	LOS E	Y	-	-	Eastbound Left/Thru/Right	4.2	A	0.01	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	7.7	A	0.07	LOS E	Y	-	-	Eastbound Left/Right	46.2	E	0.07	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	15.8	B	0.50	LOS D	Y	-	-	***Overall Intersection***	23.8	C	0.68	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	28.3	C	0.66	LOS D	Y	125 200 75 75 75	150 (WBL) 200 (WBTR) 100 (NBL) 125 (NBR) 125 (SBL)	***Overall Intersection***	39.5	D	0.78	LOS D	Y	250 495 170 195 75 425 75 75	300 (EBL) 500 (EBTR) 200 (WBL) 200 (WBT) 100 (NBL) 425 (NBT) 125 (NBR) 125 (SBL)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	24.0	C	0.94	LOS D	Y	125 495	150 (WBL) 500 (WBTR)	***Overall Intersection***	22.4	C	0.98	LOS D	Y	195 125	200 (EBTR) 150 (WBL)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	7.1	A	0.57	LOS D	Y	150	150 (EBT)	***Overall Intersection***	6.6	A	0.54	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	11.3	B	0.54	LOS D	Y	-	-	***Overall Intersection***	19.8	B	0.82	LOS D	Y	200 555	275 (EBL) 575 (EBT)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	16.0	B	0.63	LOS D	Y	75	150 (WBR)	***Overall Intersection***	53.7	D	0.85	LOS D	Y	275 850 75 600	375 (EBL) 850 (EBT) 150 (WBR) 625 (NBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	7.0	A	-	LOS E	Y	-	-	Eastbound Left	9.1	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	16.6	B	0.54	LOS D	Y	-	-	***Overall Intersection***	30.6	C	0.65	LOS D	Y	170	250 (EBL)
60	28th St. @ Main St.	Eastbound Left/Thru/Right	6.8	A	0.03	LOS E	Y	-	-	Eastbound Left/Thru/Right	6.3	A	0.03	LOS E	Y	-	-
61	28th St. @ Broadway	Northbound Thru/Right	1.9	A	-	LOS E	Y	-	-	Northbound Thru/Right	2.3	A	0.30	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Eastbound Left/Thru/Right	12.5	B	-	LOS E	Y	-	-	Westbound Left/Thru/Right	62.4	F	-	LOS E	N	-	-
63	33rd St. @ Main St.	***Overall Intersection***	18.3	B	0.45	LOS D	Y	50 50	75 (EBL) 75 (WBL)	***Overall Intersection***	48.6	D	0.56	LOS D	Y	50 50	100 (EBL) 100 (WBL)
64	39th St. @ Main St.	***Overall Intersection***	38.3	D	0.71	LOS D	Y	75 490 75 215 75 125	125 (EBL) 500 (EBTR) 100 (WBL) 225 (WBTR) 125 (NBL) 175 (SBL)	***Overall Intersection***	> 100	F	0.96	LOS D	N	75 1270 75 215 75 1570 125 360	125 (EBL) 1275 (EBTR) 125 (WBL) 225 (WBTR) 125 (NBL) 1575 (NBTR) 175 (SBL) 375 (SBT)
65	39th St. @ F St.	Northbound Left/Thru/Right	> 100	F	0.16	LOS E	N	- 50 430	- 75 (WBL) 450 (WBTR)	Northbound Left/Thru/Right	> 100	F	0.33	LOS E	N	215 50 430 305	225 (EBTR) 75 (WBL) 450 (WBTR) 325 (NBLR)
66	39th St. @ H St.	***Overall Intersection***	8.3	A	0.57	LOS D	Y	135	150 (WBTR)	***Overall Intersection***	64.3	E	0.76	LOS D	N	430 135 310	450 (EBTR) 150 (WBTR) 325 (SBLTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Northbound Left	30.0	D	-	LOS E	Y	- 55 125	- 100 (EBR) 175 (NBR)	***Overall Intersection***	43.7	D	0.76	LOS D	Y	135 55 710 1660	150 (EBT) 100 (EBR) 725 (WBT) 1150 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	23.1	C	0.76	LOS D	Y	75	125 (NBR)	***Overall Intersection***	> 100	F	0.91	LOS D	N	300 710 790 75	325 (EBL) 725 (EBT) 800 (NBLT) 100 (NBR)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	4.9	A	0.33	LOS D	Y	-	-	***Overall Intersection***	45.3	D	0.53	LOS D	Y	360	375 (NBTR)
70	45th St. @ Main St.	***Overall Intersection***	9.1	A	0.44	LOS D	Y	-	-	***Overall Intersection***	16.5	B	0.51	LOS D	Y	335 25	350 (NBL) 50 (NBR)
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	8.5	A	0.45	LOS D	Y	-	-	***Overall Intersection***	20.5	C	0.58	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	8.5	A	0.46	LOS D	Y	60 60	75 (WBL) 75 (WBR)	***Overall Intersection***	13.0	B	0.63	LOS D	Y	60 60	75 (WBL) 75 (WBR)
73	Ross St. @ North Rd.	Southbound Thru/Right	5.0	A	0.18	LOS E	Y	-	-	Southbound Thru/Right	23.0	C	0.32	LOS E	Y	-	-

Delay / LOS affected by freeway congestion
Intersection queuing spills back into upstream intersection
Note 1 The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.
Note 2 The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersections.
Note 3 2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis
* Intersection not modeled in existing conditions scenario
Y* Intersection does not meet standard in the Build scenario, but meets the "do no worse" criteria as compared to the No Build.
Y** Intersection operations are no worse than No Build, and no mitigation is required

Exhibit 6-33



No-Build
Mill Plain Interchange Sub-area

Columbia River CROSSING

Exhibit 6-34

Principal Arterial
Minor Arterial
Collector
500
5
Fourth Plain
Kauffman
Columbia
Main St
33rd St
P St
29th St
28th St
W Fourth Plain Blvd
St Johns Blvd
24th St
E Fourth Plain Blvd
Fort Vancouver Way
Waterworks Park
Washington
Broadway
C St
F St
McLoughlin Blvd
50
51
52
53
54
55
56
57
58
59
60
61
62
63

Exhibit 6-35


Principal Arterial
Minor Arterial
Collector
SR 500/
Main Street
NE Ross St
NE HazelDell Ave
NE 15th Ave
45th St
Main St
45th St
39th St
Leverich
Park
5
72
73
71
70
69
64
65
66
67
68

Exhibit 6-36


Hayden Island
N Hayden Island Dr
5
Columbia River
Hayden Island
24
25
N Marine Dr
OREGON
Principal Arterial
Minor Arterial
Urban Collector
Minor Collector

Exhibit 6-37

Portland Intersection Performance Results

AM Peak Hour		2005 Existing Conditions									2030 No-Build								
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)		Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr.	***Overall Intersection***	24.2	C	0.83	LOS D	Y	125	200 (WBL)		***Overall Intersection***	87.6	F	0.93	LOS D	N	125	250 (WBL)
02	Going and Interstate	***Overall Intersection***	31.7	C	0.75	LOS D	Y	125	250 (WBL)		***Overall Intersection***	52.9	D	0.88	LOS D	Y	125	275 (WBL)
								125	150 (NBL)								125	150 (NBL)
																	355	450 (EBL)
03	Alberta and Interstate	***Overall Intersection***	18.0	B	0.72	LOS D	Y	100	125 (SBL)		***Overall Intersection***	27.5	C	0.73	LOS D	Y	100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	***Overall Intersection***	13.6	B	0.67	0.85	Y	175	175 (WBLT)		***Overall Intersection***	46.3	D	0.78	0.85	Y	75	125 (WBL)
																	175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	***Overall Intersection***	10.1	B	0.49	0.85	Y	-	-		***Overall Intersection***	53.9	D	0.43	0.85	Y	75	100 (EBL)
06	Alberta and MLK Jr.	***Overall Intersection***	20.3	C	0.78	LOS D	Y	75	125 (WBR)		***Overall Intersection***	39.8	D	0.89	LOS D	Y	75	125 (WBR)
								100	125 (NBL)								100	150 (NBL)
																	100	125 (SBL)
07	Rosa Parks and Interstate	***Overall Intersection***	18.2	B	0.54	LOS D	Y	-	-		***Overall Intersection***	20.6	C	0.62	LOS D	Y	100	125 (WBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	***Overall Intersection***	18.3	B	0.52	0.85	Y	190	225 (WBL)		***Overall Intersection***	18.8	B	0.53	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	***Overall Intersection***	11.8	B	0.39	0.85	Y	-	-		***Overall Intersection***	12.6	B	0.44	0.85	Y	-	-
10	Rosa Parks and MLK Jr.	***Overall Intersection***	17.5	B	0.66	LOS D	Y	-	-		***Overall Intersection***	14.7	B	0.70	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	***Overall Intersection***	27.8	C	0.72	0.99	Y	150	175 (WBL)		***Overall Intersection***	> 100	F	0.90	0.99	Y	150	325 (WBL)
																	225	275 (NBL)
																	150	275 (EBL)
																	1155	1175 (EBTR)
																	555	1100 (WBTR)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.31	0.85	Y	-	-		Westbound Thru	12.9	B	0.42	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	8.5	A	0.48	0.85	Y	-	-		Northbound Right	16.8	C	0.57	0.85	Y	-	-
14	Lombard and MLK Jr.	***Overall Intersection***	61.4	E	0.79	0.99	Y	100	125 (EBL)		***Overall Intersection***	> 100	F	0.88	0.99	Y	100	175 (EBL)
								100	175 (WBL)								100	175 (WBL)
								100	175 (NBL)								100	200 (NBL)
								150	300 (SBL)								150	300 (SBL)
15	Interstate and Argyle	***Overall Intersection***	22.2	C	0.61	LOS D	Y	75	125 (EBR)		***Overall Intersection***	26.7	C	0.69	LOS D	Y	75	125 (EBR)
								50	75 (NBL)								50	125 (NBL)
																	150	150 (NBT)
16	Columbia Blvd and I-5 Ramps	***Overall Intersection***	17.6	B	0.62	0.85	Y	150	200 (WBR)		***Overall Intersection***	14.9	B	0.63	0.85	Y	150	200 (WBR)
17	Columbia Blvd and MLK Jr.	***Overall Intersection***	32.7	C	0.72	0.99	Y	100	200 (NBL)		***Overall Intersection***	37.2	D	0.89	0.99	Y	100	200 (NBL)
								225	250 (SBL)								225	250 (SBL)
18	Victory and Expo Road	***Overall Intersection***	2.2	A	0.22	LOS E	Y	-	-		***Overall Intersection***	2.9	A	0.22	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On-Ramp	Westbound Left/Thru	1.1	A	0.17	0.85	Y	-	-		Westbound Left/Thru	1.3	A	0.21	0.85	Y	-	-
20	Victory Blvd and NB On-/Off-Ramps	***Overall Intersection***	4.0	A	0.10	0.85	Y	-	-		***Overall Intersection***	5.0	A	0.13	0.85	Y	-	-
21	Union Ct and I-5 NB Off-Ramp	Eastbound Left	7.1	A	0.24	0.85	Y	-	-		Eastbound Left	8.4	A	0.28	0.85	Y	-	-
22	Union Ct/Marine Way and Vancouver Way	***Overall Intersection***	5.8	A	0.36	LOS E	Y	-	-		***Overall Intersection***	6.4	A	0.46	LOS E	Y	-	-
23	Marine Dr and I-5 On-/Off-Ramps	***Overall Intersection***	32.8	C	0.66	0.85	Y	200	275 (NBL)		***Overall Intersection***	> 100	F	0.83	0.85	Y	200	2075 (NBL)
								125	200 (SBR)								275	350 (EBL)
24	Center Ave and I-5 SB On-/Off Ramps	***Overall Intersection***	11.0	B	0.35	0.85	Y	-	-		***Overall Intersection***	11.2	B	0.35	0.85	Y	-	-
25	Hayden Island Dr and Hayden Island Dr South	***Overall Intersection***	8.2	A	0.35	0.85	Y	-	-		***Overall Intersection***	9.5	A	0.32	0.85	Y	-	-

Delay / LOS affected by freeway congestion

Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.

Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1)

Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR-99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).

Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.

7602

Exhibit 6-38

PRELIMINARY

Portland Intersection Performance Results

PM Peak Hour		2005 Existing Conditions								2030 No-Build							
#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr.	*Overall Intersection*	30.5	C	0.89	LOS D	Y	125	150 (EBL)	*Overall Intersection*	93.6	F	0.99	LOS D	N	125	175 (EBL)
								125	175 (NBL)							125	150 (NBL)
								125	150 (SBL)							125	200 (SBL)
																125	175 (WBL)
02	Going and Interstate	*Overall Intersection*	33.8	C	0.72	LOS D	Y	125	150 (NBL)	*Overall Intersection*	65.2	E	0.84	LOS D	N	125	225 (NBL)
																125	250 (WBL)
03	Alberta and Interstate	*Overall Intersection*	25.1	C	0.76	LOS D	Y	125	175 (NBL)	*Overall Intersection*	38.8	D	0.94	LOS D	Y	125	225 (NBL)
																100	150 (SBL)
																965	1150 (NBTR)
04	Alberta and SB I-5 Off-Ramp	*Overall Intersection*	10.4	B	0.63	0.85	Y	-	-	*Overall Intersection*	19.5	B	0.52	0.85	Y	75	125 (WBL)
																175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	*Overall Intersection*	10.1	B	0.70	0.85	Y	-	-	*Overall Intersection*	17.3	B	0.74	0.85	Y	75	125 (EBL)
																175	175 (EBT)
06	Alberta and MLK Jr.	*Overall Intersection*	38.0	D	0.88	LOS D	Y	75	150 (WBR)	*Overall Intersection*	71.9	E	0.91	LOS D	N	100	200 (NBL)
								100	150 (NBL)							100	200 (SBL)
								100	150 (SBL)								
07	Rosa Parks and Interstate	*Overall Intersection*	32.0	C	0.71	LOS D	Y	100	150 (WBL)	*Overall Intersection*	36.3	D	0.75	LOS D	Y	100	200 (WBL)
								175	225 (NBL)							175	225 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	*Overall Intersection*	15.0	B	0.48	0.85	Y	-	-	*Overall Intersection*	17.2	B	0.52	0.85	Y	125	175 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	*Overall Intersection*	12.7	B	0.42	0.85	Y	-	-	*Overall Intersection*	9.3	A	0.40	0.85	Y	-	-
10	Rosa Parks and MLK Jr.	*Overall Intersection*	16.5	B	0.75	LOS D	Y	100	150 (NBL)	*Overall Intersection*	16.8	B	0.84	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	*Overall Intersection*	32.4	C	0.76	0.99	Y	100	175 (NBR)	*Overall Intersection*	> 100	F	0.95	0.99	Y	100	200 (NBR)
																250	275 (SBL)
																150	250 (EBL)
																150	300 (WBL)
																225	300 (NBL)
																1150	1150 (EBTR)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	3.7	A	0.36	0.85	Y	-	-	Westbound Thru	7.6	A	0.56	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	10.7	B	0.42	0.85	Y	-	-	Northbound Right	14.9	B	0.55	0.85	Y	-	-
14	Lombard and MLK Jr.	*Overall Intersection*	74.0	E	0.85	0.99	Y	100	150 (EBL)	*Overall Intersection*	> 100	F	0.99	0.99	Y	100	200 (EBL)
								100	175 (WBL)							100	200 (WBL)
								100	225 (NBL)							100	225 (NBL)
								150	300 (SBL)							150	250 (SBL)
																1320	1325 (SBTR)
																1730	1750 (EBTR)
15	Interstate and Argyle	*Overall Intersection*	17.6	B	0.61	LOS D	Y	75	125 (EBR)	*Overall Intersection*	> 100	F	0.63	LOS D	N	1300	1300 (EBLT)
								50	75 (NBL)							50	125 (NBL)
																125	125 (NBT)
																75	150 (EBR)
16	Columbia Blvd and I-5 Ramps	*Overall Intersection*	12.6	B	0.58	0.85	Y	150	175 (WBR)	*Overall Intersection*	11.7	B	0.57	0.85	Y	-	-
17	Columbia Blvd and MLK Jr.	*Overall Intersection*	39.3	D	0.71	0.99	Y	150	175 (WBL)	*Overall Intersection*	83.5	F	0.74	0.99	Y	350	450 (WBL)
								100	225 (NBL)							100	225 (NBL)
								225	300 (SBL)							225	400 (SBL)
																150	450 (EBR)
18	Victory and Expo Road	*Overall Intersection*	4.4	A	0.32	LOS E	Y	-	-	*Overall Intersection*	45.6	E	0.39	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On-Ramp	Eastbound Thru	5.5	A	0.27	0.85	Y	-	-	Eastbound Thru	27.7	D	0.28	0.85	Y	75	75 (EBT)
20	Victory Blvd and NB On-/Off-Ramps	*Overall Intersection*	56.9	E	0.32	0.85	Y	290	325 (EBL)	*Overall Intersection*	> 100	F	0.31	0.85	Y	290	775 (EBL)
								200	250 (WBTR)							850	850 (WBT)
																200	225 (WBR)
21	Union Ct and I-5 NB Off-Ramp	Eastbound Left/Thru	33.1	D	0.30	0.85	Y	200	250 (EBL)	Northbound Thru	> 100	F	0.20	0.85	Y	200	300 (EBL)
																1195	1550 (EBR)
22	Union Ct/Marine Way and Vancouver Way	*Overall Intersection*	28.3	D	0.66	LOS E	Y	75	100 (SBLTR)	*Overall Intersection*	> 100	F	0.61	LOS E	N	75	200 (SBLTR)
								370	500 (NBLT)							370	2500 (NBLT)
								370	400 (NBR)							370	2500 (NBTR)
								55	75 (SWL)							55	100 (SWL)
								55	75 (SWTR)							55	150 (SWTR)
23	Marine Dr and I-5 On-/Off-Ramps	*Overall Intersection*	55.7	E	0.69	0.85	Y	275	325 (EBL)	*Overall Intersection*	> 100	F	0.82	0.85	Y	275	400 (EBL)
								375	1150 (WBR)							2130	2150 (EBT)
																375	2925 (WBR)
																200	1525 (NBLT)
24	Center Ave and I-5 SB On-/Off Ramps	*Overall Intersection*	20.2	C	0.61	0.85	Y	115	225 (WBLT)	*Overall Intersection*	24.8	C	0.80	0.85	Y	115	225 (WBLT)
																75	125 (WBR)
25	Hayden Island Dr and Hayden Island Dr South	*Overall Intersection*	12.9	B	0.44	0.85	Y	-	-	*Overall Intersection*	69.8	E	0.67	0.85	Y	70	100 (WBLR)
																150	200 (SBL)
																820	825 (SBT)

Delay / LOS affected by freeway congestion

Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.

Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1)

Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR-99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).

Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.

Exhibit 6-39

7603

Exhibit 6-40

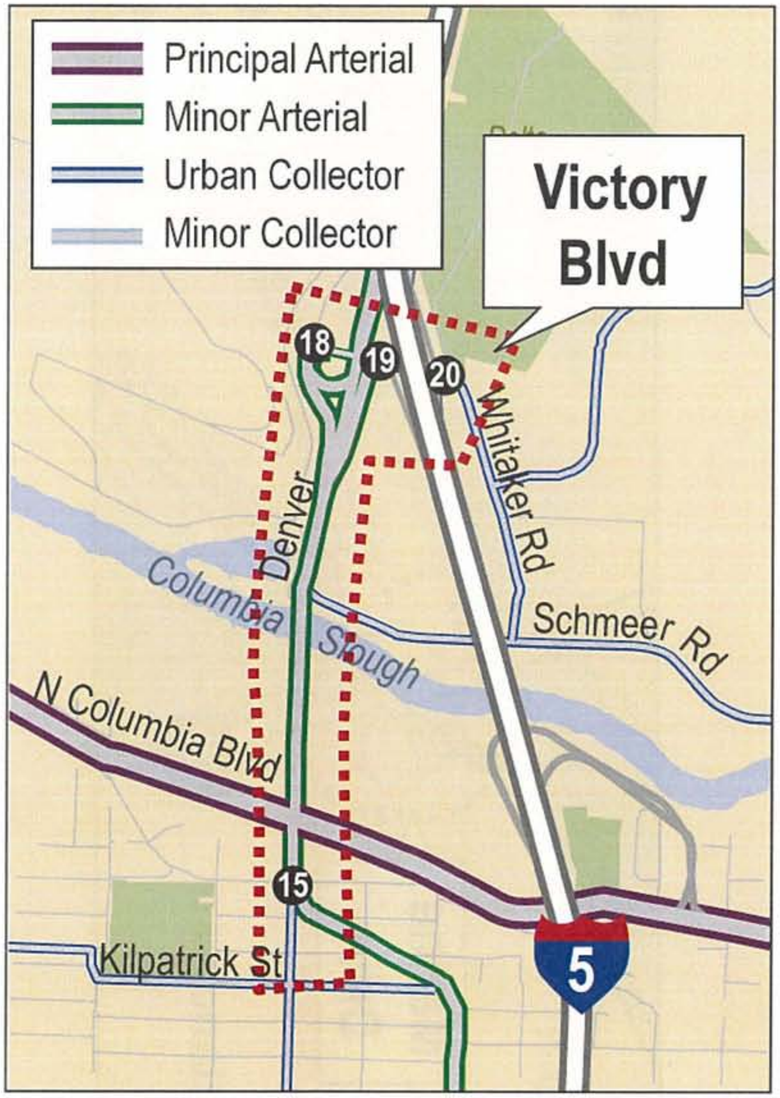
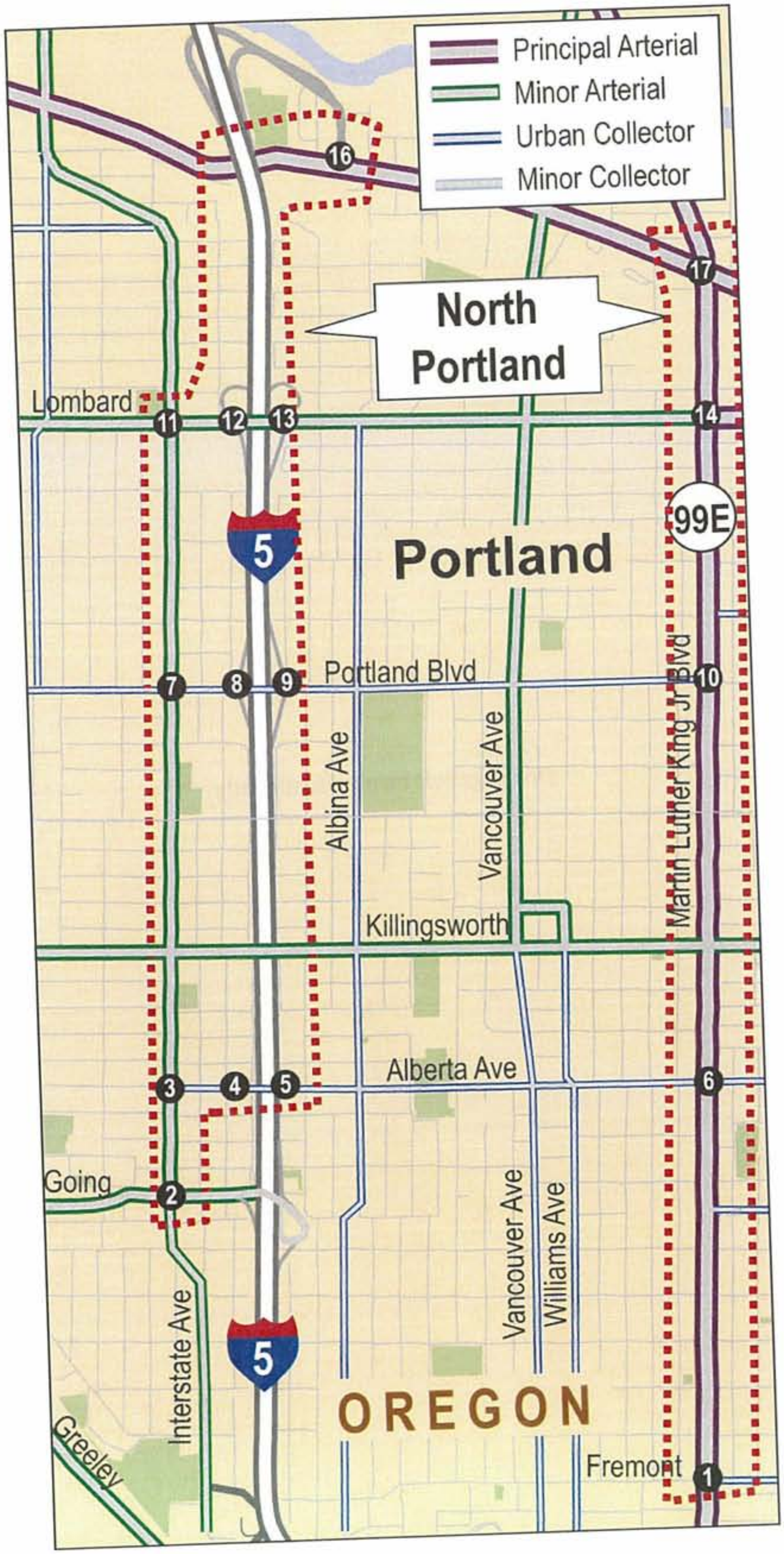

Principal Arterial
Minor Arterial
Urban Collector
Minor Collector
Victory Blvd
18
19
20
Denver
Whitaker Rd
Columbia Slough
Schmeer Rd
N Columbia Blvd
15
Kilpatrick St
5

Exhibit 6-41


Principal Arterial
Minor Arterial
Urban Collector
Minor Collector
North Portland
Portland
Lombard
Portland Blvd
Killingsworth
Alberta Ave
Going
Fremont
Albina Ave
Vancouver Ave
Williams Ave
Interstate Ave
Martin Luther King Jr Blvd
Greeley
99E
5
OREGON
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7. Locally Preferred Alternative

7.1 Description of Locally Preferred Alternative

The Locally Preferred Alternative (LPA) represents the alternative preferred by the local and regional agencies sponsoring the CRC project. Local agency-elected boards and councils determined their preference based on the results of the evaluation in the DEIS and on the public and agency comments received both before and following its publication.

In the summer of 2008, the local agencies sponsoring the CRC project adopted the following key elements of CRC as the LPA:

- A replacement bridge as the preferred river crossing,
- Light rail as the preferred high-capacity transit mode, and
- Clark College as the preferred northern terminus for the light rail extension.

The preferences for a replacement crossing and for light rail transit were identified by all six local agencies. Only the agencies in Vancouver – the Clark County Public Transit Benefit Area Authority (C-TRAN), the City of Vancouver, and the Regional Transportation Council (RTC) – expressed a preference with regard to the Vancouver light rail terminus. Each of these agencies preferred the Clark College terminus.

The LPA includes construction of a new I-5 replacement bridge to carry highway traffic, light rail, express bus, and bicycles and pedestrians across the Columbia River. The parallel bridges that form the existing I-5 crossing over the Columbia River would be replaced by two new parallel bridges. The eastern structure would accommodate northbound highway traffic on the bridge deck, with a bicycle and pedestrian path underneath; the western structure would carry southbound traffic, with a two-way light rail guideway below. Whereas the existing bridges have only three lanes each with virtually no shoulders, each of the new bridges would be wide enough to accommodate three through-lanes and two add/drop lanes. Lanes and shoulders would be built to full design standards.

The new bridges would be high enough to provide approximately 95 feet of vertical clearance for river traffic beneath, but not so high as to impede the take-offs and landings by aircraft using Pearson Field or Portland International Airport to the east. The new bridge structures over the Columbia River would not include lift spans, and both of the new bridges would each be supported by six piers in the water and two piers on land.

The LPA includes two design options: The preferred option, LPA Option A, which includes local vehicular access between Marine Drive and Hayden Island on an arterial bridge; and LPA Option B, which does not have arterial lanes on the light rail/multi-use path bridge, but instead provides direct access between Marine Drive and Hayden Island with collector-distributor (CD) lanes on the two new bridges that would be built adjacent to I-5.

The primary transit element of the LPA is a 2.9-mile extension of the current Metropolitan Area Express (MAX) Yellow Line light rail from the Expo Center in North Portland, where it currently ends, to Clark College in Vancouver. The transit element would not differ between LPA and LPA with highway phasing. To accommodate and complement this major addition to the region's transit system, a variety of additional improvements are also included in the LPA:

- Three park-and-ride facilities in Vancouver near the new light rail stations.
- Expansion of Tri-County Metropolitan Transportation District's (TriMet's) Ruby Junction light rail maintenance base in Gresham, Oregon.
- Changes to C-TRAN local bus routes.
- Upgrades to the existing light rail crossing over the Willamette River via the Steel Bridge.

7.1.1 LPA with highway phasing

Depending on the availability of funding, construction of several elements of the LPA could be deferred to some later date. As such, this FEIS technical report evaluates two versions of the LPA, including the LPA and the LPA with highway phasing option. The LPA with highway phasing option would build most of the LPA in the first phase, and would defer construction of specific elements of the project to some future undetermined date as summarized in **Section 2.1.2.1** and **Section 2.1.2.2**. When the results differ between the LPA and LPA with highway phasing alternative, the results are differentiated at the bottom of each section. The LPA with highway phasing option is referred to as LPA Phase I in project exhibits.

7.2 I-5 and I-205 Performance

This section summarizes highway performance for the LPA as well as the LPA with highway phasing alternative in year 2030.

7.2.1 Daily Traffic Levels

The highway performance results described in this chapter assume that tolls would be collected at the I-5 crossing using an electronic toll collection system. For more information on toll collection or estimated daily traffic levels if no tolls were collected, or if tolls were collected at both the I-5 and I-205 crossings, see Chapter 8.

Average weekday traffic across the I-5 crossing in 2030 is expected to be 178,500 vehicles under the LPA, lower than the 184,000 daily vehicle trips expected under No-Build conditions. Lower traffic would be due to vehicle-trip reductions with the provision of high-capacity transit and because of tolling. Interstate 205 traffic volumes would increase from 210,000 vehicles per day under the No-Build conditions to 214,500 vehicles with the LPA. **Exhibit 7-1** summarizes ADT volumes on the I-5 bridge, the I-205 bridge, and the total river crossing.

The daily traffic levels under the LPA with highway phasing is expected to be similar to the LPA scenario.

7.2.2 Traffic Demand – Vehicles

This section compares traffic demand between the forecast No-Build and LPA in the year 2030 using four-hour peaks.

Freeway traffic volumes were developed using the seven-step process summarized in the No-Build **Section 6.2.2**. The local roadway traffic volumes for Portland were developed using the five-step process also summarized in the No-Build **Section 6.2.2**.

The growth rates in the Vancouver study area were reviewed with, and agreed upon by, the City of Vancouver staff and were consistent with the adopted VCCV plan. The agreed-upon growth rates were applied to existing traffic volumes to forecast 2030 background traffic volumes. This resulted in traffic growth of approximately 50 percent in the morning and afternoon/evening peak periods over the 25-year period, which is approximately two percent per year.

Trips utilizing park-and-ride facilities were generated for each of the facilities for the peak hour of adjacent street traffic. The trip generation rates were assumed to be similar to existing park and ride facilities located throughout the Portland/Vancouver metropolitan region. Park-and-ride trips were then assigned to the roadway network based upon origin and destination travel patterns. The origin and destination patterns for the park-and-ride trips were based on forecasts from the regional demand model.

7.2.2.1 Vehicle Demands on I-5

Exhibit 7-2 compares the vehicle demands for the four-hour morning peak period in the southbound direction for the existing conditions, 2030 No-Build, the LPA with highway phasing and LPA. The general pattern of traffic volume fluctuations along the corridor remains similar among the scenarios.

North of the Interstate Bridge, the LPA would result in increased southbound vehicle demand relative to the No-Build Alternative during the four-hour morning peak. In the vicinity of the SR 500 interchange, the LPA is forecast to have a four-hour volume 6,000 vehicles (24 percent) higher than the No-Build Alternative. Much of the travel demand volume increase can be attributed to the additional capacity of I-5 in this location; the additional capacity results in lesser traffic diversion to Main Street and other local streets in Vancouver. At the Interstate Bridge, the LPA traffic demand is only about 900 vehicles (three percent) higher than the No-Build traffic demand.

South of the Interstate Bridge, traffic demand volumes between the LPA and No-Build Alternative are nearly the same. For example, south of the Victory Boulevard interchange, the traffic demand for the LPA is about 800 vehicles (six percent) higher than the No-Build Alternative. South of the Going Street interchange, the traffic demand for the LPA is about 300 vehicles (one percent) higher than the No-Build Alternative.

Exhibit 7-3 illustrates the northbound four-hour morning peak period traffic demand. Throughout the project corridor, northbound I-5 traffic demand is forecast to decrease during the morning peak compared with the No-Build Alternative. For example, in the vicinity of the Going Street interchange, vehicle demand is forecast to be about 1,400 fewer vehicles (eight percent less) than the No-Build Alternative. Crossing the Interstate Bridge, northbound traffic demand for the LPA is forecast to be lower by 1,800 vehicles (10 percent) than the No-Build Alternative during the four-hour morning peak. These decreases relative to the No-Build Alternative can be attributed to the increased transit use in the corridor and the imposition of tolls with the LPA scenario.

Exhibit 7-4 illustrates the traffic demand for the southbound afternoon/evening peak period. Traffic demand forecasts of the No-Build and LPA scenarios are similar throughout the corridor. In some sections of I-5 the No-Build has higher demands while in others the LPA scenario has higher demands. In the vicinity of SR 500, for example, the forecast for the LPA is about 800 vehicles (four percent) higher than the No-Build Alternative. Southbound traffic demands across the I-5 bridge during the four-hour afternoon/evening peak are forecast to be 2,000 vehicles lower (10 percent) for the LPA than the No-Build. This can be attributed to higher transit usage and tolls with the LPA.

Exhibit 7-5 illustrates the northbound traffic demands during the four-hour afternoon/evening peak period. Through much of North Portland, northbound traffic demand is slightly higher with the LPA than the No-Build Alternative. In the vicinity of Going Street, for example, the traffic demand for the LPA is about 1,000 vehicles (four percent) higher than the No-Build Alternative. At the Interstate Bridge, the traffic demand for the LPA is forecast to be about 2,600 vehicles (nine percent) higher than the No-Build Alternative. Through much of Vancouver, the traffic demand for the LPA is higher than for the No-Build. In the vicinity of 39th Street, for example, the traffic demand for the LPA is forecast to be about 5,300 vehicles (23 percent) higher than the No-Build Alternative. The higher traffic demand is attributable to the increased capacity on I-5 in this area and the lesser diversion to adjacent parallel arterials including Interstate Avenue, Martin Luther King Jr. Boulevard, Main Street and other local streets.

7.2.2.2 Vehicle Demand on I-205

This section compares traffic demand in the I-205 corridor in the year 2030 using two-hour peak periods. It provides information on the existing, No-Build, and LPA scenarios. Travel demands in the I-205 corridor are the same for LPA with highway phasing and LPA scenarios.

Exhibit 7-6 illustrates the southbound I-205 traffic demand for the two-hour morning peak. At most locations along the corridor, the traffic demand for the LPA is about 1,000 vehicles (five percent) lower than the No-Build Alternative. This reduction can be attributed to the provision of high-capacity transit and tolling on I-5 that are forecast to reduce overall southbound volumes for both I-205 and I-5 during the two-hour morning peak.

Exhibit 7-7 illustrates the traffic demand for the northbound two-hour morning peak period. The traffic demand for the LPA is higher than the No-Build Alternative. The traffic demand for the LPA is about 700 vehicles (five percent) higher than the No-Build Alternative in the vicinity of I-84 and about 1,400 vehicles (20 percent) higher than the No-Build Alternative crossing the Columbia River. The increased volume with the LPA can be attributed to diversion from I-5 to I-205 due to the tolling of I-5, as well as the relatively free-flowing conditions forecast for northbound I-205 during the morning peak.

Exhibit 7-8 illustrates the traffic demand for southbound I-205 during the two-hour afternoon/evening peak. The southbound afternoon/evening traffic demand for the LPA is generally higher than the No-Build Alternative. Across the Columbia River, the traffic demand for the LPA is about 1,100 vehicles (10 percent) higher than the No-Build Alternative. This can be attributed to the free-flowing conditions on southbound I-205 during the afternoon/evening off-peak period and the tolling of I-5.

Exhibit 7-9 illustrates the traffic demand for northbound I-205 during the two-hour afternoon/evening peak. The traffic demand for the LPA is slightly lower than for the No-Build Alternative. Along much of the corridor, the LPA is forecast to have volumes of 800 fewer vehicles (about five to 10 percent less) than the No-Build Alternative. Capacity improvements identified under the LPA for I-5, combined with the forecast congestion along I-205, accounts for the forecast vehicle demand reduction along I-205.

7.2.3 Traffic Demand – Truck Freight

Daily truck travel demand would be similar for the No-Build and LPA because the movement of freight is substantially related to economic conditions in the region, and freight moved by trucks is not likely to shift travel modes due to congestion. However, truck demands by time of day would likely change because there would be fewer congested hours under the LPA, resulting in more trucks during the commuter peak and midday hours.

Year 2030 daily truck volumes were distributed to each hour of the day to develop an hourly truck volume forecast for the LPA. The hourly volumes are based on existing hourly truck volumes, predicted levels of congestion (see Section 7.2.4) and the number of congested hours. Congestion is defined in this report as travel speeds less than 30 mph.

The LPA would result in higher volumes of trucks during midday operations compared to the No-Build Alternative. The reduction in congestion and truck travel occurring throughout the day would mean more flexibility in truck scheduling and improved reliability of truck shipments. **Exhibit 7-10** summarizes the truck volumes by time of day.

The truck freight traffic demands would be similar for the LPA and the LPA with highway phasing options.

7.2.3.1 Truck Operating Characteristics

The rate of growth for truck traffic over the Interstate Bridge is predicted to be higher than the rate of growth for general purpose traffic (77 percent growth for trucks compared to 32 percent for general purpose traffic), which would result in an increase in the proportion of trucks in the overall traffic stream. Due to their size and maneuverability, large trucks, on average, operate equivalent to 2.5 passenger cars on highways such as I-5 within the Bridge Influence Area. Therefore, the proportion of highway capacity used by trucks will be greater than today. The LPA would improve highway geometries such as uphill ramp grades, super-elevation, and merge distances to current standards. Truck speeds at interchanges and at the merge points with mainline I-5 would be higher than for the existing or No-Build conditions, resulting in reduced congestion from slow-moving trucks.

7.2.3.2 Oversized Loads

The LPA would be constructed to meet standard clearance heights for a federal interstate facility and ramps would be designed for the wider turns required by oversized loads.

7.2.4 Effect of Congestion

This section compares congestion between the forecast No-Build and LPA conditions in the year 2030, using four-hour peak periods.

7.2.4.1 Duration of Congestion on Southbound I-5

The LPA would reduce southbound congestion on the Interstate Bridge from 7.25 hours under No-Build conditions to 3.5 hours, as shown **in Exhibit 7-11**. The traffic congestion remaining at the bridge would result because of an existing downstream bottleneck on I-5 just north of the I-405 split. The LPA would not exacerbate or worsen this existing bottleneck, although the CRC improvements would enable an increase in vehicular throughput of about six percent along I-5 just north of the I-405 split.

The LPA would reduce southbound congestion near the I-405 split from 11 hours under No-Build conditions to 8.25 hours. Similarly, the effects of the southbound bottleneck located near the I-5 lane drop in the Rose Quarter would remain, with approximately 3.75 hours of congestion.

The duration of congestion on southbound I-5 at the Interstate Bridge would be similar for the LPA and the LPA with highway phasing options, as shown in **Exhibit 7-12**. The two bottlenecks south of the bridge would be similar to the LPA.

7.2.4.2 Duration of Congestion on Northbound I-5

The LPA would eliminate the northbound I-5 crossing bottleneck. Northbound traffic queues would no longer extend to I-405 for multiple hours each day. The LPA would reduce the duration of congestion at the I-5 crossing from 7.75 hours to less than two hours each day (see **Exhibit 7-13**).

The other two bottlenecks located near the I-405/Rose Quarter weaving area and the Marquam Bridge would operate similar to No-Build conditions.

The duration of congestion on northbound I-5 would be similar for the LPA and the LPA with highway phasing options at the Interstate Bridge, near the I-405/Rose Quarter weaving area, and near the Marquam Bridge (see **Exhibit 7-14**). The LPA with highway phasing option would result in over two hours of congestion between SR 14 and SR 500 during the afternoon/evening peak hour compared to the LPA (see **Exhibits 7-13** and **7-14**). The cause of this new congestion spot is high afternoon/evening volumes and the amount of lane changing occurring between SR 14 and SR 500. The LPA with highway phasing has one less add/drop lane in this area requiring additional lane changes resulting in more congestion.

7.2.5 Travel Times

This section compares travel times between the forecast No-Build and LPA conditions in the year 2030 calculated during the two-hour peak periods in the direction of peak traffic flow.

7.2.5.1 Travel Time along I-5

The travel time comparisons are presented for two different segments of I-5: SR 500 to Columbia Boulevard (about 4.7 miles) and from 179th Street to I-84 (about 16.2 miles). The calculated peak period travel times are provided for the Existing, No-Build, the LPA with highway phasing, and the LPA scenarios. Morning peak travel times are calculated for the southbound direction; afternoon/evening peak travel times are calculated for the northbound direction.

Exhibit 7-15 illustrates the travel time on southbound I-5 during the morning peak period. Relative to the No-Build scenario, the LPA would result in a one minute (five percent) decrease in southbound I-5 travel time from SR 500 to Columbia Boulevard. For the longer segment from 179th Street to I-84, the LPA is calculated to produce a time savings of eight minutes (17 percent) relative to the No-Build scenario. Note that the bottleneck north of the I-405 split would occur under both the LPA and No-Build scenarios during the two-hour morning peak, affecting travel times in the corridor. Notwithstanding the downstream bottleneck, the geometric and operational highway improvements in the LPA allow traffic headed southbound from Vancouver to Portland to flow more freely.

Though they are not illustrated in the exhibit, travel times for I-5 trips that originate from SR 500, SR 14, and Mill Plain, cross the Interstate Bridge, and exit I-5 at the Marine Drive interchange also receive benefits of reduced travel time from the LPA compared with the No-Build Alternative. The LPA eliminates the bottleneck caused by the existing bridge and ramps joining I-5 from SR 14. Since trips exiting I-5 at Marine Drive do not travel far enough south to encounter the congestion originating at the bottleneck created by the I-5/I-405 split, these trips accrue a measurable benefit though their I-5 time savings is not much due to the short distance they travel on I-5.

Exhibit 7-16 illustrates the northbound travel times during the two-hour afternoon/evening peak. The travel time improvements are much more pronounced in the northbound direction during the afternoon/evening peak period than in the southbound direction during the morning peak period because northbound traffic is unaffected by a downstream bottleneck. Relative to the No-Build scenario, travel times for the LPA are predicted to improve by eight minutes (57 percent) from Columbia Boulevard to SR 500 and by 20 minutes (45 percent) from I-84 to 179th Street.

The northbound and southbound travel times along I-5 would be similar for the LPA and the LPA with highway phasing options.

7.2.5.2 Travel Time along I-205

Travel time in the I-205 corridor is presented for the segment from SR 500 to the westbound I-84 interchange (about 10.2 miles). Travel time information is also provided for the northerly portion from SR 500 to mid-point of the Glenn Jackson Bridge over the Columbia River (about 5.5 miles) and from the mid-point of the bridge to westbound I-84 (about 4.7 miles). Like the travel times for I-5, the travel times for the I-205 corridor are presented for the peak direction travel during the morning or evening peaks. The morning peak period travel time is reported for the southbound direction and the afternoon/evening peak period travel time is presented for the northbound direction.

For the entire 10.2-mile corridor, southbound I-205 travel times during the two-hour morning peak are forecast to decrease by two minutes (six percent) from SR 500 to I-84 for the LPA compared to the No-Build Alternative (see **Exhibit 7-17**). The reduction in travel time is attributed to decreased demands along I-205 resulting from a shift of traffic to I-5 due to reduced congestion in that corridor.

Northbound I-205 travel times from I-84 to SR 500 would remain similar under both the 2030 LPA and 2030 No-Build scenarios during the two-hour afternoon/evening peak (see **Exhibit 7-18**).

The northbound and southbound travel times along I-205 would be similar for the LPA and the LPA with highway phasing options.

7.2.6 Service Volumes

This section compares service volumes between the forecast No-Build and LPA conditions in the year 2030, using four-hour peak periods.

7.2.6.1 Vehicle Throughput (Served Volume) on Southbound I-5

As shown in **Exhibit 7-19**, southbound vehicle throughput along I-5 near the Pioneer Street interchange would be similar under the LPA and No-Build scenarios during the four-hour morning peak.

Southbound I-5 vehicle throughput near the SR 500 interchange during the four-hour morning peak would increase by almost 7,700 vehicles (35 percent) for the LPA. Although the LPA would serve more traffic volume, it would not serve the entire forecast demand due to a downstream bottleneck located north of the I-405 split. However, the percentage served would be higher than the No-Build Alternative.

Southbound I-5 vehicle throughput on the Interstate Bridge during the four-hour morning peak would increase by around 3,600 vehicles (16 percent) over the No-Build Alternative, even though the vehicle demand between alternatives would remain constant.

While the southbound Interstate Bridge bottleneck would be eliminated under the LPA, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the I-5 bridge to about 97 percent of its demand during the four-hour morning peak period.

In addition, southbound I-5 vehicle throughput north of the I-405 split would serve about 1,200 more vehicles (five percent) during the four-hour morning peak under the LPA than the No-Build condition. Both alternatives are forecast to serve approximately 90 percent of their demand near the I-405 split.

The vehicle throughput on southbound I-5 would be similar for the LPA and the LPA with highway phasing options.

7.2.6.2 Vehicle Throughput (Served Volume) on Northbound I-5

During the four-hour afternoon/evening peak, northbound I-5 vehicle throughput north of I-405 would increase by over 4,700 vehicles (30 percent) compared to No-Build conditions (see **Exhibit 7-20**). Although the vehicle demand would be similar for the two alternatives, the LPA would remove the bottleneck at Interstate Bridge, resulting in improved service volumes for northbound I-5.

Similarly, northbound I-5 vehicle throughputs on the Interstate Bridge and near SR 500 would increase substantially over the No-Build Alternative. The volume served during the four-hour afternoon/evening peak would increase by 9,100 vehicles (45 percent) and 12,400 vehicles (51 percent), respectively.

Northbound vehicle throughputs along I-5 near the Pioneer Street interchange would be similar under LPA and No-Build conditions during the four-hour afternoon/evening peak.

The vehicle throughput on northbound I-5 would be similar for the LPA and the LPA with highway phasing options.

7.2.7 Served vs. Unserved Ramp Volumes

This section compares ramp volumes between the forecast No-Build and LPA conditions in the year 2030, using four-hour peak periods.

7.2.7.1 Served vs. Unserved Ramp Volumes on Southbound I-5

During the four-hour morning peak, the number of southbound on-ramps in the Bridge Influence Area that would have unserved volumes would decrease from three (SR 500/39th Street, Mill Plain Boulevard, and SR 14/City Center) under No-Build conditions to one (SR 14/City Center) under the LPA, as shown in **Exhibit 7-21**. The unserved volume for the LPA would be due to the lane drop on the southbound I-5 Bridge resulting in additional congestion at the SR 14/City Center on-ramp. The number of unserved vehicles under the LPA design would be similar to existing 2005 conditions and less than 2030 No-Build conditions. The decrease in number of ramps with unserved vehicles would be due to the reduced congestion forecast for southbound I-5 during the morning peak under the LPA.

The ramps with unserved volumes would be the same for the LPA and the LPA with highway phasing.

7.2.7.2 Served vs. Unserved Ramp Volumes on Northbound I-5

During the four-hour afternoon/evening peak, the number of northbound on-ramps in the Bridge Influence Area that would have unserved volumes would decrease from five (Interstate Avenue/Victory Boulevard, Marine Drive, Hayden Island, Mill Plain Boulevard, and Fourth Plain Boulevard) to one (Mill Plain Boulevard) under the LPA, as shown in **Exhibit 7-22**. This decrease would be due to the reduced congestion forecast for northbound I-5 during the afternoon/evening peak under the LPA.

Similarly, under the LPA with highway phasing option the Mill Plain Boulevard northbound on-ramp would be the only ramp with unserved vehicles. The amount of unserved vehicles would be similar to the LPA option and much less than the No-Build alternative.

7.2.8 Person Throughput

Under the LPA, in year 2030 about 29,200 persons in southbound vehicles would be expected to use the I-5 crossing during the four-hour morning peak, an increase of 18 percent over No-Build conditions. With the provision of high-capacity transit up to 7,550 persons under the LPA option are forecast to be using transit during the four-hour morning peak.

Northbound, in year 2030 about 35,300 persons in vehicles would be expected to use the I-5 crossing under the LPA during the four-hour afternoon/evening peak, an increase of 33 percent over No-Build conditions. With the provision of high-capacity transit, up to 6,100 persons under the LPA option are forecast to be using transit during the four-hour afternoon/evening peak. **Exhibit 7-23** shows total person throughput data including auto and transit trips.

Under the LPA with highway phasing option, about 28,600 persons in southbound vehicles would be expected to use the I-5 crossing during the four-hour morning peak, an increase of 15 percent over No-Build conditions. The amount of transit users under the LPA with highway phasing option is forecast to slightly decrease to 7,500 persons during the four-hour morning peak.

The person throughput in vehicles and on transit for northbound I-5 during the four-hour afternoon/evening peak would be similar for the LPA and the LPA with highway phasing options.

7.2.9 Managed Lanes Along I-5

Managed lanes are a fairly common feature on major highways in large metropolitan areas. In contrast with general purpose lanes open to all users, managed lanes are for preferential or exclusive use and are most often reserved for high-occupancy vehicles (HOVs). On some highways, managed lanes can be used by motorcyclists and certain hybrid vehicles. Some areas of the country are experimenting with truck-only managed lanes.

Managed lanes are intended to save time for bus riders, carpoolers, and motorcyclists by enabling them to bypass areas of traffic congestion. Managed lanes increase highway efficiency by moving more people in fewer vehicles than general purpose lanes. Managed lanes allow more reliable highway travel times and help carpools and buses maintain their schedules. Managed lanes reduce single-occupant vehicle trips, overall highway demand, and the burden on the environment from greenhouse gas emissions. Managed lanes are a crucial component of offering sustainable transportation alternatives to solo driving.

On I-5, a managed lane exists northbound between Going Street and Marine Drive. The 3.2-mile lane is reserved for high-occupancy vehicle (HOV) use between 3:00 and 6:00 p.m. on weekdays. During this three-hour period, vehicles with two or more people, buses, and motorcyclists are allowed to use the lane.

The 2030 No-Build, LPA, and LPA with highway phasing options assume the current 3.2-mile HOV lane, the majority of which is located south of the project area, would remain in place through the year 2030.

Including new managed lanes on I-5 within the CRC project area would not offer operational benefits for most users, including carpools or trucks. This is due to a number of factors:

- Because of the substantial amount of traffic entering from on-ramps or exiting to off-ramps within the project area, many eligible users would not be inclined to navigate to and from a managed lane located to the inside of the highway.
- A managed lane for southbound users would terminate into a general purpose lane just south of the CRC project area, but traffic is expected to backup through the general purpose lane throughout most of the morning peak period, which would cause congestion and back-ups within the managed lane.
- A managed lane for northbound users would not offer enough time savings to be effective. For example, under the LPA and LPA with highway phasing options all of the general purpose lanes are forecast to operate at nearly free-flow conditions, with less than two hours congestion.

For the above three reasons, it is likely that only a small portion of all eligible users would use an inside managed lane along I-5 within the CRC project area. If managed lanes were positioned to be the outside lanes on the highway instead of the inside lanes, the significant volumes of traffic entering from on-ramps and/or exiting to off-ramps within the CRC area would create congestion and conflicts with managed lane users.

While managed lanes would not offer operational benefits for most users within the CRC project area, the LPA and LPA with highway phasing options could be flexible enough to allow future managed lanes within the project area if it were part of a comprehensive, system-wide network of managed lanes north and south of the CRC area (e.g., between 179th Street and I-405).

7.2.10 Safety

The LPA would address most of the non-standard geometric and safety design features for I-5's mainline and ramps within the Bridge Influence Area. Improvements would be made to the existing short on-ramp merges/acceleration lanes and off-ramp diverges/deceleration distances, short weaving areas, substandard lane widths, vertical and horizontal curves that limit sight distance, and narrow or non-existent shoulders. The LPA would remove both Interstate Bridge lift spans. In addition, the LPA would substantially reduce traffic congestion in the Bridge Influence Area compared to No-Build conditions.

As the number of vehicular collisions in the I-5 Bridge Influence Area is related to the presence of non-standard geometric design and safety features, which is exacerbated when traffic levels are at or near congested conditions, the LPA would substantially improve traffic safety in the Bridge Influence Area. It is estimated that the project would reduce average annual yearly collisions in the Bridge Influence Area from 750 under the No-Build Alternative to between 210 and 240 in the LPA.

This estimate was calculated by making the assumption that the highway geometric and safety improvements made in the Bridge Influence Area would result in a highway corridor that performed at least as good as an average, similar type of urban interstate facility in Oregon. The collision rate for a similar urban, interstate facility is approximately 0.55 collisions per MVMT. Applying this rate (with an allowance for a higher collision rate during congested periods and during late evening and early morning hours) to the forecasted traffic volumes over a year period generated an estimated annual collision total of between 210 and 240.

The safety findings would be similar for the LPA and the LPA with highway phasing options.

7.3 Local Streets

7.3.1 Travel Demand

This section compares travel demand on local streets between the forecast No-Build and LPA conditions in the year 2030. The information is reported for the one-hour peak periods. In general, local street traffic demands will decrease under the LPA as compared to the No-Build Alternative because the congestion on I-5 will be lessened; thereby shifting regional trips back to the highway instead of using local roads.

7.3.1.1 Vancouver Screenlines – Morning Peak Hour

During the morning peak, eastbound and westbound traffic west of I-5 would increase between 10 and 20 percent over No-Build conditions as shown in **Exhibit 7-24**. With the LPA, eastbound and westbound traffic east of I-5 would increase by up to five percent over No-Build conditions. Under the LPA with highway phasing, eastbound traffic east of I-5 would increase by approximately 30 percent and westbound traffic east of I-5 would remain relatively unchanged. The difference in eastbound traffic between the LPA and LPA with highway phasing would be due to the addition of the direct connect ramp from southbound I-5 to eastbound SR 500. Without the direct connect ramp, eastbound traffic would remain on 39th Street to access SR 500.

During the morning peak, southbound traffic in Vancouver would decrease between 10 and 35 percent along most major streets with the exception of the downtown area. Southbound traffic in downtown is expected to increase over the No-Build by approximately 10 percent. The decrease in southbound traffic on local streets would be caused by the improvements to I-5, which would encourage through traffic that has been observed to divert to arterial streets due to congestion on I-5 to return to I-5.

Northbound traffic south of Fourth Plain Boulevard would increase between five and 20 percent. Northbound traffic north of 39th Street would increase by approximately 80 percent (450 vehicles) compared to No-Build conditions. This would occur due to the closure of the 39th Street on-ramp to I-5 northbound; vehicles would use the arterial street network to access the northbound I-5 on-ramp at Main Street.

7.3.1.2 Vancouver Screenlines – Afternoon/Evening Peak Hour

During the afternoon/evening peak, traffic volumes along key east-west local streets west of I-5 would remain unchanged and/or increase by approximately 20 percent over No-Build conditions as shown in **Exhibit 7-25**. Under the LPA, westbound traffic just east of I-5 would increase by approximately 15 percent and eastbound traffic just east of I-5 would decrease by approximately 25 percent compared to No-Build conditions. Under LPA with highway phasing, eastbound traffic would decrease by approximately 10 percent. The difference in eastbound traffic between the LPA and LPA with highway phasing would be due to the addition of the direct-connection ramp from southbound I-5 to eastbound SR 500. Without the direct-connection ramp, eastbound traffic would remain on 39th Street to access SR 500.

During the afternoon/evening peak hour, southbound traffic in Vancouver, depending on location, would remain unchanged or could increase up to 20 percent. Under the LPA, the southbound off-ramp to 39th Street would be removed and replaced with the new southbound SR 500 off-ramp, which would cause traffic to shift from southbound I-5 to southbound Main Street to access the neighborhood.

Northbound traffic in Vancouver would decrease between five and 30 percent relative to No-Build conditions, with the highest decrease north of the Fourth Plain interchange area.

7.3.1.3 Portland Screenlines – Morning Peak Hour

During the morning peak, westbound traffic on both sides of the highway would decrease less than 10 percent compared to No-Build conditions as shown in **Exhibit 7-26**. Eastbound traffic on both sides of I-5 would increase up to 10 percent, with the higher growth forecast for the eastside of I-5.

During the morning peak, southbound traffic in Portland would decrease by up to five percent over No-Build conditions. Northbound traffic in Portland would remain unchanged or decrease between 10 and 20 percent compared to No-Build conditions.

7.3.1.4 Portland Screenlines – Afternoon/Evening Peak Hour

During the afternoon/evening peak, eastbound and westbound traffic on both sides of the highway would change by less than 10 percent compared to No-Build conditions as shown in **Exhibit 7-27**. Northbound and southbound traffic in Portland would change by less than 10 percent during the afternoon/evening peak hour.

7.3.2 Intersection Operational Performance

This section compares intersection operational performance between the forecast No-Build and LPA conditions in the year 2030, considering one-hour peak periods.

Exhibit 7-28 summarizes the applicable LOS and V/C performance criteria used when comparing year 2030 project conditions against No-Build conditions for the study intersections. The criteria recognizes under No-Build conditions some local intersections may operate at unacceptable conditions and that mitigation would not be required under the LPA options if either caused no further degradation to these intersections.

In addition to intersection LOS and/or V/C ratios, vehicular queuing impacts would be significant when, under the LPA option, a traffic lane's storage distance is exceeded, but would not be exceeded under No-Build conditions. Similarly, significant queuing impacts would result if the resulting vehicle queue extends into upstream intersection, but would not under No-Build conditions.

7.3.2.1 Vancouver Operational Peformance – Morning/Afternoon Peak Hour

The LPA includes improvements to the four interchanges along I-5 in Vancouver including SR 14, Mill Plain, 4th Plain, and SR 500. These improvements include some reconfiguration of adjacent local streets to complement the new interchange designs, as well as new facilities for bicyclists and pedestrians within and along this corridor.

Interchanges and Local Roads

SR 14 Interchange

The function of this interchange would remain largely the same as it is currently. Direct connections between I-5 and SR 14 would be rebuilt. Access to and from downtown Vancouver would be provided as it is today, but the connection points would be relocated. Downtown Vancouver I-5 access to and from the south would be at C Street rather than Washington Street, while downtown connections to and from SR 14 would be made by way of Columbia Street at 4th Street.

The multi-use bicycle and pedestrian path in the northbound (eastern) I-5 bridge would exit the structure between the Columbia River and SR 14 interchange, and then loop down to connect into Columbia Way.

Mill Plain Interchange

This interchange would be reconfigured into a SPUI. The existing diamond configuration requires two traffic signals to move vehicles through the interchange. The SPUI would use one efficient intersection that allows opposing left turns simultaneously. This would improve the capacity of the interchange by reducing delay for traffic entering or exiting I-5.

This interchange would also receive several improvements for bicyclists and pedestrians. These include bike lanes and sidewalks, clear delineation and signing, short perpendicular crossings at the ramp terminals, and ramp orientations that would make pedestrians highly visible to on-coming motorists.

Fourth Plain Interchange

The improvements to this interchange would be made to better accommodate freight mobility and access to the new park-and-ride facility near Clark College. Northbound I-5 traffic exiting to Fourth Plain would continue to use the off-ramp just north of the SR 14 interchange. The southbound I-5 exit to Fourth Plain would be braided with the SR 500 connection to I-5. Braiding these ramps would eliminate the non-standard weave between the SR 500 connection and the off-ramp to Fourth Plain as well as the westbound SR 500 to Fourth Plain Boulevard connection.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including bike lanes, neighborhood connections, and access to the park-and-ride facility.

SR 500 Interchange

Improvements would be made to the SR 500 interchange to add direct connections to and from I-5 in place of some existing connections to and from 39th Street. On- and off-ramps would be built to directly connect SR 500 and I-5 to and from the north, connections that are currently made by way of 39th Street. I-5 southbound traffic would connect to eastbound SR 500 via a new tunnel underneath I-5. SR 500 eastbound traffic would connect to I-5 northbound on a new on-ramp. The 39th Street connections with I-5 to and from the north would be eliminated. I-5 travelers would instead use Main Street to connect to and from 39th Street.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including sidewalks on both sides of 39th Street, bike lanes, and neighborhood connections.

***Potential phased construction option*:** The northern half of the existing SR 500 interchange would be retained, rather than building new connections between I-5 southbound to SR 500 eastbound and from SR 500 westbound to I-5 northbound. The ramps connecting SR 500 and I-5 to and from the north could be constructed separately in the future as funding becomes available.

Downtown Vancouver Light Rail Alignment, Stations, and Park and Ride Lots

After crossing the Columbia River, the light rail alignment would curve slightly west from the highway bridge and onto its own smaller structure over the BNSF rail line. The double-track guideway would descend on structure and touch down on Washington Street south of 5th Street, continuing north on Washington Street to 7th Street. The elevation of 5th Street would be raised to allow for an at-grade crossing of the tracks on Washington Street. Between 5th and 7th Streets, the double-track guideway would run down the center of the street. Traffic would not be allowed on Washington between 5th and 6th Streets and would be two-way between 6th and 7th Streets. There would be a station on each side of the street on Washington between 5th and 6th Streets.

At 7th Street, the light rail alignment would form a couplet. The single-track northbound guideway would turn east for two blocks, then turn north onto Broadway Street, while the single-track southbound guideway would continue on Washington Street. Seventh Street would be converted to one-way traffic eastbound between Washington and Broadway with light rail operating on the north side of 7th Street. This couplet would extend north to 17th Street, where the two guideways would join and turn east.

The light rail guideway would run on the east side of Washington Street and the west side of Broadway Street, with one-way traffic southbound on Washington Street and one-way traffic northbound on Broadway Street. On station blocks, the station platform would be on the side of the street at the sidewalk. There would be two stations on the Washington-Broadway couplet, one pair of platforms near Evergreen Boulevard, and one pair near 15th Street.

The single-track southbound guideway would run in the center of 17th Street between Washington and Broadway Streets. At Broadway Street, the northbound and southbound alignments of the couplet would become a double-track center-running guideway traveling east-west on 17th Street. The guideway on 17th Street would run until G Street, then connect with McLoughlin Boulevard and cross under I-5. Both alignments would end at a station east of I-5 on the western boundary of Clark College.

Three park-and-ride lots would be built in Vancouver along the light rail alignment:

- Within the block surrounded by Columbia, Washington, 4th and 5th Streets, with five floors above ground that include space for retail on the first floor and 570 parking stalls.
- Between Broadway and Main Streets next to the stations between 15th and 16th Streets, with space for retail on the first floor, and four floors above ground that include 420 parking stalls.
- At Clark College, just north of the terminus station, with space for retail or C-TRAN services on the first floor, and five floors that include approximately 1,910 parking stalls.

The park and ride lots would accommodate transit users driving to the lot, parking and then transferring to transit, as well as those being dropped off by others (quick drop). Peak hour vehicle-trip generation for each of these lots is a combination of park and ride trips (entered during the morning peak and departed during the afternoon/evening peak) and quick drop trips (entering and exiting during each peak). **Exhibit 7-29** summarizes the estimated vehicle-trip generation for each lot, excluding feeder and local buses serving the lots, and is differentiated by park and ride trips (parking trips) and quick drop trips (drop-off and pick-up trips). As shown in **Exhibit 7-29**, Columbia would generate an estimated 310 morning and 280 afternoon/evening peak trips; Mill Plain would generate an estimated 225 morning and 205 afternoon/evening peak trips; and Clark would generate an estimated 1,050 morning and 955 afternoon/evening peak hour trips

7.3.2.2 SR 14/City Center Interchange Area Operational Performance

Under the LPA and LPA with highway phasing, the SR 14/City Center interchange area consists of 39 study intersections as shown in **Exhibit 7-30**, of which five would be new intersections that do not exist under No-Build conditions. New or revised intersections are labeled with two letters instead of numbers to help with the identification. Two of the intersections that exist under No-Build conditions would be eliminated. The five new intersections would be at the following locations:

- Main Street at Columbia Way
- Main Street at SR 14 Eastbound
- Main Street at surface lot
- Main Street at 5th Street
- 5th Street at Columbia Park and Ride

The intersections of Washington at 4th Street and Columbia Street at 4th Street would be eliminated under the LPA and LPA with highway phasing.

With the planned highway improvements, access to and from downtown Vancouver would be provided as it is today, but the connection points would be relocated. Access to I-5 southbound from downtown Vancouver would be from C Street rather than Washington Street, while access to SR 14 would be made by way of Columbia Street at 3rd/4th Street and Main Street at 3rd/4th Street. Access from SR 14 would be made via Washington Street and Columbia Street.

Based on WSDOT and City of Vancouver staff recommendations, four new roundabouts would also be built within the SR 14 interchange area. These roundabouts would be at the following locations:

- Main Street at Columbia Way
- Columbia Street at Columbia Way
- Main Street at SR 14 Eastbound
- Columbia Street at SR 14 Westbound and 3rd/4th Street

Traffic circulation within the downtown area would also be modified compared to the No-Build Alternative. Washington Street would remain one-way southbound with light rail transit running on the east side of the street, while Broadway Street would be converted from two-way traffic to one-way northbound with light rail transit running on the west side of the street. C Street would also be converted from one-way northbound to two-way north-south traffic.

As shown in **Exhibit 7-31**, during the morning peak, all 39 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions compared to No-Build conditions.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, all 39 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions compared to No-Build conditions.

As shown in **Exhibit 7-31**, during the morning peak, 33 of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, six of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, 29 intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, 10 of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing, no traffic mitigation would be required.

7.3.2.3 Mill Plain Boulevard Interchange Area Operational Performance

The Mill Plain Boulevard interchange area consists of 29 study intersections as shown in **Exhibit 7-33**. New or revised intersections are labeled with two letters instead of numbers to help with the identification. Of the 29 study intersections, four would be new intersections that were not modeled under No-Build conditions and one would be removed by converting the I-5 northbound and southbound ramp terminals into one single point urban interchange (the existing "diamond" configuration requires two traffic signals to move vehicles through the interchange while the SPUI uses one intersection and allows opposing left turns simultaneously). The new intersections would be near the Mill District and Clark College park-and-ride lots at the following locations:

- Mill District park and ride at 15th Street
- Mill District park and ride at 16th Street
- Clark College park and ride at McLoughlin Boulevard
- Marshal Center East Access at McLoughlin Boulevard

As shown in **Exhibit 7-31**, during the morning peak, all 29 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions compared to No-Build conditions.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, 27 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. Two intersections would have unacceptable operations under the LPA and LPA with highway phasing. The intersections with unacceptable operations would be:

- Mill Plain Boulevard at C Street
- 15th Street at C Street

As shown in **Exhibit 7-31**, during the morning peak, 18 of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, 11 of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, 18 of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, 11 of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

City of Vancouver and/or WSDOT, as appropriate, would monitor traffic operations and pursue the following mitigation measures recommended under the LPA:

- Add a third lane eastbound on 15th Street between Washington Street and Columbia Street
- Add a southbound right turn lane at 15th Street and Columbia Street
- Add a third eastbound left turn at the Mill Plain interchange
- Monitor and adjust ramp meter rates at Mill Plain Boulevard on-ramps

7.3.2.4 Fourth Plain Boulevard Interchange Area Operational Performance

The Fourth Plain Boulevard interchange area, as shown in **Exhibit 7-34**, consists of 14 study intersections, all of which exist currently. The proposed LPA and LPA with highway phasing interchange configuration would allow traffic exiting the Clark park-and-ride facility to merge with traffic exiting I-5 going to Fourth Plain Boulevard. Traffic entering the park-and-ride facility will cross under traffic exiting I-5 and the park-and-ride facility.

As shown in **Exhibit 7-31**, during the morning peak, 13 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the No-Build Alternative. The unsignalized intersection of 29th Street at Main Street would degrade from acceptable operations under the No-Build Alternative to unacceptable operations under the LPA and LPA with highway phasing.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, all 14 of the study intersections with the LPA would operate acceptably with improved, similar, or slightly degraded conditions as compared to the No-Build Alternative. With the LPA with highway phasing configuration, the intersection of 33rd Street at Main Street would degrade from acceptable operations under the No-Build Alternative to unacceptable operations. This is caused by downstream congestion at the intersection of 39th Street and Main Street.

As shown in **Exhibit 7-31**, during the morning peak, 11 of the study intersections would operate with acceptable vehicle queuing. Based on 95% queuing analysis, three of the study intersections would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, 13 of the study intersections would operate with acceptable vehicle queuing with the LPA. Based on 95% queuing analysis, the intersection of Fourth Plain Boulevard at Broadway would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative. With the LPA with highway phasing configuration, the additional intersection of 33rd Street at Main Street would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

City of Vancouver and/or WSDOT, as appropriate, would monitor traffic operations and pursue the following mitigation measures recommended under the LPA:

- Monitor and adjust ramp meter rates at Fourth Plain Boulevard ramps

7.3.2.5 SR 500/Main Street/39th Street Interchange Area Operational Performance

The SR 500/Main Street/39th Street interchange area, as shown in **Exhibit 7-35**, consists of 10 study intersections, all of which currently exist.

As shown in **Exhibit 7-31**, during the morning peak, with the LPA all 10 of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions as compared to the No-Build Alternative. With the LPA with highway phasing nine of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. The intersection of 39th Street at H Street would degrade from acceptable or unacceptable operations under the No-Build Alternative to unacceptable operations under the LPA with highway phasing.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, with the LPA nine of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions. The intersection of 39th Street at I-5 Southbound would degrade from acceptable or unacceptable operations under the No-Build Alternative to unacceptable operations under the LPA. With the LPA with highway phasing, the additional intersections of 39th Street at H Street and 40th Street at Main Street would degrade from acceptable or unacceptable operations under the No-Build Alternative to unacceptable operations under the LPA with highway phasing.

As shown in **Exhibit 7-31**, during the morning peak, with the LPA eight study intersections would operate with acceptable vehicle queuing while two of the study intersections, based on 95% queuing analysis, would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative. With the LPA with highway phasing, six of the study intersections would operate with acceptable vehicle queuing while four of the study intersections, based on 95% queuing analysis, would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

As shown in **Exhibit 7-32**, during the afternoon/evening peak, with the LPA nine study intersections would operate with acceptable vehicle queuing while one of the study intersections, based on 95% queuing analysis, would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative. With the LPA with highway phasing, seven of the study intersections would operate with acceptable vehicle queuing while three of the study intersections, based on 95% queuing analysis, would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

City of Vancouver and/or WSDOT, as appropriate, would monitor traffic operations and pursue the following mitigation measures recommended under the LPA:

- Add a second westbound lane on 39th Street between F Street and Creston Avenue

The recommended mitigation should be considered for both the No-Build and LPA scenarios. The intersection of 39th Street at Main Street is overcapacity and operates unacceptable in the No-Build Alternative. There is significant background growth forecast for this area of Vancouver.

7.3.2.6 Portland Service Levels – Morning/Afternoon Peak Hour

The LPA includes improvements to the three interchanges along I-5 in Portland including Hayden Island, Marine Drive, and Victory Boulevard. These improvements include some reconfiguration of adjacent local streets to complement the new interchange designs, as well as new facilities for bicyclists and pedestrians within and along this corridor.

Interchanges and Local Roads

Hayden Island Interchange

This interchange would be completely reconfigured with replacement of the existing, obsolete, gull-wing style interchange. The new configuration would be a split, tight diamond interchange. Ramps parallel to the highway would be built, lengthening the ramps and improving merging speeds. Improvements to Jantzen Drive and Hayden Island Drive would include additional through, left-turn, and right-turn lanes. A new local road, Tomahawk Island Drive, would travel east-west through the middle of Hayden Island and under the I-5 interchange, improving connectivity across I-5 on the island. Additionally, a new multi-use path would be provided along the elevated light rail line on the west side of the Hayden Island interchange.

LPA Option A: A proposed arterial bridge with two lanes of traffic, one in each direction, would allow vehicles to travel between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island without accessing I-5.

LPA Option B: With this design option there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel on the collector-distributor bridges that parallel each side of I-5 over North Portland Harbor.

Marine Drive Interchange

This interchange would be reconfigured to reduce congestion for motorists entering and exiting I-5 at this location. The new interchange configuration would be a single-point urban interchange (SPUI) with a flyover ramp serving the east to north movement. With this configuration, three legs of the interchange would converge at a point on Marine Drive, over the I-5 mainline.

The Marine Drive eastbound to I-5 northbound flyover ramp would allow motorists, including high volume of trucks, to access I-5 northbound without stopping. Motorists from Marine Drive eastbound would also access I-5 southbound without stopping. Motorists traveling on Martin Luther King Jr. Boulevard westbound to I-5 northbound would access I-5 without stopping.

The new interchange configuration alters the road connections on the east side of I-5 and makes Martin Luther King Jr. Boulevard the principal access from the east side of I-5 to the interchange and provides a new direct connection to I-5 northbound.

In the new interchange configuration, Vancouver Way and Marine Drive traffic would be served via Martin Luther King Jr. Boulevard using improved connections further east of the reconfigured interchange. The new connection from Vancouver Way to Martin Luther King Jr. Boulevard would allow traffic to turn right from Vancouver Way and accelerate onto Martin Luther King Jr. Boulevard for easy access to northbound I-5 or the new SPUI. On the south side of Martin Luther King Jr. Boulevard, the existing loop connection would be replaced with a new connection farther east.

A new multi-use path for bicyclists and pedestrians would extend from the Bridgeton neighborhood to the existing Expo Center light rail station, and then from that station to Hayden Island. The path would be on the new bridge that also accommodates the new light rail line over North Portland Harbor.

LPA Option A: Local traffic between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel via an arterial bridge over North Portland Harbor. There would be some variation in the alignment of local streets in the area of the interchange between Option A and Option B. The most prominent differences are the alignments of Vancouver Way and Union Court.

LPA Option B: With this design option, there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island would travel on the collector-distributor bridges that would parallel each side of I-5 over North Portland Harbor. Traffic would not need to merge onto mainline I-5 to travel between the island and Martin Luther King Jr. Boulevard/Marine Drive.

***Potential phased construction option*:** The aforementioned flyover ramp could be deferred and not constructed as part of the CRC project. In this case, rather than providing a direct eastbound Marine Drive to I-5 northbound connection by a flyover ramp, the project improvements to the interchange would instead provide this connection through the signal-controlled SPUI. The flyover ramp could be constructed separately in the future as funding becomes available.

Victory Boulevard Interchange

The southern extent of the I-5 project improvements would be two ramps associated with the Victory Boulevard interchange in Portland. The Marine Drive to I-5 southbound on-ramp would be braided over the I-5 southbound to the Victory Boulevard/Denver Avenue off-ramp. The other ramp improvement would lengthen the merge distance for northbound traffic entering I-5 from Denver Avenue. The current merging ramp would be extended to become an add/drop (auxiliary) lane that would continue across the river crossing.

***Potential phased construction option*:** The aforementioned southbound ramp improvements to the Victory Boulevard interchange may not be included with the CRC project. Instead, the existing connections between I-5 southbound and Victory Boulevard could be retained. The braided ramp connection could be constructed separately in the future as funding becomes available.

Oregon Light Rail Alignment and Station

A two-way light rail alignment for northbound and southbound trains would be constructed to extend from the existing Expo Center MAX station over North Portland Harbor to Hayden Island. Immediately north of the Expo Center, the alignment would curve eastward toward I-5, pass beneath Marine Drive, and then rise over a flood wall onto a light rail/multi-use path bridge to cross North Portland Harbor. The double-track guideway over Hayden Island would be elevated at approximately the height of the rebuilt mainline of I-5, as would a new station immediately west of I-5. The alignment would extend northward on Hayden Island along the western edge of I-5, until it transitions into the hollow support structure of the new western bridge over the Columbia River.

7.3.2.7 Hayden Island Interchange Area Operational Performance

Under the LPA and LPA with highway phasing both Option A and Option B, the Hayden Island interchange area consists of 11 study intersections as shown in **Exhibit 7-36**. New intersections are labeled with two letters instead of numbers to help with the identification. Four of the new study intersections would replace the existing two ramp terminal intersections analyzed under existing and No-Build conditions. The remaining seven study intersections are used to analyze local street traffic.

As shown in **Exhibit 7-37**, during the morning peak for Option A and Option B, all four of the proposed ramp intersections and all seven of the local street intersections would operate acceptably as compared to the applicable standards. As shown in **Exhibit 7-38,** during the afternoon/evening peak for Option A and Option B, all 11 intersections would also operate acceptably. During the morning and afternoon/evening peak hours, based on 95% queuing analysis, all of the study intersections would operate with acceptable vehicle queuing.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing for both Options A and B, no traffic mitigation would be required.

7.3.2.8 Marine Drive Interchange Area Operational Performance

Under the LPA Option A and Option A with highway phasing, the Marine Drive interchange area including Bridgeton would consist of seven study intersections as shown in **Exhibit 7-39**. Under the LPA Option B and Option B with highway phasing, the Marine Drive interchange area including Bridgeton would consist of six study intersections as shown in **Exhibit 7-39.** The difference between Option A and Option B is that Option A has an additional intersection at the location of the arterial bridge and Little Marine Drive. New or revised intersections are labeled with two letters instead of numbers to help with the identification.

As shown in **Exhibit 7-37** and **Exhibit 7-38**, all of the proposed intersections during the morning and afternoon/evening peaks would operate acceptably under the LPA and LPA with highway phasing for both Options A and B as compared to the applicable standards.

As shown in **Exhibit 7-37** and **Exhibit 7-38**, based on 95% queuing analysis, all intersections during the morning and afternoon/evening peaks would operate with acceptable vehicle queuing under the LPA and LPA with highway phasing for both Options A and B.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing for both Options A and B, no traffic mitigation would be required.

7.3.2.9 Victory Boulevard Interchange Area Operational Performance

Under the LPA and LPA with highway phasing, the Victory Boulevard interchange area would remain in the same configuration as the No-Build Alternative. The interchange area consists of four study intersections as shown in **Exhibit 7-40**.

As shown in **Exhibit 7-37 and Exhibit 7-38**, during the morning and afternoon/evening peaks, all four of the study intersections would operate acceptably under the LPA and LPA with highway phasing with similar conditions as compared to the No-Build

Alternative. Based on 95% queuing analysis, all of the proposed study intersections would operate with acceptable vehicle queuing under the LPA and LPA with highway phasing when compared to the No-Build Alternative.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing, no traffic mitigation would be required.

7.3.2.10 Interstate Avenue Analysis Area Operational Performance

Under the LPA and LPA with highway phasing, the Interstate Avenue analysis area would remain the same as the No-Build Alternative. The analysis area consists of four study intersections as shown in **Exhibit 7-41**.

As shown in **Exhibit 7-37**, during the morning peak, three of the study intersections would operate acceptably with improved, similar, or slightly degraded conditions under the LPA and LPA with highway phasing compared to No-Build conditions. One would degrade from acceptable or unacceptable operations under the No-Build Alternative to unacceptable operations under the LPA and LPA with highway phasing.

As shown in **Exhibit 7-38**, during the afternoon/evening peak, all four of the study intersections would operate acceptably under the LPA and LPA with highway phasing with similar conditions as compared to the No-Build Alternative.

As shown in **Exhibit 7-37**, during the morning peak, based on 95% queuing analysis, all of the study intersections would operate with acceptable vehicle queuing under the LPA and LPA with highway phasing. As shown in **Exhibit 7-38**, during the afternoon/evening peak, two of the study intersections in the LPA and LPA with highway phasing would operate with acceptable vehicle queuing. Based on 95% queuing analysis, two intersections in the LPA and LPA with highway phasing would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

The following measures are recommended to mitigate unacceptable operations under the LPA and LPA with highway phasing:

Going Street and Interstate Avenue:

- Optimize light rail transit pre-emption at intersection.
- Install advanced signal controllers to manage light rail transit pre-emption.
- Change westbound right into a through/right choice lane to allow traffic to continue westbound.

7.3.2.11 Martin Luther King Jr. Boulevard Analysis Area Operational Performance

Under the LPA and LPA with highway phasing, the Martin Luther King Jr. Boulevard analysis area would remain the same as the No-Build Alternative. The analysis area consists of five study intersections as shown in **Exhibit 7-41**.

As shown in **Exhibit 7-37 and Exhibit 7-38**, during the morning and afternoon/evening peaks, all five of the study intersections would operate acceptably under the LPA and LPA with highway phasing with improved, similar, or slightly degraded conditions. Based on 95% queuing analysis, all five of the study intersections would operate with acceptable vehicle queuing under the LPA and LPA with highway phasing when compared to the No-Build Alternative.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing, no traffic mitigation would be required.

7.3.2.12 I-5 Ramp Terminals Analysis Area Operational Performance

Under the LPA and LPA with highway phasing, the I-5 Ramp Terminals analysis area would remain in the same configuration as the No-Build Alternative. The interchange area consists of seven study intersections as shown in **Exhibit 7-41**.

As shown in **Exhibit 7-37 and Exhibit 7-38**, during morning and afternoon/evening peaks, all of the study intersections would operate acceptably under the LPA and LPA with highway phasing with improved, similar, or slightly degraded conditions. All seven of the study intersections would operate with acceptable vehicle queuing under the LPA and LPA with highway phasing when compared to the No-Build Alternative, with the exception of Rosa Parks Way and the I-5 northbound on-/off-ramps intersection during the afternoon/evening peak hour. Based on 95% queuing analysis, this intersection would experience queuing extending past turn lane storage capacities or to upstream intersections, which would not result under the No-Build Alternative.

Recommended Mitigation Measures

As all intersections would operate acceptably under the LPA and LPA with highway phasing, no traffic mitigation would be required.

7.4 Pedestrian and Bicycle Circulation

7.4.1 Pedestrian and Bicycle Improvements

Substantial bicycle and pedestrian improvements are included in the LPA. These include new facilities such as the multi-use pathway across the river, street improvements around the rebuilt interchanges, and new facilities for bicyclists and pedestrians around the new light rail stations and park and rides. The proposed improvements are described below from the south end of the project to the north end.

7.4.1.1 Marine Drive and North Portland

The proposed configuration of the Marine Drive interchange would be entirely grade separated with a local road network and multi-use paths below. Pedestrian and bicycle improvements at the Marine Drive interchange would include a multi-use path constructed from the Marine Drive interchange to Southeast Columbia Way in downtown Vancouver. The path would be a minimum of 16 feet wide between its barriers and would direct users with pavement markings. Larger curves would provide improved sight distance and flow, and path components will meet ADA accessibility standards.

The multi-use path in North Portland would begin along Union Court at Delta Park heading west. The path will cross below Martin Luther King Jr. Boulevard at the existing Marine Way location. Marine Way would be removed along with the loop ramps connecting to Martin Luther King Jr. Boulevard in this area. After crossing below Martin Luther King Jr. Boulevard, the multi-use path would split to the east and west. To the east, the multi-use path would connect to the intersection of Marine Drive and Vancouver Way. To the west, the multi-use path would travel along the north side of the new local road extension of North Marine Drive and cross below I-5 to eliminate pedestrian and bicycle traffic through the Marine Drive interchange. There would be the opportunity for the proposed Bridgeton Trail to connect to the multi-use path at several points along the new local road extension once another jurisdiction builds the Bridgeton Trail.

Sidewalks would be constructed along the southern side of the new local road extension with crosswalks provided at the intersection of Vancouver Way, Anchor Way, and Expo Road. All elements will meet ADA accessibility standards.

After crossing below I-5, the multi-use path would travel west to an at-grade crossing of the light rail tracks and connect to the existing west leg of the 40-Mile Loop trail along the North Portland Harbor and to a new pathway to Hayden Island. An auxiliary path would connect to the Expo Center light rail station. The pathway to Hayden Island would be 16 feet wide and will be on the same structure as the light rail transit guideway over North Portland Harbor.

7.4.1.2 Hayden Island

From North Portland Harbor, the new multi-use path would continue on the same structure as the new light rail transit alignment located parallel to and west of I-5. This elevated path would connect the North Portland Harbor bridge and the Columbia River bridge. Pedestrians and bicyclists could access the multi-use path at the North Hayden Island Drive ramp, the stairs, ramp or elevator at Tomahawk Island Drive light rail transit station, or the stairs at Jantzen Beach Drive.

To improve east-west connections on Hayden Island, 8-foot wide curb separated sidewalks would be provided along Jantzen Drive, Hayden Island Drive, and Tomahawk Island Drive. Crosswalks would be provided at all intersections and would meet ADA accessibility standards. The island streets would also include 6-foot bike lanes wherever improvements are made.

7.4.1.3 River Crossing

The new northbound highway bridge over the Columbia River would also accommodate a multi-use pathway under the highway deck. The multi-use path could be up to 24-feet wide, located within the superstructure above the bridge columns and below the bridge deck. The multi-use path would separate pedestrians and bicycle traffic through pavement markings. All bicycle and pedestrian improvements would meet ADA accessibility standards.

Current designs for the bridge superstructure include an open web box using a series of discrete diagonal members instead of solid walls on either side. This affords a partially open-sided, covered pathway for bicyclists and pedestrians rather than an enclosed tunnel.

Ramps would connect the multi-use path to Columbia Way and Columbia Street in Vancouver and to Hayden Island Drive on Hayden Island. Having the multi-use path beneath the highway deck would shorten connections because the pathway's elevation would be lower than the roadway deck. Separating the multi-use path from the highway traffic would also reduce noise exposure to motor vehicles. The wide multi-use path would also reduce conflicts between bicyclists and pedestrians by affording enough space to accommodate two-way travel for both.

7.4.1.4 Downtown Vancouver

The multi-use path off the Columbia River Bridge would provide access to downtown Vancouver via a ramp to the intersection of Southeast Columbia Way and Columbia Street. A second access to the Vancouver waterfront would be by stairs or elevator off the bridge.

The multi-use path would provide connections to regional pedestrian and bikeway facilities that exist throughout Vancouver. These include the Waterfront Renaissance Trail on the north bank of the Columbia River that provides vehicle-separated access to the Confluence Land Bridge, Vancouver National Historic Reserve, and points farther east. The existing bike route along Columbia Street enables access through downtown Vancouver and northwest along 15th Street towards Vancouver Lake. There are a number of east-west streets with bike lanes that cross I-5 providing access to the Burnt Bridge Creek Greenway Trail and to the larger system of regional trails in Clark County.

Sidewalks that are 12-feet wide would be provided along both sides of Washington Street and Broadway Street along the new light rail alignments, with ADA crosswalks at all intersections to East McLoughlin Boulevard.

7.4.1.5 Evergreen Boulevard and Community Connector

The existing I-5 overpass for Evergreen Boulevard would be rebuilt. The overpass would have bike lanes and 15-foot sidewalks with clear delineation and signing. The new pedestrian and bicycle facilities would connect to existing routes along these streets. All improvements would meet the ADA accessibility standards.

In addition, a new structure may be built to the south considerably wider than the current overpass (up to approximately 250 feet wide) and would include landscaping, pathways and other public space. It would provide an ADA accessible pedestrian and bicycle connection between downtown Vancouver and the Vancouver National Historic Reserve. In addition to improved pedestrian and bicycle connections, the facility would improve visual and cultural landscape connectivity. This new public space is proposed as part of the mitigation for the project's impacts to historic resources and aesthetic quality.

7.4.1.6 Mill Plain Interchange

The Mill Plain interchange would receive several improvements for bicyclists and pedestrians. These include bicycle lanes, 12-foot sidewalks, clear delineation and signing, short perpendicular crossings at the ramp terminals, ramp orientations that would encourage high pedestrian visibility, and new connections to F Street and to Marshall Park.

7.4.1.7 McLoughlin Boulevard

Bicycle lanes, 12-foot sidewalks, and crosswalks, all meeting ADA accessibility standards, would be constructed along the light rail alignment on McLoughlin Boulevard. Bicycle lanes from McLoughlin Boulevard would connect with bike lanes on Columbia Street to head south to the Columbia River.

7.4.1.8 Fourth Plain Interchange

The proposed interchange improvements would increase bicycle and pedestrian safety by adding east and west bound bicycle lanes with a 6-foot sidewalk on the south side. Near where the ramp to northbound I-5 connects with Fourth Plain and to the east of I-5, there would be a 14-foot wide multi-use path running north and south. North of Fourth Plain Boulevard, the pathway would provide biking and walking access to and from Rose Village and other adjacent neighborhoods. To the south, the pathway would cross Fourth Plain Boulevard and connect pedestrians and bicyclists to the proposed Clark College Park and Ride. Bike lockers would be provided for cyclists at the park and ride. Clearly marked ADA accessible crossings would be placed at each intersection approaching the park and ride.

7.4.1.9 29th Street and 33rd Street

New I-5 overpasses will be built for 29th Street and 33rd Street. Each overpass would have bicycle lanes and 6-foot minimum sidewalks with clear delineation and signing. The new pedestrian and bicycle facilities would connect to existing routes along these streets. All improvements will meet the ADA accessibility standards.

7.4.1.10 SR 500 Interchange

39th Street would have 6.5-foot sidewalks and 6-foot bicycle lanes on both the north and south side from H Street vicinity to 15th Avenue. Also, connections would be made to the existing neighborhood paths within the project limits.

***Potential phased construction option*:** These improvements are contingent on the decision to advance the highway improvements as described in **Section 2.1.2.2** for the SR 500 interchange.

7.4.2 Pedestrian and Bicycle Forecasts

A methodology for forecasting pedestrian and bicycle travel demands for an improved non-motorized facility across the Columbia River in the LPA was developed in part with input from the CRC's Pedestrian and Bicycle Advisory Committee. Forecasts took into account three primary factors related to pedestrian and bicycle demand: existing and future land uses, percentage of trips by mode, and walking and bicycling trip lengths.

During peak summer conditions in 2007, about 80 pedestrians and 370 bicyclists crossed the I-5 bridge daily. Many other pedestrians and bicyclists are discouraged from doing so because of the existing non-standard facilities on the bridge and connecting multi-modal infrastructure.

Future pedestrian and bicycle trips over the I-5 bridge were forecast using a variety of data, including mode share data from the US Census, information from local travel surveys, results from a bicycle trip study conducted by Portland State University, and travel characteristics associated with the Hawthorne Bridge, the most heavily traveled bridge by pedestrians and bicyclists in the region.

Average travel times by mode were converted into trip distances by mode, creating a matrix of pedestrian and bicycle mode shares by trip length. Future scenarios, shown in **Exhibit 7-42**, developed for sensitivity testing, considered the forecasted number of trips from the regional travel demand model and factored them by the respective pedestrian and bicycle mode share percentages.

The results of the forecasting scenarios, shown in **Exhibit 7-43**, reveal that pedestrian and bicycle travel demands would increase substantially for the I-5 bridge by 2030. Pedestrian travel across the bridge would be expected to increase from 80 pedestrians today to between 600 and 1,000 daily walkers, an increase of 650 to 1,150 percent over current conditions. The number of bicyclists predicted to use the crossing would increase from 370 today to between 900 and 6,400 riders, an increase of between 150 to over 1,625 percent. Generally, the I-5 bridge would be expected to serve about five bicyclists to every pedestrian, which is logical based on the length of the bridge and the location of developed and planned land uses.

PRELIMINARY

Exhibit 7-1

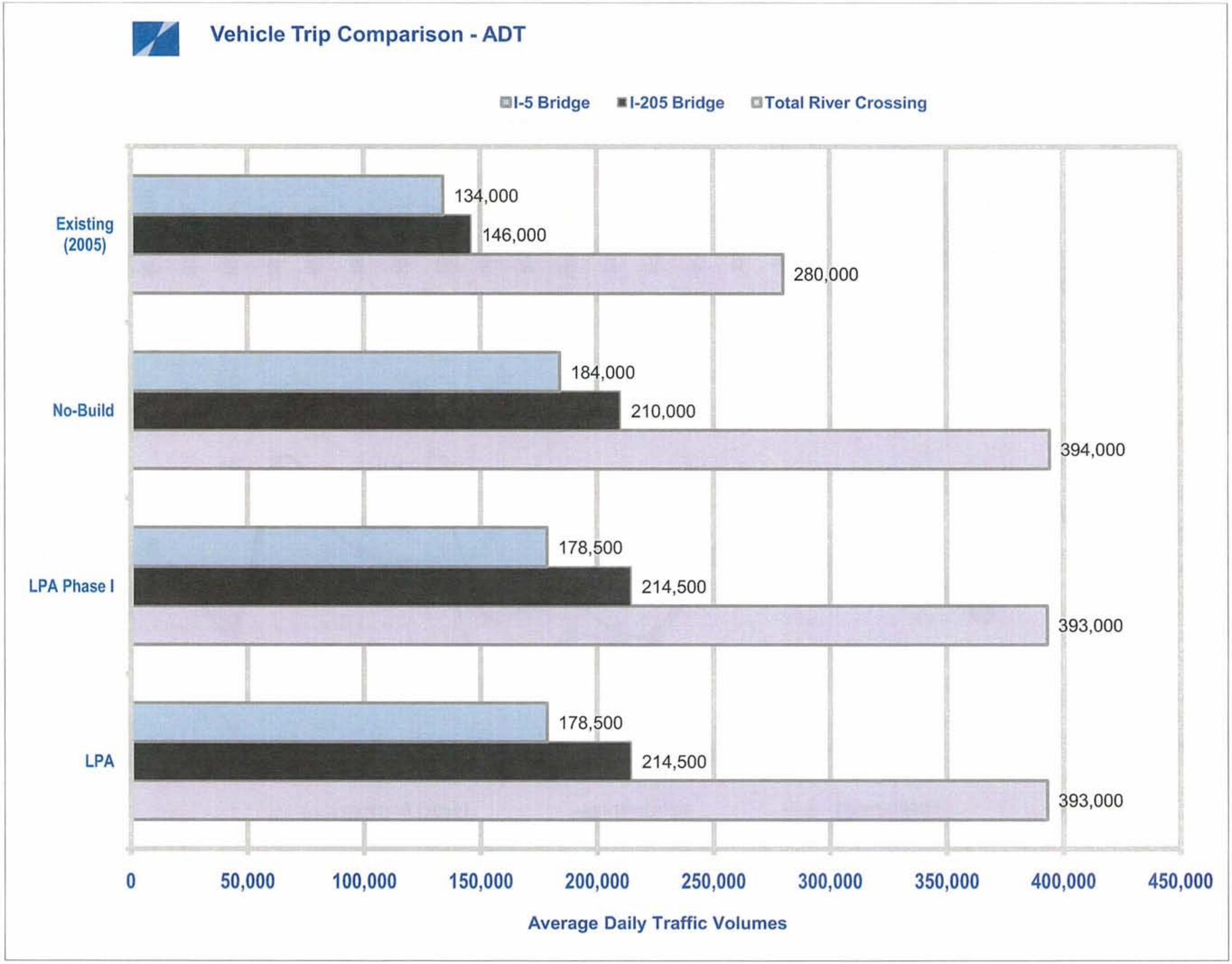
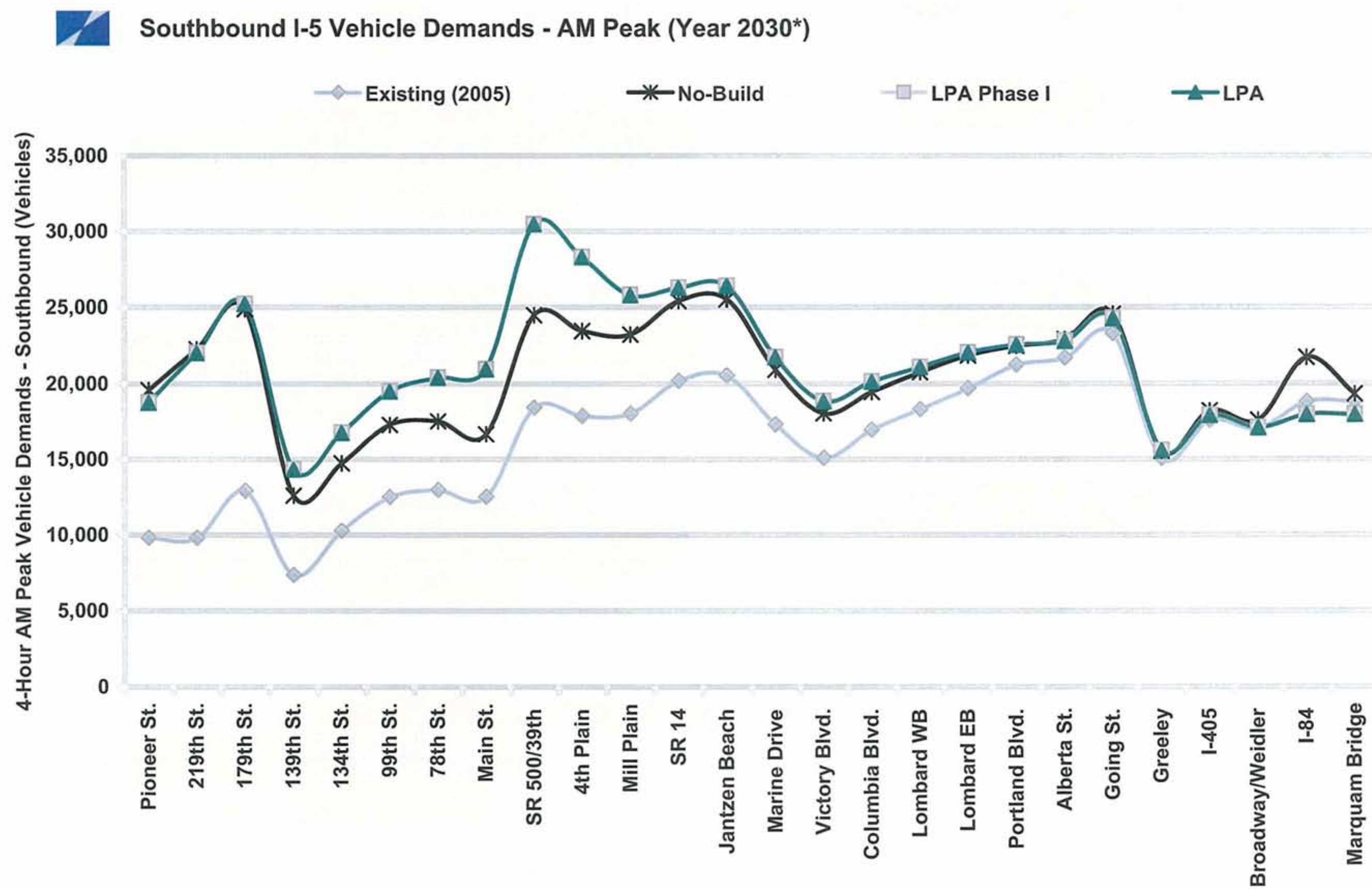


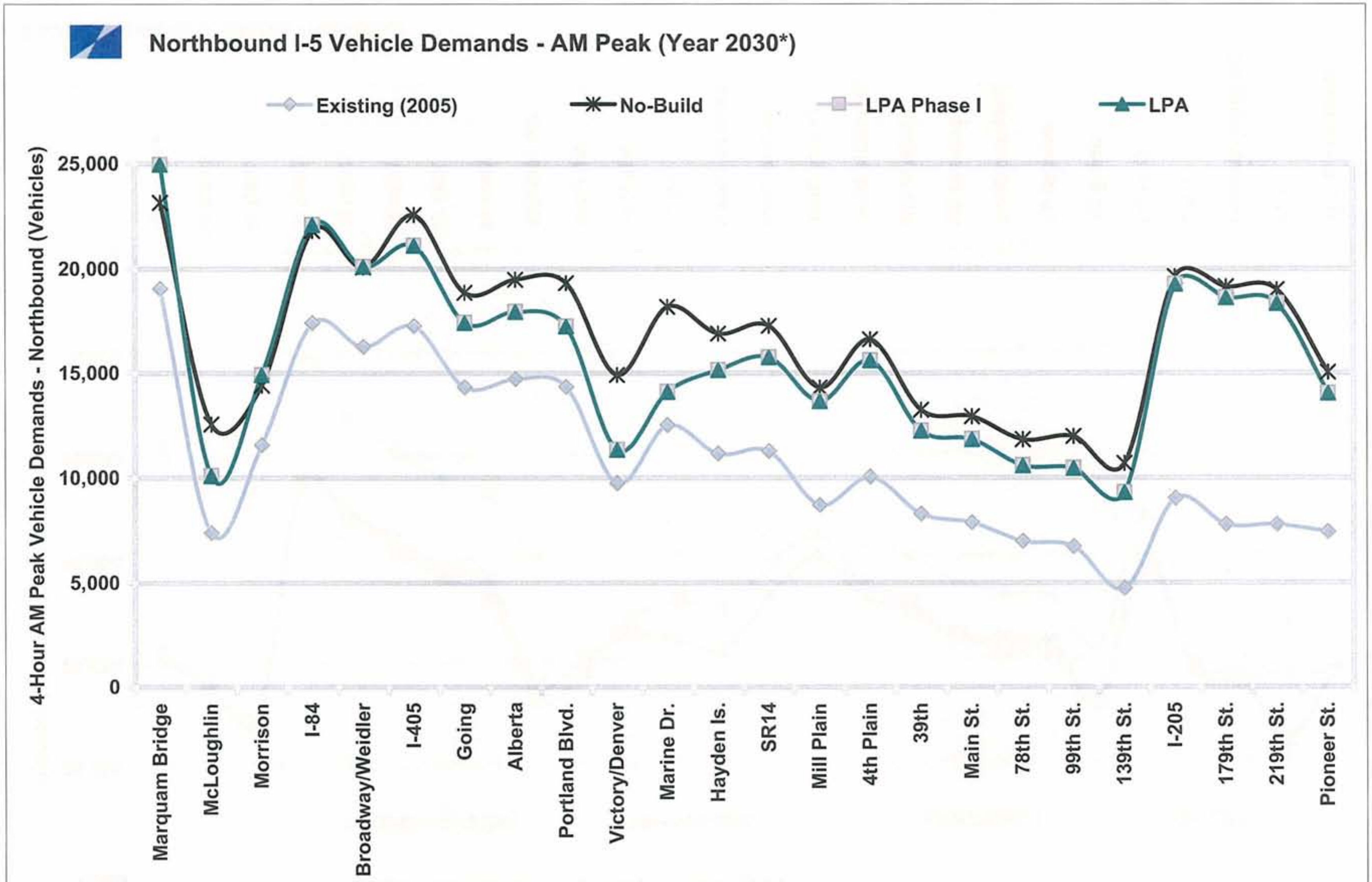
Exhibit 7-2

PRELIMINARY



*Except for Existing Conditions (Year 2005)

Exhibit 7-3



*Except for Existing Conditions (Year 2005)

Exhibit 7-4

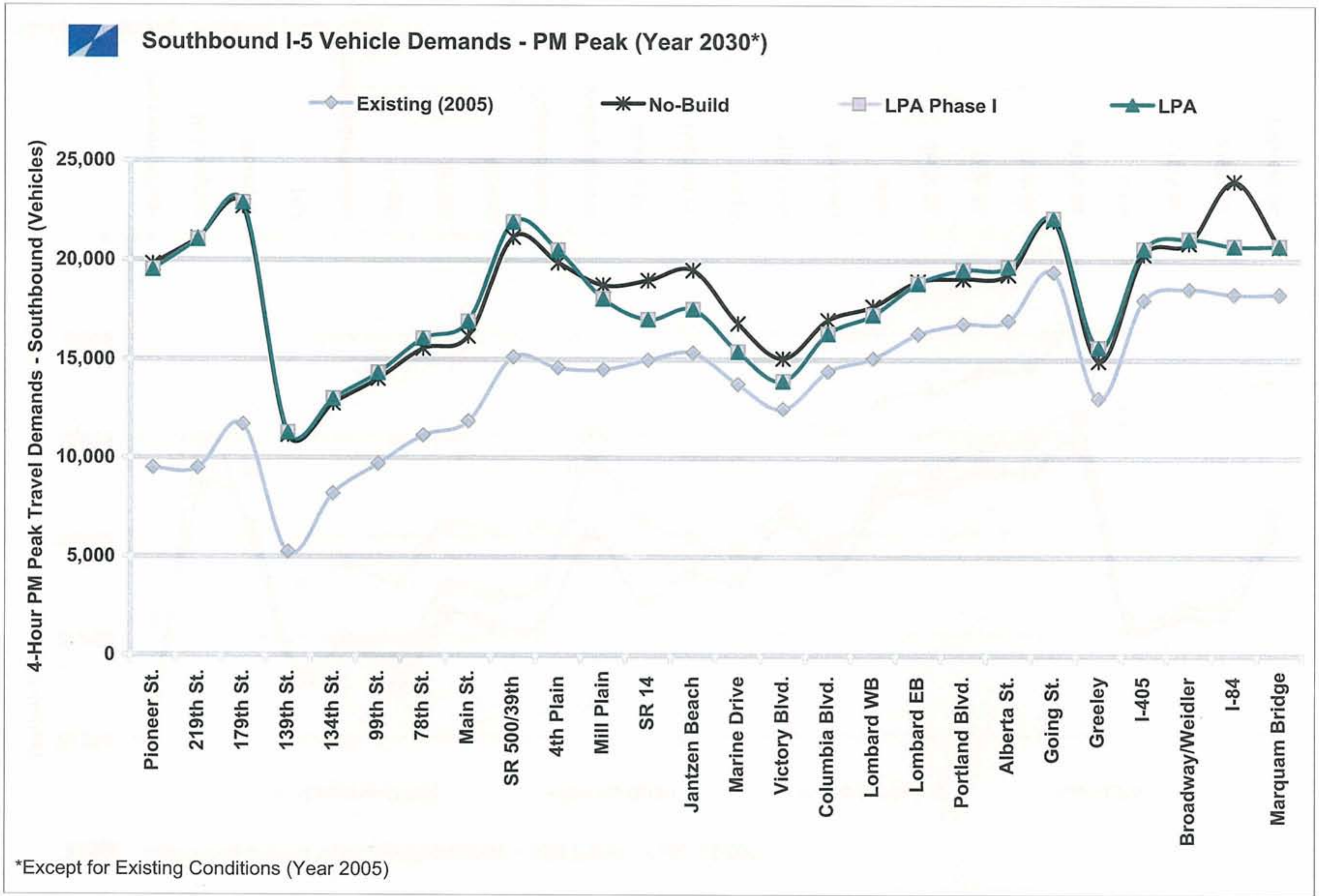
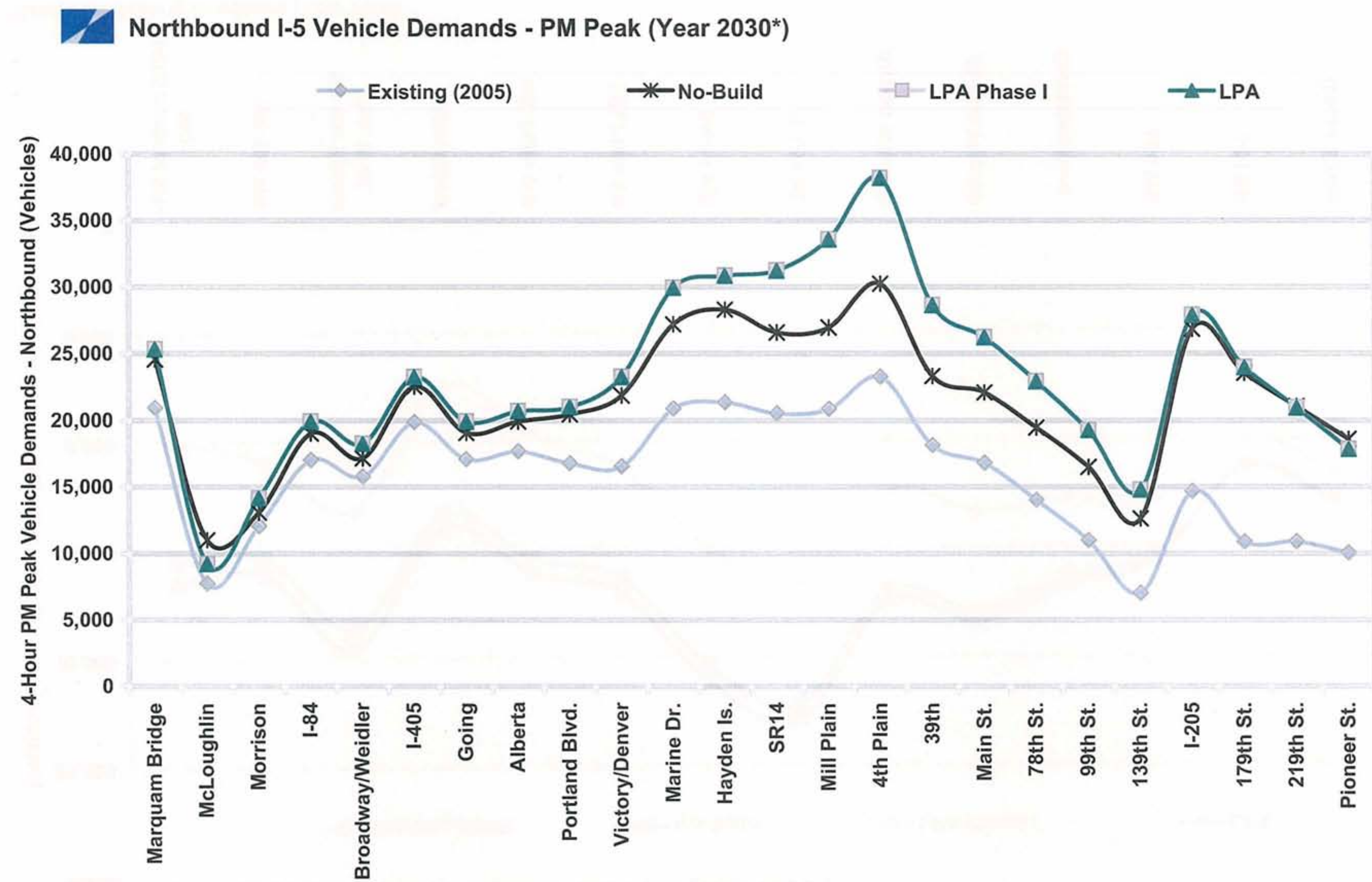
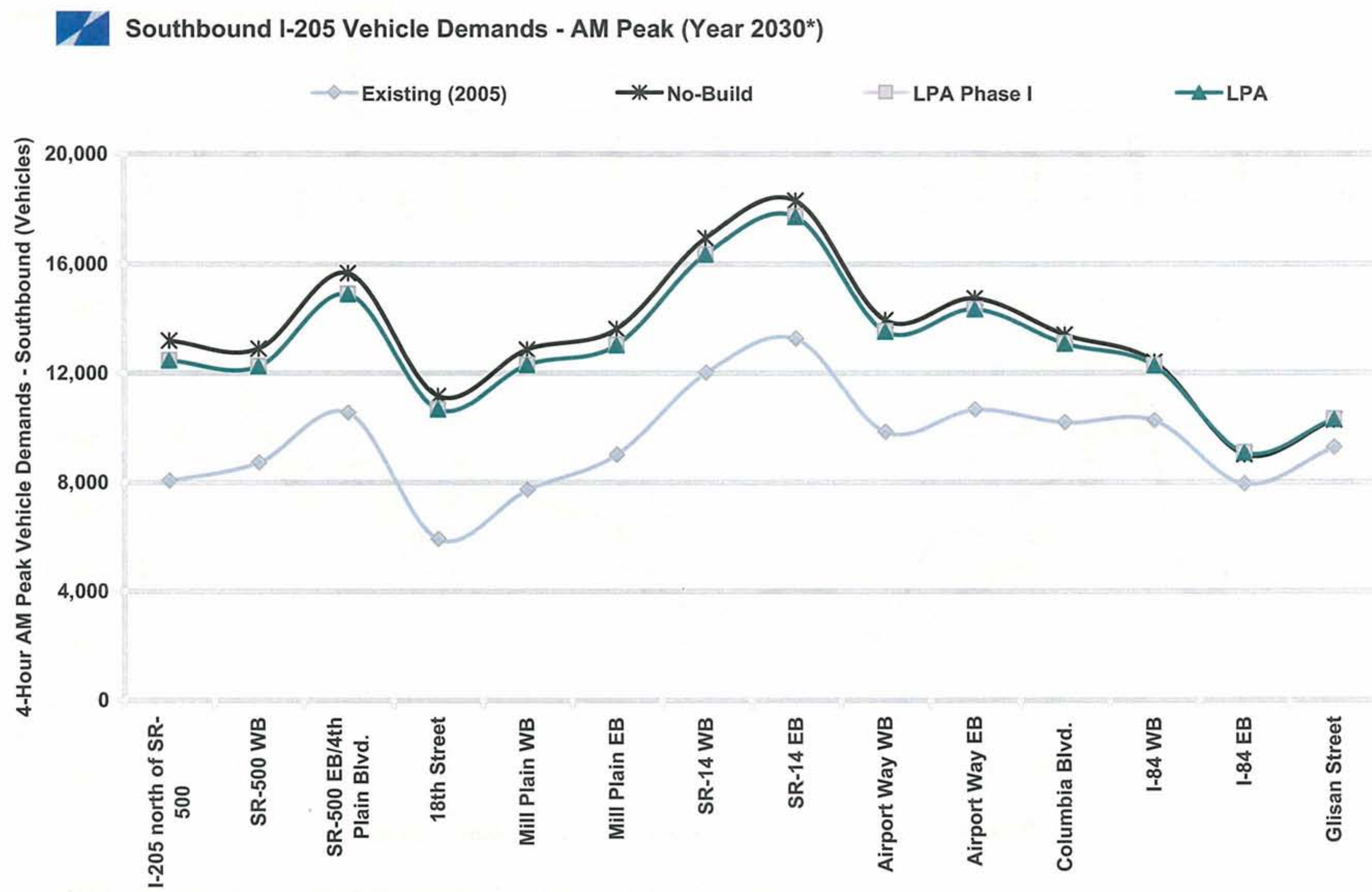

Southbound I-5 Vehicle Demands - PM Peak (Year 2030*)
Existing (2005)
No-Build
LPA Phase I
LPA
4-Hour PM Peak Travel Demands - Southbound (Vehicles)
25,000
20,000
15,000
10,000
5,000
0
Pioneer St.
219th St.
179th St.
139th St.
134th St.
99th St.
78th St.
Main St.
SR 500/39th
4th Plain
Mill Plain
SR 14
Jantzen Beach
Marine Drive
Victory Blvd.
Columbia Blvd.
Lombard WB
Lombard EB
Portland Blvd.
Alberta St.
Going St.
Greeley
I-405
Broadway/Weidler
I-84
Marquam Bridge
*Except for Existing Conditions (Year 2005)

Exhibit 7-5



*Except for Existing Conditions (Year 2005)

Exhibit 7-6



*Except for Existing Conditions (Year 2005)

Exhibit 7-7

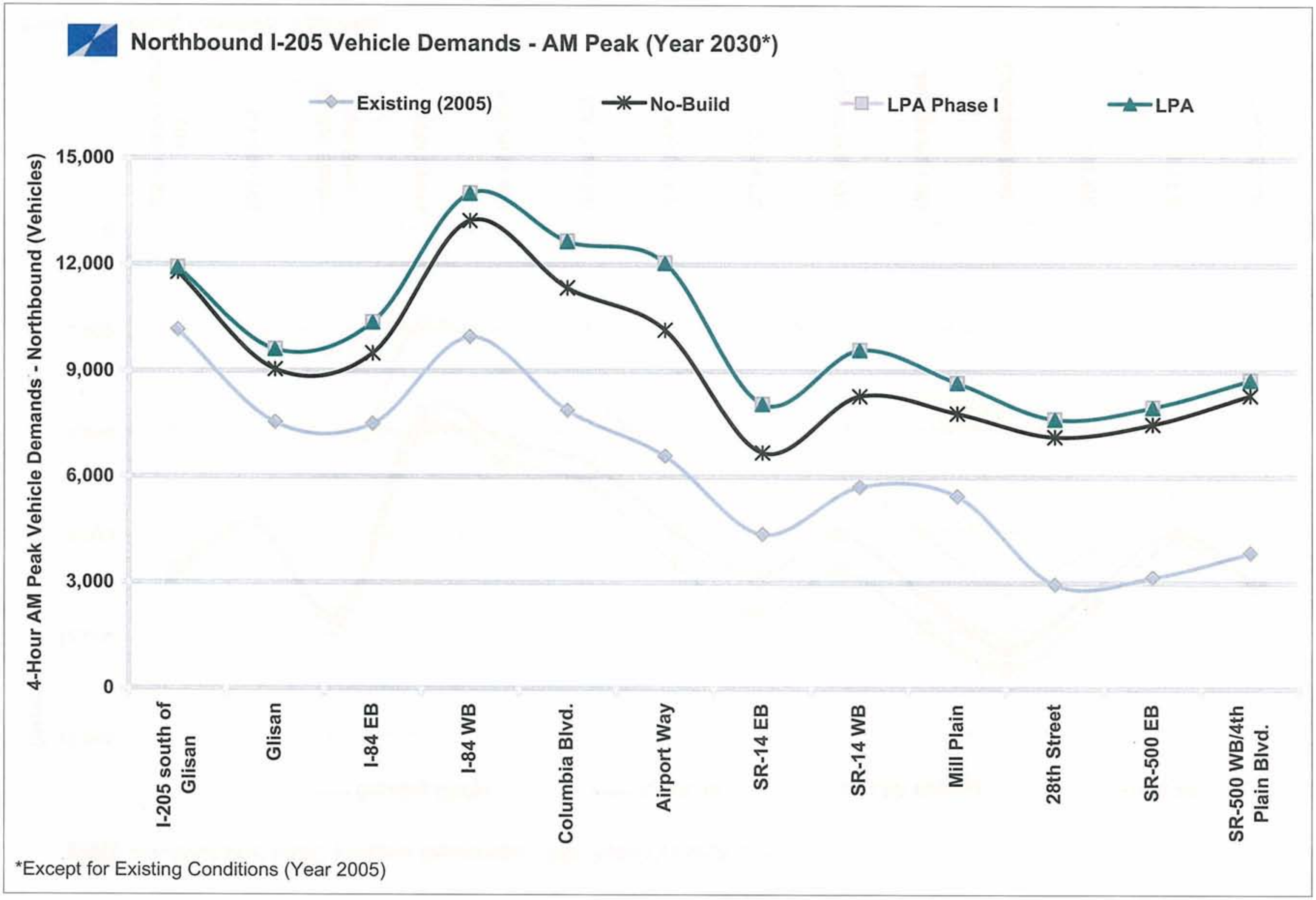
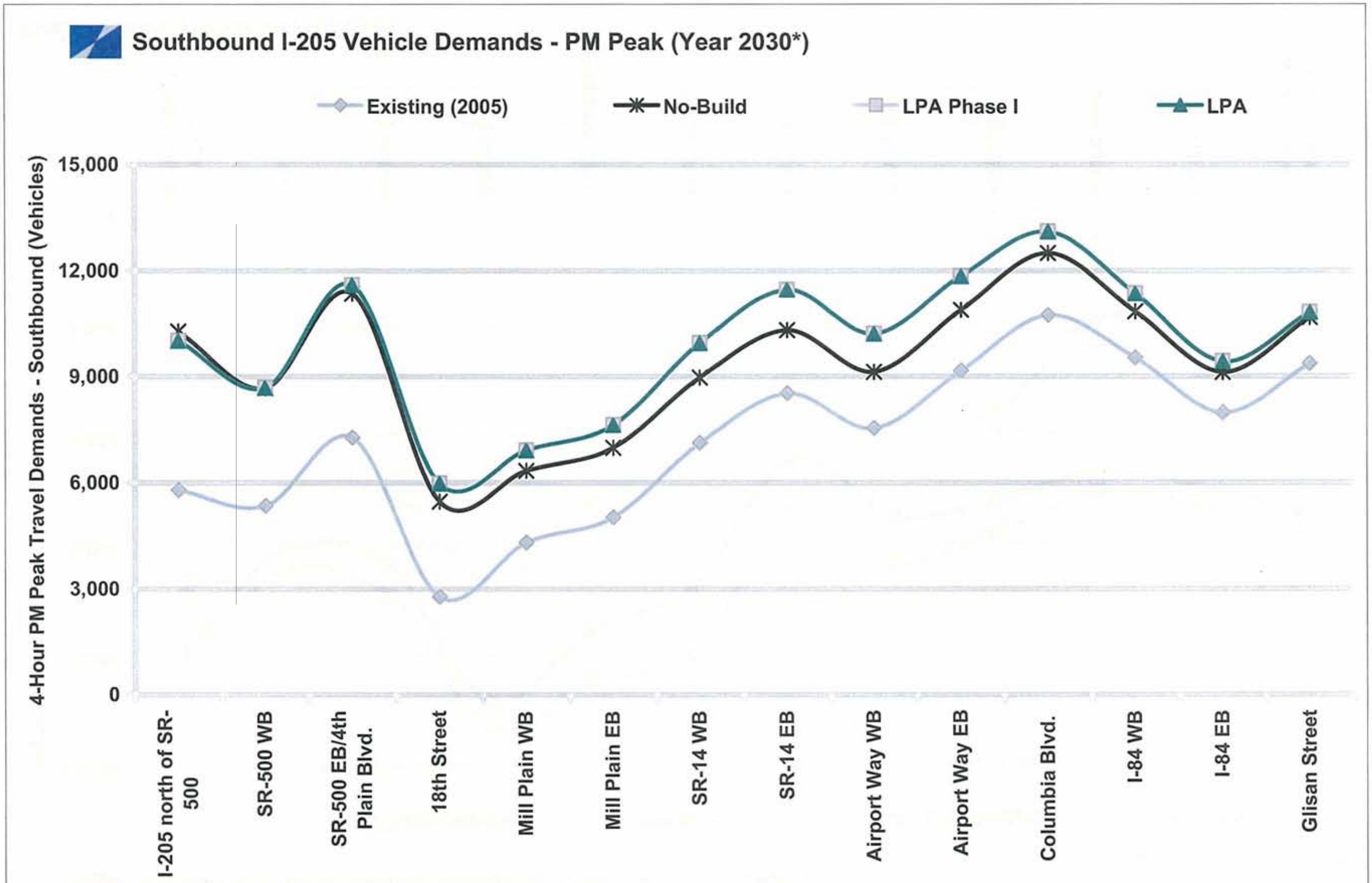

Northbound I-205 Vehicle Demands - AM Peak (Year 2030*)
Existing (2005)
No-Build
LPA Phase I
LPA
4-Hour AM Peak Vehicle Demands - Northbound (Vehicles)
15,000
12,000
9,000
6,000
3,000
0
I-205 south of Glisan
Glisan
I-84 EB
I-84 WB
Columbia Blvd.
Airport Way
SR-14 EB
SR-14 WB
Mill Plain
28th Street
SR-500 EB
SR-500 WB/4th Plain Blvd.
*Except for Existing Conditions (Year 2005)

Exhibit 7-8

PRELIMINARY



*Except for Existing Conditions (Year 2005)

Exhibit 7-9

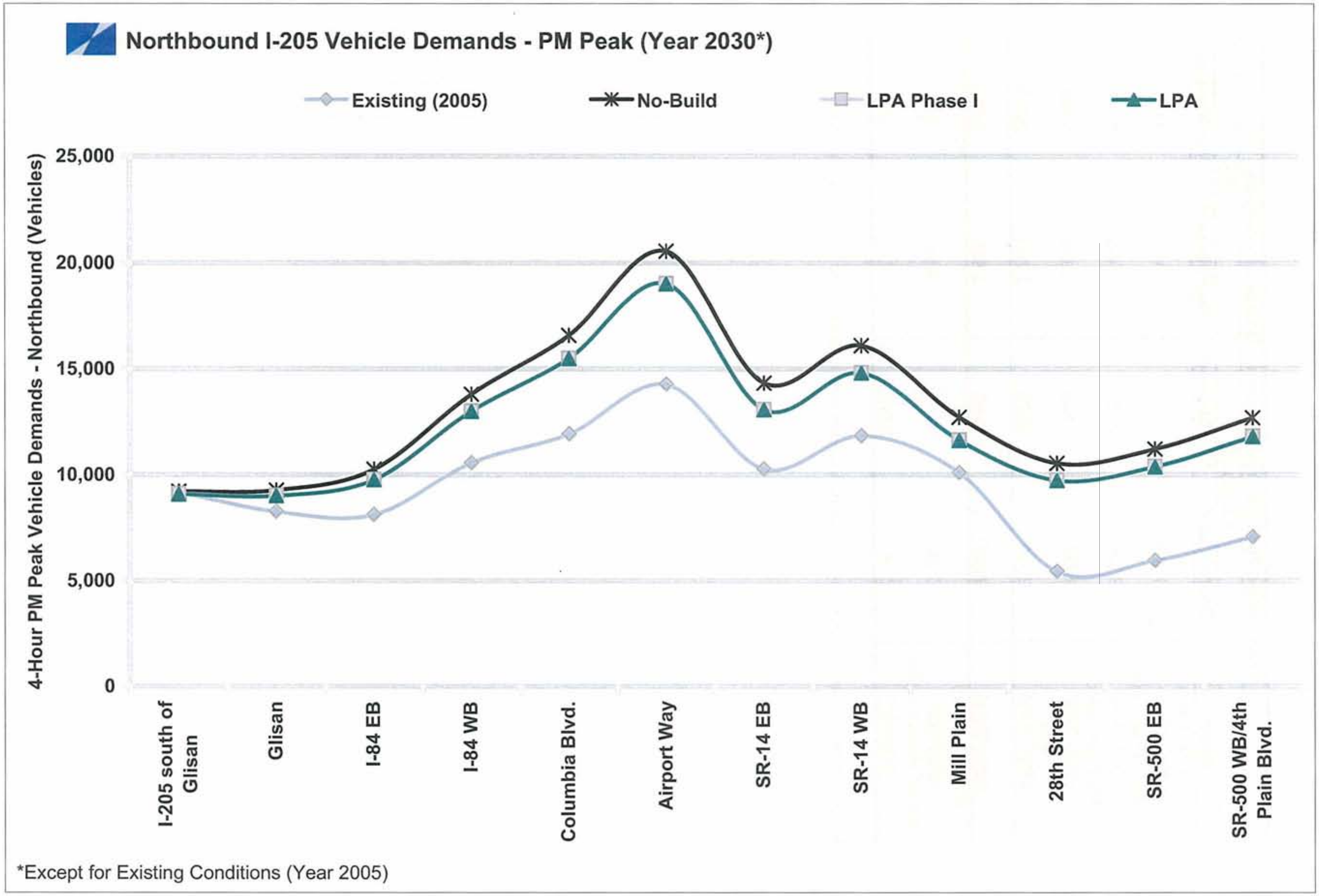

Northbound I-205 Vehicle Demands - PM Peak (Year 2030*)
Existing (2005)
No-Build
LPA Phase I
LPA
4-Hour PM Peak Vehicle Demands - Northbound (Vehicles)
25,000
20,000
15,000
10,000
5,000
0
I-205 south of Glisan
Glisan
I-84 EB
I-84 WB
Columbia Blvd.
Airport Way
SR-14 EB
SR-14 WB
Mill Plain
28th Street
SR-500 EB
SR-500 WB/4th Plain Blvd.
*Except for Existing Conditions (Year 2005)

Exhibit 7-10

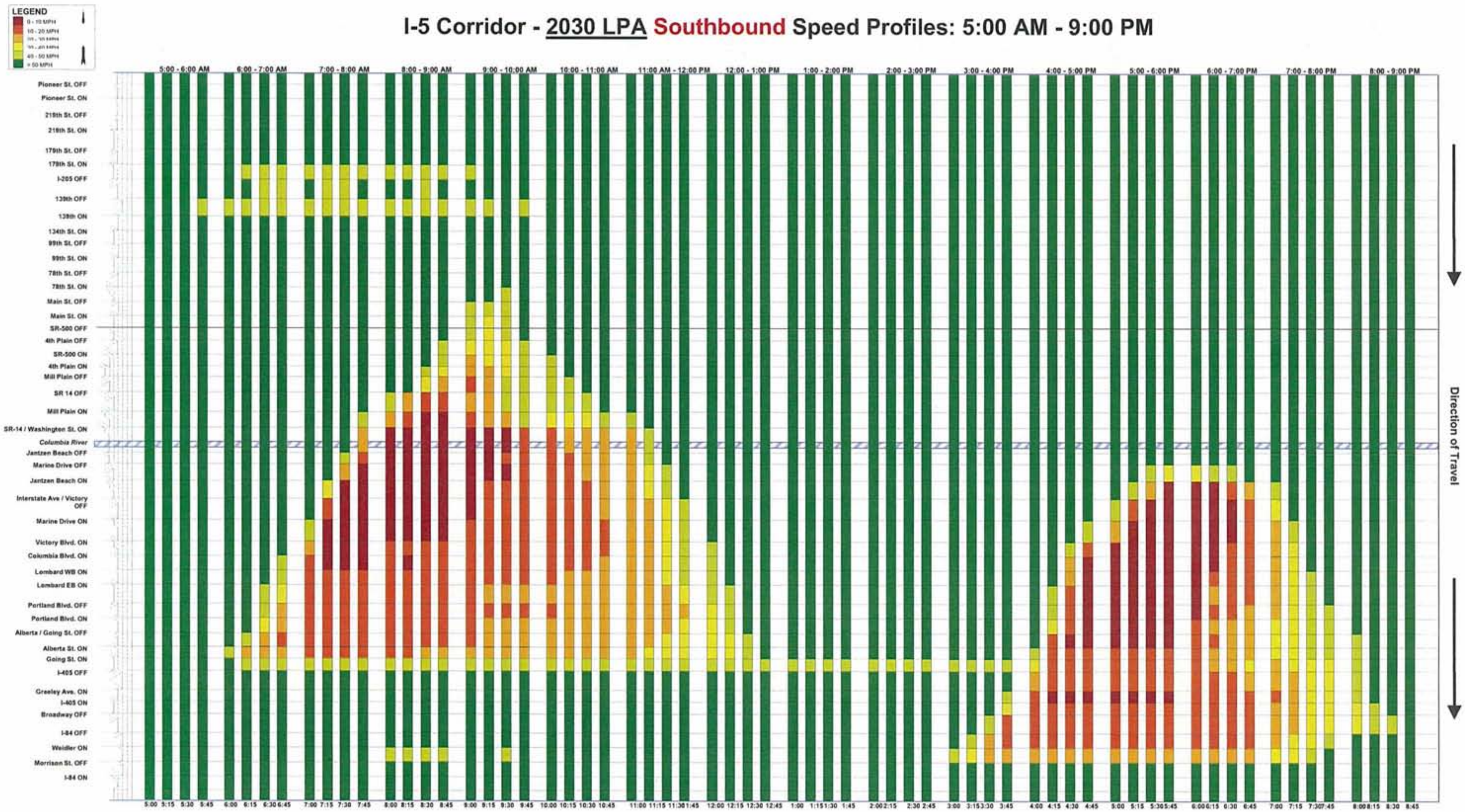
Peak Period 2030 I-5 Truck Volume - Bridge Alternatives				
	No-Build		LPA	
Hours	Southbound	Northbound	Southbound	Northbound
AM Peak Period 6 AM - 10 AM	1,140	2,195	1,175	1,960
Midday Peak Period 10 AM - 3 PM	3,525	2,900	3,505	3,225
PM Peak Period 3 PM - 7 PM	2,350	1,635	2,335	1,900
Night 7 PM - 6 AM	2,790	2,870	2,790	2,515
Daily Total	**9,805**	**9,600**	**9,805**	**9,600**
Number hours of congestion[1]	7.25	7.75	3.50	2.00
Number trucks traveling in congestion	2,220	3,075	1,275	770

Source: Portland/Vancouver International and Domestic Trade Capacity Analysis, 2006 and CRC Project, September 2009

PRELIMINARY

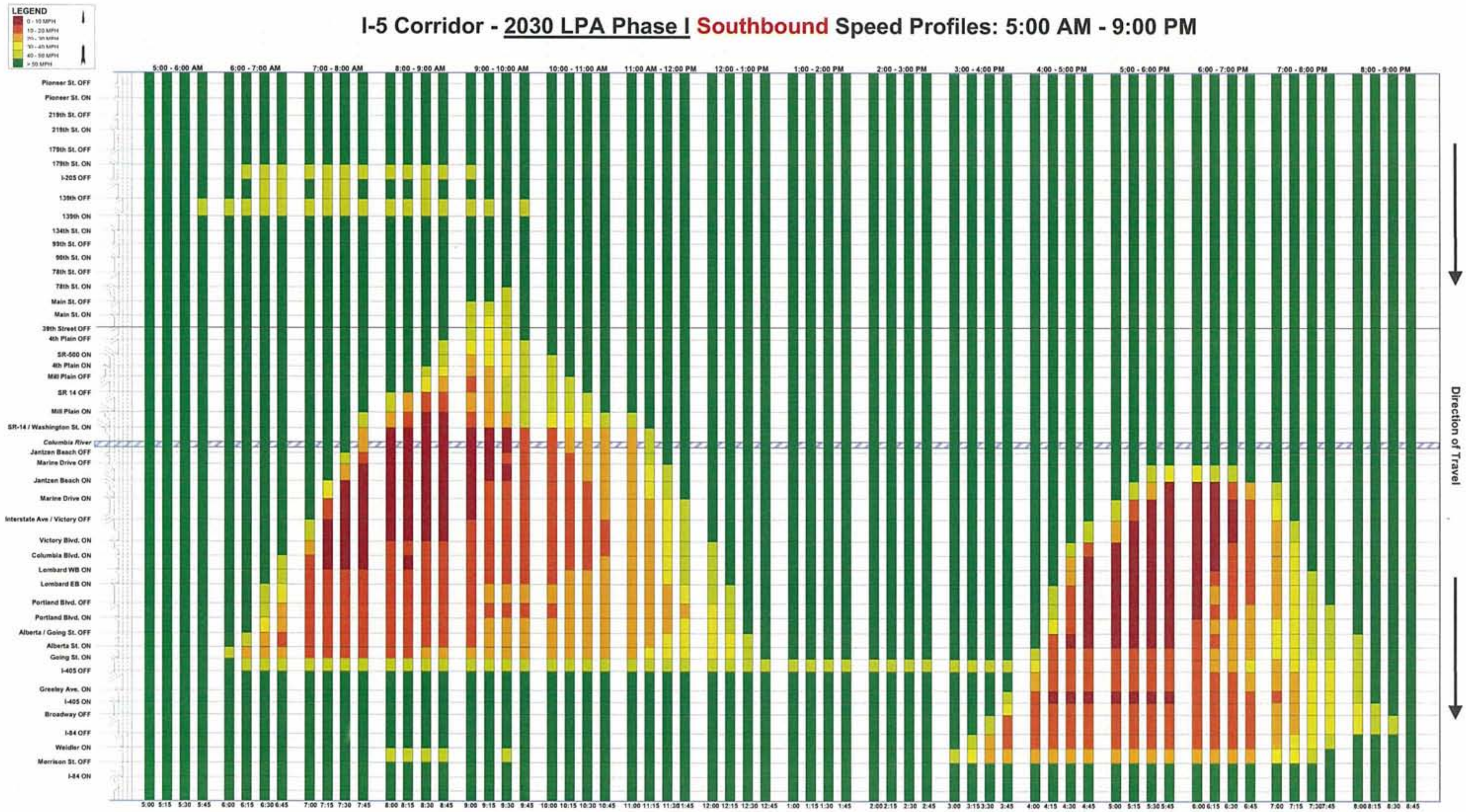
Exhibit 7-11

I-5 Corridor - 2030 LPA Southbound Speed Profiles: 5:00 AM - 9:00 PM



PRELIMINARY

Exhibit 7-12



PRELIMINARY

Exhibit 7-13

I-5 Corridor - 2030 LPA Northbound Speed Profiles: 5:00 AM - 9:00 PM

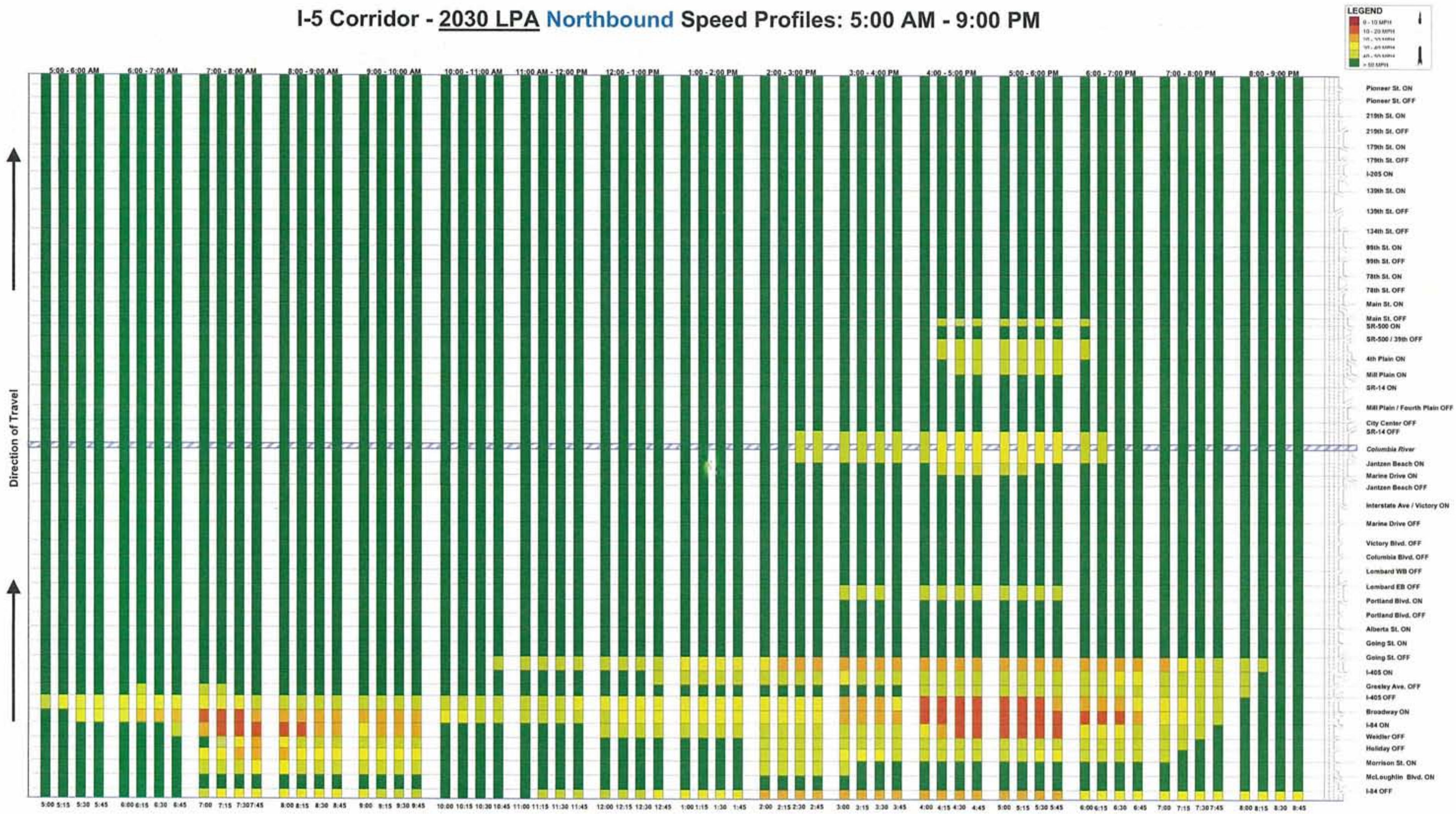


Exhibit 7-14

PRELIMINARY

I-5 Corridor - 2030 LPA Phase I Northbound Speed Profiles: 5:00 AM - 9:00 PM

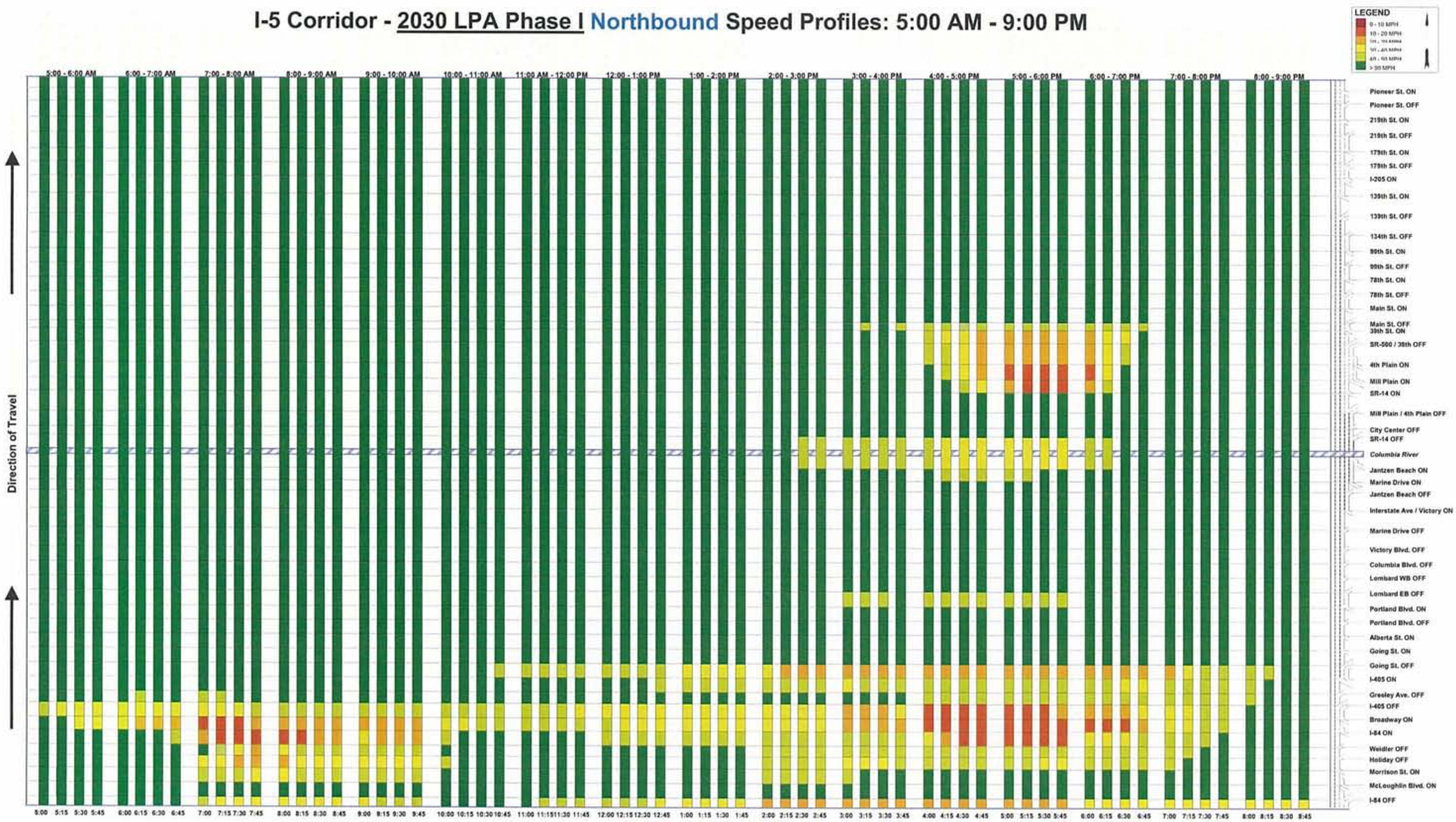


Exhibit 7-15

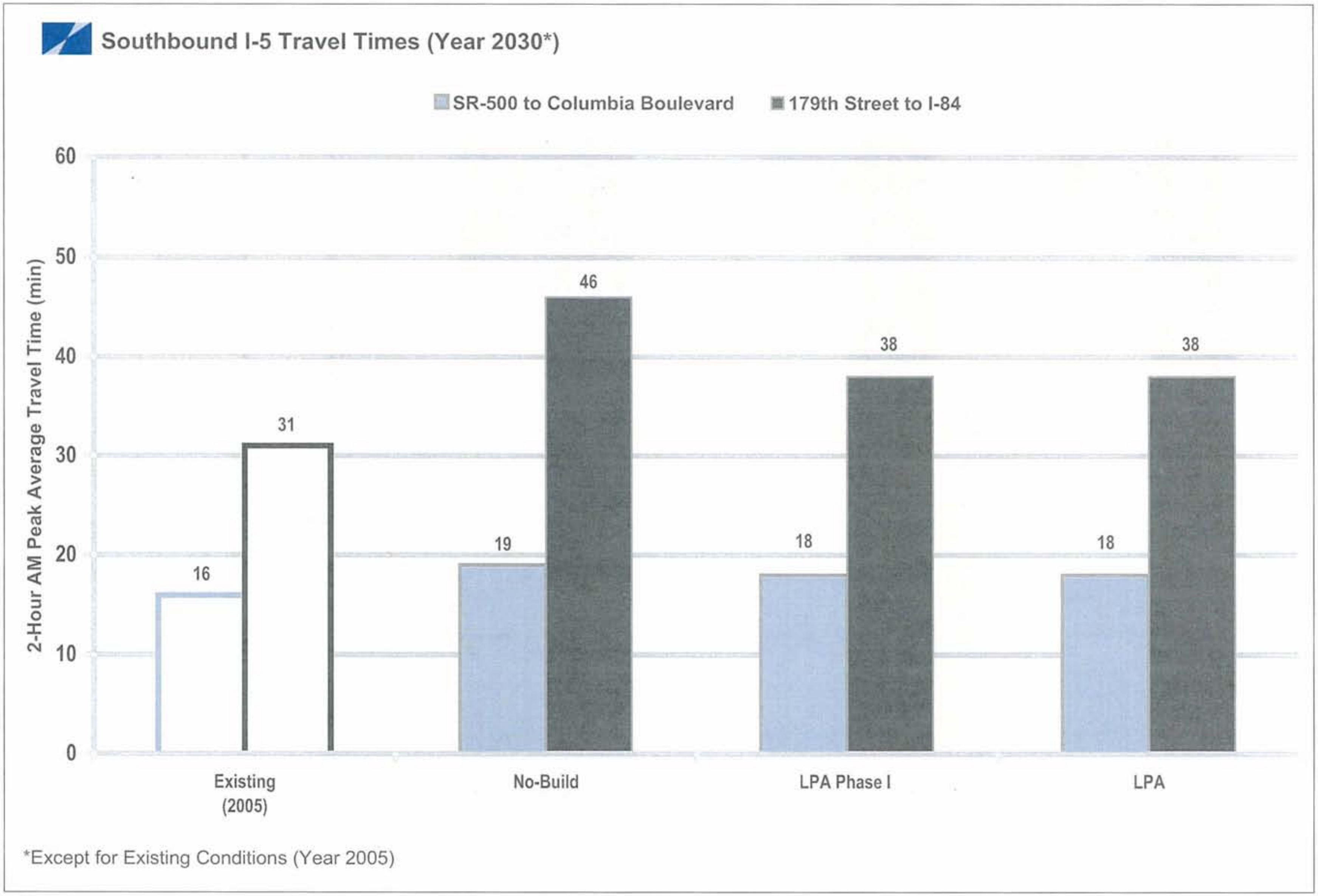
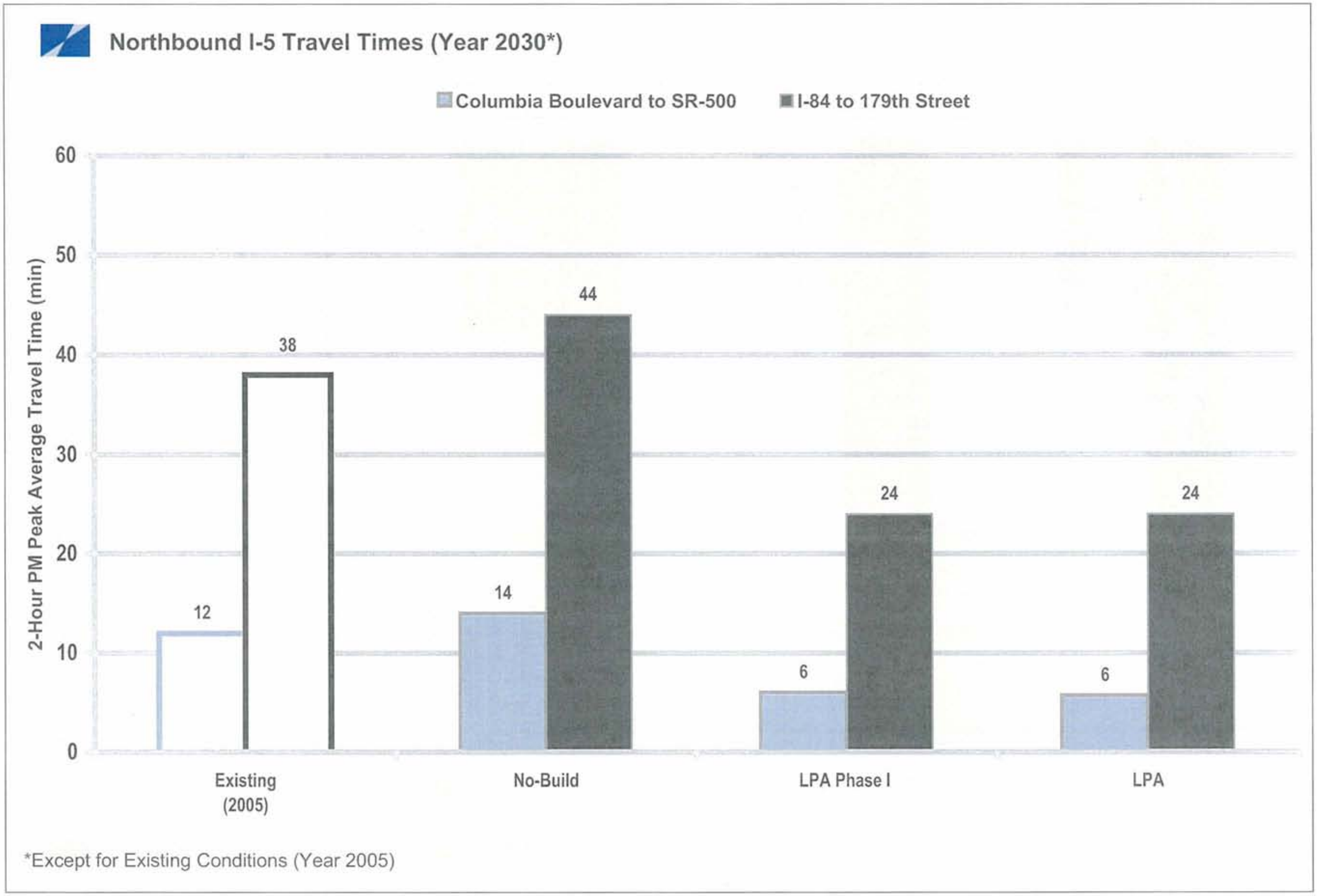
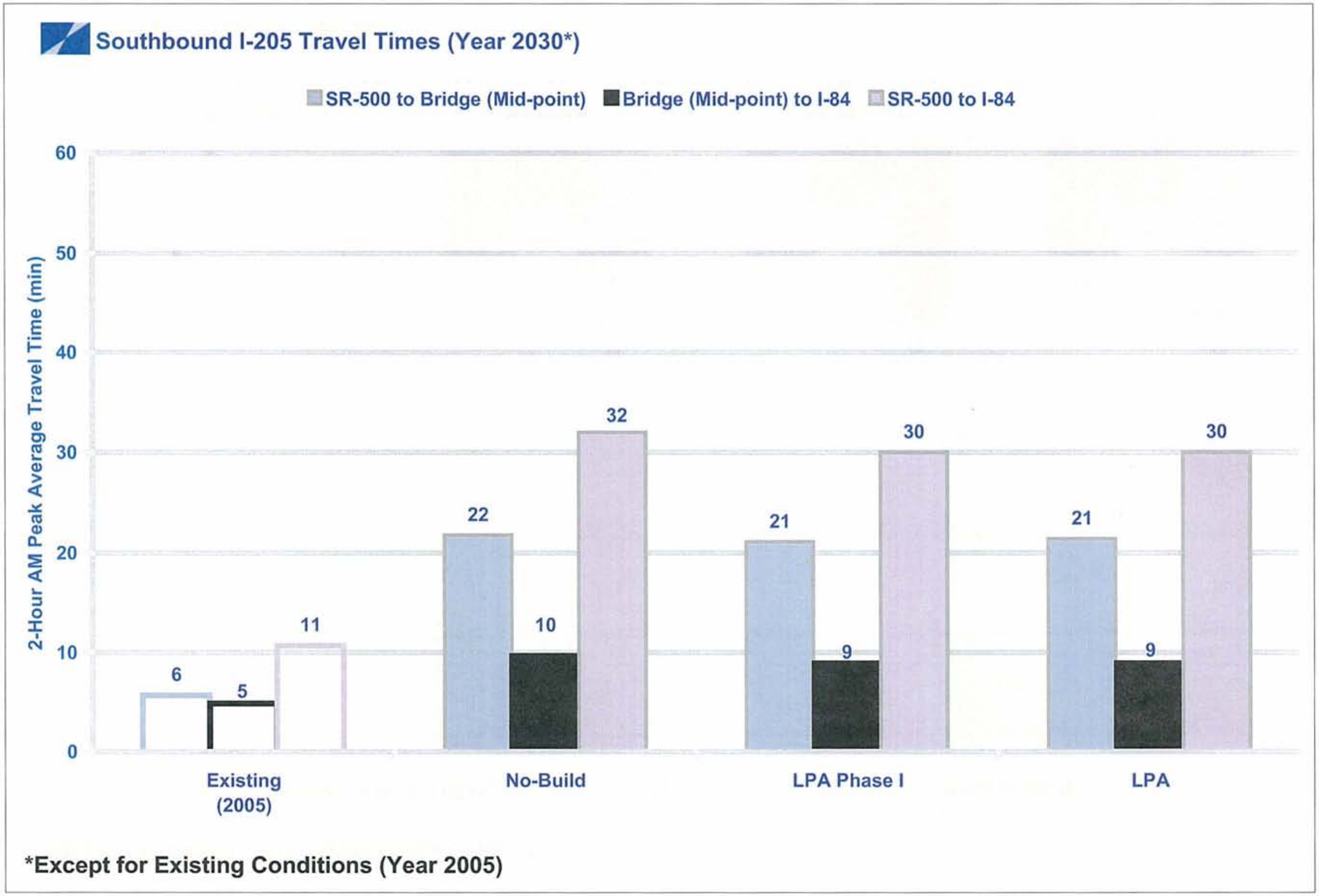

Southbound I-5 Travel Times (Year 2030*)
SR-500 to Columbia Boulevard
179th Street to I-84
2-Hour AM Peak Average Travel Time (min)
0
10
20
30
40
50
60
16
31
19
46
18
38
18
38
Existing (2005)
No-Build
LPA Phase I
LPA
*Except for Existing Conditions (Year 2005)

Exhibit 7-16


Northbound I-5 Travel Times (Year 2030*)
Columbia Boulevard to SR-500
I-84 to 179th Street
2-Hour PM Peak Average Travel Time (min)
60
50
40
30
20
10
0
12
38
14
44
6
24
6
24
Existing (2005)
No-Build
LPA Phase I
LPA
*Except for Existing Conditions (Year 2005)

PRELIMINARY

Exhibit 7-17



7654

Exhibit 7-18

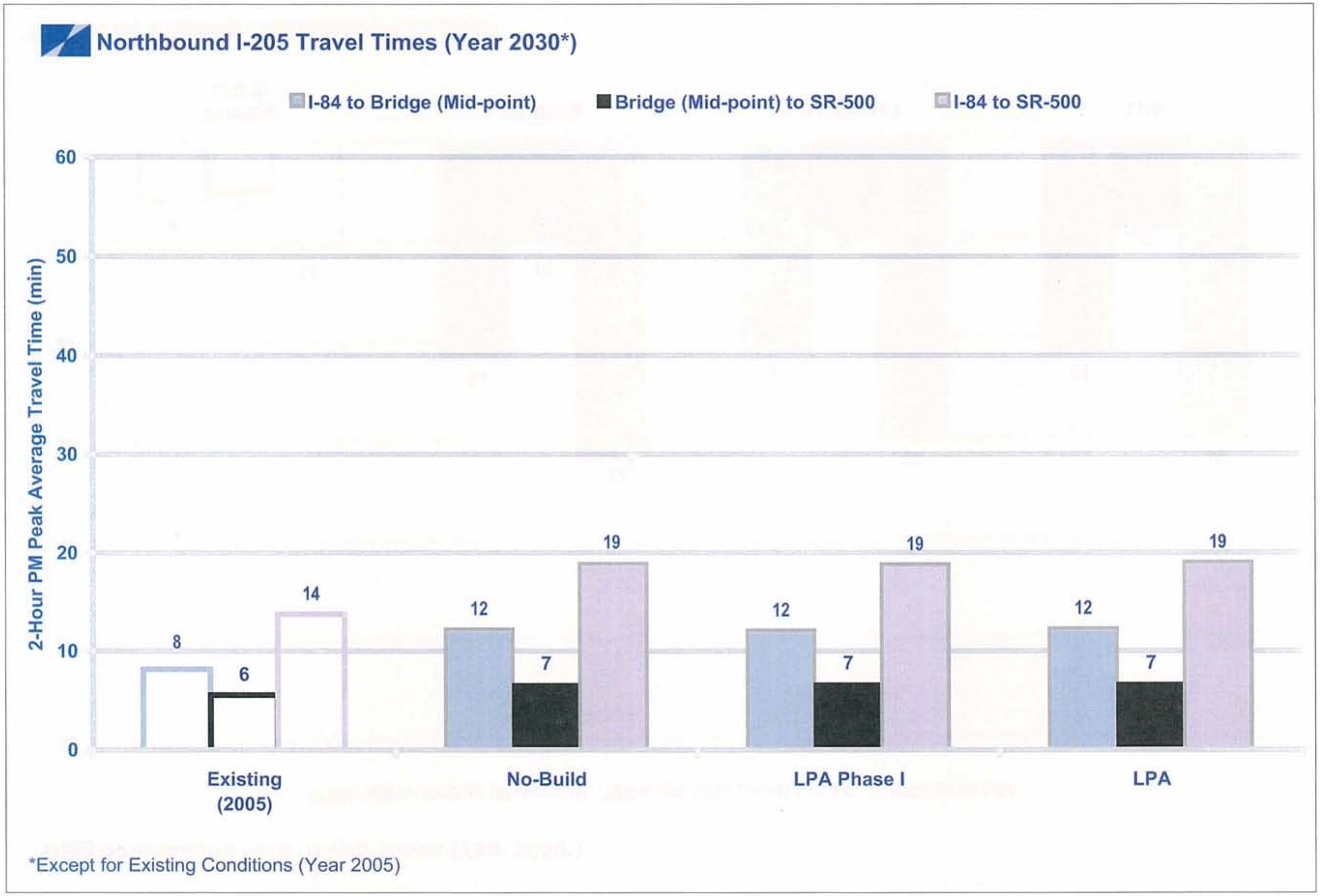


Exhibit 7-19

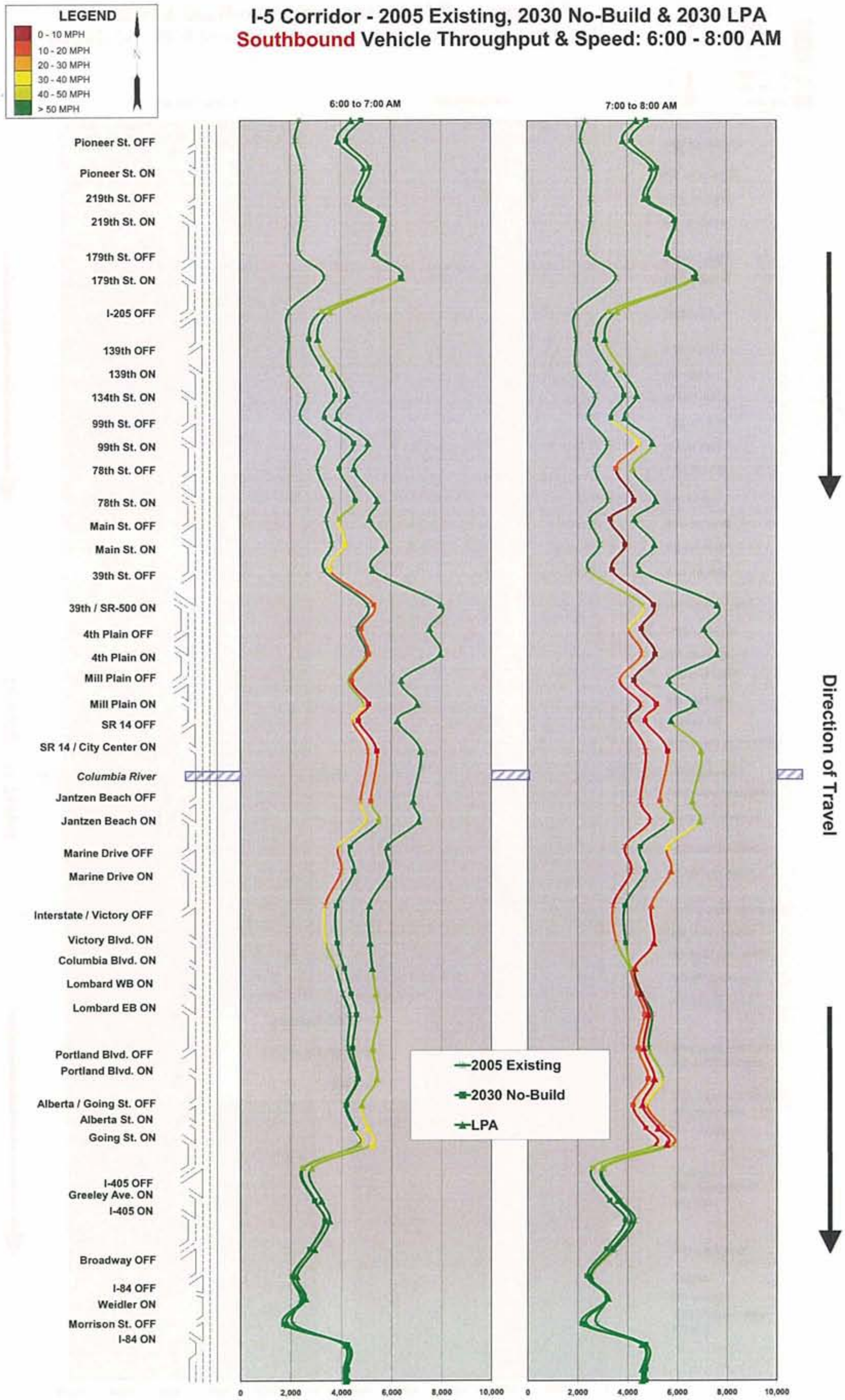

LEGEND
0 - 10 MPH
10 - 20 MPH
20 - 30 MPH
30 - 40 MPH
40 - 50 MPH
> 50 MPH
I-5 Corridor - 2005 Existing, 2030 No-Build & 2030 LPA
Southbound Vehicle Throughput & Speed: 6:00 - 8:00 AM
6:00 to 7:00 AM
7:00 to 8:00 AM
Pioneer St. OFF
Pioneer St. ON
219th St. OFF
219th St. ON
179th St. OFF
179th St. ON
I-205 OFF
139th OFF
139th ON
134th St. ON
99th St. OFF
99th St. ON
78th St. OFF
78th St. ON
Main St. OFF
Main St. ON
39th St. OFF
39th / SR-500 ON
4th Plain OFF
4th Plain ON
Mill Plain OFF
Mill Plain ON
SR 14 OFF
SR 14 / City Center ON
Columbia River
Jantzen Beach OFF
Jantzen Beach ON
Marine Drive OFF
Marine Drive ON
Interstate / Victory OFF
Victory Blvd. ON
Columbia Blvd. ON
Lombard WB ON
Lombard EB ON
Portland Blvd. OFF
Portland Blvd. ON
Alberta / Going St. OFF
Alberta St. ON
Going St. ON
I-405 OFF
Greeley Ave. ON
I-405 ON
Broadway OFF
I-84 OFF
Weidler ON
Morrison St. OFF
I-84 ON
2005 Existing
2030 No-Build
LPA
0
2,000
4,000
6,000
8,000
10,000
Direction of Travel

Exhibit 7-19 - continued

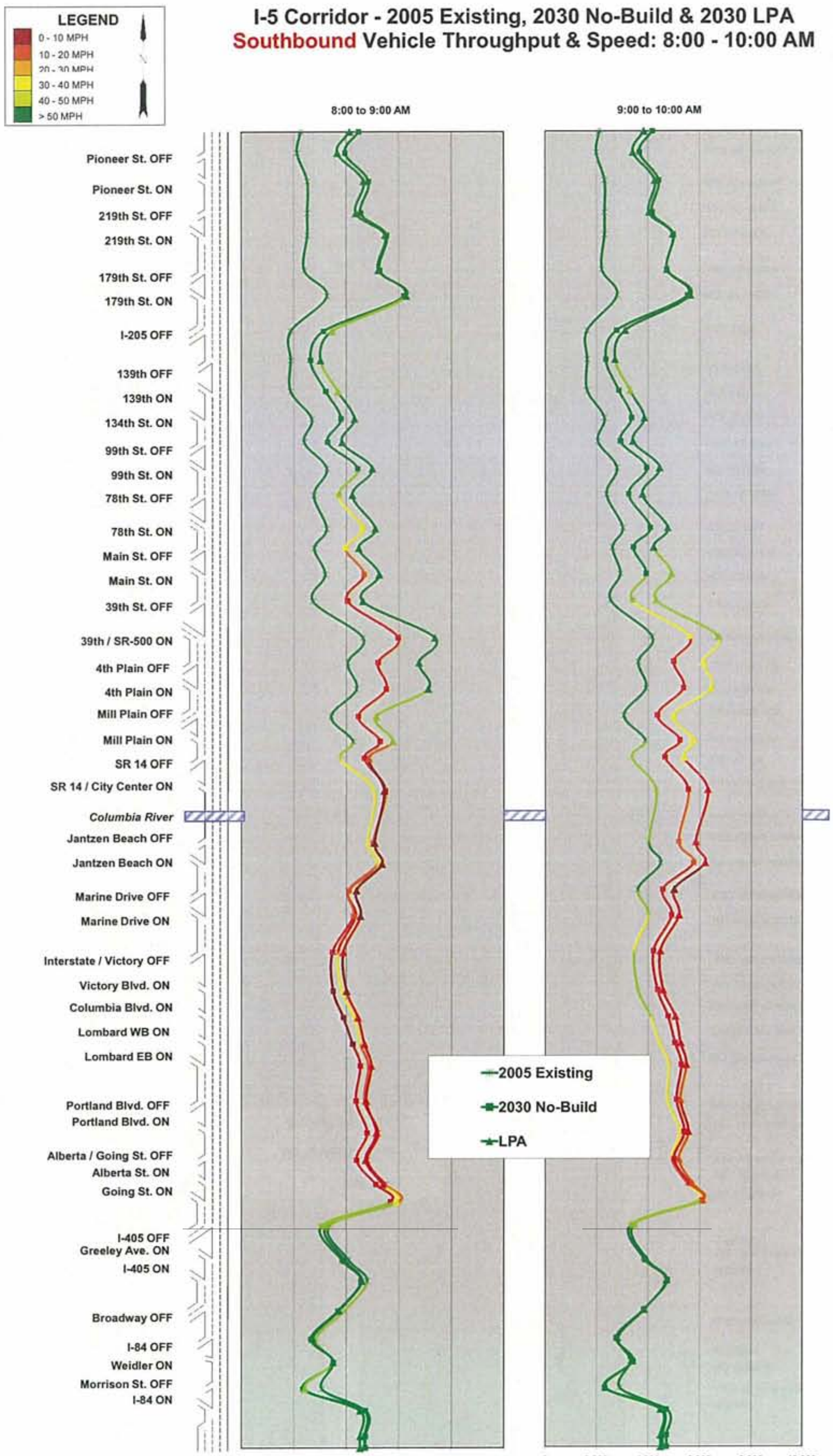
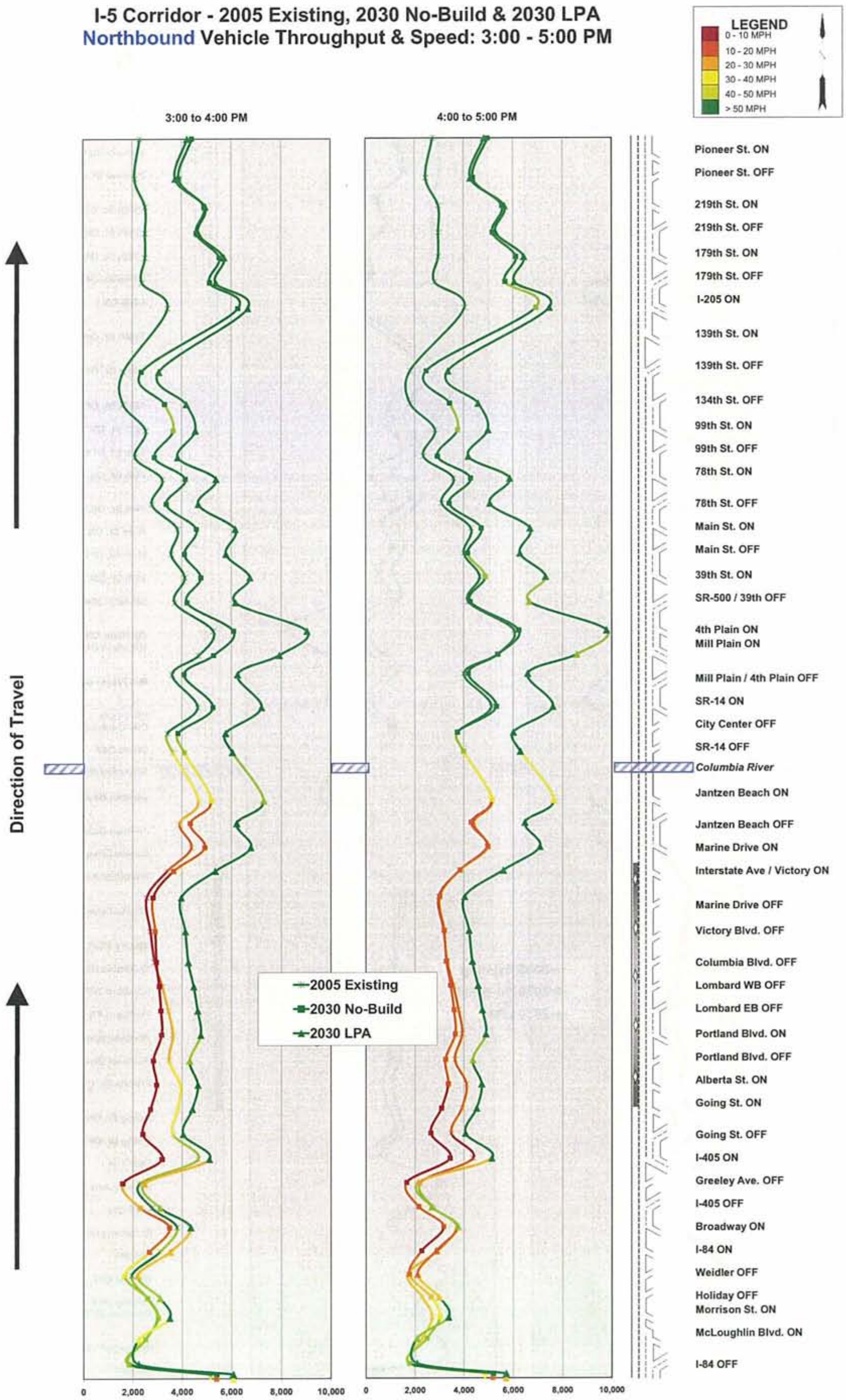


Exhibit 7-20



I-5 Corridor - 2005 Existing, 2030 No-Build & 2030 LPA
Northbound Vehicle Throughput & Speed: 3:00 - 5:00 PM
LEGEND
0 - 10 MPH
10 - 20 MPH
20 - 30 MPH
30 - 40 MPH
40 - 50 MPH
> 50 MPH
3:00 to 4:00 PM
4:00 to 5:00 PM
Direction of Travel
2005 Existing
2030 No-Build
2030 LPA
0
2,000
4,000
6,000
8,000
10,000
Pioneer St. ON
Pioneer St. OFF
219th St. ON
219th St. OFF
179th St. ON
179th St. OFF
I-205 ON
139th St. ON
139th St. OFF
134th St. OFF
99th St. ON
99th St. OFF
78th St. ON
78th St. OFF
Main St. ON
Main St. OFF
39th St. ON
SR-500 / 39th OFF
4th Plain ON
Mill Plain ON
Mill Plain / 4th Plain OFF
SR-14 ON
City Center OFF
SR-14 OFF
Columbia River
Jantzen Beach ON
Jantzen Beach OFF
Marine Drive ON
Interstate Ave / Victory ON
Marine Drive OFF
Victory Blvd. OFF
Columbia Blvd. OFF
Lombard WB OFF
Lombard EB OFF
Portland Blvd. ON
Portland Blvd. OFF
Alberta St. ON
Going St. ON
Going St. OFF
I-405 ON
Greeley Ave. OFF
I-405 OFF
Broadway ON
I-84 ON
Weidler OFF
Holiday OFF
Morrison St. ON
McLoughlin Blvd. ON
I-84 OFF

Exhibit 7-20 - continued

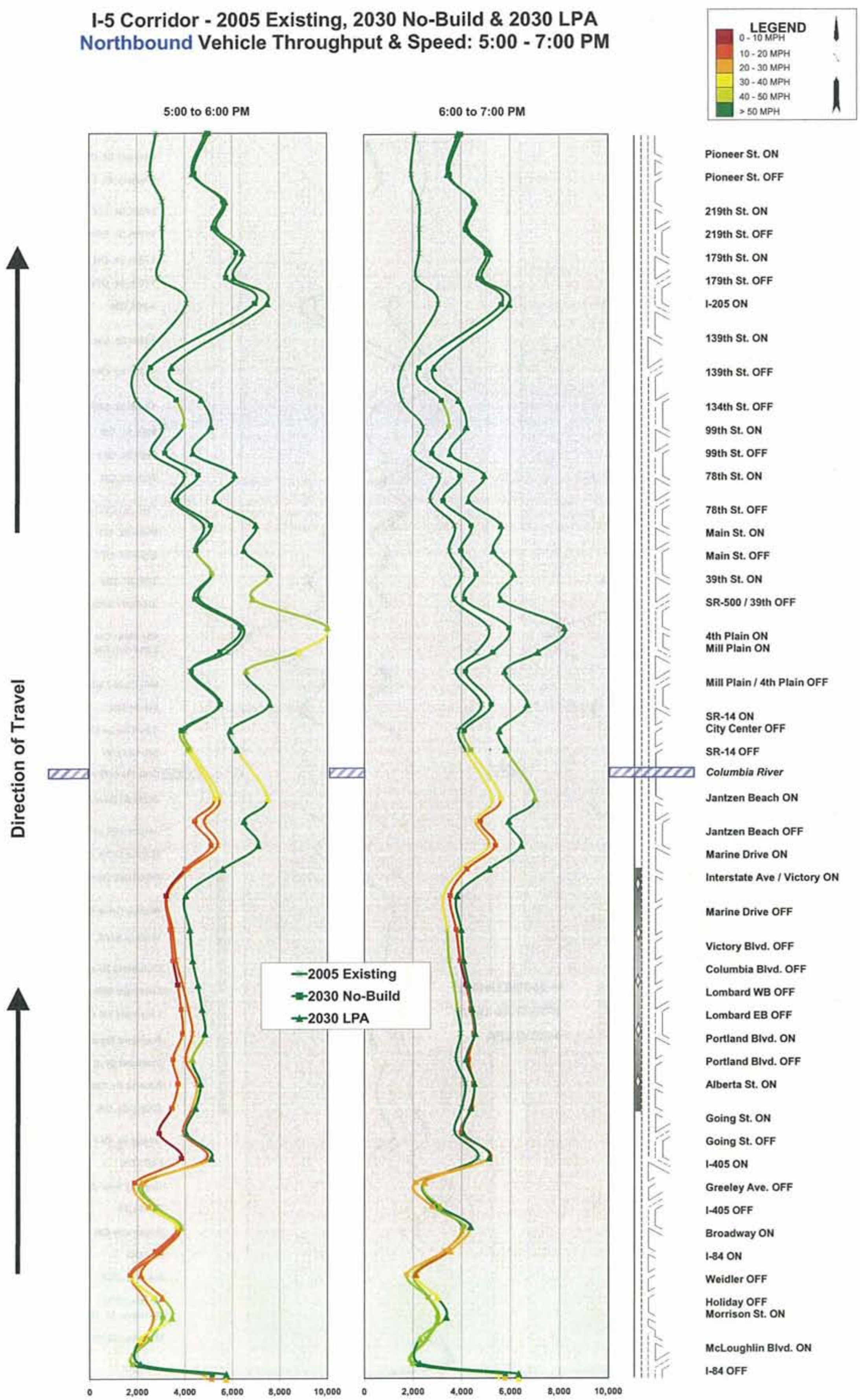
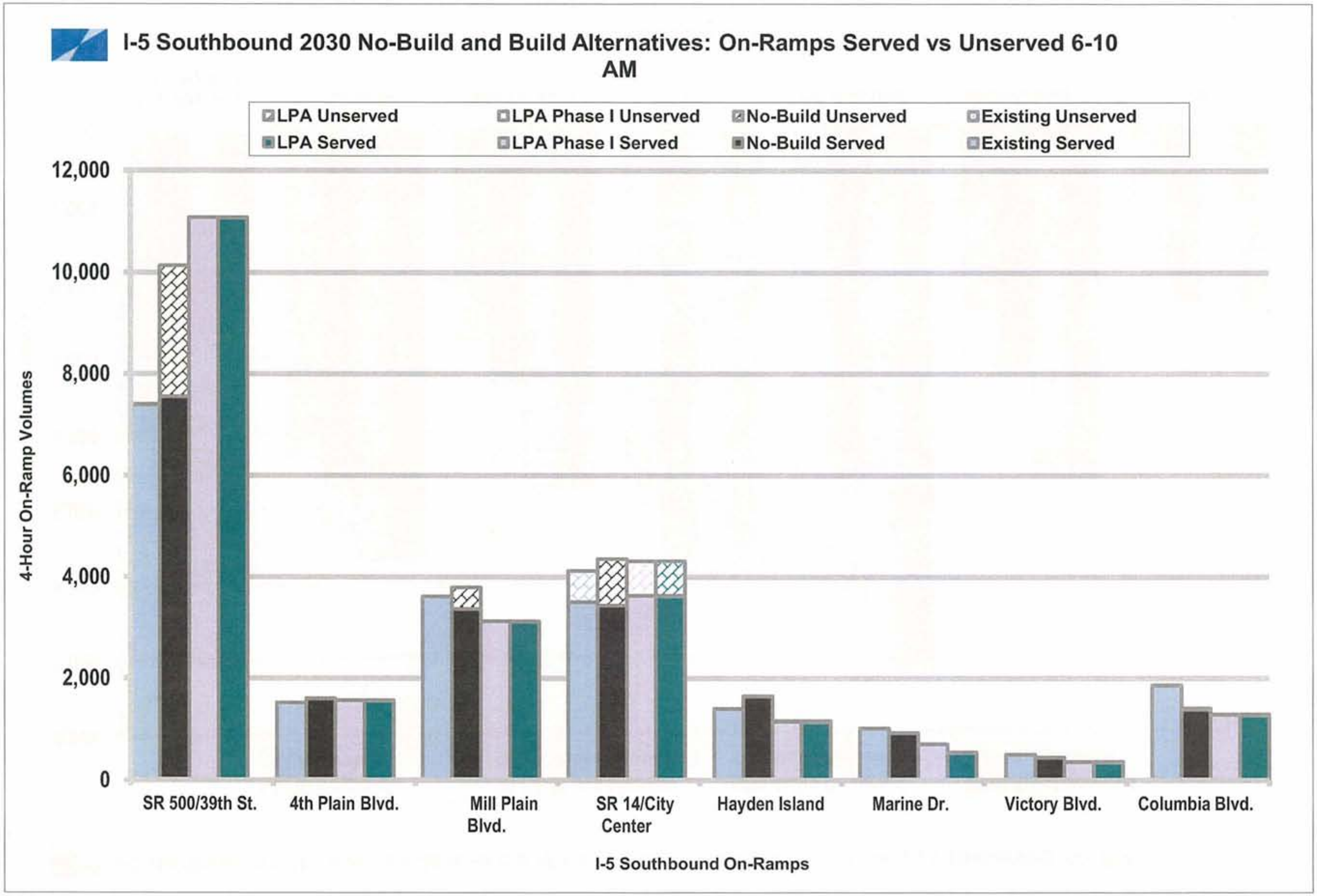


Exhibit 7-21



7659

Exhibit 7-22

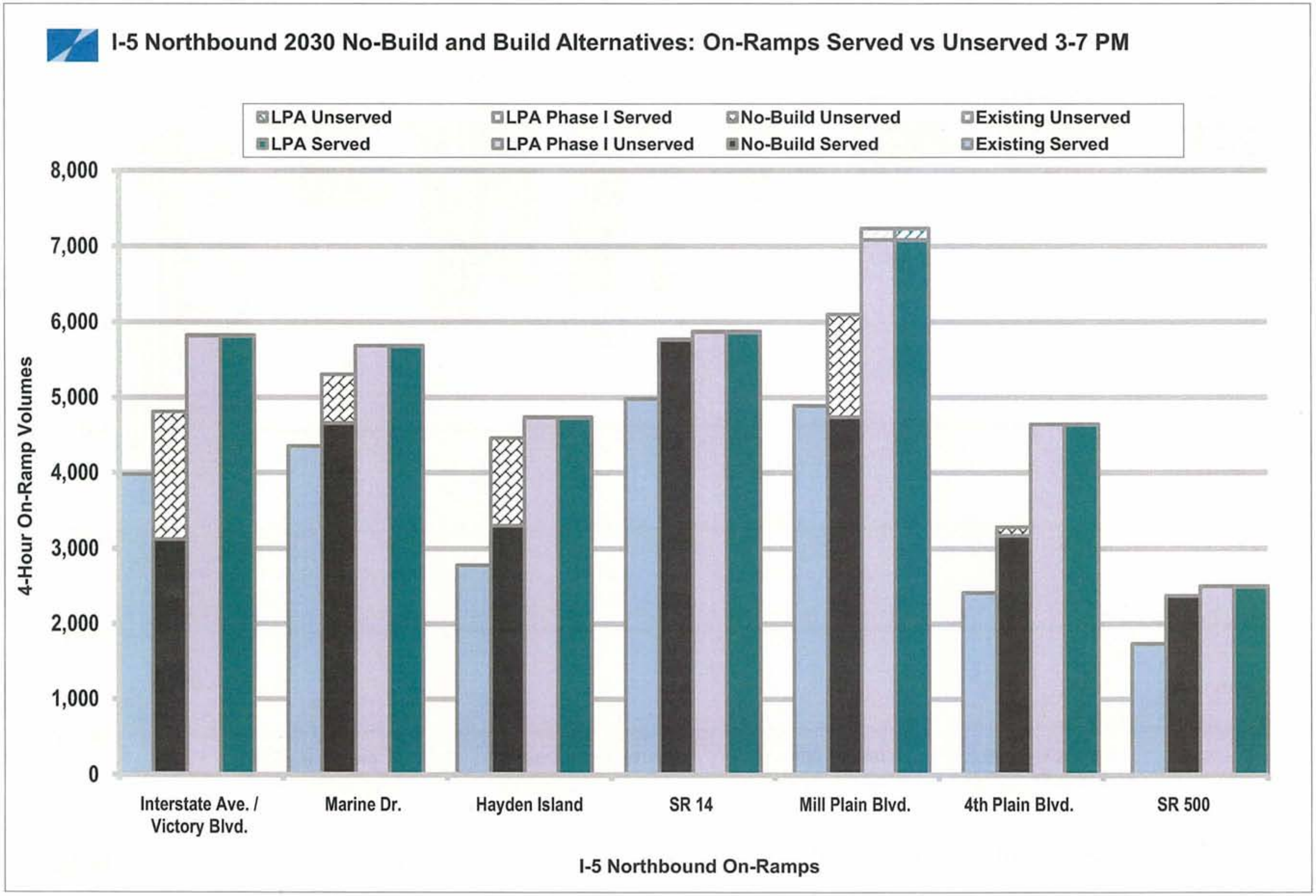
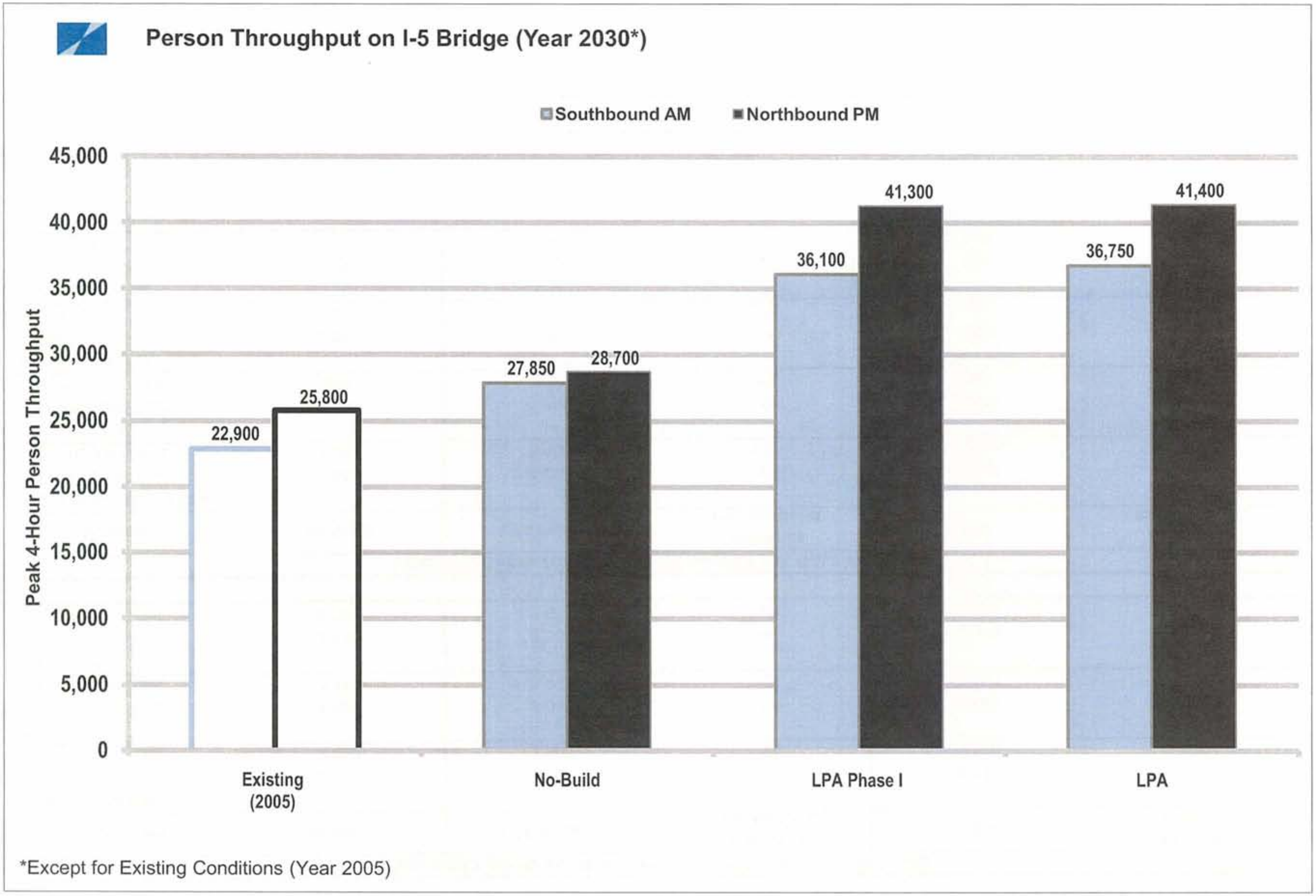

I-5 Northbound 2030 No-Build and Build Alternatives: On-Ramps Served vs Unserved 3-7 PM
LPA Unserved
LPA Served
LPA Phase I Served
LPA Phase I Unserved
No-Build Unserved
No-Build Served
Existing Unserved
Existing Served
4-Hour On-Ramp Volumes
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Interstate Ave. / Victory Blvd.
Marine Dr.
Hayden Island
SR 14
Mill Plain Blvd.
4th Plain Blvd.
SR 500
I-5 Northbound On-Ramps

Exhibit 7-23


Person Throughput on I-5 Bridge (Year 2030*)
Southbound AM
Northbound PM
Peak 4-Hour Person Throughput
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
22,900
25,800
27,850
28,700
36,100
41,300
36,750
41,400
Existing (2005)
No-Build
LPA Phase I
LPA
*Except for Existing Conditions (Year 2005)

PRELIMINARY

Exhibit 7-24

Vancouver North-South Screenlines - AM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
West of Franklin St					
Westbound Total	2,850	3,150	11%	3,150	11%
Eastbound Total	2,000	2,300	15%	2,300	15%
West of I-5					
Westbound Total	4,450	5,050	13%	5,050	13%
Eastbound Total	3,350	3,900	16%	3,750	12%
East of I-5					
Westbound Total	3,450	3,500	1%	3,500	1%
Eastbound Total	3,000	3,850	28%	3,100	3%

Vancouver East-West Screenlines - AM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
North of Evergreen Blvd					
Southbound Total	1,450	1,600	10%	1,600	10%
Northbound Total	1,050	1,100	5%	1,100	5%
North of 15th St					
Southbound Total	2,100	1,800	-14%	1,800	-14%
Northbound Total	500	600	20%	600	20%
North of 4th Plain Blvd					
Southbound Total	2,200	1,650	-25%	1,650	-25%
Northbound Total	350	450	29%	450	29%
North of 39th St					
Southbound Total	1,250	850	-32%	850	-32%
Northbound Total	250	450	80%	450	80%

Exhibit 7-25

Vancouver North-South Screenlines - PM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
West of Franklin St					
Westbound Total	2,500	2,950	18%	2,950	18%
Eastbound Total	3,500	3,600	3%	3,600	3%
West of I-5					
Westbound Total	3,950	4,450	13%	4,450	13%
Eastbound Total	5,950	6,550	10%	6,300	6%
East of I-5					
Westbound Total	3,050	3,450	13%	3,450	13%
Eastbound Total	5,800	5,250	-9%	4,350	-25%

Vancouver East-West Screenlines - PM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
North of Evergreen Blvd					
Southbound Total	1,050	1,200	14%	1,200	14%
Northbound Total	1,850	1,750	-5%	1,750	-5%
North of 15th St					
Southbound Total	1,000	1,050	5%	1,050	5%
Northbound Total	1,350	1,250	-7%	1,250	-7%
North of 4th Plain Blvd					
Southbound Total	650	650	0%	650	0%
Northbound Total	1,300	950	-27%	950	-27%
North of 39th St					
Southbound Total	550	650	18%	650	18%
Northbound Total	950	900	-5%	900	-5%

Exhibit 7-26

Portland North-South Screenlines - AM Peak Hour Volumes

Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
West of Interstate					
Westbound Total	4,250	4,250	0%	4,250	0%
Eastbound Total	3,200	2,900	-9%	2,900	-9%
East of I-5					
Westbound Total	3,450	3,150	-9%	3,150	-9%
Eastbound Total	2,950	3,050	3%	3,050	3%
East of MLK Jr Blvd					
Westbound Total	3,950	3,900	-1%	3,900	-1%
Eastbound Total	2,850	3,100	9%	3,100	9%

Portland East-West Screenlines - AM Peak Hour Volumes

Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
Columbia Slough					
Southbound Total	1,400	1,400	0%	1,400	0%
Northbound Total	1,150	1,050	-9%	1,050	-9%
North of Rosa Parks					
Southbound Total	1,150	1,200	4%	1,200	4%
Northbound Total	750	750	0%	750	0%
South of Alberta St					
Southbound Total	1,800	1,800	0%	1,800	0%
Northbound Total	1,250	1,000	-20%	1,000	-20%

Exhibit 7-27

Portland North-South Screenlines - PM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
West of Interstate					
Westbound Total	3,100	3,200	3%	3,200	3%
Eastbound Total	4,950	4,700	-5%	4,700	-5%
East of I-5					
Westbound Total	3,300	3,550	8%	3,550	8%
Eastbound Total	3,850	3,650	-5%	3,650	-5%
East of MLK Jr Blvd					
Westbound Total	3,300	3,200	-3%	3,200	-3%
Eastbound Total	4,050	3,900	-4%	3,900	-4%

Portland East-West Screenlines - PM Peak Hour Volumes					
Screenline	No-Build	LPA Phase I	Difference from No-Build	LPA	Difference from No-Build
Columbia Slough					
Southbound Total	1,450	1,350	-7%	1,350	-7%
Northbound Total	1,550	1,650	6%	1,650	6%
North of Rosa Parks					
Southbound Total	1,550	1,400	-10%	1,400	-10%
Northbound Total	1,850	1,900	3%	1,900	3%
South of Alberta St					
Southbound Total	1,750	1,600	-9%	1,600	-9%
Northbound Total	2,550	2,400	-6%	2,400	-6%

Applicable Local Street Intersection Performance Criteria for LPA

Vancouver Intersection Performance Criteria			
No-Build	**LPA**	**Determination**	**Mitigation?**
LOS E or better ≤ 80 seconds(1)	LOS E or better ≤ 80 seconds	No project impact	No
LOS E or better ≤ 80 seconds	LOS F > 80 seconds	Significant project-related impact	**Yes**
LOS F > 80 and ≤ 100 seconds	LOS E or better ≤ 80 seconds	Project-related benefit	No
LOS F > 80 and ≤ 100 seconds(2)	LOS F > 80 and ≤ 100 seconds	No project impact if delay within established range is lower under build alternative	No
LOS F > 80 and ≤ 100 seconds(2)	LOS F > 80 and ≤ 100 seconds	Significant project-related impact if delay within established range is at least 10 seconds higher under build alternative	**Yes**
LOS F > 100 seconds(3)	LOS F < 100 seconds	Project-related benefit	No
LOS F > 100 seconds	LOS F > 100 seconds	No project impact	No

Portland Intersection Performance Criteria			
No-Build	**LPA**	**Determination**	**Mitigation?**
LOS D or better ≤ 55 seconds	LOS D or better ≤ 55 seconds	No project impact	No
LOS D or better ≤ 55 seconds	LOS E or worse > 55 seconds	Significant project-related impact	**Yes**
LOS E ≤ 80 seconds	LOS E ≤ 80 seconds	Significant project-related impact if delay within established range is at least 10 seconds higher under build alternative	**Yes**
LOS F > 80 seconds	LOS E or better ≤ 80 seconds	Project-related benefit	No
LOS F > 80 seconds(2)	LOS F > 80 seconds	No project impact	No
V/C ≤ 0.85(4) or ≤ 0.99(5)	V/C > 0.85(4) or > 0.99(5)	Significant project-related impact	**Yes**
V/C ≤ 0.85(4) or ≤ 0.99(5)	V/C ≤ 0.85(4) or ≤ 0.99(5)	No project impact	No

(1) Refers to average delay per vehicle entering the intersection.

(2) LOS F gradations not established within this range.

(3) Assumed level of delay at which point motorists would change route, travel mode, or time of day for trip.

(4) A V/C ratio of 0.85 is used for ramp terminals in all scenarios.

(5) A V/C ratio of 0.99 is used for ODOT intersections that are not ramp terminals in all scenarios.

Exhibit 7-29

FEIS LPA Park-and-Ride Trip Generation								
	Trip	Parking	AM Peak Hour Trip Generation			PM Peak Hour Trip Generation		
Park-and-Ride Lot	Type	Spaces	Inbound	Outbound	Total	Inbound	Outbound	Total
	Park-and-Ride	570	200	0	**200**	0	170	**170**
Columbia	Kiss-and-Ride		55	55	**110**	55	55	**110**
	Total	570	255	55	**310**	55	225	**280**
	Park-and-Ride	420	145	0	**145**	0	125	**125**
Mill	Kiss-and-Ride		40	40	**80**	40	40	**80**
	Total	420	185	40	**225**	40	165	**205**
	Park-and-Ride	1,910	670	0	**670**	0	575	**575**
Clark	Kiss-and-Ride		190	190	**380**	190	190	**380**
	Total	1,910	860	190	**1,050**	190	765	**955**
	Park-and-Ride	**2,900**	**1,015**	**0**	**1,015**	**0**	**870**	**870**
Total	**Kiss-and-Ride**		**285**	**285**	**570**	**285**	**285**	**570**
	Total	**2,900**	**1,300**	**285**	**1,585**	**285**	**1,155**	**1,440**

AM Inbound % - Parking	**35%**
AM Inbound % - Kiss & Ride	10%
AM Outbound % - Kiss & Ride	10%
PM Outbound % - Parking	**30%**
PM Inbound % - Kiss & Ride	10%
PM Outbound % - Kiss & Ride	10%

Exhibit 7-30

PRELIMINARY

Principal Arterial	New Bridge	New Bicycle/Pedestrian Route
Minor Arterial	Existing Bridge	Existing MAX Yellow Line/Station
Collector	Roadway Improvements	Parks
Intersection Analyzed	Tunnel	Ponds
Sub-areas	New Transit Alignment	Sidewalks

LPA
SR 14 Interchange Sub-area

Columbia River CROSSING

Exhibit 7-31

PRELIMINARY

Vancouver Intersection Performance Results

AM Peak Hour — 2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way	Eastbound Left	5.6	A	0.01	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[3]	Eastbound Left	4.5	A	0.05	LOS E	Y	-	-
AA	Main St. @ Columbia Way[3]								
01	3rd/4th St. @ Columbia St[3]	Eastbound Left/Right	4.8	A	0.04	LOS E	Y	-	-
BB	SR 14 and Main Street[3]								
CC	SR 14 Park and Ride @ Main Street								
C	3rd/4th St. @ Esther St	Westbound Left/Right	3.6	A	0.09	LOS E	Y	-	-
02	4th St. @ Columbia St.	Northbound Thru/Right	0.2	A	0.08	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	2.7	A	0.03	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	3.0	A	0.12	LOS E	Y	-	-
DD	5th St. @ Columbia Park and Ride								
05	5th St. @ Washington St.	*Overall Intersection*	9.5	A	0.44	LOS E	Y	-	-
EE	5th St. @ Main St.								
06	6th St. @ Columbia St.	*Overall Intersection*	7.9	A	0.45	LOS E	Y	-	-
07	6th St. @ Washington St.	*Overall Intersection*	11.8	B	0.48	LOS E	Y	-	-
08	6th St. @ Main St.	*Overall Intersection*	7.6	A	0.53	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	4.7	A	0.36	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	16.7	C	-	LOS E	Y	850	850 (NBLT)
11	8th St. @ Esther St.	Southbound Left/Thru/Right	8.8	A	0.19	LOS E	Y	-	-
12	8th St. @ Columbia St.	*Overall Intersection*	12.2	B	0.85	LOS E	Y	-	-
13	8th St. @ Washington St.	*Overall Intersection*	11.5	B	0.59	LOS E	Y	-	-
14	8th St. @ Main St.	*Overall Intersection*	12.2	B	0.58	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Left/Thru/Right	10.3	B	0.65	LOS E	Y	-	-
16	8th St. @ C St.	*Overall Intersection*	16.2	B	0.58	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	4.2	A	6.00	LOS E	Y	-	-
18	9th St. @ Columbia St.	Westbound Left/Thru/Right	7.0	A	0.13	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Left	5.4	A	0.04	LOS E	Y	-	-
20	9th St. @ Main St.	Eastbound Left/Thru/Right	4.6	A	0.06	LOS E	Y	-	-
21	9th St. @ Broadway	Eastbound Left/Right	3.9	A	0.04	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	7.6	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	*Overall Intersection*	13.0	B	0.63	LOS E	Y	-	-
24	Evergreen Blvd. @ Washington St.	*Overall Intersection*	17.2	B	0.60	LOS E	Y	75	100 (WBL)
25	Evergreen Blvd. @ Main St.	*Overall Intersection*	14.8	B	0.68	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	*Overall Intersection*	14.9	B	0.70	LOS E	Y	75 210	125 (WBL) 225 (WBTR)
27	Evergreen Blvd. @ C St.	*Overall Intersection*	14.3	B	0.64	LOS E	Y	-	-
28	11th St. @ Esther St.	Southbound Left/Thru/Right	4.6	A	0.05	LOS E	Y	-	-
29	11th St. @ Columbia St.	Westbound Left/Thru/Right	8.1	A	0.29	LOS E	Y	-	-
30	11th St. @ Washington St.	Westbound Left/Thru	7.9	A	0.23	LOS E	Y	-	-
31	11th St. @ Main St.	Westbound Left/Thru/Right	6.3	A	0.16	LOS E	Y	-	-
32	11th St. @ Broadway	Westbound Left/Thru/Right	6.9	A	0.22	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru	6.3	A	0.17	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	*Overall Intersection*	18.4	B	0.77	LOS E	Y	75 210	150 (SBL) 225 (SBT)
35	Mill Plain Blvd. @ Washington St.	*Overall Intersection*	7.0	A	0.43	LOS E	Y	-	-
36	Mill Plain Blvd. @ Main St.	*Overall Intersection*	11.5	B	1.01	LOS E	Y	70	150 (SBL)
37	Mill Plain Blvd. @ Broadway	*Overall Intersection*	10.3	B	0.68	LOS E	Y	70	150 (SBL)
38	Mill Plain Blvd. @ C St.	*Overall Intersection*	8.0	A	0.38	LOS E	Y	-	-
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	20.4	C	0.75	LOS E	Y	800 350 275	800 (EBT) 500 (EBR) 350 (WBL)
FF	Mill Plain Blvd. @ I-5 SPUI								
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	36.0	D	0.88	LOS E	Y	590 325	600 (NBLT) 500 (NBR)
41	15th St. @ Columbia St.	*Overall Intersection*	17.4	B	0.77	LOS E	Y	220	225 (WBLT)
42	15th St. @ Washington St.	*Overall Intersection*	12.3	B	0.54	LOS E	Y	210 210	250 (WBL) 225 (WBT)
GG	15th St. @ Mill District Park & Ride								
43	15th St. @ Main St.	*Overall Intersection*	14.7	B	1.01	LOS E	Y	195	200 (WBLT)
44	15th St. @ Broadway	*Overall Intersection*	14.2	B	0.68	LOS E	Y	205	225 (WBLT)
45	15th St. @ C St.	*Overall Intersection*	8.3	A	0.58	LOS E	Y	-	-
D	16th St. @ Washington St.	Westbound Left/Thru	6.1	A	0.18	LOS E	Y	-	-
HH	16th St. @ Mill District Park & Ride								
E	16th St. @ Main St.	Eastbound Left/Thru/Right	9.6	A	0.17	LOS E	Y	-	-
F	17th Street & Washington	Westbound Left/Thru	6.6	A	0.14	LOS E	Y	-	-
G	17th Street & Main	Eastbound Thru/Right	10.5	B	0.14	LOS E	Y	-	-
H	17th Street & Broadway	Westbound Left/Thru/Right	9.5	A	0.11	LOS E	Y	-	-
I	17th Street & C Street	Eastbound Left/Thru	5.7	A	0.09	LOS E	Y	-	-
J	17th Street & G Street	Eastbound Left/Thru/Right	2.7	A	0.04	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	*Overall Intersection*	12.2	B	0.64	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.	*Overall Intersection*	5.5	A	0.39	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	*Overall Intersection*	16.1	B	0.70	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	*Overall Intersection*	18.0	B	0.59	LOS E	Y	75	100 (WBL)
L	McLoughlin Blvd. @ C St.	*Overall Intersection*	5.9	A	0.30	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.	Northbound Left/Thru/Right	6.2	A	-	LOS E	Y	-	-
II	McLoughlin Blvd. @ Clark College Park & Ride								
JJ	McLoughlin Blvd. @ Marshall CC East								
49	McLoughlin Blvd. @ Fort Vancouver Way	*Overall Intersection*	11.7	B	0.42	LOS D	Y	-	-

2030 LPA with Highway Phasing (Broadway-Washington/17th)

#	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Southbound Left/Right	5.4	A	0.32	LOS E	Y	-	-
B	Southbound Left/Right	2.3	A	0.29	LOS E	Y	-	-
AA	Westbound Thru/Right	1.3	A	0.25	LOS E	Y	-	-
01	Southbound Left/Thru/Right	7.8	A	0.73	LOS E	Y	-	-
BB	Southbound Left/Thru	2.4	A	0.34	LOS E	Y	-	-
CC	Southbound Thru/Right	1.3	A	0.24	LOS E	Y	-	-
C	Westbound Left/Right	5.1	A	0.31	LOS E	Y	-	-
02								
03								
04	Southbound Left	8.7	A	0.15	LOS E	Y	-	-
DD	Northbound Left/Right	2.6	A	0.07	LOS E	Y	-	-
05	*Overall Intersection*	9.2	A	0.43	LOS E	Y	-	-
EE	*Overall Intersection*	18.2	B	0.80	LOS E	Y	160 75 185	175 (EBLTR) 100 (SBL) 200 (SBTR)
06	*Overall Intersection*	15.0	B	0.98	LOS E	Y	200 75 205	200 (WBLTR) 100 (NBL) 225 (NBTR)
07	*Overall Intersection*	14.6	B	0.29	LOS E	Y	-	-
08	*Overall Intersection*	8.6	A	0.79	LOS E	Y	75 185	100 (NBL) 200 (NBTR)
09	Eastbound Left/Thru	1.7	A	0.25	LOS E	Y	-	-
10	Southbound Thru	3.7	A	0.36	LOS E	Y	-	-
11	Northbound Left/Thru/Right	7.3	A	0.27	LOS E	Y	-	-
12	*Overall Intersection*	15.4	B	0.68	LOS E	Y	75 75 210	125 (SBL) 100 (WBL) 225 (WBTR)
13	*Overall Intersection*	11.9	B	0.54	LOS E	Y	-	-
14	*Overall Intersection*	15.2	B	0.63	LOS E	Y	-	-
15	*Overall Intersection*	7.0	A	0.63	LOS E	Y	-	-
16	*Overall Intersection*	11.2	B	0.52	LOS E	Y	-	-
17	Westbound Left/Thru/Right	5.9	A	0.07	LOS E	Y	-	-
18	Westbound Left/Thru/Right	6.2	A	0.08	LOS E	Y	-	-
19	*Overall Intersection*	8.0	A	0.44	LOS E	Y	-	-
20	Eastbound Left/Thru/Right	7.9	A	0.17	LOS E	Y	-	-
21	*Overall Intersection*	3.6	A	0.35	LOS E	Y	-	-
22	Northbound Left/Thru/Right	10.5	B	0.23	LOS E	Y	-	-
23	*Overall Intersection*	19.4	B	0.75	LOS E	Y	225 100 205	225 (WBTR) 125 (NBL) 225 (SBTR)
24	*Overall Intersection*	11.8	B	0.56	LOS E	Y	210	225 (SBTR)
25	*Overall Intersection*	10.4	B	0.65	LOS E	Y	-	-
26	*Overall Intersection*	10.3	B	0.52	LOS E	Y	-	-
27	*Overall Intersection*	11.5	B	0.68	LOS E	Y	-	-
28	Northbound Left/Thru/Right	4.8	A	0.14	LOS E	Y	-	-
29	Eastbound Left/Thru/Right	15.6	C	0.25	LOS E	Y	-	-
30	*Overall Intersection*	10.1	B	0.46	LOS E	Y	-	-
31	Westbound Left/Thru/Right	10.5	B	0.19	LOS E	Y	-	-
32	*Overall Intersection*	10.1	B	0.40	LOS E	Y	-	-
33	Eastbound Left/Thru/Right	6.7	A	0.14	LOS E	Y	-	-
34	*Overall Intersection*	15.4	B	1.06	LOS E	Y	75 210	150 (SBL) 225 (SBT)
35	*Overall Intersection*	17.7	B	0.50	LOS E	Y	205	225 (SBLT)
36	*Overall Intersection*	14.3	B	1.09	LOS E	Y	70 210	150 (SBL) 225 (SBT)
37	*Overall Intersection*	9.4	A	0.38	LOS E	Y	-	-
38	*Overall Intersection*	12.8	B	1.02	LOS E	Y	200 75 200	200 (EBLTR) 125 (SBL) 200 (SBT)
39								
FF	*Overall Intersection*	22.1	C	0.63	LOS E	Y	-	-
40								
41	*Overall Intersection*	22.5	C	1.06	LOS E	Y	225 75	225 (WBLTR) 75 (NBL)
42	*Overall Intersection*	7.4	A	0.56	LOS E	Y	70	75 (WBT)
GG	Westbound Thru/Right	2.1	A	0.41	LOS E	Y	90	100 (WBTR)
43	*Overall Intersection*	24.2	C	1.09	LOS E	Y	190 225	200 (WBT) 225 (SBTR)
44	*Overall Intersection*	11.0	B	0.59	LOS E	Y	200	200 (WBTR)
45	*Overall Intersection*	47.1	D	1.02	LOS E	Y	-	-
D	*Overall Intersection*	21.6	C	0.30	LOS E	Y	65	75 (WBLTR)
HH	Northbound Right	2.5	A	0.03	LOS E	Y	-	-
E	*Overall Intersection*	12.8	B	0.49	LOS E	Y	180	200 (SBLTR)
F	*Overall Intersection*	8.6	A	0.27	LOS E	Y	-	-
G	*Overall Intersection*	4.1	A	0.50	LOS E	Y	-	-
H	*Overall Intersection*	9.2	A	0.15	LOS E	Y	-	-
I	*Overall Intersection*	8.0	A	0.23	LOS E	Y	-	-
J	*Overall Intersection*	6.0	A	0.13	LOS E	Y	-	-
46	*Overall Intersection*	11.8	B	0.65	LOS E	Y	-	-
K	*Overall Intersection*	9.1	A	0.52	LOS E	Y	-	-
47	*Overall Intersection*	21.2	C	0.83	LOS E	Y	220 50	225 (WBLTR) 100 (SBR)
48	*Overall Intersection*	23.7	C	0.54	LOS E	Y	200	200 (WBT)
L	*Overall Intersection*	11.3	B	0.49	LOS E	Y	-	-
M	Southbound Left/Thru/Right	5.5	A	-	LOS E	Y	-	-
II	*Overall Intersection*	10.3	B	0.33	LOS D	Y	-	-
JJ	*Overall Intersection*	1.9	A	0.30	LOS D	Y	-	-
49	*Overall Intersection*	15.4	B	0.55	LOS D	Y	-	-

2030 LPA (Broadway-Washington/17th)

#	Approach/Movement	Delay (Seconds)	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Southbound Left/Right	5.4	5.4	A	0.32	LOS E	Y	-	-
B	Southbound Left/Right	2.3	2.3	A	0.29	LOS E	Y	-	-
AA	Westbound Thru/Right	1.3	1.3	A	0.25	LOS E	Y	-	-
01	Southbound Left/Thru/Right	7.8	7.8	A	0.73	LOS E	Y	-	-
BB	Southbound Left/Thru	2.4	2.4	A	0.34	LOS E	Y	-	-
CC	Southbound Thru/Right	1.3	1.3	A	0.24	LOS E	Y	-	-
C	Westbound Left/Right	5.1	5.1	A	0.31	LOS E	Y	-	-
02									
03									
04	Southbound Left	8.7	8.7	A	0.15	LOS E	Y	-	-
DD	Northbound Left/Right	2.6	2.6	A	0.07	LOS E	Y	-	-
05	*Overall Intersection*	9.2	9.2	A	0.43	LOS E	Y	-	-
EE	*Overall Intersection*	18.2	18.2	B	0.80	LOS E	Y	160 75 185	175 (EBLTR) 100 (SBL) 200 (SBTR)
06	*Overall Intersection*	15.0	15.0	B	0.98	LOS E	Y	200 75 205	200 (WBLTR) 100 (NBL) 225 (NBTR)
07	*Overall Intersection*	14.6	14.6	B	0.29	LOS E	Y	-	-
08	*Overall Intersection*	8.6	8.6	A	0.79	LOS E	Y	75 185	100 (NBL) 200 (NBTR)
09	Eastbound Left/Thru	1.7	1.7	A	0.25	LOS E	Y	-	-
10	Southbound Thru	3.7	3.7	A	0.36	LOS E	Y	-	-
11	Northbound Left/Thru/Right	7.3	7.3	A	0.27	LOS E	Y	-	-
12	*Overall Intersection*	15.4	15.4	B	0.68	LOS E	Y	75 75 210	125 (SBL) 100 (WBL) 225 (WBTR)
13	*Overall Intersection*	11.9	11.9	B	0.54	LOS E	Y	-	-
14	*Overall Intersection*	15.2	15.2	B	0.63	LOS E	Y	-	-
15	*Overall Intersection*	7.0	7.0	A	0.63	LOS E	Y	-	-
16	*Overall Intersection*	11.2	11.2	B	0.52	LOS E	Y	-	-
17	Westbound Left/Thru/Right	5.9	5.9	A	0.07	LOS E	Y	-	-
18	Westbound Left/Thru/Right	6.2	6.2	A	0.08	LOS E	Y	-	-
19	*Overall Intersection*	8.0	8.0	A	0.44	LOS E	Y	-	-
20	Eastbound Left/Thru/Right	7.9	7.9	A	0.17	LOS E	Y	-	-
21	*Overall Intersection*	3.6	3.6	A	0.35	LOS E	Y	-	-
22	Northbound Left/Thru/Right	10.5	10.5	B	0.23	LOS E	Y	-	-
23	*Overall Intersection*	19.4	19.4	B	0.75	LOS E	Y	225 100 205	225 (WBTR) 125 (NBL) 225 (SBTR)
24	*Overall Intersection*	11.8	11.8	B	0.56	LOS E	Y	210	225 (SBTR)
25	*Overall Intersection*	10.4	10.4	B	0.65	LOS E	Y	-	-
26	*Overall Intersection*	10.3	10.3	B	0.52	LOS E	Y	-	-
27	*Overall Intersection*	11.5	11.5	B	0.68	LOS E	Y	-	-
28	Northbound Left/Thru/Right	4.8	4.8	A	0.14	LOS E	Y	-	-
29	Eastbound Left/Thru/Right	15.6	15.6	C	0.25	LOS E	Y	-	-
30	*Overall Intersection*	10.1	10.1	B	0.46	LOS E	Y	-	-
31	Westbound Left/Thru/Right	10.5	10.5	B	0.19	LOS E	Y	-	-
32	*Overall Intersection*	10.1	10.1	B	0.40	LOS E	Y	-	-
33	Eastbound Left/Thru/Right	6.7	6.7	A	0.14	LOS E	Y	-	-
34	*Overall Intersection*	15.4	15.4	B	1.06	LOS E	Y	75 210	150 (SBL) 225 (SBT)
35	*Overall Intersection*	17.7	17.7	B	0.50	LOS E	Y	205	225 (SBLT)
36	*Overall Intersection*	14.3	14.3	B	1.09	LOS E	Y	70 210	150 (SBL) 225 (SBT)
37	*Overall Intersection*	9.4	9.4	A	0.38	LOS E	Y	-	-
38	*Overall Intersection*	12.8	12.8	B	1.02	LOS E	Y	200 75 200	200 (EBLTR) 125 (SBL) 200 (SBT)
39									
FF	*Overall Intersection*	22.1	22.1	C	0.63	LOS E	Y	-	-
40									
41	*Overall Intersection*	22.5	22.5	C	1.06	LOS E	Y	225 75	225 (WBLTR) 75 (NBL)
42	*Overall Intersection*	7.4	7.4	A	0.56	LOS E	Y	70	75 (WBT)
GG	Westbound Thru/Right	2.1	2.1	A	0.41	LOS E	Y	90	100 (WBTR)
43	*Overall Intersection*	24.2	24.2	C	1.09	LOS E	Y	190 225	200 (WBT) 225 (SBTR)
44	*Overall Intersection*	11.0	11.0	B	0.59	LOS E	Y	200	200 (WBTR)
45	*Overall Intersection*	47.1	47.1	D	1.02	LOS E	Y	-	-
D	*Overall Intersection*	21.6	21.6	C	0.30	LOS E	Y	65	75 (WBLTR)
HH	Northbound Right	2.5	2.5	A	0.03	LOS E	Y	-	-
E	*Overall Intersection*	12.8	12.8	B	0.49	LOS E	Y	180	200 (SBLTR)
F	*Overall Intersection*	8.6	8.6	A	0.27	LOS E	Y	-	-
G	*Overall Intersection*	4.1	4.1	A	0.50	LOS E	Y	-	-
H	*Overall Intersection*	9.2	9.2	A	0.15	LOS E	Y	-	-
I	*Overall Intersection*	8.0	8.0	A	0.23	LOS E	Y	-	-
J	*Overall Intersection*	6.0	6.0	A	0.13	LOS E	Y	-	-
46	*Overall Intersection*	11.8	11.8	B	0.65	LOS E	Y	-	-
K	*Overall Intersection*	9.1	9.1	A	0.52	LOS E	Y	-	-
47	*Overall Intersection*	21.2	21.2	C	0.83	LOS E	Y	220 50	225 (WBLTR) 100 (SBR)
48	*Overall Intersection*	23.7	23.7	C	0.54	LOS E	Y	200	200 (WBT)
L	*Overall Intersection*	11.3	11.3	B	0.49	LOS E	Y	-	-
M	Southbound Left/Thru/Right	5.5	5.5	A	-	LOS E	Y	-	-
II	*Overall Intersection*	10.3	10.3	B	0.33	LOS D	Y	-	-
JJ	*Overall Intersection*	1.9	1.9	A	0.30	LOS D	Y	-	-
49	*Overall Intersection*	15.4	15.4	B	0.55	LOS D	Y	-	-

Continued on next page

Exhibit 7-31

PRELIMINARY

Vancouver Intersection Performance Results

AM Peak Hour — 2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	9.0	A	0.04	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	9.8	A	0.05	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	20.4	C	0.74	LOS D	Y	235	250 (SBTR)
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	36.1	D	0.76	LOS D	Y	170 195 75 470	200 (WBL) 200 (WBT) 125 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	> 100	F	0.67	LOS D	N	195 495	200 (EBLT) 500 (WBT)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	11.2	B	0.53	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	17.5	B	0.64	LOS D	Y	200	275 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	16.2	B	0.58	LOS D	Y	75	125 (WBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	7.4	A	0.00	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	16.8	B	0.42	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	> 100	F	0.10	LOS E	N	215	225 (SBTR)
61	28th St. @ Broadway	Westbound Left	5.4	A	0.24	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	74.8	F	-	LOS E	N	1000	1000 (SBTR)
63	33rd St. @ Main St.	***Overall Intersection***	34.8	C	0.70	LOS D	Y	50 50 75	50 (EBL) 75 (WBL) 100 (NBL)
64	39th St. @ Main St.	***Overall Intersection***	> 100	F	0.93	LOS D	N	75 1310 75 215 75 125 360	125 (EBL) 1325 (EBTR) 125 (WBL) 225 (WBTR) 125 (NBL) 200 (SBL) 375 (SBT)
65	39th St. @ F St.	Northbound Left/Thru/Right	> 100	F	0.12	LOS E	N	50 430	75 (WBL) 450 (WBTR)
66	39th St. @ H St.	***Overall Intersection***	26.0	C	0.66	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	64.4	E	0.60	LOS D	N	135 55 275 715 1660 125	150 (EBT) 100 (EBR) 375 (WBL) 725 (WBT) 1675 (NBL) 275 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	> 100	F	0.80	LOS D	N	300 715 1170 790 75	325 (EBL) 725 (EBT) 1175 (WBTR) 800 (NBLT) 75 (NBR)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	21.5	C	0.57	LOS D	Y	-	-
70	45th St. @ Main St.	***Overall Intersection***	9.4	A	0.64	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	13.9	B	0.71	LOS D	Y	-	-
72	Ross St. @ Main St.	***Overall Intersection***	6.7	A	0.47	LOS D	Y	60	75 (WBL)
73	Ross St. @ North Rd.	Northbound Left/Thru	7.2	A	0.39	LOS E	Y	-	-

2030 LPA with Highway Phasing (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	7.9	A	0.03	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	7.8	A	0.04	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	16.5	B	0.64	LOS D	Y	235	250 (SBTR)
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	49.5	D	0.72	LOS D	Y	170 195 75 75 470	225 (WBL) 200 (WBTR) 75 (NBR) 125 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	42.9	D	0.60	LOS D	Y	495 195	500 (WBTR) 200 (SBLTR)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	10.0	A	0.55	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	21.9	C	0.58	LOS D	Y	200	250 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	19.9	B	0.51	LOS D	Y	-	-
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	6.7	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	17.5	B	0.43	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	> 100	F	0.23	LOS E	Y**	325 215	325 (EBLTR) 225 (SBTR)
61	28th St. @ Broadway	Westbound Left	4.2	A	0.11	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	> 100	F	-	LOS E	N	1050	1050 (SBTR)
63	33rd St. @ Main St.	***Overall Intersection***	15.2	B	0.57	LOS D	Y	50	75 (WBL)
64	39th St. @ Main St.	***Overall Intersection***	> 100	F	0.96	LOS D	Y**	75 1310 75 215 75 125 360	175 (EBL) 1325 (EBTR) 250 (WBL) 225 (WBTR) 125 (NBL) 225 (SBL) 375 (SBTR)
65	39th St. @ F St.	Westbound Thru/Right	33.9	D	0.57	LOS E	Y	215 435	225 (EBTR) 450 (WBTR)
66	39th St. @ H St.	***Overall Intersection***	69.4	E	0.79	LOS D	N	430 135	450 (EBTR) 150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	30.2	C	0.96	LOS D	Y	135 55 730 130	150 (EBT) 125 (EBR) 750 (WBT) 225 (NBLR)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	> 100	F	1.05	LOS D	Y**	300 1175 790	375 (EBL) 1175 (WBT) 925 (NBL)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	40.6	D	0.47	LOS D	Y	150	200 (SBL)
70	45th St. @ Main St.	***Overall Intersection***	19.4	B	0.54	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	11.8	B	0.61	LOS D	Y	205	225 (SBLT)
72	Ross St. @ Main St.	***Overall Intersection***	8.6	A	0.52	LOS D	Y	60	75 (WBL)
73	Ross St. @ North Rd.	Northbound Left/Thru	7.7	A	0.41	LOS E	Y	-	-

2030 LPA (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	7.9	7.9	A	0.03	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	7.8	7.8	A	0.04	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	***Overall Intersection***	16.5	16.5	B	0.64	LOS D	Y	235	250 (SBTR)
53	4th Plain Blvd. @ Main St.	***Overall Intersection***	49.5	49.5	D	0.72	LOS D	Y	170 195 75 75 470	225 (WBL) 200 (WBTR) 75 (NBR) 125 (SBL) 475 (SBTR)
54	4th Plain Blvd. @ Broadway	***Overall Intersection***	42.9	42.9	D	0.60	LOS D	Y	495 195	500 (WBTR) 200 (SBLTR)
55	4th Plain Blvd. @ F St.	***Overall Intersection***	10.0	10.0	A	0.55	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	***Overall Intersection***	21.9	21.9	C	0.58	LOS D	Y	200	250 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	19.9	19.9	B	0.51	LOS D	Y	-	-
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	6.7	6.7	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	***Overall Intersection***	17.5	17.5	B	0.43	LOS D	Y	-	-
60	28th St. @ Main St.	Eastbound Left/Thru/Right	520.0	> 100	F	0.23	LOS E	Y**	325 215	325 (EBLTR) 225 (SBTR)
61	28th St. @ Broadway	Westbound Left	4.2	4.2	A	0.11	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	264.8	> 100	F	-	LOS E	N	1050	1050 (SBTR)
63	33rd St. @ Main St.	***Overall Intersection***	21.6	21.6	C	0.57	LOS D	Y	50	75 (WBL)
64	39th St. @ Main St.	***Overall Intersection***	76.9	76.9	E	0.90	LOS D	Y*	75 1310 75 215 75 125 360	175 (EBL) 1325 (EBTR) 225 (WBL) 225 (WBTR) 125 (NBL) 200 (SBL) 350 (SBT)
65	39th St. @ F St.	Westbound Thru/Right	33.3	33.3	D	0.56	LOS E	Y	435	450 (WBTR)
66	39th St. @ H St.	***Overall Intersection***	18.4	18.4	B	0.78	LOS D	Y	135	150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Westbound Thru	36.7	36.7	E	0.64	LOS E	Y	55 730	100 (EBR) 750 (WBT)
68	39th St. @ I-5 NB On-/Off-Ramps	***Overall Intersection***	72.8	72.8	E	0.72	LOS D	Y*	1175 790	1175 (WBT) 800 (NBL)
69	WSDOT/40th St. @ Main St.	***Overall Intersection***	29.3	29.3	C	0.47	LOS D	Y	150	175 (SBL)
70	45th St. @ Main St.	***Overall Intersection***	11.6	11.6	B	0.54	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	***Overall Intersection***	11.5	11.5	B	0.61	LOS D	Y	205	225 (SBLT)
72	Ross St. @ Main St.	***Overall Intersection***	8.4	8.4	A	0.52	LOS D	Y	60	75 (WBL)
73	Ross St. @ North Rd.	Northbound Left/Thru	7.0	7.0	A	0.41	LOS E	Y	-	-

Delay / LOS affected by freeway congestion
Intersection queuing spills back into upstream intersection
Note 1 The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.
Note 2 The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersections.
Note 3 2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis
* Intersection not modeled in existing conditions scenario
Y* Intersection does not meet standard in the Build scenario, but meets the "do no worse" criteria as compared to the No Build.
Y** Intersection operations are no worse than No Build, and no mitigation is required.

Exhibit 7-32

PRELIMINARY

Vancouver Intersection Performance Results

PM Peak Hour — 2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way	Eastbound Left	6.2	A	0.08	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[3]	Eastbound Left	6.0	A	0.07	LOS E	Y	-	-
AA	Main St. @ Columbia Way[3]								
01	3rd/4th St. @ Columbia St[3]	Eastbound Left/Right	6.7	A	0.16	LOS E	Y	-	-
BB	SR 14 and Main Street[3]								
CC	SR 14 Park and Ride @ Main Street								
C	3rd/4th St. @ Esther St.	Westbound Left/Right	3.1	A	0.01	LOS E	Y	-	-
02	4th St. @ Columbia St.	Northbound Thru/Right	0.4	A	0.21	LOS E	Y	-	-
03	4th St. @ Washington St.	Eastbound Right	2.7	A	0.01	LOS E	Y	-	-
04	5th St. @ Columbia St.	Southbound Left	9.1	A	0.41	LOS E	Y	90	125 (SBL)
DD	5th St. @ Columbia Park and Ride								
05	5th St. @ Washington St.	*Overall Intersection*	13.4	B	0.54	LOS E	Y	180 210	200 (EBR to SR-14) 225 (SBT)
EE	5th St. @ Main St.								
06	6th St. @ Columbia St.	*Overall Intersection*	13.1	B	0.69	LOS E	Y	-	-
07	6th St. @ Washington St.	*Overall Intersection*	15.2	B	0.57	LOS E	Y	-	-
08	6th St. @ Main St.	*Overall Intersection*	6.5	A	0.60	LOS E	Y	-	-
09	6th St. @ Broadway	Southbound Right	4.7	A	0.22	LOS E	Y	-	-
10	6th St. @ C St.	Northbound Left/Thru	2.9	A	0.30	LOS E	Y	-	-
11	8th St. @ Esther St.	Northbound Left/Thru/Right	14.6	B	0.50	LOS E	Y	-	-
12	8th St. @ Columbia St.	*Overall Intersection*	21.6	C	1.10	LOS E	Y	215	225 (SBLTR)
13	8th St. @ Washington St.	*Overall Intersection*	10.2	B	0.56	LOS E	Y	-	-
14	8th St. @ Main St.	*Overall Intersection*	13.5	B	0.58	LOS E	Y	-	-
15	8th St. @ Broadway	Southbound Left/Thru/Right	8.1	A	0.38	LOS E	Y	-	-
16	8th St. @ C St.	*Overall Intersection*	15.3	B	0.42	LOS E	Y	-	-
17	9th St. @ Esther St.	Eastbound Left/Thru/Right	3.7	A	0.02	LOS E	Y	-	-
18	9th St. @ Columbia St.	Eastbound Left/Thru/Right	13.8	B	0.14	LOS E	Y	-	-
19	9th St. @ Washington St.	Westbound Thru	7.2	A	0.08	LOS E	Y	-	-
20	9th St. @ Main St.	Eastbound Left/Thru/Right	6.0	A	0.06	LOS E	Y	-	-
21	9th St. @ Broadway	Eastbound Left/Right	4.0	A	0.04	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Southbound Left/Thru/Right	6.4	A	0.12	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	*Overall Intersection*	18.4	B	0.59	LOS E	Y	225	225 (NBTR)
24	Evergreen Blvd. @ Washington St.	*Overall Intersection*	13.2	B	0.55	LOS E	Y	-	-
25	Evergreen Blvd. @ Main St.	*Overall Intersection*	13.1	B	0.55	LOS E	Y	-	-
26	Evergreen Blvd. @ Broadway	*Overall Intersection*	10.0	A	0.54	LOS E	Y	-	-
27	Evergreen Blvd. @ C St.	*Overall Intersection*	16.8	B	0.63	LOS E	Y	75	100 (EBL)
28	11th St. @ Esther St.	Northbound Left/Thru/Right	5.8	A	0.11	LOS E	Y	-	-
29	11th St. @ Columbia St.	Eastbound Left/Thru/Right	11.6	B	0.34	LOS E	Y	-	-
30	11th St. @ Washington St.	Eastbound Thru/Right	7.4	A	0.17	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Left/Thru/Right	15.6	C	0.31	LOS E	Y	-	-
32	11th St. @ Broadway	Westbound Left/Thru/Right	6.7	A	0.30	LOS E	Y	-	-
33	11th St. @ C St.	Westbound Right	11.1	B	0.19	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	*Overall Intersection*	> 100	F	0.75	LOS E	N	810 150 75	825 (EBLTR) 225 (NBR) 100 (SBL)
35	Mill Plain Blvd. @ Washington St.	*Overall Intersection*	54.6	D	0.57	LOS E	Y	215	225 (EBTR)
36	Mill Plain Blvd. @ Main St.	*Overall Intersection*	78.5	E	0.79	LOS E	Y	210 765 70	225 (EBT) 775 (NBTR) 100 (SBL)
37	Mill Plain Blvd. @ Broadway	*Overall Intersection*	39.9	D	0.77	LOS E	Y	210 70	225 (EBT) 100 (SBL)
38	Mill Plain Blvd. @ C St.	*Overall Intersection*	51.9	D	0.78	LOS E	Y	205	225 (EBT)
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	94.4	F	0.87	LOS E	N	795 350 275 610	800 (EBT) 525 (EBR) 400 (WBL) 625 (WBT)
FF	Mill Plain Blvd. @ I-5 SPUI								
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	36.5	D	0.97	LOS E	Y	450 75	450 (WBT) 150 (WBR)
41	15th St. @ Columbia St.	*Overall Intersection*	8.3	A	0.75	LOS E	Y	-	-
42	15th St. @ Washington St.	*Overall Intersection*	10.1	B	0.43	LOS E	Y	-	-
GG	15th St. @ Mill District Park & Ride								
43	15th St. @ Main St.	*Overall Intersection*	8.8	A	0.79	LOS E	Y	-	-
44	15th St. @ Broadway	*Overall Intersection*	8.3	A	0.77	LOS E	Y	70 25	100 (NBL) 75 (SBR)

PM Peak Hour — 2030 LPA with Highway Phasing (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way	Southbound Left/Right	8.7	A	0.42	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[3]	Southbound Left/Right	2.2	A	0.40	LOS E	Y	-	-
AA	Main St. @ Columbia Way[3]	Eastbound Left/Thru	1.2	A	0.20	LOS E	Y	-	-
01	3rd/4th St. @ Columbia St[3]	Southbound Left/Thru/Right	4.9	A	0.73	LOS E	Y	-	-
BB	SR 14 and Main Street[3]	Eastbound Left/Thru/Right	14.1	B	0.79	LOS E	Y	-	-
CC	SR 14 Park and Ride @ Main Street	Eastbound Left/Right	8.2	A	0.03	LOS E	Y	-	-
C	3rd/4th St. @ Esther St.	Westbound Left/Right	6.0	A	0.13	LOS E	Y	-	-
02	4th St. @ Columbia St.								
03	4th St. @ Washington St.								
04	5th St. @ Columbia St.	Westbound Left/Right	3.6	A	0.04	LOS E	Y	-	-
DD	5th St. @ Columbia Park and Ride	Northbound Left/Right	3.9	A	0.23	LOS E	Y	-	-
05	5th St. @ Washington St.	*Overall Intersection*	9.7	A	0.32	LOS E	Y	85	100 (EBTR)
EE	5th St. @ Main St.	*Overall Intersection*	12.7	B	0.60	LOS E	Y	175	175 (SBTR)
06	6th St. @ Columbia St.	*Overall Intersection*	22.2	C	0.85	LOS E	Y	200 205 75	200 (WBLTR) 225 (NBTR) 75 (SBL)
07	6th St. @ Washington St.	*Overall Intersection*	4.7	A	0.33	LOS E	Y	-	-
08	6th St. @ Main St.	*Overall Intersection*	14.4	B	0.70	LOS E	Y	165 220	175 (NBLTR) 225 (SBLTR)
09	6th St. @ Broadway	Eastbound Left/Thru	2.0	A	0.21	LOS E	Y	-	-
10	6th St. @ C St.	Southbound Thru	5.8	A	0.84	LOS E	Y	-	-
11	8th St. @ Esther St.	Northbound Left/Thru/Right	14.3	B	0.35	LOS E	Y	-	-
12	8th St. @ Columbia St.	*Overall Intersection*	30.2	C	0.75	LOS E	Y	150 75 75	200 (EBL) 125 (WBL) 125 (SBL)
13	8th St. @ Washington St.	*Overall Intersection*	12.8	B	0.56	LOS E	Y	-	-
14	8th St. @ Main St.	*Overall Intersection*	24.2	C	0.74	LOS E	Y	75 200 75 215 215	125 (EBL) 200 (EBTR) 125 (WBL) 225 (NBLTR) 225 (SBLTR)
15	8th St. @ Broadway	*Overall Intersection*	23.0	C	0.64	LOS E	Y	-	-
16	8th St. @ C St.	*Overall Intersection*	12.3	B	0.70	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	5.1	A	0.06	LOS E	Y	-	-
18	9th St. @ Columbia St.	Eastbound Left/Thru/Right	15.9	C	0.34	LOS E	Y	-	-
19	9th St. @ Washington St.	*Overall Intersection*	11.2	B	0.40	LOS E	Y	-	-
20	9th St. @ Main St.	Eastbound Left/Thru/Right	18.0	C	0.36	LOS E	Y	-	-
21	9th St. @ Broadway	*Overall Intersection*	26.7	C	0.37	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	9.7	A	0.22	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	*Overall Intersection*	28.8	C	0.71	LOS E	Y	100 220 205	125 (EBL) 225 (NBTR) 225 (SBTR)
24	Evergreen Blvd. @ Washington St.	*Overall Intersection*	19.6	B	0.61	LOS E	Y	225 210	225 (EBTR) 225 (SBLTR)
25	Evergreen Blvd. @ Main St.	*Overall Intersection*	29.3	C	0.74	LOS E	Y	75 210 75 215	125 (EBL) 300 (EBTR) 125 (WBL) 225 (NBLTR)
26	Evergreen Blvd. @ Broadway	*Overall Intersection*	19.3	B	0.66	LOS E	Y	100 210 220	150 (EBL) 225 (EBTR) 225 (NBLTR)
27	Evergreen Blvd. @ C St.	*Overall Intersection*	28.2	C	0.77	LOS E	Y	75 200 150 100 210	150 (EBL) 200 (EBTR) 175 (WBL) 125 (SBL) 225 (SBTR)
28	11th St. @ Esther St.	Northbound Left/Thru/Right	6.2	A	0.10	LOS E	Y	-	-
29	11th St. @ Columbia St.	Eastbound Left/Thru/Right	12.1	B	0.38	LOS E	Y	-	-
30	11th St. @ Washington St.	*Overall Intersection*	11.5	B	0.44	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Left/Thru/Right	12.0	B	0.50	LOS E	Y	-	-
32	11th St. @ Broadway	*Overall Intersection*	11.7	B	0.47	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru/Right	21.9	C	0.24	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	*Overall Intersection*	> 100	F	1.10	LOS E	Y**	810 200 150	825 (EBLTR) 200 (NBT) 175 (NBR)
35	Mill Plain Blvd. @ Washington St.	*Overall Intersection*	46.6	D	0.61	LOS E	Y	235	250 (EBTR)
36	Mill Plain Blvd. @ Main St.	*Overall Intersection*	37.9	D	0.71	LOS E	Y	205 100 70	225 (EBLTR) 150 (NBR) 150 (SBL)
37	Mill Plain Blvd. @ Broadway	*Overall Intersection*	44.0	D	0.71	LOS E	Y	210 210	225 (EBLT) 225 (NBTR)
38	Mill Plain Blvd. @ C St.	*Overall Intersection*	81.4	F	1.35	LOS E	N	200 215 75 195	200 (EBLTR) 225 (NBTR) 100 (SBL) 200 (SBT)
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps								
FF	Mill Plain Blvd. @ I-5 SPUI	*Overall Intersection*	63.3	E	0.99	LOS E	Y	700 700 740 200	800 (EBL) 850 (EBT) 750 (WBT) 275 (WBR)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps								
41	15th St. @ Columbia St.	*Overall Intersection*	12.0	B	1.10	LOS E	Y	-	-
42	15th St. @ Washington St.	*Overall Intersection*	6.4	A	0.52	LOS E	Y	60	75 (WBT)
GG	15th St. @ Mill District Park & Ride	Westbound Thru/Right	0.9	A	0.34	LOS E	Y	-	-
43	15th St. @ Main St.	*Overall Intersection*	9.5	A	0.71	LOS E	Y	70	75 (NBL)
44	15th St. @ Broadway	*Overall Intersection*	6.5	A	0.54	LOS E	Y	-	-

PM Peak Hour — 2030 LPA (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
A	Esther St. @ Columbia Way	Southbound Left/Right	8.7	8.7	A	0.42	LOS E	Y	-	-
B	Columbia St. @ Columbia Way[3]	Southbound Left/Right	2.2	2.2	A	0.40	LOS E	Y	-	-
AA	Main St. @ Columbia Way[3]	Eastbound Left/Thru	1.2	1.2	A	0.20	LOS E	Y	-	-
01	3rd/4th St. @ Columbia St[3]	Southbound Left/Thru/Right	4.9	4.9	A	0.73	LOS E	Y	-	-
BB	SR 14 and Main Street[3]	Eastbound Left/Thru/Right	14.1	14.1	B	0.79	LOS E	Y	-	-
CC	SR 14 Park and Ride @ Main Street	Eastbound Left/Right	8.2	8.2	A	0.03	LOS E	Y	-	-
C	3rd/4th St. @ Esther St.	Westbound Left/Right	6.0	6.0	A	0.13	LOS E	Y	-	-
02	4th St. @ Columbia St.									
03	4th St. @ Washington St.									
04	5th St. @ Columbia St.	Westbound Left/Right	3.6	3.6	A	0.04	LOS E	Y	-	-
DD	5th St. @ Columbia Park and Ride	Northbound Left/Right	3.9	3.9	A	0.23	LOS E	Y	-	-
05	5th St. @ Washington St.	*Overall Intersection*	9.7	9.7	A	0.32	LOS E	Y	85	100 (EBTR)
EE	5th St. @ Main St.	*Overall Intersection*	12.7	12.7	B	0.60	LOS E	Y	175	175 (SBTR)
06	6th St. @ Columbia St.	*Overall Intersection*	22.2	22.2	C	0.85	LOS E	Y	200 205 75	200 (WBLTR) 225 (NBTR) 75 (SBL)
07	6th St. @ Washington St.	*Overall Intersection*	4.7	4.7	A	0.33	LOS E	Y	-	-
08	6th St. @ Main St.	*Overall Intersection*	14.4	14.4	B	0.70	LOS E	Y	165 220	175 (NBLTR) 225 (SBLTR)
09	6th St. @ Broadway	Eastbound Left/Thru	2.0	2.0	A	0.21	LOS E	Y	-	-
10	6th St. @ C St.	Southbound Thru	5.8	5.8	A	0.84	LOS E	Y	-	-
11	8th St. @ Esther St.	Northbound Left/Thru/Right	14.3	14.3	B	0.35	LOS E	Y	-	-
12	8th St. @ Columbia St.	*Overall Intersection*	30.2	30.2	C	0.75	LOS E	Y	150 75 75	200 (EBL) 125 (WBL) 125 (SBL)
13	8th St. @ Washington St.	*Overall Intersection*	12.8	12.8	B	0.56	LOS E	Y	-	-
14	8th St. @ Main St.	*Overall Intersection*	24.2	24.2	C	0.74	LOS E	Y	75 200 75 215 215	125 (EBL) 200 (EBTR) 125 (WBL) 225 (NBLTR) 225 (SBLTR)
15	8th St. @ Broadway	*Overall Intersection*	23.0	23.0	C	0.64	LOS E	Y	-	-
16	8th St. @ C St.	*Overall Intersection*	12.3	12.3	B	0.70	LOS E	Y	-	-
17	9th St. @ Esther St.	Westbound Left/Thru/Right	5.1	5.1	A	0.06	LOS E	Y	-	-
18	9th St. @ Columbia St.	Eastbound Left/Thru/Right	15.9	15.9	C	0.34	LOS E	Y	-	-
19	9th St. @ Washington St.	*Overall Intersection*	11.2	11.2	B	0.40	LOS E	Y	-	-
20	9th St. @ Main St.	Eastbound Left/Thru/Right	18.0	18.0	C	0.36	LOS E	Y	-	-
21	9th St. @ Broadway	*Overall Intersection*	26.7	26.7	C	0.37	LOS E	Y	-	-
22	Evergreen Blvd. @ Esther St.	Northbound Left/Thru/Right	9.7	9.7	A	0.22	LOS E	Y	-	-
23	Evergreen Blvd. @ Columbia St.	*Overall Intersection*	28.8	28.8	C	0.71	LOS E	Y	100 220 205	125 (EBL) 225 (NBTR) 225 (SBTR)
24	Evergreen Blvd. @ Washington St.	*Overall Intersection*	19.6	19.6	B	0.61	LOS E	Y	225 210	225 (EBTR) 225 (SBLTR)
25	Evergreen Blvd. @ Main St.	*Overall Intersection*	29.3	29.3	C	0.74	LOS E	Y	75 210 75 215	125 (EBL) 300 (EBTR) 125 (WBL) 225 (NBLTR)
26	Evergreen Blvd. @ Broadway	*Overall Intersection*	19.3	19.3	B	0.66	LOS E	Y	100 210 220	150 (EBL) 225 (EBTR) 225 (NBLTR)
27	Evergreen Blvd. @ C St.	*Overall Intersection*	28.2	28.2	C	0.77	LOS E	Y	75 200 150 100 210	150 (EBL) 200 (EBTR) 175 (WBL) 125 (SBL) 225 (SBTR)
28	11th St. @ Esther St.	Northbound Left/Thru/Right	6.2	6.2	A	0.10	LOS E	Y	-	-
29	11th St. @ Columbia St.	Eastbound Left/Thru/Right	12.1	12.1	B	0.38	LOS E	Y	-	-
30	11th St. @ Washington St.	*Overall Intersection*	11.5	11.5	B	0.44	LOS E	Y	-	-
31	11th St. @ Main St.	Eastbound Left/Thru/Right	12.0	12.0	B	0.50	LOS E	Y	-	-
32	11th St. @ Broadway	*Overall Intersection*	11.7	11.7	B	0.47	LOS E	Y	-	-
33	11th St. @ C St.	Eastbound Left/Thru/Right	21.9	21.9	C	0.24	LOS E	Y	-	-
34	Mill Plain Blvd. @ Columbia St.	*Overall Intersection*	128.0	> 100	F	1.10	LOS E	Y**	810 200 150	825 (EBLTR) 200 (NBT) 175 (NBR)
35	Mill Plain Blvd. @ Washington St.	*Overall Intersection*	46.6	46.6	D	0.61	LOS E	Y	235	250 (EBTR)
36	Mill Plain Blvd. @ Main St.	*Overall Intersection*	37.9	37.9	D	0.71	LOS E	Y	205 100 70	225 (EBLTR) 150 (NBR) 150 (SBL)
37	Mill Plain Blvd. @ Broadway	*Overall Intersection*	44.0	44.0	D	0.71	LOS E	Y	210 210	225 (EBLT) 225 (NBTR)
38	Mill Plain Blvd. @ C St.	*Overall Intersection*	81.4	81.4	F	1.35	LOS E	N	200 215 75 195	200 (EBLTR) 225 (NBTR) 100 (SBL) 200 (SBT)
39	Mill Plain Blvd. @ I-5 SB On-/Off-Ramps									
FF	Mill Plain Blvd. @ I-5 SPUI	*Overall Intersection*	63.3	63.3	E	0.99	LOS E	Y	700 700 740 200	800 (EBL) 850 (EBT) 750 (WBT) 275 (WBR)
40	Mill Plain Blvd. @ I-5 NB On-/Off-Ramps									
41	15th St. @ Columbia St.	*Overall Intersection*	12.0	12.0	B	1.10	LOS E	Y	-	-
42	15th St. @ Washington St.	*Overall Intersection*	6.4	6.4	A	0.52	LOS E	Y	60	75 (WBT)
GG	15th St. @ Mill District Park & Ride	Westbound Thru/Right	0.9	0.9	A	0.34	LOS E	Y	-	-
43	15th St. @ Main St.	*Overall Intersection*	9.5	9.5	A	0.71	LOS E	Y	70	75 (NBL)
44	15th St. @ Broadway	*Overall Intersection*	6.5	6.5	A	0.54	LOS E	Y	-	-

Continued on next page

Exhibit 7-32

PRELIMINARY

Vancouver Intersection Performance Results

PM Peak Hour — 2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
45	15th St. @ C St.	*Overall Intersection*	12.1	B	0.50	LOS E	Y	-	-
D	16th St. @ Washington St.	Westbound Left/Thru	6.1	A	0.19	LOS E	Y	-	-
HH	16th St. @ Mill District Park & Ride								
E	16th St. @ Main St.	Eastbound Left/Thru/Right	8.1	A	0.24	LOS E	Y	-	-
F	17th Street & Washington	Westbound Left/Thru	5.6	A	0.06	LOS E	Y	-	-
G	17th Street & Main	Westbound Left/Thru/Right	8.6	A	0.15	LOS E	Y	-	-
H	17th Street & Broadway	Eastbound Left/Thru/Right	7.1	A	0.14	LOS E	Y	-	-
I	17th Street & C Street	Eastbound Left/Thru	6.1	A	0.14	LOS E	Y	-	-
J	17th Street & G Street	Southbound Left/Thru/Right	3.4	A	0.03	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	*Overall Intersection*	12.1	B	0.61	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.	*Overall Intersection*	5.9	A	0.50	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	*Overall Intersection*	15.7	B	0.76	LOS E	Y	-	-
48	McLoughlin Blvd. @ Broadway	*Overall Intersection*	12.0	B	0.50	LOS E	Y	-	-
L	McLoughlin Blvd. @ C St.	*Overall Intersection*	9.0	A	0.30	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.	Northbound Left/Thru/Right	5.8	A	-	LOS E	Y	-	-
II	McLoughlin Blvd. @ Clark College Park & Ride								
JJ	McLoughlin Blvd. @ Marshall CC East								
49	McLoughlin Blvd. @ Fort Vancouver Way	*Overall Intersection*	12.5	B	0.42	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	4.2	A	0.01	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	46.2	E	0.07	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	*Overall Intersection*	23.8	C	0.68	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	*Overall Intersection*	39.5	D	0.78	LOS D	Y	250 495 170 195 75 425 75 75	300 (EBL) 500 (EBTR) 200 (WBL) 200 (WBT) 100 (NBL) 425 (NBT) 125 (NBR) 125 (SBL)
54	4th Plain Blvd. @ Broadway	*Overall Intersection*	22.4	C	0.98	LOS D	Y	195 125	200 (EBTR) 150 (WBL)
55	4th Plain Blvd. @ F St.	*Overall Intersection*	6.6	A	0.54	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	19.8	B	0.82	LOS D	Y	200 555	275 (EBL) 575 (EBT)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	53.7	D	0.85	LOS D	Y	275 850 75 600	375 (EBL) 850 (EBT) 150 (WBR) 625 (NBR)
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	9.1	A	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	*Overall Intersection*	30.6	C	0.65	LOS D	Y	170	250 (EBL)
60	28th St. @ Main St.	Eastbound Left/Thru/Right	6.3	A	0.03	LOS E	Y	-	-
61	28th St. @ Broadway	Northbound Thru/Right	2.3	A	0.30	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	62.4	F	-	LOS E	N	-	-
63	33rd St. @ Main St.	*Overall Intersection*	48.6	D	0.56	LOS D	Y	50 50	100 (EBL) 100 (WBL)
64	39th St. @ Main St.	*Overall Intersection*	> 100	F	0.96	LOS D	N	75 1270 75 215 75 1570 125 360	125 (EBL) 1275 (EBTR) 125 (WBL) 225 (WBTR) 125 (NBL) 1575 (NBTR) 175 (SBL) 375 (SBT)
65	39th St. @ F St.	Northbound Left/Thru/Right	> 100	F	0.33	LOS E	N	215 50 430 305	225 (EBTR) 75 (WBL) 450 (WBTR) 325 (NBLR)
66	39th St. @ H St.	*Overall Intersection*	64.3	E	0.76	LOS D	N	430 135 310	450 (EBTR) 150 (WBTR) 325 (SBLTR)
67	39th St. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	43.7	D	0.76	LOS D	Y	135 55 710 1660	150 (EBT) 100 (EBR) 725 (WBT) 1150 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	> 100	F	0.91	LOS D	N	300 710 790 75	325 (EBL) 725 (EBT) 800 (NBLT) 100 (NBR)
69	WSDOT/40th St. @ Main St.	*Overall Intersection*	45.3	D	0.53	LOS D	Y	360	375 (NBTR)
70	45th St. @ Main St.	*Overall Intersection*	16.5	B	0.51	LOS D	Y	335 25	350 (NBL) 50 (NBR)
71	Hazel Dell @ Main St. (West)	*Overall Intersection*	20.5	C	0.58	LOS D	Y	-	-
72	Ross St. @ Main St.	*Overall Intersection*	13.0	B	0.63	LOS D	Y	60 60	75 (WBL) 75 (WBR)
73	Ross St. @ North Rd.	Southbound Thru/Right	23.0	C	0.32	LOS E	Y	-	-

2030 LPA with Highway Phasing (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
45	15th St. @ C St.	*Overall Intersection*	> 100	F	1.35	LOS E	N	-	-
D	16th St. @ Washington St.	*Overall Intersection*	23.5	C	0.29	LOS E	Y	65	75 (WBLT)
HH	16th St. @ Mill District Park & Ride	Northbound Right	3.9	A	0.15	LOS E	Y	-	-
E	16th St. @ Main St.	*Overall Intersection*	11.2	B	0.61	LOS E	Y	85	100 (EBLTR)
F	17th Street & Washington	*Overall Intersection*	10.4	B	0.26	LOS E	Y	-	-
G	17th Street & Main	*Overall Intersection*	8.3	A	0.35	LOS E	Y	-	-
H	17th Street & Broadway	*Overall Intersection*	8.4	A	0.18	LOS E	Y	-	-
I	17th Street & C Street	*Overall Intersection*	15.0	B	0.23	LOS E	Y	-	-
J	17th Street & G Street	*Overall Intersection*	4.5	A	0.13	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	*Overall Intersection*	19.0	B	0.60	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.	*Overall Intersection*	6.5	A	0.53	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	*Overall Intersection*	14.4	B	0.87	LOS E	Y	200 50	200 (NBLTR) 100 (SBR)
48	McLoughlin Blvd. @ Broadway	*Overall Intersection*	12.9	B	0.61	LOS E	Y	75	125 (EBL)
L	McLoughlin Blvd. @ C St.	*Overall Intersection*	8.5	A	0.45	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.	Southbound Left/Thru/Right	6.5	A	-	LOS E	Y	-	-
II	McLoughlin Blvd. @ Clark College Park & Ride	*Overall Intersection*	8.7	A	0.38	LOS D	Y	-	-
JJ	McLoughlin Blvd. @ Marshall CC East	*Overall Intersection*	8.1	A	0.32	LOS D	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	*Overall Intersection*	15.4	B	0.55	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	4.0	A	0.02	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	9.3	A	0.07	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	*Overall Intersection*	32.8	C	0.64	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	*Overall Intersection*	49.5	D	0.78	LOS D	Y	250 495 170 195 75 75 75	300 (EBL) 500 (EBTR) 225 (WBL) 200 (WBTR) 100 (NBL) 125 (NBR) 125 (SBL)
54	4th Plain Blvd. @ Broadway	*Overall Intersection*	33.9	C	0.73	LOS D	Y	195 195	200 (EBLTR) 200 (SBLTR)
55	4th Plain Blvd. @ F St.	*Overall Intersection*	7.3	A	0.55	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	16.5	B	0.56	LOS D	Y	200	275 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	29.7	C	0.72	LOS D	Y	-	-
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	21.5	C	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	*Overall Intersection*	40.3	D	0.57	LOS D	Y	175	250 (EBL)
60	28th St. @ Main St.	Eastbound Left/Thru/Right	9.5	A	0.10	LOS E	Y	-	-
61	28th St. @ Broadway	Westbound Left	4.6	A	0.03	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	29.7	D	0.00	LOS E	Y	-	-
63	33rd St. @ Main St.	*Overall Intersection*	> 100	F	0.58	LOS D	N	50 770 50 600 1000 75	100 (EBL) 775 (EBTR) 100 (WBL) 600 (WBTR) 1000 (NBT) 100 (SBL)
64	39th St. @ Main St.	*Overall Intersection*	> 100	F	1.06	LOS D	Y**	75 1270 75 215 75 1570 125 360	200 (EBL) 1275 (EBTR) 225 (WBL) 225 (WBTR) 125 (NBL) 1575 (NBTR) 175 (SBL) 375 (SBT)
65	39th St. @ F St.	Westbound Thru/Right	50.4	F	0.60	LOS E	Y*	215 430	225 (EBTR) 450 (WBTR)
66	39th St. @ H St.	*Overall Intersection*	> 100	F	0.80	LOS D	N	430 135 310	450 (EBTR) 150 (WBTR) 325 (SBLTR)
67	39th St. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	65.7	E	0.89	LOS D	N	135 55 730 680	200 (EBT) 125 (EBR) 775 (WBT) 725 (NBR)
68	39th St. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	> 100	F	1.10	LOS D	Y**	300 710 1170 790 75	425 (EBL) 725 (EBT) 1175 (WBTR) 800 (NBLT) 150 (NBR)
69	WSDOT/40th St. @ Main St.	*Overall Intersection*	65.1	E	0.39	LOS D	N	150 1200	200 (SBL) 1200 (SBTR)
70	45th St. @ Main St.	*Overall Intersection*	38.5	D	0.51	LOS D	Y	200 560	225 (EBL) 575 (SBTR)
71	Hazel Dell @ Main St. (West)	*Overall Intersection*	27.7	C	0.63	LOS D	Y	-	-
72	Ross St. @ Main St.	*Overall Intersection*	15.2	B	0.68	LOS D	Y	60 60	100 (WBL) 75 (WBR)
73	Ross St. @ North Rd.	Southbound Thru/Right	42.0	E	0.29	LOS E	Y	-	-

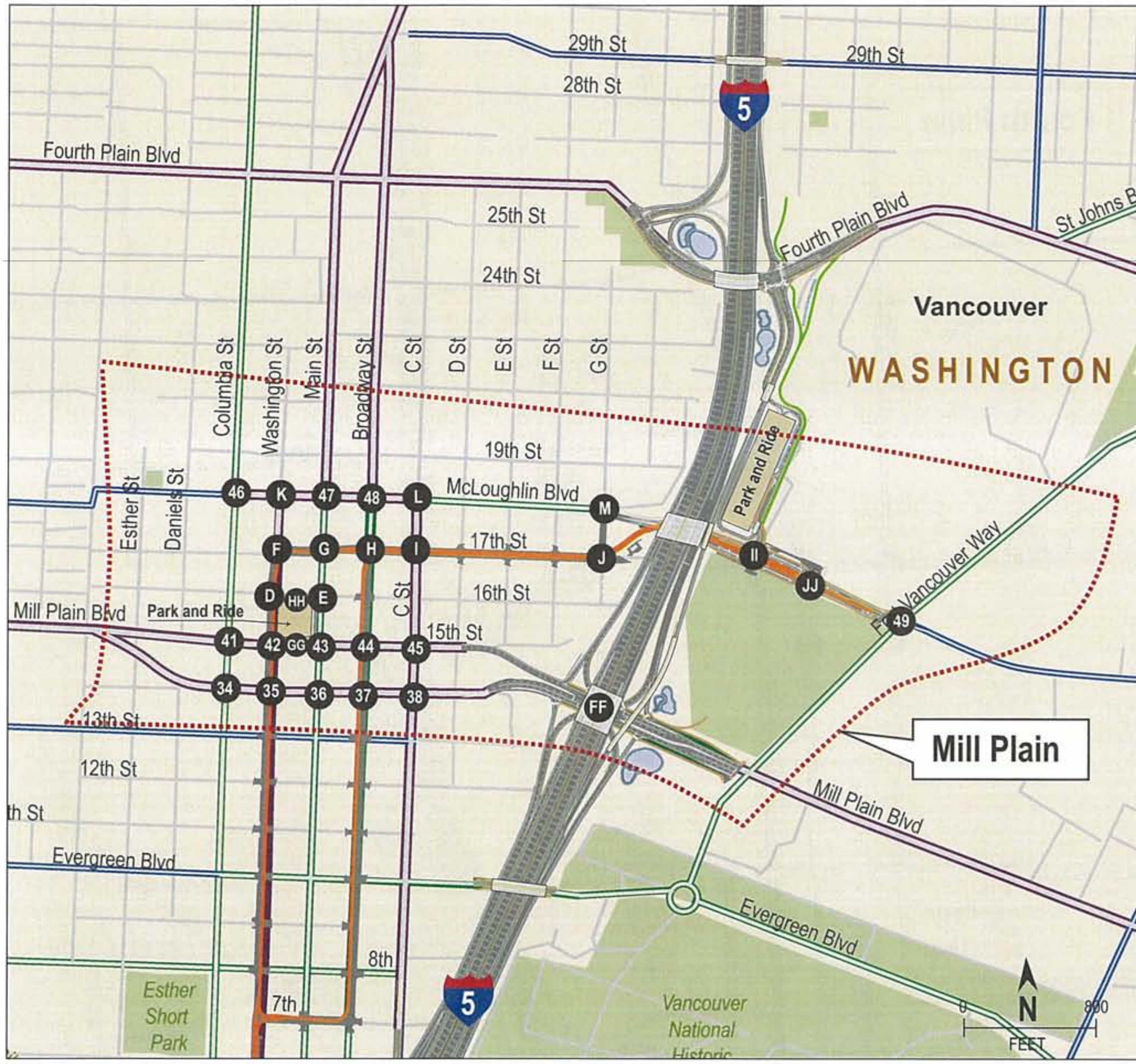
2030 LPA (Broadway-Washington/17th)

#	Intersection	Approach/Movement	Delay (Seconds)	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2]	Meets Standard	Storage Length	95% Queue (ft)
45	15th St. @ C St.	*Overall Intersection*	119.0	> 100	F	1.35	LOS E	N	-	-
D	16th St. @ Washington St.	*Overall Intersection*	23.5	23.5	C	0.29	LOS E	Y	65	75 (WBLT)
HH	16th St. @ Mill District Park & Ride	Northbound Right	3.9	3.9	A	0.15	LOS E	Y	-	-
E	16th St. @ Main St.	*Overall Intersection*	11.2	11.2	B	0.61	LOS E	Y	85	100 (EBLTR)
F	17th Street & Washington	*Overall Intersection*	10.4	10.4	B	0.26	LOS E	Y	-	-
G	17th Street & Main	*Overall Intersection*	8.3	8.3	A	0.35	LOS E	Y	-	-
H	17th Street & Broadway	*Overall Intersection*	8.4	8.4	A	0.18	LOS E	Y	-	-
I	17th Street & C Street	*Overall Intersection*	15.0	15.0	B	0.23	LOS E	Y	-	-
J	17th Street & G Street	*Overall Intersection*	4.5	4.5	A	0.13	LOS E	Y	-	-
46	McLoughlin Blvd. @ Columbia St.	*Overall Intersection*	19.0	19.0	B	0.60	LOS E	Y	-	-
K	McLoughlin Blvd. @ Washington St.	*Overall Intersection*	6.5	6.5	A	0.53	LOS E	Y	-	-
47	McLoughlin Blvd. @ Main St.	*Overall Intersection*	14.4	14.4	B	0.87	LOS E	Y	200 50	200 (NBLTR) 100 (SBR)
48	McLoughlin Blvd. @ Broadway	*Overall Intersection*	12.9	12.9	B	0.61	LOS E	Y	75	125 (EBL)
L	McLoughlin Blvd. @ C St.	*Overall Intersection*	8.5	8.5	A	0.45	LOS E	Y	-	-
M	McLoughlin Blvd. @ G St.	Southbound Left/Thru/Right	6.5	6.5	A	-	LOS E	Y	-	-
II	McLoughlin Blvd. @ Clark College Park & Ride	*Overall Intersection*	8.7	8.7	A	0.38	LOS D	Y	-	-
JJ	McLoughlin Blvd. @ Marshall CC East	*Overall Intersection*	8.1	8.1	A	0.32	LOS D	Y	-	-
49	McLoughlin Blvd. @ Fort Vancouver Way	*Overall Intersection*	15.4	15.4	B	0.55	LOS D	Y	-	-
50	24th St. @ Columbia St.	Eastbound Left/Thru/Right	4.0	4.0	A	0.02	LOS E	Y	-	-
51	24th St. @ Main St.	Eastbound Left/Right	9.3	9.3	A	0.07	LOS E	Y	-	-
52	4th Plain Blvd. @ Columbia St.	*Overall Intersection*	32.8	32.8	C	0.64	LOS D	Y	-	-
53	4th Plain Blvd. @ Main St.	*Overall Intersection*	49.5	49.5	D	0.78	LOS D	Y	250 495 170 195 75 75 75	300 (EBL) 500 (EBTR) 225 (WBL) 200 (WBTR) 100 (NBL) 125 (NBR) 125 (SBL)
54	4th Plain Blvd. @ Broadway	*Overall Intersection*	33.9	33.9	C	0.73	LOS D	Y	195 195	200 (EBLTR) 200 (SBLTR)
55	4th Plain Blvd. @ F St.	*Overall Intersection*	7.3	7.3	A	0.55	LOS D	Y	150	150 (EBT)
56	4th Plain Blvd. @ I-5 SB On-/Off-Ramps	*Overall Intersection*	16.5	16.5	B	0.56	LOS D	Y	200	275 (EBL)
57	4th Plain Blvd. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	29.7	29.7	C	0.72	LOS D	Y	-	-
58	4th Plain Blvd. @ Post Cemetery	Eastbound Left	21.5	21.5	C	0.01	LOS E	Y	-	-
59	4th Plain Blvd. @ St. Johns Blvd.	*Overall Intersection*	40.3	40.3	D	0.57	LOS D	Y	175	250 (EBL)
60	28th St. @ Main St.	Eastbound Left/Thru/Right	9.5	9.5	A	0.10	LOS E	Y	-	-
61	28th St. @ Broadway	Westbound Left	4.6	4.6	A	0.03	LOS E	Y	-	-
62	29th St. @ Main St./Broadway	Westbound Left/Thru/Right	29.7	29.7	D	0.00	LOS E	Y	-	-
63	33rd St. @ Main St.	*Overall Intersection*	14.5	14.5	B	0.58	LOS D	Y	50 50	75 (EBL) 75 (WBL)
64	39th St. @ Main St.	*Overall Intersection*	283.4	> 100	F	1.03	LOS D	Y**	75 1270 175 215 75 125	200 (EBL) 1275 (EBTR) 200 (WBL) 225 (WBTR) 125 (NBL) 200 (SBL)
65	39th St. @ F St.	Westbound Thru/Right	50.6	50.6	F	0.59	LOS E	Y*	430	450 (WBTR)
66	39th St. @ H St.	*Overall Intersection*	30.8	30.8	C	0.76	LOS D	Y	435 135	450 (EBTR) 150 (WBTR)
67	39th St. @ I-5 SB On-/Off-Ramps	Westbound Thru	71.0	71.0	F	0.63	LOS E	N	55 730	100 (EBR) 750 (WBT)
68	39th St. @ I-5 NB On-/Off-Ramps	*Overall Intersection*	401.4	> 100	F	0.65	LOS D	Y**	1175 790 75	1175 (WBT) 800 (NBL) 150 (NBR)
69	WSDOT/40th St. @ Main St.	*Overall Intersection*	4.2	4.2	A	0.41	LOS D	Y	-	-
70	45th St. @ Main St.	*Overall Intersection*	11.6	11.6	B	0.51	LOS D	Y	-	-
71	Hazel Dell @ Main St. (West)	*Overall Intersection*	18.8	18.8	B	0.63	LOS D	Y	-	-
72	Ross St. @ Main St.	*Overall Intersection*	15.2	15.2	B	0.68	LOS D	Y	60 60	100 (WBL) 75 (WBR)
73	Ross St. @ North Rd.	Southbound Thru/Right	47.8	47.8	E	0.29	LOS E	Y	-	-

Delay / LOS affected by freeway congestion
Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for overall intersections (signalized and unsignalized). The V/C is used for the identified movement(s) at unsignalized intersections.
Note 2 The 2003 Vancouver Concurrency Administration Manual designates an acceptable LOS standard of LOS E for downtown and LOS D for all other intersections.
Note 3 2030 LPA and LPA Phase I Roundabout intersection operations taken from VISSIM analysis
* Intersection not modeled in existing conditions scenario
Y* Intersection does not meet standard in the Build scenario, but meets the "do no worse" criteria as compared to the No Build.
Y** Intersection operations are no worse than No Build, and no mitigation is required.

Exhibit 7-33 PRELIMINARY



Principal Arterial
Minor Arterial
Collector
Intersection Analyzed
Sub-areas
New Bridge
Existing Bridge
Roadway Improvements
Tunnel
New Transit Alignment
New Bicycle/Pedestrian Route
Existing MAX Yellow Line/Station
Parks
Ponds
Sidewalks

LPA
Mill Plain Interchange Sub-area

Columbia River CROSSING

Principal Arterial
Minor Arterial
Collector
Intersection Analyzed
Sub-areas
New Bridge
Existing Bridge
Roadway Improvements
Tunnel
New Transit Alignment
New Bicycle/Pedestrian Route
Existing MAX Yellow Line/Station
Parks
Ponds
Sidewalks

LPA
Fourth Plain Interchange Sub-area

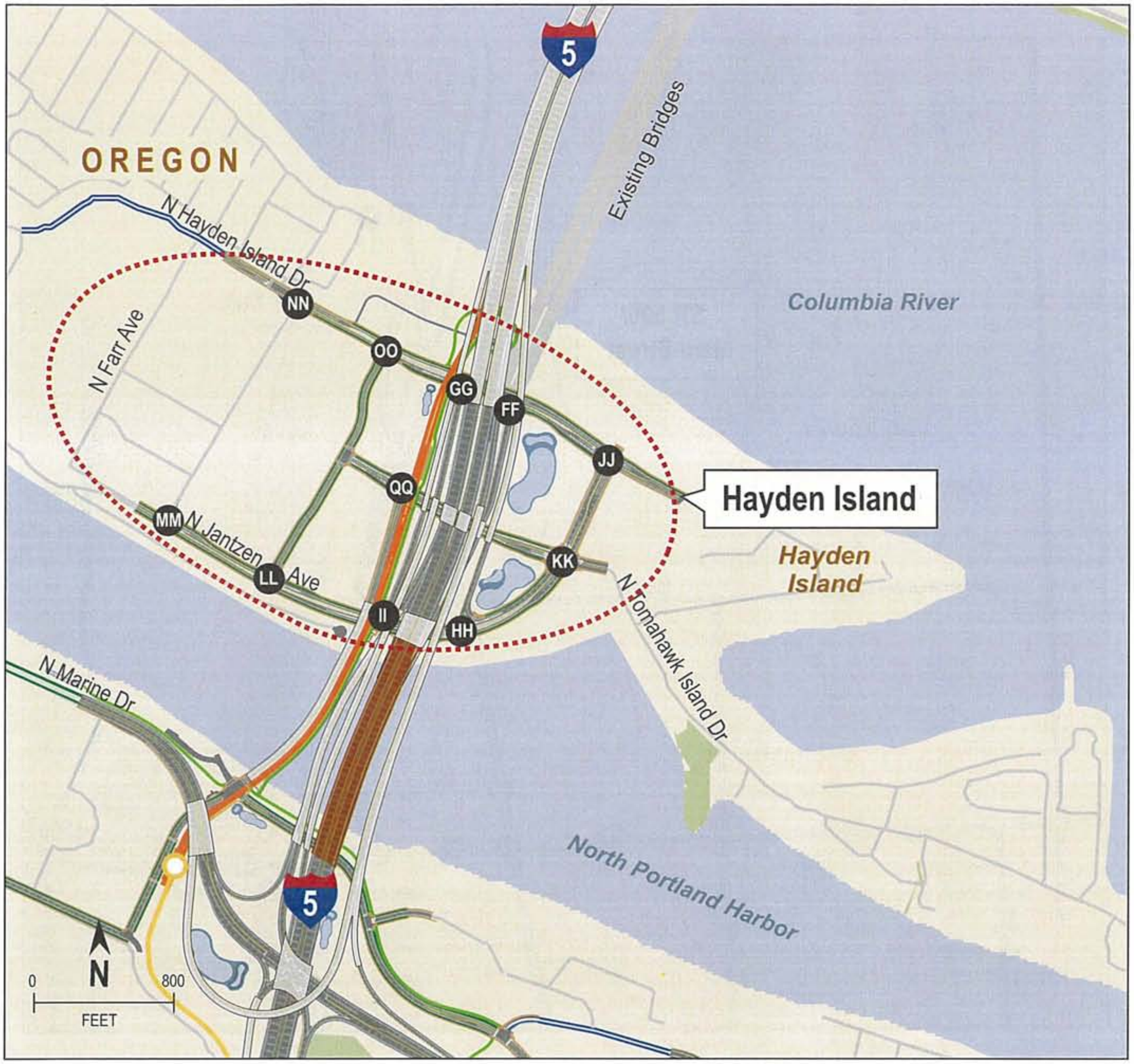
Columbia River CROSSING

Exhibit 7-35

LPA
SR 500/Main Street
Interchange Sub-area

Columbia River CROSSING

Exhibit 7-36 PRELIMINARY



Principal Arterial	New Bridge	New Bicycle/Pedestrian Route
Minor Arterial	Existing Bridge	Existing MAX Yellow Line/Station
Collector	Roadway Improvements	Parks
Intersection Analyzed	Tunnel	Ponds
Sub-areas	New Transit Alignment	Sidewalks

LPA
Hayden Island Interchange Sub-area

Columbia River CROSSING

Exhibit 7-37

PRELIMINARY

Portland Intersection Performance Results

AM Peak Hour — 2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	47.9	F	0.53	LOS D	N	125	250 (WBL)
02	Going and Interstate	Overall Intersection	52.9	D	0.89	LOS D	Y	125	275 (WBL)
								125	150 (NBL)
								305	450 (EBL)
03	Alberta and Interstate	Overall Intersection	27.5	C	0.73	LOS D	Y	100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	46.1	D	0.78	0.85	Y	75	125 (WBL)
								175	175 (NBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	53.9	D	0.43	0.85	Y	75	100 (EBL)
06	Alberta and MLK Jr	Overall Intersection	39.8	D	0.83	LOS D	Y	75	125 (WBR)
								100	150 (NBL)
								100	125 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	20.6	C	0.62	LOS D	Y	100	125 (WBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	16.5	B	0.51	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	12.6	B	0.44	0.85	Y	-	-
10	Rosa Parks and MLK Jr	Overall Intersection	14.7	B	0.76	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.90	0.99	Y	150	325 (WBL)
								225	275 (NBL)
								150	275 (EBL)
								1155	1175 (EBTR)
								555	1100 (WBTR)
12	Lombard and I-5 SB On-Ramps	Westbound Thru	12.9	B	0.42	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	18.8	C	0.57	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.88	0.99	Y	100	175 (EBL)
								100	175 (WBL)
								100	200 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	Overall Intersection	26.7	C	0.69	LOS D	Y	75	125 (EBR)
								50	125 (NBL)
								150	150 (NBT)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	14.9	B	0.63	0.95	Y	150	200 (WBR)
17	Columbia Blvd and MLK Jr	Overall Intersection	37.2	D	0.89	0.99	Y	100	200 (NBL)
								225	250 (SBL)
18	Victory and Expo Road	Overall Intersection	2.9	A	0.22	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On-Ramp	Westbound Left/Thru	1.1	A	0.21	0.85	Y	-	-
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	5.8	A	0.13	0.85	Y	-	-
21	Union Ct and I-5 NB Off-Ramp	Eastbound Left	8.4	A	0.28	0.85	Y	-	-
22	Union Ct/Marine Way and Vancouver Way	Overall Intersection	6.4	A	0.46	LOS E	Y	-	-
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	> 100	F	0.83	0.85	Y	200	2075 (NBL)
								275	350 (SBL)
24	Center Ave and I-5 SB On-/Off Ramps	Overall Intersection	11.2	B	0.35	0.85	Y	-	-
25	Hayden Island Dr and Hayden Island Dr South	Overall Intersection	9.5	A	0.32	0.85	Y	-	-
AA	Vancouver Way and MLK Jr ramps								
BB	Vancouver Way and new underpass								
CC	Union Ct and new underpass								
DD	Union Ct and MLK ramps								
EE	Connector Road and Marine Drive								
FF	Hayden Island Northbound Off-Ramp								
GG	Hayden Island Southbound On-Ramp								
HH	Hayden Island Northbound On-Ramp								
II	Hayden Island Southbound Off-Ramp								
JJ	Hayden Island Drive and Jantzen Drive								
KK	Tomahawk Island Drive and Jantzen Drive								
LL	Jantzen Ave and [illegible]								
MM	Jantzen Ave and Main Street								
NN	Hayden Island Drive and Main Street								
OO	Hayden Island Drive and [illegible]								
PP	Local Bridge and Little Marine Drive								
QQ	Local Bridge and Tomahawk Is Drive								

2030 LPA Option A with Highway Phasing

#	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,4,5,6]	Meets Standard	Storage Length	95% Queue (ft)
01	Overall Intersection	58.7	E	0.92	LOS D	Y*	125	250 (WBL)
02	Overall Intersection	78.4	E	0.88	LOS D	N	355	550 (EBL)
							125	300 (WBL)
							175	300 (NBL)
03	Overall Intersection	25.3	C	0.79	LOS D	Y	100	150 (SBL)
04	Overall Intersection	22.6	C	0.68	0.85	Y	75	125 (WBL)
							175	175 (NBT)
05	Overall Intersection	34.5	C	0.41	0.85	Y	75	125 (EBL)
06	Overall Intersection	34.6	C	0.87	LOS D	Y	75	150 (WBR)
							100	150 (NBL)
							100	175 (SBL)
07	Overall Intersection	20.1	C	0.65	LOS D	Y	-	-
08	Overall Intersection	17.8	B	0.49	0.85	Y	-	-
09	Overall Intersection	13.2	B	0.44	0.85	Y	-	-
10	Overall Intersection	15.1	B	0.71	LOS D	Y	100	125 (NBL)
11	Overall Intersection	> 100	F	0.77	0.99	Y	150	325 (WBL)
							555	625 (WBTR)
							225	400 (NBL)
12	Westbound Thru	4.3	A	0.70	0.85	Y	-	-
13	Northbound Right	7.1	A	0.59	0.85	Y	-	-
14	Overall Intersection	> 100	F	0.85	0.99	Y	100	200 (EBL)
							100	200 (WBL)
							100	200 (NBL)
							150	300 (SBL)
15	Overall Intersection	23.8	C	0.69	LOS D	Y	75	125 (EBR)
							50	125 (NBL)
							150	150 (NBT)
16	Overall Intersection	13.8	B	0.54	0.85	Y	-	-
17	Overall Intersection	33.1	C	0.72	0.99	Y	100	225 (NBL)
							225	300 (SBL)
18	Overall Intersection	2.6	A	0.20	LOS E	Y	-	-
19	Westbound Left/Thru	1.1	A	0.10	0.85	Y	-	-
20	Overall Intersection	5.6	A	0.28	0.85	Y	-	-
23	Overall Intersection	15.8	B	0.47	0.75	Y	-	-
AA	Overall Intersection	18.7	B	0.61	0.75	Y	-	-
BB	Overall Intersection	14.9	B	0.62	LOS D	Y	-	-
CC	Eastbound Left/Right	5.4	A	0.03	LOS E	Y	-	-
DD	Westbound Right	3.7	A	0.41	0.75	Y	-	-
EE	Southbound Left/Right	8.9	A	0.67	LOS E	Y	-	-
FF	Overall Intersection	13.4	B	0.32	0.75	Y	-	-
GG	Overall Intersection	8.4	A	0.27	0.75	Y	-	-
HH	Overall Intersection	7.2	A	0.28	0.75	Y	-	-
II	Overall Intersection	2.6	A	0.35	0.75	Y	-	-
JJ	Overall Intersection	11.2	B	0.35	0.85	Y	-	-
KK	Overall Intersection	18.5	B	0.57	0.85	Y	-	-
LL	Southbound Left/Right	9.4	A	0.02	0.85	Y	-	-
MM	Overall Intersection	12.0	B	0.43	0.85	Y	-	-
NN	Overall Intersection	7.8	A	0.38	0.85	Y	-	-
OO	Northbound Right	3.8	A	0.06	0.85	Y	-	-
PP	Overall Intersection	4.4	A	0.32	LOS D	Y	-	-
QQ	Overall Intersection	3.4	A	0.21	LOS D	Y	-	-

2030 LPA Option A

#	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,4,5,6]	Meets Standard	Storage Length	95% Queue (ft)
01	Overall Intersection	58.7	E	0.92	LOS D	Y*	125	250 (WBL)
02	Overall Intersection	78.4	E	0.88	LOS D	N	355	550 (EBL)
							125	300 (WBL)
							175	300 (NBL)
03	Overall Intersection	25.3	C	0.79	LOS D	Y	100	150 (SBL)
04	Overall Intersection	22.9	C	0.68	0.85	Y	75	125 (WBL)
							175	175 (NBT)
05	Overall Intersection	34.5	C	0.41	0.85	Y	75	125 (EBL)
06	Overall Intersection	34.6	C	0.87	LOS D	Y	75	150 (WBR)
							100	150 (NBL)
							100	175 (SBL)
07	Overall Intersection	20.1	C	0.65	LOS D	Y	-	-
08	Overall Intersection	17.8	B	0.49	0.85	Y	-	-
09	Overall Intersection	13.2	B	0.44	0.85	Y	-	-
10	Overall Intersection	15.1	B	0.71	LOS D	Y	100	125 (NBL)
11	Overall Intersection	> 100	F	0.77	0.99	Y	150	325 (WBL)
							555	625 (WBTR)
							225	400 (NBL)
12	Westbound Thru	4.3	A	0.70	0.85	Y	-	-
13	Northbound Right	7.1	A	0.59	0.85	Y	-	-
14	Overall Intersection	> 100	F	0.85	0.99	Y	100	200 (EBL)
							100	200 (WBL)
							100	200 (NBL)
							150	300 (SBL)
15	Overall Intersection	23.8	C	0.69	LOS D	Y	75	125 (EBR)
							50	125 (NBL)
							150	150 (NBT)
16	Overall Intersection	13.8	B	0.54	0.85	Y	-	-
17	Overall Intersection	33.1	C	0.72	0.99	Y	100	225 (NBL)
							225	300 (SBL)
18	Overall Intersection	2.6	A	0.20	LOS E	Y	-	-
19	Westbound Left/Thru	1.1	A	0.10	0.85	Y	-	-
20	Overall Intersection	5.6	A	0.28	0.85	Y	-	-
23	Overall Intersection	10.2	B	0.37	0.75	Y	-	-
AA	Overall Intersection	12.1	B	0.61	0.75	Y	-	-
BB	Overall Intersection	14.8	B	0.62	LOS D	Y	-	-
CC	Eastbound Left/Right	4.9	A	0.03	LOS E	Y	-	-
DD	Westbound Right	3.4	A	0.41	0.75	Y	-	-
EE	Southbound Left/Right	9.7	A	0.67	LOS E	Y	-	-
FF	Overall Intersection	12.5	B	0.32	0.75	Y	-	-
GG	Overall Intersection	5.9	A	0.27	0.75	Y	-	-
HH	Overall Intersection	14.4	B	0.26	0.75	Y	-	-
II	Overall Intersection	4.3	A	0.35	0.75	Y	-	-
JJ	Overall Intersection	10.8	B	0.34	0.85	Y	-	-
KK	Overall Intersection	16.3	B	0.57	0.85	Y	-	-
LL	Southbound Left/Right	7.5	A	0.02	0.85	Y	-	-
MM	Overall Intersection	8.7	A	0.43	0.85	Y	-	-
NN	Overall Intersection	7.5	A	0.38	0.85	Y	-	-
OO	Northbound Right	4.8	A	0.08	0.85	Y	-	-
PP	Overall Intersection	4.4	A	0.32	LOS D	Y	-	-
QQ	Overall Intersection	2.6	A	0.21	LOS D	Y	-	-

2030 LPA Option B with Highway Phasing

#	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,4,5,6]	Meets Standard	Storage Length	95% Queue (ft)
01	Overall Intersection	58.7	E	0.92	LOS D	Y*	125	250 (WBL)
02	Overall Intersection	79.4	E	0.88	LOS D	N	355	550 (EBL)
							125	300 (WBL)
							175	300 (NBL)
03	Overall Intersection	25.3	C	0.75	LOS D	Y	100	150 (SBL)
04	Overall Intersection	22.6	C	0.68	0.85	Y	75	125 (WBL)
							175	175 (NBT)
05	Overall Intersection	34.5	C	0.41	0.85	Y	75	125 (EBL)
06	Overall Intersection	34.6	C	0.87	LOS D	Y	75	150 (WBR)
							100	150 (NBL)
							100	175 (SBL)
07	Overall Intersection	20.1	C	0.65	LOS D	Y	-	-
08	Overall Intersection	17.8	B	0.49	0.85	Y	-	-
09	Overall Intersection	13.2	B	0.44	0.85	Y	-	-
10	Overall Intersection	15.1	B	0.71	LOS D	Y	100	125 (NBL)
11	Overall Intersection	> 100	F	0.77	0.99	Y	150	325 (WBL)
							555	625 (WBTR)
							225	400 (NBL)
12	Westbound Thru	4.3	A	0.70	0.85	Y	-	-
13	Northbound Right	7.1	A	0.59	0.85	Y	-	-
14	Overall Intersection	> 100	F	0.85	0.99	Y	100	200 (EBL)
							100	200 (WBL)
							100	200 (NBL)
							150	300 (SBL)
15	Overall Intersection	23.0	C	0.69	LOS D	Y	75	125 (EBR)
							50	125 (NBL)
							150	150 (NBT)
16	Overall Intersection	13.8	B	0.54	0.85	Y	-	-
17	Overall Intersection	33.1	C	0.72	0.99	Y	100	225 (NBL)
							225	300 (SBL)
18	Overall Intersection	2.6	A	0.20	LOS E	Y	-	-
19	Westbound Left/Thru	1.1	A	0.10	0.85	Y	-	-
20	Overall Intersection	5.6	A	0.28	0.85	Y	-	-
23	Overall Intersection	15.2	B	0.50	0.75	Y	-	-
AA	Overall Intersection	14.1	B	0.62	0.75	Y	-	-
BB	Overall Intersection	16.7	B	0.60	LOS D	Y	-	-
CC	Northbound Thru	4.2	A	0.31	LOS E	Y	-	-
DD	Westbound Right	4.0	A	0.44	0.75	Y	-	-
EE	Overall Intersection	11.8	B	0.58	LOS D	Y	-	-
FF	Overall Intersection	15.7	B	0.45	0.75	Y	-	-
GG	Overall Intersection	3.5	A	0.35	0.75	Y	-	-
HH	Overall Intersection	13.7	B	0.37	0.75	Y	-	-
II	Overall Intersection	4.2	A	0.37	0.75	Y	-	-
JJ	Overall Intersection	10.7	B	0.35	0.85	Y	-	-
KK	Overall Intersection	15.8	B	0.57	0.85	Y	-	-
LL	Southbound Left/Right	3.5	A	0.61	0.85	Y	-	-
MM	Overall Intersection	6.5	A	0.41	0.85	Y	-	-
NN	Overall Intersection	8.3	A	0.41	0.85	Y	-	-
OO	Northbound Right	4.8	A	0.12	0.85	Y	-	-

2030 LPA Option B

#	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,4,5,6]	Meets Standard	Storage Length	95% Queue (ft)
01	Overall Intersection	58.7	E	0.92	LOS D	Y*	125	250 (WBL)
02	Overall Intersection	79.4	E	0.88	LOS D	N	355	550 (EBL)
							125	300 (WBL)
							175	300 (NBL)
03	Overall Intersection	25.3	C	0.75	LOS D	Y	100	150 (SBL)
04	Overall Intersection	22.6	C	0.68	0.85	Y	75	125 (WBL)
							175	175 (NBT)
05	Overall Intersection	34.5	C	0.41	0.85	Y	75	125 (EBL)
06	Overall Intersection	34.6	C	0.87	LOS D	Y	75	150 (WBR)
							100	150 (NBL)
							100	175 (SBL)
07	Overall Intersection	20.1	C	0.65	LOS D	Y	-	-
08	Overall Intersection	17.8	B	0.49	0.85	Y	-	-
09	Overall Intersection	13.2	B	0.44	0.85	Y	-	-
10	Overall Intersection	15.1	B	0.71	LOS D	Y	100	125 (NBL)
11	Overall Intersection	> 100	F	0.77	0.99	Y	150	325 (WBL)
							555	625 (WBTR)
							225	400 (NBL)
12	Westbound Thru	4.3	A	0.70	0.85	Y	-	-
13	Northbound Right	7.1	A	0.59	0.85	Y	-	-
14	Overall Intersection	> 100	F	0.85	0.99	Y	100	200 (EBL)
							100	200 (WBL)
							100	200 (NBL)
							150	300 (SBL)
15	Overall Intersection	23.0	C	0.69	LOS D	Y	75	125 (EBR)
							50	125 (NBL)
							150	150 (NBT)
16	Overall Intersection	13.8	B	0.54	0.85	Y	-	-
17	Overall Intersection	33.1	C	0.72	0.99	Y	100	225 (NBL)
							225	300 (SBL)
18	Overall Intersection	2.6	A	0.20	LOS E	Y	-	-
19	Westbound Left/Thru	1.1	A	0.10	0.85	Y	-	-
20	Overall Intersection	5.6	A	0.28	0.85	Y	-	-
23	Overall Intersection	11.1	B	0.39	0.75	Y	-	-
AA	Overall Intersection	12.9	B	0.62	0.75	Y	-	-
BB	Overall Intersection	16.6	B	0.60	LOS D	Y	-	-
CC	Northbound Thru	4.3	A	0.31	LOS E	Y	-	-
DD	Westbound Right	4.2	A	0.44	0.75	Y	-	-
EE	Overall Intersection	12.1	B	0.58	LOS D	Y	-	-
FF	Overall Intersection	15.7	B	0.45	0.75	Y	-	-
GG	Overall Intersection	3.9	A	0.35	0.75	Y	-	-
HH	Overall Intersection	13.7	B	0.37	0.75	Y	-	-
II	Overall Intersection	4.2	A	0.37	0.75	Y	-	-
JJ	Overall Intersection	10.7	B	0.36	0.85	Y	-	-
KK	Overall Intersection	15.8	B	0.57	0.85	Y	-	-
LL	Southbound Left/Right	3.5	A	0.61	0.85	Y	-	-
MM	Overall Intersection	6.5	A	0.41	0.85	Y	-	-
NN	Overall Intersection	8.3	A	0.41	0.85	Y	-	-
OO	Northbound Right	4.8	A	0.12	0.85	Y	-	-

Delay / LOS affected by freeway congestion
Intersection queuing spills back into upstream intersection

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.
Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1).
Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR 99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).
Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.
Note 5 The ODOT V/C standard of 0.85 is used for ramp terminals in the LPA scenarios that remain unchanged from the No-Build scenario, as stated in the Oregon Highway Plan (Action 1F1). New or reconstructed ramp terminals in the LPA scenarios have a V/C standard of 0.75 as
Note 6 The ODOT V/C standard of 0.85 is used for ODOT-controlled intersections along regional highways or district/local roads in the Build scenarios as stated in the Oregon Highway Design Manual (Table 10-1).
Y* Intersection does not meet the stated standard in the LPA scenarios, but meets the PBOT "do-no-worse" practice as compared to the No-Build.

Exhibit 7-38

PRELIMINARY

Portland Intersection Performance Results

PM Peak Hour

2030 No-Build

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	93.6	F	0.99	LOS D	N	125	175 (EBL)
								125	150 (NBL)
								125	200 (SBL)
								125	175 (WBL)
02	Going and Interstate	Overall Intersection	65.2	E	0.84	LOS D	N	125	225 (NBL)
								125	250 (WBL)
03	Alberta and Interstate	Overall Intersection	38.8	D	0.94	LOS D	Y	125	225 (NBL)
								100	150 (SBL)
								865	1150 (NBTR)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	18.5	B	0.52	0.85	Y	75	125 (WBL)
								175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	17.3	B	0.74	0.85	Y	75	125 (EBL)
								175	175 (EBT)
06	Alberta and MLK Jr	Overall Intersection	71.9	E	0.91	LOS D	N	100	200 (NBL)
								100	200 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	38.3	D	0.75	LOS D	Y	100	200 (WBL)
								175	225 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	17.2	B	0.52	0.85	Y	125	175 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	9.3	A	0.40	0.85	Y	-	-
10	Rosa Parks and MLK Jr	Overall Intersection	18.6	B	0.84	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.95	0.99	Y	100	200 (NBR)
								250	275 (SBL)
								150	250 (EBL)
								150	300 (WBL)
								225	300 (NBL)
								1150	1100 (EBTR)
12	Lombard and I-5 SB On-Ramps	Westbound Thru	7.6	A	0.56	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Northbound Right	14.9	B	0.55	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.99	0.99	Y	100	200 (EBL)
								100	200 (WBL)
								100	225 (NBL)
								150	250 (SBL)
								1320	1325 (SBTR)
								1730	1750 (EBTR)
15	Interstate and Argyle	Overall Intersection	> 100	F	0.83	LOS D	N	1300	1300 (EBLT)
								90	125 (NBL)
								125	125 (NBT)
								75	150 (EBR)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	11.7	B	0.57	0.85	Y	-	-
17	Columbia Blvd and MLK Jr	Overall Intersection	83.5	F	0.74	0.99	Y	350	450 (WBL)
								100	225 (NBL)
								225	400 (SBL)
								150	450 (EBR)
18	Victory and Expo Road	Overall Intersection	45.6	E	0.39	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On Ramp	Eastbound Thru	27.7	D	0.28	0.85	Y	75	75 (EBT)
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	> 100	F	0.31	0.85	Y	290	775 (EBL)
								850	850 (WBT)
								200	225 (WBR)
21	Union Ct and I-5 NB Off Ramp	Northbound Thru	> 100	F	0.20	0.85	Y	200	300 (EBL)
								1195	1600 (EBR)
22	Union Ct/Marina Way and Vancouver Way	Overall Intersection	> 100	F	0.61	LOS E	N	75	200 (SBLTR)
								370	2500 (NBLT)
								370	2500 (NBTR)
								55	100 (SWL)
								55	180 (SWTR)
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	> 100	F	0.82	0.85	Y	275	400 (EBL)
								2130	2150 (EBT)
								375	2525 (WBR)
								200	1525 (NBLT)
24	Center Ave and I-5 SB On-/Off Ramps	Overall Intersection	24.8	C	0.80	0.85	Y	115	225 (WBLT)
								75	125 (WBR)
25	Hayden Island Dr and Hayden Island Dr South	Overall Intersection	69.8	E	0.67	0.85	Y	70	100 (WBLR)
								150	200 (SBL)
								820	825 (SBT)
AA	Vancouver Way and MLK Jr ramps								
BB	Vancouver Way and new underpass								
CC	Union Ct and new underpass								
DD	Union Ct and MLK ramps								
EE	Connector Road and Marina Drive								
FF	Hayden Island Northbound Off-Ramp								
GG	Hayden Island Southbound On-Ramp								
HH	Hayden Island Northbound On-Ramp								
II	Hayden Island Southbound Off-Ramp								
JJ	Hayden Island Drive and Jantzen Drive								
KK	Tomahawk Island Drive and Jantzen Drive								
LL	Jantzen Ave and Sunrise								
MM	Jantzen Ave and Main Street								
NN	Hayden Island Drive and Main Street								
OO	Hayden Island Drive and Sunrise								
PP	Local Bridge and Little Marina Drive								
QQ	Local Bridge and Tomahawk Is Driv								

2030 LPA Option A with Highway Phasing

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4,5]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	61.9	E	0.98	LOS D	Y*	125	150 (EBL)
								125	175 (WBL)
								125	150 (NBL)
								125	225 (SBL)
02	Going and Interstate	Overall Intersection	43.2	D	0.83	LOS D	Y	355	425 (EBL)
								125	200 (WBL)
								175	200 (NBL)
03	Alberta and Interstate	Overall Intersection	42.9	D	0.90	LOS D	Y	125	200 (NBL)
								100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	18.5	B	0.56	0.85	Y	75	125 (WBL)
								175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	20.0	B	0.75	0.85	Y	75	125 (EBL)
								175	175 (EBT)
06	Alberta and MLK Jr	Overall Intersection	45.6	D	0.88	LOS D	Y	100	175 (NBL)
								100	175 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	45.4	D	0.77	LOS D	Y	100	125 (EBL)
								100	175 (WBL)
								175	300 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	15.5	B	0.54	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	15.7	B	0.59	0.85	Y	100	225 (EBL)
10	Rosa Parks and MLK Jr	Overall Intersection	19.5	B	0.82	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.82	0.99	Y	150	250 (EBL)
								1150	1150 (EBTR)
								150	275 (WBL)
								350	425 (NBL)
								100	175 (NBR)
								325	450 (SBL)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.54	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Overall Intersection	4.6	A	0.53	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.90	0.99	Y	100	175 (EBL)
								1750	1750 (EBTR)
								100	200 (WBL)
								100	200 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	Overall Intersection	19.5	B	0.66	LOS D	Y	75	150 (EBR)
								50	75 (NBL)
								125	125 (NBT)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	14.4	B	0.51	0.85	Y	-	-
17	Columbia Blvd and MLK Jr	Overall Intersection	46.3	D	0.77	0.99	Y	350	425 (WBL)
								100	225 (NBL)
								225	400 (SBL)
18	Victory and Expo Road	Overall Intersection	5.4	A	0.41	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On Ramp	Westbound Left/Thru	2.0	A	0.18	0.85	Y	-	-
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	13.5	B	0.50	0.85	Y	-	-
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	22.1	C	0.64	0.75	Y	-	-
AA	Vancouver Way and MLK Jr ramps	Overall Intersection	21.3	C	0.66	0.75	Y	-	-
BB	Vancouver Way and new underpass	Overall Intersection	23.6	C	0.64	LOS D	Y	-	-
CC	Union Ct and new underpass	Eastbound Left/Right	8.0	A	0.06	LOS E	Y	-	-
DD	Union Ct and MLK ramps	Westbound Right	5.8	A	0.45	0.75	Y	-	-
EE	Connector Road and Marina Drive	Southbound Left/Right	12.4	B	0.07	LOS E	Y	-	-
FF	Hayden Island Northbound Off-Ramp	Overall Intersection	13.3	B	0.31	0.75	Y	-	-
GG	Hayden Island Southbound On-Ramp	Overall Intersection	8.4	A	0.39	0.75	Y	-	-
HH	Hayden Island Northbound On-Ramp	Overall Intersection	11.3	B	0.52	0.75	Y	-	-
II	Hayden Island Southbound Off-Ramp	Overall Intersection	6.8	A	0.54	0.75	Y	-	-
JJ	Hayden Island Drive and Jantzen Drive	Overall Intersection	12.5	B	0.51	0.85	Y	-	-
KK	Tomahawk Island Drive and Jantzen Drive	Overall Intersection	20.1	C	0.63	0.85	Y	-	-
LL	Jantzen Ave and Sunrise	Southbound Left/Right	5.3	A	0.08	0.85	Y	-	-
MM	Jantzen Ave and Main Street	Overall Intersection	11.6	B	0.56	0.85	Y	-	-
NN	Hayden Island Drive and Main Street	Overall Intersection	21.7	C	0.57	0.85	Y	-	-
OO	Hayden Island Drive and Sunrise	Northbound Right	5.4	A	0.23	0.85	Y	-	-
PP	Local Bridge and Little Marina Drive	Overall Intersection	5.4	A	0.44	LOS D	Y	-	-
QQ	Local Bridge and Tomahawk Is Driv	Overall Intersection	8.2	A	0.34	LOS D	Y	-	-

2030 LPA Option A

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4,5]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	61.9	E	0.98	LOS D	Y*	125	150 (EBL)
								125	175 (WBL)
								125	150 (NBL)
								125	225 (SBL)
02	Going and Interstate	Overall Intersection	43.2	D	0.83	LOS D	Y	355	425 (EBL)
								125	200 (WBL)
								175	200 (NBL)
03	Alberta and Interstate	Overall Intersection	42.9	D	0.90	LOS D	Y	125	200 (NBL)
								100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	18.5	B	0.56	0.85	Y	75	125 (WBL)
								175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	20.0	B	0.75	0.85	Y	75	125 (EBL)
								175	175 (EBT)
06	Alberta and MLK Jr	Overall Intersection	45.6	D	0.88	LOS D	Y	100	175 (NBL)
								100	175 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	45.4	D	0.77	LOS D	Y	100	125 (EBL)
								100	175 (WBL)
								175	300 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	15.5	B	0.54	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	15.7	B	0.59	0.85	Y	100	225 (EBL)
10	Rosa Parks and MLK Jr	Overall Intersection	19.5	B	0.82	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.82	0.99	Y	150	250 (EBL)
								1150	1150 (EBTR)
								150	275 (WBL)
								350	425 (NBL)
								100	175 (NBR)
								325	450 (SBL)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.54	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Overall Intersection	4.6	A	0.53	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.90	0.99	Y	100	175 (EBL)
								1750	1750 (EBTR)
								100	200 (WBL)
								100	200 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	Overall Intersection	19.5	B	0.66	LOS D	Y	75	150 (EBR)
								50	75 (NBL)
								125	125 (NBT)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	14.4	B	0.51	0.85	Y	-	-
17	Columbia Blvd and MLK Jr	Overall Intersection	46.3	D	0.77	0.99	Y	350	425 (WBL)
								100	225 (NBL)
								225	400 (SBL)
18	Victory and Expo Road	Overall Intersection	5.4	A	0.41	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On Ramp	Westbound Left/Thru	2.0	A	0.18	0.85	Y	-	-
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	13.5	B	0.50	0.85	Y	-	-
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	11.8	B	0.42	0.75	Y	-	-
AA	Vancouver Way and MLK Jr ramps	Overall Intersection	18.8	B	0.69	0.75	Y	-	-
BB	Vancouver Way and new underpass	Overall Intersection	23.2	C	0.64	LOS D	Y	-	-
CC	Union Ct and new underpass	Eastbound Left/Right	11.8	B	0.09	LOS E	Y	-	-
DD	Union Ct and MLK ramps	Westbound Right	5.9	A	0.60	0.75	Y	-	-
EE	Connector Road and Marina Drive	Southbound Left/Right	17.7	B	0.07	LOS E	Y	-	-
FF	Hayden Island Northbound Off-Ramp	Overall Intersection	12.6	B	0.31	0.75	Y	-	-
GG	Hayden Island Southbound On-Ramp	Overall Intersection	5.8	A	0.39	0.75	Y	-	-
HH	Hayden Island Northbound On-Ramp	Overall Intersection	11.6	B	0.52	0.75	Y	-	-
II	Hayden Island Southbound Off-Ramp	Overall Intersection	8.4	A	0.54	0.75	Y	-	-
JJ	Hayden Island Drive and Jantzen Drive	Overall Intersection	12.0	B	0.51	0.85	Y	-	-
KK	Tomahawk Island Drive and Jantzen Drive	Overall Intersection	18.8	B	0.63	0.85	Y	-	-
LL	Jantzen Ave and Sunrise	Southbound Left/Right	7.1	A	0.06	0.85	Y	-	-
MM	Jantzen Ave and Main Street	Overall Intersection	11.1	B	0.56	0.85	Y	-	-
NN	Hayden Island Drive and Main Street	Overall Intersection	22.0	C	0.57	0.85	Y	-	-
OO	Hayden Island Drive and Sunrise	Northbound Right	5.8	A	0.23	0.85	Y	-	-
PP	Local Bridge and Little Marina Drive	Overall Intersection	5.6	A	0.44	LOS D	Y	-	-
QQ	Local Bridge and Tomahawk Is Driv	Overall Intersection	6.0	A	0.34	LOS D	Y	-	-

2030 LPA Option B with Highway Phasing

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4,5]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	61.9	E	0.98	LOS D	Y*	125	150 (EBL)
								125	175 (WBL)
								125	150 (NBL)
								125	225 (SBL)
02	Going and Interstate	Overall Intersection	43.2	D	0.83	LOS D	Y	355	425 (EBL)
								125	200 (WBL)
								175	200 (NBL)
03	Alberta and Interstate	Overall Intersection	42.9	D	0.90	LOS D	Y	125	200 (NBL)
								100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	18.5	B	0.56	0.85	Y	75	125 (WBL)
								175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	20.0	B	0.75	0.85	Y	75	125 (EBL)
								175	175 (EBT)
06	Alberta and MLK Jr	Overall Intersection	45.6	D	0.88	LOS D	Y	100	175 (NBL)
								100	175 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	45.4	D	0.77	LOS D	Y	100	125 (EBL)
								100	175 (WBL)
								175	300 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	15.5	B	0.54	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	15.7	B	0.59	0.85	Y	100	225 (EBL)
10	Rosa Parks and MLK Jr	Overall Intersection	19.5	B	0.82	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.82	0.99	Y	150	250 (EBL)
								1150	1150 (EBTR)
								150	275 (WBL)
								350	425 (NBL)
								100	175 (NBR)
								325	450 (SBL)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.54	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Overall Intersection	4.6	A	0.53	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.90	0.99	Y	100	175 (EBL)
								1750	1750 (EBTR)
								100	200 (WBL)
								100	200 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	Overall Intersection	19.5	B	0.66	LOS D	Y	75	150 (EBR)
								50	75 (NBL)
								125	125 (NBT)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	14.4	B	0.51	0.85	Y	-	-
17	Columbia Blvd and MLK Jr	Overall Intersection	46.3	D	0.77	0.99	Y	350	425 (WBL)
								100	225 (NBL)
								225	400 (SBL)
18	Victory and Expo Road	Overall Intersection	5.4	A	0.41	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On Ramp	Westbound Left/Thru	2.0	A	0.18	0.85	Y	-	-
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	13.5	B	0.50	0.85	Y	-	-
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	32.1	C	0.71	0.75	Y	-	-
AA	Vancouver Way and MLK Jr ramps	Overall Intersection	18.3	B	0.63	0.75	Y	-	-
BB	Vancouver Way and new underpass	Overall Intersection	27.7	C	0.62	LOS D	Y	-	-
CC	Union Ct and new underpass	Northbound Thru	5.1	A	0.48	LOS E	Y	-	-
DD	Union Ct and MLK ramps	Westbound Right	7.8	A	0.66	0.75	Y	-	-
EE	Connector Road and Marina Drive	Overall Intersection	12.5	B	0.69	LOS D	Y	-	-
FF	Hayden Island Northbound Off-Ramp	Overall Intersection	12.1	B	0.61	0.75	Y	-	-
GG	Hayden Island Southbound On-Ramp	Overall Intersection	5.2	A	0.52	0.75	Y	-	-
HH	Hayden Island Northbound On-Ramp	Overall Intersection	14.3	B	0.52	0.75	Y	-	-
II	Hayden Island Southbound Off-Ramp	Overall Intersection	7.6	A	0.52	0.75	Y	-	-
JJ	Hayden Island Drive and Jantzen Drive	Overall Intersection	11.1	B	0.61	0.85	Y	-	-
KK	Tomahawk Island Drive and Jantzen Drive	Overall Intersection	17.5	B	0.65	0.85	Y	-	-
LL	Jantzen Ave and Sunrise	Southbound Right	4.1	A	0.03	0.85	Y	-	-
MM	Jantzen Ave and Main Street	Overall Intersection	8.1	A	0.57	0.85	Y	-	-
NN	Hayden Island Drive and Main Street	Overall Intersection	21.6	C	0.56	0.85	Y	-	-
OO	Hayden Island Drive and Sunrise	Northbound Right	7.9	A	0.35	0.85	Y	-	-
PP	Local Bridge and Little Marina Drive								
QQ	Local Bridge and Tomahawk Is Driv								

2030 LPA Option B

#	Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]	Standard[2,3,4,5]	Meets Standard	Storage Length	95% Queue (ft)
01	Fremont and MLK Jr	Overall Intersection	61.9	E	0.98	LOS D	Y*	125	150 (EBL)
								125	175 (WBL)
								125	150 (NBL)
								125	225 (SBL)
02	Going and Interstate	Overall Intersection	43.2	D	0.83	LOS D	Y	355	425 (EBL)
								125	200 (WBL)
								175	200 (NBL)
03	Alberta and Interstate	Overall Intersection	42.9	D	0.90	LOS D	Y	125	200 (NBL)
								100	150 (SBL)
04	Alberta and SB I-5 Off-Ramp	Overall Intersection	18.5	B	0.56	0.85	Y	75	125 (WBL)
								175	175 (WBT)
05	Alberta and NB I-5 Off-Ramp	Overall Intersection	20.0	B	0.75	0.85	Y	75	125 (EBL)
								175	175 (EBT)
06	Alberta and MLK Jr	Overall Intersection	45.6	D	0.88	LOS D	Y	100	175 (NBL)
								100	175 (SBL)
07	Rosa Parks and Interstate	Overall Intersection	45.4	D	0.77	LOS D	Y	100	125 (EBL)
								100	175 (WBL)
								175	300 (NBL)
08	Rosa Parks and I-5 SB On-/Off Ramps	Overall Intersection	15.5	B	0.54	0.85	Y	125	150 (SWR)
09	Rosa Parks and I-5 NB On-/Off Ramps	Overall Intersection	15.7	B	0.59	0.85	Y	100	225 (EBL)
10	Rosa Parks and MLK Jr	Overall Intersection	19.5	B	0.82	LOS D	Y	100	150 (NBL)
11	Lombard and Interstate	Overall Intersection	> 100	F	0.82	0.99	Y	150	250 (EBL)
								1150	1150 (EBTR)
								150	275 (WBL)
								350	425 (NBL)
								100	175 (NBR)
								325	450 (SBL)
12	Lombard and I-5 SB On-Ramps	Eastbound Thru/Right	4.8	A	0.54	0.85	Y	-	-
13	Lombard and I-5 NB Off-Ramps	Overall Intersection	4.6	A	0.53	0.85	Y	-	-
14	Lombard and MLK Jr	Overall Intersection	> 100	F	0.90	0.99	Y	100	175 (EBL)
								1750	1750 (EBTR)
								100	200 (WBL)
								100	200 (NBL)
								150	300 (SBL)
15	Interstate and Argyle	Overall Intersection	19.5	B	0.66	LOS D	Y	75	150 (EBR)
								50	75 (NBL)
								125	125 (NBT)
16	Columbia Blvd and I-5 Ramps	Overall Intersection	14.4	B	0.51	0.85	Y	-	-
17	Columbia Blvd and MLK Jr	Overall Intersection	46.3	D	0.77	0.99	Y	350	425 (WBL)
								100	225 (NBL)
								225	400 (SBL)
18	Victory and Expo Road	Overall Intersection	5.4	A	0.41	LOS E	Y	-	-
19	Victory Blvd and I-5 SB On Ramp	Westbound Left/Thru	2.0	A	0.18	0.85	Y	-	-
20	Victory Blvd and NB On-/Off Ramps	Overall Intersection	13.5	B	0.50	0.85	Y	-	-
23	Marine Dr and I-5 On-/Off Ramps	Overall Intersection	13.1	B	0.46	0.75	Y	-	-
AA	Vancouver Way and MLK Jr ramps	Overall Intersection	17.1	B	0.63	0.75	Y	-	-
BB	Vancouver Way and new underpass	Overall Intersection	27.5	C	0.62	LOS D	Y	-	-
CC	Union Ct and new underpass	Northbound Thru	5.5	A	0.48	LOS E	Y	-	-
DD	Union Ct and MLK ramps	Westbound Right	7.3	A	0.66	0.75	Y	-	-
EE	Connector Road and Marina Drive	Overall Intersection	11.2	B	0.68	LOS D	Y	-	-
FF	Hayden Island Northbound Off-Ramp	Overall Intersection	15.3	B	0.61	0.75	Y	-	-
GG	Hayden Island Southbound On-Ramp	Overall Intersection	5.2	A	0.53	0.75	Y	-	-
HH	Hayden Island Northbound On-Ramp	Overall Intersection	14.3	B	0.52	0.75	Y	-	-
II	Hayden Island Southbound Off-Ramp	Overall Intersection	7.6	A	0.52	0.75	Y	-	-
JJ	Hayden Island Drive and Jantzen Drive	Overall Intersection	11.1	B	0.61	0.85	Y	-	-
KK	Tomahawk Island Drive and Jantzen Drive	Overall Intersection	17.5	B	0.65	0.85	Y	-	-
LL	Jantzen Ave and Sunrise	Southbound Right	4.1	A	0.03	0.85	Y	-	-
MM	Jantzen Ave and Main Street	Overall Intersection	8.1	A	0.57	0.85	Y	-	-
NN	Hayden Island Drive and Main Street	Overall Intersection	21.6	C	0.56	0.85	Y	-	-
OO	Hayden Island Drive and Sunrise	Northbound Right	7.9	A	0.36	0.85	Y	-	-
PP	Local Bridge and Little Marina Drive								
QQ	Local Bridge and Tomahawk Is Driv								

Delay / LOS affected by freeway congestio

Intersection queuing spills back into upstream intersectio

Note 1 The ICU is used for signalized and AWSC intersections. The V/C is used for the critical movement at other intersections.

Note 2 The ODOT V/C standard of 0.85 is used for ramp terminals in the Existing and No-Build scenarios (Action 1F1).

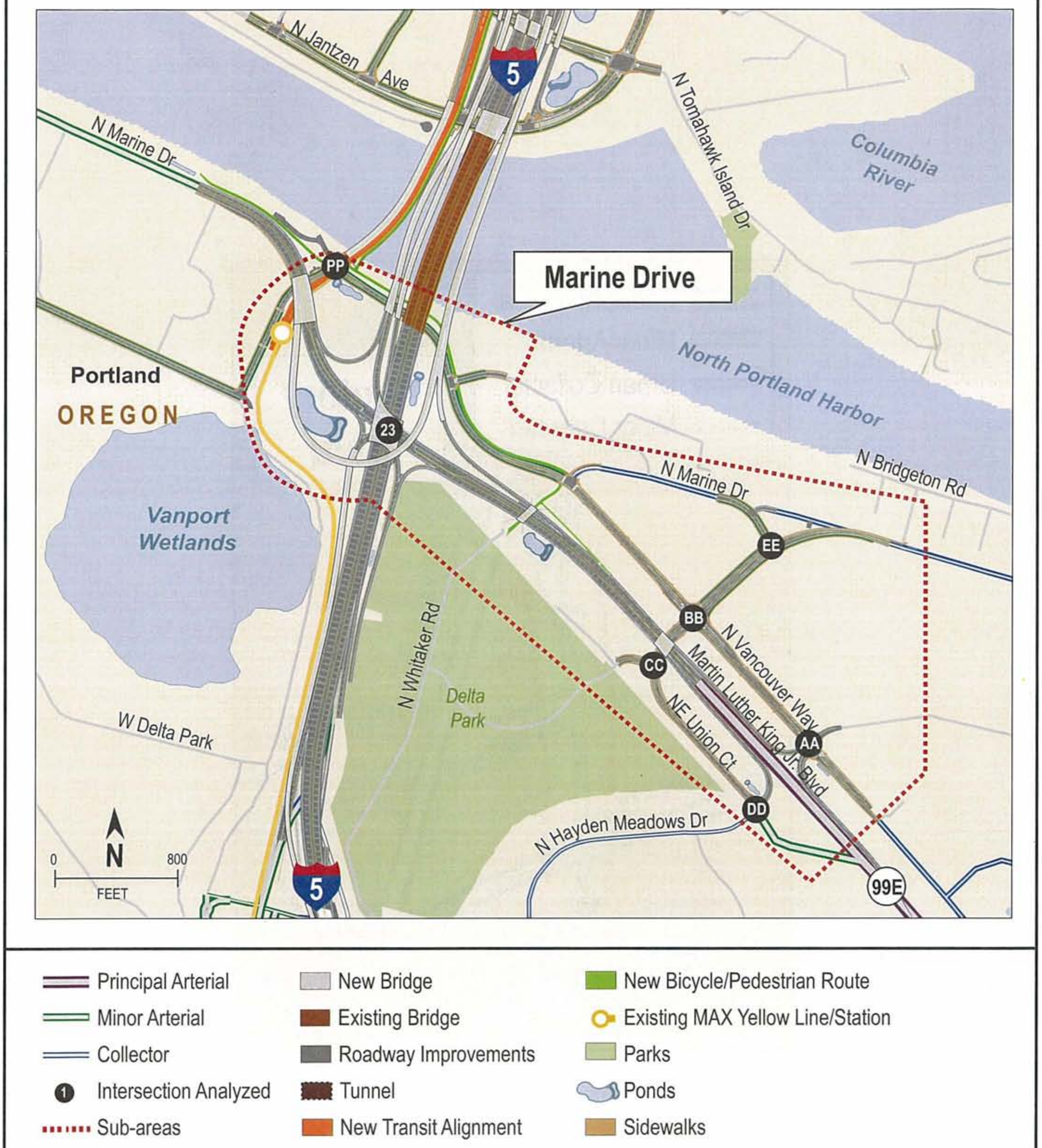
Note 3 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along Lombard Street (US-30) and MLK Jr. Boulevard (OR-99W), that are not ramp terminals, for the Existing, No-Build and LPA scenarios as stated in the OHP (Table 7, 2004 update).

Note 4 The PBOT operational standard for signalized intersections is LOS D and, for unsignalized intersections, is LOS E.

Note 5 The ODOT V/C standard of 0.85 is used for ramp terminals in the LPA scenarios that remain unchanged from the No-Build scenario, as stated in the Oregon Highway Plan (Action 1F1). New or reconstructed ramp terminals in the LPA scenarios have a V/C standard of 0.75.

Note 6 The ODOT V/C standard of 0.99 is used for ODOT-controlled intersections along regional highways or [illegible] in the Build scenarios as stated in the Oregon Highway Design Manual (Table 10-1).

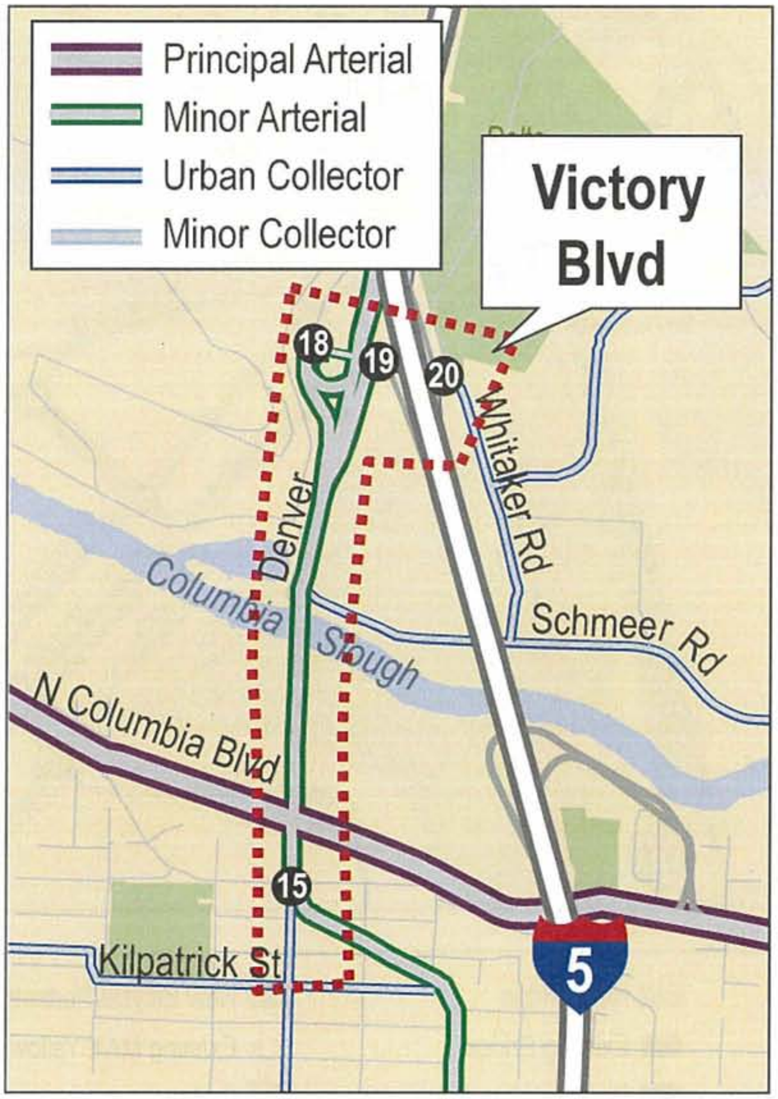
Y* Intersection does not meet the stated standard in the LPA scenarios, but meets the PBOT "no worse" practice as compared to the No-Build.



LPA
Marine Drive Interchange Sub-area

Columbia River CROSSING

Exhibit 7-40


Principal Arterial
Minor Arterial
Urban Collector
Minor Collector
Victory Blvd
18
19
20
15
Denver
Whitaker Rd
Schmeer Rd
Columbia Slough
N Columbia Blvd
Kilpatrick St
5

PRELIMINARY

Exhibit 7-41

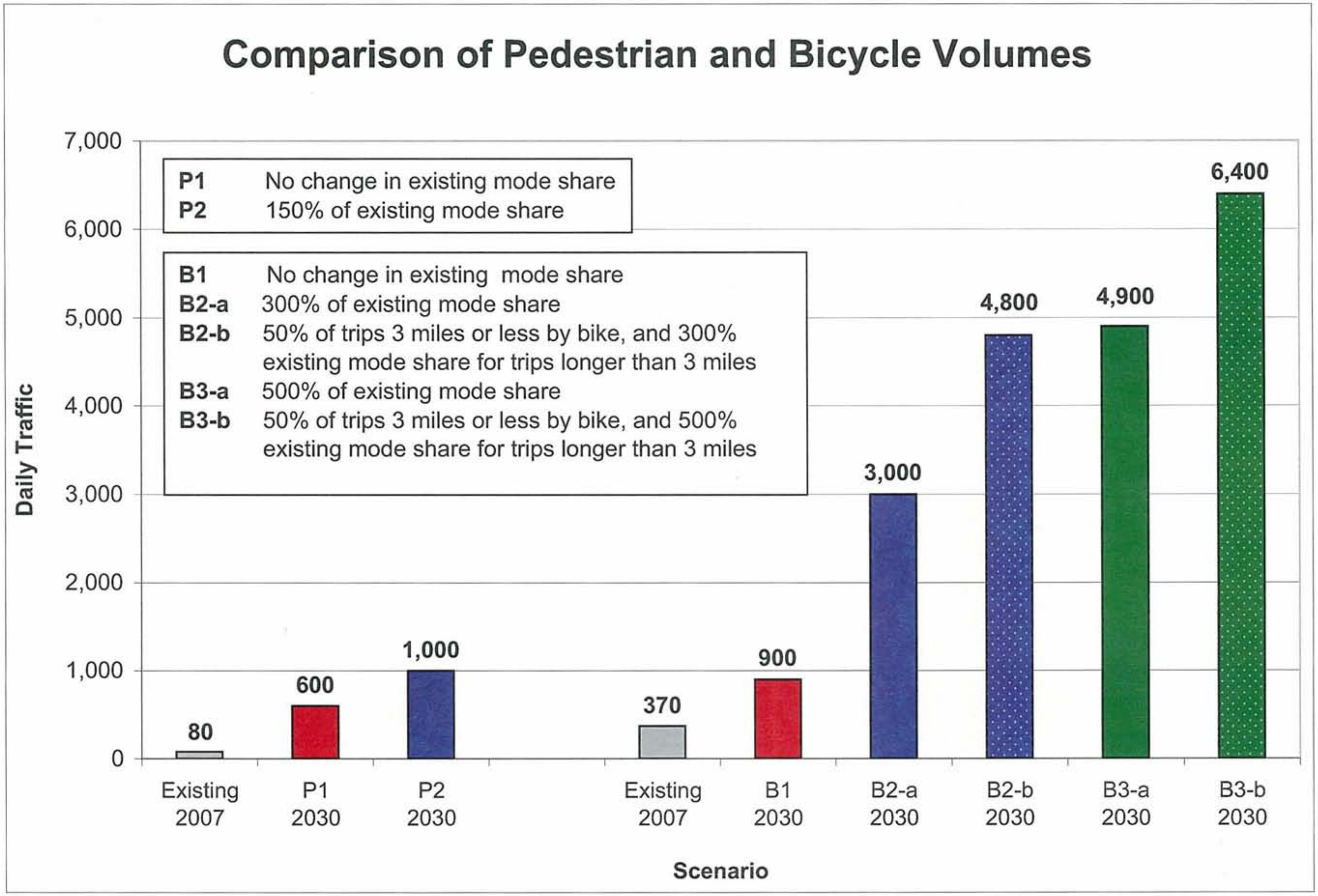
PRELIMINARY

Exhibit 7-42

Bicycle Scenarios	Description
B1	No change in existing mode share for all trip lengths
B2-a	300% of existing mode share for all trip lengths
B2-b	50% of all trips 3 miles or less are made by bicycle, and 300% of existing mode share for all trips longer than 3 miles
B3-a	500% of existing mode share for all trip lengths
B3-b	50% of all trips 3 miles or less are made by bicycle, and 500% of existing mode share for all trips longer than 3 miles

Pedestrian Scenarios	Description
P1	No change in existing mode share for all trip lengths
P2	150% of existing mode share for all trip lengths

Exhibit 7-43


Comparison of Pedestrian and Bicycle Volumes
P1 No change in existing mode share
P2 150% of existing mode share
B1 No change in existing mode share
B2-a 300% of existing mode share
B2-b 50% of trips 3 miles or less by bike, and 300% existing mode share for trips longer than 3 miles
B3-a 500% of existing mode share
B3-b 50% of trips 3 miles or less by bike, and 500% existing mode share for trips longer than 3 miles
Daily Traffic
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
80
600
1,000
370
900
3,000
4,800
4,900
6,400
Existing 2007
P1 2030
P2 2030
Existing 2007
B1 2030
B2-a 2030
B2-b 2030
B3-a 2030
B3-b 2030
Scenario

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8. Tolling Effects on Traffic

8.1 Description of Tolling Scenarios

As a part of the LPA, all motor vehicle users on I-5 crossing the Columbia River would pay a toll. Open Road Tolling (ORT) technology would be used. ORT allows the collection of tolls without the use of lane-dividing barriers or toll-booths. With ORT, users are able to drive through at highway speeds without having to slow down at barriers or to physically pay a toll. Full use of ORT eliminates the need for toll plazas.

Tolls would be tracked using transponders affixed to vehicles. Motorists would establish a pre-paid account for their transponder. For vehicles without a transponder, license plate images would be scanned and users would be mailed a bill.

Exhibit 8-1 summarizes the tolling rate structure assumed for analysis purposes for the LPA. The values shown are example tolling rates for planning and testing purposes only. Actual toll rates will depend upon a final finance plan and will be determined by the Oregon and Washington state transportation commission's with approval by the state legislatures.

Toll rates are assumed to vary depending upon time of day. Medium trucks are assumed to be charged twice the rate of passenger vehicles, and heavy trucks would pay four times the passenger car rate.

With I-5 only tolled, tolls would be administered for each direction of travel along I-5. For example, a vehicle with a transponder traveling southbound across the bridge at 8 a.m. and northbound across the bridge at 5 p.m. would pay two dollars each way, for a total of four dollars in tolls.

Exhibit 8-1 also summarizes a testing scenario if both the I-5 and I-205 bridges were tolled. This is not a part of the LPA, but was evaluated for comparison purposes. Under this scenario, it was assumed vehicles would be tolled in the southbound direction only across the bridges.

Traffic volumes crossing the Columbia River along I-5 and I-205 were estimated for the LPA (where I-5 is tolled). Sensitivity tests were also conducted for a no-toll condition and a scenario where both the I-5 and I-205 Columbia River bridges were tolled.

8.2 I-5 and I-205 Traffic Volumes

Exhibit 8-2 illustrates daily traffic volumes predicted to cross the I-5 and I-205 bridges in 2030 under several scenarios.

The LPA, which assumes a toll on the I-5 bridge, would result in 178,500 vehicles crossing the I-5 bridge daily and 214,500 vehicles crossing the I-205 bridge. Compared to the No-Build Alternative, the LPA would result in three percent less traffic on I-5 and two percent more traffic on I-205. Less traffic would result along I-5 due to the provision of tolling and light rail transit (in addition, the duration of daily traffic congestion along I-5 would decrease substantially, as discussed in Section 7.2.4).

Daily traffic increases along I-205 and connecting highways would be marginal. For example, I-205's traffic volumes would increase by one percent south of I-84, while I-84's traffic levels would increase by one percent west of I-205 and by 0.2 percent east of I-205. Airport Way's traffic volumes would increase by 1.4 percent west of I-205 and by 0.5 percent east of I-205.

If the LPA was constructed, but tolling was not provided, I-5's daily traffic would be 23 percent higher than the tolled condition. I-205's daily volumes would be five percent less.

For sensitivity, a test run where both I-5 and I-205 were tolled, total cross-river vehicle trips would be the lowest. However, I-5 vehicle trips would be 11 percent higher than the LPA with I-5 tolling (I-205 trips would be 18 percent less).

The LPA with highway phasing option would result in similar traffic levels on the I-5 and I-205 bridges compared to the LPA.

Exhibit 8-1

Columbia River CROSSING

PRELIMINARY

Rate Schedules for I-5 Toll Scenarios

	Time Period	No Tolls	Tolling I-5	Tolling I-5 & I-205	
			One-Way Tolls	Roundtrip Tolls	
			Both Directions	Northbound	Southbound
2006 Dollars	Midnight to 5 AM		$1.00		$2.00
	5 AM to 6 AM		$1.50		$3.00
	6 AM to 7 AM				
	7 AM to 9 AM		$2.00		$4.00
	9 AM to 10 AM				
	10 AM to 3 PM	No Toll Collected	$1.50	No Toll Collected	$3.00
	3 PM to 4 PM				
	4 PM to 6 PM		$2.00		$4.00
	6 PM to 7 PM				
	7 PM to 8 PM		$1.50		$3.00
	8 PM to midnight		$1.00		$2.00
2017 Dollars	Midnight to 5 AM		$1.31		$2.62
	5 AM to 6 AM		$1.97		$3.94
	6 AM to 7 AM				
	7 AM to 9 AM		$2.62		$5.25
	9 AM to 10 AM				
	10 AM to 3 PM	No Toll Collected	$1.97	No Toll Collected	$3.94
	3 PM to 4 PM				
	4 PM to 6 PM		$2.62		$5.25
	6 PM to 7 PM				
	7 PM to 8 PM		$1.97		$3.94
	8 PM to midnight		$1.31		$2.62

Notes

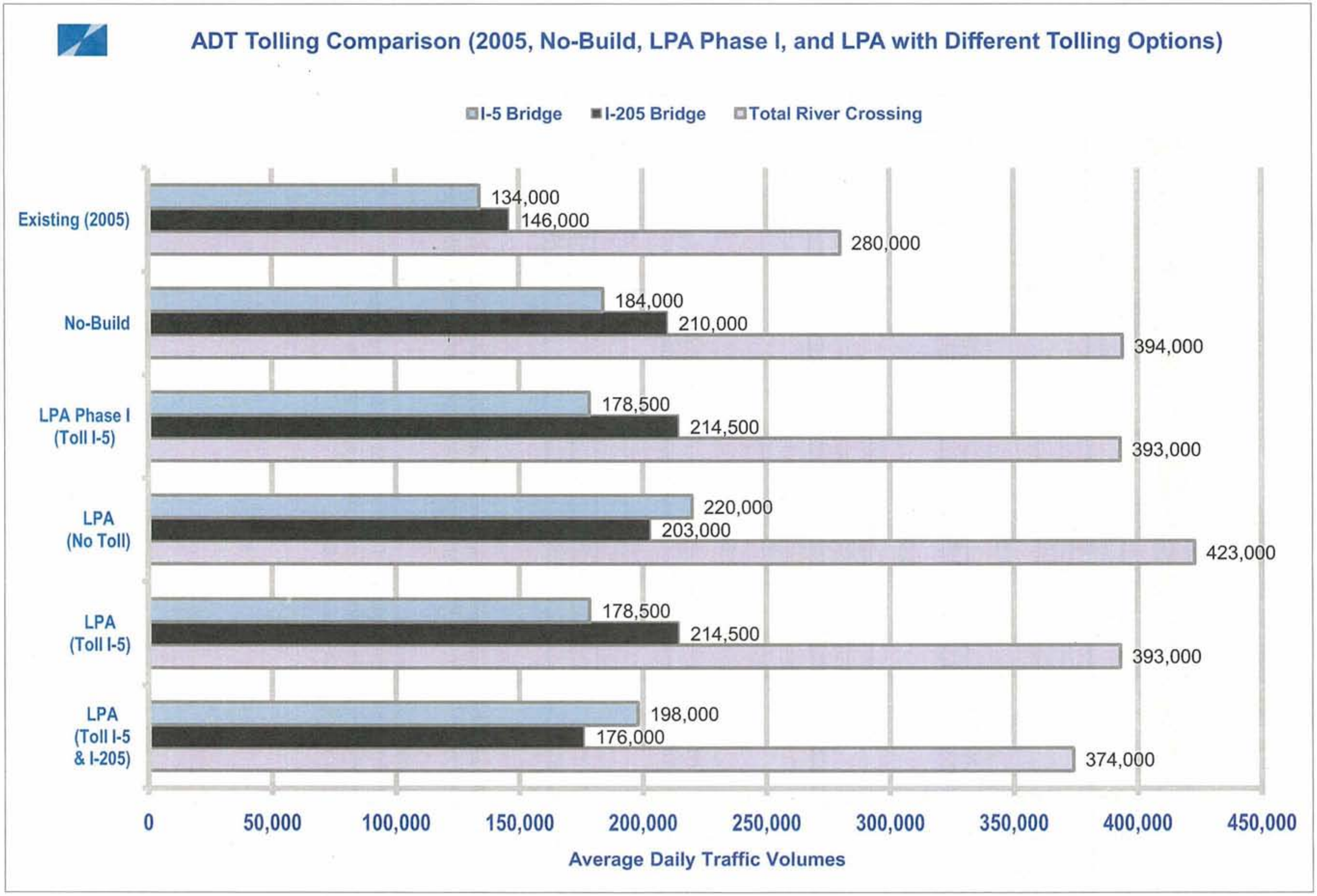
1. These are example tolling rates for planning and testing purposes. Actual toll rates will depend on a final finance plan and determined by the Oregon and Washington state transportation commissions with approval by the state legislatures.

2. Funding contribution assumes a 30-year bond.

3. Assumes medium trucks pay 2x and large trucks pay 4x the auto toll rate using a transponder; administrative fee would be added to process payments not involving a transponder.

4. Tolls escalated at 2.5% per year to match expected inflation.

Exhibit 8-2


ADT Tolling Comparison (2005, No-Build, LPA Phase I, and LPA with Different Tolling Options)
I-5 Bridge
I-205 Bridge
Total River Crossing
Existing (2005)
134,000
146,000
280,000
No-Build
184,000
210,000
394,000
LPA Phase I (Toll I-5)
178,500
214,500
393,000
LPA (No Toll)
220,000
203,000
423,000
LPA (Toll I-5)
178,500
214,500
393,000
LPA (Toll I-5 & I-205)
198,000
176,000
374,000
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
400,000
450,000
Average Daily Traffic Volumes

PRELIMINARY

INTERSTATE 5 COLUMBIA RIVER CROSSING SECTION 106 ARCHAEOLOGY TECHNICAL REPORT

Appendix 1C

Archaeological Discovery and Evaluation: WSDOT Parcels

Rick Minor
Linda P. Hart
Kendra R. Carlisle
Curt D. Peterson

Heritage Research Associates Report No. 345

INTERSTATE 5 COLUMBIA RIVER CROSSING SECTION 106 ARCHAEOLOGY TECHNICAL REPORT

Appendix 1C

Archaeological Discovery and Evaluation: WSDOT Parcels

Rick Minor
Linda P. Hart
Kendra R. Carlisle
Curt D. Peterson

Report to
Washington State Department of Transportation
Oregon Department of Transportation

Submitted to David Evans and Associates, Inc.
Under Agreement No. Y-9245

Rick Minor
Principal Investigator
Heritage Research Associates, Inc.

December 2010

Heritage Research Associates Report No. 345

MANAGEMENT SUMMARY

This volume describes the procedures and results of archaeological discovery investigations carried out in 18 Washington Department of Transportation (WSDOT) parcels in connection with the Columbia River Crossing (CRC) project. Extending along Interstate 5 (I-5), the CRC Area of Potential Effect (APE) is bounded on both sides by areas settled early in Pacific Northwest history. East of I-5 is the former site of Hudson's Bay Company (HBC) Fort Vancouver established at this location in 1829, as well as the later site of the U.S. Army's Vancouver Barracks, both now encompassed by the Vancouver National Historic Reserve (VNHR). West of I-5 is the City of Vancouver, which emerged to the west of HBC Fort Vancouver beginning in the late 1840s and early 1850s. The alignment of I-5 extends northward along the former boundary between the City of Vancouver and the U.S. Army military reservation. The 18 WSDOT parcels investigated include properties in both the city and the former military reservation.

The CRC APE is situated in an area in which major impacts to the natural and cultural landscape have occurred, including the in-filling of a slough in the city and a pond on the military reservation, the building and later relocation of a railroad viaduct across several city blocks and the military reservation near the waterfront, and construction of two interstate bridges (completed in 1917 and 1957) across the Columbia River. In conjunction with the second bridge, I-5 was extended northward through a cut in terraces formed by the Missoula Floods. Later reconfigurations of the I-5/SR 14 and I-5/SR 500 interchanges contributed substantially to ground disturbance in the CRC APE.

In view of the severe ground disturbance in the I-5 corridor, GPR surveys using the profile method were undertaken to map buried soil horizons, identify natural and artificial cut-and-fill episodes, and estimate the depth to cultural strata and features below fill. The traditional approach to archaeological site discovery involving manual excavation of shovel probes and test pits was not adequate to determine if significant archaeological resources are present in the CRC APE. The methods employed during the archaeological discovery investigations were necessarily adapted to the field conditions in the construction zone along I-5.

In the implemented field methodology, backhoe trenches were generally excavated first, and the stratigraphy exposed was compared with GPR profiles to help distinguish fill from intact deposits. An effort was made to extend the backhoe trenches into the gravels deposited by the Missoula Floods, which serve as a baseline for human occupation in the river valley. Trench excavations into the top of the gravels ensured the discovery of any prehistoric and historic cultural features and artifacts present. Manual probes and test pits were then excavated in follow-up investigations to sample any intact cultural strata and cultural features found.

Altogether, 93 probes and 49 test units were excavated manually, and 96 trenches with a total length of 2,253.5 m were excavated mechanically, resulting in the discovery of 64 cultural features and recovery of 14,649 artifacts. Extensive ground disturbance in the WSDOT parcels is reflected in the fact that a substantial number of the artifacts (n=2,669 or 18.2 percent) were recovered from fill and/or disturbed deposits. Few of these artifacts are diagnostic, and the deposits in which they were found do not contribute to site significance. Sufficient archaeological remains were encountered to warrant the recording of archaeological sites with DAHP in 17 of the 18 WSDOT parcels.

Although no prehistoric archaeological sites have been formally recorded on the north shore of the Columbia River within the CRC APE, Native American artifacts have been found during previous investigations in the VNHR. Nineteen stone items indicative of Native American activity were recovered from the WSDOT sites. Three of these items are tools (one tip fragment from a chert biface that might have served as a projectile point, one chert scraper edge fragment, and one chert uniface); the remaining 16 items are debitage. All 19 stone artifacts found at the WSDOT sites were recovered from the same excavation levels as historical materials, suggesting association with Native American activity in the historic period.

The archaeological evidence at sites in the WSDOT parcels pertains primarily to civilian activity and occupation in the City of Vancouver. Ten WSDOT sites are situated entirely in the city. Two WSDOT sites straddle the boundary between the city and the former military reservation. Five WSDOT sites are situated wholly within the former military reservation.

Of the 64 cultural features recorded, 45 (70.3 percent) were in WSDOT sites in the city. The most common cultural features consisted of brick and/or concrete structural remains. The largest concentration of structural remains was found on the west side of I-5 at site 45CL921, where extensive brick foundations/walls correspond to buildings that formerly stood on the west side of the 300 and 400 blocks of Main Street. Burned structural remains from a building identified as a confectionary and cigar store were found at site 45CL922.

The next most frequently represented type of cultural feature found consisted of trash deposits, which usually occurred in pits of various sizes and depths. Most of these deposits contained ash and charcoal from the burning of domestic refuse, but others primarily contained building debris with domestic materials as a secondary component. The trash deposits often contained dense concentrations of artifacts. The highest frequencies of artifacts were recovered at the WSDOT sites where multiple trash deposit features were found. The largest number of trash features (n=8) occurred, along with substantial structural remains, at site 45CL920 on the west side of I-5.

In comparison with the WSDOT sites in the city, the WSDOT sites on the former military reservation generally contained less evidence of activity and occupation. Nineteen cultural features (29.7 percent) were found at WSDOT sites in the former military reservation. The largest concentration of features occurred at site 45CL917, where structural remains included a concrete foundation associated with a stable/corral complex, a brick wall on a concrete footing associated with a wagon shed, and a brick cistern. Other cultural features found at WSDOT sites on the former military reservation included a burned surface from a blacksmith shop, brick piers from various structures, a wood post, a post mold, and a posthole, and terra-cotta drain pipe segments.

Very little evidence of use of the area by the HBC and/or the inhabitants of Kanaka Village was found in the WSDOT sites. A review of the artifact collections from all of the WSDOT sites identified only 43 diagnostic historical artifacts that might possibly date to before 1860, when the HBC abandoned Fort Vancouver. Only 11 items were recovered from WSDOT sites that can be reasonably thought to have been within Kanaka Village. The remaining 32 items were recovered from WSDOT sites beyond the known boundaries of Kanaka Village.

Eight of the 17 WSDOT sites are assessed as National Register eligible under criterion d, as sites that "have yielded, or may be likely to yield, information important in prehistory or history." Six sites are in the City of Vancouver: 45CL910, 45CL920, 45CL921, 45CL922, 45CL924, and 45CL926. Two WSDOT sites assessed as National Register eligible are on the former military reservation: 45CL914 and 45CL917. None of the 17 WSDOT sites meets the requirements for significance under NRHP criteria a, b, or c. Massive earth-moving during construction in the I-5 corridor and the I-5/SR 14 and I-5/SR 500 interchanges destroyed the integrity of setting required for cultural resources to be considered National Register eligible under these criteria.

The area along the Washington shore where the CRC project will be constructed was the setting for some of the earliest settlement and development in the Pacific Northwest in the historic period. Previous archaeological investigations in connection with highway construction in this area have focused exclusively on Kanaka Village at HBC Fort Vancouver and the Quartermaster's Depot at Vancouver Barracks. The CRC project will primarily affect historical archaeological sites in the City of Vancouver. The WSDOT sites in the CRC APE assessed as National Register eligible hold the promise of yielding significant new information about the history of Vancouver, one of the oldest cities in the Pacific Northwest.

PREFACE AND ACKNOWLEDGMENTS

Heritage Research Associates, Inc. (HERITAGE) carried out archaeological investigations on the Washington shore for the Columbia River Crossing (CRC) project under the terms of a contract with David Evans and Associates, Inc. (DEA), a prime contractor on the CRC project. Rick Minor served as Principal Investigator for HERITAGE. Jenna Gaston and Tom Becker served as Cultural Resource Coordinator for the CRC project.

Archaeology is one aspect of the CRC Environmental Program under the direction of Heather Wills, Environmental Manager. At the time the archaeological fieldwork was conducted, Andrew Beagle served as CRC Archaeology Coordinator. Mark Degenhart (CRC) prepared safety plans to ensure the protection of the archaeologists in the field.

The research design for the archaeological investigations on the Washington shore was developed during the course of discussions over the last two years between Rick Minor, Curt Peterson (Department of Geology, Portland State University), Mike Gallagher (Senior Planner/Northwest Cultural Resource Team Manager, Parametrix, Inc.), and Scott Williams (Cultural Resources Program Manager), Sarah Shufelt and Roger Kiers (Cultural Resource Specialists), of the Washington State Department of Transportation (WSDOT).

Implementation of the research design was accomplished under the direct supervision of Rick Minor. Field investigations began in 2008 with a pedestrian archaeological survey. This was followed by ground-penetrating radar (GPR) surveys directed by Curt Peterson, assisted by HERITAGE personnel Galen Peterson and Sam Suárez. The main archaeological discovery and evaluation efforts involved excavations at 18 WSDOT parcels conducted between February 10, 2009, and January 27, 2010.

HERITAGE discovery excavations were directed by Rick Minor, with Robert R. Musil, Kendra R. Carlisle, John Goodwin, Kevin C. McCornack, Galen Peterson, Sam Suárez, and Robert S. Wenger serving as field assistants. Soil descriptions and profiles were recorded by Kendra R. Carlisle. Mapping of excavations in the field was undertaken by Kevin C. McCornack. Ed Arthur of the Cowlitz Tribe participated in the fieldwork at site 45CL918.

Field investigations in the heavily disturbed WSDOT parcels along I-5 were greatly facilitated by the use of a backhoe provided by WSDOT, capably operated by Kevin Reese. Backhoe excavations in the last three WSDOT parcels investigated were expertly conducted by Craig Herbert of Dan J. Fischer Excavating, Inc.

Following completion of the fieldwork, the artifact collections recovered were taken to the laboratory at HERITAGE's home office in Eugene, Oregon. Under the supervision of Linda P. Hart, the artifacts were catalogued by Chrisanne Beckner, Rachel Liggett, and Kendra R. Carlisle, using the Sonoma Historic Artifact Research Database (SHARD). SHARD is a cooperative effort between the Society for Historical Archaeology and the Anthropological Studies Center at Sonoma State University. This system was designed for mid-nineteenth to twentieth century artifacts. Use of SHARD will facilitate comparison of the historical assemblages from archaeological sites in Vancouver with those from contemporary sites elsewhere in western North America where SHARD has been employed.

Asian artifacts recovered from the WSDOT parcels were identified and interpreted by Priscilla Wegars of ArchaeoLogical Research Consultants in Moscow, Idaho. Faunal remains were identified and analyzed by Julie A. Ricks. Confirmation of the discovery of human teeth at historical archaeological site 45CL922 was made by Guy Tasa, Washington State Physical Anthropologist. Radiocarbon samples were processed by Beta Analytic, Inc.

This volume was edited by Linda P. Hart. Graphics were prepared by Kevin C. McCornack. Final responsibility for preparation of this volume was assumed by Kathryn Anne Toepel.

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1. INTRODUCTION

The Columbia River Crossing (CRC) project is a bridge, transit, and highway improvement project under joint development by the Washington Department of Transportation (WSDOT) and Oregon Department of Transportation (ODOT), in cooperation with the Federal Highway Administration (FHWA) and the Federal Transit Authority (FTA), as well as other sponsoring agencies. This project seeks to improve safety, access, and capacity for traffic and transit in the Interstate 5 (I-5) corridor crossing the Columbia River between Portland, Oregon, and Vancouver, Washington.

As an appendix to *Interstate 5 Columbia River Crossing, Section 106 Archaeology Technical Report* (Minor 2010), this volume contains chapters describing the methods and results of archaeological discovery and significance evaluation investigations carried out on WSDOT parcels in support of the CRC project. A companion volume, entitled *Appendix 1B: Archaeological Discovery and Evaluation: ODOT Parcels* (Minor et al. 2010), describes archaeological discovery investigations in support of the CRC project on the Oregon shore.

The Area of Potential Effect (APE) on the Washington shore extends from the Columbia River northward along the I-5 corridor through the City of Vancouver, Clark County, Washington. In terms of legal description, the archaeological APE occupies approximately 422 acres in Clark County in T2N, R1E, Sections 14, 15, 22, 23, 26, 27, and 34. The APE is characterized by (1) an archaeological record in which both Native American and Euroamerican features and artifacts occur in relatively shallow soils overlying Pleistocene gravels; (2) the previous occurrence of earthmoving on a massive scale and the deposition of compacted fill in conjunction with earlier reconfigurations of the I-5/SR 14 interchange and construction of the I-5/SR 500 interchange; and (3) the restriction of archaeological investigations for the most part to narrow strips of ground within the existing WSDOT right-of-way along I-5, SR 14, and SR 500.

Native Americans clearly were present in the CRC APE on the Washington shore over a long span of time, as indicated by temporally diagnostic projectile points recovered during previous investigations. To date, however, stone artifacts that very well may date to the prehistoric period have almost all been found along with items of Euroamerican manufacture introduced after historic contact. Although no prehistoric sites have been formally recorded on the Washington shore, the evidence clearly indicates the potential for prehistoric archaeological remains to be encountered during construction of the CRC project.

The CRC APE is bounded on both sides by areas settled early in the historic period. East of I-5 is the site of the Hudson's Bay Company's (HBC) Fort Vancouver and the later site of the U.S. Army's Vancouver Barracks. West of I-5 is the Historic City of Vancouver, the oldest portion of the city, which emerged to the west of HBC Fort Vancouver beginning in the late 1840s and early 1850s (Figure 1-1).

Originally established in 1825 on high ground roughly one mile to the east, HBC Fort Vancouver was relocated in 1829 to the present site of a reconstructed stockade in the Vancouver National Historic Reserve (VNHR). An extensive, multi-cultural settlement known historically as Kanaka Village, where the majority of the HBC employees lived, emerged along the southwest side of the

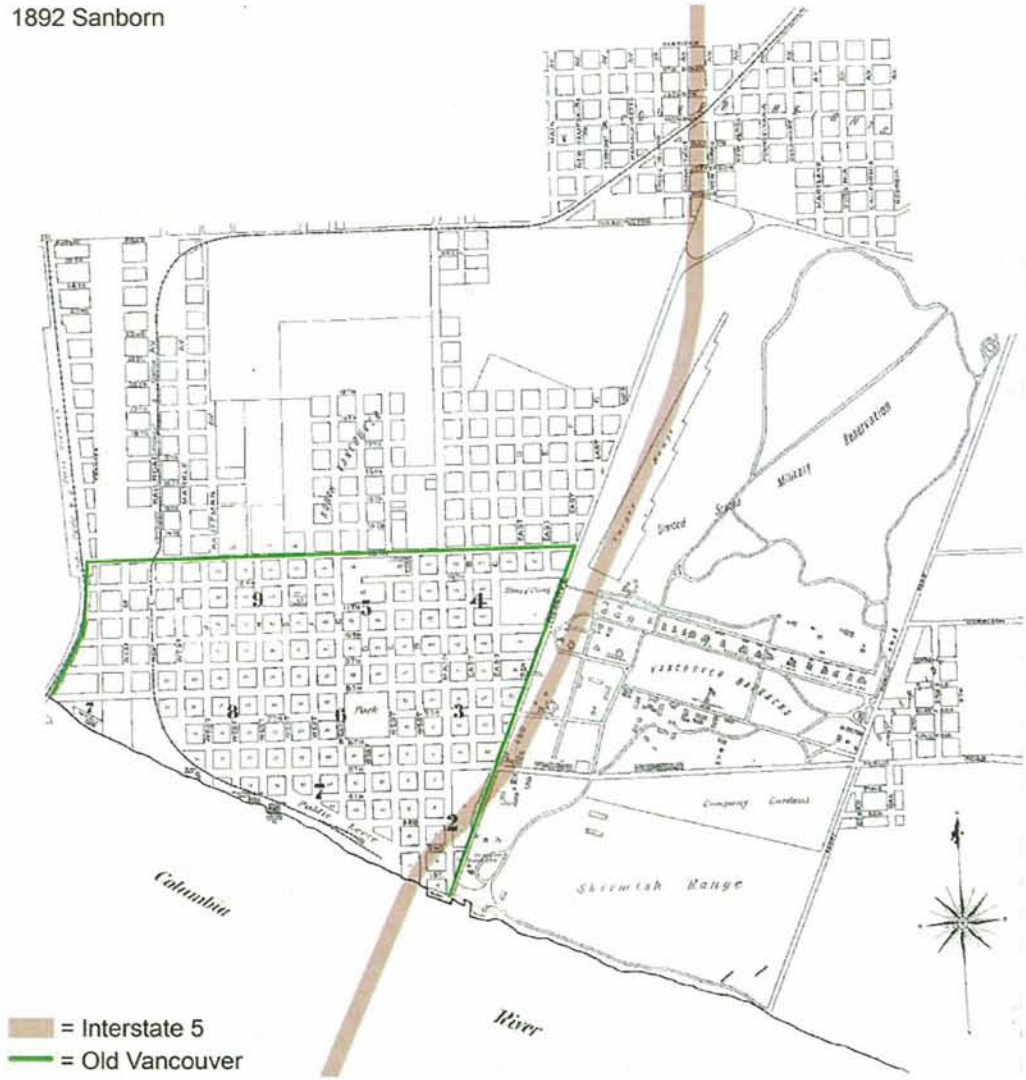

Figure 1-1. Approximate position of present-day I-5 (brown line) in relation to the Historic City of Vancouver (outlined in green) and U.S. military reservation as shown on the 1892 Sanborn fire insurance map.

fort. In 1849, the U.S. Army established Camp Vancouver on the upper plain above the HBC stockade. With establishment of a military reservation in 1850 the name was changed to Columbia Barracks.

This post expanded over the years, with the name changed to Vancouver Barracks in 1879, to become one of the most important military installations in the Pacific Northwest during the late nineteenth and early twentieth centuries. This area is encompassed within the Vancouver National Historic Reserve Historic District, listed on the National Register of Historic Places (NRHP) in 2007 (Owens et al. 2007).

The City of Vancouver developed on the north bank of the Columbia River immediately west of the military reserve and was incorporated as a city in 1857. The Historic City of Vancouver can be defined as encompassing the core blocks in which the earliest settlement and development occurred. Settlement and development began on the north bank of the Columbia River and generally spread northward along Main Street and the adjacent streets to the east (Broadway) and west (Washington and Columbia). For the purposes of the CRC project, the boundaries of the Historic City of Vancouver can be shown on the 1892 Sanborn fire insurance map as extending north from the river to 19th Street, and from West Reserve Street on the east to the Union Pacific Railroad tracks and depot on the west.

Archaeological remains in the city for the most part postdate the initial HBC occupation at Fort Vancouver and relate to civilian settlement and development coterminous with the U.S. Army occupation at Vancouver Barracks. Although much less intensively investigated compared to the area east of I-5, recent historical archaeological investigations in the oldest portions of the city have begun to shed light on the development over time of Vancouver's urban environment. The urban archaeology in the Historic City of Vancouver is different in many ways from the archaeological record of the HBC and U.S. Army on the east side of I-5 (e.g., in terms of material culture, architecture, and nature of population represented), and is worthy of study in its own right.

Data recovery excavations to mitigate impacts from construction during earlier reconfigurations of the I-5/SR 14 interchange were undertaken within a sizable portion of the present-day CRC APE in 1974 and 1975 (Chance and Chance 1976; Chance et al. 1982), in 1977 (Carley 1982), and again from 1980 to 1983 (Thomas and Hibbs 1984). Afterwards, massive construction excavations were conducted through these areas in connection with construction of the I-5/SR 14 interchange. In these areas, investigations for the CRC project involved determining if any significant archaeological remains were still extant after the previous data recovery fieldwork and freeway construction. Other areas in the CRC APE, especially along the west side of I-5, had not been subject to any previous archaeological investigations.

Archaeological investigations on the Washington shore for the CRC project have focused primarily on the narrow WSDOT right-of-way in areas where sediments are exposed along the margins of I-5 and associated interchanges, as well as immediately east of the I-5 corridor on the western margin of the VNHR. The CRC APE on the Washington shore is divided by roadways associated with the I-5/SR 14 interchange and the I-5/SR 500 interchange into a number of small parcels.

For ease in identification, an alpha-numeric system was developed, with the areas designated "W1" through "W24" (Figures 1-2 and 1-3). The bulk of these areas are WSDOT-owned lands. A number of additional non-WSDOT parcels (e.g., City of Vancouver, U.S. Army, National Park Service [NPS], and private properties) were initially included in this designation system. Some of these areas were not subjected to archaeological investigations either because they were no longer identified as affected parcels or because landowners declined access.

The designations for areas within the VNHR were later changed to VNHR Area #1 through VNHR Area #5. Archaeological investigations in connection with the CRC project were conducted in the VNHR Areas by NPS archaeologists, and are reported in *Appendix 1D: Results of National Park Service Evaluation and Testing on the Vancouver National Historic Reserve for the Columbia River Crossing Project* (O'Rourke et al. 2010).

Altogether, the archaeological investigations reported here were conducted on 18 separate WSDOT parcels concentrated around the I-5/SR 14 interchange and the I-5/SR 500 interchange in

Figure 1-2. Areas investigated in the southern portion of the CRC APE on the Washington Shore (W24 shown as a reference point connecting this map with Figure 1-2).

Figure 1-3. Areas investigated in the northern portion of the CRC APE on the Washington Shore (W24 shown as a reference point connecting this map with Figure 1-1).

Vancouver. Sufficient archaeological remains were found to warrant the formal recording of archaeological sites with DAHP in 17 of these areas (except W24). The 17 archaeological sites recorded by HERITAGE (sites 45CL910 through 45CL926) all refer to archaeological deposits on WSDOT lands (Figures 1-4 and 1-5). An area by area summary of the archaeological investigations conducted on the Washington shore to date for the CRC project is presented in Table 1-1.

The recording of the archaeological sites on the WSDOT parcels was based on the extent and nature of their cultural deposits. The WSDOT parcels are bounded by freeway travel lanes, on- and off-ramps, city streets, public and private properties, bicycle paths, sidewalks, and the ubiquitous chain-link property fences. As is common practice in urban archaeology, cultural deposits and features found in each parcel were recorded as separate sites. This approach is justified by the fact that the continuity of the cultural deposits from one WSDOT parcel to another could not be demonstrated. Recording archaeological remains on each city block in any given WSDOT parcel as a separate site was considered, but not implemented, because the actual archaeological evidence from separate blocks was so limited and fragmented as to not make such distinctions justifiable.

Six of the 17 sites recorded on the WSDOT parcels overlap with the boundaries of previously recorded site 45CL300 in the VNHR. As originally assigned in the late 1970s, this site number referred to a relatively small area east of I-5 and north of SR 14 known as Kanaka Village, described as "an historic village; housing for majority of Hudson's Bay Co employees at Fort Vancouver" (Anonymous n. d.). In a Determination of Eligibility (DOE) document for "Fort Vancouver–Kanaka Village" prepared in 1980 in conjunction with proposed improvements to the I-5/SR 14 interchange, the area of 45CL300 was greatly expanded to encompass over 50 acres that include lands administered by NPS, the U.S. Army, and WSDOT to be affected by this project (Smith 1980).

The expanded boundaries of 45CL300 were based on land ownership within an anticipated construction impact area rather than any delineation of the extent of archaeological deposits by means of archaeological fieldwork. The expanded boundaries of 45CL300 overlap with those of the Fort Vancouver National Historic Site (45CL163H) and completely envelop the Pond (45CL47). The designation 45CL300 continues to be used by NPS today. Encompassed under this designation are archaeological resources ranging in age from prehistoric to historic, with significant historical archaeological remains from HBC Fort Vancouver, Kanaka Village, the U.S. Army Quartermaster's Depot, and later U.S. Army facilities through the Spanish-American War, World War I, and World War II eras.

In a similar way, the current recording of archaeological sites on WSDOT property, noted above, was undertaken for a specific purpose, namely for the management of archaeological sites that may be affected by construction of the CRC project. The site designations obtained from DAHP refer to specific archaeological deposits on WSDOT property. The strict definition of these sites is intended to allow for directed management, and if needed, mitigation, to maintain compliance with the NHPA Section 106 process for the CRC project.

The approach implemented for WSDOT facilitates the treatment and management of each recorded archaeological site. At the time of the field investigations, the CRC project's effects on the WSDOT parcels were not yet known. This approach avoids having the same site number applied to archaeological deposits and features in different WSDOT parcels that will be differentially affected by the CRC project.

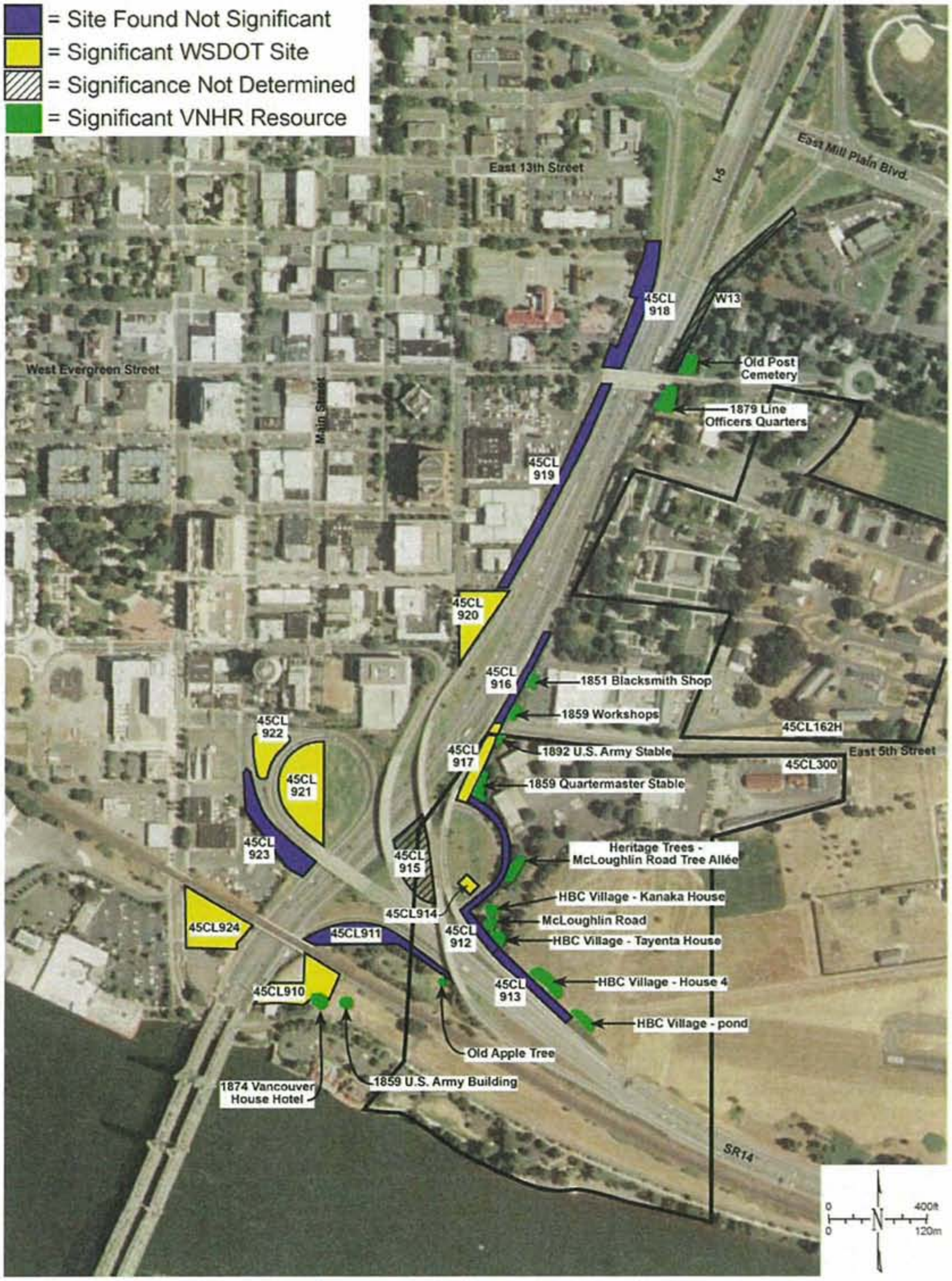

Figure 1-4. Archaeological resources identified as significant in the southern portion of the CRC APE on the Washington Shore.

Figure 1-5. Archaeological resources identified as significant in the northern portion of the CRC APE on the Washington Shore.

Table 1-1. Summary of Archaeological Investigations by Area on the Washington Shore.

Area Designation	Site Number[a]	Archaeological Investigator	Significant Archaeology	Comments
W1	45CL910	HERITAGE Appendix 1C	Yes	Only eastern portion tested; western portion not accessible
W2		None		No access–BNSF/City of Vancouver property
VNHR 5	45CL163H[b]	NPS Appendix 1D	Yes	
W4	45CL911	HERITAGE Appendix 1C	No	
W5A	45CL912	HERITAGE Appendix 1C	Yes	
W5B	45CL913	HERITAGE Appendix 1C	No	
VNHR 4	45CL300[b]	NPS Appendix 1D	Yes	
VNHR 3	45CL300[b]	NPS Appendix 1D	Yes	
W8A	45CL914	HERITAGE Appendix 1C	Yes	
W8B	45CL915	HERITAGE Appendix 1C	Undetermined	Covered by deep fill for SR 14 on & off ramps
W9A	45CL916	HERITAGE Appendix 1C	No	
W9B	45CL917	HERITAGE Appendix 1C	Yes	
VNHR 2	45CL162H[b]	NPS Appendix 1D	Yes	
W13			Undetermined	Fieldwork pending; within former Post Cemetery
VNHR 1	45CL160H[b]	NPS Appendix 1D	Yes	Human remain recovered
W15		None		Outside APE
W16		None		Outside APE
W17	45CL918	HERITAGE Appendix 1C	No	
W18A	45CL919	HERITAGE Appendix 1C	No	
W18B	45CL920	HERITAGE Appendix 1C	Yes	
W19A	45CL921	HERITAGE Appendix 1C	Yes	
W19B	45CL922	HERITAGE Appendix 1C	Yes	
W19C	45CL923	HERITAGE Appendix 1C	No	
W20	45CL924	HERITAGE Appendix 1C	Yes	
W21		None		No access–Red Lion property
W22		None		No access–private parcel
W23A	45CL925	HERITAGE Appendix 1C	No	
W23B	45CL926	HERITAGE Appendix 1C	Yes	
W24		HERITAGE Appendix 1C	No	No archaeological remains found

[a] Site number is a trinomial in which 45 refers to Washington, CL refers to Clark County, and the final three digits are assigned according to the order in which archaeological sites are recorded by DAHP.

[b] Correlation of VNHR Areas with previously recorded archaeological sites suggested by the National Park Service (O'Rourke et al. 2010:286-287).

2. DISCOVERY AND EVALUATION METHODS: ARCHAEOLOGY IN A CONSTRUCTION ZONE

The CRC project follows in the wake of the discovery of significant archaeological resources during two large-scale construction projects in the state of Washington: (1) the so-called "graving dock" project in Port Angeles, carried out in connection with replacement of the Hood Canal Bridge; and (2) the Station Camp project, involving realignment of U.S. Highway 101 in Pacific County to create an interpretive space for the Lewis and Clark National Historical and State Parks. In both cases, significant cultural deposits and features (including Native American burials) were missed during initial archaeological discovery investigations and were not found until later project stages.

A concerted effort was made to learn from the shortcomings of these earlier projects in designing and implementing the archaeological discovery investigations for the CRC project. Several suggestions for "avoiding similar disasters in the future" identified in an appraisal of the graving docks "catastrophe" (King 2009) were already implemented for the CRC project before archaeological fieldwork commenced (e.g., closer consultation with Tribes, more in-depth background research before test excavations). The major "improvements" undertaken for the CRC project involved greater integration of geoarchaeological research and more thorough and systematic subsurface sampling in the various WSDOT parcels. Within limits imposed by the nature of the CRC project area (as discussed below), the presence/absence of significant archaeological resources in the WSDOT parcels has been identified with a high level of confidence.

OBJECTIVES

In advance of any subsurface investigations, a document entitled *An Archaeological Research Design for the Washington Portion of the Columbia River Crossing CRC Project* was prepared, reviewed, and submitted to DAHP (Williams 2009). Building on *The Interstate 5 Columbia River Crossing Archaeology Technical Report* (Minor et al. 2007), this document discussed research domains and research questions that data recovered during archaeology in the CRC APE might potentially address. Various methods that might potentially be employed in identifying and evaluating archaeological sites were outlined in some detail. These methods ranged from remote sensing to manual probing and augering to mechanical coring and trenching. The actual methods of investigation employed in the field were selected from the range of possibilities outlined in the research design and were necessarily adapted to the variable ground conditions encountered in different subareas of the CRC APE.

The overall objective of the archaeological discovery investigations was to identify any significant evidence of human occupation or activity within the CRC project's APE over the last 12,000 years BP (Before Present). This date is derived from the estimated time of occurrence of the last of the Pleistocene Missoula Floods. At least 40 floods from cataclysmic releases of glacially-dammed Lake Missoula in Montana swept down the Columbia River, eroding away many of the earlier landforms and creating the modern landscape in the Lower Columbia Valley.

Figure 2-1. Aerial photograph looking north at newly constructed I-5 in Vancouver; military reservation to east and City of Vancouver to west (WSDOT Photograph PSH 155, April 15, 1955). The width of the interstate was roughly doubled, and the I-5/ SR 14 interchange (barely visible at lower left) was reconfigured, in the early 1980s.

The Pleistocene gravels deposited by these floods underlie all sediments in which archaeological remains might potentially be found. A stratigraphic profile derived from borehole logs extending north–south across the Columbia River illustrates that, from the deep cut in the river channel, the gravels rise on the Washington shore to where they often are within 1.2 to 1.5 m of the surface (Figure 2-2). The Pleistocene gravels thus serve as a baseline and reference point for archaeology. Reaching these "target gravels" was an important priority during the archaeological discovery investigations, ensuring that the search for archaeological evidence extended through the full time range during which humans may have occupied the APE.

Extension of the search for evidence of human occupation in the CRC APE back to 12,000 BP requires an emphasis on the detailed reconstruction of the near-surface geology of the Portland–Vancouver Basin. The effort to identify strata buried deep below the ground surface that may potentially contain evidence of human occupation requires close collaboration between archaeologists and geologists. Archaeological investigations for the CRC project involved an

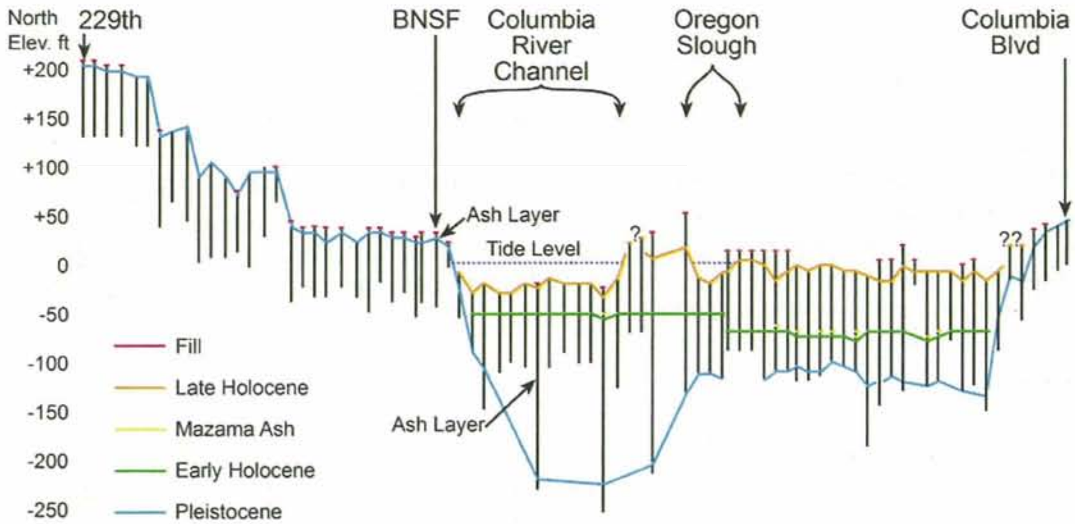

Figure 2-2. Stratigraphic cross-section showing the varying depths of the Pleistocene gravels across the Columbia River Valley in the CRC APE.

integration of archaeology and geology, often referred to as the geoarchaeological approach, to a significantly greater extent than has been the case in previous archaeological research in the Lower Columbia Valley.

FIELD INVESTIGATIONS

Pioneering archaeological investigations at the site of HBC Fort Vancouver and Kanaka Village established that the archaeological record is restricted for the most part to shallow deposits just below the ground surface. Both stone tools characteristically made by prehistoric Native Americans as well as artifacts of Euroamerican manufacture associated with the HBC Fort Vancouver and later U.S. Army occupations at Vancouver Barracks are found within a shallow A horizon soil generally no more than 30 cm deep. As a result, even investigations carried out over large areas and/or involving exposure of cultural features extending into the B horizon can be accomplished by traditional field methods based on manual excavations.

The traditional approach to archaeology as practiced at HBC Fort Vancouver and the U.S. Army's Vancouver Barracks (i.e., manual excavation of probes and test pits) was found to be not directly transferable to the WSDOT parcels within the CRC APE. Construction of I-5 and the SR 14 and SR 500 interchanges in the CRC APE involved earthmoving on a massive scale, including cut-and-fill episodes that removed native soils over large areas and then replaced them with fill materials that were purposefully compacted to support highway overpasses, ramps, and travel lanes (Figure 2-1). The extensive ground disturbance in the former construction zone along the I-5 corridor required a nontraditional approach to archaeological discovery in the CRC APE.

Pedestrian Survey

A standard pedestrian survey found no evidence of prehistoric or historic occupation or activity exposed on the ground surface along the margins of I-5 and within the SR 14 and SR 500 interchanges in the CRC APE. At the time, it was assumed that the negative survey results were due to the presence of a shallow mantle of topsoil introduced for landscaping purposes, and that this topsoil was shallow enough that manual excavations would be sufficient to reach intact native soil below. Surveys using ground-penetrating radar (GPR) provided the first clue that the disturbance to the native soils from previous highway construction within the CRC APE is considerably more extensive than initially estimated.

GPR Surveys

As proposed in *Archaeological Work Plan for Ground-Penetrating Radar (GPR) Exploration, Columbia River Crossing Project* (Minor and Peterson 2008), GPR surveys were undertaken before any excavations as a means of obtaining an understanding of the near-surface geology (including cut-and-fill episodes associated with previous construction) on the WSDOT parcels. Testing of the GPR equipment to ensure best results for the particular field conditions in the CRC APE is described in Appendix 1C-I: Testing of Ground Penetrating Radar (GPR) in Soils of the Vancouver Gravel Plains on the Washington Shore, by Curt D. Peterson.

The actual application of GPR in the WSDOT parcels is described in Chapter 3: Integrated Geoarchaeological Investigations on the Vancouver Gravel Plains, Vancouver, Washington. The GPR surveys were carried out in phases, with both 200 to 250 megahertz (MHz) and 500 MHz antennae employed. The results of the GPR surveys were "ground-truthed" during the follow-up discovery probing and evaluative testing by regular inspection and profiling of exposed walls in backhoe trenches and manual excavation units.

Summaries of the GPR results are provided in a separate section integrated into the chapters prepared for each WSDOT parcel. GPR proved highly useful in establishing (1) the extent of introduced materials from cut-and-fill activities, (2) the depth to native soils, and (3) the depth to the target Pleistocene gravels on the Washington shore. The profile method of GPR data presentation, in which GPR data are presented as cross-sections, proved highly amenable to comparison with the stratigraphy exposed in the trenches and test units.

Initial Discovery Procedures

In all areas within the WSDOT rights-of-way where GPR surveys were conducted, the GPR data strongly suggested that the native soils, in which evidence of prehistoric and historic occupation might be found, are covered by fill material. The presence of deep fill deposits was repeatedly confirmed as the discovery investigations proceeded from one WSDOT area to another. The search beneath these fill deposits for native soils containing evidence of prehistoric and historic occupation, a search that routinely extended to the top of the underlying Pleistocene gravels, required a change in the anticipated approach to discovery probing.

It was originally assumed that discovery probing for archaeological deposits would follow a standard approach involving manual excavation of round (30-cm diameter) or square (50 × 50 cm) shovel probes placed at systematic intervals (e.g., 10 m apart) across each WSDOT parcel. This approach was successfully implemented, although not without difficulty, in the first parcel subjected to archaeological investigations (W17). In this parcel, however, the fill deposits were relatively shallow, and the Pleistocene gravels were close to the surface.

In the second parcel investigated (W9A), shovel probes (30-cm diameter) placed at 10-m intervals recovered recent and historical items as deep as 70 cm below surface (cmbs). However, the stratigraphic context of these items remained uncertain because the small diameter of the probes precluded visual inspection of the sediments and the interval spacing hindered correlations in probes spaced so far apart. Recent and historical items were still being found at the maximum depths excavated in the probes (70 cm), and the top of the Pleistocene gravels had not been reached.

The stratigraphic context of the items recovered in the probes became clear after excavation of a backhoe trench. The trench stratigraphy clearly showed that fill material containing recent and historical items extended to depths greater than the probes could reach. The historical artifacts recovered from the probes, then, occurred in fill material introduced onto the WSDOT property from elsewhere. The extent and depth of fill material across this area was easily traced in the trench walls. The presence of historical artifacts, often with items of recent manufacture, in fill material was subsequently encountered on a regular basis during archaeological discovery probing on the other WSDOT parcels.

Below the fill material, near the bottom of the trench at 120 cmbs, a cultural feature was exposed consisting of black-stained sediments associated with a nineteenth century blacksmith shop at the U.S. Army's Quartermaster's Depot. This feature almost certainly would have been missed if discovery probing had been limited to manual excavations. The south end of the backhoe trench excavation reached the top of the Pleistocene gravels, ensuring that the full time-depth represented in the sediments in this area was tested for the presence of archaeological remains.

This sequence of discovery excavation methods—manual excavation of probes and/or test units followed by mechanical trenching with a backhoe—was repeated in the next three areas investigated (W9B, W5A, and W5B). These investigations clearly demonstrated that limiting the discovery investigations to manual excavations would have resulted in (1) misinterpretations of stratigraphy (e.g., in distinguishing fill and disturbed sediments from intact cultural deposits), and (2) failure to expose significant cultural features deeply buried beneath the surface. Mechanical trenching with a backhoe proved essential in establishing the presence or absence of archaeological remains in the former construction zone along the I-5 corridor.

Implemented Field Methodology

Given the objective of extending the search for archaeological remains to the top of the target Pleistocene gravels, as well as the presence of substantial fill deposits along the I-5 corridor, mechanical excavations with a backhoe emerged as the most suitable method for archaeological discovery investigations. In the implemented field methodology, backhoe trenches were excavated first, with manual probes and test units excavated in follow-up investigations to more fully expose and document any cultural features encountered. In some areas the trenches were spaced at systematic intervals roughly 10 m apart (e.g., in W1, W8A, and W19A), but in most areas the trenches were placed opportunistically as best they could fit on the properties.

The reliance on backhoe trench excavations during the discovery investigations is consistent with the feature-oriented nature of historical archaeology, the primary focus of the archaeological investigations on the Washington shore. The introduced fill covering the parcels is analogous to the layers of building debris that have to be removed before buried architectural and archaeological remains can be studied. Evidence of several extensive cut-and-fill episodes, in which the introduced fill material contained cultural debris, was exposed in the trench excavations (e.g., in W5B and W19A). The fill introduced during these episodes could easily have been mistaken for intact cultural features if examined through the narrow aperture of a manual shovel probe or test unit.

The exposures provided in the backhoe trench walls proved crucial to understanding site formation processes, particularly in distinguishing different types of fill material (e.g., highway construction fill versus building rubble) from buried cultural strata. In discovery investigations under these conditions, recovery of individual artifacts found in undifferentiated deposits is not the primary concern. Instead, the focus is on the identification of intact artifact-bearing strata and cultural features that can yield meaningful information about the prehistoric and historic past.

Excavation and Recovery Methods

As discussed above, the archaeological investigations for the CRC project were adapted to the particular field conditions encountered in each WSDOT parcel and involved a combination of mechanical and manual excavations.

Mechanical trenches (MTs) were excavated with a Bobcat 334 trackhoe with a 24-inch-wide bucket provided by WSDOT, or by a backhoe (John Deere 310E) with a 24-inch-wide bucket provided by Dan J. Fischer Excavating, Inc. The mechanical trench excavations generally extended from the present-day ground surface to a depth of 120 cm (4 feet), the depth to which trenches can be safely entered without shoring according to OSHA standards. Excavation to this depth was often sufficient to penetrate through fill and expose any remnant A horizon and/or B horizon soils above the ca. 12,000 year old Pleistocene gravels. In some areas covered by deep fill material, excavation to the regular depth of 120 cm was not deep enough to reach the gravels. In these situations, the backhoe was used to dig deep "tests" to establish the relationship of the fill and any remnant soils to the underlying gravels.

Manual excavations involved a variety of unit types, including 30-cm-diameter round probes (RPs), 50 × 50 cm shovel probes (SPs), and test units (TUs) of various sizes. Most test units measured 1 × 1 m, but some test units adapted to fit into defined spaces (e.g., backhoe trench floors or between brick foundations) were sometimes smaller. Except in a few cases where the overlying sediments had been removed during previous construction, manual excavation units, especially the smaller probes, could not penetrate deep enough to reach the Pleistocene gravels. The manual excavations generally proceeded in 10-cm levels subdivided by stratigraphy. In situations where previous excavations had established the presence of overlying fill, the fill was shoveled off to focus on intact archaeological deposits.

Information from each excavation level in the manual units recorded on level record forms includes the WSDOT parcel designation, unit provenience, level, stratum, excavator, date of excavation, excavation technique, plan sketch (if appropriate), sediment description, inventory of samples, and descriptive narrative. Profiles of selected exposures were drawn to scale, showing stratigraphic divisions, strata designations, soil constituents, features, and evidence of disturbance.

Artifacts were collected by level and stratigraphic unit. Matrix from all manual excavation units was generally screened through ⅛-inch (3 mm) mesh hardware cloth. Exceptions occurred in situations where previous excavations had established the presence of overlying fill, in which case the fill material was removed without screening. Diagnostic artifacts observed in fill, a common occurrence in the WSDOT parcels, were recovered by means of "grab samples" to characterize the age of the cultural materials present in these deposits. Manual excavations and recovery efforts were focused on the recovery of artifacts from intact cultural deposits and cultural features. Artifact collection policy in these contexts generally followed the same approach used by the NPS (O'Rourke et al. 2010:9). Cultural features were assigned a unique number, and were documented on separate forms with scaled plans and by digital photography.

Cultural features were assigned a unique number, and were documented on separate forms with scaled plans and by digital photography. The locations of all mechanical trenches and manual excavation units were mapped using a total station and tied to a global geographic referent (e.g., NAD83, Washington State Plane South). In addition to all of the above, the investigations were documented by the field director and an assistant in charge of geoarchaeological recording, each of whom maintained daily notebooks recording the progress, personnel, field methods, and preliminary interpretations of the fieldwork.

In excavating the backhoe trenches from the present-day ground surface into the top of the ca. 12,000 year old Pleistocene gravels, all evidence of prehistoric and historic cultural deposits and features was exposed, regardless of whether they were associated with A, B, or C soil horizons. Backhoe trenching was intentionally undertaken in acknowledgment of the potential for the presence of deeply buried cultural features, and was highly successful in finding archaeological features below fill deposits that extended into the B and C horizons. This same approach was followed on WSDOT parcels associated with the former military reserve as well as those in the Historic City of Vancouver. Many, if not most, of the cultural features found would have been missed if the discovery investigations were limited to manually excavated test units.

ASSEMBLAGE ANALYSIS AND COLLECTIONS MANAGEMENT

Based on the results of the archaeological discovery investigations, the great majority of the artifacts recovered from intact cultural deposits and features on the WSDOT parcels were associated with civilian occupation and activities in the Historic City of Vancouver, rather than with the HBC or U.S. Army. Accordingly, the cultural materials recovered from the WSDOT parcels were catalogued using the SHARD (Sonoma Historic Artifact Research Database) artifact catalog system.

A cooperative effort of the Society for Historical Archaeology and the Anthropological Studies Center at Sonoma State University, this catalog system was developed specifically for use with mid-nineteenth to early twentieth century artifacts. Agencies from all over the world have downloaded SHARD to catalog their collections. SHARD was selected for use during the CRC project because the system will allow comparison of the artifact assemblages recovered during the CRC project in Vancouver with databases from historical archaeological sites across the United States.

For the purposes of the present document, summaries of the artifact assemblages are provided, with each site chapter including at least two tables: (1) summarizing the contents of the assemblage as a whole in terms of various provenience units, especially intact contexts versus fill; and (2) a summary of temporally diagnostic artifacts found. Along with interpretations of stratigraphy, these tables provide the basis for conclusions drawn regarding the significance/non-significance of the archaeological remains in each parcel.

The presentation of information about the artifacts recovered is supplemented by three appendices. Asian artifacts recovered from sites in the WSDOT parcels are reported in Appendix 1C-II: Asian Artifacts from the Columbia River Crossing Project, by Priscilla Wegars. Faunal materials (animal bones, mollusc shell fragments, and coral) recovered from sites in the WSDOT parcels are identified in Appendix 1C-III: Faunal Remains from the Columbia River Crossing Project. A catalog of the artifacts recovered is provided in Appendix 1C-IV: Artifact Collections from WSDOT Parcels: Analytical Database.

3. INTEGRATED GEOARCHAEOLOGICAL INVESTIGATIONS ON THE VANCOUVER GRAVEL PLAINS, VANCOUVER, WASHINGTON

Widespread ground disturbances are likely to have occurred from past highway construction activities in the CRC APE along the I-5 corridor in Vancouver, Washington. Geoarchaeological investigations were carried out to establish (1) the extent of cut-and-fill activities during previous construction, (2) the nature of introduced fill materials, and (3) the depth to undisturbed native soils in the project area. With these objectives in mind, three types of subsurface analyses were undertaken: morphostratigraphy, ground penetrating radar (GPR), and soil profiling.

Morphostratigraphic correlations were initiated with the study of logs from previously reported geotechnical boreholes (Peterson 2007). The correlations were refined with in-field examination of measured sections in quarry and excavation unit exposures in the project area (Peterson 2009). GPR surveys were conducted in several stages, including (1) system testing, (2) high-power GPR profiling, (3) selected high-frequency profiling, and (4) time-slice amplitude mapping. The profile mode of data presentation proved to be the most useful for presenting depth of cut-and-fill prior to archaeological testing (Peterson 2009). Soil profiling was conducted in exposures provided by archaeological investigations to verify initial GPR interpretations. The results of these various subsurface analyses were of considerable value in determining the most appropriate excavation methods for locating and assessing buried archaeological remains in the CRC APE.

MORPHOSTRATIGRAPHY

The morphostratigraphic relationships in the CRC APE across the Vancouver Plains are summarized in previous reports (Peterson 2007, 2009). Four morphostratigraphic units are of interest: (1) late Pleistocene flood gravels, (2) early Holocene loess deposits, (3) late Holocene flood silts, and (4) recent cut-and-fill layers. The fluvial facies identified in this report follow standard terminology presented by Leopold and others (1992). The reference to Pleistocene flood gravels follows early stratigraphic nomenclature for the Portland Basin provided by Trimble (1963). Elevations are provided in NAVD88.

The Pleistocene gravels are well documented in 27 geotechnical boreholes in the CRC APE on the Vancouver Plains (Figure 3-1). These boreholes generally exceeded 20.0 m (65.0 ft) in depth. To summarize, the geotechnical borehole logs indicate a change from gravel to sandy gravel or gravelly sand with increasing elevation from 9.2 m (30.0 ft) to 60.1 m (200.0 ft) above present Columbia River level (river datum is about 0.0 m/ft NAVD88). The apparent change in Pleistocene gravel-to-sand ratios with elevation is denoted by a shift from basal gravels to sand and gravel rhythmites in the stratigraphic cross-section.

For this report, distinctions are made between (1) the lower terraces at 5.0 to 15.0 m (16.0 to 47.0 ft) elevation, (2) the middle terraces, including the Evergreen Blvd. and Mill Plain Blvd. terraces, at about 20.0 to 40.0 m (66.0 to 131.0 ft) elevation, and (3) the upper, Fourth Plain,

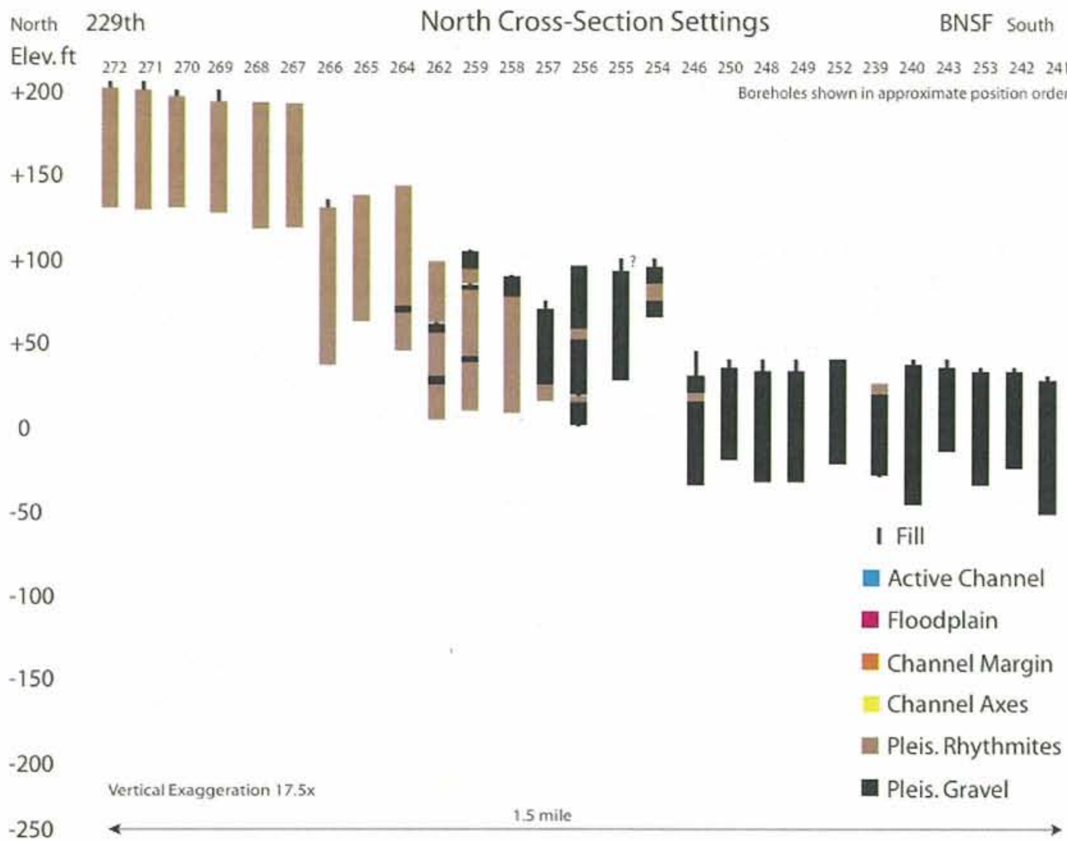

Figure 3-1. Stratigraphic cross-section of depositional settings documented in boreholes plotted against elevation from BNSF railroad tracks north to 229th Street in Vancouver, Washington (from Peterson 2007).

terraces at about 60.0 m (197.0 ft) elevation. The latter terraces form the ridge-crest drainage divide in the CRC APE. The specific Pleistocene "flood" ages of the different gravel plains have not been established.

An important feature of the Vancouver gravel plains is the lack of a constructional terrace depositional sequence. Typically, a cut strath surface is overlain by a fining-upward sequence of channel thalweg gravel, bar sands, and flood silts. Such a sequence would indicate gradual terrace abandonment by lateral channel migration or by channel lowering during river channel rejuvenation. On the Vancouver gravel plains, however, the Pleistocene gravels occur near the top of the terrace depositional sequence. Where the prehistoric surfaces are intact, the Pleistocene gravels are covered by only about one meter of overlying sand or silt (see below section on Soil Profiling). In areas of the CRC APE disturbed by previous highway construction, the Pleistocene gravels often occur just below artificial fill (Figure 3-2). The sand or silt deposits atop the Pleistocene gravels represent strath surfaces that were abruptly abandoned following catastrophic flooding in latest Pleistocene time.

Figure 3-2. View of fill material above native soil (Bw horizon) at 1.0 m (3.0 ft) depth in the east wall of MT2 in WSDOT parcel W9B.

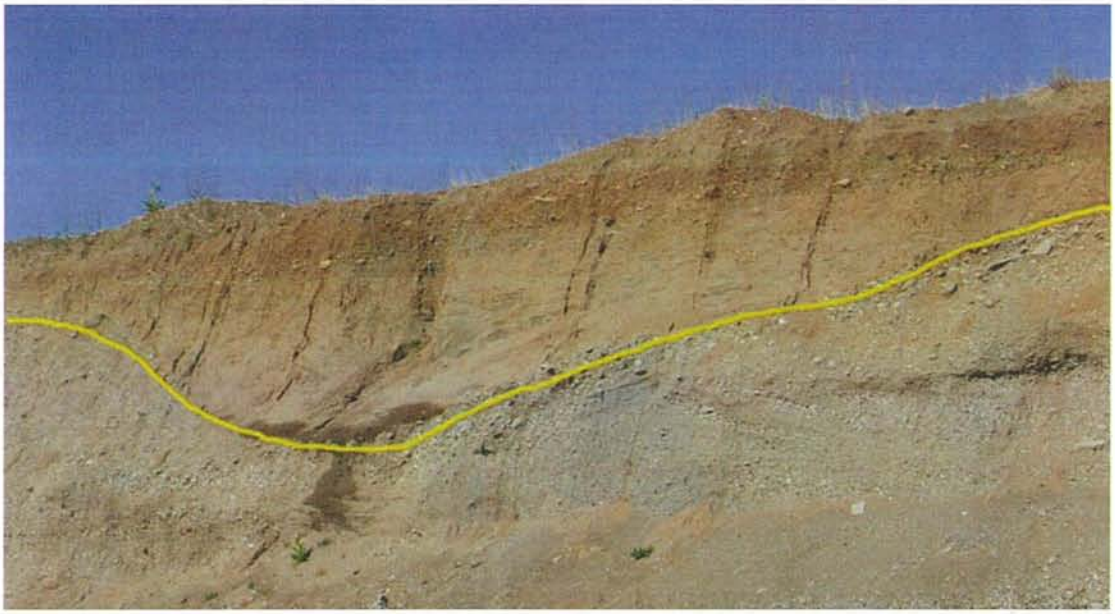

Figure 3-3. Pleistocene channel form feature at top of west wall exposure in English Quarry, northeast Vancouver. Yellow line denotes the channel cut-and-fill (2.0–3.0 m/7.0–10.0 ft deep) in the late Pleistocene gravels.

Minor channel forms occurring in the Pleistocene gravels are clearly visible in the walls of the deep pit at the English Quarry in northeast Vancouver (Figure 3-3) (Peterson 2009). These channel forms could be mistaken in GPR profiles for artificial cut-and-fill features. The channel forms exposed in the quarry walls, however, were created by the Missoula Floods, and therefore antedate the Holocene period of interest. Once exposed in mechanical trenches, cut-and-fill features in the CRC APE were easily distinguished from channel forms by the presence of historical artifacts in the fill material.

Gullies occasionally formed in the Vancouver gravel plains as a result of headward erosion during catastrophic flood discharge. The headward erosion gullies serve as catchments basins for Holocene soils, creating contexts in which early cultural materials may be preserved. Such gully features are likely to have developed in the CRC APE, but they may have been in-filled by construction activities. This process was documented on the west side of I-5, where a "slough" shown on Sanborn Insurance maps from 1884, 1888, and 1890 was filled by 1892 for townsite development (Figure 3-4). Evidence of this buried slough was found during deep testing in CRC Areas W19C and W20.

The Vancouver gravel plains exert a particularly important geomorphic control on groundwater level in the CRC project vicinity. As indicated by geotechnical borehole logs, the high permeability of the thick gravel beds results in a deep groundwater level, typically 10.0 to 20.0 m (33.0 to 66.0 ft) below surface. As a result of the exceptional drainage, there are no surface creeks, ponds, or lakes in the higher elevation gravel plains. Weathering profiles show oxidation in the Pleistocene gravels, thereby decreasing preservation potential of organic materials (see section below on Soil Profiling).

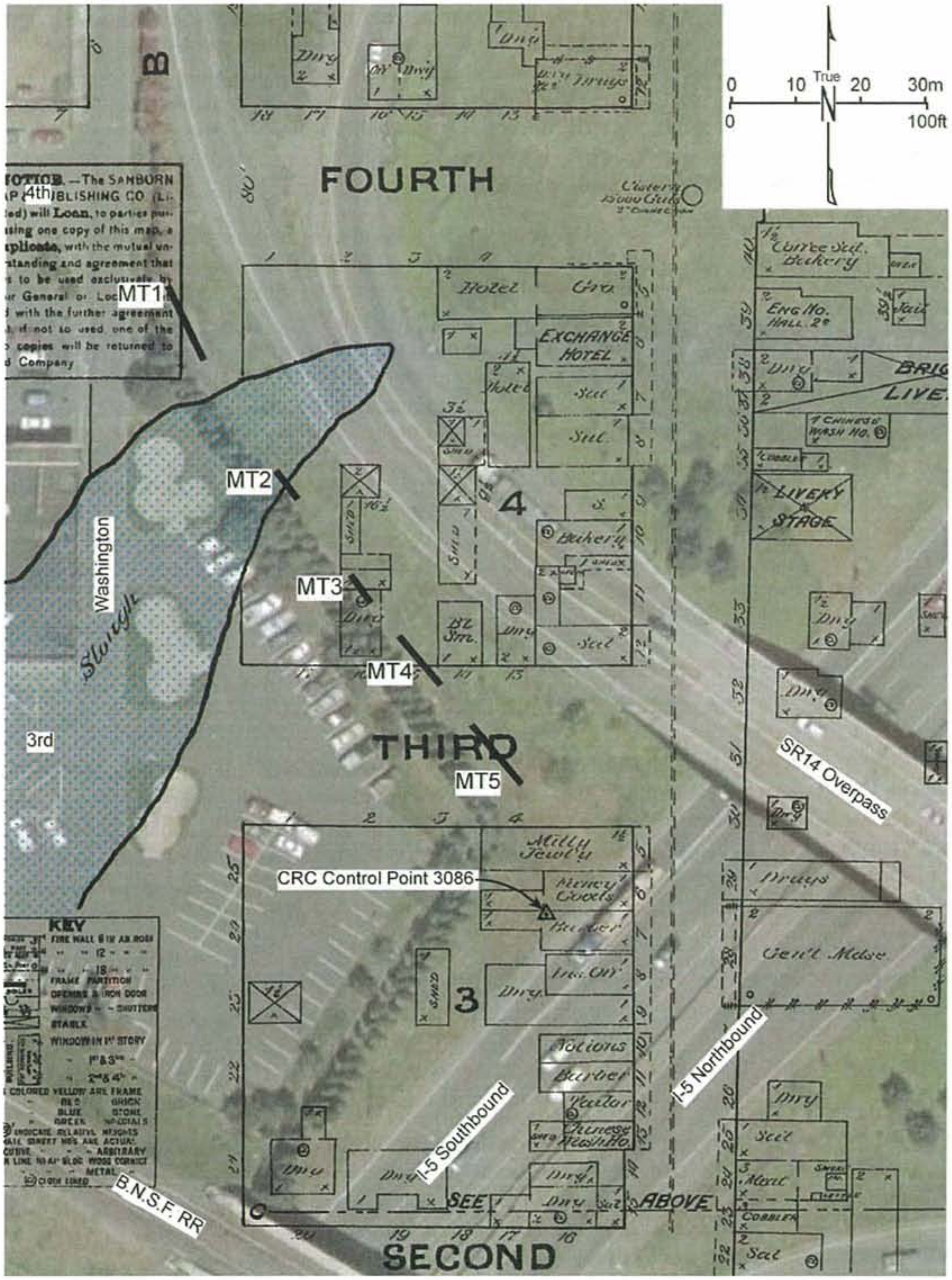

Figure 3-4. The slough shown on this 1884 Sanborn fire insurance map represents an example of a gully formed by headward erosion during catastrophic flood discharge on the Vancouver gravel plains. The slough was filled by 1892 to allow additional townsite development.

Two other geologic strata, early Holocene loess topsoils and late Holocene flood silts, are locally preserved in the CRC project area. The loess topsoils are rich in silt, but not in cohesive clay. In the higher terrace elevations, the loess topsoils are bioturbated and oxidizing, as observed in a wall profile from an NPS test unit on the Parade Grounds at Vancouver Barracks (Figure 3-5). The loess is believed to have originated from nearby Columbia River banks that were exposed to eolian sediment transport during lower water levels. However, much additional work on the source(s) and timing(s) of loess deposition is warranted.

Late Holocene flood silts are expected to occur on the surface of only the lower elevation terraces in the Vancouver area. The 1948 Columbia River flood in the CRC project area reached an elevation of 11.0 m (36.27 ft) NAVD88. This flood elevation corresponds to an estimated discharge of 29,000 m^3s^{-1}. The 1948 event is the largest flood recorded in the 20th century. A larger flood occurred in 1894, reaching an estimated discharge of 35,000 m^3s^{-1} (David Jay, personal communication 2009). The 1894 flood represents a 100- to 500-year flood event, based on extrapolated historic discharge records. This event inundated the early historic Fort Vancouver "prairie" at an elevation of 11.0 to 13.0 m (36.0 to 43.0 ft).

These flood elevations were reached during historic high sea levels in the Columbia River. The lower Columbia River is a fluvial-tidal system, with modern tides extending to the Bonneville dam. Lower sea levels during the late Holocene, changing at a rate of 1.0 m (3.0 ft)/1000 years (Peterson et al. 2009), would have reduced levels of equivalent flood heights by 1.0 to 3.0 m during the last several thousand years. It is not expected that any late Holocene flood silts would be encountered at terrace elevations above 15.0 m (49.0 ft) NAVD88 in the CRC project area.

GROUND PENETRATING RADAR

The testing of GPR systems in the Vancouver gravel plains setting is detailed in a separate report (Peterson 2009). That report contains details on the combinations of transducers, antennae, step sizes, digital stacking, data processing, and plot formatting used in the geoarchaeological investigations for the CRC project. The procedures described here follow those of Bristow and Jol (2003). Other methods have been used in the historic Fort Vancouver areas by other investigators (see National Park Service reports).

GPR surveys were undertaken in the various subareas of the CRC APE prior to any archaeological excavations. The layout of the GPR profile lines, and subsequent ground-truth sites, was based on (1) project area boundaries, (2) historic maps, (3) equipment access, and (4) personnel safety near high-speed traffic. The GPR profile data were archived as raw data files, processed data files, and jpg cross-section plot images. The GPR profiles are geo-referenced; the profile metadata are detailed in a GPRLineLog database (Excel spreadsheet).

The GPR profiles were generally spaced at 3.0 m-intervals, where survey areas were wide enough to accept multiple lines. The ground-truth transects were established on every third GPR profile, with about 10 m spacing between transects. Ground-truth locations were placed directly on the GPR profile at 10.0 m-intervals along the line, and at anomalies identified along the line that appeared to potentially represent buried cultural features. The ground-truth probe, test unit, or mechanical trench was logged for fill levels, morphostratigraphy, and soil sequence. These data were compiled in a GroundtruthProfiles database (Excel spreadsheet).

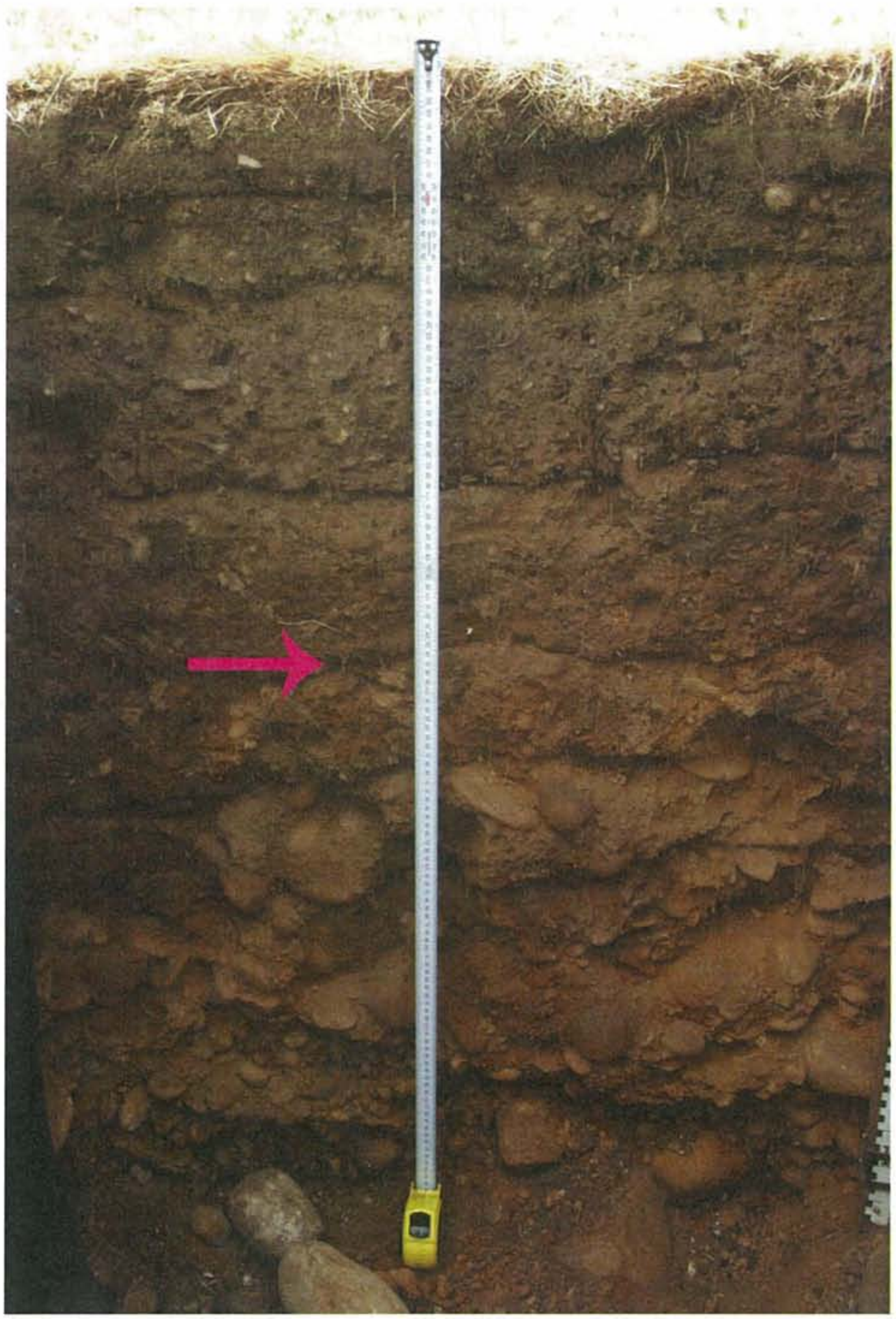

Figure 3-5. Shallow soil profile (0.0 to 1.25 m/4.0 ft deep) exposed in south face of NPS test unit PG43 on the Parade Ground at Vancouver Barracks. Pebbly silt (bioturbated loess) overlies imbricated cobble and infiltrated silt matrix at 70.0 cmbs (28.0 in) (see arrow).

At least two probe, auger, or trench sites were needed for the initial ground-truthing of reflection facies in GPR profiles. Verifying reflection facies distribution and/or continuity required dense ground-truth testing, to at least 10 m distance intervals along GPR lines. This nested ground-truthing approach required that the geoarchaeologist(s) be present on-site throughout archaeological testing along the previously collected GPR profiles.

Ground-truthing of the GPR reflection signatures in the archaeological excavation units permitted greater confidence in the interpretation of fill materials, cultural features, and continuity of buried conductive layers. The GPR profiles extended the coverage of fill depths between the probe or trench locations. The GPR profiles also extended the record of native soil depths below the reach of manual probing or mechanical trenching where these methods terminated in thick fill deposits.

The GPR and ground-truth profile databases, including interpreted depth of fill, parent strata identification, and large feature anomalies, are cross-referenced by GPR line numbers and ground-truth site accession numbers. The two databases can be searched for (1) geographic coordinates, (2) artificial fill depth, (3) fill compaction, (4) buried cultural features, (5) preservation of native soils, (6) depth to native soils, and (7) continuity of native geomorphic surfaces.

SOIL PROFILING

The major focus of the geoarchaeological investigations in the CRC project area was the identification of key soil horizons that either (1) may contain prehistoric or historical artifacts, or (2) are older than the 12,000 BP time line, as established for archaeological investigations in the CRC APE. Typically, weathered soils that form over long time periods in a subaerial surface develop A horizons (dark organic-rich topsoil) over B horizons (zone of hydroxide mineral accumulation) over C horizons (unweathered parent materials). In the CRC project area, the soils on the Vancouver gravel plains are expected to postdate the Missoula Floods, which ended by 12,000 BP. Periods of loess deposition or Columbia River flood silt deposition have added to the soil thickness following the termination of Missoula flood scouring in the ancestral river valley. The late Holocene flood silts should not be present in terraces above 15.0 m (49.0 ft) NAVD88 (see earlier section on Morphostratigraphy). The loess deposits are widespread, occurring locally on all of the intermediate and higher terrace surfaces where the prehistoric soil profiles are preserved.

Standard soil profiling methods (following Birkland 1999) were employed in recording the stratigraphy observed in the exposures provided in the various archaeological excavation units. Color of moist soil was measured in the field using Munsell color charts. Sand was discriminated from mud in the field using calibrated grain-size cards. The presence of cohesive clay was determined from ribbon texturing by hand in the field. Selected soil profiles were analyzed quantitatively for grain size by sieving the gravel and sand size fractions and settling decantation of the silt and clay site fractions.

In addition, the relative compaction and cementation of soil layers was measured semi-quantitatively in the field by pocket penetrometer (kg/cm^{-2}). To support and stabilize the paved travel lanes, heavy equipment was employed during previous highway construction to compact the ground along the margins of I-5 and associated interchanges. The compactness of the ground made manual archaeological excavations difficult. Calibrated field tests during fieldwork in the various CRC subareas established that the compaction of the fill, which often contained gravel, asphalt, and/or structural debris, often reached or exceeded 3 kg/cm^{-2} (unconfined compressive strength)—the limit, according to engineering manuals, at which manual excavations are no longer feasible and mechanical trenching must be employed.

Manually-excavated test units (TUs) and mechanical trenches (MTs) were examined for relative soil development to establish the sequence, thickness, and key characteristics of soil horizons A, B, and C. The A horizon is expected to be a time-transgressive surface that extended from the termination of scouring by the Missoula Floods to modern time, unless disturbed by anthropogenic removal (cut) or burial (fill). The Bw horizon is also time-transgressive during this period, but it was developed underground by translocation of fine silt particles and dissolved hydroxide minerals downwards through gravel pore spaces. The Bw horizon represents a diagenetic layer that is physically undisturbed since the Missoula floods ended by 12,000 BP.

The A horizon represents a layer of intermittent bioturbation; the enrichment of organics in the A horizon makes this layer particularly unstable. It is frequently eroded during construction. The A horizon is expected to potentially contain prehistoric and/or historical artifacts and cultural features. The Bw horizon is weakly cemented by the hydroxide mineral precipitates, so it is more resistant to construction activities. Unless artifacts were introduced from the overlying A horizon, the Bw horizon should be culturally sterile. Where soil horizons are clearly mixed with artificial fill, they are termed "mixed." Mixed A, Bw, or C horizons indicate disturbed soils that cannot be used to establish sequence age.

INTEGRATED GEOARCHAEOLOGY DATABASES

Two databases were constructed to compile the GPR profile data and the soil profile data. The databases are linked to each other, as well as to the archaeology field notes, through site-specific accession numbers. The accession numbers are based on numbered GPR lines and numbered probe or trench locations for each CRC project subarea in Washington. Positions along the numbered GPR lines are cross-referenced to positions in the probe and mechanical trench transects. Site identification is independently verified by 12-channel WAAS-assisted 3D differential GPS coordinates for all GPR profile endpoints and for all ground-truth profile sites.

The metadata for each database are identified by text descriptions in the database header pages. The data entries for the GPRLineLog database include: (1) GPR Line number, (2) CRC subarea, (3) date of data collection, (4) UTM location coordinates— northing and easting (m +/- 5.0 m EPE nominal), (5) line position— distance from start point (m ± 0.5 m error over 100 m distance), (6) elevation— local or regional datum (m ± 0.1 m error), (7) GPR system—500 and 250 MHz (shielded antennae with 180 v transducer) or 200, 100 and 50 MHz (unshielded antennae with 1000 v transducer), (8) step size (0.xx m), 9) reflection facies type (electromagnetic anomaly-EMA, high or low amplitude, horizontal or inclined, convex or concave, truncated, chaotic), (10) two-way travel time to reflection (ns) and estimated depth (m), assuming default 0.1 m/ns signal velocity, and (11) summarized ground-truth data for corresponding GPR line distance. Additional site notes document CRC subarea, layout of GPR lines, line spacing, reversed lines, and repeated lines with higher-frequency.

The data entries for the GroundtruthProfiles database include: (1) ground-truth profile location on corresponding GPR line, (2) ground-truth site accession number (based on GPR line, probe or mechanical trench number, and/or trench distance), (3) date of data collection, (4) UTM location coordinates—northing and easting (m ± 5.0 m EPE), (5) profile subsurface depth (m), (6) age and soil horizon (fill, buried "A," Pleis. Bw, Pleistocene Cox, Pleistocene C, or mixed), (7) texture (fill—gravel, sand, silt, brick, concrete, asphalt, charcoal; natural materials—cobble, pebble, sand, silt), (8) sedimentary structure (framework or matrix support, other), (9) moist color (Munsell code and abbreviation), (10) pocket penetrometer (kg/cm^{-2}), and (11) alteration (compaction, MnOx, or white precipitate "WZ"). The white precipitate was identified as opal by x-ray diffraction (XRD). Additional site notes document site position in corresponding GPR line, and/or in mechanical trench, and other nearby features observed in the trench during profiling.

Color-coding identifies key data in the two databases. In the GPRLineLog database, the key estimates of "depth of fill" and structure anomaly positions are shown in orange. In this database and in the GroundtruthProfiles database, the corresponding ground-truth profiles are highlighted in purple. The absence of the key cultural soil layer, the A horizon, is identified in orange.

INTEGRATED GEOARCHAEOLOGICAL INVESTIGATIONS AT W9

The methodology of integrating the geoarchaeological investigations is detailed below using WSDOT parcel W9 as a representative area. The results of the GPR surveys undertaken in other CRC parcels on the Washington shore are summarized under the heading "GPR Reconnaissance" in the discussions of each site presented in the remaining chapters of this appendix.

Located on the northeast side of the I-5/SR-14 intersection, W9 consists of a narrow strip of ground bounded on the east by the chain-link WSDOT property fence and on the west by a ramp connecting SR-14 to northbound I-5 (Figure 3-6). The northern portion of W9 (W9A) is bordered to the east by the FHWA property. The southern portion (W9B) is bordered to the east by U.S. Army property. The FHWA and U.S. Army properties are separated by East 5th Street. Before construction of I-5, East 5th Street continued westward, providing a connection between the military reservation to the east and the City of Vancouver to the west. East 5th Street now dead-ends at the WSDOT property along the east side of I-5.

GPR Reconnaissance

Significant slopes associated with highway shoulder construction resulted in 1.0 to 3.0 m (3.0 to 10.0 ft) of relief at W9. Based on apparent fill thickness, a decision was made to use the Sensors & Software pulseEKKO 100Ka system with a 1000v transmitter and 200 MHz antennae. Previous testing for the CRC project indicated that this system could penetrate to the 2.0 to 3.0 m (7.0 to 10.0 ft) depth needed to establish the predicted cut-and-fill relationships in W9. Following the initial GPR testing, it appeared that shallower fill depths (<1.0 m/<3.0 ft) might be encountered in W9B. A high-frequency Sensors & Software EkkoPro system with a 180v transmitter and 500 MHz shielded antennae was used to repeat one GPR line along the chain-link fence in this southern segment. Comparisons of the GPR records from the two systems were verified by observations of the corresponding exposures in the walls of mechanical trenches (MT) excavated in W9A and W9B.

Four 200 MHz GPR north-south profiles were completed in W9, including CRC Line 10 (179.5 m/588.8 ft length), CRC Line 11 (78.0 m/255.8 ft length), CRC Line 12 (100.0 m/328.0 ft length), and CRC Line 13 (81.75 m/268.1 ft length). The GPR lines provided reconnaissance coverage at 3.0-m intervals between the highway shoulder and chain-link WSDOT property fence. A GPR step spacing of 0.25 m (about 1.0 ft) provided sub-meter resolution for features along the profile. Subsequent ground-truthing of the recorded GPR profiles (see earlier section on

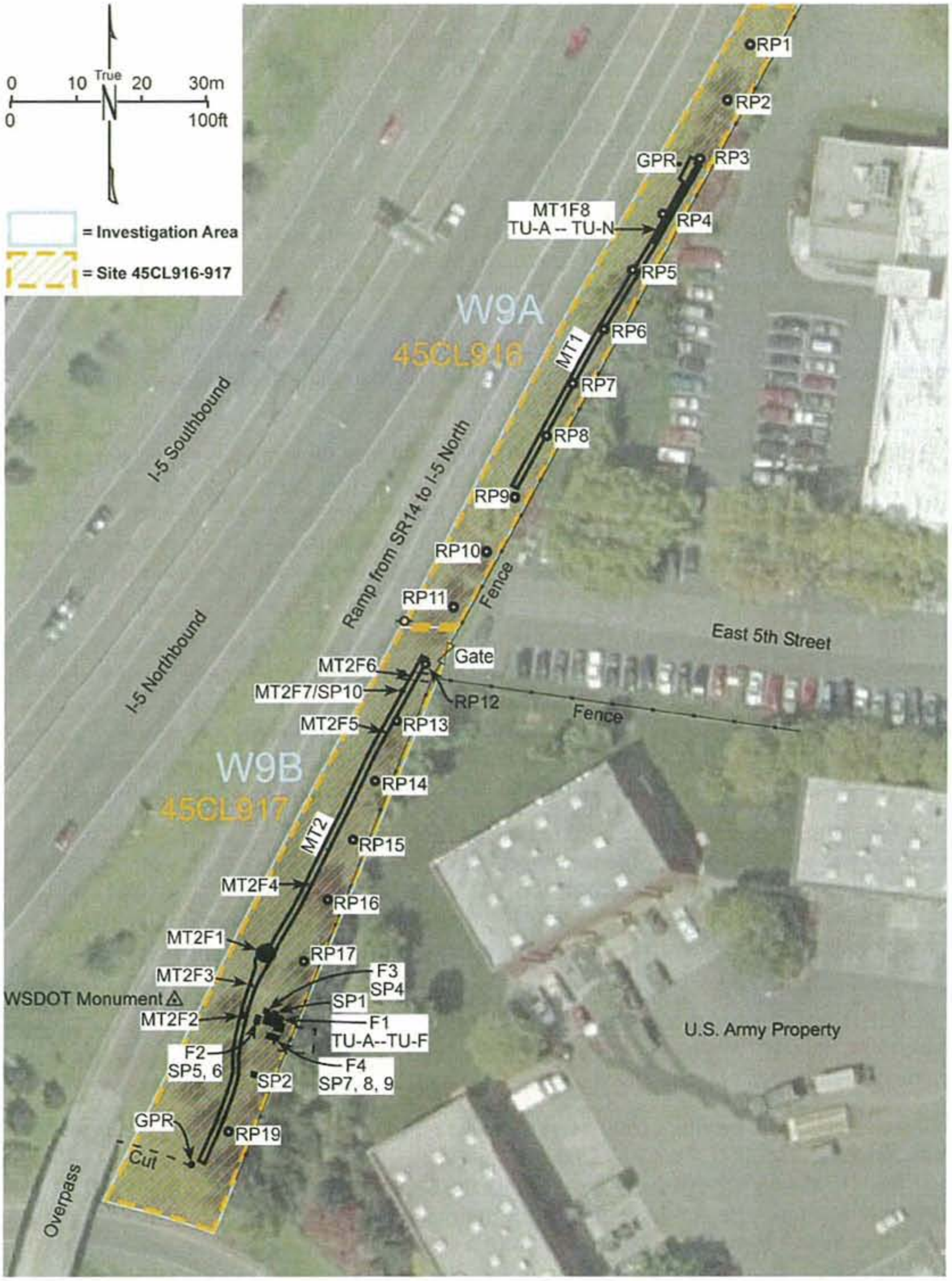

Figure 3-6. Locations of manual excavations (RP, SP, TU) and mechanical trenches (MT) along previously collected GPR profiles in WSDOT parcels W9A and W9B.

soil profiling) confirmed both an assumed signal velocity (0.1 m ns^{-1}) and depth of penetration to 2.0 to 2.5 m (7.0 to 8.0 ft) below surface for the 1000 v, 200 MHz GPR system. One 500 MHz GPR profile, CRC Line 221 (81.65 m/267.8 ft length), was repeated along CRC Line 11 in W9B. Step resolution for CRC Line 221 was 5.0 cm (2.0 in), providing nearly decimeter scale spatial resolution. However, the high spatial resolution reduced the on-site field interpretation of the GPR record due to the "stretched" profile plot.

The GPR profile from the northern portion of CRC Line 10 (in W9A) demonstrated the presence of a continuous conductive layer at 40-50 ns time travel distance (2.0 m/7.0 ft below surface). The buried conductive layer was overlain by discontinuous chaotic reflections, which included many small (<0.5 m/<1.6 ft) anomalies (Figure 3-7). Most of the manually excavated round probes (RP) later placed in this area were terminated by 70.0 cm (approximately 2.0 ft) below surface, and therefore did not extend deep enough to reach the buried conductive layer. However, these probes did establish that the resistive materials overlying the buried conductive layer were artificial fill.

Subsequent ground-truthing of the GPR profile was conducted by means of mechanical trenches (MT1 in W9A and MT2 in W9B) located about 2.0 m (7.0 ft) down-slope (0.5 m/1.6 ft vertical distance) from CRC Line 10. The continuous mechanical trenches confirmed that the conductive layer was a buried Bw soil horizon (see below for further discussion). The measured depth to the top of the Bw conductive layer confirmed a GPR signal velocity of 0.1 m ns^{-1} in the resistive fill materials in W9.

The GPR profile from CRCLine10 revealed five large anomalies (Table 3-1) in W9A and W9B. Excavation of the mechanical trenches established that these anomalies are cultural features. The anomalies correspond to a catch basin (at 55.0 m/180.0 ft distance), a buried concrete sidewalk/brick foundation (at 100.0 m/328.0 ft distance), a buried brick pier on top of a concrete footing (at 112.0 m/367.0 ft distance), a buried brick cistern (at 145.0 m/476.0 ft distance), and a buried concrete foundation corner (at 155.0 m/508.0 ft distance) (Table 3-2).

Large anomalies are illustrated by bold red lines in segments of GPR profiles from CRC Line 10 provided in Figure 3-8. The profile on the left shows the anomaly at 143.0 to 150.0 m (469.0 to 492.0 ft) distance that corresponds to the brick cistern (MT2 Feature 1) (Figure 3-9). The profile on the right shows the anomaly at 155.0 to 160.0 m (508.0 to 525.0 ft) distance that corresponds to the concrete foundation corner (Feature 1 exposed in TU-A–TU-F, SP1, and SP3) (Figure 3-10).

These large anomalies are clearly identified by the 200 MHz antennae in profile format. The base of these larger features (>1.0 m/3.0 ft below surface) cuts into natural soil layers below the fill (Table 3-3), thereby displaying disturbed strata under chaotic or parabolic reflections. Such chaotic reflections are produced by steep angled surfaces of the structural features.

High-frequency GPR profiling (500 MHz shielded antennae) was used to repeat CRC Line 11, which parallels the half of CRC Line 10 in W9B. The 500 MHz line was identified as CRCLine221. The higher frequency system lacks the penetration of the 1000 v, 200 MHz GPR, but it demonstrates much higher resolution in profile mode. The 180 v, 500 MHz antennae reliably collect data from 5 to 10 ns, or 0.25 to 0.5 m (0.8 to 1.6 ft) depth range (very-near surface). This very-near surface interval is largely obscured with the high-power 200 MHz antennae.

An example of the resolving capacity of the 500 MHz GPR antennae is shown in the CRC Line 221 segment at 10.0 to 20.0 m (33.0 to 66.0 ft) distance (Figure 3-11). The subsurface reflection record starts at 3 ns (15.0 cm/6.0 inch deep). A conductive triplet layer is shown at 15 to 20 ns, or

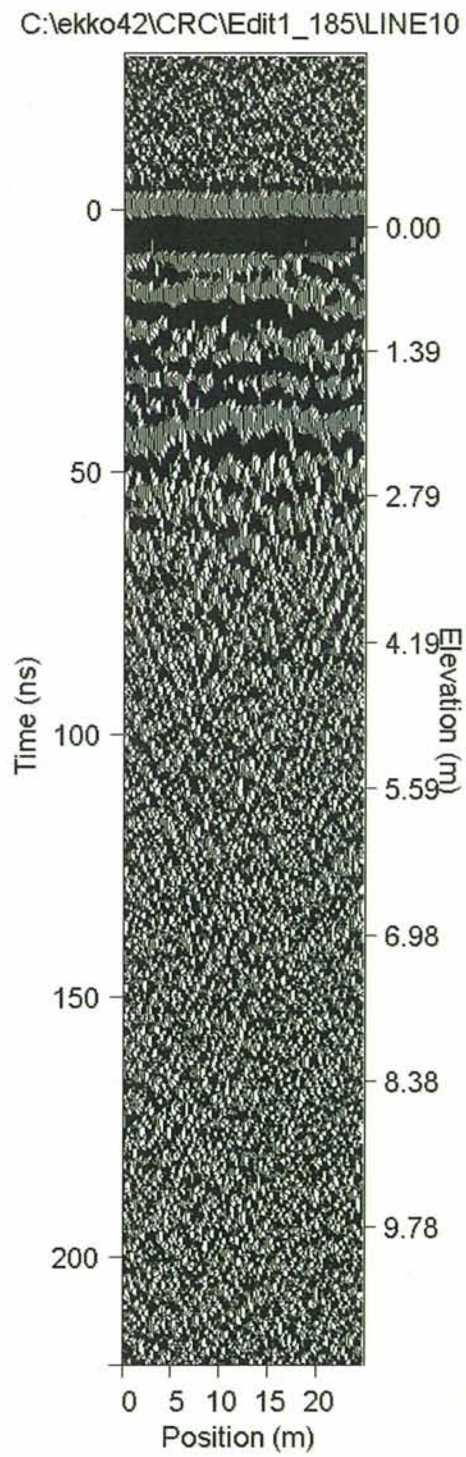

Figure 3-7. Segment (0.0–25.0 m/82.0 ft) of GPR profile from CRC Line 10 in WSDOT parcel W9. A conductive soil layer (40 ns signal travel time or 2.0 m/7.0 ft depth) underlies discontinuous reflections in resistive fill materials.

Table 3-1. GPR Data Log from CRC Line 10 in WSDOT Parcel W9.

Line	Start UTM_E	Start UTM_N	End UTM_E	End UTM_N	Antennae
CRCLine10	525853	5052488	525780	5052327	200

Profile Dist (m)	Notes
0	SOL
10	fill to 2 m, ***Basal reflection at 60 ns. Resistive to 2.5 m depth.
20	
30	
40	Basal reflection at 50 ns. Resistive to 2.0 m depth.
43	EMA anomaly at 1 m depth.
58	fence post EMA
50	
55	Large anomaly (15-50 ns) at 55-60 m position.
60	
70	Basal reflection at 50 ns. Resistive to 2.0 m depth.
80	
90	Shallow large anomaly at 90-100 m position.
95	***Shallow multiple peak anomaly at 100-105 m position.
100	
105	
110	Basal reflection at 70 ns. Resistive to 3.0 m depth.
112	Narrow anomaly (25-50 ns) at 112-113 m position.
120	
130	Basal reflection 40-50 ns, resistive fill to 35 ns (1.75 m depth).
140	
147	***Large convex anomaly (25-40 ns) at 143-147 m distance.
150	
155	*** Shallow concave anomaly (25-50 ns) at 155-165 m distance
160	Weak chaotic reflections (20-40 ns) occur at 155 m distance.
165	
170	
179.75	EOL

Table 3-2. GPR Ground-truthing Log for CRC Line 10 in WSDOT Parcel W9.

Line	W9 5th Street
CRC Line 10	Line starts ~ 70 m north of 5th St side access gate. Line runs 5 m west (parallel) of chain-link fence. Fence is located in apparent cut (1 m) compared to east grade. Hwy shoulder climbs 2 m on fill to west.
Profile Dist (m)	**Notes**
0	
10	
20	**RP3(10m)/RP4(20m)** shows fill to 1.5 m depth, Pleis. Bw at 1.5 m depth, confirms deeper Pleis. Bw conductive layer at 2.0-2.5 m depth in higher CRC Line 10 GPR to west.
30	
40	
43	**RP6(40m)** shows 3" metal pipe at 1 m depth.
58	
50	
55	**RP7(50m)** shows large metal grate (surface) over large drain vault (located 2 m east of CRCLine10 profile)
60	
70	**RP8(60m)** shows fill to 1.55 m depth, confirming the Bw conductive layer at 2.0 m depth in upslope CRCLine10 to west.
80	
90	**RP910 (70m)** shows gravel, brick fill to 0.7 m depth (in former 5th Street)
95	
100	**RP12(100m)** shows shallow 0.5-0.75 depth pavement, brick stub wall, and cement foundation over fill to 1.2 m depth, over truncated Pleis. Bw at > 1.2 m depth. **MT2/Feature 6**. Confirms soil Bw conductive layer at ~ 2.5 m depth at 5 m west of fence (CRCLine10).
105	
110	
112	**RP13(110m)** shows brick on cement pad (50x50cm) in west side of trench (30-100 cm depth). **MT2/Feature 5.**
120	**RP14(120m)** shows fill to 1.1 m over Pleis. Bw
130	**RP15(130m)** shows fill to 0.65 m over Pleis. Bw, confirms Bw conductive layer at 1.5-2.0 m depth in CRCLine10.
140	**RP16(140m)** shows fill over Pleis. Bw at 0.6 m depth.
145	**Radiocarbon sample** (wood) at 115 cm depth. **MT2/Feature 4.**
150	**RP17(150m)** shows brick cistern (2x2 m) centered at 151.5 m in west wall. **MT2/Feature 1.**
155	**SP1(160m)** shows 5x5m foundation/footing area.
160	Concrete stable foundation corner at 0.3-0.8 m depth. **Feature 1.**
165	
170	
179.75	

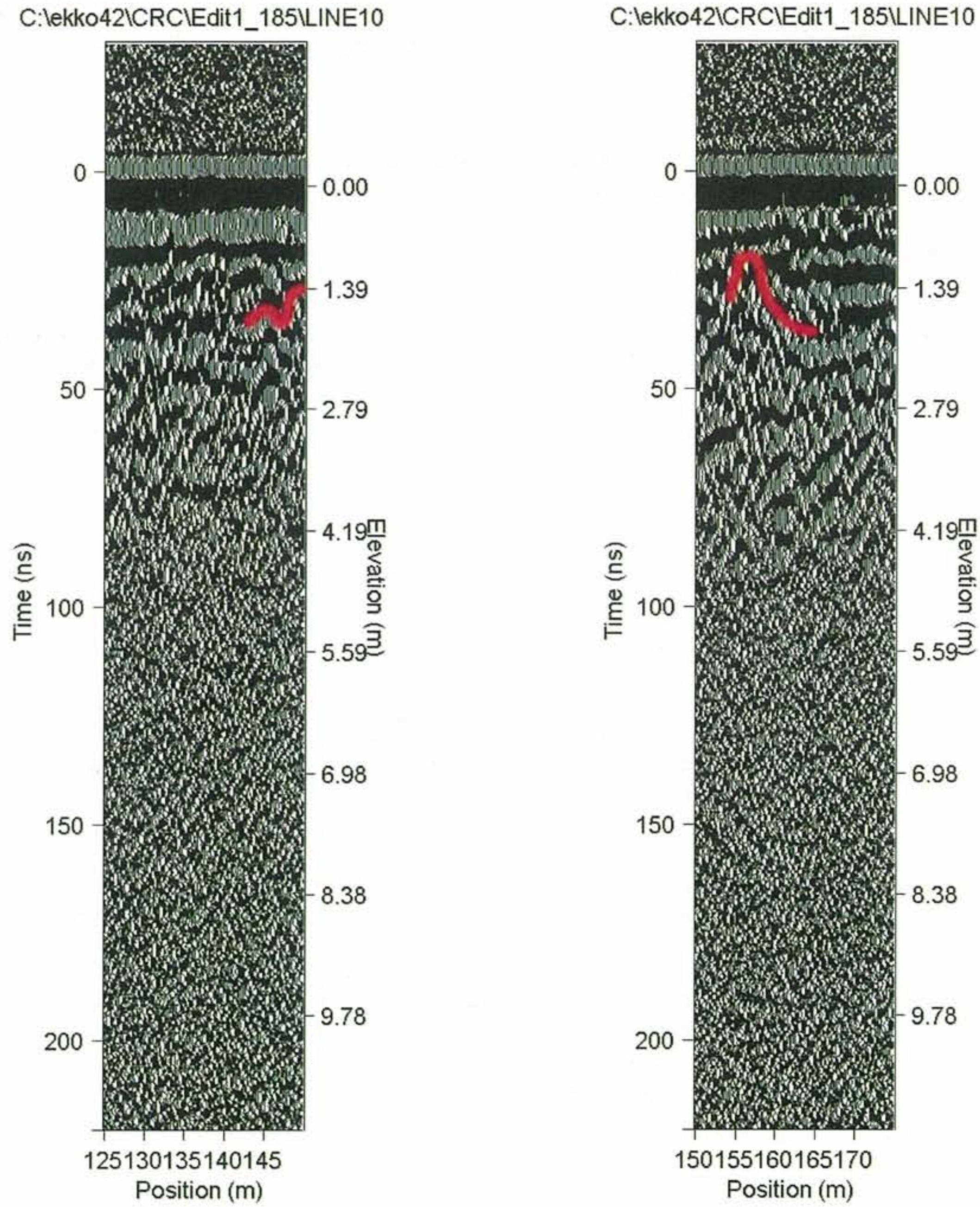

Figure 3-8. Segments of GPR profiles from CRC Line 10 in WSDOT parcel W9, showing large anomalies (bold red lines at 143.0 to 150.0 m/469.0 to 492.0 ft distance in left profile, and at 155.0–160.0 m/508.0–525.0 ft distance in right profile). These anomalies correspond to large structural features shown in Figures 3-9 and 3-10.

Figure 3-9. Buried brick cistern (MT2 Feature 3) exposed in WSDOT parcel W9B.

Figure 3-10. Concrete foundation corner (Feature 1) exposed during excavations in WSDOT parcel W9B.

Table 3-3. Relationships Between Feature Depths and Soil Strata in WSDOT Parcel W9.

GT Unit Location	LineStake#	Date	UTM_E	UTM_N
CRC Line 10_150m CRC Line 11_44m	**RP17**	4/2/08	525790	5052356

Depth (m)	Age/Horizon	Texture	Moist Color	Pocket Pen
0-0.6	Fill			
0.6-0.8	Buried A			
0.8-1.2	Pleis./ Bw			

Notes:
Trench profile site is 150 m south on CRC Line 10.
Trench profile site is 44 m south on CRC Line 11.
Trench wall is 5 m west of fence.
Brick cistern (2x2m) centered 1.5 m south of RP17, extends into west wall of trench.
Cistern is at least 2 m depth subsurface.
MT2/Feature 1.

GT Unit Location	LineStake#	Date	UTM_E	UTM_N
CRCLine10_160m CRCLine11_54m	**SP1**	4/2/08	525786	5052350

Depth (m)	Age/Horizon	Texture	Moist Color	Pocket Pen
0-1.1	Fill	Gravel, sand, silt, brick		
1.1-1.2	Fill	Terracotta Pipes oriented NE-SW		

Notes:
This site area was re-numbered from RP18 to SP1
Subsequent excavation resulted in several additional SP excavations:
  SP3, located 1.5 m SE of SP1
  SP3 was later expanded into TU-A (0.5-2 m west of fence)
  SP4 located 1 m west of SP1 (5 m west of fence)
  SP5 and SP6 located 2 m SW of SP1
Excavation revealed concrete foundation corner and brick debris.
The complex is thought to represent a stable shown on historic maps.
Recorded as W9 **Feature 1.**
Trench profile site is 160 m south on CRC Line 10.
Trench profile site is 54 m south on CRC Line 11.
Trench wall is 7 m west of fence.

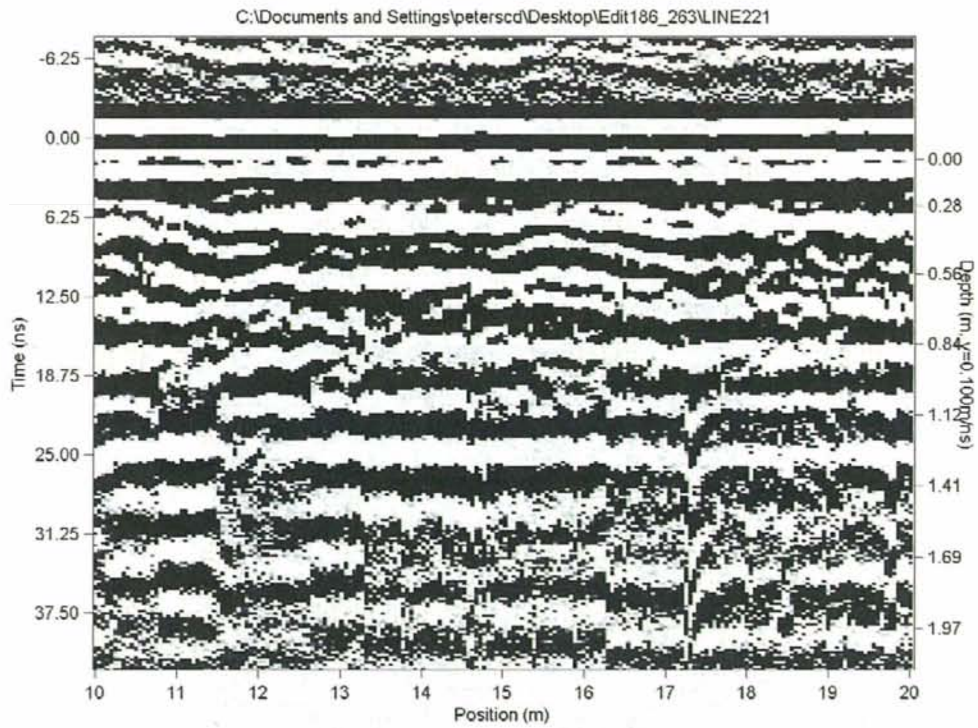

Figure 3-11. High-frequency GPR (500 MHz) profile segment at 10.0 to 20.0 m (33.0 to 66.0 ft) distance along CRC Line 221 (repeat of high-power CRC Line 11) in WSDOT parcel W9.

0.75 to 1.0 m (2.5 to 3.0 ft) depth. This triplet layer corresponds to an intact Pleistocene Bw soil horizon. Multiple shallow concave anomalies and short wave-length chaotic reflections are shown in the upper 5 to 14 ns. These anomalies correspond to shallow fill materials above the Pleistocene Bw soil horizon.

Observations of fill materials in the mechanical trenches showed them to consist of gravel, sand, and silt. Within these fill materials were asphalt, brick, and concrete fragments, as well as occasional metal straps, chain, cans, and nails. These cultural items were not targeted by GPR during this survey of cut-and-fill relationships in the CRC areas. These minor anomalies could have produced many misleading (false positive) GPR targets in time-slice amplitude mapping.

The depth of fill relationships established by the GPR profile method, and verified by the probe and trench ground-truthing, shows the shallow electromagnetic anomalies (EMA) to be hosted in the artificial fill. The higher power GPR systems (1000 v and either 200 or 100 MHz frequency) were used to penetrate through the fill and into the parent Pleistocene gravel deposits, thereby constraining the depth of the culturally relevant Holocene A horizon soils between fill and the Pleistocene gravels.

An example GPR profile segment is used to compare records from the low-resolution (high-power) CRC Line 11 (Figure 3-12) and from the high-resolution (low-power) CRC Line 221 (Figure 3-13). In the high-power 200 MHz GPR line segment, the recorded subsurface data starts at about 0.5 m (1.6 ft) depth, but extends to nearly 4.0 m depth (13.0 ft), or 80 ns. The lower half of the profile (below 30 ns or 1.5 m/5.0 ft depth) shows steeply inclined reflections that correspond to cross-

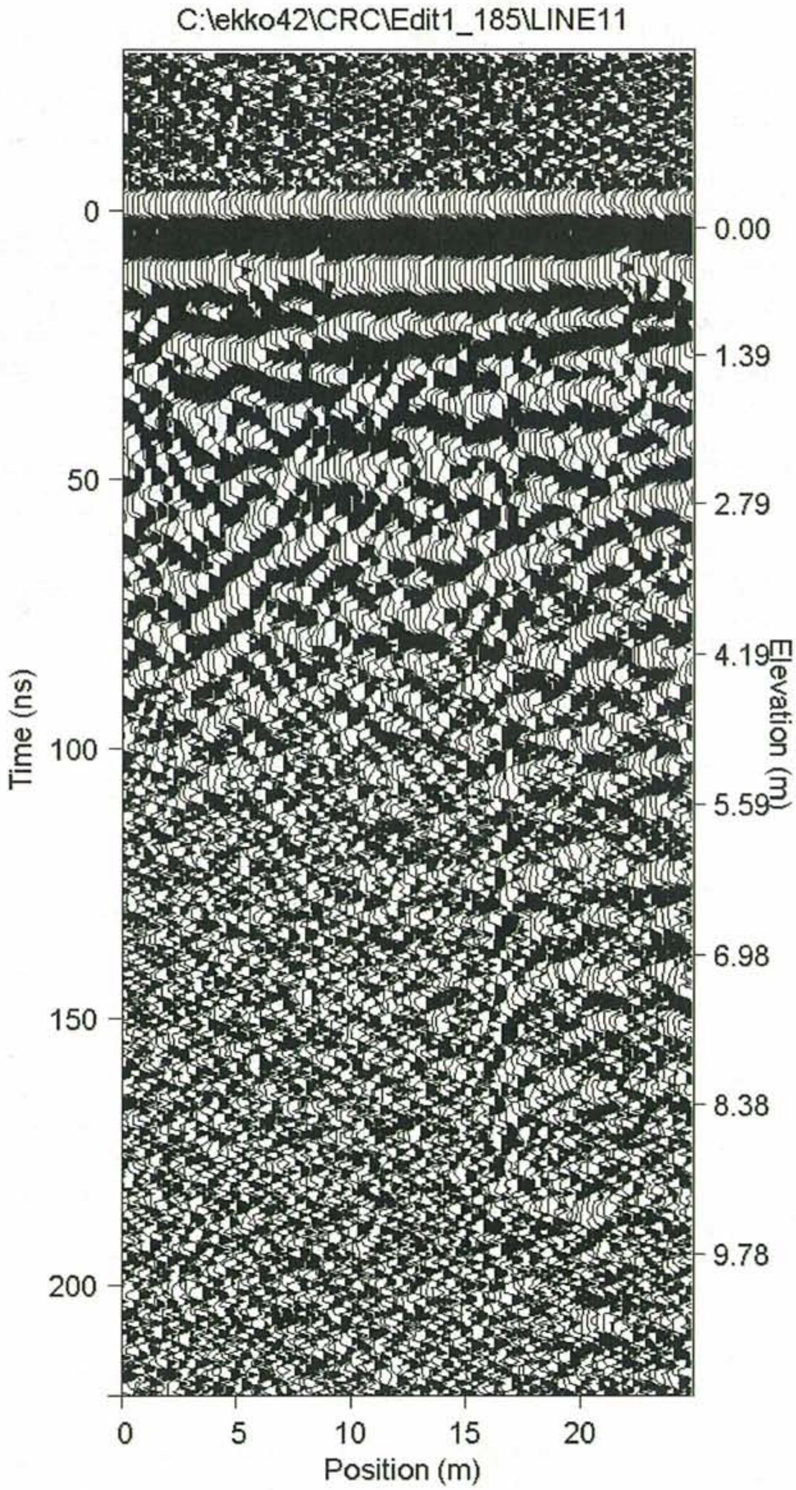

Figure 3-12. GPR profile from CRC Line 11 (200 MHz) at 0.0 to 25.0 m (0.0 to 82.0 ft) distance in WSDOT parcel W9.

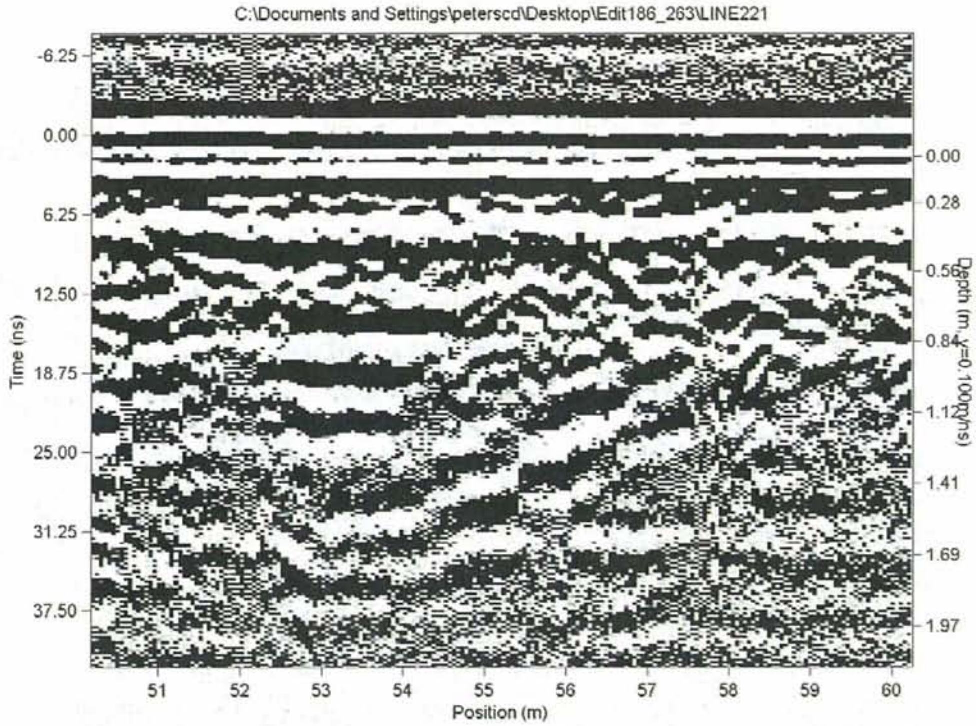

Figure 3-13. Striking concave anomaly from buried brick cistern at 47.0 to 58.0 m (154.0 to 190.0 ft) distance along CRC Line 221 (500 MHz antennae) in WSDOT parcel W9.

bedded strata in the Pleistocene gravels. This depth of penetration (80 ns) is more than three times the penetration (25 ns) of the 500 MHz system. The deeper penetration shows the context of the fill overlying the truncated cross-beds of the Pleistocene gravels, but at the cost of not showing small anomalies in the fill and not resolving the contact between the fill and the underlying Pleistocene Bw soil horizon. Both GPR systems have their advantages and disadvantages and can be used in succession where needed.

The high-resolution (500 MHz) GPR line segment (Figure 3-13) shows quite a difference in reflection response from the buried brick cistern exposed in MT2 (in W9B) relative to the low-resolution GPR record in CRC Line 10 (Figure 3-8, left). The high-frequency GPR run (CRC Line 221) was located a couple meters off to the side of the cistern, resulting in the "apparent deeper" reflected signal travel time distance (35 ns). The top of the cistern was actually only about 0.75 m below surface. However, the strong reflection response from the cistern allowed the weaker 500 MHz signal to be reflected at distance from the buried feature.

Another comparison between the high-power and low-power GPR systems is shown for the concrete foundation corner exposed in TU-A–TU-F (in W9B). In the high-power GPR profile (CRC Line 10), the shallow foundation is not resolved, but the fill-contact under the foundation shows a concave anomaly (Figure 3-8, right). By comparison, the low-power GPR record (CRC Line 221) does not penetrate below the fill, but it resolves overlapping high-amplitude concave anomalies and chaotic reflections associated with the concrete stable foundation from 0.1 to 0.7 m (0.3 to 2.3 ft) depth (Figure 3-14).

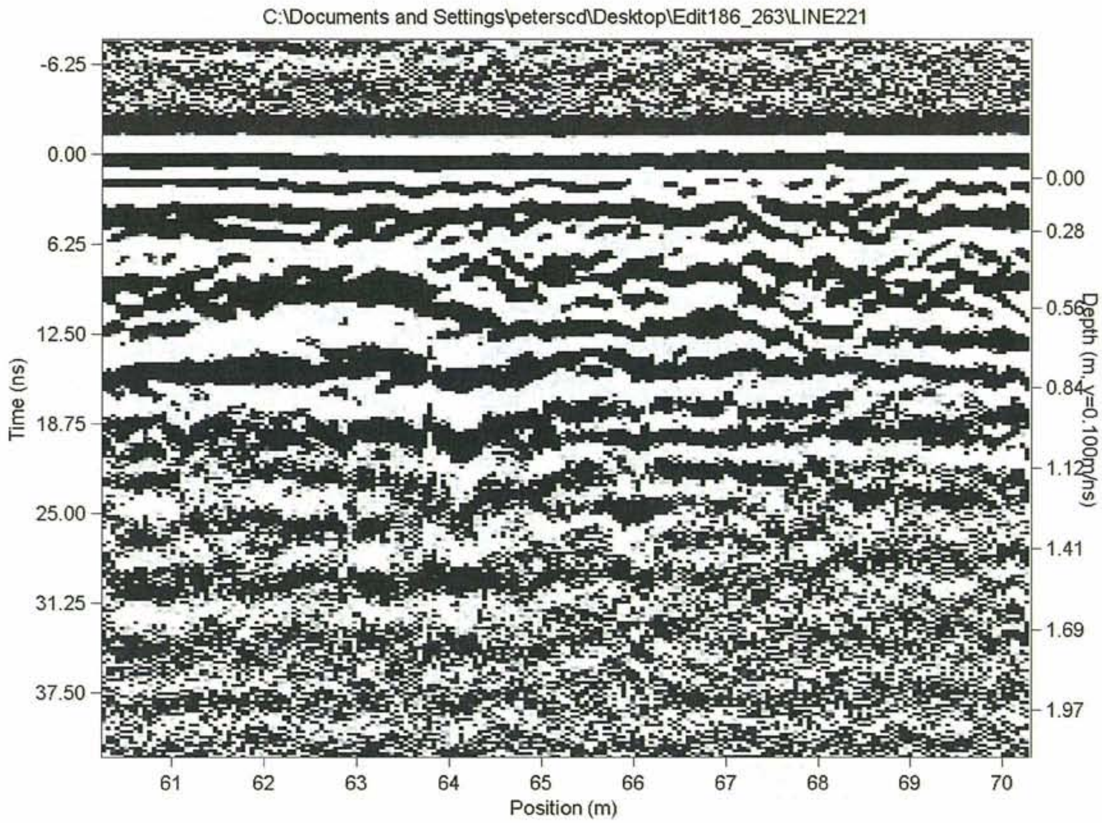

Figure 3-14. Overlapping shallow concave and parabolic reflections from the concrete foundation (Feature 1) at 5 to 15 ns, or down to 0.75 m (2.5 ft) depth, from 64.0 to 69.0 m (210.0 to 226.0 ft) distance along CRC Line 221 in WSDOT parcel W9.

The GPR log for the CRC Line 221 profile is provided in Table 3-4. The GPR profile for CRC Line 221 differs from those of CRC Line 10 and CRC Line 11 in the apparent boldness of the anomalies, an expression of the better identification of reflection types. However, the lack of signal penetration associated with the 500 MHz antennae does not show the contact relations between fill and the underlying Pleistocene gravels in W9. The deeper GPR records (200 MHz) from CRC Line 10 and CRC Line 11 established the clear need to conduct mechanical trenching to reach below the imaged depth of resistive fill materials throughout W9.

Soil Profiling

The initial archaeological discovery investigations involved excavation of 19 round probes (RPs) placed at 10-m intervals along the length of W9. These probes were then used as reference points for recording observations about soil conditions in adjacent (but generally deeper) mechanical trenches. Intact soil profiles were exposed below fill materials in the bottom of eight probes or nearby trenches. These ground-truth sites were at RP3, RP12, RP14, RP15, RP16, RP17, SP2, and RP19. Three soil profiles from these locations are summarized in Table 3-5. Exposures in the

Table 3-4. GPR Data Log from CRC Line 221 in WSDOT Parcel W9.

Line	Start UTM_E	StartUTM_N	End UTM_E	End UTM_N
CRCLine221 8/25/08 500 MHz	525810	5052401	525779	5052326

Profile Dist (m)	Notes
0	SOL
5	high-amplitude reflection anomaly (25 ns) @ 3-7 m
15	basal reflection triplet (15-20 ns) @ 12-20 m; multiple small concave anomalies (5-10 ns) fill
33	small concave anomaly at 20-25 ns
47	very-large concave anomaly (>35 ns) from 47 to 56 m distance.
64	shallow chaotic reflections (15-15 ns) from 64 to 69 m distance.
76	EMA (metal) at 5 ns (30 cm depth) in fill

mechanical trenches near these three representative ground-truth sites illustrate the depth relationships between fill and buried soil horizons at the north end (RP3), middle (RP12), and south end (RP19) of W9, as shown in Figures 3-15, 3-16, and 3-17, respectively.

The historic fill exposed in MT2 near RP19 in W9B, extends to 0.7 m (2.0 ft) depth (Figure 3-17). The top of a preserved and buried A horizon (20.0 cm/8.0 in thick) occurs at 0.8 m (2.6 ft) depth. The preserved portion of the buried A horizon is dark (7.5yr3/3 dark brown) and relatively soft (1.5-2.75 kg/cm-2 unconfined compressive strength), as measured by pocket penetrometer. Undisturbed A horizons should have strengths of 1.0 kg/cm-2. The greater value of 2.75 shows significant mechanical compaction of the A horizon during past highway construction. Compressive strengths greater than 3 are very difficult to excavate manually. Compacted soils with values of 4 or 5 cannot be efficiently excavated by hand. The buried A horizon contains minor pebbles in silt matrix support. The pebbles are likely bioturbated upwards into the pre-fill topsoil silts.

Below a thin transition zone, the top of the buried B horizon occurs at 1.1 m (4.0 ft) depth (Figure 3-17). The B horizon is weakly developed with modest FeOx coloration and trace amounts of cohesive clay minerals. Due to its weak cementation, the B horizon in the W9B gravels is designated as a Bw. The Bw is distinctive in color (10yr4/4 dark yellow brown) and is significantly stiffer (3 kg/cm^{-2}) than the uncemented A horizon. It contains significant trans-located silt between the pebbles and cobbles. The cobbles and pebbles vary from matrix support (upper Bw) to framework support (lower Bw) with depth in the B horizon. Although the clay content is low in the W9B Bw soils, the clay content is significantly greater than in the loess soils of the upper terraces (Peterson 2009). The origins of the trace clay component in the lower terrace Bw horizons could represent addition of fines by late Holocene floods that reached at least 11.0 to 13.0 m (36.0 to 43.0 ft) NAVD88 (see earlier Morphostratigraphy section).

The C horizon, at a depth of 1.6 m (5.0 ft), is oxidized; this is evidenced by a distinctive, dark, manganese hydroxide covering of pebbles and cobbles (Figure 3-17). This oxidative C horizon of

Table 3-5. Soil Profiles Observed in Three Locations near the Mechanical Trenches in WSDOT Parcel W9.

GT Unit Location	LineStake#	Date	UTM_E	UTM_N
CRCLine10_10m	**RP3**	4/2/08	525855	525245
Depth	**Age/Horizon**	**Texture**	**Moist Color**	**Pocket Pen**
0-1.0	Fill	gravel, sand		
1.0-1.2	Fill	pebble, cobble, silt		
1.3-1.4	Fill	Large cobble	2.5y3/1 vdg	
1.5-1.6	Pleis./Bw	pebble, silt	7.5yr4/6sb	3.5-5.0

Notes:
North of 5th Street Access Gate.
Site is 10 m south on CRCLine10.
North end of backhoe trench, at 1.5 m west of fence.

GT Unit Location	LineStake#	Date	UTM_E	UTM_N
CRCLine10_100m	**RP12**	4/2/08	525811	505244
Depth	**Age/Horizon**	**Texture**	**Moist Color**	**Pocket Pen**
0-0.5	Fill	gravel, concrete frags		
0.5-1.2	Fill	gravel, brick	10yr4/2dgb	
1.2-1.6	Pleis./Bw	cobble	7.5yr4/6sb	1.5-2.75

Notes:
Trench profile site is 100 m south on CRCLine10.
Profile site is 3 m south of north end of trench.
Profile taken on east wall of trench, 1 m north of buried 5th St sidewalk/foundation. MT2/ Feature 6.

GT Unit Location	LineStake#	Date	UTM_E	UTM_N
CRCLine10_180m CRCLine11_78m	**RP19**	4/2/08	525777	505239
Depth	**Age/Horizon**	**Texture**	**Moist Color**	**Pocket Pen**
0	Fill	sampled	10yr3/1dg	0.5-1.0
0.5			10yr5/2gb	0.5-1.0
0.7	Fill			1.5-3.5
0.8	top Buried A	sampled	7.5yr3/2db	2.5-3.5
1	bott Buried A	sampled	7.5yr3/3db	1.75-2.5
1.2	top Plies./Bw	sampled	10yr4/4dyb	3-4.5
1.4	Plies./Bw	sampled	10yr5/4yb	3.0-5
1.5	bott Pleis./Bw	sampled		3.5-5
1.6	Pleis./Cox			
1.8	Pleis./Cox	sampled		

Notes:
Trench profile site is 4 m south of RP19, located at the south end of the trench.
Trench profile site is 180 m south on CRCLine10.
Trench profile site is 74 m south on CRCLine11.
Trench wall is 5 m west of fence, 3 m west of SP2.

Figure 3-15. View of stratigraphy at the north end (near RP3) of MT1 in WSDOT parcel W9A, showing fill over truncated Bw horizon at 1.5 m (5.0 ft) depth.

Figure 3-16. View of concrete sidewalk and brick wall (MT2/Feature 6) near RP12 in WSDOT parcel W9A overlying buried Bw horizon. Before construction of I-5, this sidewalk extended east–west along the south side of East 5th Street, connecting the military reservation and the City of Vancouver.

Figure 3-17. View of west wall at the south end of MT2 (near RP19) in WSDOT parcel W9B. The exposed section shows (1) ~1.0 m (3.0 ft) of highway gravel fill (light gray), overlying (2) ~0.5 m (1.6 ft) of silty-sandy-gravel in a buried prehistoric soil (yellow brown), overlying (3) Pleistocene flood gravels (gray-black) at the bottom of the trench.

parent pebbles and cobbles in framework support is defined here as Cox. It represents the unweathered top of the gravel plain deposits. This gravel unit has not been radiocarbon dated in the CRC project area, so its age and origin are not established. Many of the C horizon pebbles and cobbles contain a white precipitate, identified as opal, on their bottom sides.

The utility of the Bw horizon identification is shown in two soil profiles associated with cultural features exposed in the mechanical trenches. At RP12 in W9B, the buried concrete sidewalk and adjacent brick wall (MT2/Feature 6) were constructed on top of fill (gray) which cut into the top of the buried Bw horizon (yellow brown) (Figure 3-16). No buried A horizon is preserved at this location (Table 3-5). In MT1, near RP3 inW9A, the distinctive yellow brown Bw horizon is shown buried at 1.5 m (5.0 ft) depth below anthropogenic fill (Figure 3-15). The base of the fill, including charcoal and stacked boulders, is cut into the Bw horizon. The A horizon was removed prior to emplacement of the fill.

CONCLUSIONS

In view of the complex relationships observed in W9 between the artificial fill, intact A and Bw horizon soils, and the Pleistocene gravels, a two-step strategy was developed for GPR surveys in other CRC subareas. The first step was to target the tops of the Pleistocene gravels using the high-power (1000 v, 200 MHz or 100 MHz) GPR to estimate fill thickness. Where the fill was estimated to be thin (less than 1.0 m/3.0 ft deep), the higher-resolution system (180 v, 500 MHz or 250 MHz shielded GPR) was repeated over the previously surveyed high-power GPR lines to resolve (1) anomalies within the fill, and (2) contact relations between the fill and the underlying native soils. If the fill exceeded the depth reached by mechanical trenching, or no buried A horizon soils were preserved, then no further interpretations of the high-frequency GPR profiles were performed (though the digital profiles were archived for potential future applications).

The interpretations of the GPR records, together with the results of ground-truthing by means of manual excavations and mechanical trenches in W9, provide a basis for recommending methods for archaeological testing in other CRC subareas. In areas where the verified GPR interpretations indicate less than 0.5 m (1.6 ft) of conductive fill (loam or organic debris) over native soils, manual methods of probing (e.g., shovel or auger probe excavations) may be adequate. In areas where the verified GPR interpretations indicate resistive fill (gravel and structural debris) to depths of 0.5 to 3.0 m (1.6 to 10.0 ft), mechanical trenching by backhoe is necessary. Where GPR interpretations indicate that fill thickness exceeds 3.0 m (10.0 ft) depth, a mechanical drilling method is needed to reach native soils.

In addition, the GPR interpretations suggest that the archaeological investigations should target the locations of (1) large chaotic reflection packages, which often represent buried structures, (2) large concave anomalies, possibly representing cut-and-fill features such as deep utility ditches, borrow pits, or structure basements, and (3) convex or parabolic anomalies, often representing point-source reflective features. Such point-source features can include metal pipes, storage tanks, and/or metal fragments in trash pits. These features in the GPR profiles can be targeted specifically for archaeological testing or flagged for avoidance during mechanical trenching.

The soil profiling provides general guidelines regarding the preservation of archaeological deposits in the Vancouver gravel plains on the Washington shore in the CRC project area. Intact soil sequences indicate undisturbed sites. They provide relative timelines for associated subsurface strata. The absence of intact soil sequences indicates disturbance, which in the CRC project area is usually the result of cut-and-fill activity during past construction. Due to the potential for extensive grading in most CRC subareas, the presence of mixed soil units, such as a mixed and backfilled Bw, can be misleading. Intact soil sequences, preferably viewed in soil profiles exposed in long trench walls, are needed to establish time lines for the potential occurrence of cultural strata in the CRC project area.

4. WASHINGTON AREA 1 (45CL910)

Washington Area 1 (W1) is a WSDOT parcel on the east side of I-5 a short distance north of the Columbia River. Specifically, this irregularly shaped area is bounded by the Burlington Northern Santa Fe (BNSF) Railroad on an elevated berm on the north; a triangular, City of Vancouver parcel on the northwest (W2); the northbound travel lanes of I-5 on the southwest, a City of Vancouver parcel on the south and east, and a Vancouver National Historic Reserve parcel (VNHR Area 5), also on the south (Figure 4-1).

Archaeological discovery investigations were undertaken at W1 from May 14 to 19, 2009. At the time fieldwork was conducted, the boundaries of the WSDOT parcel were not marked on the ground. Much of the western portion of W1 is covered by an asphalt roadway (formerly 1st Street) that currently provides access to the Clark Public Utilities Residential Conservation Services building (the historic PEP Co. Sub-Station) standing southwest of W1. To ensure that excavations did not intrude onto adjacent non-WSDOT parcels, and to avoid ripping up asphalt in the existing roadway, archaeological discovery investigations were limited to the eastern portion of W1. The archaeological remains encountered at W1 have been recorded with DAHP as site 45CL910.

HISTORICAL SETTING

W1 is situated on the southwestern edge of the HBC Village at Fort Vancouver. Although no structures associated with the village are known to have been located in W1, it is possible that the remains of unknown village structures may be uncovered in this area during ground-disturbing construction excavations for the CRC project (O'Rourke et al. 2010:234).

The earliest map with detailed coverage of the W1 vicinity, the 1874 "Map of the U.S. Military Reserve at Fort Vancouver, W.T." by F. K. Ward, shows a large building that corresponds to the Vancouver House Hotel situated on the west side of Reserve Street (Figure 4-2). This hotel was located on the City of Vancouver's Block 2, a small, wedge-shaped block where the city's north–south oriented grid adjoined the U.S. military reserve, originally HBC land, which was oriented to the river. The 1884 and 1888 Sanborn fire insurance maps show the original extent of the hotel (Figures 4-3 and 4-4). The 1888 Sanborn map shows two boundary lines for West Reserve Street, one of which cuts through the outline of the hotel. The boundary disagreement with the city, reflected by these two lines, was resolved in favor of the U.S. Army. West Reserve Street was widened at the expense of the hotel, which appears considerably reduced in size on the 1890 and 1892 Sanborn maps. (Figures 4-5 and 4-6)

The Vancouver House Hotel no longer appears on the 1907 Sanborn map, having disappeared along with most of the other earlier structures on Block 2 about the same time as construction of a berm for the Spokane, Portland, and Seattle (SP & S) Railroad line across the central portion of Block 2 (Figure 4-7). The railroad berm was later moved some 30 to 40 m to the north during a highway improvement project in 1984 (O'Rourke et al. 2010:235).

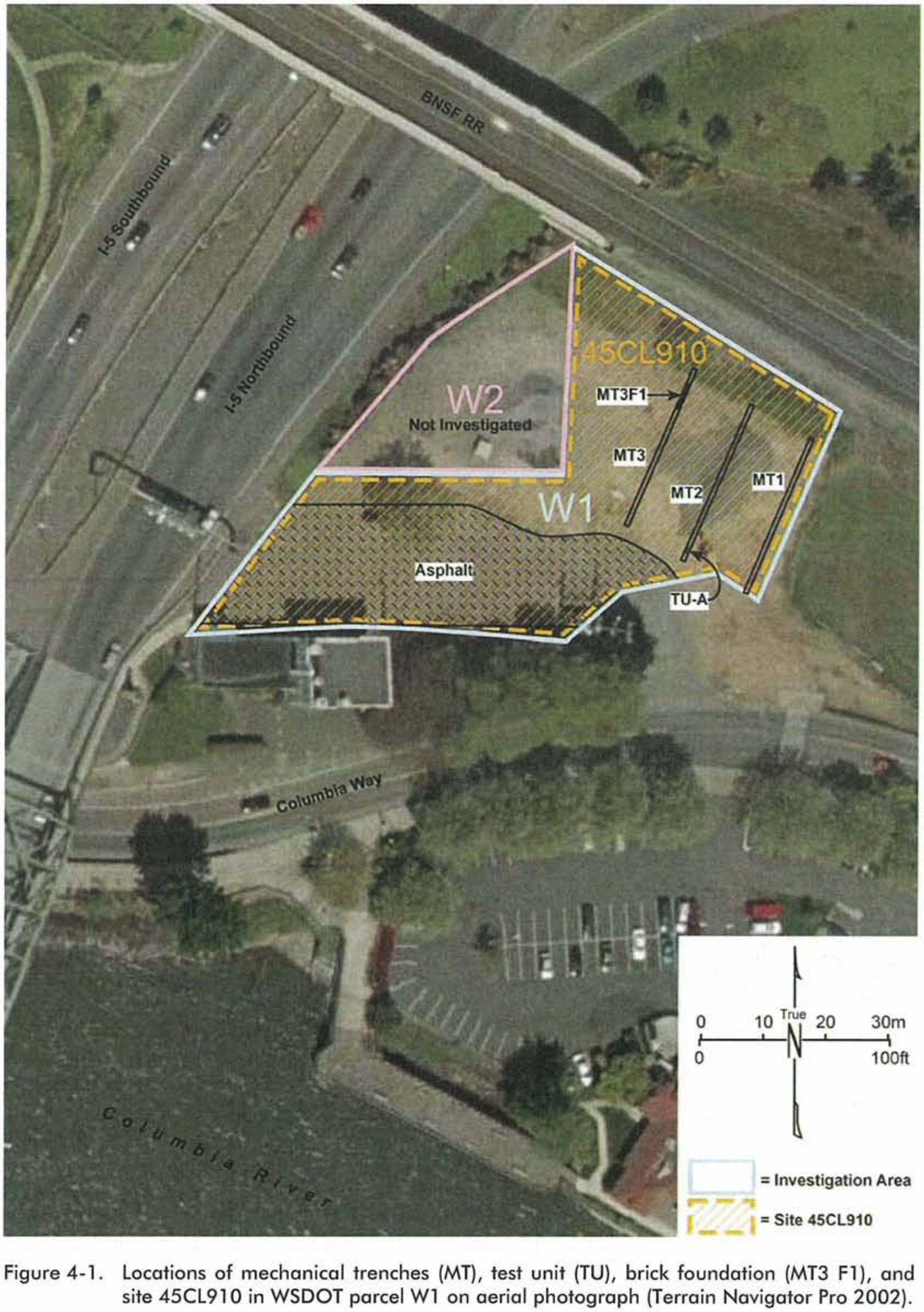

Figure 4-1. Locations of mechanical trenches (MT), test unit (TU), brick foundation (MT3 F1), and site 45CL910 in WSDOT parcel W1 on aerial photograph (Terrain Navigator Pro 2002).

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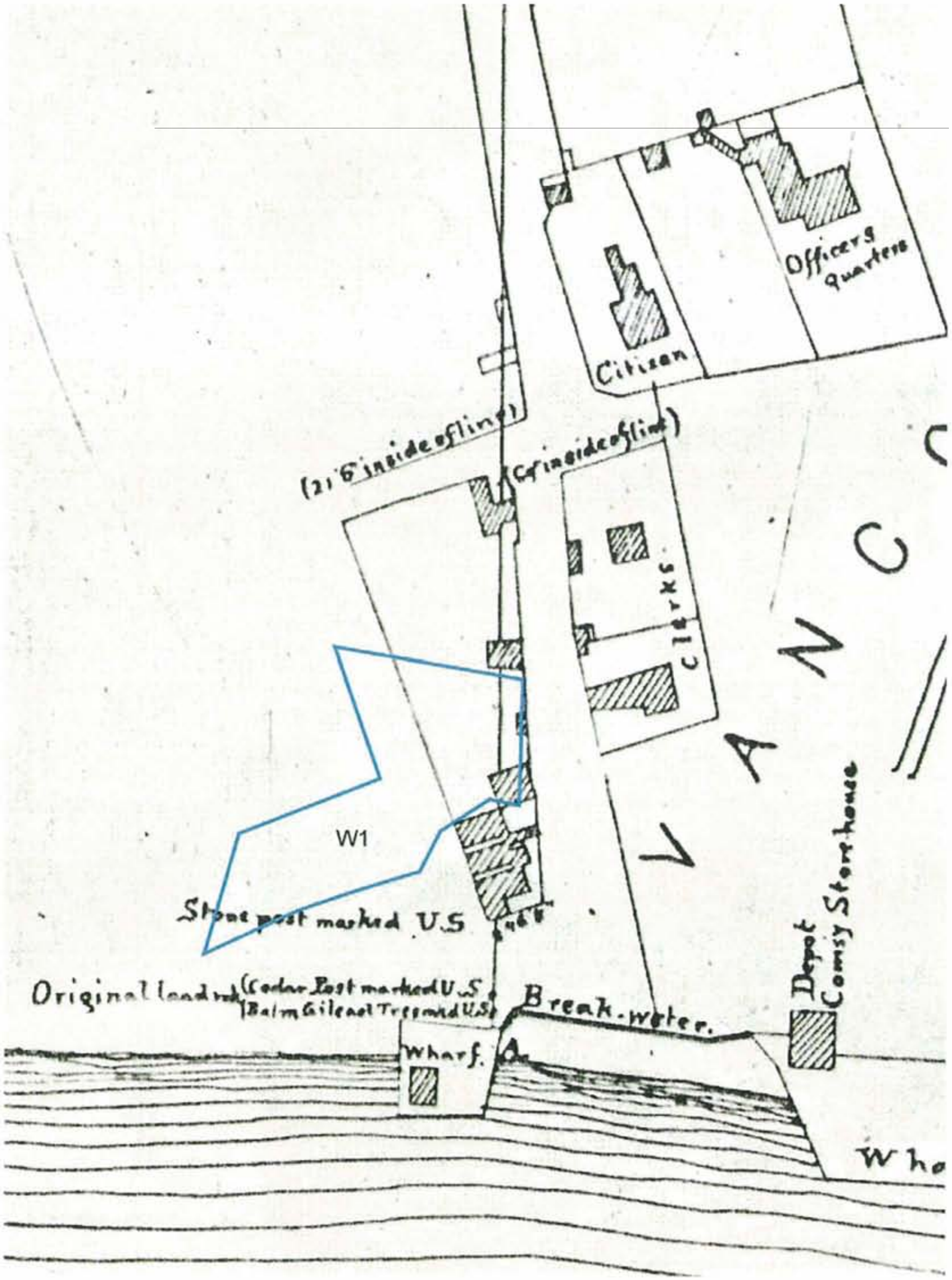

Figure 4-2. Approximate location of WSDOT parcel W1 superimposed on a portion of Ward's 1874 map of the military reserve (map courtesy of the National Archives, Washington D.C.).

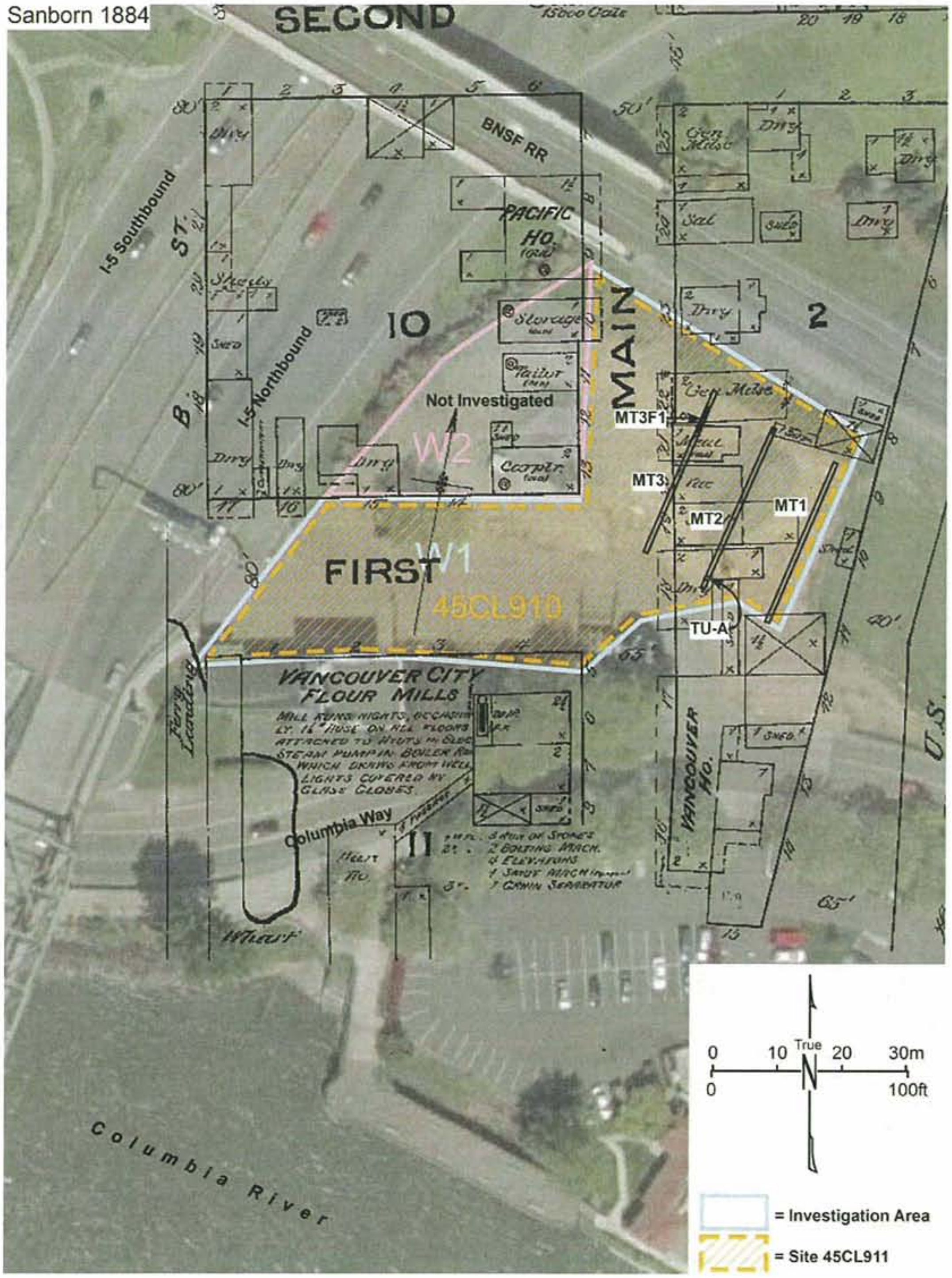

Figure 4-3. WSDOT parcel W1 (site 45CL910) superimposed on the 1884 Sanborn fire insurance map.

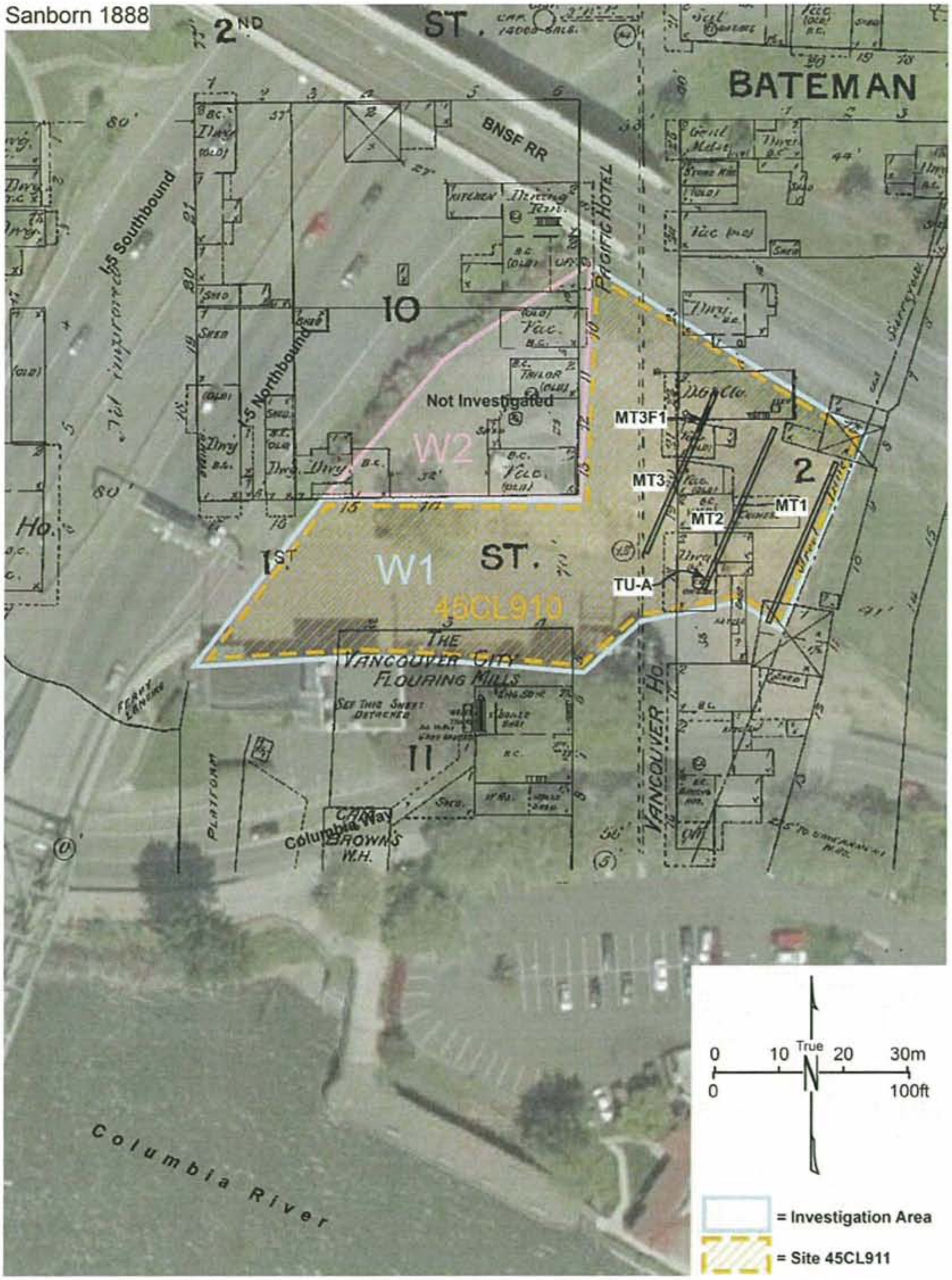

Figure 4-4. WSDOT parcel W1 (site 45CL910) superimposed on the 1888 Sanborn fire insurance map.

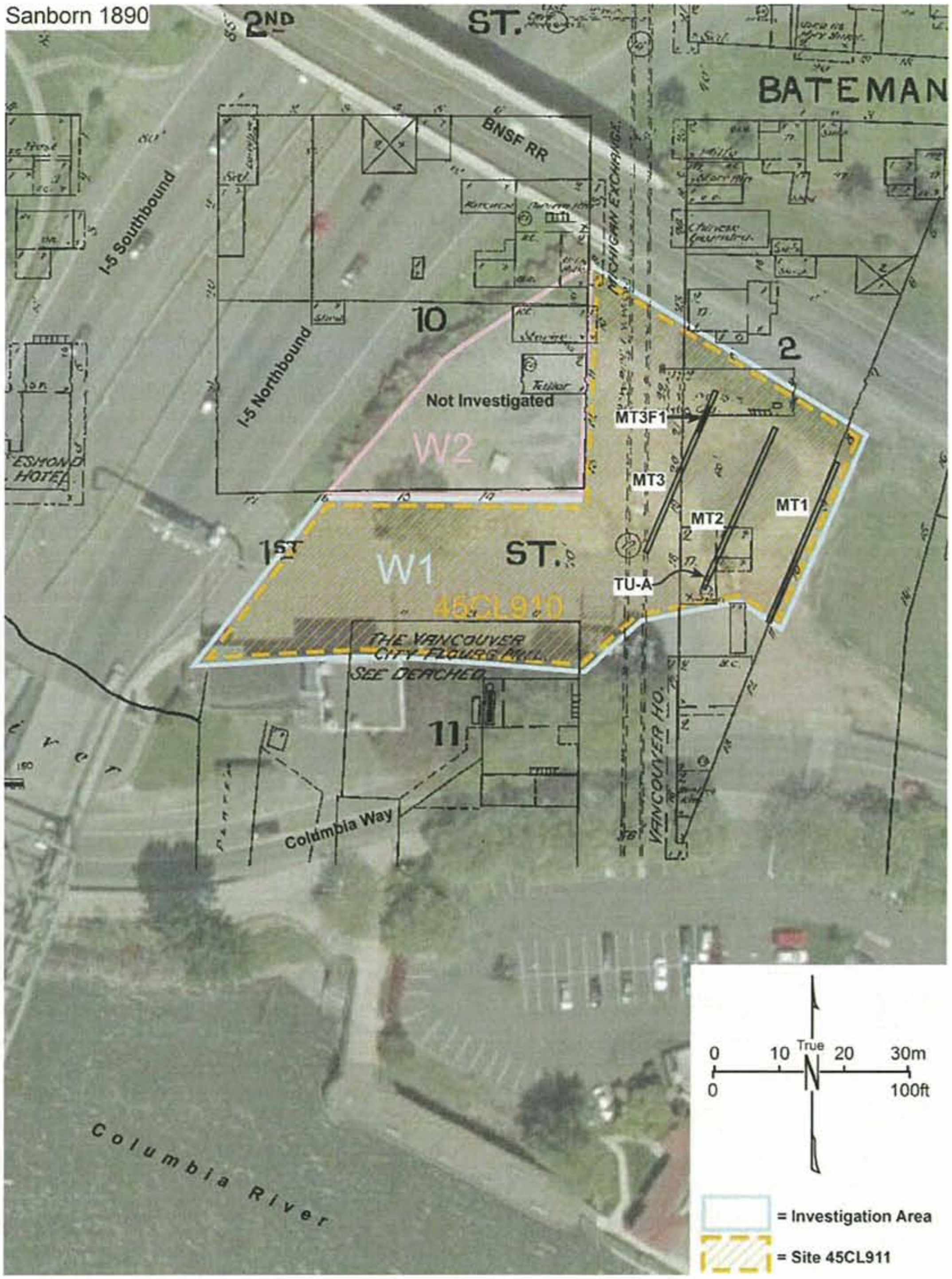

Figure 4-5. WSDOT parcel W1 (site 45CL910) superimposed on the 1890 Sanborn fire insurance map.

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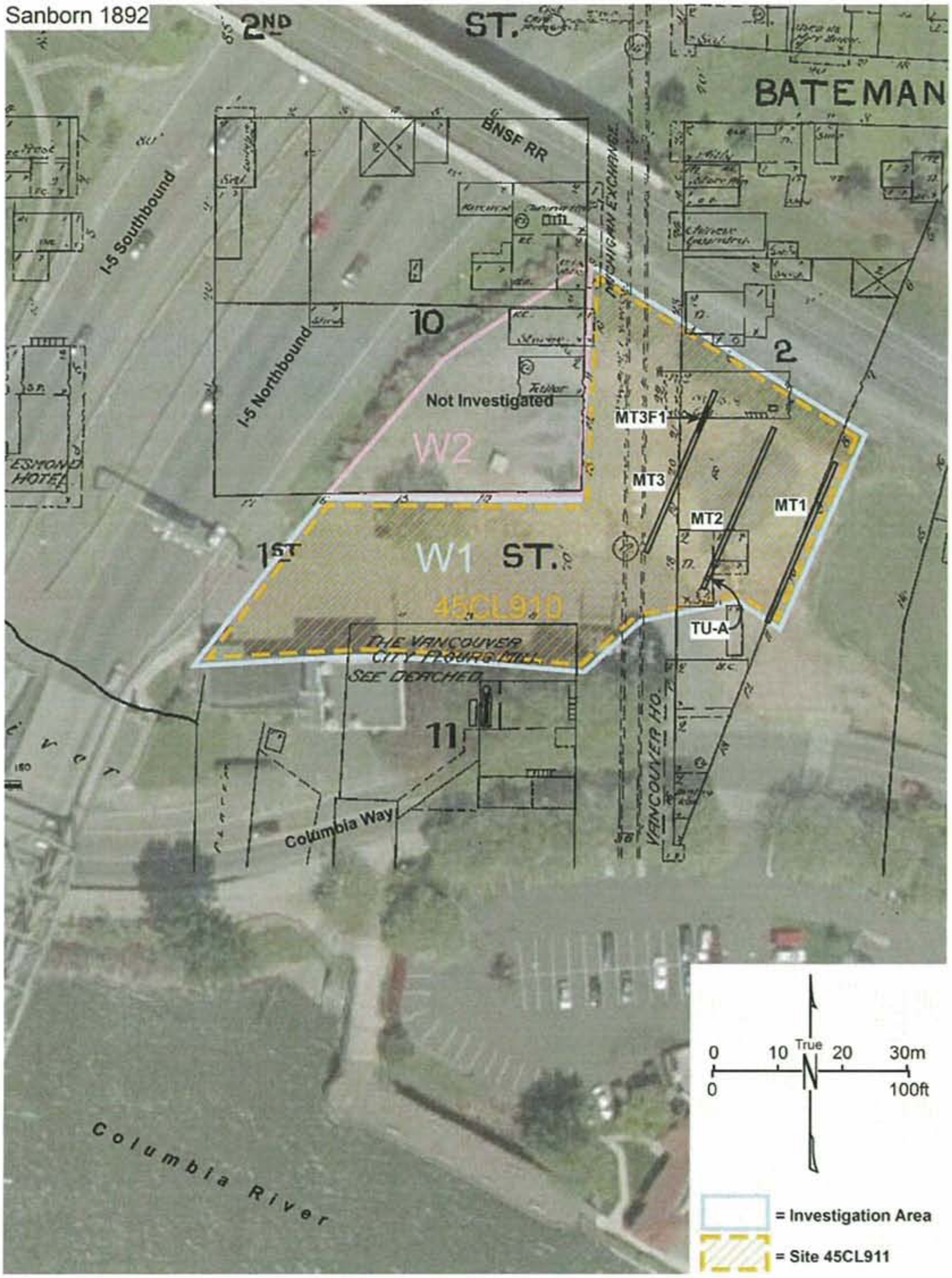

Figure 4-6. WSDOT parcel W1 (site 45CL910) superimposed on the 1892 Sanborn fire insurance map.

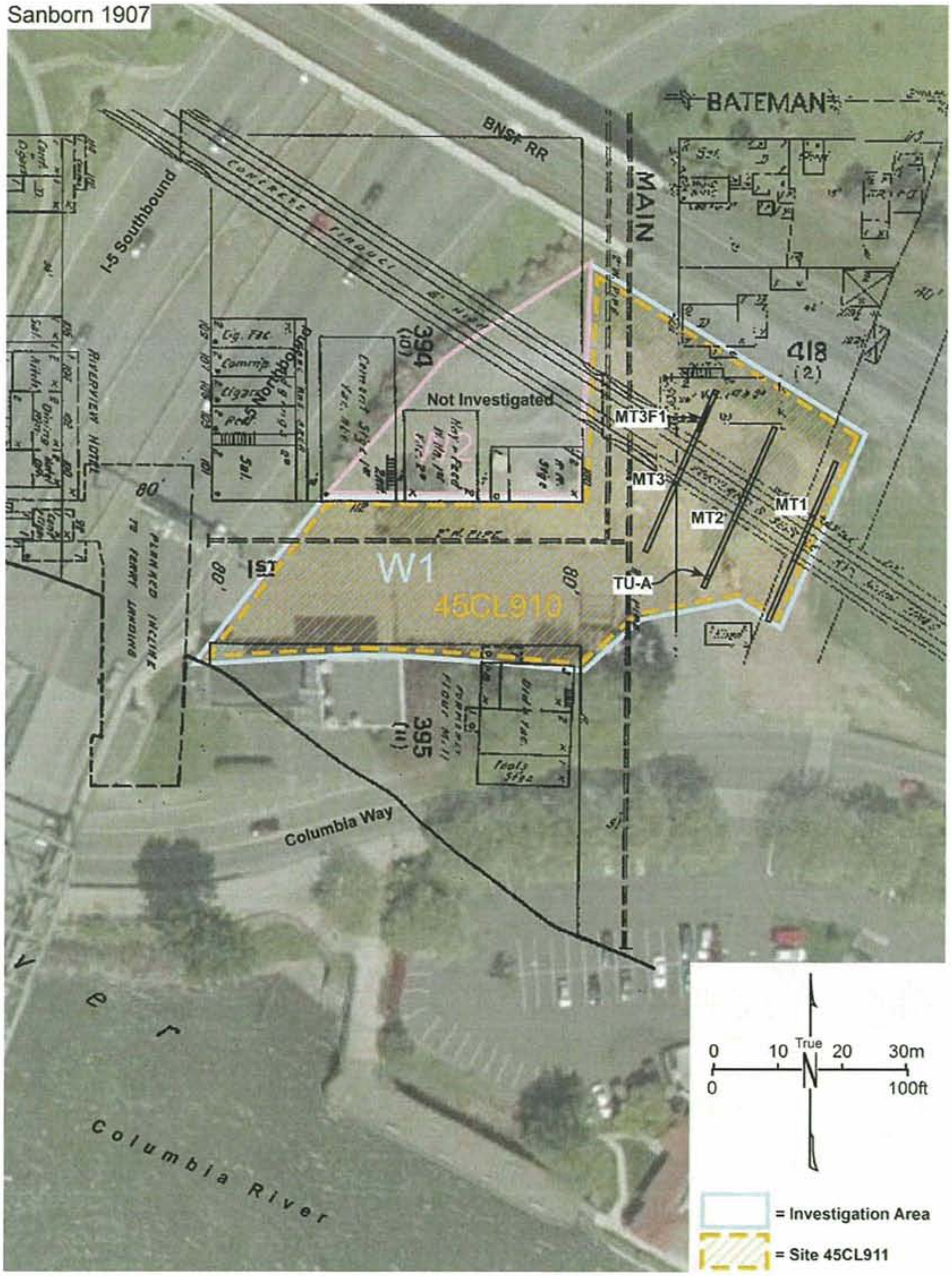

Figure 4-7. WSDOT parcel W1 (site 45CL910) superimposed on the 1907 Sanborn fire insurance map.

W1 is within the earliest area of settlement and development in the Historic City of Vancouver. Located roughly one block north of the Columbia River, the parcel includes the former intersection of 1st and Main streets, among the very first streets platted in the city. Sanborn fire insurance maps and updates published in 1884, 1888, 1890, 1892, 1907, 1911, 1928, and 1949 document development on and around this parcel.

On the earliest Sanborn maps (1884, 1888, 1890, 1892), the Ferry Landing and the Vancouver City Flour Mill were identified on the west side of Main Street, immediately south of W1 in Block 11, which extends to the bank of the Columbia River (Figures 4-3–4-6). East of Main were the Vancouver House Hotel and the boundary with the U.S. Military Reservation. North of the hotel, a series of buildings (including a dwelling, a set of shops that housed several short-lived businesses, and a general merchandise/dry goods and clothing store) extended northward along the east side of Main Street on Block 2. Buildings (businesses and dwellings) also extended along the west side of Main Street and north side of 1st Street on Block 10, just beyond the boundary between W1 and W2.

The 1907 Sanborn map reflects a revision to the system of designating city blocks in Vancouver (Figure 4-7). The area between 1st Street and the Columbia River was redesignated Block 395 (11). The area on the east side of Main Street was within the southern portion of Block 418 (2). The area north of 1st Street and west of Main Street was within Block 394 (10).

By 1907, the character of settlement and development within and around W1 had changed. South of 1st Street, the Vancouver City Flour Mill was no longer in business and the Vancouver House Hotel building was gone. The dwelling and several small shops north of the hotel had been removed as well, and the general merchandise store was vacant. In addition, a 16-foot-high viaduct labeled on the 1907 Sanborn map as being for the "Portland & Seattle RY Main Lines" was constructed across the northern portion of W1. The west side of Main Street, where numerous structures (businesses and a hotel identified by a variety of names through the years) previously stood, became vacant space, later housed a large market and a transfer and storage facility, and was vacant again by 1949 (Figure 4-8). The north side of 1st Street continued to be occupied by several large commercial structures for many decades, but these were gone by 1949. The only significant new construction in the vicinity of W1 was the building for the "P.E.P. Co. Sub-Station" on the south side of 1st Street. This building, which was built in 1916 and first appeared on the 1928 Sanborn map, still stands today.

PREVIOUS ARCHAEOLOGY

Archaeological testing and data recovery investigations were conducted in 2002–2003 along a 3,800-foot-long Northwest Natural Gas pipeline right-of-way that extended on the north side of SE Columbia Way east of I-5 (Gall 2003). This area was considered to be part of site 45CL163H, a designation assigned to the Fort Vancouver National Historic Site (Gall 2003:1). Testing identified three areas of potential archaeological significance, the westernmost of which, referred to as Area C, was along the north side of Columbia Way south of W1. The single most productive test unit in Area C (TU10), situated perhaps 10 m southeast of the southeast corner of W1, produced fragments of stoneware, glass, nails, brick, metal, ceramics, and bone in deposits between 120 and 150 cm below surface (cmbs) (Gall 2003:36). Subsequent data recovery excavations in EU J and EU L exposed, beginning at 90 cmbs, an intact line of bricks and an associated dense concentration of late nineteenth century artifacts designated Feature 1.

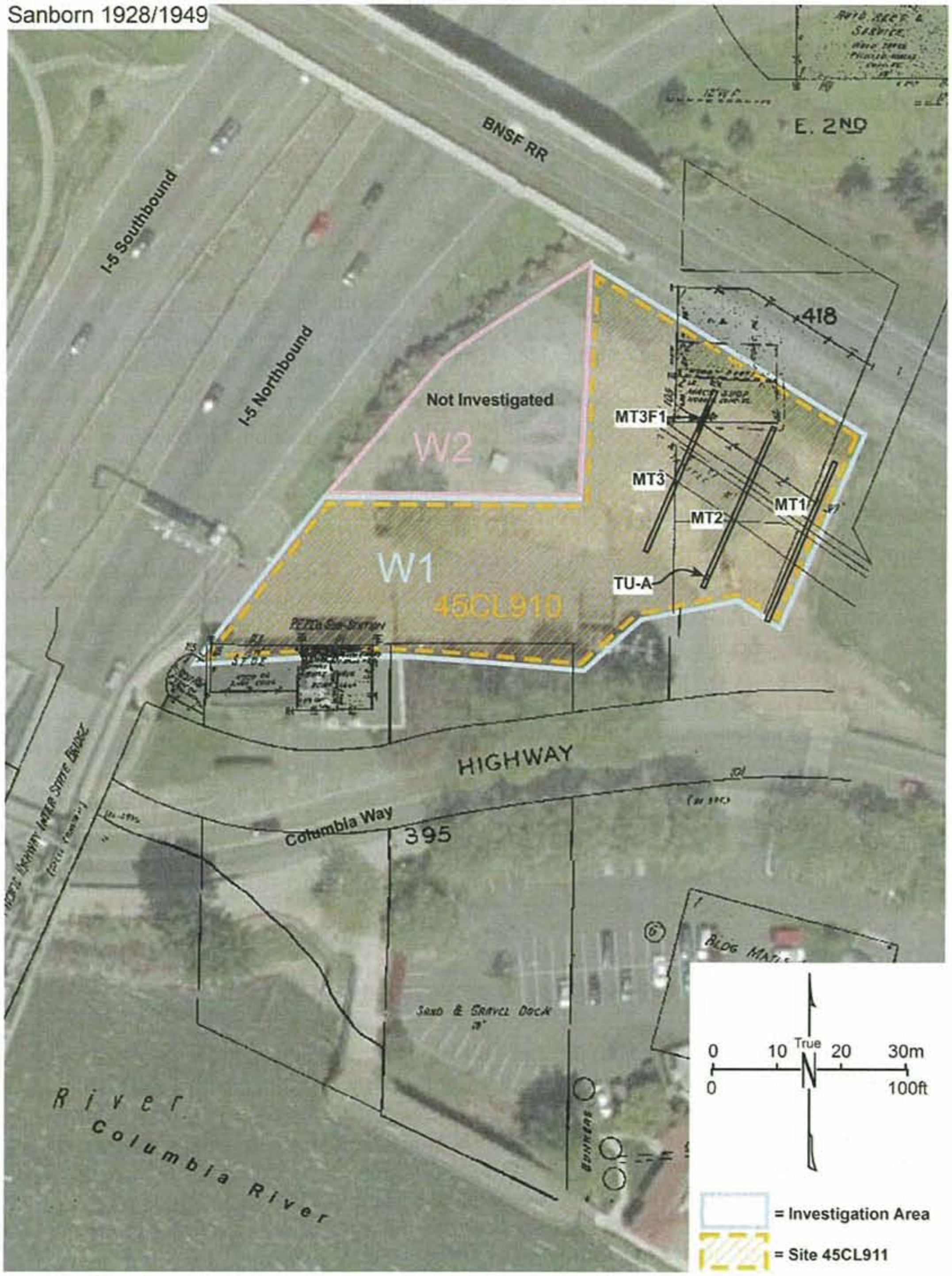

Figure 4-8. WSDOT parcel W1 (site 45CL910) superimposed on the 1949 Sanborn fire insurance map.

EU J and EU L were situated between the aforementioned test unit (TU10) and the southeast corner of W1. The nature of this brick feature could not be determined from the limited exposure. Originally thought to be in the area of a U.S. Army building (Gall 2003:99, 105), this feature is more likely associated with the Vancouver House Hotel (O'Rourke et al. 2010:239). At least some of the sediments overlying the artifact-bearing strata were introduced during the dumping of "massive dredge spoils" by the U.S. Army Corps of Engineers along the north bank of the river in 1960 (Gall 2003:97). The discovery of this feature demonstrates the potential for finding intact archaeological features and deposits deep below the surface in W1.

GPR RECONNAISSANCE

The GPR reconnaissance at W1 involved survey of 16 lines using a high-power 100 MHz antenna. The lines ran west to east, each separated from the next by 3.0 m. The 16 GPR lines were recorded as CRC Lines 74 through 89 and, altogether, extended over a total distance of 930.5 m. Resistive fill materials occurred along the full lengths of the profiles along CRC Lines 77 through 86 to a depth of at least 1.0 m. Based on these representative profiles, it appears that fill covers 100 percent of W1. The depth of resistive fill ranges from 15 nanoseconds (ns) (0.75 m below surface) to 75 ns (3.75 m below surface). The average depth of fill in W1 suggested by the GPR profiles is 35 ns (1.7 m below surface).

FIELD INVESTIGATIONS

The surface of W1 is covered by compacted gravel and often is used as an informal vehicle parking area. In view of the presence of this mantle of gravel as well as the GPR results suggesting the presence of substantial introduced fill, mechanical trench excavations were the primary means employed for archaeological discovery investigations at W1. A single manual test unit also was excavated to sample a concentration of cultural materials exposed in the bottom of one of the trenches.

Mechanical Trenching

A trackhoe (Bobcat 334 with a 24-inch-wide bucket) was used to excavate three trenches of various lengths. Numbered from east to west, MT1, MT2, and MT3 were placed at approximately 10-m intervals to provide relatively systematic coverage of the eastern portion of W1 (the only portion of W1 accessible for investigation at the time fieldwork was conducted). Excavation of all three trenches was undertaken from north to south. Measurements along the trenches (as described below) began at the north end (0.0 m) and proceeded southward.

MT1

The easternmost trench (MT1) measured 27.0 m long, 0.8 m wide, and 0.9 to 1.5 m deep (Figure 4-9). A profile was drawn and observations were recorded at intervals along the east wall from north to south (Figure 4-10).

Three layers of fill material were exposed in the trench profile. The upper layer, gray, silty, crushed gravel, changed at 10 cm below surface (cmbs) to brown silt (likely dredged from the

Figure 4-9. View west, at the beginning of excavation of MT1 in WSDOT parcel W1.

nearby river) that continued to a maximum of 95 cmbs. Situated below the gravel and silt was brown, compact, gravelly (rounded), loamy fill containing concrete, brick, ceramic, glass, and metal debris.

The trench excavation in the northern part of MT1 was not always deep enough to reach the Pleistocene gravels (Cox). Localized deeper backhoe excavations into the trench floor revealed an undisturbed remnant Bw horizon between 19.6 m (at 90 cmbs) and approximately 24.0 m (at 125 cmbs). Cox was exposed at 6.0 m (at 200 cmbs) and between 19.6 m (at 110 cmbs) and 21.7 m (at 125 cmbs).

A concentration of concrete fragments extended across the trench between 14.5 m (at 95 cmbs) and 19.6 m (at 75 cmbs). In the trench walls, this concentration appeared to consist of discontinuous concrete chunks that lacked a level, uniform surface; consequently it was identified as rubble instead of as a structural feature.

On the south side of the concentration of concrete fragments a semblance of stratigraphy was present in that the fill layers were underlain by Bw and Cox. At the south end of the trench, the Bw and Cox were again replaced by deep fill material. These fill sediments were loose and prone to slumping. At 27.6 m, a segment of filter fabric embedded in fill at the bottom of the trench was exposed at 135 cmbs.

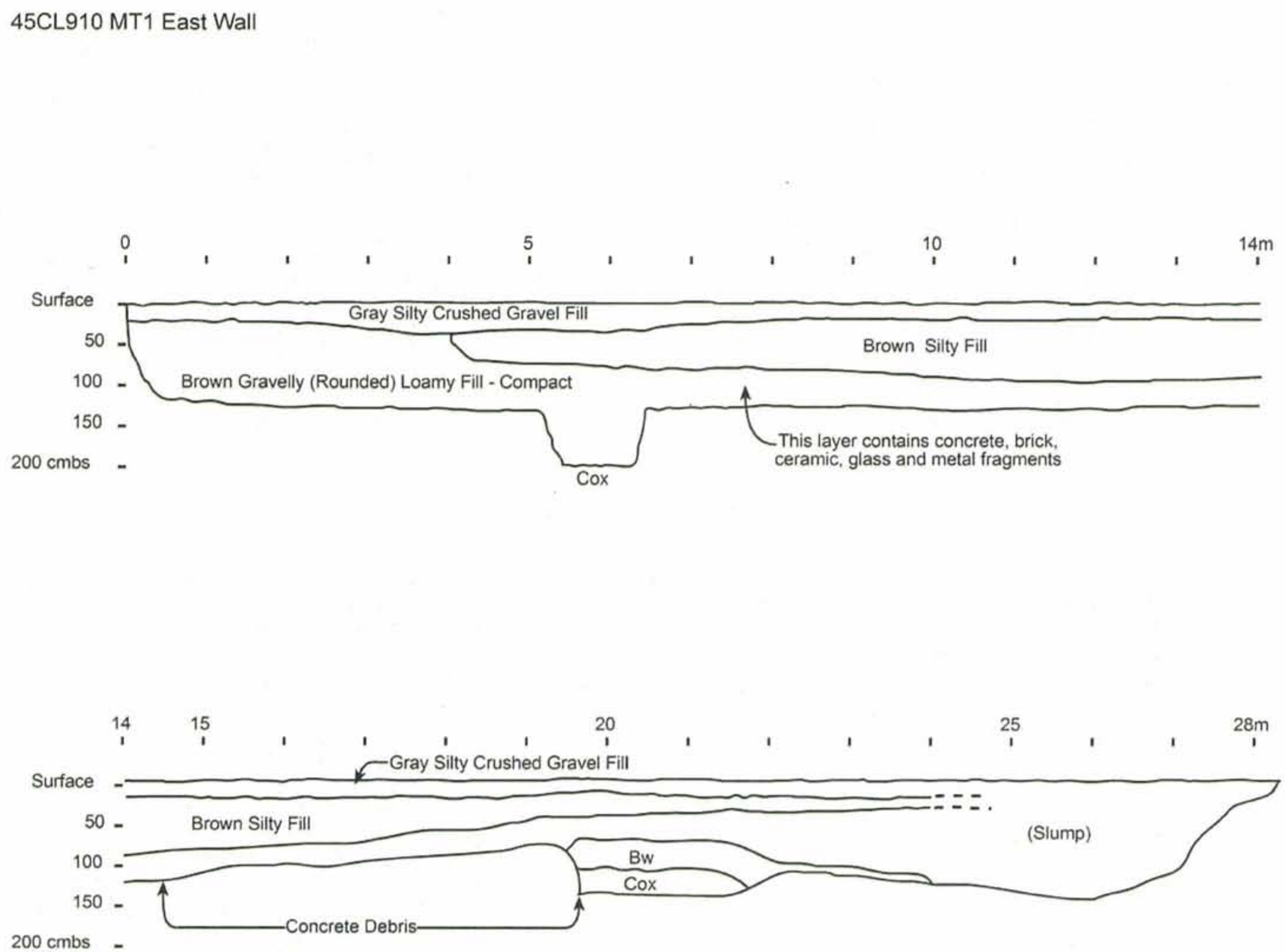

Figure 4-10. Stratigraphic profile of the east wall of MT1 at site 45CL910, showing multiple layers of fill overlying native Bw horizon and Pleistocene gravels (Cox).

MT2

MT2 was excavated between MT1 and MT3 and measured 27.0 m long, 0.8 m wide, and 1.1 to 1.4 m deep. A profile was drawn and observations were recorded at intervals along the east wall from north to south (Figure 4-11).

The first 6.0 m of the trench consisted of fill above mixed/redeposited Bw, which overlay Pleistocene gravels (Cox). Between 6.0 and 19.5 m, the fill rested directly on the Cox, except where isolated scattered pockets of mixed/redeposited Bw separated the two. From 19.5 m to the south end of the trench, fill extended from the surface to the trench floor.

The top of the Cox varied along the length of the trench between 45 and 140 cmbs. Beginning at 4.0 m, the Pleistocene gravels were cross-bedded, sloping 15–20 degrees to the south.

A concentration of debris and rounded boulders, situated in the fill, was present between 12.0 and 14.0 m. Broken concrete (possibly from a foundation or wall) was encountered in the fill at 23.5 m (at 20–75 cmbs). A glazed terra-cotta pipe, oriented south-southeast, extended into the base of the east wall at 19.6 m.

Near the south end of MT2, 1.5 to 2.0 m from the end of the trench, a concentration of artifacts was exposed. These appeared to be within an intact deposit below the fill. The concentration was sampled through manual excavation of a test unit (TU-A) in the trench floor.

MT3

The westernmost trench (MT3) measured 26.5 m long, 0.8 m wide, and 0.4 to 1.8 m deep (Figure 4-12). A profile was drawn and observations were recorded at intervals along the east wall (Figure 4-13); observations also were recorded intermittently along the west wall. The observations were recorded from north to south.

Three layers of fill material were identified in the trench profile. The upper layer, gray, silty, crushed gravel, changed at 10 cmbs to brown silt (likely dredged from the nearby river), which continued to a maximum of 60 cmbs. Situated below the gravel and silt was brown, very compact, gravelly (rounded), loamy fill containing concrete and brick rubble. Mixed/redeposited Cox was observed in this basal fill layer between 7.0 and 8.5 m at 125–130 cmbs. Deeper backhoe excavation at 15.0 m revealed an undisturbed remnant Bw horizon at 140 cmbs. Overlying the Bw at this location was a layer of dark gray gravelly (angular) loamy fill containing charcoal (at 120–140 cmbs) and asphalt with a crushed gravel base (at 105–120 cmbs).

Between 2.5 and 7.1 m from the north end of the trench, the corner of a brick foundation was exposed at 100 cmbs and recorded as MT3 Feature 1. Between 14.3 and 15.0 m, three sections of concrete slab (possibly foundation) were encountered. Originally, these sections may have been contiguous (although it was not possible to confirm this, given their limited exposure within the trench). The depth of the sections was fairly consistent at 90, 95, and 105 cmbs. The top of each section was not smooth, but was generally level. Two of the sections were vertically faced on the south end where the concrete extended northwest–southeast across the trench. Beginning at 15.0 m, an apparently intact asphalt surface extended across the bottom of the trench at 105 cmbs, sloping upward to the south end of the trench where it was at 35 cmbs.

PRELIMINARY

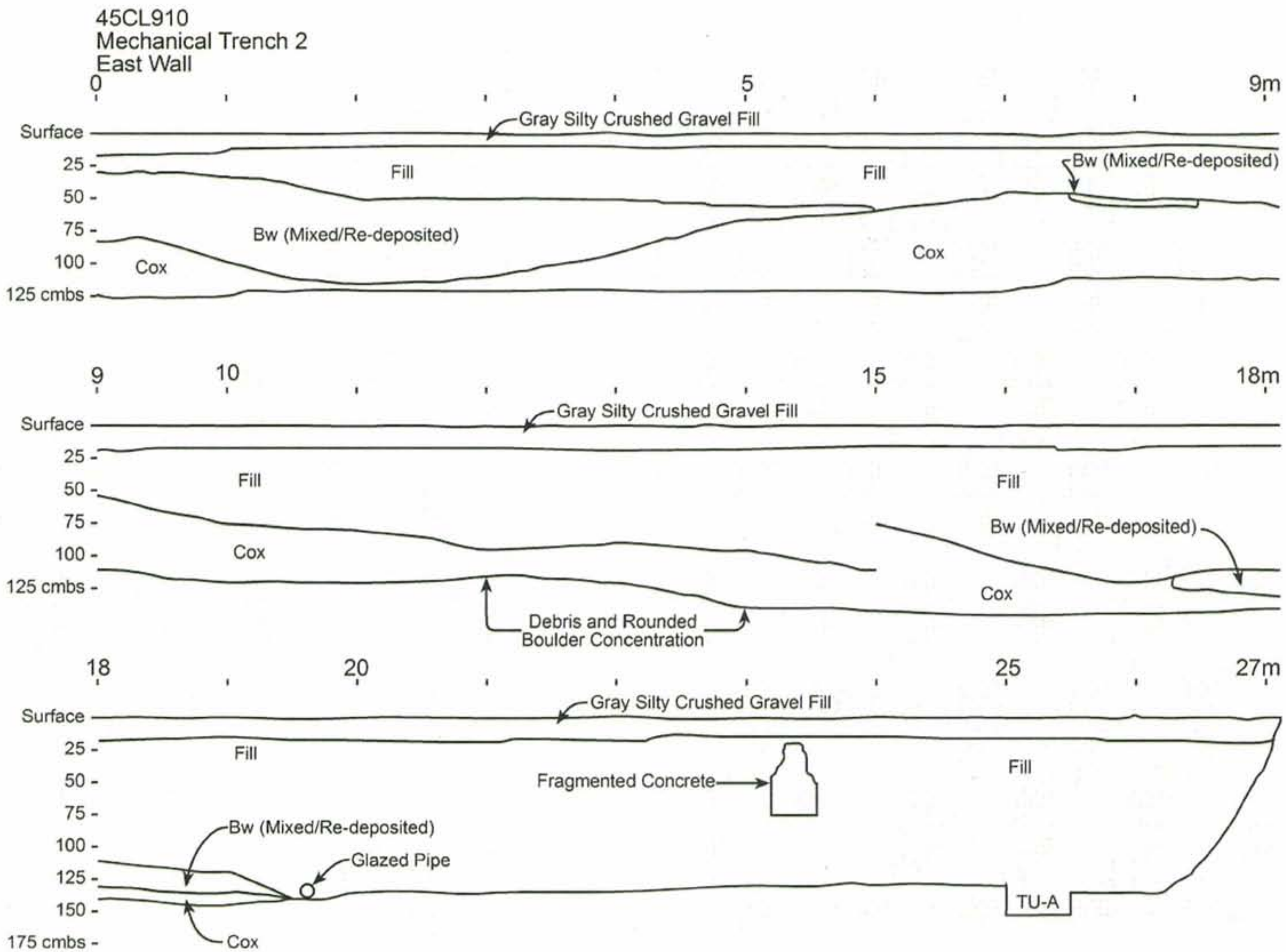

Figure 4-11. Stratigraphic profile of the east wall of MT2 at site 45CL910, showing introduced fill overlying native Bw horizon and Pleistocene gravels (Cox).

Figure 4-12. View southwest, near the conclusion of excavation of MT3 in WSDOT parcel W1.

Manual Excavations

A single test unit (TU-A) was excavated to sample the concentration of cultural materials encountered at the south end of MT2. Located 1.5 to 2.0 m from the south end of the trench, TU-A measured 50 cm long by 60 cm wide (the width of the trench floor). The test unit began at 130 cmbs, the depth of the trench floor at that location, and extended to 160 cmbs. No evidence of stratification was observed in the artifact-bearing deposit. Cultural materials were still being found at 160 cmbs where excavation was discontinued because of safety concerns. Among the artifacts found were ceramic, glass, and metal fragments as well as animal bones.

DESCRIPTION OF DEPOSITS

The trench excavations verified the GPR results in demonstrating the presence of substantial deposits of introduced fill material in W1 (Figures 4-10, 4-11, and 4-13). In general, the same three layers of fill material were represented to varying extents in all three trenches (although they are not differentiated in the MT2 profile).

The uppermost fill layer consisted of gray, silty, crushed gravel that covers the surface of W1. Below these gravels was a layer of brown silty fill that probably represents material dredged from the nearby river. Underlying these two fill layers was a third fill deposit of compact, brown, gravelly loam fill containing concrete chunks and brick fragments, as well as glass, ceramic, and metal debris.

PRELIMINARY

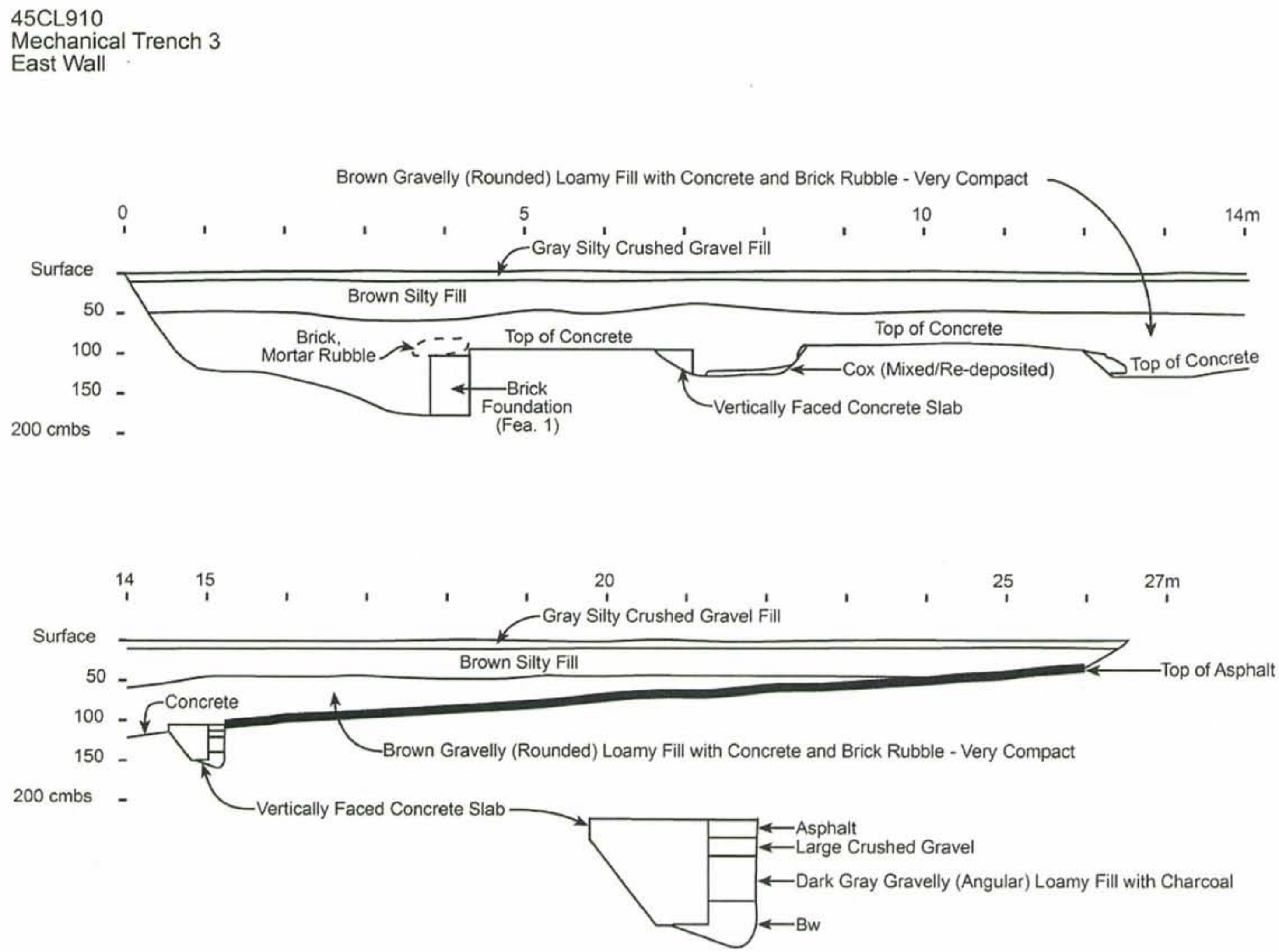

Figure 4-13. Stratigraphic profile of the east wall of MT3 at site 45CL910, showing brick foundation (Feature 1) underlying fill and concrete rubble.

No A horizon soils were observed in any of the trenches. In MT1 and MT2, the fill rested directly on Bw soil and/or Pleistocene gravels (Cox). The Bw was observed only in single, limited exposures in MT1 and MT3. More extensive exposures of Bw occurred in MT2, where mixed/redeposited Bw was observed. Cox was exposed in two deep backhoe tests in the bottom of MT1 and more extensively below mixed/redeposited Bw in the northern portion of MT2. Due to the presence of extensive sections of concrete as well as an asphalt surface, excavation MT3 did not extend deep enough to reach the underlying Pleistocene gravels.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Feature

The corner of a brick foundation was encountered between 2.5 and 7.1 m from the north end of MT3 (Figure 4-14). Recorded as Feature 1, a 4.6-m segment of the foundation was exposed in the trench. The foundation continued eastward into the trench wall. The top of the foundation was at 100 cmbs, and nine courses of bricks (8¼ × 4¼ × 2½ inches) were documented before excavation ended for safety reasons at 178 cmbs without exposing the base of the feature. This brick foundation appears to correspond to the south wall of a commercial structure shown on the 1884 and subsequent Sanborn fire insurance maps (Figures 4-3–4-8). Associated artifacts include window glass, nails and spikes, and a fence insulator, as well as fragments from a few bottles and a piece of ceramic tableware.

Artifacts

The artifact assemblage from W1, totaling 403 items (a total reflecting a few complete objects, but mostly fragments of varying sizes), consists for the most part of items from fill (79.7 percent) rather than intact cultural deposits (20.3 percent). The bulk of the assemblage was recovered from MT2, from both fill (n=256) and the apparently intact deposits sampled by TU-A near the south end of the trench (n=82). Most of the remaining artifacts are from the fill deposits in MT1 (n=48), and around the Feature 1 brick foundation in MT3 (n=17).

A summary of the artifact assemblage from intact deposits and fill in W1 is presented in Table 4-1. Dates or date ranges for manufacture determined for ceramic, glass, and metal items are summarized in Table 4-2. In view of the fact that the origins of the artifacts in the introduced fill are unknown, these materials are not discussed further. Only artifacts recovered from the cultural deposits in TU-A are described in detail.

MT2 TU-A Artifacts

The 82 items collected during the excavation of TU-A, which sampled the apparently intact, unstratified deposit encountered in MT2, are largely domestic. The assemblage contains fragments from ceramic tablewares, alcoholic beverage bottles, medicine bottles, assorted other bottles and jars that likely held products used in the home, and mammal bone (including cattle and sheep) assumed to have been related to the diet of the local residents. Also present are a small brass object, a few nails, and a piece of window glass.

Figure 4-14. View southwest, showing the MT3 Feature 1 brick foundation at site 45CL910 in relation to the historic PEP Co. sub-station building.

Table 4-1. Artifact Summary for Site 45CL910.

Artifact Group/ Category	Artifact Types*	MT1 Fill	MT2 Fill	MT2 TU-A	MT3 F1 Fill	Totals
Activities						
Animal Husbandry	Horse shoe		1			**1**
Toys	Porcelain doll		1			**1**
Domestic						
Food	Bottle, soda-pop	4			1	**5**
	Bottle, soda-water		2			**2**
	Bottle, soda-water bottle & Hutchinson stopper (1 bottle frag, 2 stopper frags)		3			**3**
Food Preparation & Consumption	Baking dish, ceramic		1			**1**
	Bowl, ceramic	5	1	1		**7**
	Cup, ceramic	1	14	1		**16**
	Indeterminate tableware, ceramic	3	29	11		**43**
	Plate, ceramic	1	19	2		**22**
	Saucer, ceramic	3	6	4		**13**
	Serving vessel, ceramic	2	7			**9**
	Tumbler, glass	2	3			**5**
Food Storage	Canning jar		2			**2**
Furnishings	Doorknob, porcelain	1				**1**
Indefinite	Ceramic item		2			**2**
	Glass item		2	1		**3**
Faunal						
Bone/tooth	Cattle bone	1	5	5		**11**
	Pig bone	1		2		**3**
	Sheep bone	2				**2**
	Unidentified mammal bone	13	9	11		**33**
Shell	Native Pacific Oyster shell	1	3			**4**
Indefinite						
Hardware	U-bolt assembly	1				**1**
Heating & Lighting	Arc-lamp rod		1			**1**
Containers	Bottle/Jar		43	20	2	**65**
	Can		3			**3**
Indefinite	Ceramic item	3	49	5	1	**58**
	Glass item		2	1	1	**4**
	Metal item		3			**3**
	Plastic item		4			**4**
	Wire		2			**2**
	Wood		2			**2**
Waste	Slag		1			**1**
Personal						
Grooming & Health	Bottle, bitters			2		**2**
	Bottle, medicine		1			**1**
	Chamber pot		4			**4**
	Patch box, ceramic		1			**1**
	Tweezers?			1		**1**
	Vial, glass			1		**1**
Social Drugs–Alcohol	Bottle, alcoholic beverage	1	8	9		**18**
	Bottle, beer		1			**1**
	Bottle, gin			1		**1**
	Bottle, wine/champagne		1			**1**

Table 4-1. Artifact Summary for Site 45CL910 (*continued*).

Artifact Group/ Category	Artifact Types	MT1 Fill	MT2 Fill	MT2 TU-A	MT3 F1 Fill	Totals
	Demijohn		3			3
Social Drugs–Tobacco	Clay pipe	1	2			3
Structural						
Electric	Fence insulator				1	1
Hardware	Nail, cut		1	2	1	4
	Nail, wire	1	1	1	3	6
	Screw		1			1
	Spike, cut		1		1	2
	Spike, wire				1	1
Materials	Brick, common red	1	7			8
	Brick, paving		1			1
Totals		**48**	**256**	**82**	**17**	**403**

MT = Mechanical Trench TU = Test Unit F = Feature
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

Among the temporally diagnostic ceramic items is a base fragment impressed with a faint British registry mark, which, based on its diamond shape, indicates that the pattern was registered sometime between 1842 and 1883. However, the pooled glaze in the impressed mark has a slight blue tint, indicating that this is probably from a pearlware vessel. These wares were produced from the 1770s until around 1840. Therefore, it is likely that this piece was manufactured early in the 1840s. Several additional pearlware fragments are present in the assemblage. A few fragments from white improved earthenware vessels were also recovered. This highly durable English import began showing up in the U.S. and Canadian markets in the 1840s and was being manufactured by U.S. potteries by the end of the nineteenth century. The only fragment decorated with any color is a hand-painted piece exhibiting the tips of brush-applied light green leaves common on some of the spongeware/stick spatter wares introduced in the 1830s and made well into the early 1900s.

Several black glass bottle fragments suggest manufacture before the 1890s (black glass was in use well before the 1800s). Two appear to be from bitters bottles (likely Dr. J. Hostetter's Stomach Bitters and Hart's Virginia Aromatic Bitters, based on a small amount of embossing on each). Another has an applied mineral finish indicating that the bottle was produced sometime after 1820. A dark olive case gin bottle with a flared finish was manufactured in a dip mold between 1745 and 1880. A piece of pressed glass, once colorless, has turned a light shade of amethyst, indicating use of manganese dioxide for decolorizing, a technique commonly employed from the 1870s until ca. 1920. The improved tooled finish from an aqua bottle places manufacture sometime between 1895 and the early 1920s.

One fragment of window glass was recovered from TU-A. The piece measures 0.054 inch thick. According to Roenke's (1978:116) Pacific Northwest window glass dating formula, glass of this thickness is might have been used in a building constructed between 1810 and 1845 (caution should be exercised, however, in relying on a construction date derived from a single fragment). The single wire nail recovered was likely made after 1884.

Table 4-2. Temporally Diagnostic Artifacts from Site 45CL910.

Provenience	Item Description*	Dateable Characteristics	Date/Date Range	Reference
MT1 Fill	Black alcoholic beverage bottle fragment	Black glass	pre-1800–ca. 1890s	SHA (2009)
	Earthenware saucer fragment	Impressed mark from Richard Alcock pottery	1870–1881	Kowalsky and Kowalsky (1999:92)
	Porcelain doorknob	Gold gilt decoration	Since ca. 1880	Polk and Phillips (2005)
	Wire nail	Wire nail technology	Readily available since 1884	Adams (2002)
	Aqua/pale green soda-pop bottle fragment	Coca-Cola hobbleskirt bottle with applied color label	Post-1933	SHA (2009)
	Colorless soda-pop bottle fragment	Owens-Illinois Glass Co. "diamond OI" mark with year code "0"	1940	Lockhart (2006); SHA (2009)
MT2 Fill	Aqua bottle fragment	Glass-tipped pontil	Until ca. 1850	SHA (2009)
	Black alcoholic beverage bottle fragments (n=3)	Black glass; free blown	Pre-1800–early 1860s	SHA (2009)
	Black alcoholic beverage bottle fragments (n=5)	Black glass	Pre-1800–ca. 1890s	SHA (2009)
	Aqua bottle fragment	Base-hinged two-piece mold; glass-tipped pontil	ca. 1810–1850	SHA (2009)
	Earthenware cup fragment	Brown transferware	Since ca. 1820s	Price (2007)
	Earthenware plate fragment	Spongeware/stick spatter pattern	ca. 1830s–1930s or later	Country Living (2009)
	Earthenware cup fragment	Spongeware/stick spatter pattern	ca. 1830s–1930s or later	Country Living (2009)
	Earthenware tableware fragment	Flow blue pattern	ca. 1835–early 1900s	Snyder (2007)
	White improved earthenware plate fragment	No center shield in British royal arms in mark	Since 1837	The Potteries (2009)
	Light blue bottle fragments (n=4)	Bare iron pontil	ca. 1845–mid-1860s	SHA (2009)
	Olive glass bottle fragment	Laid-on ring finish	Until ca. 1850	SHA (2009)
	Earthenware bowl fragment	Flow blue sheet pattern	ca. 1860s–early 1900s	Snyder (2007)
	Aqua canning jar fragment	Shoulder seal type Mason jar	1870s–ca. 1915	SHA (2009)
	Colorless bottle/jar fragments (n=6)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Porcelain saucer fragment	Gold gilt decoration	Since ca. 1880	Polk and Phillips (2005)
	White improved earthenware cup fragment	Gold gilt decoration	Since ca. 1880	Polk and Phillips (2005)
	Earthenware tableware fragments (n=2)	Gold gilt decoration	Since ca. 1880	Polk and Phillips (2005)
	Aqua soda-water bottle with stopper	Hutchinson stopper	ca. mid-1880s–mid-1910s	SHA (2009)
	Wire nail	Wire nail technology	Readily available since 1884	Adams (2002)
	Aqua bottle fragments (n=2)	Tooled finish	ca. 1885–early 1920s	SHA (2009)
	Amber beer bottle fragment	C & CO LIM mark from Cunningham & Co, Ltd.	1892–1903	Lockhart et al. (2005b:3); Whitten (2009)
	Aqua soda-water bottle fragment	Cup-bottom mold	ca. 1900–late 1910s	SHA (2009)
	Aqua medicine bottle fragment	Dr. Pitcher's Castoria with multiple air venting marks in embossing	1900–ca. 1920s	Fike (1987:177); SHA (2009)

Table 4-2. Temporally Diagnostic Artifacts from Site 45CL910 (*continued*).

Provenience	Item Description*	Dateable Characteristics	Date/Date Range	Reference
	Colorless bottle fragments (n=2)	Automatic bottle machine mold seams	Since ca. 1905	SHA (2009)
	Earthenware tableware fragment	Partial printed mark from Arthur J. Wilkinson pottery	Since ca. 1930	Kovel and Kovel (1986); The Potteries (2009)
	Amber bottle fragment	K in keystone mark from Knox Glass Bottle Co.	1932–1968	Lockhart et al. (2008)
MT2 TU-A	Dark olive case gin bottle fragment	Dip molded with flared finish	1745–1880	SHA (2009)
	Pearlware tableware fragments (n=16, MNI=5)	Blue tint to glaze	1770s–ca. 1840	The Potteries (2010);
	Black bitters bottle fragment (Hostetter's?)	Black glass	pre-1800 to early 1890s	SHA (2009)
	Black bitters bottle fragment (Hart's?)	Black glass	pre-1800–early 1890s	SHA (2009)
	Black alcoholic beverage bottle fragments (n=8)	Black glass	pre-1800–early 1890s	SHA (2009)
	Black alcoholic beverage bottle fragment	Black glass, applied mineral finish	1820s–ca. 1890s	SHA (2009)
	Earthenware tableware fragment	Possible hand painted spongeware/stick spatter	Introduced in the 1830s	Florida Museum of Natural History (2010)
	Pearlware tableware fragment	Impressed British registry mark exhibiting second configuration of diamond pattern	early 1840s?	The Potteries (2009)
	White improved earthenware tableware fragments (n=2, MNI=2)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless glass fragment	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Amethyst pressed glass tumbler fragment	Sun-colored amethyst (use of manganese dioxide in the decolorization process)	1870s–ca. 1920	SHA (2009)
	Wire nail	Wire nail technology	Readily available since 1884	Adams (2002)
	Aqua bottle fragment	Improved tooled finish	1895–early 1920s	SHA (2009)
MT3 Feature 1	Colorless glass fragment	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Wire nail (n=3)	Wire nail technology	Readily available since 1884	Adams (2002)
	Wire spike	Wire nail technology	Readily available since 1884	Adams (2002)
	Green Coca-Cola bottle fragment; contents marketed by a Eugene bottling company	Embossed Owens-Illinois diamond OI mark with 44 date code	1944	Whitten (2009); SHA (2009); Lockhart (2006)
	Window glass fragment	0.054 inch thick	1810–1845?*	Roenke (1978:116)

MT = Mechanical Trench TU = Test Unit

* A window glass thickness mode (Roenke 1978) was not calculated for the glass from MT3 Feature 1, as only one fragment was found. The thickness of this piece is listed, and the date range provided reflects the mode into which the individual measurement would fall if a modal analysis was being conducted.

The temporally diagnostic items from the apparently intact deposits sampled by the excavation of TU-A suggest production between the 1880s and the very early 1900s. Since most of these items are bottles that contained rapidly consumed commodities, it is assumed that disposal took place relatively soon after manufacture. The location of TU-A in the vicinity of a dwelling shown on Sanborn fire insurance maps from 1884 through 1892 (Figures 4-3–4-6), but gone as of 1907 (Figure 4-7), suggests that these artifacts may be related to that structure. Furthermore, the date ranges suggested by the temporally diagnostic pieces are consistent with the lifespan of the dwelling.

ANALYSIS AND INTERPRETIVE RESULTS

Altogether, archaeological discovery investigations in W1 involved excavation of three trenches that extended over a total distance of 80.5 m. These trenches encountered evidence of widespread and deep introduced fill deposits. Along most of the trench sections, the trackhoe excavations either (1) did not penetrate below fill, or (2) the fill rested directly on Pleistocene gravels. Discontinuous patches of Bw horizon soil, sometimes undisturbed but in other places remobilized, were observed beneath the fill in all three trenches, at depths varying from 90 cmbs to 140 cmbs. No evidence of an intact A horizon, in which cultural features and deposits associated with historic or prehistoric occupation might be expected to be found, was encountered in W1.

Roughly 80 percent of the artifacts recovered from W1 were retrieved from the deep fill deposits that mantle this area. The fill artifacts are largely domestic in nature, consisting, for the most part, of ceramic tablewares, glass bottles, food remains in the form of mammal bone and oyster shell, and other household and personal items. Some structural materials, such as nails, bricks, and window glass, were also found. The wide range of manufacturing dates for these items suggests multiple episodes of deposition. Items manufactured before the 1850s and continuing through the end of the nineteenth century were found in the same deposits as those dating to as late as the 1930s and 1940s.

A single test unit (TU-A) was excavated near the south end of MT2 to sample artifacts thought to be situated below fill. Most of these items are also domestic. Manufacturing dates for these artifacts suggest acquisition, use, and discard beginning sometime around 1880 and terminating no later than 1915–1920, possibly earlier. These items were encountered in an area identified as the site of a dwelling on Sanborn fire insurance maps produced from 1884 to 1892 (Figures 4-3–4-6). By the time the 1907 map was issued, the house was gone (Figure 4-7). The nature of the TU-A assemblage and the artifact dates support a possible affiliation with this structure.

A single cultural feature, the corner of a brick foundation, was exposed at 1.0 m below surface near the north end of MT3. This discovery indicates that structural remains associated with a sizable building are preserved below the fill in this part of W1. Comparison of the location of MT3 with buildings shown on the Sanborn fire insurance maps suggests that the brick foundation corresponds with the south wall of a large building identified as housing a general merchandise store in 1884 and a dry goods and clothing store in 1888, 1890, and 1892 (Figures 4-3–4-6). It stood vacant in 1907 (Figure 4-7), but by 1911 it was used for lard rendering and storage. On the 1928 and 1949 Sanborn maps it is identified as a machine shop (Figure 4-8).

When the locations of the W1 discovery trenches are plotted on the Sanborn maps, it is evident that all three trenches were excavated within or east of the former location of Main Street (in Block 418/2). Block 394/10, on the west side of Main Street, falls within W2. Exposure of the brick foundation in MT3 suggests that a high potential exists for the discovery of structural remains associated with other early buildings to the west in W2.

NRHP ELIGIBILITY

Although the presence of substantial fill deposits had a limiting effect on the archaeological investigations, the results of discovery investigations indicate that W1 contains significant historical archaeological remains. W1 is situated within the area of the earliest settlement and development in the Historic City of Vancouver. The brick foundation encountered approximately 1.0 m below surface near the north end of MT3 appears to correlate with the south wall of a large building shown on the 1884 Sanborn map, the earliest edition of the series of Sanborn maps prepared for Old Vancouver. This same building appears on all of the subsequent Sanborn map editions through 1949.

Although the brick foundation exposed in MT3 was the only cultural feature recorded, some of the fragmentary concrete exposed elsewhere in the trenches also may be associated with unexposed intact foundations from buildings that once lined the east side of Main Street. The limited exposures provided in the narrow discovery trenches made it difficult to distinguish concrete debris in fill deposits from intact structural remains.

In addition to the discovery of the brick foundation, cultural materials were recovered from apparently intact cultural deposits deep below the surface near the south end of MT2. These deposits were situated at 130–160 cmbs in the test unit (TU-A) placed in the floor of the trench, documenting the considerable depth of fill in that portion of W1.

Considering the presence of architectural remains and apparently intact artifact-bearing deposits below the fill, site 45CL910 has the potential to contribute important information on the early decades of settlement and development in the Historic City of Vancouver. As such, W1 appears to be a significant archaeological site that is eligible for listing on the National Register of Historic Places under criterion d.

Site 45CL910 does not appear to meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5 and SR 14, and the massive amount of earth-moving during highway construction resulted in the widespread destruction of the historic setting in the I-5 and SR 14 corridors. As a result, the site does not meet the integrity requirement for significance under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

W1 is bordered on the east by the western edge of the southern portion of VNHR Area 5, which consists of NPS property measuring 155 m east–west by 13 m north–south between the north side of SE Columbia Way and the BNSF Railroad berm. Archaeological testing by NPS archaeologists in 2009 found this area to be covered by thick layers of fill, predominantly dredge materials in the eastern two-thirds, and gravelly silt loam containing concrete chunks and other construction debris in the western one-third adjacent to W1 (O'Rourke et al. 2010:252). A backhoe employed to test for archaeological deposits and features buried below the fill deposits encountered significant archaeological deposits in two areas.

In the first area, about 40 m east of W1, beneath 70 cm of fill material a possible privy or cellar containing 11 distinct strata reflecting at least two depositional episodes was found. A dense concentration of nineteenth century artifacts was recovered from these strata. The excavation continued to a depth of 266 cm below surface without reaching the B horizon soil. This area is near the former location of a small unidentified structure shown on the 1859 Harney map (O'Rourke et al. 2010:263–264).

In the second area, about 8 m east of W1, a dense concentration of nineteenth century artifacts was found beneath fill material from about 100 to 133 cm below surface. This midden is likely to have been associated with the Vancouver House Hotel (O'Rourke et al. 2010:265-266). As previously discussed, this hotel originally was constructed on property that was later affected by a boundary dispute between the City of Vancouver and the U.S. Army. The eastern portion of the hotel was dismantled when the dispute was settled in favor of the U.S. Army (O'Rourke et al. 2010:265).

The results of the HERITAGE excavations in W1 and the NPS excavations at the west end of VNHR Area 5 are complementary. W1 is situated north and west of this portion of VNHR Area 5, but both contain archaeological remains associated with early development in the Historic City of Vancouver. The significant archaeological remains found farther east in VNHR Area 5 are associated with U.S. Army occupation. The results of the investigations in W1 and VNHR Area 5 are important in demonstrating the presence of significant archaeological features and deposits below substantial amounts of introduced fill material along this portion of the Columbia River shore.

FUTURE MANAGEMENT OPTIONS

As noted at the beginning of this chapter, archaeological discovery investigations were concentrated in the eastern portion of W1. At the time of the fieldwork, the precise boundaries of the WSDOT parcel had not been established on the ground, and trenches were placed to avoid intrusion onto adjacent, non-WSDOT parcels. As a result, additional archaeological discovery investigations may be necessary at W1 when the effects of the CRC project on this parcel are identified.

In view of the assessment of site 45CL910 as a significant historical archaeological site, the CRC project has the option of (1) avoiding any use of W1 that might result in impacts to site 45CL910, or (2) mitigating any impacts to site 45CL910 through data recovery excavations. Any further archaeological field investigations undertaken should be conducted in conjunction with thorough historical research of past uses and developments to maximize the interpretation of the historical archaeological record at W1.

5. WASHINGTON AREA 4 (45CL911)

Located in the southeast quadrant of the I-5/SR 14 interchange, Washington Area 4 (W4) is a WSDOT parcel situated between the I-5 Exit 1A off-ramp connecting I-5 to SR 14 on the north and the BNSF Railroad berm and the City of Vancouver's Apple Tree Park on the south (Figure 5-1). The historic apple tree (recorded with DAHP as 45CL164H), located a short distance east of the east boundary of W4, is generally thought to stand on a remnant of the original ground surface (Wilson 2005:24). Much of W4 is only slightly lower in elevation, suggesting that relatively intact cultural deposits associated with prehistoric and/or historic occupation might have survived previous city street, highway, and railroad construction in the area.

Archaeological discovery investigations were conducted at W4 from April 24 to April 30, 2009. These investigations resulted in the recovery of cultural materials from construction fill deposits overlying the Bw soil horizon and/or Pleistocene gravels. No intact cultural deposits and no cultural features were observed. The archaeological remains at W4 have been recorded with DAHP as site 45CL911.

The eastern portion of site 45CL911 overlaps the boundary for site 45CL300. Originally applied to Kanaka Village, the designation 45CL300 was expanded in 1984 to subsume all HBC and U.S. Army related archaeological resources in this area, including the eastern portion of the area in which 45CL911 has been recorded (Thomas and Hibbs 1984:2). Site 45CL911 lies outside the boundary of the Vancouver National Historic Reserve Historic District listed on the National Register of Historic Places in 2007 (Owens et al. 2007, Map D).

HISTORICAL SETTING

The boundary between the Historic City of Vancouver and the U.S. Military Reservation extended from the Columbia River in a northeasterly direction through W4, with the result that the western portion of W4 encompassed some of the first streets platted in the city, while the eastern portion was on the southwestern periphery of the military reserve and the earlier HBC-period Kanaka Village.

Sanborn fire insurance maps published in 1884, 1888, 1890, 1892, 1907, 1911, 1928, and 1949 document development in and around the portion of W4 within the City of Vancouver. The Sanborn maps provide limited detail within the military reserve. On the earliest Sanborn maps (1884, 1888, 1890, 1892) the western portion of W4 was included in Blocks 1 and 2, which encompassed developments east of Main Street on the south and north sides of 2nd Street (1884 [Figure 5-2]), later renamed Bateman Street between Main and Reserve streets (1888, 1890, 1892). The maximum extent of development on and around the western end of W4 is shown on the 1892 and 1907 Sanborn maps (Figures 5-3 and 5-4).

Beginning with the 1907 Sanborn map, the system of designating city blocks changed. The area east of Main Street and north of Bateman (formerly the southern end of Block 1) was re-designated Block 417 and the area east of Main Street and south of Bateman (formerly

PRELIMINARY

7804

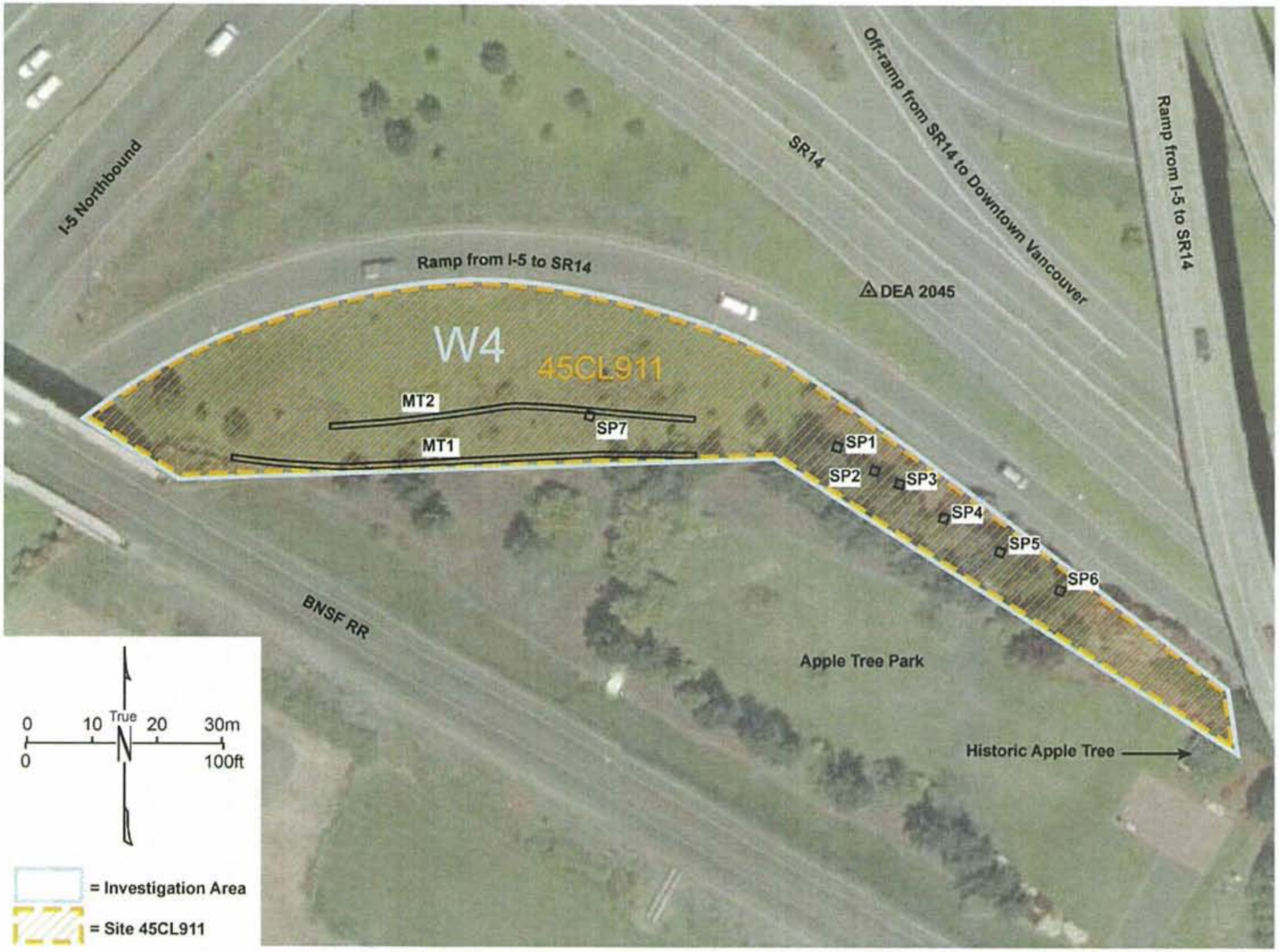

Figure 5-1. Locations of shovel probes (SP), mechanical trenches (MT), and site 45CL911 in WSDOT parcel W4 on aerial photograph (Terrain Navigator Pro 2002).

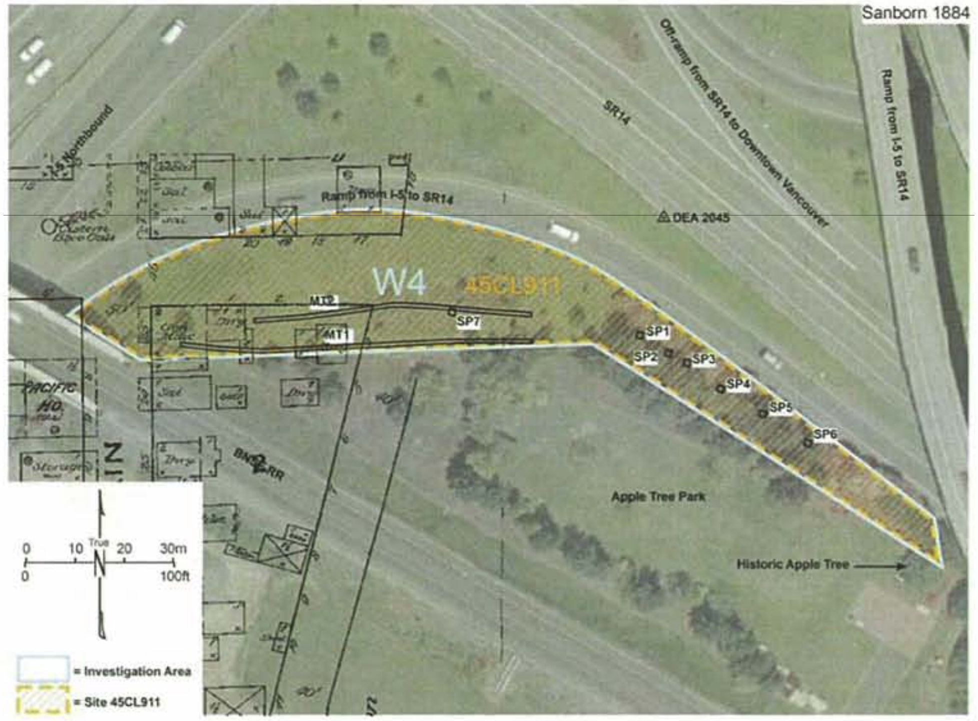

Figure 5-2. WSDOT parcel W4 (site 45CL911) superimposed on the 1884 Sanborn fire insurance map.

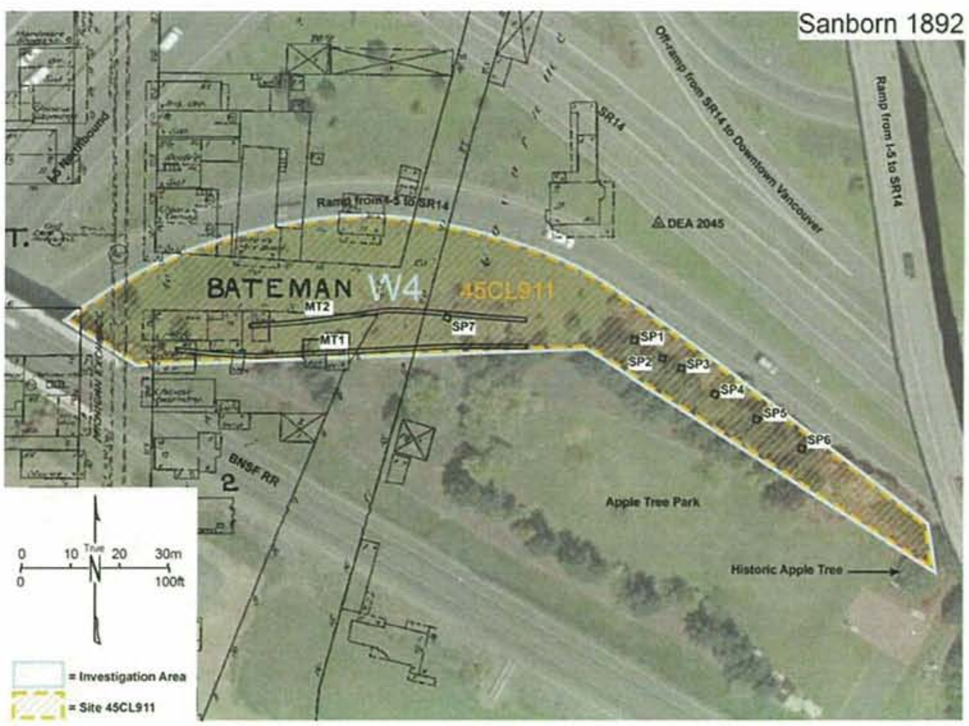

Figure 5-3. WSDOT parcel W4 (site 45CL911) superimposed on the 1892 Sanborn fire insurance map.

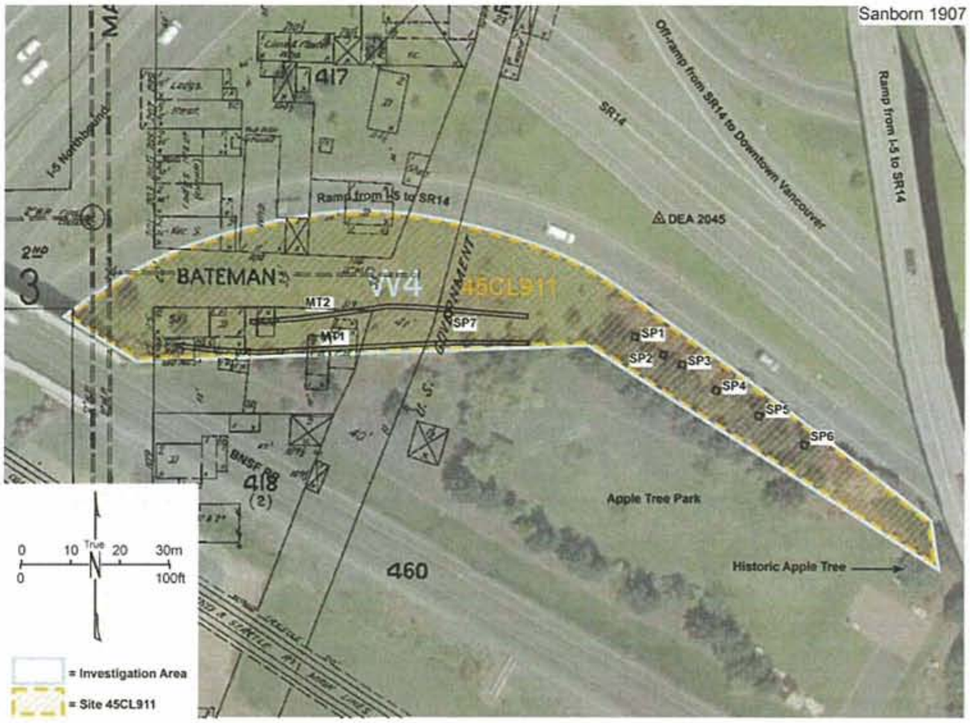

Figure 5-4. WSDOT parcel W4 (site 45CL911) superimposed on the 1907 Sanborn fire insurance map.

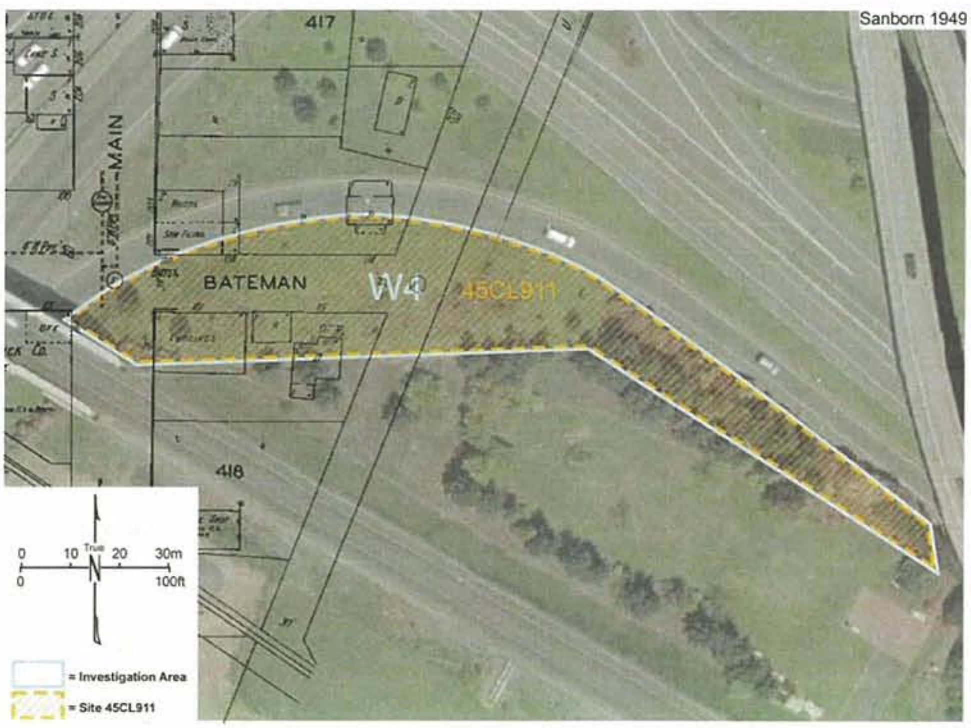

Figure 5-5. WSDOT parcel W4 (site 45CL911) superimposed on the 1949 Sanborn fire insurance map.

Block 2) became Block 418. While some of the buildings shown on the 1892 Sanborn map still appeared on the 1907 map, by 1911 there were no structures remaining within the area of W4. By 1928, a few buildings had been constructed on both sides of Bateman, with "Lodgings," a store, and a dwelling lining the south side of Bateman (Block 418), and a "Saw Filing" business and a dwelling on the north (Block 417). By 1949, Bateman Street had become a wedge-shaped, eastern extension of 2nd Street, a portion of which had been carved out of the northeast corner of Block 418. Block 418 contained only one building, a machine shop situated south of W4, and an auto repair shop occupied most of the southern edge of Block 417 along East 2nd Street (Figure 5-5).

As the Sanborn maps were focused on municipal developments, they do not regularly show buildings immediately to the east on the U.S. military reserve. A notable exception in the W4 vicinity is a large building identified as a dwelling on the 1888, 1890, and 1892 Sanborn maps (see Figure 5-3), which is the same structure variously labeled "Citizen" (Chance and Chance 1976:12), "Officers Quarters" (Chance and Chance 1976:13), "Chief Comm'y" (1892 buildings on Taylor 1992), and building "R" (Chance and Chance 1976:14) on various maps of the Reserve. This building was situated just beyond the northeast boundary of W4.

Many maps of the HBC fort and later the Military Reservation were prepared over the years. Some depict several structures in the general vicinity of W4. The 1846 Covington map of Kanaka Village for example, a significantly earlier rendering of the area than any of the Sanborn maps, seems to show two buildings overlapping or abutting the boundaries of present-day W4 (O'Rourke et al. 2010:102). Covington identified one as "Servants" and the other as "John Johnson's."

PREVIOUS ARCHAEOLOGY

Among archaeological investigations conducted in 1974 in conjunction with the expansion of the I-5/SR 14 interchange was excavation at Operations 14, 15, and 17, located north of Apple Tree Park in areas now covered by SR 14 or associated on-ramps. Operation 14, which contained one 5 × 5 foot test unit and an exploratory trench measuring 2.5 feet wide by 30 feet long, was situated "about a hundred feet east of the 'Old Apple Tree'" (Chance and Chance 19776:29). Altogether, the Operation 14 investigations involved excavation of a 95 ft^2 area within which five cultural features were exposed (Chance and Chance 1976:23). The evidence recovered from disturbed deposits suggested the presence of an HBC structure and a U.S. Army structure (Depot Residence P) below a coal dump adjacent to a railroad trestle that extended through this area.

Relatively small test excavations (each involving excavations in a 50 ft^2 area) at Operations 15 and 17, situated to the northwest of Operation 14. These investigations encountered disturbed deposits containing mixed HBC and twentieth century materials. It was suggested that the disturbed nature of these deposits was a result of material being scraped up from the area to the east when the coal pad was constructed (Chance and Chance 1976:30).

Construction excavations within the proposed boundaries of SR 14 led to further archaeological investigations north of the Old Apple Tree in the Operation 14 area in 1981 (Thomas and Hibbs 1984). These investigations included excavation of 109 5 × 5 foot test units, exposing a 2,725 ft^2 area encompassing a house belonging to John Johnson, a cooper at Fort Vancouver, known to have been demolished in 1857. Some 229 cultural features were recorded, including cellars, post casts and postholes, stakes, pits, and fire areas. The excavations resulted in the recovery of the largest collection of HBC artifacts (more than 43,000 items) then reported from a Kanaka Village residence. In addition to the test units, a 210 ft long backhoe trench was excavated, extending mostly to the east of the HBC residence. This trench encountered disturbed deposits associated with U.S. Army structure P (Thomas and Hibbs 1984:117). Although almost three decades have elapsed since its excavation, the John Johnson house remains the most thoroughly described and reported HBC residence at Kanaka Village.

In 1993, in connection with a proposed pedestrian undercrossing project at SR 14, a single shovel probe (about 1 ft in diameter) was excavated "south of SR 14 near Old Apple Tree Park" (Thomas 1993:12). Eleven artifacts were found, five of which "were twentieth century architectural items and could be associated with the US Army building that stood in this area" (Thomas 1993:22). It was added that "the number of artifacts from this probe was too small to require further work" (Thomas 1993:22). The report concluded with the statement "no significant contributing elements to the history of Fort Vancouver were found in the project area south of SR 14" (Thomas 1993:24).

In 2004, archaeological testing was conducted to the east and south of W4 in connection with proposed construction of the Confluence Project Land Bridge (Wilson 2005). The testing in Area C, "between SR 14 and the BNSF railroad from Old Apple Tree Park to the proposed location for the bridge crossing," included six backhoe test pits and seven 50 × 50 cm shovel test units. The backhoe test pits were excavated in the eastern portion of Area C, described as "likely heavily impacted during the realignment of SR-14 and the railroad in the 1980s," in order "to determine the depth of disturbance and to locate the top of intact archaeological deposits" (Wilson 2005:18) Five of the seven shovel test units were placed in the western portion of Area C closer to the historic Apple Tree; the other two shovel test units were placed in the bottom of backhoe test pits.

The shovel test units excavated in the western portion of Area C "within or near Old Apple Tree Park....contained largely disturbed deposits" (Wilson 2005:25). The mixed modern and historical artifacts occurring in introduced fill encountered in these units "suggest that archaeological deposits were destroyed during the construction and/or demolition of the original alignment of SR-14" (Wilson 2005:26). The two shovel tests placed in the bottom of backhoe test pits in the eastern portion of Area C, some 200 m southeast of the historic apple tree, reached "cultural remains associated with the HBC and prehistoric components of the Kanaka Village site (45CL300)" (Wilson 2005:25).

GPR RECONNAISSANCE

The GPR reconnaissance undertaken at W4 in August 2008 employed a 250 MHz antenna (CRC Lines 230 to 236) and a 500 MHz antenna (CRC Lines 237 to 243). Using the 250 MHz shielded antennae, seven GPR lines (CRC Lines 230 to 236) were surveyed from west to east, each separated from the next by 3.0 m. The 250 MHz lines extended over a total distance of 505.0 m. These lines were repeated using the 500 MHz antennae (CRC Lines 237 to 243). However, the 500 MHz GPR records are not interpreted, as most of the signals did not penetrate the highway construction fill. Resistive fill materials occur along the full lengths of the longest profiles (CRC Lines 230, 231, and 233). The depth of resistive fill ranges from 10 nanoseconds (ns) (0.5 m below surface) to 40 ns (2.0 m below surface). The average depth of fill in W4 suggested by the GPR profiles is 24 ns (1.2 m below surface).

FIELD INVESTIGATIONS

The field investigations were tailored to the particular ground conditions at W4. The eastern one-third of W4, closer to the historic apple tree, is a narrow strip of land bounded on the south by a line of fir trees and on the north by a line of tall, closely spaced bushes. This landscaping precluded use of a trackhoe. Accordingly, manually excavated shovel probes were placed in this narrow eastern portion of W4. The western two-thirds of W4 is considerably wider and relatively sparsely covered by landscaping vegetation, allowing use of a trackhoe to excavate discovery trenches in that area.

Manual Excavations

The eastern portion of W4 is approximately 90.0 m long. The westernmost 60 m ranges from 8.0 to 14.0 m wide between the WSDOT/Apple Tree Park boundary fence and the curb along the SR 14 on-ramp. Approximately half of this narrow space is taken up by a 6.0-m-wide earthen berm, along which fir trees are growing, that parallels the boundary fence. From this berm, the ground slopes down to the SR 14 on-ramp, along which grows a line of tall bushes. As noted above, the presence of dense landscaping vegetation in this narrow strip of ground precluded use of a trackhoe in this area (Figure 5-6).

Discovery investigations began with manual excavation of six 50 × 50 cm shovel probes (SP) at roughly 10-m intervals along the narrow space between these two lines of landscaping vegetation. In general, excavation of SP1 through SP6 in the eastern section of W4 exposed fill deposits directly overlying either the Bw soil horizon or Pleistocene gravels (Table 5-1). A few scattered cultural items were recovered from the gravelly fill in SP3 and SP4. It appears that cutting of the original ground surface during previous SR 14 construction removed the A horizon soil and any evidence of significant prehistoric or historic activity or occupation that once might have been present.

The GPR reconnaissance included lines surveyed west to east down the center of the narrow eastern section of W4. Two anomalies thought to potentially represent cultural features were identified. SP2 at 16.6 m, and SP3 at 21.0 m, excavated at the approximate locations of these anomalies, encountered no evidence of subsurface cultural features. Based on experience in other CRC project areas, the anomalies identified by the GPR probably relate to phenomena in the underlying Pleistocene gravels.

SP6, the easternmost shovel probe, was about 12.0 m west of an east–west trending concrete wall that stands 8.7 m north of the historic apple tree. This concrete wall, which is 38.4 m long and 2.2 m high, was presumably built as a visual and sound barrier shielding the historic apple tree from SR 14. The concrete wall stands less than 3.0 m south of the curb bordering the ramp from I-5 onto east-bound SR 14 (Figure 5-7). The line of shovel probes was not extended farther eastward between the concrete wall and the SR 14 ramp in view of previous ground disturbance from construction along this narrow strip as well as the presence of a buried electrical line extending roughly east–west parallel to the SR 14 ramp.

An additional shovel probe (SP7) was excavated at the location of an anomaly identified during the GPR reconnaissance in the western portion of W4. A common red brick on the ground surface 1.5 m southwest of the anomaly measured 8 × 4 × 2¼ inches. A few pieces of recent cultural debris were recovered from a gravelly fill deposit. Excavation was terminated at 60 cmbs when

Figure 5-6. View southeast, showing narrow eastern portion of WSDOT parcel W4 (to right of SR 14 ramp) where manual shovel probes were excavated between a line of dense bushes and a stand of trees along the WSDOT/Apple Tree Park boundary fence.

Figure 5-7. View of the narrow strip of ground at the east end of WSDOT parcel W4 not subject to discovery probing due to previous construction-related ground disturbance and the presence of a buried electrical line paralleling the curb along the ramp onto east-bound SR 14.

Table 5-1. Summary of Discovery Probe Excavations at Site 45CL911.

Probe No.	Level/ Stratum	Depth Below Surface (cm)	Sediment Description	Cultural Material*
1	1-4/1	0-35	Gray-brown sand with gravel (fill)	None
	4/2	35-50	Yellow-brown silt with rounded pebbles/cobbles (Bw)	None
2	1-2/1	0-20	Light brown compact gravelly sand (fill)	None
	3-5/2	20-50	Light orange-brown silt with rounded pebbles/cobbles (Bw)	None
	6/3	50-60	Gray loose rounded Pleistocene gravels	None
3	1/1	0-10	Gray-brown sand with gravel (fill)	A few brick fragments
	2/1	10-20	Same	1 indefinite glass fragment; 1 window glass fragment
	3-4/2	20-40	Yellow-brown silt with rounded pebbles/cobbles (Bw)	None
	5/3	40-50	Gray loose rounded Pleistocene gravels	None
4	1/1	0-10	Gray-brown sand with gravel (fill)	2 container glass fragments; 1 window glass fragment; 1 earthenware fragment; 1 brick fragment
	2/1	10-20	Same	1 container glass fragment; 4 indefinite glass fragments; 1 stoneware fragment
	3-5/2	20-50	Yellow-brown silt with rounded pebbles/cobbles (Bw)	None
5	1-2/1	0-20	Gray-brown sand with gravel (fill)	None
	3-5/2	30-50	Orange-brown silt with rounded pebbles/cobbles (Bw)	None
6	1-3	0-30	Gray-brown compact sand with gravel (fill)	None
	4-5/2	30-50	Yellow-brown silt with rounded pebbles/cobbles (Bw)	None
7	1/1	0-10	Gray-brown sand with gravel (fill)	None
	2/1	10-20	Same	A few small brick fragments
	3/1	20-30	Same	1 indefinite glass fragment; 1 wire nail; small brick fragments
	4/1	30-40	Same	A few small brick fragments
	5/1	40-50	Same	1 window glass fragment
	6/1	50-60	Same	Asphalt fragment with yellow paint

* Includes observed (but not collected) as well as those recovered.

an apparent indicator of recent disturbance in the form of a chunk of asphalt with yellow paint was encountered. No evidence of a subsurface cultural feature was observed at this location.

Mechanical Trenching

The northern edge of W4 is characterized by a steeply cut slope created during the construction of the SR 14 eastbound on-ramp. Pleistocene gravels are exposed in this cut-slope. The relatively level area suitable for archaeological investigations has a maximum width of 18.0 m, measured from the boundary fence to the top of the cut-slope. From this widest point, the work area in the western portion of W4 narrows to about 11.0 m at the east end, and to only about 5.0 m at the west end. Discovery investigations in the wider western portion of W4 primarily involved use of a trackhoe (Bobcat 334 with a 24-inch-wide bucket) to excavate two mechanical trenches (MTs) (Figure 5-8).

MT1

MT1, 71.0 m long by 0.9 m wide and 1.15 to 1.3 m deep, extended west to east parallel to the WSDOT/Apple Tree Park fence (Figure 5-9). At the west end of MT1, fill deposits were present to a depth of 120 cmbs (4 feet). Localized deeper excavation at the west end of the trench established that at least 2.4 m (8 feet) of fill are present in this area; the full extent of the fill deposits was not determined. The deep fill deposits were probably introduced during construction of the BNSF Railroad overpass crossing I-5 immediately west of W4.

The north and south walls of MT1 exhibited the same general stratigraphic profile. Measuring from the west end, where excavation began, the first 24.0 m of the trench contained gray-brown gravelly fill with brick, asphalt, and concrete debris from the surface to the trench floor. At 24.4 m, the lower boundary of the fill layer sloped up to the east and Pleistocene flood gravels appeared at 60 cmbs. The top of the Pleistocene gravels varied along the length of the trench between 35 and 105 cmbs according to fluctuations in the thickness of the overlying layers. Mixed/redeposited Bw appeared between the overlying fill and basal Pleistocene gravels at 26.8 m. At 48.0 m, the lower boundary of the fill layer began to dive, pinching out the mixed/redeposited Bw by 55.0 m. The top of the Pleistocene gravels also sloped downward in this section. The Pleistocene gravels disappeared by 68.0 m and were replaced by an apparently mixed/redeposited layer of Pleistocene gravels.

The location and orientation of MT1 corresponded to the alignment of a GPR line surveyed in August 2008. An anomaly thought to possibly represent a cultural feature identified during the GPR survey was found to be a bowl-shaped depression extending from 30.8 and 35.0 m in the north trench wall (Figure 5-10). This depression appears to correspond with location of a dwelling shown on Sanborn maps dating from 1884 to 1928. At the deepest point, the depression extended to 120 cmbs, terminating on the Pleistocene gravels. The depression was filled with mixed/redeposited Bw containing glass, metal, and charcoal. No evidence of a structure was observed, and the anomaly thus appears to have been created in conjunction with deposition of fill over the area, rather than as a result of historic activity or occupation.

It is noteworthy that most of the Pleistocene gravels visible in MT1 were deposited in inclined beds consisting of alternating clast-supported, imbricated pebbles and cobbles. The orientation of the fabric paralleled that of the beds with a dip bearing of 277 degrees and angle of 35 degrees. The beds represent the downstream end of a gravel bar formed when the river current flowed west-southwest through the area.

MT2

MT2 was 57.0 m long by 0.8 m wide, and extended to 1.1 to 1.4 m deep (Figure 5-11). The west end contained gravelly fill with brick and asphalt chunks to the trench bottom. Pleistocene gravels appeared underneath the fill at 90 cmbs at 9.0 m from the west end. The top of the Pleistocene gravels rose to 20 cmbs by 14.5 m. The fabric of the gravels at this point formed alternating inclined beds (except in the uppermost 25 cm where the gravels were horizontally bedded) like those observed in MT1.

Figure 5-8. View southwest, at the beginning of MT1 excavation in WSDOT parcel W4 (Columbia River bridges in background).

Figure 5-9. View east, showing MT1 in WSDOT parcel W4 (WSDOT/Apple Tree Park fence on right, SR 14 on-ramps in background).

Figure 5-10. View of GPR anomaly exposed in the north wall of MT1 in WSDOT parcel W4.

Figure 5-11. View southwest, near conclusion of MT2 excavation in WSDOT parcel W4.

By 25.0 m from the west end, the overlying fill thickened again, with the lower boundary dropping to 55 cmbs. The fill consisted of sand in the north wall, but continued to be gravelly and contained construction debris in the south wall. By 32.0 m, the fill extended to 105 cmbs and contained a layer of redeposited Pleistocene gravels. A possibly undisturbed remnant Bw horizon appeared by 42.0 m, sandwiched between the fill and basal Pleistocene gravels at roughly 90 to 110 cmbs. It disappeared again by the east end of the trench, where gravelly, loamy fill containing bricks, asphalt, and glass debris extended to the top of the Pleistocene gravels at 80 cmbs.

DESCRIPTION OF DEPOSITS

Although the contours of the ground surface at W4 suggest a relatively undisturbed landform, the results of the archaeological investigations indicate otherwise. It appears that the A horizon soil has been removed in its entirety. The underlying Bw horizon also has been removed over most of this area. In place of these native soils, fill material has been deposited. In some areas the fill rests on mixed/redeposited or remnant Bw, while in other areas the fill material rests on Pleistocene gravels. It appears, then, that the stratigraphy at W4 reflects a relatively massive cut-and-fill episode that occurred during construction of SR 14 or the adjacent railroad berm. The few cultural materials recovered were all collected from fill deposits and, therefore, are intrusive into the site.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

No cultural features associated with prehistoric or historical activity were exposed during the shovel probe and trench excavations. Shovel-probe excavations at two anomalies identified during the GPR reconnaissance in the eastern portion of W4 revealed no evidence of subsurface cultural features. These GPR anomalies probably reflect variation in the bedding of Pleistocene gravels deeper below the ground surface.

In contrast, a GPR anomaly in the western portion of W4 was confirmed as indicating the presence of a subsurface depression during excavation of MT1. At the location of the anomaly, a bowl-shaped depression filled with mixed/redeposited Bw was exposed in the north trench wall. In this case, however, the depression appears to have been created in conjunction with large-scale earth movement and fill deposition during previous highway and/or railroad construction rather than as a result of prehistoric or historical activity.

Artifacts

A small amount of cultural material was recovered from three of the shovel probe excavations, specifically in SP3, SP4, and SP7 (Tables 5-1 and 5-2). These 17 artifacts include colorless, amber, and olive bottle/jar fragments; indeterminate aqua and colorless glass fragments (so small that their function could not be determined, but presumably from bottles, jars, or glass tableware); an undecorated earthenware rim fragment too small to determine vessel form but likely from tableware; a stoneware crock fragment; a very small brick fragment; window glass fragments;

Table 5-2. Artifact Summary for Site 45CL911.

Artifact Group/ Category	Artifact Types	SP3 Fill	SP4 Fill	SP7 Fill	Totals
Domestic					
Food Storage	Stoneware crock		1		1
Indefinite					
Containers	Bottle/Jar	2	2		4
Indefinite	Ceramic		1		1
	Ridged flat glass (shelf?)			1	1
	Glass item		5	1	6
Structural					
Hardware	Wire nail			1	1
Materials	Brick		1		1
	Window glass	1	1		2
Totals		3	11	3	17

SP = Shovel Probe
Notes: No cultural materials were found in SP 1, 2, 5, or 6
Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

Table 5-3. Temporally Diagnostic Artifacts from Site 45CL911.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	Reference
SP3 L2 Fill	Colorless bottle fragments (n=2)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Window glass fragment	0.083 in. thick	1855–1885?*	Roenke (1978:116)
SP4 L1 Fill	Colorless glass fragment	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Window glass fragment	0.089 in. thick	1855–1885?*	Roenke (1978:116)
SP4 L2 Fill	Colorless glass fragments (n=3)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Amethyst glass fragment	Sun-colored amethyst—use of manganese dioxide in decolorization	ca. 1870s–ca. 1920s	SHA (2009)
SP7 L3 Fill	Wire nail	Wire nail technology	Readily available since 1884	Adams (2002)

SP = Shovel Probe L = Level
* Window glass thickness modes (Roenke 1978) could not be calculated for the glass from fill in SP3 and SP4, as only one fragment was found in each probe. The thicknesses of these pieces are listed, and the date ranges provided reflects the modes into which the individual measurements would fall if a modal analysis was being conducted.

and a wire nail. Similar cultural materials were observed, but not collected, in the deposits exposed during the mechanical trenching. In both cases, the cultural materials occurred in gravelly fill deposits introduced as a result of large-scale earthmoving during construction of either the SR 14 on-ramp that borders W4 on the north or the BNSF Railroad overpass crossing I-5 immediately west of W4.

The few temporally diagnostic artifacts in this fill assemblage (Table 5-3) are of limited utility in establishing a time frame for disposal of these items. The two window glass fragments measure 0.083 and 0.089 inches thick, which, according to Roenke's (1978:116) formula, suggest a construction date (for whatever building they came from) between 1855 and 1885; however two fragments constitute too small an assemblage to yield a statistically reliable date. Based on the dates for common use of manganese dioxide for decolorizing container glass and glass tablewares and the general availability of wire nails, the artifacts from W4 likely postdate the 1870s and 1880s. No firm end date for the artifacts in these fill deposits can be determined, nor is it known whether this material came from nearby or more distant contexts.

ANALYSIS AND INTEPRETIVE RESULTS

Six shovel probes were excavated manually along the narrow eastern portion of W4. These probes contained fill materials overlying the Bw horizon soil or Pleistocene gravels. One more shovel probe and two mechanical trenches (with a combined length of 128.0 m) were excavated in the broader western portion of W4. The probe and trench excavations exposed gravelly fill above patches of mixed/redeposited Bw or directly overlying Pleistocene gravels, indicating that the Bw horizon was removed or re-mobilized during realignment of Bateman Street or during highway or railroad construction in that area.

No evidence of an A horizon soil, in which cultural deposits and features associated with prehistoric or historic occupation might be found, was exposed during the investigations at W4. In the narrow eastern portion of W4, the ground surface slopes down from Apple Tree Park to the SR 14 onramp. It is likely that the A horizon was removed during the downcutting of this slope, which probably occurred shortly after the 1981 investigations in Operation 14 to the east (Thomas and Hibbs 1984). The line of fir trees and dense bushes in this area probably reflect landscaping vegetation planted about that time.

The broader western portion of W4 reflected even greater ground disturbance. This area appears to have been systematically graded to remove the sediments, with fill material then introduced to restore the ground back to its approximate original elevation. This kind of large-scale cut-and-fill activity was later documented at the other WSDOT parcels around the I-5/SR 14 interchange.

No cultural features were exposed during the excavations. The few cultural items recovered during the probe excavations and observed during the mechanical trenching occurred in gravelly fill deposits. Although the few temporally diagnostic artifacts indicate original discard as early as the 1870s and 1880s, an end date for deposition cannot be firmly established, and the origin of the artifacts in the fill material is not known.

NRHP ELIGIBILITY

As a result of the discovery investigations, site 45CL911 has been identified as consisting of cultural materials occurring within fill deposits at W4. No intact cultural deposits and no cultural features were observed during the field investigations. The fill deposits at site 45CL911 reflect multiple episodes of deposition. Although a few of the artifacts in these fill deposits can be assigned to broad time ranges, as a whole the cultural materials are not particularly temporally diagnostic. The original sources of these artifacts are unknown.

The cultural materials at site 45CL911 exhibit the characteristics of historical archaeological properties that the National Park Service has indicated are *not eligible* for the National Register, namely "temporally diverse cultural material found in undifferentiated/mixed stratigraphic contexts or disturbed spatial associations and the absence of classifiable archaeological features" (Townsend et al. 1993:29–30). Site 45CL911 clearly lacks the integrity (level of preservation and quality of information contained in the deposits) of an archaeological site considered National Register eligible under criterion d (Little et al. 2000:31–44). Accordingly, site 45CL911 is not considered to be a significant archaeological site.

Site 45CL911 also does not appear to meet the requirements for significance under criteria a, b, or c due to its loss of integrity. The site is situated in the construction zone of I-5 and SR 14, and the massive amount of earth-moving during highway construction resulted in the destruction of the resource in the highway corridor. As a result, the site does not meet the integrity requirement for significance under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

The eastern portion of site 45CL911 overlaps the boundary for site 45CL300 as amended in *Kanaka Village Vancouver Barracks Washington 1980/1981* (Thomas and Hibbs 1984:2). Site 45CL911 appears to lie outside the boundary of the Vancouver National Historic Reserve listed on the National Register of Historic Places in 2007 (Owens et al. 2007, Map D).

Site 45CL911 is west and slightly north of Operation 14, where extensive excavations in 1981 revealed the remains of the Kanaka Village residence of John Johnson, a cooper at Fort Vancouver (Thomas and Hibbs 1984). The former location of this structural feature is now covered by SR 14.

The methods used during the investigations at W4 are directly comparable to those employed during testing in connection with the Confluence Project Land Bridge (Wilson 2005). In both cases, 50 × 50 cm shovel tests were excavated to search for archaeological deposits in proximity to the historic apple tree, while a backhoe was used to test for cultural deposits buried beneath deep fill farther away. The primary difference in methodology between the two projects is that short backhoe test pits (lengths not reported) were excavated during the Land Bridge testing, while long, continuous trenches (totaling 128.0 m in length) were excavated at W4. Neither project resulted in identification of significant archaeological deposits near the historic apple tree.

In 2009, NPS archaeologists excavated four 50 × 50 cm shovel test units and two 1 × 1 m test units within a small triangle of land in the northwest corner of Apple Tree Park, adjacent to the southern boundary of W4. The area investigated is on City of Vancouver property lying west of the mapped boundary of site 45CL300 and the Vancouver National Historic Reserve. As was the case in W4, cultural materials were found in fill deposits. No intact A horizon sediments were observed in any of these units, and it was concluded that "this area appears to have been heavily disturbed by highway and railroad construction" (O'Rourke et al. 2010:285).

The results of the investigations by HERITAGE in W4 are consistent with the negative results of archaeological testing on the east side of the historic apple tree carried out in connection with the Confluence Project Land Bridge (Wilson 2005) as well as archaeological testing in the small triangle of land in the northwest corner of Old Apple Tree Park undertaken by the NPS for the CRC project (O'Rourke et al. 2010). Although significant archaeological resources (e.g., the Kanaka Village residence of HBC cooper John Johnson) were formerly present along the eastern margin of W4, and archaeological features and cultural deposits associated with civilian occupation in the Historic City of Vancouver were probably once present in the western portion of W4, any intact archaeological evidence associated with prehistoric or historic use of the area appears to have been removed during previous highway and/or railroad construction.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL911 as not National Register eligible, there appear to be no restrictions on construction at W4 during the CRC project. However, there is always a possibility that previously unidentified and potentially significant evidence of prehistoric or historic occupation or activity may be exposed during construction-related earthmoving. Considering the former presence of significant archaeological resources in the vicinity (e.g., Operation 14, where the Kanaka Village residence of John Johnson was excavated), monitoring by an archaeologist is recommended during any earthmoving in this area associated with construction for the CRC project.

6. WASHINGTON AREA 5A (45CL912)

Washington Area (W5) is a WSDOT parcel in the northeast quadrant of the I-5/SR 14 interchange. Based in part on adjacent landownership, W5 is divided into two parts: (1) W5A, a western area bounded by a U.S. Army parcel; and (2) W5B, an eastern area bounded by a National Park Service parcel. This chapter describes the procedures and results of discovery investigations and testing in W5A (Figure 6-1).

W5A, in turn, can be divided into two subareas: (1) a northern subarea consisting of a narrow strip of ground between the WSDOT/U.S. Army fence line and the I-5 Exit 1B off-ramp to downtown Vancouver, and (2) a southern subarea that extends to the southeast along a slightly wider strip of ground situated between the WSDOT/U.S. Army fence line and the ramp from SR 14 onto I-5.

Data recovery excavations to mitigate impacts from construction during earlier reconfigurations of the I-5/SR 14 interchange were undertaken within the area of present-day W5A in 1974 (Chance and Chance 1976) and again in 1981 (Thomas and Hibbs 1984). Afterwards, massive construction excavations were conducted through this area in connection with emplacement of the I-5 Exit 1B off-ramp to downtown Vancouver. The existing WSDOT/U.S. Army boundary fence has been in place since the conclusion of the archaeological data recovery excavations in the mid-1980s, providing a clear separation of the former construction zone on WSDOT property from the U.S. Army property, which was not affected by highway construction.

In order to determine if any significant archaeological resources were still present, discovery investigations were conducted at W5A from April 6 to April 16, 2009. Evidence of substantial cut-and-fill activity from previous highway construction was found throughout W5A. Beneath the fill, remnant pockets of A horizon soils, from which a small number of artifacts were recovered, were identified in the northern subarea of W5A. No A horizon soils were encountered in the southern subarea of W5A, but five cultural features were discovered beneath the fill deposits. The archaeological remains in W5A have been recorded with DAHP as site 45CL912.

Site 45CL912 is in a WSDOT parcel (W5A) situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army's Quartermaster's Depot at Vancouver Barracks. The site designation 45CL300, originally applied to Kanaka Village, was expanded in 1984 to subsume all archaeological resources in this area (Thomas and Hibbs 1984:2). The WSDOT parcel containing 45CL912 was identified as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007:Map D).

HISTORICAL SETTING

W5A is situated on the northwestern edge of Kanaka Village at Fort Vancouver. One of the HBC servant's houses, identified as "Kanaka's House" on the 1846 Covington map, was located roughly 10 m east of the intersection of the northern and western subareas of W5A. A second Kanaka Village house, identified simply as "Servant's" on the 1846 Covington map, was located

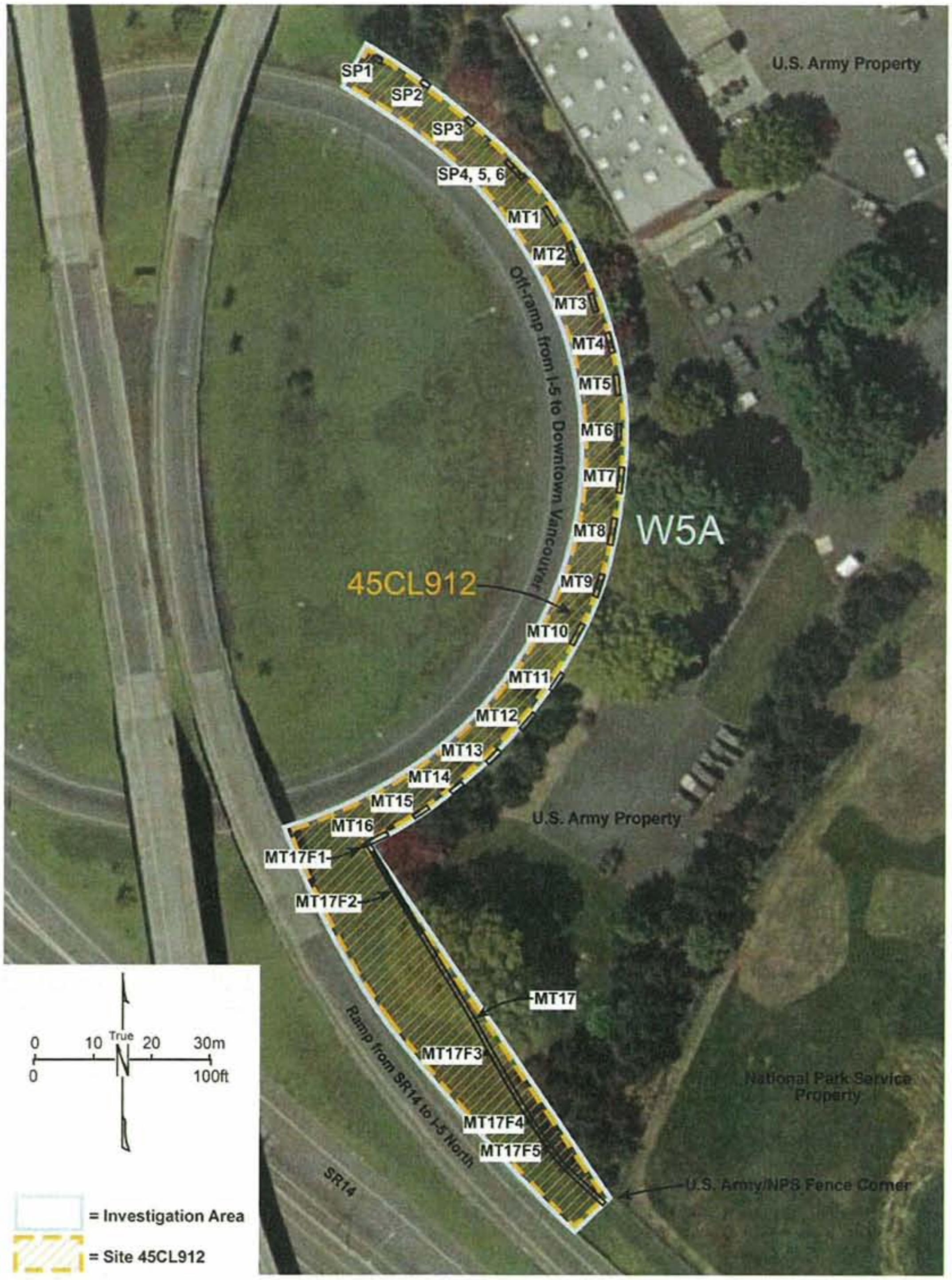

Figure 6-1. Locations of shovel probes (SP), mechanical trenches (MT), cultural features (F), and site 45CL912 in WSDOT parcel W5A on aerial photograph (Terrain Navigator Pro 2002).

to the east. This second house was recently identified as that of Joseph Tayentas, an Iroquois Indian employed by the HBC (O'Rourke et al. 2010:101). Evidence of this house was concentrated roughly 10 m north of the boundary between W5A and W5B, in the vicinity of the 1906 railroad spur, the location of which is still visible on U.S. Army property.

Several U.S. Army buildings were formerly located within, or adjacent to, the northern subarea of W5A. These included structures associated with the Quartermaster's Depot, which, beginning in the 1850s, was developed in the southwest portion of Vancouver Barracks. The former locations of some of these buildings overlap into W9B to the north. At least two later U.S. Army buildings (dating from 1936 and 1944) once stood in the vicinity of the intersection of the northern and southern subareas of W5A (O'Rourke et al. 2010:101). Historical maps spanning the interval from 1859 through 1878 show a road, which became McLoughlin Road in the 1880s, extending from present-day East 5th Street southward through the southern subarea of W5A to the Columbia River (O'Rourke et al. 2010:102).

PREVIOUS ARCHAEOLOGY

Archaeological investigations were carried out within the general area of W5A in conjunction with construction during the two earlier reconfigurations of the I-5/SR 14 interchange. The first reconfiguration prompted investigations in 1974 and 1975 by the University of Washington (Chance and Chance 1976; Chance et al. 1982). The second reconfiguration led to investigations from 1980 through 1983 by Eastern Washington University (Thomas and Hibbs 1984). Additional archaeological probing was carried out in W5A in connection with a proposed pedestrian undercrossing under SR 14 in 1994 (Thomas 1994).

University of Washington Investigations

In connection with the first reconfiguration of the I-5/SR 14 interchange, in 1974 two operations were undertaken in which excavations of varying extents were conducted in proximity (slightly west) to W5A. These were described by Chance and Chance (1976) as Operations 6 and 16.

Excavation in Operation 6 exposed several features in stratigraphic order, beginning with (1) a cobble drain probably associated with an Army building still standing at that time, (2) a square concrete footing with the remains of a wooden post on its center that was probably part of a fence, and (3) a line of square post molds in round post holes from a still earlier fence. The post molds and holes "penetrated a silty flood layer" that was initially "believed to be from the flood of 1862" (Chance and Chance 1976:26). Below the silt layer was a thin scatter of HBC period artifacts, some of which were found within shallow, basin-shaped pits measuring 12 to 18 inches in diameter. These pits, which contained mottled orange soil that suggests fires, "probably date from the Kanaka Village period" (Chance and Chance 1976:26).

The silt stratum observed in Operation 6 was encountered again in Operation 10 a short distance to the west. Unlike the situation in Operation 6, where the silt stratum "clearly separated Hudson's Bay Company from Army materials," the silt stratum in Operation 10 contained wire nails and amber-colored glass, "casting doubt on the belief that it represented the 1862 flood" (Chance and Chance 1976:27). The idea that the silt stratum corresponded to the 1862 flood eventually was rejected when "an examination of elevations showed that the relevant layer at Operation 6 was about six feet higher than the 1862 maximum" (Chance and Chance 1976:47).

In comparison to Operation 6, Operation 16 was not particularly productive. This investigation was limited to a small test in which two wooden posts situated 4.5 feet apart were exposed 2 feet below surface (Chance and Chance 1976:30).

Eastern Washington University Investigations

The University of Washington's Operation 6 (as well as nearby Operations 5 and 10) from the 1974 investigations were later encompassed by the 1981 Eastern Washington University investigations in the area referred to as Operation 6, in which 64 units, each measuring 5 × 5 feet, were excavated. The stratigraphy in this area was described as containing "the ideal sequence for Kanaka Village:"

> Stratum 1, twentieth century U.S. Army gravel fill, was found throughout the operation, and included the construction pad fills for Building 134. Stratum 2 is a homogeneous, sterile dark brown silt flood deposit similar to that found in other 1981 operations. Stratum 2 had been extensively disturbed by the digging of sewer lines, trenches, storm drains, etc. Stratum 3 is a culturally enriched A horizon and includes early U.S. Army and Hudson's Bay Company period deposits. (Thomas and Hibbs 1984:66)

Sixty-eight cultural features were recorded, with 30 from Stratum 1 and 38 from Stratum 3. The Stratum 1 features are 9 posts, 6 trenches and pipelines, 5 pits, 2 large cobble drains, 2 features associated with the building pad for the mule barn, 1 brick fireplace, 1 shallow depression, 1 stake, and 1 possible drip line, as well as Chance and Chance's 1974 excavation units and plow scars. The Stratum 3 features are 8 posts, 5 stakes, 2 pits, 15 fire areas, 3 lineal features, and 5 surficial features. The results of the Operation 6 investigations were interpreted as representing four components."

- Component 1 (1826–1860) "consisted of a scatter of fire areas" that "varied widely in size, shape, and contents, and their use probably should not be attributed to a single function" (Thomas and Hibbs 1984:87, 90). At least some of these features were thought to represent small hearths or firepits at campsites used by travelers visiting Fort Vancouver.

- Component 2 (pre-1845) consisted of a compact floor outlined by three posts suggesting a structure measuring 15 by 8 feet. The structural remains and artifacts suggest "an insubstantial dwelling" estimated to date from before 1845, based on the absence of a structure at this location on the Vavasour and Covington maps (Thomas and Hibbs 1984:94).

- Component 3 contained evidence of the gardens and related features associated with the Quartermaster's residence, which were depicted as early as the 1854 McConnell map (Hussey 1957:Plate XVI). This "garden may have been in existence as early as 1850 when Rufus Ingalls first erected the 'Quartermaster's ranch'" (Thomas and Hibbs 1984:94).

- Component 4 (post-1860) consisted of evidence of a saddler's shop or a harness shop that are known from documentary sources, although neither is shown on any historic maps (Thomas and Hibbs 1984:94–95).

The Eastern Washington University investigations also included Operation 50, which consisted of unit excavations and "extensive machine stripping of swaths" around the University of Washington's Operation 16 (and 12) in the northern portion of W5A (Thomas and Hibbs 1984:363–402). The "machine operations" resulted in the recording of "a relatively large number of features" (Thomas and Hibbs 1984:363). These investigations revealed "evidence of the later quartermaster's depot stable sheds," documented "an early fence line," and verified the locations of "two 1906 buildings" (Thomas and Hibbs 1984:363).

Pedestrian Undercrossing Project

In 1993, in connection with a proposed pedestrian undercrossing under SR 14, 19 shovel probes were excavated at intervals "in the narrow strip of right-of-way between the chain-link fence that marks the U.S. Army and WSDOT property boundary and the highway" (Thomas 1994:8). Actually, the first two of these shovel probes (1A, 2) appear to have been located slightly to the east, where the WSDOT parcel is bounded on the north by National Park Service land. The shovel probes were spaced at 20- or 40-foot intervals beginning where the north side of the pedestrian crossing bridge was to be located and proceeding west and then north along the fence.

Ten of the 19 shovel probes were situated within the area currently encompassed by W5A. Shovel probes 4, 6, and 8 were placed along the straight stretch between U.S. Army land and the ramp from SR 14 onto I-5 corresponding to the southern subarea of W5A. Shovel probes 10, 12, 14, 16, 18, 20 and 22 were along the curving section between U.S. Army land and the deep cut for the I-5 Exit 1B ramp corresponding to the northern subarea of W5A. According to Thomas (1994:8), "fill material, usually imported bark dust and sand and gravel, was observed in all of the probes....The fill material had been placed directly onto native sediments which were generally characterized as dark to light brown gravelly loam." A graph providing data on the "maximum depth of fill per shovel probe" indicates that the fill in the probes in W5A ranged from approximately 25 to 125 cm below surface (cmbs) (Thomas 1994:9). Data on the maximum depth of excavation reached in these probes was not provided. A total of 266 artifacts were recovered during this project, but data relating the artifacts to the particular probes in which they were found was not provided. Apparently, no noteworthy cultural materials were found in any of the 1993 probes excavated within W5A.

GPR RECONNAISSANCE

The GPR reconnaissance at W5 began in June 2008 with the survey of four GPR lines using high-power 200 MHz antennae, with the lines running parallel to chain-link fences bordering the U.S. Army and NPS parcels. Of these four lines, CRC Line 14 (100 m) extended north to south along the I-5 Exit 1B ramp to downtown Vancouver, and CRC Line 15 (41.75 m), CRC Line 16 (57.0 m), and CRC Line 17 (36.0 m) extended west to east more or less parallel to the ramp from SR 14 onto I-5. These 200 MHz lines extended a total distance of 234.75 m.

In August 2008, the W5 GPR survey was repeated along the same lines using 500 MHz shielded antennae, with CRC Line 222 being a repeat of CRC Line 14, CRC Line 223 being a repeat of CRC Line 15, CRC Line 224 being a repeat of CRC Line 16, and CRC Line 225 being a repeat of CRC Line 17. The 500 MHz lines covered a distance of 238.55 m.

Resistive fill materials were found along the full length of the narrow W5 segments, including the east loop margin (CRC Line 14) and the SR 14 margin (CRC Lines 15-17). Top-truncated inclined reflectors (Pleistocene gravels) were found at 25–30 nanoseconds (ns) (1.25–1.5 m below surface) along the east loop margin with the 200 MHz antennae (CRC Line 14). The 500 MHz antennae were used along the same line (CRC Line 222) to clarify the depth of the contact between fill and a buried conductive layer (verified Pleistocene Bw soil horizon) at 15–20 ns (0.75–1.0 m below surface).

Similar stratigraphic relations were observed in the west and central parts of the SR 14 segment. The 200 MHz antennae (CRC Lines 15-17) demonstrated inclined Pleistocene gravel reflections at 20–30 ns (1.0–1.5 m below surface), and the 500 MHz antennae identified a buried conductive layer (verified Pleistocene Bw horizon) at 15–20 ns (0.75–1.0 m below surface). The resistive fill materials in W5 ranged from 15 to 30 ns (0.75–1.5 m below surface, given a 0.1 m/ns one-way travel time velocity). The average depth of fill in W5 suggested by the GPR profiles was 24 ns (1.25 m below surface). Buried conductive layers were discontinuous, but present in all GPR profiles. Top-truncated inclined reflections (Pleistocene gravels) occur in three of the four GPR profiles. No large chaotic reflection packages that might indicate cultural surfaces or features were observed in the GPR profiles from W5.

FIELD INVESTIGATIONS

W5A is situated adjacent to areas subjected to significant cut-and-fill impacts from the reconfiguration of the I-5/SR 14 intersection in the mid-1980s. Construction of the I-5 Exit 1B ramp to downtown Vancouver involved excavation of a deep cut that extended well into the top of the Pleistocene gravels. The northern subarea of W5A is a narrow strip of remnant landform (approximately 3.0 m above the bottom of the cut in which the ramp travel lanes are now situated) that extends along the outside of the curve from the I-5 ramp for a distance of 170 m to the southwest corner of U.S. Army land. From that point, the southern subarea of W5A extends southeastward for 74.0 m across the remnant landform adjacent to a high artificial berm that supports the ramp from SR 14 onto northbound I-5 to the southeast corner of the U.S. Army property.

Manual Excavations

Although the GPR reconnaissance indicated that substantial fill deposits covered the ground surface, the narrowness of the available work space between the I-5 Exit 1B travel lanes and WSDOT/U.S. Army fence in the northern portion of W5A required that initial discovery excavations be conducted manually(Figure 6-2). Four shovel probes (SP) measuring 50 × 100 cm were placed at 10-m intervals in this area. All of these probes were excavated to a depth of 120 cmbs

The stratigraphy encountered in SP1 through SP4 was generally similar, with distinctive layers of fill at the top of the profile. An upper layer of dark organic fill (about 20 cm thick) was underlain by a lower layer of rocky fill (from 20 to about 70 cmbs). Fragments of bricks and concrete rubble were sometimes found in the lower fill layer, and an asphalt road surface sitting over large angular gravels was encountered at about 50 cmbs in SP4.

Beginning around 70 cmbs, a medium to dark brown, gravelly silty clay, A horizon soil was encountered in all four shovel probes. This horizon extended to about 105 cmbs in SP1 and SP3, to about 120 cmbs in SP2, and to 90 cmbs in SP4. In all units, the A horizon was underlain by dark yellow-brown, very gravelly Bw soil. A small concrete chunk was recovered at 110–120 cmbs in Bw soil in SP1. Continued excavation in the bottom of the west side of SP1 exposed Pleistocene gravels at 145 cmbs.

Historical artifacts were recovered from the A horizon soil in SP1, SP3, and SP4. The most noteworthy finds were in SP4, where a chert projectile point fragment and a badly worn commemorative coin were recovered from the western (50 ×50 cm) portion of the probe at 80–90 cmbs. In an attempt to recover additional artifacts from this area, SP5 (100 × 50 cm) was excavated on the west side of SP4, and SP6 (50 × 50 cm) was excavated on the east side of SP4 (Figure 6-3). Together, SP4/SP5/SP6 comprised a block excavation measuring 2.5 m long and 50 cm wide. Although a thin band of A horizon soil was encountered in SP5 and SP6, no additional historical artifacts were recovered during these excavations.

PRELIMINARY

Figure 6-2. View northwest, showing the narrow strip of ground above deep cut for I-5 ramp where manual excavations were conducted in the northern subarea of WSDOT parcel W5A (chain-link fence indicates WSDOT/U.S. Army property boundary).

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Figure 6-3. View northwest, showing excavation in progress in the SP4/5/6 block in WSDOT parcel W5A.

Figure 6-4. View south, at the beginning of mechanical trench excavations in the northern subarea of WSDOT parcel W5A.

Mechanical Trenching

Beginning about 10 m south of SP4, the available work area between the I-5 Exit 1B travel lanes and WSDOT/U.S. Army fence began to widen, making it possible to employ a Bobcat 334 trackhoe with a 24-inch-wide bucket in the search for cultural deposits and features below the fill deposits (Figure 6-4). Sixteen short mechanical trenches (MT1 through MT16) were excavated along the top of the artificial terrace.

All of these trenches contained fill deposits to various depths. As in the shovel proves, structural debris was sometimes present in these fill deposits. By far the greatest amount of structural debris was encountered in the fill in MT2, where 3 whole bricks, 6 roughly half-size brick fragments (including one with the HIDDEN brand), and several concrete chunks were found.

A horizon soils were identified in only 6 of the 16 short trenches (MT1, 3, 6, 7, 8, 9, and 11). In most of the other trenches, the fill deposits rested directly on the Bw soil, indicating that the A horizon soil in which evidence of historical and/or prehistoric occupation might most likely be found had been removed during previous highway construction. MT2 contained only fill deposits, with the Bw horizon not yet exposed at 120 cmbs. Excavation of MT16, at the south end of the line of trenches (Figure 6-5), exposed the top of the Pleistocene gravels at 135 cmbs (Figure 6-6).

Discovery trenching continued in the southern subarea of W5A between the WSDOT/U.S. Army chain-link fence and the toe of the slope for the berm supporting the ramp that connects SR 14 to I-5. The area available for investigation, at the base of the ramp connecting SR 14 to I-5 northbound, is only 5.0 m wide at its northwest end, declining to 3.0 m wide at its southeast end. MT17 was a long, northwest-southeast trending, trench parallel to and about 1.0 m from the property fence (Figure 6-7). Excavated to a depth of 120 cm, MT17 began 1.3 m east of MT16 and extended southeast for 74.0 m to the U.S. Army/NPS property fence corner. Measurements along this trench (as reported below) began at the northwest end (0.0 m) and proceeded to the southeast.

Excavation of MT17 exposed substantial fill (55–125 cm thick) overlying the Bw horizon. No evidence of the A horizon soil was present. A deep "test" in the bottom of the trench, at 13.0 to 14.0 m from the northwest end, exposed the top of the Pleistocene gravels at 140 cmbs. A similar "test" in the bottom at the southeast end of the trench revealed the top of the Pleistocene gravels at 130 cmbs.

Below the deep fill, a concrete/brick pier (MT17 F1) was uncovered at the northwest end of MT17. Extending 20.5 m to the southeast from the beginning of the trench, and overlying the pier, a 10-cm thick horizontal layer of crushed gravel (MT17 F2) was observed. A buried 2¼-inch metal pipe with an orientation a few degrees east of magnetic north was exposed in the bottom of the trench at a distance of 2.7 m (north wall) to 3.1 m (south wall) from the west end of the trench. Three macadam surfaces (MT17 F3, F4, and F5) were noted in the southern part of the trench. The trench fill contained a substantial number of concrete and asphalt chunks, occasional common red brick fragments, and at least one creosote-soaked timber. The concrete chunks were especially common from 24.8 to 47.8 m, where they occurred most often within 60 cm of the surface.

Near its southeast end, MT17 cut across a historic railroad berm (situated above two of the macadam surfaces—MT17 F4 and F5). This berm is a prominent reference point for previous archaeological investigations (Chance and Chance 1976:37). It was constructed in 1906 for "the railroad spur extending onto the military reservation" (Thomas and Hibbs 1984:620).

Figure 6-5. View north, showing geomorphologist Curt Peterson (in trench) and HERITAGE archaeologist Kendra Carlisle inspecting MT16 in WSDOT parcel W5A.

Figure 6-6. View of the west wall of MT16 in WSDOT parcel W5A, showing fill directly overlying Bw horizon, with Pleistocene gravels appearing at base of trench (left foreground).

Figure 6-7. View northwest, showing narrow strip of ground available for investigation between toe of sloping berm that supports SR 14 ramp (left) and WSDOT/U.S. Army property fence (right) in the southern subarea of WSDOT parcel W5A.

Previous exposure of this berm in Eastern Washington University's Operation 58 to the north described it as "consisting of river sand with pebbles" (Thomas and Hibbs 1984:620). This description corresponds to a distinctive deposit of river sand exposed near the east end of MT17. The cross-section of this sand followed the berm topography. Measuring from the northwest end of the trench, this sand deposit was first encountered at 50.2 m, where it was 100 cm below surface. From there, the deposit sloped upward to within 10 cm of the surface at 54.0 m. The deposit was still within 15 cm of the surface at 64.5 m, but then it began to slope downward to 35 cmbs at 65.0 m. It finally pinched out at 50 cmbs at 70.2 m. This sand deposit, which was unlike any other sediments exposed in MT17, is almost certainly not related to gravel and sand fill introduced to protect archaeological resources following demolition of buildings on the U.S. Army property to the north (Thomas and Hibbs 1984:718).

DESCRIPTION OF DEPOSITS

As described above, the sediments encountered during archaeological discovery probing and trenching in W5A reflect severe disturbance from previous highway-related construction. The same cut-and-fill practice observed elsewhere around the I-5/SR 14 interchange was in evidence. This construction sequence began with removal of the native soils, usually extending deep into the Bw horizon and often into the top of the Pleistocene gravels. Following highway construction, fill material was introduced to bring the excavated margins along the highway back up to grade. The introduced fill itself had been excavated from somewhere else around the I-5/SR 14 interchange, and it often contained historical artifacts from occupation or activity on the Military Reservation or in the Historic City of Vancouver.

The northern and southern subareas of W5A are both covered with fill material that extended to depths ranging from 50 to 120 cmbs (Table 6-1). Buried A horizon soil was encountered in all six manual shovel probes and in six of the 16 short mechanical trenches excavated in the northern subarea. The most distinctive profile containing the A horizon observed was in the east wall of the SP4/SP5/SP6 block (Figure 6-8).

In general, the A horizon soil was difficult to discern from the overlying fill, with any change in color or texture gradational in nature. This condition is consistent with the dearth of cultural material recovered from the buried A horizon soil. Considering its intermittent distribution and non-distinctive appearance, the buried A horizon soils appear to represent disturbed remnants from grading on the WSDOT property during previous highway construction.

Below the A horizon, Bw soil was exposed at regular intervals in the probes and short mechanical trenches excavated across the northern subarea of W5A. No cultural features were observed in either the A horizon or Bw soils in that subarea. Deep tests exposed the top of the underlying Pleistocene gravels at 145 cmbs in SP1 on the north and at 135 cmbs in MT16 on the south. These depths are consistent with the widespread exposure of Pleistocene gravels on the slope cut into the landform during construction excavations for the adjacent I-5 ramp in the 1980s.

Substantial fill deposits were also encountered in MT17 excavated across the southern subarea of W5A. In contrast to the northern subarea in which remnant A horizon soils were at least intermittently present, no evidence of the A horizon was observed in MT17. Below the fill, five cultural features were recorded in the Bw soils (Figure 6-9). Deep tests exposed the top of the Pleistocene gravels at 130 cmbs and 140 cmbs at the southeast and northwest ends of MT17, respectively.

Table 6-1. Summary of Discovery Excavations at Site 45CL912.

Unit No.	Dimensions	Maximum Depth	Fill Depth	A Horizon	Top of Intact Bw
SP1	1.0 × 0.5 m	120 cmbs	70 cmbs	70–110 cmbs	110 cmbs[a]
SP2	1.0 ×0.5 m	120 cmbs	65 cmbs	65–90 cmbs	90 cmbs
SP3	1.0 × 0.5 m	120 cmbs	70 cmbs	70–110 cmbs	110 cmbs
SP4	1.0 × 0.5 m	120 cmbs	80 cmbs	80–110 cmbs	110 cmbs
SP5	1.0 ×0.5 m	130 cmbs	70 cmbs	70–120 cmbs	120–125 cmbs
SP6	0.5 × 0.5 m	120 cmbs	75 cmbs	75–115 cmbs	115 cmbs
MT1	3.0 × 0.7 m	100 cmbs	70 cmbs	not identified[b]	not identified[b]
MT2	5.0 × 0.7 m	120 cmbs	120 cmbs	not present	not identified
MT3	3.2 × 0.7 m	120 cmbs	80 cmbs	80–90 cmbs	90 cmbs
MT4	3.6 × 0.7 m	110 cmbs	90 cmbs	not present	90 cmbs
MT5	3.5 × 0.7 m	120 cmbs	90 cmbs	not present	90 cmbs
MT6	3.6 × 0.7 m	110 cmbs	80 cmbs	80–95 cmbs	95 cmbs
MT7	3.9 × 0.7 m	120 cmbs	70 cmbs	70–90 cmbs	90 cmbs
MT8	4.6 × 0.7 m	120 cmbs	70 cmbs	70–90 cmbs	90 cmbs
MT9	4.0 × 0.7 m	120 cmbs	60 cmbs	60–90 cmbs	90 cmbs
MT10	4.0 × 0.7 m	120 cmbs	70 cmbs	not present	70 cmbs
MT11	3.6 × 0.7 m	120 cmbs	60 cmbs	60–70 cmbs	70 cmbs
MT12	3.6 × 0.7 m	120 cmbs	50 cmbs	not identified[c]	65 cmbs
MT13	3.1 × 0.7 m	120 cmbs	65 cmbs	not present	65 cmbs
MT14	2.5 × 0.7 m	120 cmbs	50 cmbs	not present	50 cmbs
MT15	3.0 × 0.7 m	120 cmbs	70 cmbs	not present	70 cmbs
MT16	4.1 × 0.7 m	135 cmbs[d]	80 cmbs	not present	80 cmbs
MT17	74.0 × 0.7 m	110–150 cmbs[e]	55–125 cmbs	not present	55–125 cmbs

[a] cmbs = centimeters below surface.
[b] below fill in MT1, "transition" stratum was observed that could not be positively identified as either fill or buried A horizon
[c] in MT12, "transition" stratum between fill and Bw
[d] top of Pleistocene gravels at 135 cmbs
[e] top of Pleistocene gravels at 130 cmbs at east end, 140 cmbs at west end, of MT17

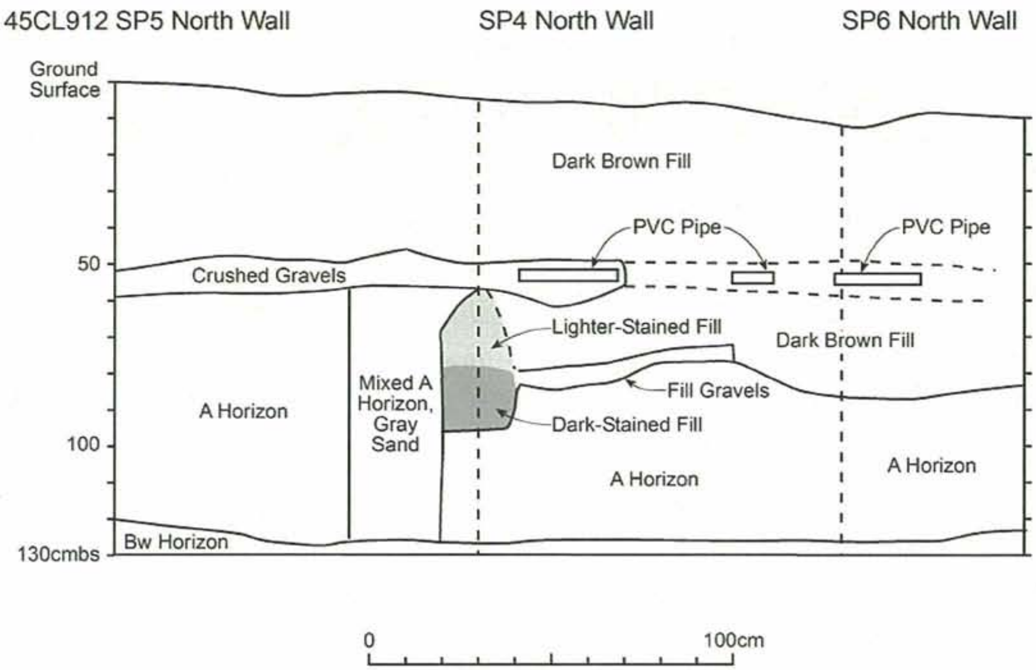

Figure 6-8. Stratigraphic profile of SP4, SP5, and SP6 at site 45CL912, showing A horizon soil below fill.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

No cultural features were encountered during the shovel probe and mechanical trench excavations in the northern subarea of W5A. Five cultural features were recorded during the excavation of MT17 across the southern subarea (Table 6-2).

Table 6-2. Summary of Cultural Features Site 45CL912.

Feature No.	Distance from West End of Trench	Depth Below Surface	Description
1	at west end	87–106 cm	Concrete/brick pier
2	0–20.5 m	80–90 cm	Horizontal layer of crushed small angular basalt gravel
3	35.6–47.0 m	70–75 cm	Horizontal macadam surface
4	53.0–56.7 m	110–120 cm	Horizontal macadam surface
5	60.3–63.4 m	110–115 cm	Horizontal macadam surface

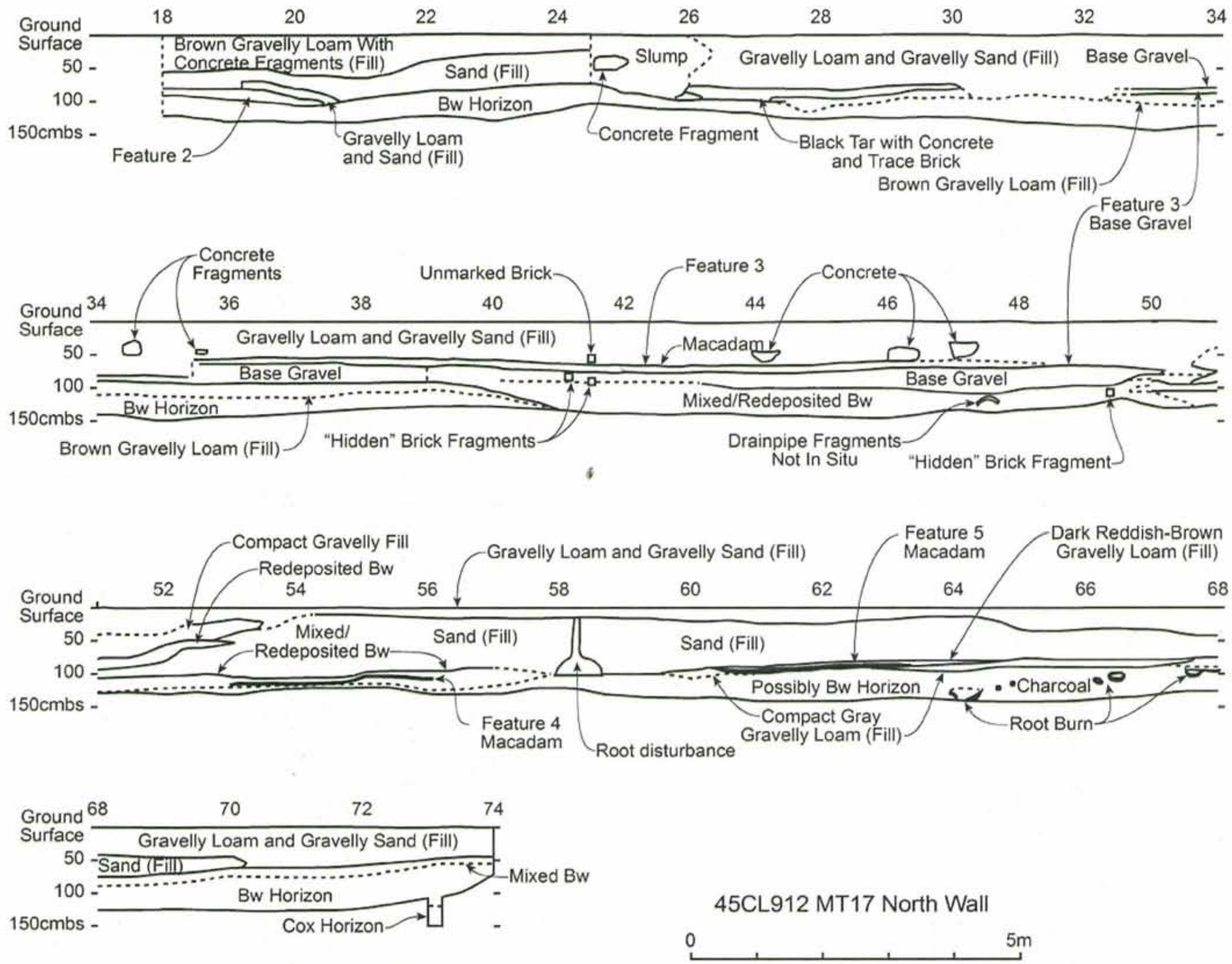

Figure 6-9. Stratigraphic profile of MT17 excavated across the southern subarea of site 45CL912.

MT17 Feature 1

A concrete/brick pier was uncovered at the northwest end of MT17 (Figures 6-10–6-12). In plan view, the pier measured 57 by 57 cm (22½ inches) square. In cross-section, the concrete base was 14 cm (5½ inches) thick. Wooden form remnants were still present on two sides of the concrete base. A single brick course, consisting of common red bricks measuring 7½ × 4 × 2 inches, was mortared to the top of the concrete base, but associated brick rubble suggests additional brick courses were once present. The top of the brick course was at 87 cmbs, and the base of the concrete pier at 106 cmbs. The pier was below fill deposits and rested in the top of the Bw soil. Screening of sediments from around this feature through ⅛-inch mesh resulted in the recovery of three very small earthenware fragments (two of which are from a shell-edged vessel), a mammal bone fragment, a bolt with nuts rusted into place, one machine-cut nail that appears to be an American made 9d common cut nail, and two unmarked clay pipe stem fragments.

MT17 Feature 2

A horizontal layer of small, crushed, angular basalt gravel extended from the northwest end of MT17 southeastward for a distance of 20.5 m (Figure 6-13). This gravel layer was visible in both trench walls at 80 to 90 cmbs. It was overlain by sand fill, and rested on Bw soil. This gravel layer, measuring 7 to 10 cm thick, was also noted in MT16 to the north. No artifacts were recovered in association with Feature 2.

MT17 Feature 3

A horizontal macadam surface was exposed at 70 cmbs in MT17. It was visible in the south wall from 37.3 to 47.0 m, and in the north wall from 35.6 to 46.0 m (Figure 6-14). It averaged about 5 cm thick, with a maximum thickness of 10 cm. This surface was overlain by mixed fill deposits that contained large chunks of concrete. It was underlain by as many as three gravel base layers, visible in both trench walls, that extended over a somewhat longer distance (from 32.7 to 50.2 m). At 41.5 m, a crude, older style brick was observed (not collected) resting on the Feature 3 surface. Measuring 8 × 3 × 2 inches, the appearance and especially the size of this brick suggest that it was American (rather than British) made. Three brick fragments (roughly half a brick each) with the HIDDEN brand were observed in the gravel fill below the macadam surface. The location of the Feature 3 surface corresponds to the former location of McLoughlin Road (in place by 1850) as shown on Carsner's ca. 1935 map of Vancouver Barracks (Thomas and Hibbs 1984:787).

MT17 Feature 4

A second horizontal macadam surface was visible from 53.0 to 56.7 m in MT17 (Figure 6-15). It measured 5cm thick in the north wall, and 10 cm thick in the south wall. Situated below a mixed sand deposit thought to be from the 1906 railroad spur, this surface was at 110 cmbs within a dark brown band of sediment that appeared to be redeposited Bw. Unlike Feature 3, the Feature 4 surface lacked a gravel base layer. One black bottle base fragment and one olive green bottle neck fragment were embedded in the underside of the surface.

Figure 6-10. View west, showing concrete/brick pier (Feature 1) at northwest end of MT17 at site 45CL912.

Figure 6-11. Close-up view of concrete/brick pier (Feature 1) at northwest end of MT17 at site 45CL912.

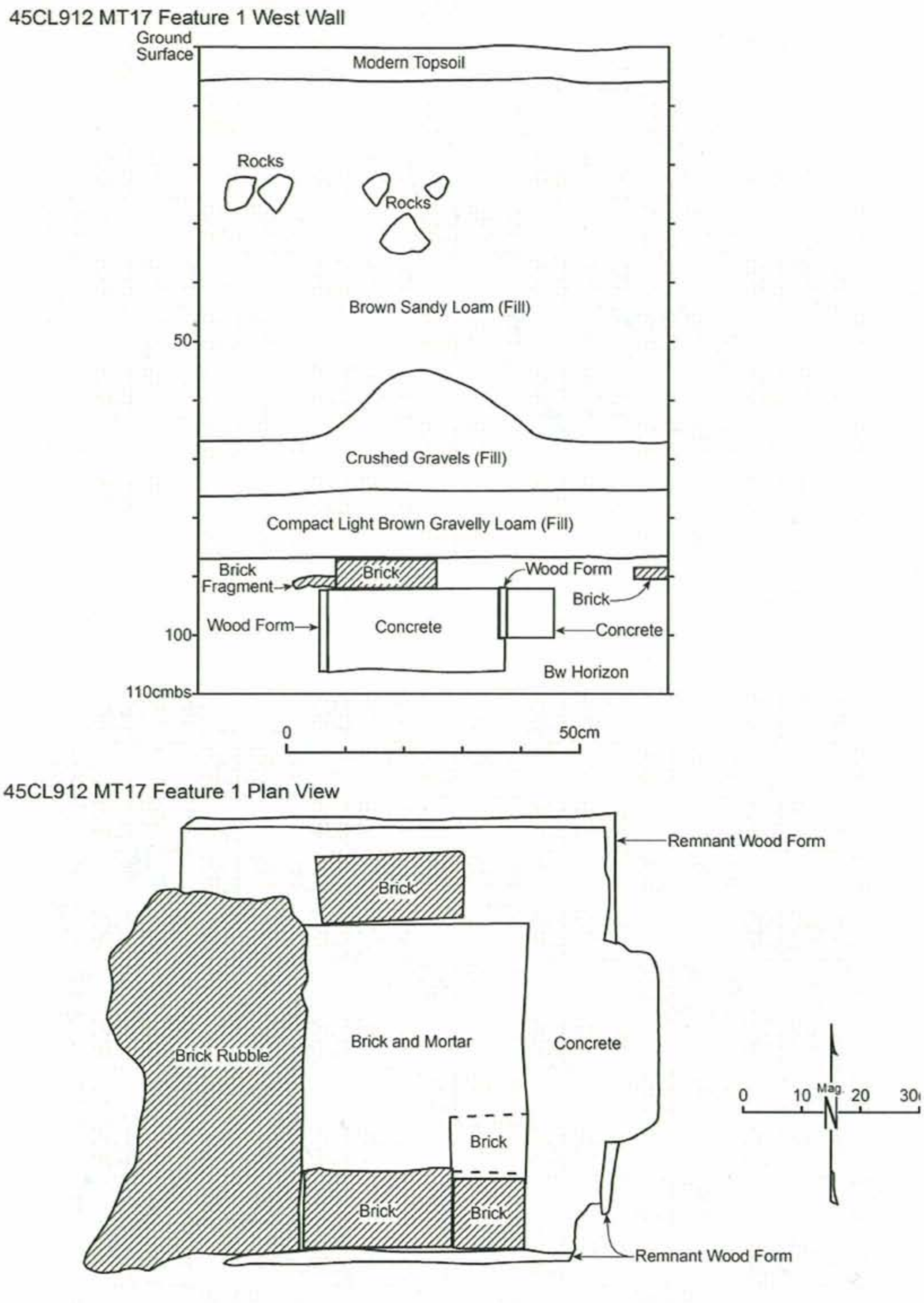

Figure 6-12. West wall profile (top) and plan view (bottom) drawings of MT17 Feature 1 at site 45CL912.

Figure 6-13. View of gravel layer recorded as Feature 2 in north wall of MT17 at site 45CL912.

Figure 6-14. View of horizontal macadam surface recorded as Feature 3 in north wall of MT17 at site 45CL912.

Figure 6-15. View of horizontal macadam surface recorded as Feature 4 in north wall of MT17 at site 45CL912.

Figure 6-16. View of the macadam surface recorded as Feature 5 below the railroad spur sand base in the north wall of MT17 at site 45CL912.

MT17 Feature 5

A third horizontal macadam surface was exposed in the north wall of MT17 from 60.3 to 63.4 m. Situated at 110 cmbs, the same depth as Feature 4, this 5-cm-thick surface was recorded as a separate feature based on its thinner appearance and physical separation from Feature 4 in the trench profile (Figure 6-16). It was overlain by two deposits, one of sand thought to be from in the historic railroad spur and the other of reddish, gravelly loam, and rested on apparently intact Bw. No artifacts were recovered in association with Feature 5.

Artifacts

The artifact assemblage from W5A, totaling 153 items (a total reflecting few complete objects; most are fragments of varying sizes), consists for the most part of artifacts from fill, as well as one intrusive specimen (84.8 percent), rather than from intact cultural deposits or feature associations (15.2 percent). The bulk of the assemblage (88.8 percent) was recovered from SP1–SP4 and SP6 (no artifacts were found in SP5). The artifacts recovered in these manual probes are from fill (n=122), A horizon soils (n=13), and Bw soil (n=1). Ten items were associated with the features encountered in MT17. The remaining artifacts are from fill deposits in MT1–MT3 (n=4) and MT17 (n=3).

A summary of the artifact assemblage recovered from W5A is presented in Table 6-3. Dates or date ranges for manufacture determined for temporally diagnostic ceramics, glass, and metal items are summarized in Table 6-4. However, in view of the fact that the origins of the artifacts in the introduced fill are unknown, these fill artifacts are not discussed further. Only artifacts recovered in association with cultural features or from A horizon soils are described in detail.

Feature-Associated Artifacts

Of the 10 feature-associated artifacts, 8 were recovered from the sediments surrounding the MT17 Feature 1 brick pier. These items are 3 tiny earthenware fragments (2 mending blue shell-edge pieces and 1 undecorated piece); 2 short, unmarked, clay pipe stem fragments; 1 American made, machine-cut nail; 1 bolt; and 1 large mammal bone fragment. Only the shell-edge ceramic fragments are temporally diagnostic. Shell-edge decoration appeared on pearlware tablewares from 1785 to 1840.

Embedded in the underside of the MT17 Feature 4 macadam surface were a base fragment from a black glass bottle (probably made in a dip mold and having a push-up exhibiting a bluish tint produced by an iron pontil rod) and an olive green bottle neck fragment (free-blown or mold blown—not determinable on this fragment) were found. Dip molds and pontils were in use until around the 1870s; however, the bluish tint is generally seen only until mid-century. Stretch marks are imperfections that might occur on the neck of any bottle produced before the advent of the automatic bottle machine, ca. 1905.

A Horizon Artifacts

The 13 artifacts recovered from remnant pockets of A horizon soils include 1 item from SP1, 1 item from SP2, 5 items from SP3, 3 items from SP4, and 3 items from SP6. SP1 yielded a nondiagnostic body fragment from an amber bottle; SP2 contained a nondiagnostic body

Table 6-3. Artifact Summary for Site 45CL912.

Artifact Group/ Category	Artifact Types	SP1–4 Fill	SP1–6* A Hzn	SP1 Bw Hzn	MT1–3 Fill	MT17 Fill	MT17 F1	MT17 F4	Totals
Activities									
Animal Husbandry	Metal curry comb	1							1
Commerce	Copper coin		1						1
Tools	Metal wedge		1						1
Domestic									
Food Preparation & Consumption	Ceramic serving vessel lid				1				1
	Ceramic plate	1							1
	Indeterminate ceramic tableware	1					3		4
Food Storage	Stoneware crock		3						3
Faunal									
Mammal	Large mammal bone	2							2
	Unidentifiable mammal bone						1		1
Indefinite									
Fuel	Coal	1							1
Containers	Bottle/jar	9	1					1	11
Hardware	Metal item	3							3
Indefinite	Ceramic item	5							5
	Glass item	6	1						7
Personal									
Clothing	Ceramic Prosser button	1							1
Social Drugs - Alcohol	Alcoholic beverage bottle	1	1					1	3
Social Drugs - Tobacco	Clay pipe						2		2
Structural									
Electrical	Porcelain insulator	1							1
Hardware	Bolt	1					1		2
	Cut nail	6	1				1		8
	Cut spike	1							1
	Nail—type indeterminate	17	2						19
	Pipe fitting(?)	1							1
	Wire	1							1
	Wire nail	11							11
Materials	Brick, common red	1			3	3			7
	Concrete			1					1
	Mortar	1							1
	Roofing slate	10							10
	Tar paper	6							6
	Window glass	34	1						35
Native American									
Hunting	Chert projectile point		1						1
Totals		**122**	**13**	**1**	**4**	**3**	**8**	**2**	**153**

SP = Shovel Probe MT = Mechanical Trench F = Feature Hzn = Horizon
* No A horizon artifacts were recovered from SP5
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

Table 6-4. Temporally Diagnostic Artifacts from Site 45CL912.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	References
SP1 L1–7 Fill	Prosser button	Prosser technology	1840–mid-1900s	Sprague (2002)
	Window glass fragments (n=29)	Primary mode = 0.095 Secondary mode = 0.085	1870–1900 1855–1885	Roenke (1978:116)
	White improved earthenware fragment, indeterminate vessel type	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle fragment	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Wire nails (n=7)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
SP2 L1–5 Fill	Window glass fragments (n=4)	0.064, 0.078, 0.081, & 0.091 inches thick	1845-1900*	Roenke (1978:116)
	Wire nails (n=3)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
SP3 L2 Fill	White improved earthenware plate fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Window glass fragment	0.092 inch thick	1870–1900*	Roenke (1978:116)
SP3 L8 A Horizon	Alcoholic beverage bottle fragment	Use of black glass for containers	pre-1800–ca. 1890s	SHA (2009)
	Window glass fragment	0.061 inch thick	1845–1855*	Roenke (1978:116)
SP4 L1–8 Fill	Alcoholic beverage bottle fragment	Use of black glass for containers	pre-1800–ca. 1890s	SHA (2009)
	White improved earthenware fragment, indeterminate vessel type	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Wire nail	Wire nail technology	Readily available since ca. 1884	Adams (2002)
SP4 L9 A Horizon	Copper coin	Sir Isaac Brock copper half-penny	1816	Waterford County Museum (2009)
	Projectile point	Native American	Late prehistoric/early historic period	N/A
MT2 Fill	Common red brick	HIDDEN brand from Hidden Brick Co., Vancouver	1871–1991	Gurcke (1987:246); Clark Co. Historical Museum (2009)
MT3 Fill	Blue transferware serving dish lid fragment	Spode/Copeland Lily pattern	Ca. 1837–20th century	Sussman (1979:138–141)
MT17 Fill	Common red bricks (n=2)	HIDDEN brand from Hidden Brick Co., Vancouver	1871–1991	Gurcke (1987:246); Clark Co. Historical Museum (2009)
MT17 Feature 1	Shell-edged earthenware fragments (n=2, 1 vessel)	Blue shell-edged style	1785-1840	Florida Museum of Natural History (2010)
MT17 Feature 4	Alcoholic beverage bottle fragment	"Black" glass with bluish cast to push-up; likely blown into a dip mold	pre-1800–ca. 1850s	SHA (2009)
	Olive green bottle fragment	Stretch marks on neck	until ca. early 1920s	SHA (2009)

SP = Shovel Probe MT = Mechanical Trench L = Level

* Window glass thickness modes (Roenke 1978) are not presented for the glass from these proveniences, as too few fragments were found for such a study. The date ranges provided reflect the mode(s) into which the individual measurements would fall if a modal analysis was being conducted.

fragment from an aqua bottle. A neck fragment from a black alcoholic beverage bottle, a fragment of window glass, a rusty iron wedge, and two nails so rusty that they could not be identified as to type (hand-wrought, machine-cut, or wire) were recovered from SP3. SP4 yielded an 1816 commemorative coin, a machine-cut nail, and a chert projectile point fragment. The three items in SP6 are fragments from a salt-glazed stoneware crock.

Only four of the artifacts from A horizon contexts are temporally diagnostic (Table 6-4). The single fragment of window glass in SP3 measures 0.061 inch thick. According to Roenke's (1978:116) Pacific Northwest window glass dating formula, glass of this thickness might be from a building constructed between 1845 and 1855 (caution should be used, however, in deriving a construction date from a single fragment). The black bottle fragment from SP3 is small and exhibits no diagnostic manufacturing characteristics. Little can be said about this piece other than that it likely dates prior to the 1890s, when the use of black glass in bottle production dropped off sharply.

Although badly worn, the coin from SP4 has been identified as a commemorative copper half-penny issued in Canada in 1816 in honor of Sir Isaac Brock, "the Hero of Upper Canada" (Figure 6-17). Under Brock's leadership, British forces defeated the U.S. forces at Detroit during the War of 1812 (Waterford County Museum 2009). This item is obviously early, even for HBC contexts, but it could have made its way south from Canada with HBC personnel or employees. The coin was found at the same depth (80–90 cmbs) in SP4 as the chert projectile point fragment, which is assumed to be of Native American manufacture (Figure 6-18). The dimensions of this fragment suggest that it is from a small projectile point characteristic of the late prehistoric/early historic period. The point may have been broken and discarded in this location, or it may have been collected elsewhere by a later occupant and subsequently discarded.

ANALYSIS AND INTERPRETIVE RESULTS

Discovery investigations involving both manual and mechanical excavations verified the results of the GPR reconnaissance, confirming that fill materials cover W5A to depths ranging from 50 to 125 cmbs. Of the 22 excavation units of various sizes along the northern portion of W5A, all but two (MT1, MT2) were successful in reaching prehistoric soils, either A or Bw horizons.

Remnant A horizon soil, in which evidence of prehistoric and historic occupation might be most likely to be found, was identified in 12 units. These units were clustered in two areas, with A horizon soils present in SP1 through SP6 at the north end of W5A, and again in MT6 through MT9, roughly in the center of the northern portion of W5A.

In all cases, the remnant A horizon soil appeared mixed and/or disturbed to some extent. As noted above, 13 artifacts were recovered from remnant A horizon soil in five shovel probes (SP1, SP2, SP3, SP4, and SP6). The presence of a small concrete chunk in the Bw soil in SP1 raises questions about the integrity of the A horizon soils in the northern subarea of W5A. No artifacts were observed in the remnant A horizon soil exposed in six mechanical trenches in the northern subarea of W5A.

Among the few artifacts recovered from remnant A horizon soil are a commemorative coin issued in 1816 in honor of Sir Isaac Brock, the blade portion from a small projectile point, and a fragment of window glass the thickness of which suggests manufacture in the period 1845–1855. The coin and point fragment were recovered from Level 9 (80–90 cmbs) in SP4; the window glass is from Level 8 (70–80 cmbs) in nearby SP3. The issue date of the early coin, the possible

Figure 6-17. Poorly preserved Sir Isaac Brock half-penny from the A horizon in SP4 at site 45CL912 (above) and images of the same coin in a collection at the Currency Museum of the Bank of Canada (below).

Figure 6-18. Projectile point fragment recovered from the A horizon in SP4 at site 45CL912.

manufacturing date for the window glass, and their stratigraphic co-occurrence with the projectile point almost certainly indicate an association with the inhabitants of Kanaka Village at HBC Fort Vancouver.

Previous archaeological research has not identified any Kanaka Village habitations in the vicinity of the northern portion of W5A (see Thomas and Hibbs 1984:725). SP5 excavated on one side of SP4 did not yield any artifacts, and SP6 excavated on the other side of SP4 yielded only 3 items. It appears, then, that previous construction destroyed any substantial evidence of a Kanaka Village occupation that might once have been present in the northern portion of W5A.

No evidence of A horizon soil was observed in MT17, in the southern subarea of W5A, but five cultural features somehow survived extensive earthmoving during previous construction. The Feature 3 macadam surface appears to correlate with McLoughlin Road. The Feature 4 and Feature 5 macadam surfaces probably represent other early roads that extended toward the Columbia River. The latter features were stratigraphically below the deposit of sand thought to be associated with the 1906 railroad spur. The Feature 2 gravel deposit has the appearance of the kind of surface associated with a parking area.

The most noteworthy feature encountered in MT17 was a concrete/brick pier (Feature 1) at the northwest end of the trench. This location within W5A appears to fall along the southeast margin of Eastern Washington University's Operation 20A investigated in 1981. Concrete/brick piers were characteristically used in the construction of U.S. Army buildings. An "officers' quarters, Building Q," was built within the general area of Operation 20A sometime between 1904 and 1914 and was destroyed before 1944 (Thomas and Hibbs 1984:304). The pier recorded as Feature 1 may have been associated with Building Q or with some other U.S. Army building in this area. The presence of a few artifacts immediately surrounding the pier may be the result of the hole dug to construct the pier being filled in with nearby sediments that contained the earlier materials (e.g., blue shell-edge earthenware manufactured 1785–1840).

Previous archaeological investigations identified what were believed to be flood-deposited sediments in the vicinity of W5A. For example, "a silty flood layer believed to be from the flood of 1862" was reported in Operation 6 , immediately west of W5A during the 1974 University of Washington investigations (Chance and Chance 1976:26). Likewise, Stratum 2, a "homogeneous, sterile, dark brown silt flood deposit" attributed to the 1861–1862 floods was observed in the expanded Operation 6 investigations conducted by Eastern Washington University in 1981 (Thomas and Hibbs 1984:66). Stratum 2 was described as a cap over Stratum 3, the "culturally enriched A horizon [that] includes early U.S. Army and Hudson's Bay Company period deposits" (Thomas and Hibbs 1984:66). Not surprisingly, in view of the evidence of extensive earthmoving during previous highway construction, no evidence of this or any other flood deposit was found during the investigations in W5A.

NRHP ELIGIBILITY

Site 45CL912 is in a WSDOT parcel (W5A) situated in an area where extensive data recovery excavations of archaeological resources associated with Kanaka Village and the U.S. Army Quartermaster's Depot were undertaken in the mid-1970s and early 1980s during earlier reconfigurations of the I-5/SR 14 interchange (Chance and Chance 1976; Thomas and Hibbs 1984). Construction of the SR 14 ramps in the northeast quadrant of the interchange resulted in the removal of most of the archaeological resources identified during these earlier investigations.

The objective of the discovery probing and trenching reported here was to determine if significant archaeological remains are still extant in W5A.

The results of archaeological investigations in W5A indicate that the A horizon soils, in which evidence of prehistoric and/or historic occupation is mostly likely to be found, for the most part were severely disturbed (northern subarea) or completely removed (southern subarea) during previous highway construction. The few historical artifacts recovered from remnant pockets of A horizon soil in the northern portion of W5A, in particular the 1816 commemorative coin, are noteworthy, but most of the A horizon soil in this area contained little or no cultural material.

In the southern portion of W5A, five cultural features survived highway construction. A concrete/brick pier (MT17 Feature 1) at the west end of MT17 is similar to piers constructed to support late nineteenth century structures associated with the U.S. Army's Quartermaster's Depot at Vancouver Barracks. However, because of the narrowness of the available work space in W5A, the potential for finding additional evidence of a structure in this area is very limited. No evidence of a structure with which the brick pier in W5A might have been associated was found during archaeological testing by NPS on the adjacent U.S. Army property.

The other four cultural features in the southern portion of W5A appear to be road-related. Of these, MT17 Feature 3, an approximately 10-m-long segment of macadam exposed at 70 cmbs, is noteworthy because it appears to correlate with a segment of McLoughlin Road identified during archaeological testing by the NPS on U.S. Army property to the north. Historical maps from 1859 through 1878 show a road in this area that became McLoughlin Road in the 1880s (O'Rourke et al. 2010:151).

The segment identified as McLoughlin Road on U.S. Army property passes between two heritage oak trees that were part of the allée planted in the 1880s. The McLoughlin Road Tree Allée is a landscape feature that extends across the U.S. Army property (O'Rourke et al. 2010:176-177). The segment of McLoughlin Road identified by archaeological testing on the U.S. Army property and the McLoughlin Road Tree Allée were both assessed by the NPS as National Register eligible under criteria a and d (O'Rourke et al. 2010:192, 287).

MT17 Feature 3 does not appear to meet the requirements for significance under National Register criteria a, b, or c due to the loss of the integrity of its setting. MT17 Feature 3 is situated on the edge of the construction zone of I-5 and SR 14. Highway construction, which characteristically involved removal of sediments down to the Pleistocene gravels, almost certainly obliterated any evidence of former roads beneath the high earthen berm supporting freeway travel lanes that occupies the greater part of W5A. The massive earth-moving during highway construction resulted in destruction of the historic landscape, including any heritage trees formerly present.

MT17 Feature 3 also is not considered a significant archaeological resource under National Register criterion d because of its minimal potential to "yield information important in prehistory or history." While the discovery of a remnant of an historic road is noteworthy, it is unclear how further investigation of this feature would yield significant information. In view of the widespread impacts from highway construction in W5A, any additional information about McLoughlin Road can best be obtained from the extant segment on the adjacent U.S. Army property.

In general, site 45CL912 in W5A exhibits the characteristics of historical archaeological properties that the National Park Service has indicated are *not eligible* for the National Register, namely "temporally diverse cultural material found in undifferentiated/mixed stratigraphic contexts or disturbed spatial associations and the absence of classifiable archaeological features"

(Townsend et al. 1993:29–30). The remaining archaeological deposits and cultural features that have survived massive earth-moving during highway construction lack the integrity (level of preservation and quality of information contained in the deposits) characteristic of a significant archaeological site (Little et al. 2000:31–44).

The archaeological discovery probing and trenching has resulted in thorough sampling of the narrow strips of ground in both the northern and southern subareas of W5A. There is little space in which additional testing could be conducted at this time. The evidence found is not sufficient to support a recommendation that significant archaeological remains are present. Accordingly, site 45CL912 is not considered eligible for inclusion in the National Register of Historic Places.

RELATIONSHIP TO ADJACENT RESOURCES

Site 45CL912 is in a WSDOT parcel (W5A) situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army's Quartermaster's Depot at Vancouver Barracks. The site designation 45CL300, originally applied to Kanaka Village, was later expanded to subsume all archaeological resources in this area (Thomas and Hibbs 1984:2). Archaeological testing was conducted in the portion of site 45CL300 on the U.S. Army property adjacent to W5A by the NPS in 2009 (O'Rourke et al. 2010).

The results of the discovery probing and trenching by HERITAGE in the northern subarea of site 45CL912 are remarkably consistent with the results of the NPS testing on the adjacent U.S. Army property, as "the sediments throughout the northern portion of VNHR Area #3 are largely disturbed, with imported fill layers resting directly on B-horizon sediments in most locations" (O'Rourke et al. 2010:127). Similarly, "the sediments throughout the central portion of VNHR Area #3 are heavily disturbed, with imported fill layers resting directly on B-horizon sediments" (O'Rourke et al. 2010:140).

Beginning with NPS backhoe trenches 13 and 15 on the south and extending northward through trenches 17 through 31, the sediments on the U.S. Army property were regularly described as consisting of multiple fill episodes over Bw with no "buried cultural layers" present. Two trenches described as containing "a possible thin cultural layer" (with no associated artifacts) or "an apparent buried cultural layer" ("only a few 20th-century artifacts were collected") were both situated well east of the WSDOT/U.S. Army property fence (O'Rourke et al. 2010:141-142). A buried cultural layer exposed in Trench 31 "appeared to be largely missing" in an adjacent test unit (TU3-18) (O'Rourke et al. 2010:131).

Only in the northernmost NPS trench (32) adjacent to the northern subarea of site 45CL912 were substantial archaeological remains encountered. Test units excavated there exposed brick footings associated with the Quartermaster's Stable in the area previously identified as Operation 60 investigated in 1981 (Thomas and Hibbs 1984).

The closest HERITAGE test units (SP1 and SP2) to the brick footing exposed on the U.S. Army property both contained A horizon soils but produced little in the way of cultural material. As previously noted, the chunk of concrete found in the Bw soil in SP1 suggests the A horizon in this area has been disturbed. Clearly, evidence of the Quartermaster's Stable does not extend westward into site 45CL912. Further evidence of the Quartermaster's Stable complex was encountered during archaeological discovery probing and trenching on the WSDOT parcel to the north (W9B) where the archaeological remains were recorded as site 45CL917.

Turning to the NPS testing on the U.S. Army property adjacent to the southern subarea of site 45CL912, it was again noted that "the sediments in much of the southern portion of VNHR Area #3 reflect the same numerous fill episodes seen in the northern and central portions of this area" (O'Rourke et al. 2010:145). Several of the NPS trenches and test units closest to the WSDOT/U.S. Army boundary fence contained no "buried cultural layer" and/or relatively little in the way of cultural material (e.g., Trenches 1, 7, 9, and 11). The 1981 Operation 20A excavations in the area of the Kanaka House (Thomas and Hibbs 1984) were relocated 10 to 15 m from the WSDOT/U.S. Army property fence.

In addition, a concentration of artifacts associated with the Kanaka Village house of Joseph Tayentas was found in the vicinity of the 1906 railroad spur. Although the highest artifact frequencies occurred in test units 8 to 10 m away from the WSDOT/U.S. Army boundary (TU3-01, TU3-07, TU3-08), the concentration continued to within a couple meters of the property fence (TU3-02). No evidence of this artifact concentration was found on the adjacent WSDOT parcel, where the upper sediments that might have contained this material had been removed during earlier highway construction.

As was the case in the northern subarea, little continuity is apparent in the distribution of artifacts and cultural features across the WSDOT/U.S. Army property boundary in the southern subarea of site 45CL912. The only clear example is the Feature 3 macadam surface exposed at 70–75 cmbs in MT17 that appears to correspond to the former location of McLoughlin Road. A later expression of this road was found at 18–27 cmbs in TU3-10 on U.S. Army property (O'Rourke et al. 2010:162).

The archaeological record on the two sides of the WSDOT/U.S. Army property fence is remarkably different. This situation is not surprising, as the WSDOT parcel lies within a construction zone that was subject to substantial impacts during previous reconfigurations of the I-5/SR 14 interchange, while the U.S. Army property behind the boundary fence was largely protected from major impacts. Although significant archaeological resources were formerly present in site 45CL912, the archaeological evidence appears to have been largely removed during previous highway construction.

The area containing WSDOT parcel W5A was identified as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District, placed on the National Register of Historic Places in 2007 (Owens et al. 2007). The results of the investigations reported here do not support any change in that status, as the archaeological remains in site 45CL912 do not contribute any substantial new information about the archaeology or history of the Vancouver National Historic Reserve Historic District.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL912 as not National Register eligible, no further archaeological investigations are recommended at W5A. However, there is always a possibility that previously unidentified and potentially significant evidence of prehistoric or historical occupation or activity may be exposed during construction-related earthmoving. Considering the recovery of a few historical artifacts from remnant A horizon soils in the northern portion of W5A and the discovery of cultural features below fill deposits, including a concrete/brick pier and an macadam surface that appears to correspond to McLoughlin Road in the southern portion of W5A, monitoring by an archaeologist is recommended during any earthmoving activities in this area during construction of the CRC project.

7. WASHINGTON AREA 5B (45CL913)

Washington Area 5 (W5) is a WSDOT parcel in the northeast quadrant of the I-5/SR 14 intersection. Based in part on adjacent land ownership, W5 is divided into two parts: (1) W5A, a western area, is bounded by U.S. Army land; and (2) W5B, an eastern area, is bounded by National Park Service land. This chapter describes the procedures and results of discovery investigations and testing in W5B, a narrow strip of ground situated between the ramp from SR 14 onto northbound I-5 on the south and National Park Service land on the north (Figure 7-1).

Data recovery excavations to mitigate impacts associated with an earlier reconfiguration of the I-5/SR 14 interchange were conducted within the present-day area of W5B in 1974 and 1975 (Chance and Chance 1976; Chance et al. 1982). Afterward, SR 14 was widened and the alignment was shifted northward to its present position in proximity to National Park Service property. The existing WSDOT/NPS boundary fence has been in place since the data recovery excavations in the mid-1970s. This fence provides a clear separation of the former construction zone on WSDOT property from the adjacent National Park Service property which was not affected by highway construction.

Archaeological investigations were conducted at W5B from April 9 to April 30, 2009. These investigations encountered evidence of massive cut-and-fill activity associated with previous construction throughout W5B. Relatively little preservation of A horizon soils, in which cultural materials associated with prehistoric and historical occupation and activity are most likely to be found, is in evidence. Most of the cultural materials recovered were from mixed and/or disturbed contexts, including substantial fill deposits introduced during previous highway construction. The archaeological remains at W5B have been recorded with DAHP as site 45CL913.

Site 45CL913 is on WSDOT property situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army's Quartermaster's Depot at Vancouver Barracks. The designation 45CL300, originally applied to Kanaka Village, was expanded in 1984 to subsume all Kanaka Village and U.S. Army related archaeological resources in this area, including the area in which site 45CL913 has been recorded (Thomas and Hibbs 1984:2).

The WSDOT parcel containing site 45CL913 was identified as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007. The nomination form, based on documentation prepared in 2004, specifically refers to the area now recorded as site 45CL913, when it states, "State Highway 14, portion within the Historic District has lost integrity" (Owens et al. 2007:22 [Section 7]).

HISTORICAL SETTING

W5B extends across the former location of the southwestern portion of Kanaka Village at Fort Vancouver. This WSDOT parcel lies north of a concentration of buildings situated around the pond and along the Columbia River shoreline that, as identified on the 1846 Covington map, included a salmon store, hospital, workshops, storehouses, sheds, and stables. Although historic

Figure 7-1. View west from the Land Bridge, showing WSDOT parcel W5B in the narrow strip of ground between the ramp from SR 14 to I-5 north and the WSDOT/NPS chain-link boundary fence.

maps do not appear to show any village houses in the area of present-day W5B, one structure has been identified by archaeology just to the north on NPS property. Similarly, no U.S. Army structures are known to have existed in the area of present-day W5B, as Army activity was apparently limited to use of this area of Vancouver Barracks as a polo ground and firing range in the early twentieth century (O'Rourke et al. 2010:196).

PREVIOUS ARCHAEOLOGY

Archaeological investigations in proximity to W5B have a long history, beginning with some of the earliest excavations carried out at Kanaka Village in 1969, followed by excavations in 1974 and 1975 by the University of Washington within the general area of W5B in conjunction with construction during an earlier reconfiguration of the I-5/SR 14 interchange (Chance and Chance 1976; Chance et al. 1982). Additional small-scale archaeological probing was carried out in W5B in connection with a proposed pedestrian undercrossing beneath SR 14 in 1994 (Thomas 1994) and proposed construction of the Land Bridge in 2005 (Wilson 2005).

Bryn Mawr Investigations

Following up on an initial exploratory survey of Kanaka Village in 1968 (Larrabee and Kardas 1968), more extensive excavations resulted in identification of additional cultural features, including houses, burials of two horses and a dog and a pig, as well as discoveries of a trash dump, a well, and a rock foundation (Kardas 1970). Most of these features were a considerable distance north of W5B, but the well, rock foundation, and evidence of a residence referred to as House 4 were just north of the present-day WSDOT/NPS property fence.

The previous season's excavations had established that most evidence of occupation at Kanaka Village occurs within 12 inches of the surface (Kardas 1970:9, 18). In order to expose cultural materials below the sod in 1969, a "tractor with a 6 foot wide blade" was employed to lift off the sod along several "swaths" across different areas of the site (Kardas 1970:18). Two of these swaths, referred to on the site map as the "Fence Line Swaths," were oriented northeast–southwest parallel to one another a short distance east of the NPS/U.S. Army property fence. The south ends of these swaths apparently extended into the west end of present-day W5B.

Artifact concentrations exposed in these swaths were then subject to test excavations (Kardas 1970:19). A single test pit placed in one of these fence line swaths yielded 13 artifacts, "almost all of them on the surface," and it was concluded that "no indications of any cultural activity was present in this area" (Kardas 1970:24). This test pit appears to have been a considerable distance north of the present WSDOT/NPS property boundary.

University of Washington Investigations

In connection with the earlier reconfiguration of the I-5/SR 14 interchange, excavations of varying extents were conducted in 1974 in several areas, referred to as "operations," within the immediate vicinity of W5B. Excavation was carried out at eight operations in the space between the boundary line identified as "Right of Way," which corresponds to the present WSDOT/NPS fence line, and the former alignment of SR 14 (Chance and Chance 1976:36).

As summarized in Table 7-1, most of these operations were relatively unproductive, as disturbed deposits often were encountered. The only operation that apparently was situated within present-day W5B was Operation 2, which exposed a large pit "dug in the early 1960s to receive building remains and trash from the World War II Army barracks that had covered the center of Kanaka Village" (Chance and Chance 1976:22).

By far, the most significant results were obtained from Operations 11, 13, and 24, which yielded samples from dense artifact deposits in the historic pond shown on early maps of HBC Fort Vancouver and U.S. Army's Vancouver Barracks. Relocated in 1974, excavations determined that the pond had been used as a "garbage dump," and that periodic floods had sealed the cultural layers into 16 artifact-bearing strata. The resulting stratification of artifacts in the pond deposits was described as "the best stratified sequence of historic sealed units yet found in the Pacific Northwest" (Chance and Chance 1976:27).

In 1975, Operation 11 from the previous year was expanded to expose more of a mass of timbers thrown into the pond, apparently during the dismantling of Kanaka Village by the U.S. Army in 1859–1860. Further investigations were also conducted north of Operation 11 in Operation 26, where samples from the former pond bottom (Stratum 10) as well as the overlying HBC strata

Table 7-1. Summary of 1974 and 1975 Investigations in the Vicinity of Site 45CL913.*

Operation	Description
1	Prompted by the discovery of a scatter of HBC period artifacts just below the surface, a test was undertaken with radiating trenches. Unable to discover an increased frequency of artifacts in any direction, the operation was abandoned. It was noted that "much of the topsoil had apparently been removed from this area" (Chance and Chance 1976:22).
2	A large excavated pit was identified along what turned out to be the northwestern side of the pond. This pit had been dug in the 1960s to receive building remains and trash from the World War II Army barracks that had covered the center of Kanaka Village. The uppermost foot of fill contained a relatively pure HBC assemblage, but this was later found to have been pushed on top of the recent trash by machinery, probably from the area lying west of the former pond.
7	A basin-like pit 6 inches in diameter and 18 inches deep contained bakelite "clay pigeon" fragments in the bottom overlain by a thin scatter of HBC and recent material. As in Operation 1, the stratigraphy indicated that the upper culture-bearing sediments had been mostly graded off.
11	A backhoe trench across the pond exposed 16 superimposed artifact-bearing strata, some of which were separated by flood deposits. The densest stratum (9B) contained almost entirely HBC cultural material. The lowest stratum (10), "black and rich in organic material" contained prehistoric artifacts, and antedates the arrival of the HBC in 1825. Operation 11 was expanded in 1975 to expose timbers thrown into the pond, apparently during the dismantling of Kanaka Village by the U.S. Army in 1859-1860
13	Two 5 by 5 foot pits excavated in the bottom of a backhoe trench to the north of Operation 11 found less 19th-century U.S. Army material but the strata containing HBC material were thicker than in any other pond operations.
23	A series of 2 by 5 foot test pits placed near the old railroad spur showed disturbance, with coal lying on top of the B horizon. The topsoil in this area was apparently scraped off when the railroad berm was constructed.
24	A test pit placed between Operation 11 and the SR 14 highway encountered abundant U.S. Army materials, especially bricks, below which were two strata bearing HBC materials of moderate productivity.
25	A series of test pits was excavated along the north right-of-way boundary to see if the origin of the HBC artifacts in Operation 1 could be determined. Results were disappointing as unmistakable signs of disturbance were encountered.
26	Continued excavation of U.S. Army and HBC strata in the pond in 1975 found evidence of massive dumping of earth and gravel to cover the garbage, probably a reflection of improved sanitation in the 1880s and 1890s.

* From Chance and Chance (1976) and Chance et al. (1982)

(Stratum 9 series) and U.S. Army strata (Strata 6 and 7) were recovered. Toxic gases in the deposits from the 1870s and 1880s hampered the excavations of pond deposits in Operation 26 (Chance et al. 1982:6–7). The U.S. Army strata showed "the dumping of earth and gravel in a massive way, probably to cover the garbage," a development interpreted as reflecting the improved sanitation standards implemented by the U.S. Army in the 1880s and 1890s (Chance et al. 1982:290).

Pedestrian Undercrossing Project

Archaeological investigations in conjunction with a proposed pedestrian undercrossing beneath SR 14 connecting the City of Vancouver's Apple Tree Park with National Park Service property north of SR 14 were undertaken in two phases. In 1993, fieldwork was conducted within a 300 × 140 foot grid on NPS property (Thomas 1993). The southernmost 30 feet of this grid extended into VNHR Area #4 adjacent on the north to W5B (O'Rourke et al. 2010:199). A controlled surface collection, shovel probe (1-foot diameter) and test unit excavations, and a ground-penetrating radar (GPR) survey were conducted within this grid. One of the GPR anomalies identified corresponded to a concentration of nineteenth century artifacts found in shovel probes in the vicinity of the projected site of House 4 discovered by Kardas (1970). A mix of HBC and U.S. Army artifacts was recovered, with the majority of this material thought to date to the twentieth century. The proposed pedestrian crossing was relocated to avoid impacts to the Fort Vancouver National Historic Site.

In 1994, 19 shovel probes were excavated at intervals "in the narrow strip of right-of-way between the chain-link fence that marks the U.S. Army and WSDOT property boundary and the highway" (Thomas 1994:8). Actually, the first two of these shovel probes (1A and 2) appear to have been located slightly to the east where the WSDOT parcel is bounded on the north by National Park Service land. These two shovel probes were excavated to depths of 30 and 20 cm, respectively, apparently without encountering substantial cultural remains. The remaining 17 shovel probes excavated in 1994 in connection with the proposed undercrossing project were all located farther west in the area identified as WSDOT parcel W5A.

Land Bridge Project

Archaeological discovery probing undertaken in 2005 in connection with the proposed construction of the Confluence Project Land Bridge over SR 14 included excavation of three shovel tests (ST6, ST7, and ST8) in the present area of W5B (Wilson 2005). Excavations extended to 60 cmbs in ST6 and to 50 cmbs in ST7 and ST8. Historical materials were found to depths of 60 cm, 50 cm, and 30 cm in these probes, respectively. Large amounts of construction debris, including slate fragments from the roofs of nineteenth century U.S. Army structures, were found in the upper sediments. Lower sediments contained an abundance of coal, apparently from a mid-twentieth-century coal storage facility. Overall, "artifacts from these units tended to reflect mixed 19th and 20th century contexts, suggesting significant disturbance" (Wilson 2005:23).

GPR RECONNAISSANCE

The W5 GPR reconnaissance in June 2008 began in W5A and continued eastward into W5B. Specifically, CRC Line 16 (57.0 m) included the easternmost portion of W5A and the westernmost portion of W5B. CRC Line 17 (36.0 m) continued across the remainder of W5B approximately as far eastward as the future locations of TU-F and TU-G. Standing water in the ditch alongside SR 14 precluded GPR surveys farther eastward at that time.

CRC Lines 16 and 17 were initially surveyed using the high-power 200 MHz antennae, with the lines running parallel to chain-link fences bordering the U.S. Army and NPS parcels. In August 2008, all the W5 GPR lines were repeated with a 500 MHz shielded antennae. In W5B, CRC Line 224 was a repeat of CRC Line 16 and CRC Line 225 was a repeat of CRC Line 17.

Resistive fill materials were found along the full length of the narrow W5 segments, including along the SR 14 margin in W5B (CRC Lines 16 and 17). The 200 MHz antennae surveys along CRC Lines 16 and 17 indicated inclined Pleistocene gravel reflections at 20–30 ns (1.0–1.5 m below surface). The 500 MHz antennae clarified the depth of a buried conductive layer (later verified as the Pleistocene Bw horizon) at 15–20 ns (0.75–1.0 m below surface). No large chaotic reflection packages possibly indicating cultural surfaces or features were observed in the GPR profiles from W5.

FIELD INVESTIGATIONS

W5B extends southeast from the U.S. Army/NPS fence corner for approximately 130 m to the vicinity of the northern approach to the Land Bridge. This area is bounded by the WSDOT/NPS fence on the north and by the toe of the slope below SR 14 on the south. The width of the "work area" in which discovery investigations could be conducted ranged from 3.0 m at the northwest end to a maximum of 4.8 m at the southeast end. A combination of manually excavated units and backhoe trenches was used to test for the presence of archaeological remains in W5B (Figure 7-2).

Manual Excavations

In view of the previous discovery of significant historical archaeological remains in the W5B vicinity during data recovery excavations in 1974 and 1975, archaeological discovery investigations began with excavation of test units (1 × 1 m) instead of shovel probes (50 × 50 cm). Reasoning that the greatest amount of subsurface disturbance during previous highway construction occurred closest to SR 14, the test units were placed as far as possible from the current roadway, 1 m south of the WSDOT/NPS fence, and were generally spaced at 10-m intervals (Figure 7-3). Beginning on the northwest and continuing to the southeast, 11 test units designated TU-A through TU-K were excavated across this area. At the southeast end of this line of test units, approximately 10 m southeast of TU-K, a single shovel probe (SP10) was excavated as part of the search for the historic pond. The results of the test unit and shovel probe excavations are summarized in Table 7-2.

In general, the test units encountered widespread evidence of cutting and filling during previous highway construction. A remnant A horizon was found in TU-A at the northwest end of the line of test pits, and disturbed remnants of A horizon soils were found in TU-F and TU-G (Figure 7-4). The disturbed remnant of A horizon in TU-F and TU-G yielded some early artifacts that may be associated with Kanaka Village occupation. In the intervening test units (TU-B, TU-C, TU-D, TU-E), the A horizon occurs only in a disturbed condition mixed with fill deposits. An apparently undisturbed Bw horizon was represented in the northwestern test units (TU-A through TU-H).

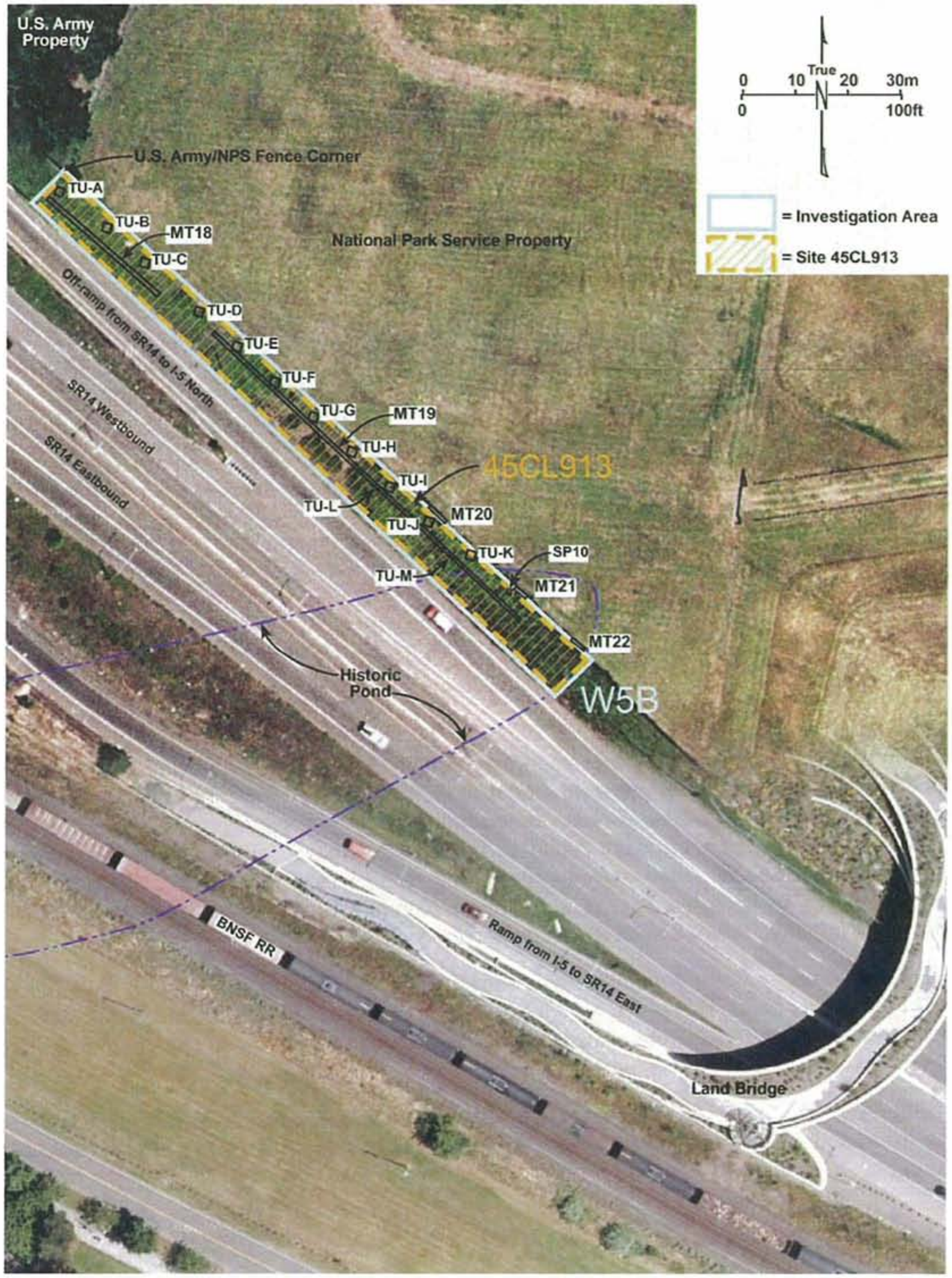

Figure 7-2. Locations of test units (TU), shovel probe (SP), mechanical trenches (MT), and site 45CL913 in WSDOT parcel W5B on aerial photograph (adapted from Google Maps image).

Figure 7-3. View east, showing excavations in progress at TU-C in WSDOT parcel W5B (southeast end of MT17 in W5A in left foreground; Land Bridge in background).

Beginning with TU-H and continuing southeast through TU-K and SP10, the uppermost strata in which the A horizon and Bw horizon should have been present were replaced by mixed fill deposits (Figure 7-5). In other words, the naturally occurring sediments in the area of the southeastern excavation units were found to have been removed and replaced by sediments imported from elsewhere and introduced as fill (cf. Chance and Chance 1976:22). The disturbance was so extensive that in some places continued excavation encountered artifacts below what initially appeared to be intact Bw horizon soils.

At the end of this line of test units, a single shovel probe (SP10) was excavated in the projected area of the former pond. This probe contained building debris including slate fragments, wire and machine-cut nails (wire nails dominated), electrical wire, and a red asphalt shingle to a depth of 100 cmbs where excavation was halted.

In addition to the test units spaced at regular intervals, two more test units (TU-L and TU-M) were excavated to examine concentrations of cultural debris exposed in MT19 (see discussion below).

Mechanical Excavations

The test unit excavations established that the southeastern portion of W5B has experienced extensive disturbance. In order to supplement the information obtained from the test units, a Bobcat 334 trackhoe was used to excavate two long trenches (MT18 and MT19) and gain a better

Table 7-2. Summary of Discovery Excavations at Site 45CL913.

Unit No.	Size	Thickness of Fill	Condition of A Horizon	Depth to Top of Undisturbed Bw Horizon	Maximum Depth
TU-A	1 × 1 m	30 cm	Remnant 30–40 cmbs	ca. 40 cmbs	80 cmbs
TU-B	1 × 1 m	30 cm	Mixed fill[a]	30 cmbs	60 cmbs
TU-C	1 × 1 m	45 cm	Mixed A/fill	45 cmbs	60 cmbs
TU-D	1 × 1 m	30 cm	Mixed A/fill	50 cmbs	50 cmbs
TU-E	1 × 1 m	35 cm	Mixed fill[a]	50 cmbs	50 cmbs
TU-F	1 × 1 m	Minimal	Disturbed remnant 0–30 cmbs	50 cmbs	50 cmbs
TU-G	1 × 1 m	Minimal	Disturbed remnant 0–20 cmbs	45 cmbs	50 cmbs
TU-H	1 × 1 m	60 cm	Mixed fill[a]	60–70 cmbs	70 cmbs
TU-I	1 × 1 m	40 cm	Mixed A/fill	Removed?	80 cmbs
TU-J	1 × 1 m	70 cm	Mixed fill[a]	70 cmbs	80 cmbs
TU-K	1 × 1 m	100 cm	Mixed fill[a]	Removed	110 cmbs
SP10	50 × 50 cm	100 cm	Mixed fill[a]	Removed?	100 cmbs
TU-L	70 × 100 cm	50 cm[c]	Mixed A/fill	Not Reached	50 cmbs
TU-M	70 × 80 cm	170 cm[d]	Absent	Removed	180 cmbs
MT18	1.1 × 28.0 m	30–70 cm	Absent	30–70 cmbs	120–140 cmbs
MT19	0.8 × 82.0 m	50–170 cm	Mixed A/fill	ca. 50 cmbs[b]	85–180 cmbs
MT20	0.8 × 3.0 m	140 cm	Absent	Removed	230 cmbs
MT21	0.8 × 2.5 m	180 cm	Absent	Removed	190 cmbs
MT22	0.8 × 3.0 m	110 cm	Remnant 110–160 cmbs	160 cmbs	210 cmbs

[a] mixed fill—imported sediments
[b] pocket of remnant intact Bw at 30.0 m; otherwise in situ Bw not represented
[c] excavation began at 30 cmbs
[d] excavation began at 120 cmbs

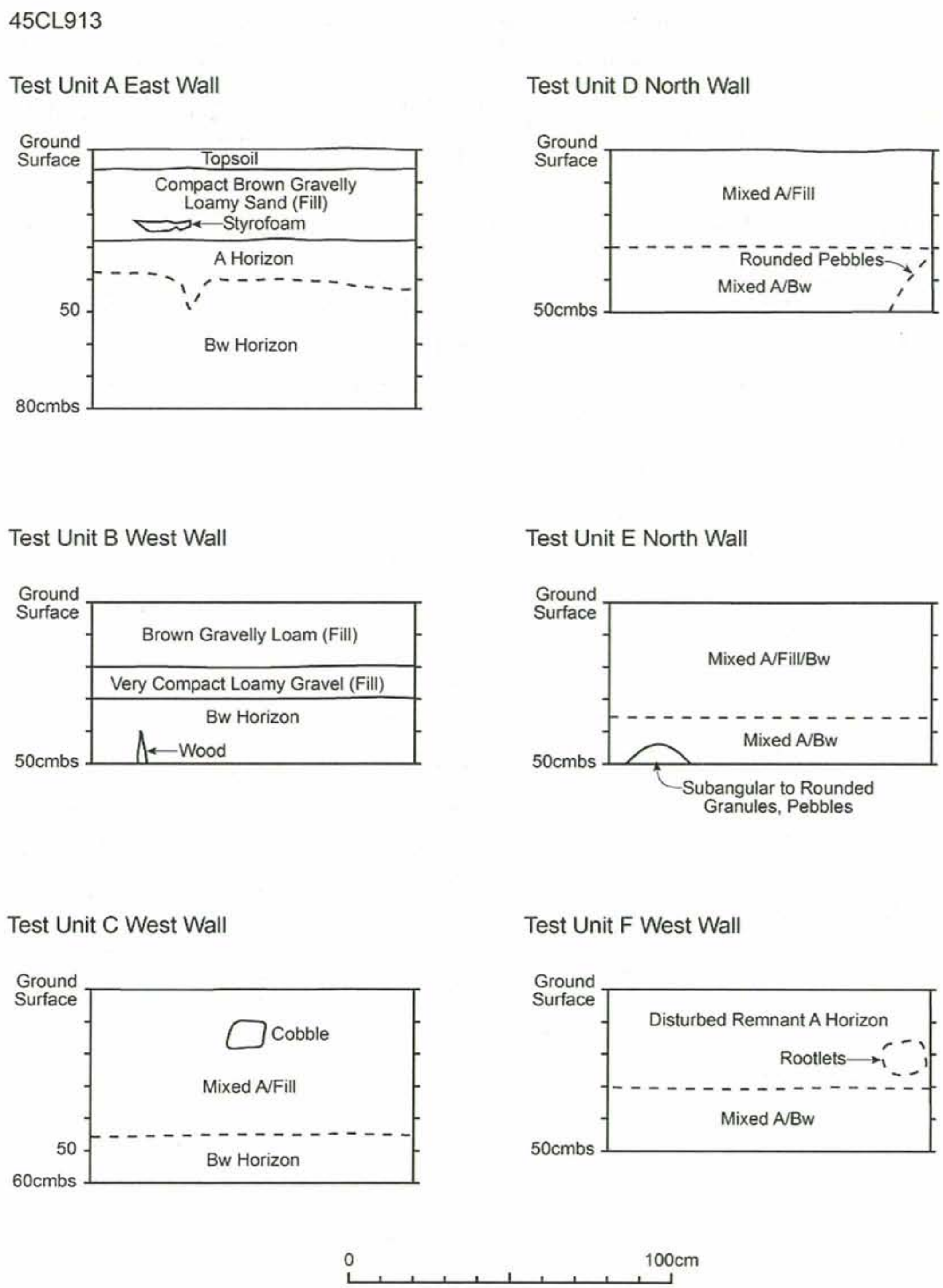

Figure 7-4. Stratigraphic profiles of TU-A through TU-F at site 45CL913.

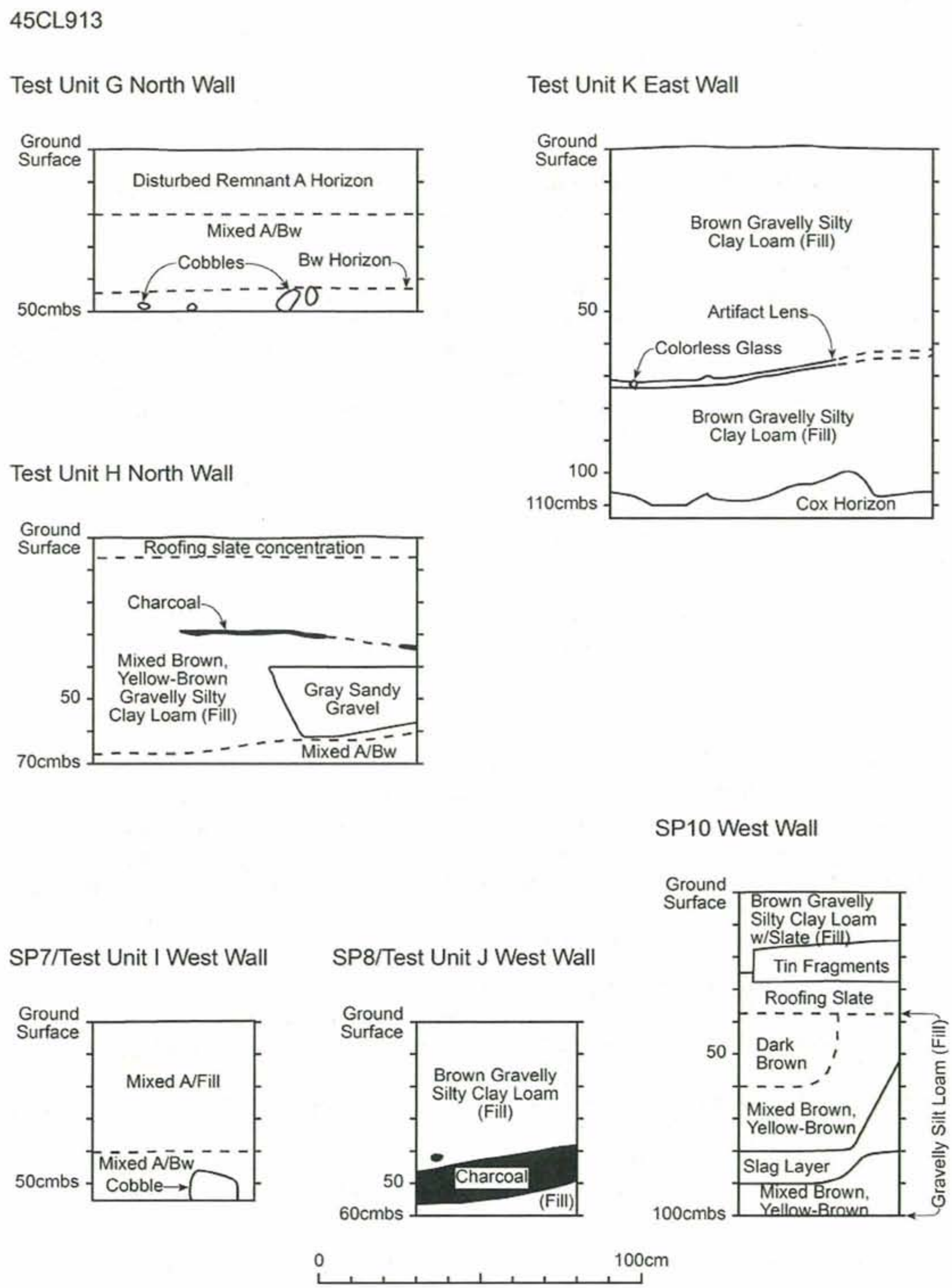

Figure 7-5. Stratigraphic profiles of TU-G through TU-K and SP10 at site 45CL913.

understanding of the W5B stratigraphy (Figures 7-6 and 7-7). These trenches were along a single alignment, but they were separated by a 10-m gap in order to avoid damage to a large bush. Results of the trench excavations are summarized in Table 7-2.

MT18

MT18 began at the U.S. Army/NPS fence corner and extended to the southeast along the south side of TU-A, TU-B, and TU-C for 28.0 m. This trench was 1.1 m wide and reached depths of 120 to 140 cmbs.

The stratigraphy in the trench consisted of introduced fill and/or mixed/disturbed soil layer(s) overlying Bw and basal Pleistocene flood gravels (Figure 7-8). The extent of the overlying fill/disturbed sediments varied, but was greatest at the northwest end of the trench. Correspondingly, the depth of undisturbed Bw was variable along the trench. The top of the Bw was 65–70 cmbs at the northwest end, averaged 45 cmbs between 10.0 and 20.0 m, and rose to 30 cmbs at the southeast end of MT18.

Pleistocene gravels were exposed for most of the length of the trench, beginning at approximately 10.0 m from the west end. Between 10.0 and 20.0 m, the top of the Pleistocene gravels ranged from 115 to 125 cmbs. The gravels became increasingly shallow toward the southeast end of the trench, climbing to 85 cmbs by 25.0 m.

Aside from a seam of coal above introduced sand and mixed/redeposited A and Bw horizon soils, no cultural materials were observed during the excavation of MT18.

MT19

MT19 was 82.0 m long by 0.8 m wide and extended to depths of 85 to 150 cmbs. The north and south trench walls exhibited the same general stratigraphic profile (Figure 7-9). In the northwest half of the trench (0.0–41.0 m), the upper 50–80 cm of the profile was disturbed and consisted of a mixed fill/A horizon layer that graded into a mixed A/Bw horizon (a pocket of possibly undisturbed Bw was observed at 50–80 cmbs at 30.0 m). Immediately below the mixed A/Bw were the basal Pleistocene flood gravels, the top of which was encountered at 50 or 55 cmbs until after 15.0 m, where it dropped to 70–80 cmbs.

Between 41.0 and 65.0 m, the overlying mixed fill/A changed abruptly to a mixed/redeposited Bw at 60–65 cmbs. The mixed/redeposited Bw, in turn, was underlain by Pleistocene gravels, the top of which continued to occur between 70 and 80 cmbs. At 65.0 m, the mixed/redeposited Bw disappeared, leaving mixed fill/A sitting directly on Pleistocene gravels. The lower boundary of the mixed fill/A began to dive at 68.0m, resulting in a corresponding drop in the occurrence of the Pleistocene gravel. By 69.0 m, the top of the Pleistocene gravels was at 95 cmbs; at 75.0 m it dropped to 105 cmbs. The Pleistocene gravels disappeared below the trench floor by 75.5 m, at which point the profile consisted entirely of mixed fill/A to the southeast end of the trench at 82.0 m.

The stratigraphy exposed during excavation of MT19 exhibited considerable evidence of disturbance. Three cuts in the sediments that formed depressions visible in the wall profiles were noted. A small depression exposed between 24.7 and 26.4 m (visible in the north trench wall only) cut into the mixed A/Bw and Pleistocene gravels and extended to the bottom of the trench

Figure 7-6. View east, showing excavation of MT18 in progress in WSDOT parcel W5B (reconstructed HBC Fort Vancouver and Land Bridge in background).

Figure 7-7. View southeast, showing excavation of MT19 in progress in WSDOT parcel W5B (Land Bridge in background).

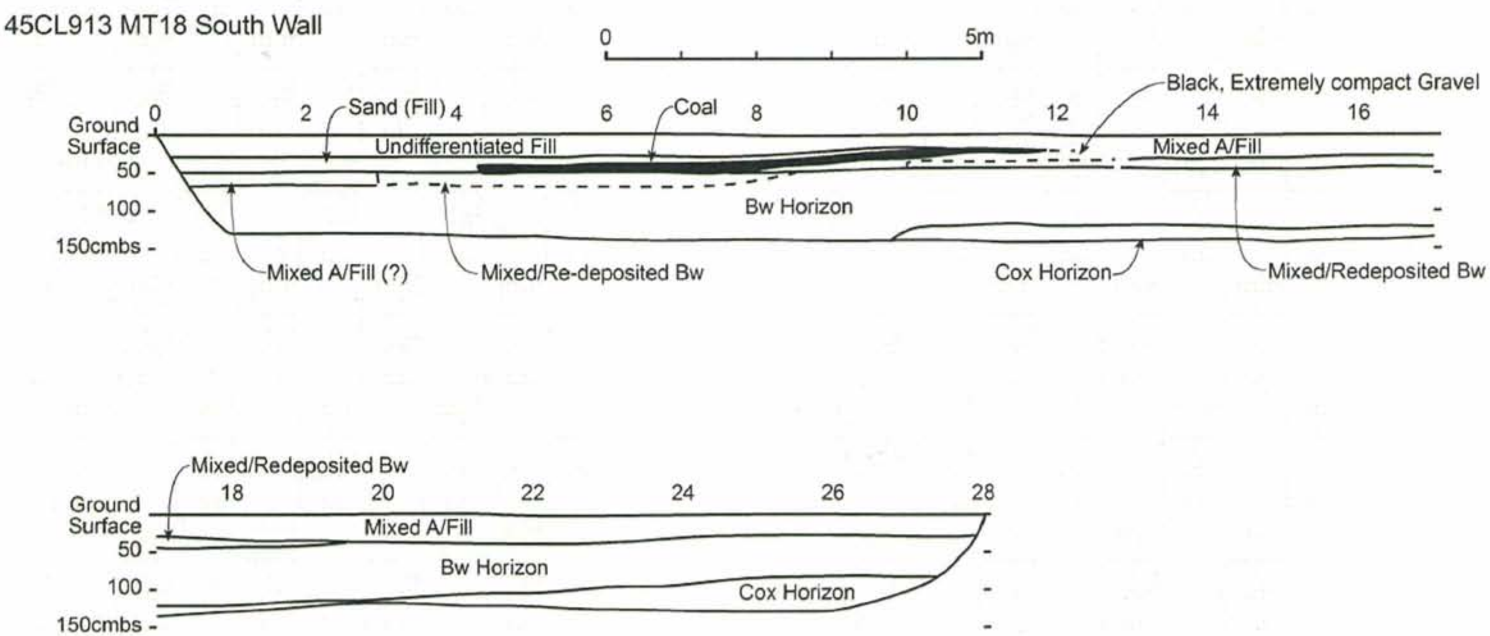

Figure 7-8. Stratigraphic profile of the south wall of MT18 at site 45CL913.

PRELIMINARY

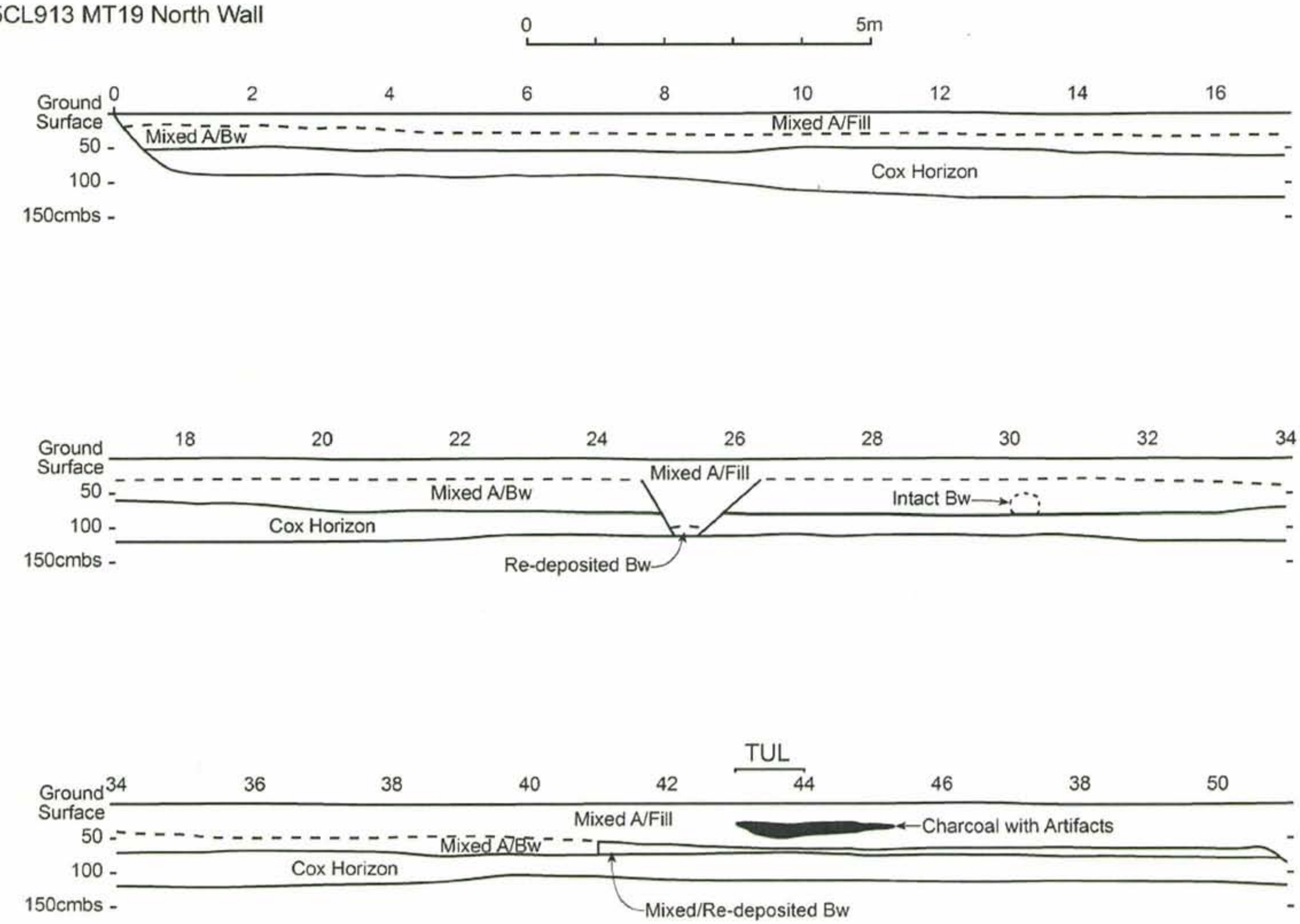

Figure 7-9a. Stratigraphic profile of the north wall of MT19 at site 45CL913.

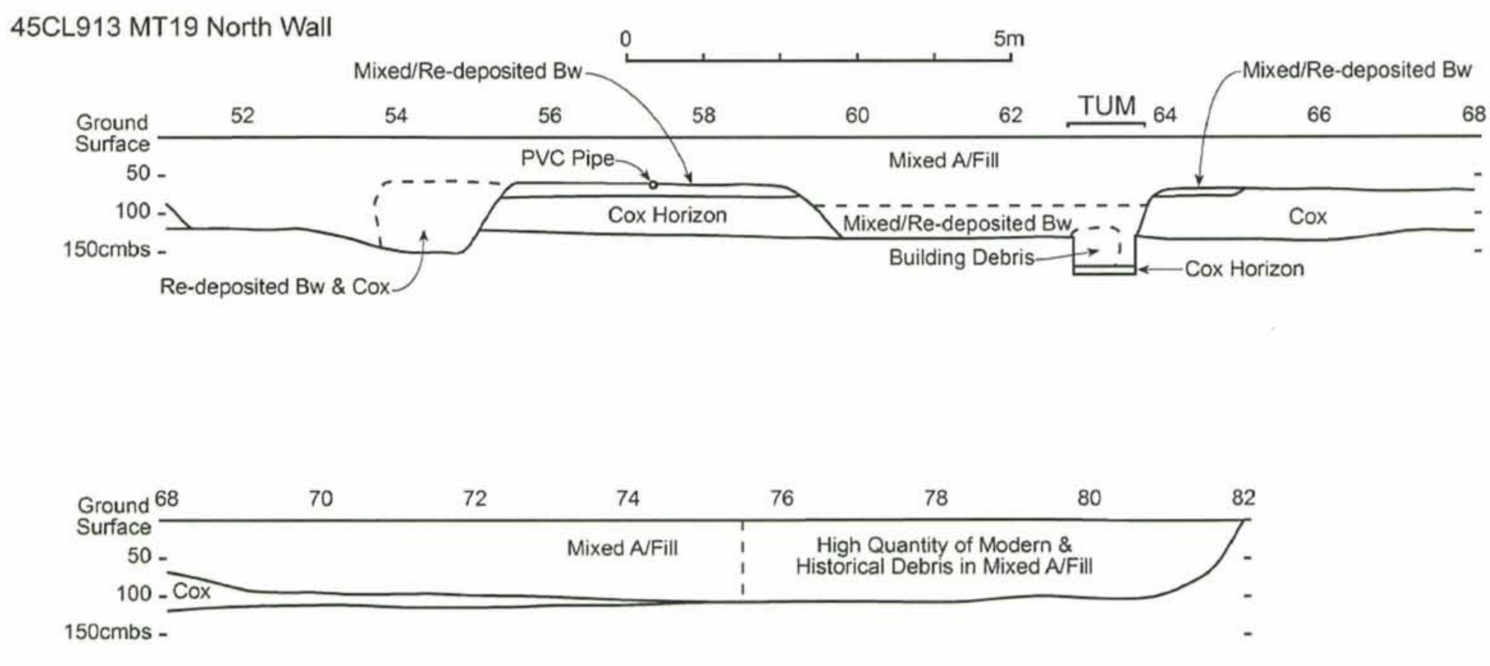

Figure 7-9b. Stratigraphic profile of the north wall of MT19 at site 45CL913.

at 110 cmbs. This depression contained mixed A/fill and redeposited Bw sediments. A large depression from 50.7 to 55.4 m extended to the trench floor at 150 cmbs. It contained primarily mixed A/fill, but also redeposited Bw and Pleistocene gravels as well as small fragments of structural debris. The third and deepest depression began at about 76.0 m and continued to the end of the trench. The Pleistocene gravels visible farther west sloped downward, replaced by a thick deposit of mixed A/fill that continued to the end of the trench.

Three concentrations of cultural material were encountered in MT19. The first concentration initially became apparent at 30 cmbs between 43.0 and 44.0 m, and was associated with a band of charcoal that extended from 43.1 to 45.3 m. TU-L, set up within the trench to determine if structural remains were present, measured 1.0 m in length (along the trench) by 70 cm (the trench width at the bottom). The controlled excavation (two 10-cm levels) from 30 to 50 cmbs encountered mixed A/fill sediments. Recovered from TU-L were rusty metal fragments such as a short section of metal pipe, machine-cut and wire nails, bolts, and a metal drawer/cabinet knob. Other artifacts included container glass fragments, earthenware and porcelain fragments, burned wood, asphalt chunks, and bricks with attached mortar. The one whole common brick in this concentration measured 8¼ × 3¾ × 2¼ inches. Among the cultural materials is an earthenware cup fragment marked Shenango China and decorated with the "fouled anchor" used on U.S. Navy tableware manufactured by Shenango China Co. between 1940 and the 1970s. This particular vessel is stamped with the number 10, indicating production in 1952 (Lehner 1988:421).

A second concentration of cultural material was exposed in the bottom of a depression containing mixed fill/A and redeposited Bw between 62.8 and 63.4 m. The depression itself extended from 59.0 to 63.8 m and was bowl-shaped, cutting into the mixed/redeposited Bw and Pleistocene gravel to 170 cmbs (as revealed in a localized deeper excavation of the trench floor). TU-M, excavated within the trench to determine if structural remains were present, measured 80 cm long (from 62.8 to 63.6 m along the trench) by 70 cm wide (the trench width at the bottom). Excavation in TU-M extended from 120 to 180 cmbs and exposed bricks, charcoal, partially burned wood, tar paper, wire nails, bolts, metal strap fragments, and a pipe clamp. Eight whole common red bricks and about a dozen brick halves were observed. Among the whole bricks were examples measuring 8 × 3¾ × 2¼ (n=2), 8 × 3¾–4 × 2¼ (n=3), 8¼ × 3¾ × 2¼ (n=2), and 8¼ × 3½ × 2¼ (n=1) inches. Underlying the artifacts beginning at approximately 140 cmbs were larger pieces of burned wooden planks and siding lying flat and generally oriented north–south. The planks and siding appeared to rest on Pleistocene gravel encountered at 170 cmbs (Figure 7-10).

The third concentration of cultural material began at about 76.0 m, where the Pleistocene gravels at the bottom of the trench disappeared as they were replaced by a deep fill deposit that continued southeastward to the end of the trench at 82.0 m. The fill, composed of soft sediments prone to slumping, contained numerous chunks of concrete, at least one asphalt chunk, whole and fragmentary common bricks (including examples measuring 8 × 4 × 2 inches and 8 × 4 × 2¼ inches, and one with the HIDDEN brand from Vancouver's Hidden Brick Co., in business since 1871), charred and unburned wood fragments, wire nails, and an assortment of other structural debris. A number of temporally diagnostic artifacts place disposal of this artifact concentration relatively late in time: a Full Flavor brand carbonated beverage marketed sometime beginning in 1951, a drug vial made by Kimble Glass Co. in 1947 or later, Coca-Cola bottle fragments dated 1938–1951, a Bubble-Up bottle made by Owens-Illinois Glass Co. in 1955, a medicine bottle made by the same company in 1946, and a ceramic tile manufactured sometime between 1923 and 1976. Also recovered were two mold-blown bottle necks exhibiting sheared rims with laid-on finishes, characteristics common to bottles manufactured only until the 1860s. The presence of

Figure 7-10. View southeast during trenching of MT19 in WSDOT parcel W5B, showing TU-J under plywood and excavation of TU-K in progress (left), with Land Bridge in background. Pebbles and cobbles in backdirt (left foreground) are Pleistocene gravels directly underlying deep fill deposits in this area.

items likely manufactured sometime around the mid-1800s in combination with glass bottles of recent manufacture clearly indicates the mixed nature of the fill. Before backfilling, the trackhoe excavated more deeply at the east end of MT19, establishing that this extensive fill deposit rested on Pleistocene gravel at 140 cmbs.

Search for the Historic Pond

The historic pond was situated in the far southeastern portion of W5B, west of the recently constructed Land Bridge. This pond was described as "the western end of a flood channel of the Columbia River that passed between the fort and the river. The pond had an outlet, a very short creek of a few yard's length that connected it with the Columbia River" (Chance and Chance 1976:2). This landscape feature proved to be of considerable importance to archaeology because it was used as a trash dump during the nineteenth century by both the Hudson's Bay Company and the U.S. Army.

The pond is shown on the 1846 Covington map of HBC Fort Vancouver and Kanaka Village (Thomas and Hibbs 1984:753), and regularly appears on U.S. Army maps of the fort from 1854 through 1905 (e.g., Thomas and Hibbs 1984:761, 763, 769, 773, 787). It is last shown on the 1906 Hubbard map of Vancouver Barracks (O'Rourke et al. 2010:109), and apparently was subsequently filled in.

This landscape feature was relocated and investigated in 1974 and 1975, at which time it was found to contain stratified refuse layers interposed with flood silt deposits in which preservation of material culture was excellent. Maps prepared by Chance and Chance (1976:37) show the approximate location of the historic pond along the WSDOT right-of-way in relation to the historic railroad berm. Estimating from this map, the west edge of the pond should be 123 m (400 feet), and the east edge of the pond 149 m (485 feet), southeast of the U.S. Army/NPS fence corner (located at the east edge of the railroad berm) used as a datum in calculating distances during discovery investigations at W5B. The pond's projected location on various National Park Service maps was later used to place this landscape feature on the W5B project area map (see Figure 7-2).

Due to the presence of standing water in a roadside ditch, it was not possible to extend MT19 along the same alignment farther to the southeast across the full extent of the former pond. Nor was sufficient room available to excavate additional trenches closer to SR 14. In an effort to determine if any evidence of the historic pond remained within W5B, three short trenches were excavated north and east of MT19 in the narrow space between the roadside ditch and the WSDOT/NPS fence. These three trenches, which were situated 1.25 m south of the fence, were excavated by backhoe under the supervision of HERITAGE's consulting geomorphologist Curt Peterson.

MT20 was located 97.0 to 100.0 m southeast of the U.S. Army/NPS fence corner. Fill extended from the surface to 140 cmbs. Mixed Bw containing fragments of slate, bricks, and other cultural material was observed from 140 to 220 cmbs. Pleistocene gravels were reached at 220 to 230 cmbs.

MT21 was located 118.0 to 120.5 m southeast of the U.S. Army/NPS fence corner. In this trench, fill containing fragments of slate, bricks, metal, and other materials extended from the surface to 180 cmbs. Mixed Bw was observed from 180 to 190 cmbs. The trench was not excavated deep enough to reach the Pleistocene gravels.

MT22 (Figures 7-11 and 7-12) was located 133.0 to 136.0 m southeast of the U.S. Army/NPS fence corner. It is perhaps worth noting that MT22 was 6.0 m beyond the southeasternmost probe excavated on adjacent NPS land in 2009. Fill was found from the surface to 110 cmbs, with the fill from 90 to 110 cm containing ash and charcoal. A buried A horizon was present from 110 to 160 cmbs; this was underlain by Bw from 160 to 210 cmbs.

No evidence of an A horizon soil, and no intact Bw, were present in MT20 or MT21. The relatively thick A horizon (1.1 to 1.6 m) in MT22 could reflect minor addition from late Holocene flood silts at the east end of W5B. However, there is no evidence of peaty sediments, and no laminae in the sediments, to indicate a seasonal pond or wetland at this location (Curt Peterson, personal communication April 21, 2009).

Although the sediments in these three trenches became increasingly moist with depth below surface, no evidence of any kind of a stratigraphic sequence of artifact-bearing layers separated by flood deposits such as that described by Chance and Chance (1976) was encountered. Instead of peat-like sediments characteristic of a pond, the three short trenches mostly encountered fill deposits apparently imported from elsewhere like those found in MT19 and the test units to the northwest.

Figure 7-11. View northwest, showing excavation of MT22 in progress in WSDOT parcel W5B.

Figure 7-12. View southeast, showing excavation of MT22 in progress in WSDOT parcel W5B (MT21 in foreground; Land Bridge in background).

DESCRIPTION OF DEPOSITS

As described above, archaeological discovery probing and trenching in W5B encountered evidence of severe soil disturbance from previous highway-related construction. The same cut-and-fill practice observed elsewhere around the I-5/SR 14 interchange was in evidence. This construction sequence began with removal of the native soils, usually extending deep into the Bw horizon and often into the top of the Pleistocene gravels. Following highway construction, fill material was introduced to bring the excavated margins along the highway back up to grade. The subsurface disturbance in W5B also included evidence of the intentional excavation of a pit for the purpose of disposing of building debris, a practice observed during archaeological testing in other WSDOT parcels around the interchange.

During manual and mechanical excavations, several different strata were observed that consisted of undisturbed and remnant intact soil horizons, mixed and disturbed remnant soil horizons, mixed soil/fill, and fill. The strata can be divided into eight types. Four of these either contain or potentially contain some form of A horizon soil (Table 7-2) and are designated as remnant intact A horizon, disturbed remnant A horizon (featuring minimal artifact content), mixed A/fill (featuring relatively high artifact content), and mixed fill (imported sediments that may contain redeposited A, Bw, and Cox soils as well non-soil deposits and cultural debris (typically a combination of these materials). The remaining four strata consist of mixed Bw/A (a transitional unit that may overlie in situ Bw or Cox), undisturbed or remnant intact Bw horizon, mixed/ redeposited Bw (lacking internal bedding, typically featuring random orientation of clasts, and sometimes containing artifacts), and undisturbed or remnant intact Cox horizon.

Selected profiles of the manually-excavated test units (Figure 7-4 and 7-5) and of MT18 (Figure 7-8) and MT 19 (Figure 7-9) are provided. The highly variable distribution of the different deposits observed in the test units and trenches indicates a considerable level of disturbance across the W5B area.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

No cultural features were encountered during either the manual test unit or the mechanical trench excavations. Three artifact concentrations encountered during excavation of MT19 all proved, on closer examination, to occur within fill deposits introduced during previous episodes of construction-related excavations.

Artifacts

The artifact assemblage from W5B, totaling 1,322 artifacts (a total reflecting few complete objects; most are fragments of varying sizes), consists for the most part of artifacts from disturbed fill deposits. Of these, 81 items were collected as "grab samples" while monitoring the mechanical trench excavations. The remaining 1,241 artifacts were recovered during the controlled test unit and shovel probe excavations. Of these, 149 (12.0 percent) were recovered from A horizon sediments in TU-A, TU-F, and TU-G; 11 (0.8 percent) were recovered from Bw horizon sediments in TU-A and TU-C; and 1,081 (87.1 percent) were recovered from mixed/disturbed deposits.

A summary of the artifact assemblage recovered from W5B is provided in Table 7-3. Dates or date ranges for manufacture determined for temporally-diagnostic ceramics, glass, metal, and assorted other items are summarized in Table 7-4. In view of the fact that the origins of the artifacts in the mixed fill deposits are unknown, these fill artifacts are not discussed further. Only artifacts recovered in association with A horizon soils are described in detail.

Most of the 149 artifacts recovered from A horizon contexts in TU-A, TU-F, and TU-G appear to be domestic/household and personal items (e.g., ceramic tableware and/or furnishings, glass bottles and other containers, clay pipes, animal bone) or structural materials and hardware (e.g., a brick, roofing slate, window glass, nails). Of the 149 items, 23 were recovered from TU-A, 32 from TU-F, and 94 from TU-G. The artifacts are discussed below by unit.

TU-A Artifacts

The artifact assemblage (n=23) from the A horizon in TU-A contains fragments from ceramic and glass containers, clay smoking pipes, window glass, nails, and animal bone. The ceramic items are a tiny, undecorated, nondiagnostic, earthenware body fragment; an undecorated, nondiagnostic white improved earthenware body fragment; and a nondiagnostic, salt-glazed stoneware crock body fragment. White improved earthenware was patented in England in 1813; commercial imports to the United States began in the 1840s. Seven bottle and jar fragments (olive, amber, and colorless glass) were recovered, although all are nondiagnostic body fragments. Three additional colorless glass body fragments from unidentified items complete the glass assemblage. While colorless glass has been recovered from significantly earlier contexts at Fort Vancouver, large-scale production of colorless glass containers did not occur until the 1870s and 1880s.

The clay pipe fragments are small, unmarked segments from the stem(s). Only two pieces of window glass were recovered from the A horizon in TU-A. Their thicknesses (0.050 and 0.085 inches thick) place them into manufacturing date ranges of 1810–1835 and 1855–1885, respectively, based on Roenke's Pacific Northwest dating formula; however, relying on only two measurements for this calculation is not advised. The two nails in the assemblage are too rusty to identify as wrought, machine-cut, or wire. The three animal bone fragments are assumed to be food remains discarded sometime during the historical use of this area. Based on the few dates suggested by the limited number of artifacts from the A horizon in TU-A, it is difficult to attribute the assemblage to either the HBC or the U.S. Army use of the area.

TU-F Artifacts

The assemblage from the A horizon in TU-F (n=32) is also largely of a domestic and structural nature, consisting of ceramic and glass fragments, as well as a metal latch piece, a Bakelite fragment, roofing slate, coal, coral, and a basalt flake. The five ceramic items are all tiny fragments. Three were recognized as floral blue transferwares, but the patterns could not be identified; two additional pieces are from undecorated, nondiagnostic, earthenware and porcelain items. Seven amber, black, and olive fragments from bottles or jars, and 12 nondiagnostic fragments from aqua and colorless unidentifiable glass items (likely containers) were noted. Large-scale production of colorless glass containers did not take place until the 1870s and 1880s (although colorless glass containers were being produced in small quantities long before this).

Table 7-3. Artifact Summary for Site 45CL913.

Artifact Group/ Category	Artifact Types	TU-A A Hzn	TU-F A Hzn	TU-G A Hzn	TU Mixed Fill/ A Hzn	TU Mixed A/Bw Hzns	TU/SP Mix of Fill/A/B Hzns	TU Bw Hzn	MT19	Totals
Activities										
Communication	Newspaper						3			**3**
Ammunition	Cartridge case				1		1			**2**
Toy	Glass marble						1			**1**
	Tiny plastic toilet seat								1	**1**
Domestic										
Food	Soda-pop bottle				1		3		4	**8**
	Syrup bottle						3			**3**
	Metal key & strip from can						1			**1**
Food Preparation & Consumption	Ceramic bowl						1			**1**
	Ceramic cup				1		1			**2**
	Ceramic plate						5		3	**8**
	Chinese rice bowl						1			**1**
	Indeterminate ceramic tblware			3	1		5			**9**
	Glass Stemware				2					**2**
Food Storage	Stoneware crock				2		1			**3**
Furnishings	Flower pot/planter						1			**1**
	Glass lamp chimney				1	1	6			**8**
	Glass lampshade/globe						2			**2**
	Metal caster						2			**2**
	Metal drawer pull				3		1			**4**
	Mirror						1			**1**
	Vitreous china kit./bath fixture						2		3	**5**
Faunal										
Mammal	Deer	2								**2**
	Cattle			5					2	**7**
	Hare/rabbit			1						**1**
	Unidentified mammal	1		1			4			**6**
Bird	Chicken								1	**1**
Mollusc	Unidentified mollusc shell				2					**2**
Other	Stony coral		2							**2**
Indefinite										
Fuel	Coal		2	5	2		6			**15**

Table 7-3. Artifact Summary for Site 45CL913 (*continued*).

Artifact Group/ Category	Artifact Types	TU-A A Hzn	TU-F A Hzn	TU-G A Hzn	TU Mixed Fill/ A Hzn	TU Mixed A/Bw Hzns	TU/SP Mix of Fill/A/B Hzns	TU Bw Hzn	MT19	Totals
Closures	Metal lid						1			1
Containers	Barrel hoop			1						1
	Bottle/jar	7	6	13	34	4	294		7	365
	Can				1		113			114
	Crown cap						1			1
	Stoneware container	1					2			3
Indefinite	Aluminum foil						3			3
	Ceramic item	2	5	6	13	3	40	5		74
	Glass item	3	12	13	16		27	2	1	74
	Graphite item								1	1
	Latch?		1							1
	Leather item						1			1
	Metal-edged ring tag				1					1
	Metal item/fragment				2	2	25		2[1]	31
	Paper tag/label				1					1
	Plastic item		1	4	4	1	5			15
	Rubberized cloth								11	11
	Unidentifiable material						1			1
	Wood item						7			7
Waste	Clinker						3			3
	Slag						4			4
Personal										
Accoutrements	Decorative hair comb					1				1
	Metal button				2[2]					2
	Metal military button						2			2
	Shoe/boot						11		1	12
	Shoe nail						3			3
	Suspender hardware						1			1
Health	Medicine Bottle								1	1
	Vial								1	1
Social Drugs - Alcohol	Alcoholic beverage bottle		1	1	3		9			14
	Glass ale/beer bottle				1		1			2
	Wine/champagne bottle								1	1
Social Drugs - Tobacco	Clay pipe	3			2		3			8
	Plastic cigarette holder								1	1

Table 7-3. Artifact Summary for Site 45CL913 (*continued*).

Artifact Group/ Category	Artifact Types	TU-A A Hzn	TU-F A Hzn	TU-G A Hzn	TU Mixed Fill/ A Hzn	TU Mixed A/Bw Hzns	TU/SP Mix of Fill/A/B Hzns	TU Bw Hzn	MT19	Totals
Structural										
Electrical	Electrical wire						10			10
	Metal conduit								1	1
	Porcelain insulator						1			1
Hardware	Bolt				3		3		3[1]	9
	Chain-link fence part				1					1
	Cut nail			7	5		15	1		28
	Metal washer						1			1
	Nail—type indeterminate	2			16		79		16[1]	113
	Pipe clamp								1[1]	1
	Pipe fitting						3			3
	Spike—type indeterminate						2			2
	Wire nail			13	14		66		10[1]	109
	Wire spike				1		1			1
Heating/Lighting	Light socket								1	1
Materials	Brick			1	3		6		1	11
	Ceiling/floor tile								2	2
	Concrete item						1			1
	Ceramic tile								1	1
	Linoleum/other flooring								2	2
	Mortar				1		1			2
	Roofing slate		1	6	2	1	29			39
	Wood shake						8			8
	Tar paper				1		8			9
	Terra-cotta pipe				7		3		1	11
	Window glass	2		12	20	4	41		1	80
Native American										
Tools	Uniface						1			1
Lithic debitage	Flake		1	2				3		6
	Heat spall						1			1
Totals		23	32	94	176	17	888	11	81	1,322

TU = Test Units SP = Shovel Probe MT = Mechanical Trench Hzn = Horizon
[1]Artifacts from TU-M, which was located within MT19
[2]Artifact found on the surface, 3 m east of TU-D
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

Table 7-4. Temporally Diagnostic Artifacts from Site 45CL913.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	References
TU-A L1–3 Mixed fill/ A Horizon	Black glass bottle fragment	Used for containers	Pre-1800 to ca. 1890s	SHA (2009)
	Window glass fragments (n=7)	0.091–0.126 inch thick	1870–1915, 1924+*	Roenke (1978:116); Weiland (2009:30)
	Amethyst bottle fragment	Sun-colored amethyst indicates manganese dioxide used in decolorization process	1870s–ca. 1920	SHA (2009)
	Colorless bottle/jar fragments (n=5)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Green Coca-Cola bottle fragment	Hobbleskirt design	Since 1917	Antique Bottles (2009)
TU-A L4 A Horizon	Window glass fragments (n=2)	0.050 and 0.085 inch thick	1810–1835, 1855–1885*	Roenke (1978:116)
	White improved earthenware fragment, indeterminate vessel type	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle fragments (n=3)	Glass decolorization	Common after ca. 1870s	SHA (2009)
TU-A L5 Bw Horizon	White improved earthenware rim and body fragments, indeterminate vessel type (n=3)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
TU-B L1 Mixed fill	Clay pipe bowl with spur	I & F embossed on opposite sides of peg spur indicate manufacture by Jesse & Thomas Ford, London.	1836–1909(?)	Pfeiffer (1982, 2006)
	Amethyst bottle base fragment	Sun-colored amethyst indicates manganese dioxide used in decolorization process	1870s–ca. 1920	SHA (2009)
	Colorless bottle fragments (n=90, 1 bottle)	Mold seams indicate production in automatic bottle machine	Since ca. 1905	SHA (2009)
	Amber ale/beer bottle base fragment	Stippling on base	Since ca. 1940	SHA (2009)
TU-C L2–4 Mixed fill/ A Horizon	Black bottle fragment	Used for containers	Pre-1800 to ca. 1890s	SHA (2009)
	Window glass fragments (n=4)	0.079–0.099 inch thick	1850–1900*	Roenke (1978:116)
	Bakelite fragment	Patented Bakelite technology	Since 1909	Bakelite Museum (2009)
	Styrofoam fragments (n=2)	Styrofoam technology	Since 1944	Dow Chemical Co. (2009)
	Bakelite fragment	Patented Bakelite technology	Since 1909	Bakelite Museum (2009)
TU-D L1–5 Mixed fill/ A Horizon	Bakelite fragment	Patented Bakelite technology	Since 1907	Bakelite Museum (2009)
TU-F L1–2 A Horizon	Black bottle fragment	Used for containers	Pre-1800 to ca. 1880s	SHA (2009)
	Amber bottle fragments (n=2)	Seams from 4-piece mold	Early 1880s–mid-1910s	SHA (2009)
	Bakelite fragment	Patented Bakelite technology	Since 1909	Bakelite Museum (2009)
TU-G L1–2 A Horizon	Black bottle base fragment	Used for containers	Pre-1800 to ca. 1890s	SHA (2009)
	White improved earthenware fragment, indeterminate vessel type	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Window glass fragments (n=12)	Dual primary mode of 0.065 & 0.075 inch	1845–1865*	Roenke (1978:116)
	Olive bottle/jar fragments (n=3)	Stria indicate turn-mold manufacture	1850s–early 1920s	SHA (2009)

Table 7-4. Temporally Diagnostic Artifacts from Site 45CL913 (*continued*).

Provenience	Item Description	Dateable Characteristics	Date/Date Range	References
	Colorless bottle/jar fragments (n=2)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Aqua bottle base fragment	Possible hinge/key or post-bottom mold	1890s and earlier	SHA (2009)
	Amethyst bottle/jar fragments (n=2)	Sun-colored amethyst indicates manganese dioxide used in decolorization process	1870s–ca. 1920	SHA (2009)
	Wire nails (n=13)	Readily available	Since ca. 1884	Adams (2002)
	Bakelite fragment	Patented Bakelite technology	Since 1909	Bakelite Museum (2009)
TU-H L1–6 Mixed fill	Window glass fragments (n=4)	0.048–0.121 inch thick	1830–1915, 1924+*	Roenke (1978:116); Weiland (2009:30)
	Ferrous can lid	Lacquer finish	Since 1860	Rock (1989:67)
	Colorless bottle/jar fragments (n=13)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Black alcoholic beverage bottle fragments (n=4)	Used for containers	Pre-1800 to ca. 1890s	SHA (2009)
	Wire nails (n=25)	Readily available	Since ca. 1884	Adams (2002)
	Straw color glass fragment	Straw-color indicates selenium or arsenic used w/ cobalt oxide in decolorization process	Mid-1910s–ca. 1950s	SHA (2009)
	Amber alcoholic beverage bottle fragments (n=3)	Stippling on base	Since 1940	SHA (2009)
	Aqua Coca-Cola bottle fragments (n=3)	Hobbleskirt design	Since 1917	Antique Bottles (2009)
	Colorless jar fragments with metal screw-cap lid (n=53, 1 jar)	Owens-Illinois Glass Co. mark with date code 7 and Duraglas in script	1947	Lockhart (2006)
TU-H L7 Mixed A/Bw	Aqua bottle fragment	Crown finish; manufactured in automatic bottle machine1	Since ca. 1910	SHA (2009)
TU-I L3–4 Mixed fill/ A Horizon	Window glass fragments (n=9)	0.047–0.096 inch thick	1830–1900*	Roenke (1978:116)
	Cartridge case	Center fire with visible primer	Since early 1870s	Barnes (2000)
	Wire nails (n=4)	Readily available	Since ca. 1884	Adams (2002)
	Amber beer bottle fragment	Stubbie shoulder ring	Since 1935	SHA (2009)
TU-I L5 Mixed A/Bw Horizons	Window glass fragments (n=4)	0.060–0.088 inch thick	1845–1885*	Roenke (1978:116)
	Colorless bottle fragment	Glass decolorization	Common after ca. 1870s	SHA (2009)
TU-J L1–7 Mixed fill	White improved earthenware handle and body fragment, indeterminate vessel type	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Window glass fragments (n=12)	0.069–0.108 inch thick	1845–1915+*	Roenke (1978:116)
	Chinese rice bowl fragment	Bamboo pattern	ca. 1850–ca. 1890	Wegars (Appendix 1C-II)
	Colorless bottle/jar fragments (n=24)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Black bottle fragment	Used for containers	Pre-1800 to ca. 1890s	SHA (2009)
	Wire nails (n=3)	Readily available	Since ca. 1884	Adams (2002)
	Brown-glazed porcelain insulator	Embossed THO[MAS]	1905–1957	Insulator Research Service (2009)
	Cellophane	Cellophane introduced	Since ca. 1912	Bellis (2010)

Table 7-4. Temporally Diagnostic Artifacts from Site 45CL913 (*continued*).

Provenience	Item Description	Dateable Characteristics	Date/Date Range	References
	Aluminum foil	Aluminum foil introduced	Since 1913	Wikipedia (2009b)
	Amber beer bottle fragment	TMC mark of Thatcher Glass Manufacturing Co. with 57 date code	1957	Lockhart et al. (2007a)
	Amber Mrs. Butterworth's syrup bottle fragments (n=3)	Mrs. Butterworth's syrup	Since 1961	Elliott (2009)
TU-K L1–9 Mixed fill	Black alcoholic beverage bottle fragment	Used for containers; turn molded	ca. 1850s to ca. 1890s	SHA (2009)
	Black bottle fragments (n=2)	Used for containers	Pre-1800 to ca. 1880s	SHA (2009)
	Window glass fragments (n=15)	0.064–0.115 inch thick	1845–1915+*	Roenke (1978:116)
	Colorless bottle/jar fragments (n=11)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Leather shoe heel fragments (n=4)	Use of wood pegs and metal nails	Since 1862	Anderson (1968)
	U.S. Army General Service buttons (n=2)	Prussian eagle with raised lined shield design	Ca. 1880–1902	Wycoff (1984:91)
	Amethyst bottle/jar fragment	Sun-colored amethyst indicates manganese dioxide used in decolorization process	1870s–ca. 1920	SHA (2009)
	Amber bottle fragment	Tooled finish	Mid-1870s–early 1920s	SHA (2009)
	Wire nails (n=26)	Readily available	Since ca. 1884	Adams (2002)
	Key from key-wind can	Key-wind can introduced	Since ca. 1860s	
	Aluminum foil	Aluminum foil introduced	Since 1913	Wikipedia (2009b)
SP10 L1–10 Mixed fill/ A/Bw Horizons	Wire nails (n=14)	Readily available	Since ca. 1884	Adams (2002)
	Crown cap	Closure produced	Since 1892	SHA (2009)
	Colorless bottle/jar fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Window glass fragments (n=2)	0.119–0.129 inch thick	1924+*	Roenke (1978:116); Weiland (2009:30)
MT19 Fill	Green bottle neck fragments (n=4, 2 items)	Sheared rim with champagne-style, laid-on finish	ca. 1870s?	SHA (2009)
	Linoleum flooring fragments (n=2)	Linoleum production	1860–1960s	About.com (2009)
	Common red brick	HIDDEN brand from Hidden Brick Co., Vancouver	1871–1992	Gurcke (1987:246); Hidden (1930)
	Colorless bottle neck/finish fragment	Produced using automatic bottle machine	Since ca. 1905	SHA (2009)
	Window glass fragment	0.117 inch thick	1915+*	Roenke (1978:116)
	Ceramic tile	Pamona Manufacturing Co. mark	1923–1976	Tile Heritage (2007)
	Aqua Coca-Cola bottle fragments (	"D-patent" style hobbleskirt	1938–1951	Antique Bottles (2009)
	Amber external-thread medicine (aspirin) bottle	Owens-Illinois Glass co. mark with 6 date code and stippling on base	1946	Lockhart (2006)
	Colorless drug vial	Kimble Glass Co. mark	Since 1947	Whitten (2009)
	Colorless soda bottle fragments (n=2)	Full Flavor Bottling Co. applied color label	Ca. 1951–unknown	Fowler (1986:108–109)
	Green Bubble-Up bottle	Owens-Illinois Glass Co. mark; 55 date code	1955	Lockhart (2006)

Table 7-4. Temporally Diagnostic Artifacts from Site 45CL913 (*continued*).

Provenience	Item Description	Dateable Characteristics	Date/Date Range	References
MT19 TU-L L4 Mixed fill/ A Horizon	Window glass fragments (n=6)	0.091–0.119 inch thick	1870–1915, 1924+*	Roenke (1978:116); Weiland (2009:30)
	Colorless bottle fragments (n=2)	Glass decolorization	Common after ca. 1870s	SHA (2009)
	Wire nails (n=10)	Readily available	Since ca. 1884	Adams (2002)
	Porcelain coffee cup fragment (U.S. Navy Mess–Wardroom Officers' pattern)	Blue fouled anchor design on side of cup; Shenango China mark with 10 date code	1952	Lehner (1988:421) Pirate's Lair (2009)
MT19 TU-M Fill	Wire nails (n=10)	Readily available	Since ca. 1884	Adams (2002)

TU = Test Unit   L = Level   SP = Shovel Probe   MT = Mechanical Trench

Note: window glass thickness modes (Roenke 1978) are not presented for fill/mixed contexts, as artifact counts are low and deposits are mixed and/or probably from off-site locations. The range of thickness is provided for each provenience. The date ranges reflect a composite of the modes into which the individual measurements would fall. For the window glass from A horizon contexts, too few fragments were found to calculate modes. Thicknesses are listed and the date ranges provided reflect the modes into which the individual measurements would fall if a modal analysis was conducted.

One amber bottle shoulder fragment exhibits seams from a four-piece mold. Bottles made in four-piece molds generally dated from the early 1880s to the mid-1910s. A black base fragment has no seams, suggesting manufacture in a dip or turn mold or that it was free blown. Black glass was commonly used for containers until the early 1890s; unfortunately, the indeterminate nature of the manufacturing process for this bottle does not permit a more refined date.

The metal latch fragment resembles many found on wooden trunks. The Bakelite fragment may be from a clay pigeon. Chance and Chance (1976:26) encountered numerous such fragments during excavation in their Operation 7, in the vicinity of present-day W5B. Bakelite was patented in 1909. A single piece of roofing slate was recovered. Many of the U.S. Army buildings had slate roofs, so it is assumed that this piece comes from such a structure. The two chunks of coal were probably fuel. The two pieces of stony coral could have been for use in mortar; however, Forbes (1992:56, 69) notes that coral (burned into lime and ground) was also used by Hawaiians to adorn their hair, and the location of W5B within the area of Kanaka Village raises the possibility that the coral may have been used for personal grooming. The single basalt flake was probably a product of Native American stone tool manufacture. The few manufacturing dates derived from these artifacts suggest that the A horizon in TU-F probably dates from the last quarter of the nineteenth century; however, it is possible that some of the temporally nondiagnostic items are related to earlier (HBC) use of the area.

TU-G Artifacts

By far, the greatest number of A horizon artifacts from W5B were encountered in TU-G (n=94). As in TU-A and TU-F, the assemblage is made up of largely domestic and structural items—fragments from ceramic tablewares and unidentifiable ceramic objects; fragments from bottles, jars, and indeterminate glass items; a barrel hoop, chunks of coal, pieces from miscellaneous plastic items, nails, a brick fragment, roofing slate, and window glass. Also present are two flakes.

The ceramic tablewares are three earthenware fragments (rim and body) from blue transferware(s) so small that the pattern(s) cannot be identified. Other ceramic fragments (from indeterminate vessel types) are one undecorated white improved earthenware handle fragment (from a pitcher that could be food or toiletry related), one hand-painted earthenware fragment, one earthenware fragment with blue glaze, and three undecorated, nondiagnostic earthenware fragments. Although patented in England in 1813, commercial import of white improved earthenware to the United States did not begin until the 1840s.

The only bottle for which function could be identified is represented by a single fragment of black glass. This fragment is too small to exhibit temporally diagnostic characteristics and can, therefore, only be dated to sometime before the 1890s, by which time black glass was rarely used for containers. Thirteen other bottle/jar fragments in the assemblage are from aqua, olive, green, amethyst, colorless, and amber containers. A small aqua base fragment may be from a two piece mold dating to sometime in the 1800s. Three olive body fragments exhibit turn-mold stria, which indicates manufacture sometime between the 1850s and early 1920s. Large-scale production of colorless glass containers became common the 1870s and 1880s (although colorless glass containers were being produced in smaller quantities long before this). Two sun-colored amethyst fragments are likely from a bottle produced between the 1870s and ca. 1920. In addition, 13 fragments from unidentifiable glass objects were recovered. Of these, 12 are colorless and one is aqua. None exhibits diagnostic manufacturing characteristics.

Seven machine-cut nails were recovered. These appear to be American made common nails. Thirteen wire nails were collected. Wire nails were commonly available as of ca 1884. The twelve window glass fragments in the assemblage have a primary mode of 0.065 and a secondary mode of 0.075, suggesting a date range of 1845 to 1865 for construction according to Roenke's Pacific Northwest formula; however, fragments that correspond to dates from as early as 1810 and to 1915 or later are also present, indicate a mixing of materials from different dates or repeated remodeling. Unfortunately, it is not known from what building(s) these fragments might be from. A common red brick fragment with no brand and too incomplete to provide any measurement is present in this assemblage. Its color is consistent with American made common red bricks throughout the project area. Nine pieces of roofing slate, probably from U.S. Army buildings in the area were also recovered.

A barrel hoop fragment, five chunks of coal (probably fuel), two plastic fragments, one Bakelite fragment, five cow molar fragments, one hare/rabbit bone, one unidentified mammal bone, and two chert flakes complete the TU-G assemblage. Only the Bakelite, patented in 1909, is temporally diagnostic. The flakes are attributed to Native American use of the area.

In general, the temporally diagnostic artifacts from TU-G suggest that this A horizon dates to sometime between the mid-nineteenth and very early twentieth centuries. While most of the items appear to be related to the U.S. Army occupation of the area, a few pieces are likely from the earlier (HBC) occupation, indicating deposition of materials over a long span of time.

ANALYSIS AND INTERPRETIVE RESULTS

The extensive presence of "resistive fill materials" in W5B, as indicated by the GPR reconnaissance, was confirmed by discovery investigations involving both manual and mechanical excavations. The resistive fill materials proved to include not only fill introduced from elsewhere but also thoroughly disturbed/mixed and redeposited A and Bw horizon soils overlying the basal Pleistocene gravels. The only occurrence of an apparently intact A horizon soil was a thin layer at 30–40 cmbs in TU-A, at the northwestern end of W5B. Disturbed remnant A horizon soils were identified in TU-F and TU-G to the southeast, where their preservation may be due to the presence of a remnant of the original landform at a slightly higher elevation in this portion of W5B.

Although the stratigraphy in the test unit excavations clearly reflected soil disturbance, the massive scale of the mixing and redeposition of sediments only became apparent after the excavation of the mechanical trenches, particularly MT19. For most of the lengths of the mechanical trenches, mixed and redeposited sediments extended either into the top of the Bw or to the top of the Pleistocene gravels at depths of a meter or more below the surface. With the exception of one pocket of possibly undisturbed Bw at 50 to 80 cmbs at 30.0 m in MT19, no intact deposits of Bw horizon soils were exposed anywhere in W5B.

Particular note should be made of the concentration of cultural materials encountered at the southeast end of MT19, where soft fill contained numerous chunks of concrete, whole and fragmentary common bricks, charred and unburned wood fragments, wire nails, a few earthenware and container glass fragments, and a complete Bubble-Up soft drink bottle manufactured in 1955. The location of this concentration at the east end of MT19 seems to correspond closely with the University of Washington's Operation 2 investigated in 1974. The description of investigations at Operation 2 contains the following statement:

> It was here that we first discovered the presence of a large excavation along what turned out to be the northwestern side of the pond. According to informants, this pit had been dug in the early 1960s to receive building remains and trash from the World War II Army barracks that had covered the center of Kanaka Village. (Chance and Chance 1976:22)

The artifact concentration at the east end of MT19 extended for at least 6 m without encountering any evidence of the historic pond. In an effort to avoid this deep fill deposit, MT22 was placed another 10.0 m to the southeast adjacent to the WSDOT/NPS fence where it was expected the ground would be less disturbed. Situated about 135.0 m east of the NPS/U.S. Army fence corner, MT22 is estimated to have extended the test excavations most of the way across the width of the historic pond. Only disturbed deposits overlying Bw at 160 cmbs were exposed in MT22.

The map of the 1974 University of Washington operations indicates that the historic pond projected only a short distance to the north of the right-of-way, which corresponds to the present WSDOT/NPS fence (Chance and Chance 1976:36–37). In contrast to investigations in Operation 2, two test pits excavated farther east in Operation 13 encountered a thick deposit of HBC artifacts in pond deposits (Chance and Chance 1976:29). Operation 13 was the closest of the investigations in the pond to the right of way, and clearly indicated the former existence of artifact-bearing deposits in the pond in proximity to the present WSDOT/NPS fence.

No evidence of the historic pond was found during the discovery investigations in W5B. Any portion of the pond that formerly existed within the boundaries of W5B appears to have been destroyed by previous highway construction.

It is possible that evidence of the pond may still exist on National Park Service land to the north. It has been asserted that "north of the SR 14, within the park, the pond is known to contain dense deposits of 19th century artifacts dating to the Hudson's Bay Company and U.S. Army periods" (Wilson 2005:32). The existence of dense artifact-bearing deposits in the pond is derived from the 1974 and 1975 investigations, which were all south of NPS land (Chance and Chance 1976). If dense artifact-bearing deposits in the pond have been found on NPS land, their discovery and documentation remains unreported.

It is also possible that evidence of the pond may still exist on WSDOT land east of W5B in the vicinity of the Land Bridge. Although testing in connection with the Land Bridge project was not conducted within the projected location of the pond north of SR 14, placement of the Land Bridge was shifted to the east to avoid impacts to the pond (Wilson 2005:32). Monitoring by an archaeologist was recommended during the pier excavations for the Land Bridge (Wilson 2005:32). Whether any evidence of the historic pond, or any other archaeological evidence, was encountered during construction of the Land Bridge has not been reported.

Also of note are the artifact assemblages from TU-F and TU-G. These two test units, particularly TU-G, are in proximity to the Kanaka Village House 4 excavated by the NPS in VNHR Area 4. Although some of the temporally diagnostic artifacts may date to the time period of occupation of House 4 or other structures in Kanaka Village, the artifact collection as a whole represents a mixed late nineteenth century assemblage of the kind common at Vancouver Barracks that cannot be directly linked specifically to either the Hudson's Bay Company or to the U.S. Army.

NRHP ELIGIBILITY

W5B is a WSDOT parcel situated within the former area of Kanaka Village at the HBC Fort Vancouver and the U.S. Army's Quartermaster's Depot at Vancouver Barracks. This parcel was included as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007). In the National Register of Historic Places Nomination Form, W5B corresponds to an area along "State Highway 14, [a] portion within the Historic District [that] has lost integrity" (Owens et al. 2007:22 [Section 7]).

The results of the archaeological discovery investigations and testing in W5B indicate that the A horizon soils, in which evidence of prehistoric and/historic occupation might most likely be found, have been almost entirely removed or seriously disturbed during previous highway construction. Cutting and filling during previous highway construction extended more or less right up to the existing WSDOT/NPS fence. Although well over 1,000 artifacts were recovered during the field investigations, aside from the materials from the A horizon soils (TU-A, TU-F, and TU-G), the vast majority (88.5 percent) were from mixed/disturbed contexts, including introduced fill material.

The cultural deposits at site 45CL913 exhibit the characteristics of historical archaeological properties that the National Park Service has indicated are *not eligible* for the National Register, namely "temporally diverse cultural material found in undifferentiated/mixed stratigraphic contexts or disturbed spatial associations and the absence of classifiable archaeological features" (Townsend et al. 1993:29-30). Site 45CL913 clearly lacks the integrity (level of preservation and quality of information contained in the deposits) of a significant archaeological site (Little et al. 2000:31–44). Accordingly, site 45CL913 is not considered a significant archaeological site eligible for inclusion in the National Register under criterion d.

Site 45CL913 also does not appear to meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5 and SR 14, and the massive amount of earth-moving during highway construction resulted in the widespread destruction of the historic setting in the I-5 and SR 14 corridors. As a result, the site does not meet the integrity requirement for significance under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

Site 45CL913 is in a WSDOT parcel (W5B) situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army's Quartermaster's Depot at Vancouver Barracks, The site designation 45CL300, originally applied to Kanaka village, was later expanded to subsume all archaeological resources in this area (Thomas and Hibbs 1984:2). Archaeological testing was conducted in the portion of site 45CL300 on the National Park Service property adjacent on the north side of site 45CL913 in 2009 (O'Rourke et al. 2010).

The results of the discovery probing and trenching by HERITAGE at site 45CL913 are consistent with the results of NPS testing in this WSDOT parcel in connection with the Confluence Project Land Bridge (Wilson 2005). Shovel probes ST06, ST07, and ST08 were excavated in this area:

> The upper sediments usually contained large amounts of construction-demolition debris, including large numbers of slate roofing fragments associated with demolition of 19th century U.S. Army structures. More intact sediments contained an increased abundance of coal, probably associated with a mid-20th century, coal storage facility located in this area and also noted by Thomas [1993]. Artifacts recovered from these units tended to reflect mixed 19th and 20th century contexts, suggesting significant disturbance. No significant cultural deposits were identified. (Wilson 2005:23)

In connection with the CRC project, NPS archaeologists excavated 11 test units (TUs) in VNHR Area #4, the National Park Service property adjacent to site 45CL913. Nine test units were spaced at irregular intervals within 15 m of the WSDOT/NPS property fence; two test units were to the north, outside the CRC project APE (O'Rourke et al. 2010:206). In addition, five shovel tests (STs) were excavated to the southeast between the test units and landscaping for the Land Bridge.

A concentration of artifacts recovered in five test units in the central portion of VNHR Area #4 is interpreted as evidence of Kanaka Village House 4. The highest frequencies of artifacts in this area occurred in the test units to the north outside the CRC project APE (TU-01, TU-03). Substantial numbers of artifacts continued to occur to the northwest (TU4-010) and southeast (TU4-02) within the CRC APE, as well as to within about 3 m of the WSDOT/NPS boundary fence (TU4-04). The latter test unit "appears to be on the outer edge of the house and house yard deposits related to House 4/4B" (O'Rourke et al. 2010:208).

The remaining test units, all situated to the north, reflected various levels of disturbance, such as buried asphalt and coal layers, from later activity. Similarly, the first three shovel tests to the south also reflected disturbance, probably from "one of the many phases of SR 14 construction" (O'Rourke et al. 2010:214). In contrast, the southern two shovel probes "may be within the historic pond" (O'Rourke et al. 2010:214, 216). ST4-04 and ST4-05 both contained high frequencies of "mixed 19th and 20th century" cultural materials in fill deposits. These shovel tests were excavated to depths of 90 cm and 80 cm, respectively, without reaching the bottom of the fill deposits.

As elsewhere in the I-5/SR-14 interchange area, the archaeological record on the two sides of the WSDOT/NPS property fence is remarkably different. This situation is not surprising, as the WSDOT parcel lies within a construction zone that was subject to substantial impacts during previous reconfigurations of the I-5/SR 14 interchange, while the NPS Army property behind the boundary fence was largely protected from major impacts.

Almost no continuity is apparent in the distribution of artifacts and cultural features across the WSDOT/NPS property boundary. The one only possible exception is the slightly higher frequency of artifacts in TU-G, the closest test unit on WSDOT property to the test units on NPS property interpreted to reflect the presence of House 4/4B. No cultural features were encountered and no evidence of the historic pond was found during the investigations on the WSDOT property. Although significant archaeological resources were formerly present in site 45CL913, the archaeological evidence appears to have been almost totally removed during previous highway construction.

The area containing WSDOT parcel W5B was identified as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007). The results of the investigations reported here do not support any change in that status, as the archaeological remains in site 45CL913 do not contribute any substantial new information about the archaeology or history of the Vancouver National Historic Reserve Historic District.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL913 as not National Register eligible, no further archaeological investigations are recommended at W5B. However, there is always a possibility that previously unidentified and potentially significant evidence of prehistoric or historic occupation or activity may be exposed during construction-related earthmoving. Considering its location within the former site of the Kanaka Village at HBC Fort Vancouver, monitoring by an archaeologist is recommended during any earthmoving in this area associated with construction for the CRC project.

8. WASHINGTON AREA 8A (45CL914)

Located in the northeast quadrant of the I-5/SR 14 interchange, Washington Area 8 (W8) is a WSDOT parcel within a loop created by the I-5 Exit 1B off-ramp connecting to C Street in downtown Vancouver (Figure 8-1). W8 is divided into two subareas by a set of overpasses. W8A is on the east side of a ramp from westbound SR 14 onto northbound I-5. W8B is on the west side of a ramp from southbound I-5 onto eastbound SR 14. This chapter describes the results of archaeological discovery investigations and testing in W8A (Figure 8-1).

Data recovery excavations to mitigate impacts from construction during earlier reconfigurations of the I-5/SR 14 interchange were undertaken within the area of present-day W8A in 1974 and 1975 (Chance and Chance 1976; Chance et al. 1982) and again in 1981 (Thomas and Hibbs 1984). Afterwards, massive construction excavations were conducted through this area in connection with emplacement of the I-5 Exit 1B off-ramp to downtown Vancouver and the SR 14 ramps crossing W8A today.

Construction of the loop for the I-5 Exit 1B off ramp involved a deep cut into the Pleistocene gravels that removed a substantial amount of native soil, including previously identified cultural deposits associated within the HBC's Kanaka Village and the U.S. Army Quartermaster's Depot at Vancouver Barracks. Construction of the overpasses involved placement of deep fill inside the loop that covers most of the ground surface within W8.

In order to determine if any significant archaeological deposits are still present, archaeological investigations were conducted at W8A between April 14 and April 24, 2009. These investigations resulted in the discovery of intact cultural features and associated cultural materials beneath the fill in the southern portion of W8A. These archaeological remains have been recorded with DAHP as site 45CL914.

Site 45CL914 is on WSDOT property situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army Quartermaster's Depot at Vancouver Barracks. The designation 45CL300, originally applied to Kanaka Village, was expanded in 1984 to subsume all archaeological resources in this area, including the parcel in which 45CL914 has been recorded (Thomas and Hibbs 1984:2). The WSDOT parcel containing 45CL914 was identified as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007).

HISTORICAL SETTING

W8A is situated on the northwestern edge of Kanaka Village at HBC Fort Vancouver. Although no village houses are known to have been present in this area, it is possible that evidence of activity by the residents of Kanaka Village could be found in W8A. Several U.S. Army buildings were formerly located within, or adjacent to, W8A. Although situated in proximity to the Quartermaster's Depot, which developed along the southwest side of Vancouver Barracks beginning in the 1850s, U.S. Army buildings formerly present in W8A date from later times. Two

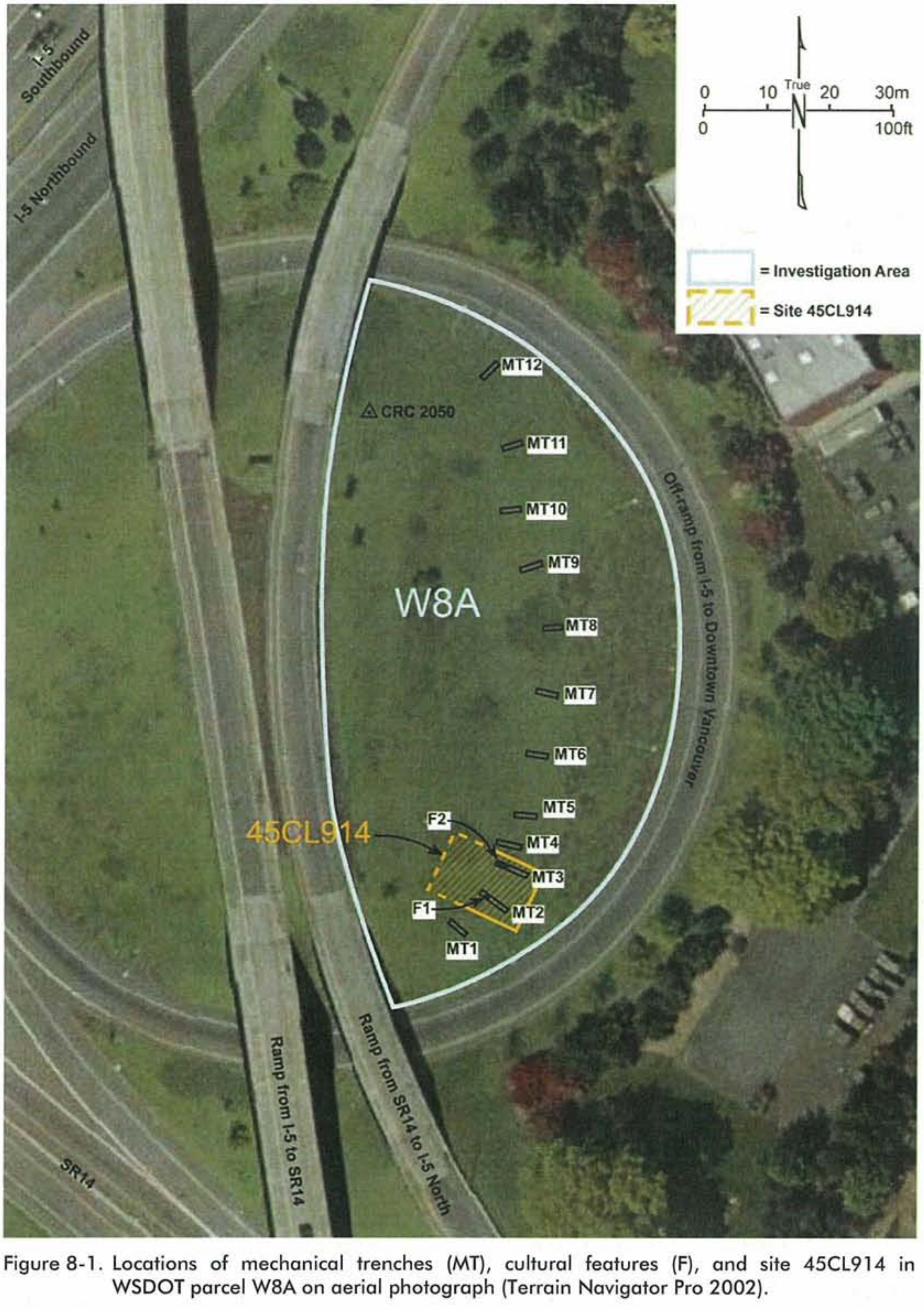

Figure 8-1. Locations of mechanical trenches (MT), cultural features (F), and site 45CL914 in WSDOT parcel W8A on aerial photograph (Terrain Navigator Pro 2002).

U.S. Army buildings dating from 1936 and 1944 once stood on the ground now encircled by ramps in the I-5/SR 14 interchange (O'Rourke and Wilson 2010:101).

PREVIOUS ARCHAEOLOGY

Archaeological investigations were carried out within the general area of W8 in conjunction with construction during two earlier reconfigurations of the I-5/SR 14 interchange. The first reconfiguration prompted investigations in 1974 and 1975 by the University of Washington (Chance and Chance 1976; Chance et al. 1982). The second configuration led to investigations in 1980 through 1983 by Eastern Washington University (Thomas and Hibbs 1984).

University of Washington Investigations

The map of the University of Washington investigations indicates that two large U.S. Army buildings (B. 120 and B. 134) covered much of present-day W8A in 1974 (Chance and Chance 1976:38). Five operations (Operations 5, 6, 10, 12, and 16) involving excavations of varying extents were conducted within the immediate vicinity of W8A (Chance and Chance 1976).

In Operation 5, "shadows" from several planks were exposed that appeared to "derive from the Kanaka Village or early Army period;" however, "the associated artifacts were insufficient for temporal assignment" (Chance and Chance 1976:25). It was observed that, as in other operations, "there was abundant evidence that the Army had repeatedly paved the area with various layers of gravel" (Chance and Chance 1976:25).

In Operation 6, several features were exposed in stratigraphic order, beginning with (1) a cobble drain probably associated with a still-standing Army building; (2) a square concrete footing with the remains of a wooden post on its center that was probably part of a fence; and (3) a line of square post molds in round post holes from a still earlier fence. The post molds and holes "penetrated a silty flood layer believed to be from the flood of 1862" (Chance and Chance 1976:26). Below the silt layer was a thin scatter of Hudson's Bay Company period artifacts, some of which were found within shallow basin-shaped pits 12 to 18 inches in diameter. These pits, which contained mottled orange soil that suggests fires, "probably date from the Kanaka Village period" (Chance and Chance 1976:26).

Operation 10, roughly midway between the two operations described above, also contained the silt stratum encountered in Operation 6. However, unlike the situation in Operation 6, where the silt stratum "clearly separated Hudson's Bay Company from Army materials," the silt stratum in Operation 10 contained wire nails and amber-colored glass, "casting doubt on the belief that it represented the 1862 flood" (Chance and Chance 1976:27).

In Operation 12, "a shallow 20th-century pit filled with coal, ash and clinkers" was partially excavated; four artifacts "assignable to the Hudson's Bay Company or early Army period" were found (Chance and Chance 1976:28). Excavation in Operation 16 was limited to a small test in which two wooden posts situated 4.5 feet apart were exposed 2 feet below surface (Chance and Chance 1976:30).

Eastern Washington University Investigations

Operations 5, 6, and 10 from the 1974 University of Washington investigations were later encompassed by the 1981 Eastern Washington University investigation area referred to as Operation 6, in which 64 units, each measuring 5 by 5 feet, were excavated. The stratigraphy in this area was described as containing "the ideal sequence for Kanaka Village:"

> Stratum 1, twentieth century U.S. Army gravel fill, was found throughout the operation, and included the construction pad fills for Building 134. Stratum 2 is a homogeneous, sterile dark brown silt flood deposit similar to that found in other 1981 operations. Stratum 2 had been extensively disturbed by the digging of sewer lines, trenches, storm drains, etc. Stratum 3 is a culturally enriched A horizon and includes early U.S. Army and Hudson's Bay Company period deposits. (Thomas and Hibbs 1984:66)

Sixty-eight cultural features were recorded, including 30 from Stratum 1 and 38 from Stratum 3. The Stratum 1 features are 9 posts, 6 trenches and pipelines, 5 pits, 2 large cobble drains, 2 features associated with the building pad for the mule barn, 1 brick fireplace, 1 shallow depression, 1 stake, and 1 possible dripline, as well as Chance and Chance's 1974 excavation units and plow scars. The Stratum 3 features are 8 posts, 5 stakes, 2 pits, 15 fire areas, 3 lineal features, and 5 surficial features. The results of the Operation 6 investigations were interpreted as representing four components.

- Component 1 (1826–1860) "consisted of a scatter of fire areas" that "varied widely in size, shape, and contents, and their use probably should not be attributed to a single function" (Thomas and Hibbs 1984:87, 90). At least some of these features were thought to represent small hearths or firepits at campsites used by travelers visiting Fort Vancouver.

- Component 2 (pre-1845) consisted of a compact floor outlined by three posts suggesting a structure measuring 15 by 8 feet. The structural remains and artifacts suggest "an insubstantial dwelling" estimated to date from before 1845, based on the absence of a structure at this location on the Vavasour and Covington maps (Thomas and Hibbs 1984:94).

- Component 3 contained evidence of the gardens and related features associated with the Quartermaster's residence, which were depicted as early as the 1854 McConnell map (Hussey 1957:Plate XVI). This "garden may have been in existence as early as 1850 when Rufus Ingalls first erected the 'Quartermaster's ranch'" (Thomas and Hibbs 1984:94).

- Component 4 (post-1860) consisted of evidence of a saddler's shop or a harness shop that are known from documentary sources, although neither is shown on any historic maps (Thomas and Hibbs 1984:94–95).

The Eastern Washington University investigations in 1981 included further work in Operation 20, a designation used during the earlier University of Washington investigations to refer to the site of the Quartermaster's House built in 1850–1851 by Rufus Ingalls. The Eastern Washington University investigations, which involved several "separate excavation blocks," were all situated to the east of the University of Washington's Operation 20. Of the 1981 investigations, Operation 20A (Phase 1) falls within the southernmost portion of W8A. Eleven 5-by-5 foot units were excavated in this area, resulting in the documentation of nine features. Two features, a wooden stake and a "possible posthole," "were tentatively identified as pre-1860." The remaining seven features were "associated with the twentieth century" (Thomas and Hibbs 1984:312).

The Eastern Washington University investigations also included work at Operation 50, where unit excavations and "extensive machine stripping of swaths" were conducted around the University of Washington's Operations 12 and 16 in the northern portion of W8A (Thomas and Hibbs 1984:363–402) Implementation of these "machine operations" resulted in documentation of "a relatively large number of features" (Thomas and Hibbs 1984:363). These investigations revealed "evidence of the later quartermaster's depot stable sheds," documented "an early fence line," and verified the locations of "two 1906 buildings" (Thomas and Hibbs 1984:363).

GPR RECONNAISSANCE

The GPR reconnaissance at W8A involved surveys along four lines using high-power 200 MHz antennae. The lines were oriented north–south, with about 3.0 m between lines. The four GPR lines were CRC Line 113 (120.5 m), CRC Line 114 (120.0 m), CRC Line 115 (115.0 m), and CRC Line 116 (108.5 m). The 200 MHz lines extended over a total distance of 464.0 m.

Inclined reflections from the underlying Pleistocene gravels were truncated at about 20 nanoseconds (ns) (1.0 m below surface) along most of CRC Line 114, CRC Line 115, and CRC Line 116. Along CRC Line 113, the lowest in elevation and closest to the base of the slope, the inclined reflections indicated that the Pleistocene gravels were closer to the surface. Based on these representative lines, it is predicted that fill covers 100 percent of W8A. The depth of resistive fill ranges from 15 ns (0.75 m below surface) to 60 ns (3.0 m below surface). The average depth of fill in W8A suggested by the GPR profiles was 32 ns (1.6 m below surface). Fill depth is predicted to increase with distance upslope (from east to west) at elevations above 10.0 m NAVD88.

Large concave anomalies at 30–50 ns (1.5–2.5 m below surface) with lateral chaotic reflections occurring in the south ends of profiles along CRC Line 114 and CRC Line 115 at profile distances of about 100.0 m were later determined to be cultural features.

FIELD INVESTIGATIONS

Most of W8A consists of steeply sloping terrain created when fill material was brought in to support the ramps/overpasses in this quadrant of the I-5/SR 14 interchange. The highest ground is adjacent to the SR 14 ramp onto I-5 on the west side of W8A. From there, the ground slopes downward to the I-5 Exit 1B off-ramp loop into downtown Vancouver. This loop was constructed by excavation of a deep cut into the natural ground surface immediately west of the U.S. Army land. As noted above, substantial highway archaeology investigations in 1981 documented extensive evidence related to historic U.S. Army activities in this area.

In view of the substantial ground disturbance associated with construction of the I-5 Exit 1B loop, which included both cutting and filling, it was first necessary to determine the approximate elevations on the filled slope in W8A at which discovery investigations might intercept the original ground surface on which cultural deposits and features might be found. A Total Station was employed to record elevations on the surface of the Kanaka Village area around the Engagé House reconstructed in 2007 on National Park Service land to the east. These measurements were then used to arrive at a general idea of the elevation of the original ground surface in W8A.

Mechanical Trenching

In view of the results of the GPR reconnaissance indicating the presence of deep fill, archaeological discovery investigations in W8A involved excavation of series of 12 short trackhoe trenches perpendicular to the slope (Figure 8-2). Original plans called for these mechanical trenches (MTs) to be located at 10-m intervals. However, discovery of cultural deposits and features (historical artifacts and brick piers) in the southern portion of W8A shortly after mechanical excavation commenced necessitated a different approach, and trenches in this area were spaced more closely to help define the extent of archaeological remains. The five southern trenches (MT1 through MT5) were excavated at roughly 5-m intervals, while the remaining trenches (MT6 through MT12) were excavated at 10-m intervals (Figure 8-3). All trenches contained an upper layer of black topsoil from landscaping, below which were gravelly fill deposits that extended down to the top of the Bw horizon. The fill in MT1 through MT6 contained building rubble in the form of concrete chunks and common red brick fragments. The thickness of the fill layers was greater in the southern trenches (MT1 through MT6) relative to the northern trenches (MT7 through MT12) because of the way in which construction excavations had contoured the sloping ground adjacent to the I-5 Exit 1B loop in the 1980s.

No intact, buried A horizon soil was noted in any of the trenches. A compacted, mixed A horizon was present in MT2 and MT3. Intact Bw horizon soil and Pleistocene gravels were observed below the fill in most of the trenches (Bw was absent in MT5 and MT6). In some cases, a transition zone of mixed or redeposited Bw separated the overlying fill from the intact Bw (MT7 through MT11). The depth (below current ground surface) of the intact Bw and Pleistocene gravels was significantly less in MT7 through MT12 due to the reduced amount of overlying fill.

In general, the stratigraphy in the trenches indicates that past grading of the area removed the original A horizon as well as some (or at MT5 and MT6, all) of the underlying Bw horizon. Below the fill, the compacted, mixed A horizon in MT2 and MT3 contained cultural features and associated artifacts. The mechanical excavations continued to the top of the Pleistocene gravels in all trenches, except in MT11 where the lowest sediments (at 110 cmbs) were characterized as "transitional" to the gravels.

Manual Excavations

Upon encountering cultural features in the trackhoe trenches, manual excavations were undertaken in MT2 and MT3 to further expose the brick piers and to recover associated artifacts. The manual excavations were carried out in two test units situated to encompass the features.

In MT2, manual excavations involved removal of shallow, dark-stained artifact-bearing deposits in a unit measuring 150 cm north–south (the trench width) by 250 cm east–west. The brick pier (Feature 1) and associated cultural deposit were encountered below multiple layers of fill in a mixed, compacted, A horizon soil. This cultural layer, situated at roughly 100–120 cmbs (measured from the ground surface at west end of the trench), overlay intact Bw horizon soil. A distinct area of dark soil distinguishable from adjacent mixed Bw and identified as additional mixed, compacted, A horizon soil, was present in the southwest corner of the trench. Situated about 50 cm west of the brick pier, this area measured 80 cm north–south by 60 cm east–west (continuing westward into unexcavated ground) and extended from 120 to 140 cmbs. It was excavated in two 10-cm levels. Fifteen of the 21 artifacts recovered during exposure of the brick pier came from this dark soil area.

Figure 8-2. View north, at the beginning of mechanical trench excavations in the southern portion of WSDOT parcel W8A.

Figure 8-3. View southwest, at the end of mechanical trench excavations in the northern portion of WSDOT parcel W8A.

In MT3, the manual excavations involved removal of shallow dark-stained cultural deposits to the top of the underlying Bw in a test unit measuring 150 cm north–south (the trench width) by 210 cm east-west. In comparison with Feature 1 in MT2, where most of the artifacts were recovered from a distinct deposit (the dark soil area), the 195 artifacts recovered during exposure of the Feature 2 brick pier in MT3 were fairly evenly distributed across the excavated area. The cultural materials occurred below multiple layers of fill in a mixed, compacted, A horizon soil situated at roughly 80 to 90 cmbs (measured from the ground surface at the west end of the trench.

DESCRIPTION OF DEPOSITS

The dimensions and depths of the mechanical trenches excavated at site 45CL914, as well as the depths to intact Bw and Pleistocene gravels, are summarized in Table 8-1. The stratigraphy across the site was reasonably uniform, with four main depositional units recognized: (1) black topsoil containing an ivy root zone, (2) gravelly fill deposits, (3) the Bw horizon, and (4) Pleistocene gravels. An intact A horizon soil was not present in any of the trenches, but a compacted mixed A horizon containing cultural features and associated artifacts was exposed in MT2 and MT3. Profiles of the stratigraphy exposed during documentation of the cultural features clearly indicate that the archaeological deposits continue to the west beneath the sloping earthen berm supporting the SR 14 ramps (Figure 8-4).

Table 8-1. Summary of Discovery Trench Excavations at Site 45CL914.

Trench No.	Dimensions (N–S by E–W)	Maximum Depth (at West End)	Top of Intact Bw (at Mid-Trench)	Top of Pleistocene Gravels (at Mid-Trench)
MT1	1.1 × 2.9 m	210 cmbs	170 cmbs	190 cmbs[a]
MT2	2.0 × 5.8 m	146 cmbs	102 cmbs	92 cmbs[b]
MT3	2.0 × 6.0 m	112 cmbs	48 cmbs	58 cmbs[c]
MT4	1.3 × 4.5 m	160 cmbs	110 cmbs	130 cmbs
MT5	1.5 × 4.5 m	140 cmbs	not present	13 cmbs
MT6	1.1 × 3.3 m	140 cmbs	not present	85 cmbs[d]
MT7	1.0 × 2.8 m	130 cmbs	35 cmbs	85 cmbs
MT8	1.2 × 3.3 m	110 cmbs	45 cmbs	65 cmbs
MT9	1.2 × 2.0 m	70 cmbs	25 cmbs	50 cmbs
MT10	1.2 × 2.2 m	130 cmbs	45 cmbs	100 cmbs
MT11	1.3 × 2.6 m	130 cmbs	40 cmbs	110 cmbs[e]
MT12	1.3 × 2.0 m	120 cmbs	10 cmbs	40 cmbs

[a] cmbs = centimeters below surface.
[b] at east end only; mixed A Horizon at ca. 80 cmbs in middle of trench.
[c] at east end only; mixed A Horizon at ca. 42 cmbs in middle of trench.
[d] at east end only.
[e] top of *transition* to Pleistocene gravels.

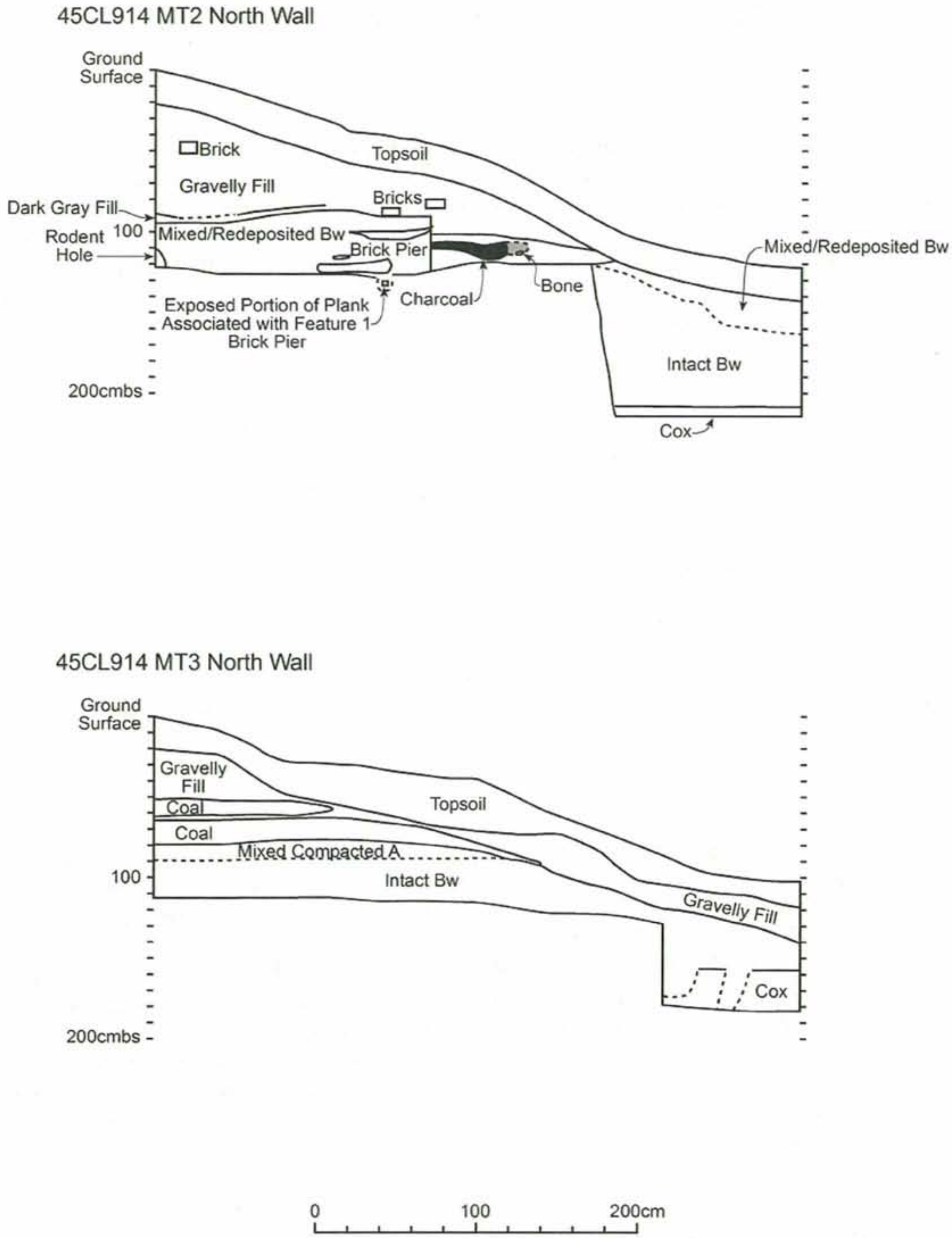

Figure 8-4. Stratigraphic profiles of the north walls of MT2 (upper) and MT3 (lower) at site 45CL914.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

Feature 1, exposed in MT2, consisted of a brick pier, wood pole and plank, and associated artifacts (Figure 8-5). The top of the pier was at about 140 cmbs and the base (at about 160 cmbs) rested on the top of the Bw soil horizon. The brick pier, which was aligned according to true north, was constructed of three courses of common red bricks. Most of these bricks measure 8 × 3¾ × 2 inches. One brick on the southeast corner of the pier represents a cruder brick style and measures 7¾ × 3½ × 2 inches. The wood plank, which was aligned east–west, was bordered on its south side by a horizontally lying wooden pole. The pole and plank were both underlain by a deposit of clean, salt-and-pepper sand of undetermined thickness and horizontal extent.

Feature 2, exposed in MT3, consisted of three groups of bricks (Figure 8-6). The westernmost group was a brick pier aligned to true north like the pier in Feature 1, but with only two courses intact. The easternmost group had a similar configuration to the Figure 1 brick pier but was incomplete. The middle group of bricks appeared to be debris from the other groups. Together, the three groups of bricks extended over an area measuring about 50 cm north–south by 190 cm east–west. The tops of the bricks ranged from about 65 to 75 cmbs, depending on how many courses were present; the bases rested on the Bw soil. The bricks comprising Feature 2 were common red bricks measuring 8 × 4 × 2–2¼ inches.

The orientation of the brick piers (in terms of cardinal direction) appears to be the same. They also are at approximately the same elevation. Considering these factors and the location of the brick piers close to one another, it seems likely that these two features were associated with the same building.

Artifacts

In contrast to the other sites in WSDOT parcels around the I-5/SR 14 interchange, where most of the artifact assemblages were recovered from fill deposits, the 217 historical artifacts (a total reflecting a few complete objects, but mostly fragments of varying sizes) recovered during the investigations at W8A were found in mixed A horizon soils and were directly associated with cultural features (Table 8-2). Well over half of this assemblage is made up of items classifiable as domestic (household accoutrements, food products, and food preparation, consumption, and storage vessels) and personal (smoking implements and alcoholic beverage containers, clothing, and containers for grooming and medical products), as well as fragments of unidentifiable bottles and jars, the contents of which were very likely domestic or personal in nature. Slightly less than 40 percent of the assemblage consists of structural materials (largely window glass) and tools and hardware (mostly nails). Because of the highly fragmentary nature of most of the artifacts, none were considered suitable for illustration.

MT 2 Feature 1 Artifacts

The artifacts recovered during the excavation of the Feature 1 brick pier in MT2 are divided into two groups—those from immediately around the pier and those from the dark soil area situated just west of the pier. Only six items were present in the mixed A horizon soil surrounding the

Figure 8-5. View west, showing Feature 1, a brick pier, in MT2 at site 45CL914.

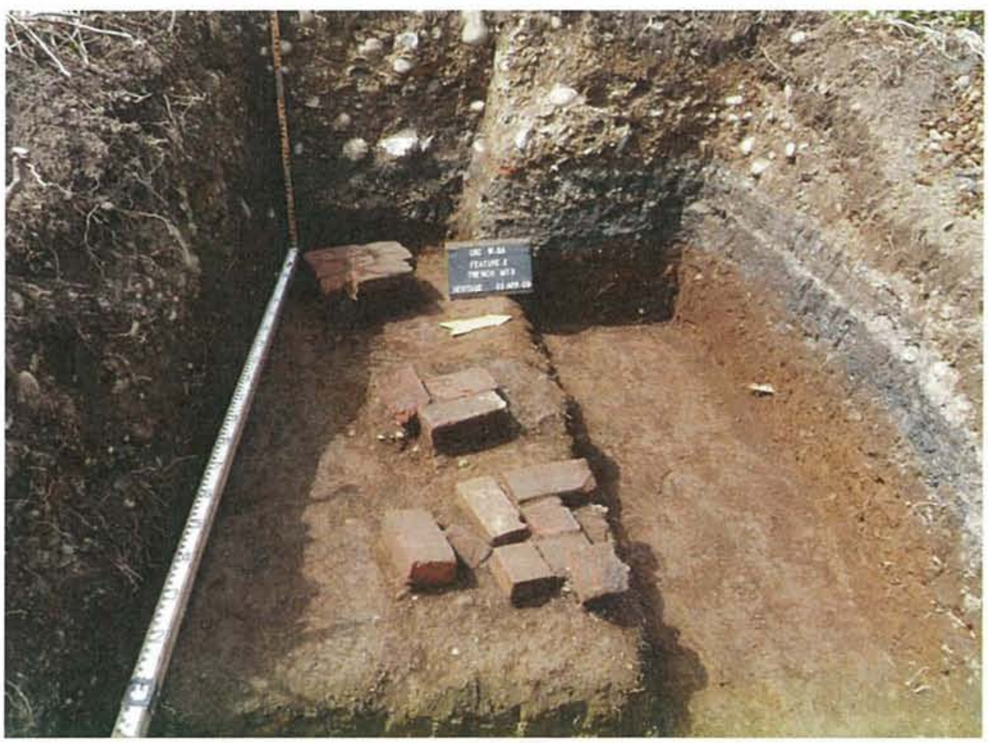

Figure 8-6. View west, showing Feature 2, a brick pier and fallen bricks, in MT3 at site 45CL914.

Table 8-2. Artifact Summary for Site 45CL914.

Artifact Group/ Category	Artifact Types	MT2* F1	MT3 F2	Totals
Activities				
Firearms	Rifle bullet		1	1
Tools	Metal file	1		1
Domestic				
Food Preparation & Consumption	Ceramic saucer	(3)		3
	Metal flatware		3	3
Food Storage	Stoneware crock		3	2
Faunal				
Mollusc	Smooth Washington clam shell		1	1
	Oyster shell	(1)		1
Indefinite				
Containers	Glass bottle/jar	(3) + 1	70	74
Indefinite	Ceramic item	(4)	17	21
	Flat glass		1	1
	Glass item		19	19
	Metal item		2	2
	Wire	1		1
	Plastic wrapper		2	2
Personal				
Clothing	Overall buckle		1	1
Grooming & Health	Metal medicine bottle cap		1	1
Social Drugs - Alcohol	Beer bottle		1	1
Social Drugs - Tobacco	Clay pipe	(1)		1
Structural				
Hardware	Bolt		1	1
	Wing nut		1	1
	Wire nail	2	17	19
	Indeterminate nail	(2)	4	6
Materials	Brick	1	1	2
	Roofing slate		1	1
	Window glass	(1)	49	50
Totals		(15) + 6	196	217

MT = Mechanical Trench F = Feature
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments
* Artifacts in parentheses were recovered from the "dark soil area" associated with the Feature 1 brick pier in MT2

pier; most are structural materials and hardware. One complete common red brick with no brand, two wire nails, one piece of wire imbedded in a piece of concrete, one three-sided metal file, and one nondiagnostic aqua bottle body fragment make up this part of the assemblage.

The 15 artifacts from the dark soil area adjacent to MT2 Feature 1 are more domestic and/or personal in nature. Ceramic table wares are represented by three earthenware saucer fragments, one of which appears to exhibit a tiny remnant of a blue transferware design and the others being undecorated. One of the saucer fragments is of white improved earthenware. Of four additional undecorated pieces for which vessel form and function could not be determined because of their small size, three are earthenware and one is vitreous china. Glass items are three nondiagnostic bottle body fragments—one aqua, one amber, and one colorless. A piece from a clay smoking pipe stem has no mark identifying the maker. The remaining items are two wire nails and a fragment of window glass measuring 0.077 inch thick.

MT3 Feature 2 Artifacts

The assemblage associated with the Feature 2 brick pier in MT3 is much larger than that from Feature 1, with a total of 196 artifacts. This is largely the result of the presence of large amounts of bottle/jar and window glass (n=70 and n=49, respectively). Domestic/personal items in the assemblage are and a one or more crocks, pieces of metal flatware, fragments from beer and possible soda-pop bottles, a cap from a Bayer Aspirin bottle, glass and ceramic fragments from containers of indeterminate function, an overall buckle, and a clam shell assumed to be food remains. Among the ceramic items are base fragments from an earthenware dish manufactured by Poxon China, Ltd., and seven pieces of undecorated white improved earthenware. The bottle fragments include pieces with an applied bead finish, the signature shoulder ring from a stubbie beer bottle, and marks from Obear-Nester and Owens-Illinois glass companies. Colorless glass is abundant in the assemblage; eight pieces have turned a pale shade of amethyst.

Structural materials and hardware items from MT3 Feature 2, while dominated by window glass, also contains numerous wire nails and some nails that are too deteriorated to type, as well as nuts and bolts, wire, a brick, roofing slate, and a piece of thick flat glass. Also present is a bullet from a rifle cartridge.

Temporally Diagnostic Artifacts from the Features

Since the two brick piers are viewed as parts of a single building, temporally diagnostic artifacts from these two features are discussed together. The feature assemblages contain numerous temporally diagnostic artifacts (Table 8-3), but few with narrow enough date ranges to help identify time(s) of construction and/or activity at site 45CL914.

The blue transferware tableware fragment was much too small to identify as to pattern. While the transferware process began in the 18th century, it is likely that this piece would date no earlier than the late 1820s (with the arrival of the HBC). A single porcelain fragment exhibits gold gilt paint, which was introduced ca. 1880. An undecorated fragment from an earthenware dish bears the mark used by the Poxon China Company from 1916 to 1928.

Several amber bottle fragments were helpful in the dating process. One appears to be an applied wide bead finish fragment from a mold-blown bottle. This type of finish was commonly produced from the 1840s until the early twentieth century. A base fragment from beer bottle exhibits the N in a square basemark used by the Obear-Nester Glass Company by 1915 (this mark continued in use until 1980). A shoulder fragment from a stubbie style beer bottle dates to sometime after their introduction in 1935. One amber fragment as well as one colorless fragment exhibit characteristics from having been produced in an automatic bottle machine (since 1905). The eight sun-colored amethyst bottle fragments likely came from bottles manufactured between the 1870s and ca. 1920. Finally, a green bottle base fragment, probably from a soda bottle, bears an Owens-Illinois Glass Company mark with a date code indicating manufacture in 1937.

A metal screw-cap closure embossed with the "Bayer Cross" is from a glass bottle that contained Bayer aspirin tablets. Non-prescription packaging labeled with the Bayer name was introduced in 1915.

Window glass from the two features was combined to derive a possible date (or dates) of construction for the building(s) from which these fragments came. Using Roenke's (1978) Pacific Northwest glass dating formula, primary, secondary, and tertiary modes were recognized. The

Table 8-3. Temporally Diagnostic Artifacts from Site 45CL914.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	Reference
MT2 Feature 1 Dark Soil	White improved earthenware saucer fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Window glass fragment	0.077 inch thick	1850–1865*	Roenke (1978:116)
	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
MT2 Feature 1 Pier Excav.	Wire nails (n=2)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
MT3 Feature 2	White improved earthenware body fragments, indeterminate vessel type (n=7)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Amber bottle neck	Applied wide bead finish	1840s–early 1900s	SHA (2009)
	Window glass fragments (n=49)	Primary thickness mode = 0.095 Secondary thickness mode = 0.85 Tertiary thickness mode = 0.65	1870–1900 1855–1885 1845–1855	Roenke (1978:116)
	Colorless bottle/jar fragments (n=21)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Amethyst bottle/jar fragments (n=8)	Sun-colored amethyst	1870s–ca. 1920	SHA (2009)
	Porcelain fragment	Gold gilt paint	Since ca. 1880	Polk and Phillips (2005)
	Wire nails (n=17)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
	Amber and colorless bottle fragments (n=2)	Produced in an automatic bottle machine	Since ca. 1905	SHA (2009)
	Amber bottle base	Embossed N-in-square mark from Obear-Nester Glass Co.	1915–1980	Whitten (2007)
	Aluminum cap to Bayer Aspirin tablet bottle	Over-the-counter packaging embossed w/ Bayer Cross logo	Since 1915	Bellis (2009); Wikipedia (2009a)
	Earthenware dish fragments (n=2)	Printed mark from Poxon China	1916–1928	Lehner (1988:488–489)
	Amber Stubbie beer bottle fragment	Stubbie-style embossed shoulder ring	Since 1935	SHA (2009)
	Green soda bottle(?) base	Embossed diamond OI mark w/ year code 7 from Owens-Illinois Glass Co.	1937	Lockhart (2006)

MT = Mechanical Trench

* A window glass thickness mode (Roenke 1978) is not presented for the glass from MT2 Feature 1, as only one fragment was found. The thickness of this piece is listed, and the date range provided reflects the mode into which the individual measurement would fall if a modal analysis was being conducted.

primary mode of 0.095 inch suggests a construction date sometime between 1870 and 1900; the secondary mode of 0.085 inch suggests construction between 1855 and 1885; and the tertiary mode of 0.065 inch suggests construction between 1845 and 1855. According to Roenke's formula, much of the window glass may be from a building (or buildings) constructed during the latter half of the nineteenth century and some may be from an earlier structure.

Although not as temporally diagnostic as the artifacts discussed above, the occurrence of 19 wire nails (and the complete absence of earlier machine-cut or hand forged nails) is largely consistent with this time frame. Wire nails became readily available ca. 1884, and by about 1900 nearly all frame structures were being constructed using this type of nail.

Also consistent is the presence of 35 fragments of colorless glass. These items, most from bottles and jars, are the likely products of glass decolorization processes that gained popularity in the 1870s because the glass could be produced in large batches. However, colorless glass was being made into bottles, tablewares, and utilitarian objects such as lamp chimneys long before this time (as witnessed by large numbers of fragments in the HBC collections at Fort Vancouver), and the presence of colorless glass is not used exclusively to date any site to the last years of the nineteenth century or later. White improved earthenwares have been found in assemblages dating to both the HBC and U.S. Army use of the area. The invention was patented in England in 1813; however, commercial imports of these wares to the United States were not common until the 1840s. These sturdy ceramics continue to be made today.

Based on these dates and date ranges for artifacts from MT2 Feature 1 and MT3 Feature 2, it is inferred that most of the items were manufactured during the early half of the twentieth century. It is possible however, examining the early ends of manufacturing date ranges, that a few of these items might have actually been produced in the nineteenth century and that the assemblage from site 45CL914 reflects a mixture of artifacts from multiple uses of the area. In particular, the broad range in window glass thickness raises the possibility that window panes from earlier structures were reused in a twentieth century building in this location.

ANALYSIS AND INTERPRETIVE RESULTS

Discovery investigations in the form of a series of short trenches excavated by means of a trackhoe verified the results of the GPR reconnaissance, confirming that fill materials to depths ranging from 0.5 to 3.0 m cover most of W8A. The mechanical trench excavations established that the native A horizon soils, in which evidence of prehistoric and historic occupation might most likely be found, for the most part are no longer present, having apparently been removed during deep excavations for construction of the I-5 Exit 1B off-ramp that forms the eastern boundary of W8A.

Despite impacts from previous highway construction, the discovery trenching exposed cultural features and associated deposits in mixed A horizon soils below multiple fill layers in the southern portion of W8A (Figures 8-7 and 8-8). The two features consist of brick piers similar to those used to support late nineteenth and early twentieth century structures associated with the U.S. Army's Quartermaster's Depot at Vancouver Barracks. These features were both associated with a mixed, compacted, A horizon soil corresponding to a dark soil band visible in the adjacent trench walls. These buried structural features and associated cultural deposits correspond to large concave anomalies identified along CRC Line 114 and CRC Line 115 surveyed during the GPR reconnaissance.

The brick piers, which have the same alignment and same approximate elevation, are close enough together to suggest that they were probably associated with the same building. These features appear to be situated within the general area of Eastern Washington University's Operation 20A, where several unremarkable features dating to the twentieth century were documented (Thomas and Hibbs 1984:312). It was suggested that the Operation 20A features might be associated with "Building Q," an officer's quarters built sometime between 1904 and 1914 and destroyed before 1944 (Thomas and Hibbs 1984:304, 312). This building is shown as located to the east of the Quartermaster's house, identified as "Officers S" on the 1914 Homan map, and as building "S" on the 1935 Carsner map of Vancouver Barracks (Thomas and Hibbs 1984:785, 787). The manufacturing date ranges for the artifacts recovered, with the possible exception of the window glass, are not inconsistent with the idea that the brick piers at site 45CL914 were associated with "Building Q".

NRHP ELIGIBILITY

W8A consists of WSDOT property situated in an area where data recovery excavations of archaeological resources associated with Kanaka Village and the U.S. Army Quartermaster's Depot were undertaken in the mid-1970s and early 1980s during earlier reconfigurations of the I-5/SR 14 interchange (Chance and Chance 1976; Chance et al. 1982; Thomas and Hibbs 1984). Construction of the I-5 ramp into Vancouver resulted in the removal of most of the archaeological resources identified during these earlier investigations. The objective of the discovery probing and trenching reported here was to determine if significant archaeological remains are extant in W8A.

W8A was included as a Non-Contributing Property within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007). The results of the archaeological discovery investigations and testing indicate that site 45CL914 in W8A contains significant historical archaeological remains. The brick piers recorded as Features 1 and 2 were probably associated with an early twentieth century U.S. Army structure, possibly with "Building Q," an officer's quarters built sometime between 1904 and 1914 and destroyed before 1944 (Thomas and Hibbs 1984:304, 312). The artifacts recovered in association with these features are generally consistent with this time period, and indicate that use of the area around these structures occurred during the early decades of the twentieth century. As a result, site 45CL914 is considered a significant historical archaeological site that meets the eligibility criteria for inclusion in the National Register under criterion d.

Site 45CL914 does not appear to meet the requirements for National Register eligibility under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5 and SR 14, and the massive amount of earth-moving during highway construction resulted in the widespread destruction of the historic setting in the I-5 and SR 14 corridors. As a result, the site does not meet the integrity requirement for significance under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

Site 45CL914 is in a WSDOT parcel (W8A) situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army Quartermaster's Depot at Vancouver Barracks. The designation 45CL300, originally applied to Kanaka Village, was later expanded to subsume all

Figure 8-7. View southwest, showing the portion of WSDOT parcel W8A in which brick piers were found (SR 14 ramp to I-5 and I-5 Columbia River bridges in background).

Figure 8-8. View north, showing the portion of WSDOT parcel W8A in which brick piers were found (I-5 Exit 1B off-ramp in foreground).

archaeological resources in this area, including the area recorded as site 45CL914 (Thomas and Hibbs 1984:2). The cultural features and artifacts encountered appear to relate to activities associated with a U.S. Army structure dating to the early decades of the twentieth century.

FUTURE MANAGEMENT OPTIONS

Due to the steep slope of the earthen berm that covers W8A, it was not possible to establish the western extent of the archaeological deposits at site 45CL914. In the event that subsurface impacts will occur to the west of the presently known site boundary, further investigations will be necessary to determine how far the archaeological deposits extend in that direction.

In view of the assessment of site 45CL914 as a significant historical archaeological site, the CRC project has the option of (1) avoiding any use of the southern portion of W8A that might result in impacts to site 45CL914, or (2) mitigate any impacts to site 45CL914 through data recovery excavations. Any further archaeological field investigations undertaken should be conducted in conjunction with thorough historical research of past uses and developments to maximize the interpretation of the historical archaeological record at W8A.

9. WASHINGTON AREA 8B (45CL915)

Located in the northeast quadrant of the I-5/SR 14 interchange, Washington Area 8 (W8) is a WSDOT parcel within a loop created by the I-5 Exit 1B off-ramp connecting to C Street in downtown Vancouver. W8 is divided by overpasses into two subareas. W8A is on the east side of a ramp from westbound SR 14 onto northbound I-5. W8B is on the west side of a ramp from southbound I-5 onto eastbound SR 14. This chapter describes the procedures and results of archaeological discovery investigations in W8B (Figure 9-1)

Data recovery excavations to mitigate impacts from construction during earlier reconfigurations of the I-5/SR 14 interchange were undertaken within the area of present-day W8B in 1974 and 1975 (Chance and Chance 1976; Chance et al. 1982) and again in 1981 (Thomas and Hibbs 1984). These investigations established the presence of significant archaeological resources in the southernmost portion of W8B. Subsequent construction of the overpasses for SR 14 that separate W8A and W8B involved placement of deep fill over the original ground surface.

In an effort to determine if any significant archaeological deposits are still present, archaeological investigations were conducted at W8B on April 14, 2009. Discovery trenching established that the fill material covering W8B contains historical artifacts. The great depth of the fill prevented the discovery investigations from determining whether undisturbed archaeological resources are present below the fill. The archaeological remains in W8B have been recorded with DAHP as site 45CL915.

Site 45CL915 is on WSDOT property situated on the western edge of the former area of Kanaka Village at HBC Fort Vancouver, and the southwestern edge of the U.S. Army Quartermaster's Depot at Vancouver Barracks. The designation 45CL300, originally applied to Kanaka Village, was expanded in 1984 to subsume all archaeological resources in this area (Thomas and Hibbs 1984:2). The revised western boundary of 45CL300 appears as a straight line, drawn without consideration for archaeological evidence or land ownership, that trends north–south more or less through the middle of 45CL915.

Site 45CL915 is within a WSDOT parcel (W8B) that lies outside the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007).

HISTORICAL SETTING

W8B is situated on the western edge of Kanaka Village at HBC Fort Vancouver. Although no village houses are known to have been located in this area, it is possible that evidence of activity by the residents of Kanaka Village may be present. An A horizon soil containing HBC artifacts was apparently scraped aside during construction of the U.S. Army Quartermaster's house on the southern margin of W8B (Chance and Chance 1976:32). A pit feature containing HBC artifacts was found during archaeological investigations at the Quartermaster's house in 1981 (Thomas and Hibbs 1984:334).

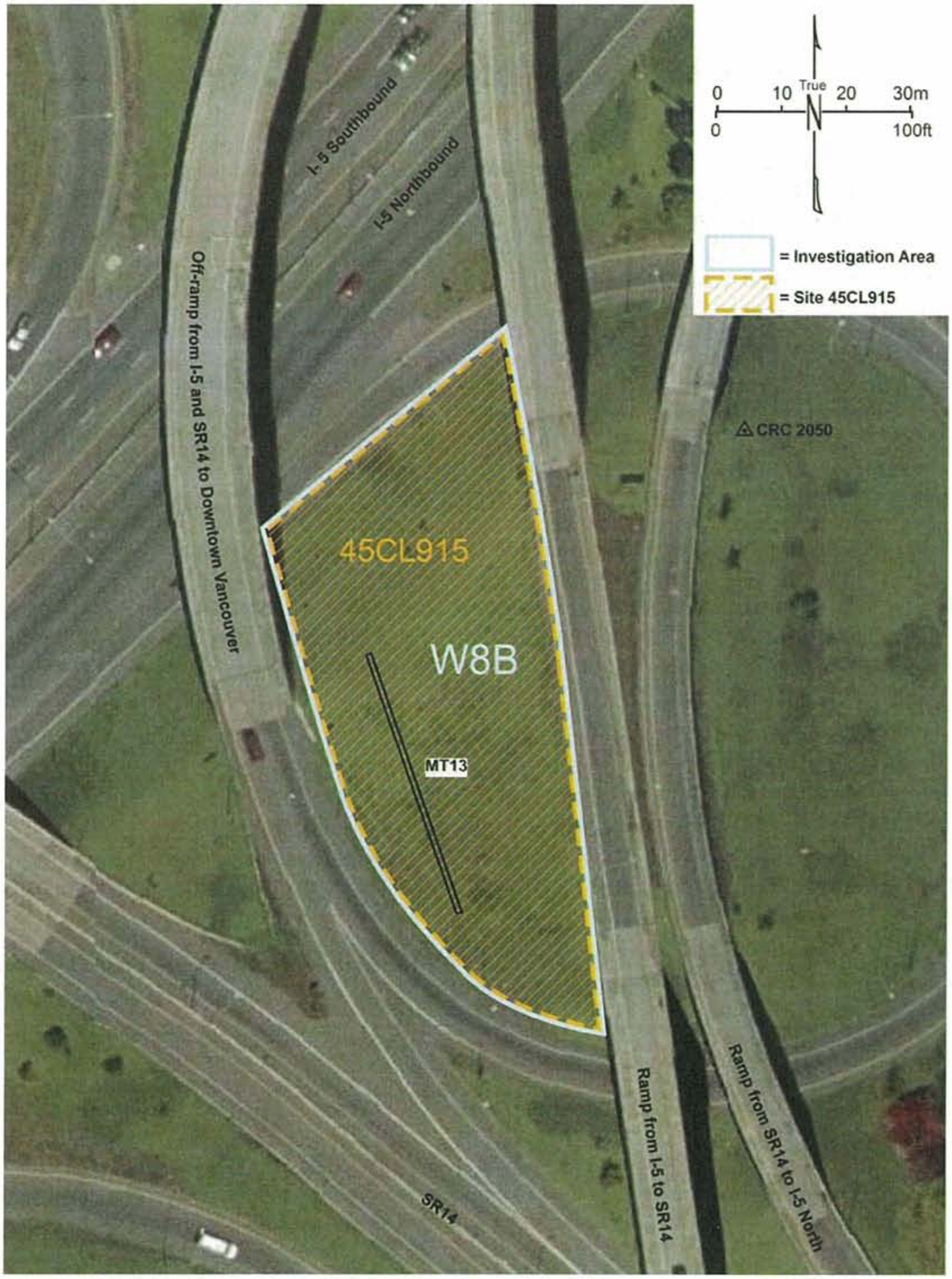

Figure 9-1. Locations of mechanical trench (MT) and site 35CL915 in WSDOT parcel W8B on aerial photograph (Terrain Navigator Pro 2002).

Sanborn Fire Insurance maps indicate that W8B lies immediately east across Reserve Street from the City of Vancouver. With the exception of the Quartermaster's house along the southern margin, historical maps of Vancouver Barracks show no significant buildings within W8B. The Quartermaster's house was built between 1850 and 1853 by Rufus Ingalls, the first U.S. Army Quartermaster at what was then Columbia Barracks, and stood until razed in January 1937 (Addington 1976). Not surprisingly, then, this building appears on most historical maps of Vancouver Barracks, for example on the 1874 Ward map where it is identified as "Officers Quarters," and on the 1906 Homan map where it is identified as "Officers S."

PREVIOUS ARCHAEOLOGY

Archaeological investigations were carried out within the southern portion of W8B in conjunction with construction during two earlier reconfigurations of the I-5/SR 14 interchange. The first reconfiguration prompted investigations in 1974 and 1975 by the University of Washington (Chance and Chance 1976; Chance et al. 1982). The second configuration led to investigations in 1981 by Eastern Washington University (Thomas and Hibbs 1984).

University of Washington Investigations

The University of Washington's investigations in 1974 included large-scale excavations in Operation 20, the site of the Quartermaster's house built between 1850 and 1853 by Rufus Ingalls. These excavations were hampered by the presence of a 6-inch-thick concrete coal pad constructed after World War II that covered much of the house site. Of 31 features exposed during the 1975 excavations, 9 involved brick constructions, including the west wall of the post-1879 north wing of the house. The house was found to have been constructed on "subsoil (upper B horizon) and that a Hudson's Bay Company bearing A horizon was scraped off prior to construction" (Chance and Chance 1976:32). A foundation of water-worn boulders that proved to be the kitchen/dining room fireplace, and a privy containing artifacts mostly dating to the interval from 1855 to 1870, also were excavated (Chance and Chance 1976:32–33).

During the second season of investigations by the University of Washington in 1975, additional extensive excavations were undertaken at the Quartermaster's house (Operation 20). Most of the remaining foundation was uncovered, as were "various privies, soaking pits, and a root cellar associated with the early history of the house" (Chance et al. 1982:6). Evidence of "an earlier Kanaka Village component" was also found at that time (Chance et al. 1982:292). This evidence was encountered in a trench (Feature 60), apparently "a manifestation of the early sewage system," that contained HBC artifacts including dark olive-green vessel glass, English fire brick, and copper and cut nails (Chance et al. 1982:27). HBC artifacts, including English bricks, also were found in fill within a sump (Feature 99) (Chance et al. 1982:30).

Although the investigations over two seasons at the Quartermaster' house were extensive, it was nevertheless observed that "hindsight judgment always comes easy, but one such conclusion we cannot dismiss is that we could have done much more in Operation 20, or done it better, with more people and time" (Chance et al. 1982:292).

Eastern Washington University Investigations

The Eastern Washington University investigations in 1981 included further excavations in Operation 20, a designation previously used to refer to the Quartermaster's house. These investigations involved work in several "separate excavation blocks," each given an individual designation (e.g., Operation 20A, 20B, 20C) (Thomas and Hibbs 1985:301). Of these 1981 investigations, Operation 20D, at the site of the Quartermaster's house, fell along the southeast edge of W8B.

The concrete coal pad that had covered most of the Operation 20 area was removed by heavy machinery, allowing access to locations not previously investigated. The Operation 20D investigations resulted in the recording of 52 features in and around the Quartermaster's house site. The features found in Operation 20D included wood footings, brick footings, the basement, various exterior features, and a cluster of features to the north of the Ingalls House that "suggested the foundation of a separate structure" (Thomas and Hibbs 1984:334–345). These features "dated from original construction, 1850–1851, on through to the house demolition in 1937" (Thomas and Hibbs 1984:334).

One feature appeared to antedate the Ingalls House and to be associated with a Kanaka Village occupation. An intrusive pit (Feature 54) measuring 2 feet in diameter and 2 feet deep found under the north porch of the house contained "a surprising number of such non-Army artifacts as heat-treated lithic detritus, polished bone, and a small metal tube 'tinkler' ornament" (Thomas and Hibbs 1984:334). The pit also contained items of Euroamerican manufacture, including clay tobacco pipe fragments, American machine-cut nails, window glass, ceramics, faunal remains, and six straight pins, leading to the inference that the feature dated to the "late Hudson's Bay Company period" (Thomas and Hibbs 1984:334).

FIELD INVESTIGATIONS

Most of W8B consists of artificially elevated terrain bounded by steep slopes created when fill material was brought in to support construction of the SR 14 overpasses. The highest ground (elevation ca. 56 feet) is adjacent to the SR 14 overpasses that separate W8A and W8B. From this raised elevation, the ground in W8B slopes downward to the I-5 Exit 1B off-ramp into downtown Vancouver. In view of the obvious substantial depth of the fill deposits, W8B was not included among the parcels examined during the GPR reconnaissance undertaken for the CRC project.

Discovery investigations were limited to use of a trackhoe to excavate a single trench across the lowest ground in W8B, which is adjacent to the I-5 Exit 1B off-ramp (Figures 9-2 and 9-3). This trench (MT13), which was limited to a depth of 1.2 m for safety and was 42.0 m in length, contained only fill material.

DESCRIPTION OF DEPOSITS

The fill exposed in the trench was primarily sand with rounded gravels and cobbles. The single backhoe trench excavated at W8B did not extend deep enough to reach beneath the massive fill material used in constructing the artificial terrain that supports the SR 14 overpasses. The presence of historical artifacts in the uppermost fill deposits exposed in the trench indicates that

Figure 9-2. View northwest, showing trench excavation in WSDOT parcel W8B (off-ramp from I-5 and SR 14 into downtown Vancouver in background).

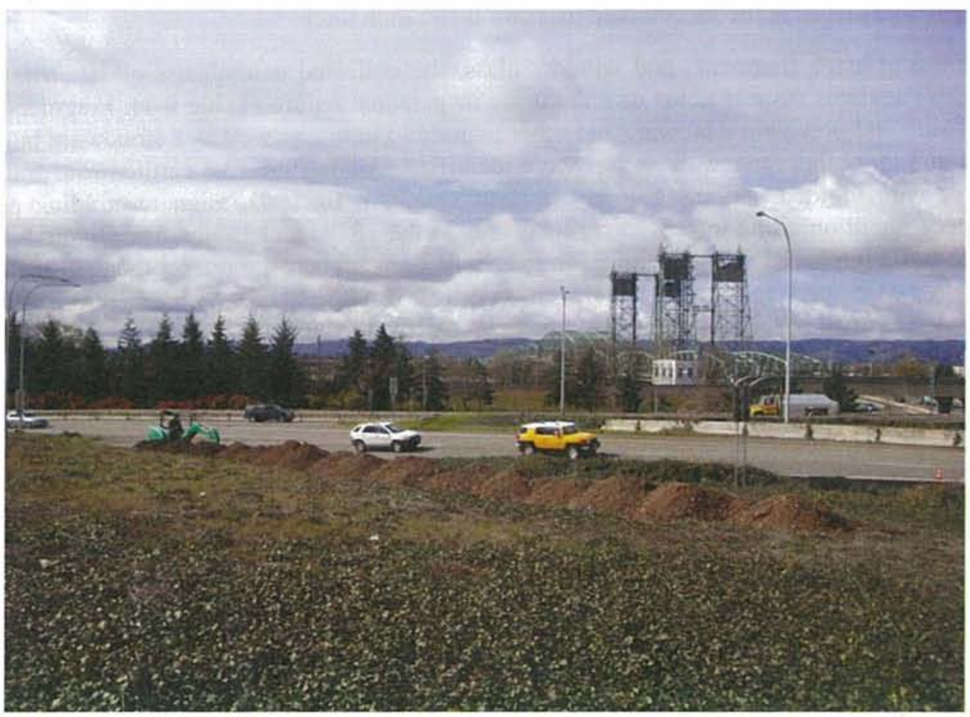

Figure 9-3. View southwest, showing trench excavation in WSDOT parcel W8B (ramps from SR 14 onto I-5 and Columbia River bridges in background).

this material was excavated from somewhere close by where occupation occurred during the historic period. The thickness of the fill material covering W8B could not be established.

WSDOT geotechnical borehole CRC-WB02-01P-10, excavated within a few meters of the location of the backhoe trench (MT13), encountered well-graded gravelly sand from the surface down to the Pleistocene gravels. The fill/native soil contact could not be distinguished. The only difference in the sediments noted was a change in color from brown to grayish-brown from 15 to 20 feet below surface (Brian Hilts, personal communication 2010).

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

No cultural features were encountered during the mechanical trench excavations in W8B. MT13 could not be excavated deep enough to reach any cultural features associated with prehistoric or historic occupation or activity that might be present below the fill that covers W8B.

Fill Artifacts

During the excavation of MT13, chunks of concrete and asphalt were observed in the fill deposits, as were a few common red brick fragments (4 inches wide by 2¼ inches thick). A representative sample of the brick fragments was collected. These appear to be American made bricks based on size, color, and composition. The other structural material observed was window glass. The two pieces in the assemblage measure 0.105 inch thick.

In addition to brick fragments and window glass, the collected assemblage of 30 artifacts (all fragments) contains several items of a domestic or personal nature (Table 9-1). Fragments from earthenware and porcelain tableware and other household items, as well as a stoneware butter pot (crock) and one other stoneware vessel were identified. Among the five earthenware fragments are three with molded patterns around the rims. One is a fig leaf design resembling patterns commonly found on white improved earthenwares in the 1840s and 1850s (The Potteries 2010). The two white improved earthenware fragments in this assemblage are undecorated, although one exhibits a partial mark that might have been used by J & G Meakin anytime between 1890 and 2000. The one small porcelain fragment, from a saucer, has a scalloped pattern around the cup well.

Also present are fragments from amber, blue-green, aqua, and colorless glass bottles as well as the lid to a colorless glass patch box and pieces of very thick flat glass that might be shelf fragments or from sheets of glass designed to protect the horizontal surfaces of wooden furniture (e.g., tables, dressers). Of the four bottle fragments, two appear to be from mold blown bottles and two were produced in automatic bottle machines. One of the mold-blown bottles fragments exhibits the stria typical of turn molding; the other fragment has thick vessel walls that are full of tiny bubbles.

Only a few items could be assigned production dates based on manufacturing techniques or marks (Table 9-2). The partial mark on the white improved earthenware fragment consists of the British royal arms and the first letter "J." The royal arms design detail and print style very closely resemble complete examples of marks on ceramics made by J & G Meakin between 1890 and 2000.

Table 9-1. Artifact Summary for Site 45CL915.

Artifact Group/ Category	Artifact Types	MT13/ Totals
Domestic		
Food Preparation & Consumption	Ceramic plate	2
	Ceramic saucer	1
	Indeterminate ceramic tableware	3
Food Storage	Stoneware crock (butter pot)	5
Indefinite		
Containers	Glass bottle/jar	3
Indefinite	Ceramic item	1
	Thick flat glass	6
Personal		
Grooming & Health	Glass patch box lid	1
Social Drugs - Alcohol	Alcoholic beverage bottle	1
Structural		
Materials	Brick	5
	Window glass	2
Total		30

MT = Mechanical Trench
Note: Artifact types are listed as complete items; however only fragments were recovered

Table 9-2. Temporally Diagnostic Artifacts from Site 45CL915.

Provenience	Item Description	Dateable Characteristics	Date/ Date Range	Reference
MT13 Fill	Dark bluish-green wine(?) bottle fragment	Turn-mold stria	ca. 1850s–early 1920s	SHA (2009)
	Earthenware item	Printed mark possibly from J & G Meakin	1890–2000	The Potteries (2009)
	Window glass fragments (n=2)	2 @ 0.105 inch thick	1900–1915*	Roenke (1978:116)
	Amber bottle fragment	Produced in and automatic bottle machine	Since ca. 1905	SHA (2009)
	Aqua bottle fragment	Thick vessel walls and many tiny bubbles suggest mold blown	As late as the 1930s	SHA (2009); Jones & Sullivan (1989)
	Colorless alcoholic beverage bottle shoulder fragment	Embossed: FEDERAL LAW FORBIDS SALE OR RE-USE OF THIS BOTTLE	1935–mid-1960s	SHA (2009)

MT = Mechanical Trench
*A window glass thickness mode (Roenke 1978) is not presented for the glass from MT13, as only two fragments were found. The thickness of these pieces is listed, and the date range provided reflects the mode into which the individual measurement would fall if a modal analysis was being conducted.

The blue-green turn-molded bottle fragment probably is from a wine bottle manufactured between the 1850s and the mid-1920s. The thick vessel walls and the presence of many very small bubbles in the aqua bottle body fragment are two attributes normally associated with mold-blown manufacture, which was superseded by mechanized production during the first 30 years of the twentieth century; however neither of these traits should be relied on exclusively to determine manufacturing technique.

The fragment from the shoulder of a colorless, machine-made, alcoholic beverage bottle is embossed with the warning: FEDERAL LAW FORBIDS SALE OR RE-USE OF THIS BOTTLE, a notice designed to discourage reuse of bottles for bootleg liquor from the mid-1930s to the mid-1960s.

The two window glass fragments measure 0.105 inch thick. Calculation of a window glass thickness mode is not applicable with a sample size of two. However, according to Roenke's (1978:116) Pacific Northwest window glass dating formula, glass of this thickness might have been used in a building constructed between 1900 and 1915.

Manufacturing dates for the items recovered from the fill in MT13 are consistent with those for other mixed fill deposits in the area. The date ranges extend from the mid-1800s to the 1930s or even later, and suggest no one specific time for the use or original deposition of these materials.

NRHP ELIGIBILITY

The previous existence of significant archaeological remains along the southern margin of site 45CL915 in present-day W8B was established as a result of archaeological investigations by the University of Washington in 1974 and 1975 and by Eastern Washington University in 1981. These investigations appear to have resulted in more or less the complete excavation of the Quartermaster's house as well as much of the adjacent yard. The extent to which additional significant archaeological deposits associated with the Quartermaster's house might lie beneath the deep fill at W8B remains undetermined.

Archaeological investigations conducted in the 1970s and 1980s during earlier reconfigurations of the I-5/SR 14 interchange examined only the southernmost portion of present-day W8B. The remaining area within W8B (approximately 75 percent) appears to not have been surveyed for archaeological resources in any but the most cursory fashion (Chance et al. 1982:6).

Due to the presence of substantial fill deposits, the significance of site 45CL915 remains undetermined at this time. The results of the previous investigations point to the potential for remains from Kanaka village occupations and/or structures associated with the Quartermaster's Depot at Vancouver Barracks to be found in the unexamined portions of site 45CL915. These earlier investigations also demonstrated the presence of archaeological features even in areas subject to substantial ground disturbance during construction in the historic period (e.g., beneath the concrete coal pad that covered much of the Quartermaster's house).

In the event that significant archaeological remains are uncovered beneath the deep fill, site 45CL915 would then be National Register eligible under criterion d. It is unlikely that site 45CL915 could meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5 and SR 14, and the massive amount of earth-moving during highway construction resulted in the widespread destruction of the historic setting in the I-5 and SR 14 corridors.

RELATIONSHIP TO ADJACENT RESOURCES

The definition of site 45CL300, which originally referred to Kanaka Village, was expanded in the 1980s to include the area occupied by the U.S. Army Quartermaster's Depot at Vancouver Barracks. The revised western boundary extends north-south more or less through the middle of site 45CL915. To the east, across the SR 14 overpasses, is site 45CL914 in W8A where significant archaeological resources were identified during archaeological investigations for the CRC project.

FUTURE MANAGEMENT OPTIONS

In the event that the SR 14 ramps/overpasses and supporting fill are altered or removed during construction for the CRC project and the original ground surface becomes accessible, archaeological discovery investigations for unrecorded archaeological resources are recommended at site 45CL915. This recommendation is based on the demonstrated preservation of significant archaeological resources (now excavated) in the southernmost portion of W8B (i.e., the Quartermaster's house), and the potential for archaeological evidence of the HBC Kanaka Village and/or the U.S. Army Quartermaster's Depot in the remaining, unexplored portion of site 45CL915. In the meantime, the CRC project should avoid any construction activities that might result in impacts to archaeological resources buried under the fill within W8B.

10. WASHINGTON AREA 9A (45CL916)

Located on the east side of I-5, Washington Area 9 (W9) is a narrow strip of WSDOT land bounded on the east by the WSDOT chain-link property fence and on the west by the north-bound lanes of I-5. Based in part on landownership, W9 is divided into two parts: (1) W9A, a northern area bounded on the east by a Federal Highway Administration (FHWA) parcel; and (2) W9B, a southern area bounded on the east by U.S. Army land. These two areas are divided by the former location of 5th Street which, before construction of I-5, connected the military reservation and the City of Vancouver. This chapter describes the procedures and results of discovery investigations and testing in W9A.

Data recovery excavations to mitigate impacts from construction during an earlier reconfiguration of the I-5/SR 14 interchange were conducted within the area of present-day W9A in 1982 (Thomas and Hibbs 1984). Afterwards, massive construction excavations were conducted through this area in connection with demolition of an FHWA building that formerly extended into this area and by construction of the SR 14 ramp connecting to northbound I-5.

In order to determine if any significant archaeological deposits are still present, archaeological discovery probing and trenching were undertaken at W9A between March 23 and April 2, 2009 (Figure 10-1 photo). Beneath deep compacted fill materials introduced during previous highway construction, cultural deposits associated with a historic blacksmith shop were found. Unfortunately, these cultural deposits were found to have been substantially reduced in area by trenching during installation of pipelines along the east side of the I-5 corridor. The archaeological remains at W9A have been recorded with DAHP as site 45CL916.

The WSDOT parcel (W9A) containing site 45CL916 lies to the north of the expanded boundary of 45CL300 (Thomas and Hibbs 1984:2). Site 45CL916 also lies outside the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007).

HISTORICAL SETTING

W9A is located a considerable distance to the northwest of Kanaka Village at HBC Fort Vancouver. Although no village structures are known to have been located in this area, it is possible that evidence of activity by the residents of Kanaka Village could be present.

W9A lies along the western edge of the former military reservation. A blacksmith shop is shown on the 1851 Bomford map of Columbia Barracks in the vicinity of the present-day WSDOT/FHWA property boundary north of East 5th Street (Thomas and Hibbs 1984:755). This blacksmith shop was "one of the first structures erected in the quartermaster's depot" as well as "the northernmost structure of the quartermaster's depot" (Thomas and Hibbs 1984:409). It was a frame building measuring 21 feet wide by 30 feet long, with a shed roof about 15 feet high and an 8 by 8 foot entryway on the south side. The brick chimney, which vented the forge on the north side of the building, measured 1.6 by 2.3 feet across and 16 feet high (Thomas and Hibbs

Figure 10-1. View south, showing WSDOT parcel W9A situated between the WSDOT/FHWA property fence (left) and the SR 14 onramp onto northbound I-5 (right); Columbia River bridges in background.

1984:409). The building appears on maps of the military reservation prepared in 1854, 1855, and 1859 (Thomas and Hibbs 1984:761, 769, 773).

This first building burned down in 1862 or 1863, and another blacksmith shop was constructed in the same location in 1871. It appears on Ward's 1875 map of the military reservation (Thomas and Hibbs 1984:779). This second blacksmith shop is estimated to have measured 40 by 50 feet, with a shed (possibly the forge or a storage shed) that measured 20 by 25 feet appended to the east wall (Thomas and Hibbs 1984:409). A third, much larger, blacksmith shop appears in the same general area on the 1914 Homan map (Thomas and Hibbs 1984:785).

The 1888 Patten map shows workshops standing on the north side of East 5th Street, south of the blacksmith shop location; the blacksmith shop may be one of the buildings shown but it is not identified (Thomas and Hibbs 1984:781). By the time the 1914 Homan map was drawn, a large building identified as a Paint Shop was present on the north side of East 5th Street in the location of the former workshops (Thomas and Hibbs 1984:785).

The U.S. Army buildings north of East 5th Street in the vicinity of present-day W9A were torn down by the early 1930s to make way for two new Bureau of Public Roads (later the Federal Highway Administration) buildings constructed in 1932. These new buildings appear on the 1935 Carsner map of Vancouver Barracks (Thomas and Hibbs 1984:787). The west wings of these buildings were cut off to accommodate construction of I-5 in the 1950s. In conjunction with the widening of I-5 in the early 1980s, the southern building was removed and the L-shaped building behind it was further reduced in size, resulting in the FHWA building as it appears today (O'Rourke et al 2010:60).

PREVIOUS ARCHAEOLOGY

Previous archaeological investigations were undertaken in W9A in late February 1982 by Eastern Washington University in conjunction with the reconfiguration of the I-5/SR 14 interchange. Specifically, Operation 52C uncovered the remains of the ca. 1851–1863 blacksmith shop at the U.S. Army's Quartermaster's Depot (Thomas and Hibbs 1984:409–420).

Operation 52 involved "the investigations of a machine-excavated trench for an 8-in water pipe which replaced existing facilities" (Thomas and Hibbs 1984:405). Situated at the north end of Operation 52, "Operation 52C cut diagonally across East Fifth Street to the southwest corner of the Federal Highway Administration property where it was extended north parallel to and within the right-of-way to Construction Site 2" (Thomas and Hibbs 1984:405). The maps provided are not useful for placing Operation 52C in relation to the modern landscape, but this verbal description suggests that the trench extended along the current WSDOT/FHWA property fence. According to Thomas and Hibbs (1984:406):

> Two profiles for the northern end of 52C encompassed the hypothesized boundaries of the 1850-1853 blacksmith shop. Here, relevant cultural deposits were capped by about 2 ft of Stratum 1 fill. The remainder of the Operation 52C trench walls exhibited either recent intrusive deposits (cf. the Federal Highway Administration's foundation locality) or had no significant cultural deposition in Stratum 3.

The "stratigraphic evidence" of the two blacksmith shops was referred to as Feature 8. The earlier building was represented by a stratum 3.5 feet below surface "characterized by a black coloration derived from blacksmithing residues" and by "a depression filled with ash and artifacts, designated Feature 12" that might represent "the remains of an anvil base or quench pit within the shop" (Thomas and Hibbs 1984:411). The overlying stratum, "composed of brick and mortar" interpreted as probably representing debris "from the destroyed forge and chimney," included scorched soils "supporting the historical accounts of the shop being destroyed by fire" (Thomas and Hibbs 1984:411).

A total of 404 artifacts, mostly building construction and hardware-related items, associated with the early blacksmith shop were recovered. Above a layer of pea-gravel fill placed to level the site of the earlier building, the occupation floor of the later blacksmith shop was found (Thomas and Hibbs 1984:415). Above this floor, four or five additional fill layers were present, one of which contained evidence of an even later blacksmith shop; but these later occupations were apparently minimally represented in comparison with the earliest building.

Aside from the evidence of the blacksmith shops, "the remainder of the Operation 52C trench walls exhibited either recent intrusive deposits (cf. Federal Highway Administration foundation locality) or had no significant cultural deposition in Stratum 3" [the nineteenth century surface] (Thomas and Hibbs 1984:406).

GPR RECONNAISSANCE

The GPR reconnaissance at W9 began with the survey along four GPR lines using high-power 200 MHz antennae. The four lines extended north to south, and were spaced west to east at 3.0 m line separation distance in W9. The four GPR profiles were CRC Line 10 (179.5 m), CRC Line 11 (78.0 m), CRC Line 12 (100.0 m), and CRC Line 13 (81.75 m). The total line distance for the 200 MHz profiles in W9 was 439.25 m. A repeat of CRC Line 11 undertaken using 500 MHz shielded antennae was recorded as CRC Line 221 (81.65 m).

CRC Line 10 was substantially longer than the others because it began farther north in an effort to extend GPR coverage to the maximum extent possible along the east side of I-5. Three of the four initial GPR lines extended the full length of W9, so that the northern portions of these lines relate to W9A, and the southern portions of these lines relate to W9B. CRC Line 11 began immediately south of the former location of 5th Street and, thus, pertains only to W9B.

Resistive fill reflections were found to at least 20 nanoseconds (ns) (1.0 m below surface) in all GPR profiles. Based on these representative profiles, it was predicted that fill covers 100 percent of W9. The depth of resistive fill ranges from 20 ns (1.0 m below surface) to 60 ns (3.0 m below surface). The average depth of fill in W9 suggested by the GPR profiles is 40 ns (2.0 m below surface).

Buried conductive layers (verified as Pleistocene Bw soil layers) were found in the profiles along CRC Line 10, CRC Line 11, and CRC Line 12. Top-truncated inclined reflections (Pleistocene gravels) were not found north of 5th Street in W9A but were present farther south in W9B. This situation indicates that the fill materials that cover the surface are relatively thicker in W9A on the north than in W9B south of the former location of 5th Street.

FIELD INVESTIGATIONS

The area in which archaeological investigations could be conducted in W9A is very narrow, consisting of a strip of ground between the toe of the slope extending down from the I-5 northbound travel lanes on the west and the WSDOT/FHWA chain-link property fence on the east (Figure 10-2). The available work space in W9A ranged from as little as 1.5–2.0 m wide in the north to a maximum of 4.0 m wide in the south.

Manual Excavations

Archaeological discovery investigations in W9A began with excavation of a line of 11 round probes (RP) measuring 30 cm in diameter and spaced at 10-m intervals. The north end of the line began 80.0 m south of the Exit 1C Mill Plain Blvd/Port of Vancouver sign on I-5. The location of this line of probes corresponded closely with the alignment of CRC Line 12.

The northernmost three probes (RP1, RP2, RP3) were placed 1.0 m west of the WSDOT/FHWA property fence (Figure 10-3). The rest of the probes were placed 2.0 m west of the fence, to avoid impacts to electrical irrigation boxes situated along the fence, as well as to avoid probing where the Operation 52C trench had been excavated in 1982 (Thomas and Hibbs 1984).

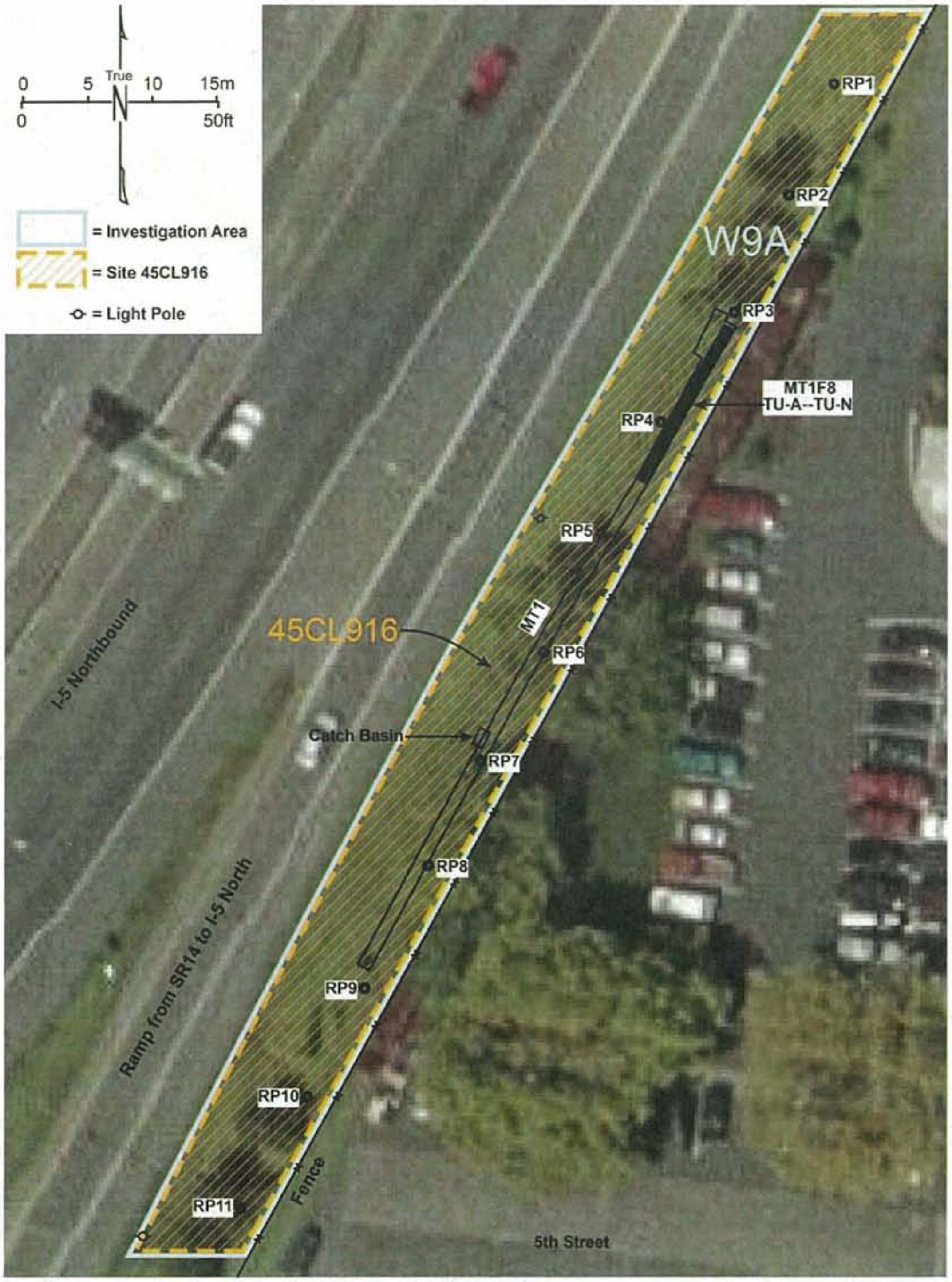

Figure 10-2. Locations of round probes (RP), test units (TU), mechanical trench (MT), cultural feature (F), and site 45CL916 in WSDOT parcel W9A on aerial photograph (Terrain Navigator Pro 2002).

Figure 10-3. View north, during excavation of RP1 in WSDOT parcel W9A (I-5 on left, FHWA property on right).

Figure 10-4. View north, showing auger hole excavation in progress at RP9 in WSDOT parcel W9A (I-5 on left).

Table 10-1. Summary of Discovery Probe Excavations at Site 45CL916.

Probe No.	Level/ Stratum	Depth Below Surface	Sediment Description[a]	Cultural Material[b]
RP1	1–2½/1	0–25 cm	Stratum 1 Fill	Spike, vitreous china fr, slate, asphalt
	2½–7/2	25–70 cm	Stratum 2 Fill	Asphalt, concrete, brick, mortar, wire nail, window glass, coal, bottle/jar fr, styrofoam
RP2	1–2½/1	0–25 cm	Stratum 1 Fill	Concrete, slate, wire
	2½–7/2	25–70 cm	Stratum 2 Fill	Asphalt, window glass
RP3	1–2/1	0–20 cm	Stratum 1 Fill	Brick, slate, bottle/jar fr, glass fr
	3–5/2	20–50 cm	Stratum 2 Fill	Concrete, slate, brick, glass fr
RP4	1–2/1	0–20 cm	Stratum 1 Fill	Slate, wire nail, porcelain and earthenware fr, chert flake
	3–7/2	20–70 cm	Stratum 2 Fill	Asphalt, concrete, wire nails, cut nail, brick, slate, window glass, horseshoe
RP5	1–2/1	0–20 cm	Stratum 1 Fill	Clay pipestem fr, slate, styrofoam
	3–7/2	20–70 cm	Stratum 2 Fill	Concrete, brick, safety glass fr, wire, plaster, nail
RP6	1–2/1	0–20 cm	Stratum 1 Fill	Wire, slate
	3–7/2	20–70 cm	Stratum 2 Fill	Concrete, brick, wire nail
RP7	1/1	0–10 cm	Stratum 1 Fill	Brick, slate, window glass, coal
	2–7/2	10–70 cm	Stratum 2 Fill	Brick, wire, window glass, linoleum tile
RP8	1/1	0–10 cm	Stratum 1 Fill	Slate
	2–7/2	10–70 cm	Stratum 2 Fill	Brick, mortar, slate, nail, window glass, plastic
RP9	1/1	0–10 cm	Stratum 1 Fill	None
	2/1–2	10–20 cm	Stratum 1/2 Fill	Slate, bottle fr, plastic
	3–5/2a	20–50 cm	Stratum 2a Fill	Bottle/jar fr, glass fr
	5–10/2b	50–100 cm	Stratum 2b Fill	None
	11–12/3	100–120 cm	Stratum 3 Fill	Window glass
	13/4a	120–130 cm	Stratum 4a Fill	Glass fr
	14–16/4b	130–160 cm	Stratum 4b Fill	Brick, window glass, cut nail, bottle glass fr
	17–23½/5	160–235 cm	Stratum 5 (Pleistocene gravels)	None
RP10	1–2/1	0–20 cm	Stratum 1 Fill	Brick, slate
	3–7/2	20–70 cm	Stratum 2 Fill	Brick, mortar, slate, nail, opaque white glass fr
RP11	1–2/1	0–20 cm	Stratum 1 Fill	Brick, mortar
	3–5/2	20–50 cm	Stratum 2 Fill	Brick, window glass, nail, bottle fr
	6–7/2	50–70 cm	Stratum 2 Fill	None

[a] Refer to the Description of Deposits section
[b] Includes cultural materials recovered as well as those observed (but not collected)

Nine of the 11 probes in W9A were excavated to at least 70 cmbs, which is generally the limit reachable in a 30-cm-diameter probe (Table 10-1). Excavation in RP3 was stopped by a chunk of concrete at 50 cmbs. In RP9 (Figure 10-4), it proved possible to continue excavation below 70 cmbs using a bucket auger, extending the depth of the probe to 235 cmbs (the auger limit). The auger measured 20 cm in diameter and excavated a hole 25 cm in diameter. Cultural materials were occasionally encountered in RP9 as deep as 150–160 cmbs.

The stratigraphy observed in the W9A probes consistently included the same two deposits. Stratum 1 consisted of darker brown, more organic, very course sandy loam with primarily rounded gravel, pebbles, and cobbles in the uppermost 20 cm. Stratum 2 consisted of light brown, loamy, very coarse sand with abundant primarily rounded gravel. Stratum 2, which was very compact, generally extended to the bottom of the probes at 70 cmbs.

Historical artifacts were consistently found in the W9A probes. In particular, the common presence of slate fragments suggested an association with historic U.S. Army buildings, on which slate was often used as a roofing material. It was later determined through excavation of a backhoe trench that the probes excavated to 70 cmbs did not penetrate below fill deposits.

In addition to shovel probes, 14 test units were manually excavated to investigate a cultural deposit/feature exposed in the bottom of a mechanical trench. The procedures and results of these additional manual excavations are described below.

Mechanical Trenching

In view of the GPR results that suggested the presence of thick fill deposits, as well as the apparent failure of the discovery probes to reach the underlying Pleistocene gravels (with the possible exception of RP9), a backhoe was used to test more deeply below the surface at W9A. A backhoe with a 3-foot-wide bucket was employed to excavate a trench trending north to south through W9A. MT1 was generally about 1.1 m wide (although this varied somewhat) and about 1.1–1.3 m deep. It extended for 58.0 m, ending in the south about 1.5 m north of RP9 or, stated another way, about 3.5 m north of where the former sidewalk along the north side of 5th Street would have extended into the WSDOT parcel.

At the north end, the trench began near RP3 and about 2.7 m west of the WSDOT/FHWA property fence, but quickly encountered a large (12-inch-diameter) concrete pipe extending north–south about 1.0 m below surface. The trench was repositioned slightly to the east (Figures 10-2 and 10-5), and excavations continued southward (Figure 10-6), exposing fill deposits that extended from the surface almost to the bottom of the trench.

Black-stained sediments were exposed in MT1 at about 120–130 cmbs, near the bottom of the trench (Figure 10-7). As excavation continued southward, another smaller (6- or 8-inch diameter) metal pipe was exposed, extending north–south along the east side of the trench. The black-stained sediments thus occurred as a remnant deposit between two previously excavated utility trenches (Figure 10-8). From the north end of the trench, the black-stained sediments extended southward for 14.6 m. Recorded as MT1 Feature 8 (Features 1 through 7 were recorded in W9B), this distinctive black-stained deposit was sampled by means of a series of 14 test units (TUs), beginning with TU-A on the north and extending through TU-N on the south, set up in the trench floor (Figure 10-6). Situated between the two utility pipes, each of the 14 test units measured 100 cm long and 50 cm wide. The objective of these excavations was to determine if any cultural features (including structural remains) were present and to recover a sample of any artifacts in the

Figure 10-5. View south, at beginning of MT1 excavation in WSDOT parcel W9A (Columbia River bridges in background).

Figure 10-6. View south, at beginning of excavation of test units in the black-stained sediments in Feature 8 at the north end of MT1, site 45CL916 (Columbia River bridges in background).

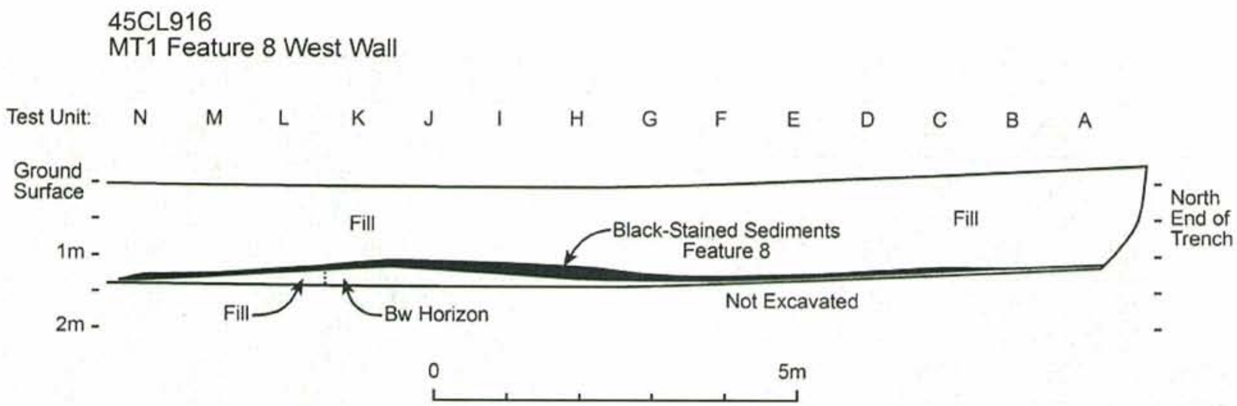

Figure 10-7. Stratigraphic profile of the west wall of MT1, showing the black-stained sediments of Feature 8.

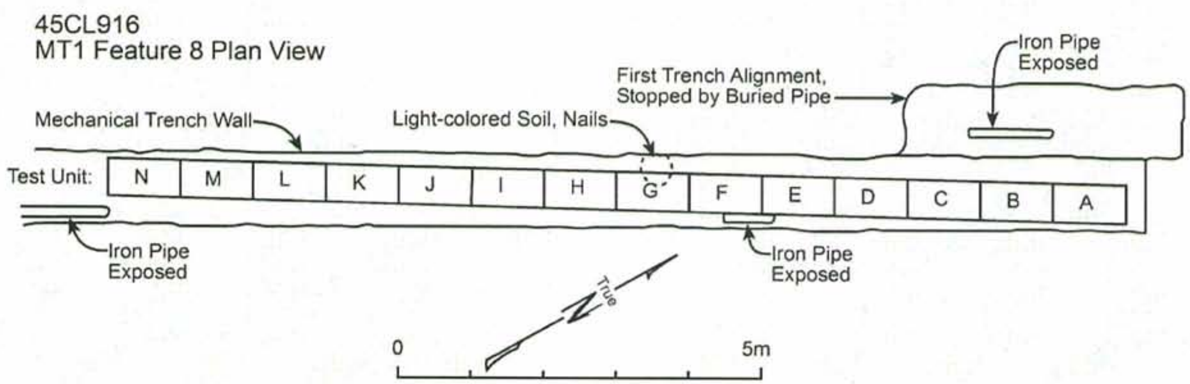

Figure 10-8. Plan view showing relationship of black-stained deposit exposed in MT1 to buried utility pipes to the east and west at site 45CL916.

black-stained deposits. In the course of these excavations, most of the black-stained sediments visible in the floor of the trench were removed.

MT1 ended just north of the location of previously excavated RP9. The trench did not continue farther south because of the presence of a stand of tall trees planted across the former location of 5th Street. This stand of trees serves as a visual screen between Vancouver Barracks on the east and I-5 on the west.

DESCRIPTION OF DEPOSITS

Inspection of the walls of the backhoe trench established that the manually excavated discovery probes were excavated into two or more layers of fill deposits laid down during construction of I-5. Over most of the area, the fill deposits extended to depths beyond which the discovery probes reached. The stratigraphy in RP9, the deepest probe excavated, included five strata (Figure 10-9). The lowest stratum presumably represents Pleistocene gravels, but the matrix was not clast supported, raising the possibility that some or all of the gravels may have been redeposited. Intact Pleistocene gravels formerly present in this area may have been removed during earlier cut-and-fill activity associated with highway construction.

The black-stained sediments exposed in the floor of MT1 were situated below fill deposits and were bracketed on both the east and west by lighter-colored sandy sediments identified as utility trench backfill (Figure 10-7). Technically, the black-stained sediments were classified as strong brown silty loam (10YR3/1). For most of its length, in TU-A and south to TU-K, the black-stained stratum rested on top of Bw horizon soils. In the southernmost test units, TU-L through TU-N, the black-stained deposit was bracketed above and below by yellow-brown, very gravelly fill (discussed further below).

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Feature

The black-stained sediments recorded as MT1 Feature 8 were almost certainly associated with one of the blacksmith shops at the Quartermaster's Depot. Previous investigations at the former location of these buildings were conducted in 1982 in Operation 52C, east of the WSDOT fence (Thomas and Hibbs 1984).

The top of the black-stained sediments was at about 120 cmbs in TU-A (Figure 10-10). Manual excavation of the test units in the trench floor established that the thickness of this distinctive deposit varied widely along its length. Thickness measured 3 cm in TU-B, 18 cm in TU-C and TU-D, 10 cm in TU-F through TU-H, 5–9 cm in TU-L, 6 cm in TU-M, and 3 cm in TU-N. The depth below surface and variable thickness of the Feature 8 black-stained deposit is consistent with the depiction in the "Stratigraphic profiles of quartermaster's depot blacksmith's shop" prepared by Thomas and Hibbs (1984:413). As noted above, the northern portion of the black-stained deposit was underlain by Bw, but the southern portion (in TU-L through TU-N) was underlain by yellow-brown fill deposits. The presence of this fill may indicate previous excavation to create a graded ground surface. As noted by Thomas and Hibbs (1984:415), construction of the second blacksmith shop began with "a leveling operation carried out over the site of the demolished shop." In view of this situation, the black-stained sediments exposed in the trench bottom at W9A may have been from one of the later buildings rather than from the earliest blacksmith shop.

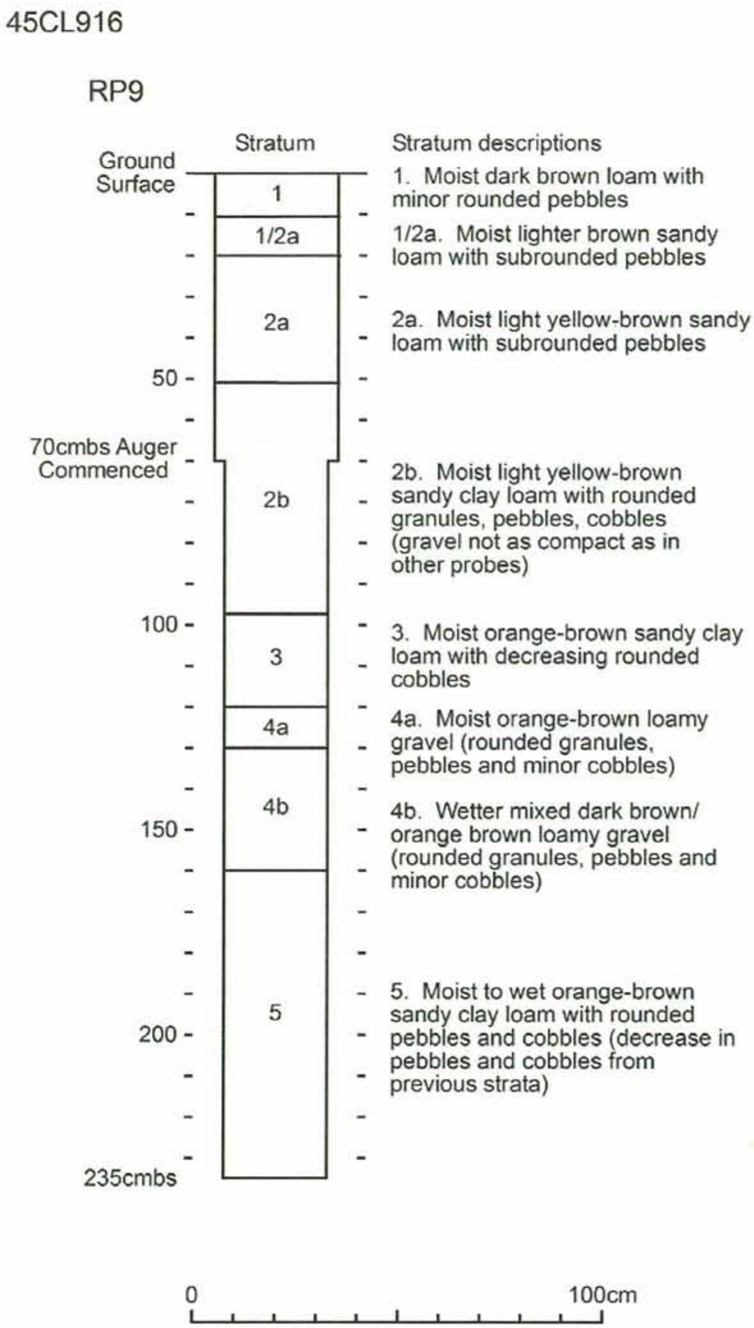

Figure 10-9. Stratigraphic profile of RP9 at site 45CL916.

Figure 10-10. View north, showing the Feature 8 black-stained deposit, likely from the blacksmith shop at the Quartermaster's Depot, underlying fill material at the north end of MT1 at site 45CL916.

Artifacts

The artifact assemblage from 45CL916, totaling 502 items (a total reflecting few complete objects, but mostly fragments of varying sizes), was collected while excavating test units (TU-A through TU-N) in the black-stained sediments of MT1 Feature 8 and during the excavation of round probes into fill deposits. The portion of the assemblage from Feature 8 contains 388 artifacts (77.3 percent); that from the fill contains 114 (22.7 percent).

A summary of the artifact assemblage from MT1 Feature 8 and fill deposits at site 45CL916 is presented in Table 10-2. Dates or date ranges for manufacture of the temporally diagnostic items are summarized in Table 10-3. Only artifacts recovered from the feature deposits in TU-A through TU-N are described in detail. In view of the fact that the origins of the artifacts recovered from the introduced fill are unknown, only a brief summary of these items is provided.

MT1 Feature 8 Artifacts

The assemblage of 388 items from the test units placed in Feature 8 at the north end of MT1 contains an abundance of hardware and structural debris and a relatively small number of household/personal items. Of the 159 nails (40.9 percent), 40 could be identified as machine cut and 17 were identified as wire nails; the remaining 102 were too heavily rusted to type. Also recovered were three complete horseshoes and one horseshoe fragment. Although nails are

Table 10-2. Artifact Summary for Site 45CL916.

Artifact Group/ Category	Artifact Types	MT1 F8 TU A–N	RP 1–11 Fill	Totals
Activities				
Animal Husbandry	Horseshoe	4	1	**5**
Domestic				
Food Preparation & Consumption	Indeterminate ceramic tableware	1		**1**
Food Storage	Crock	1		**1**
Furnishings	Vitreous china fixture		1	**1**
Indefinite				
Hardware	Metal hook	1		**1**
Containers	Bottle/Jar	33	7	**40**
Indefinite	Ceramic item	23	3	**26**
	Glass item	6	5	**11**
	Metal item	64	2	**66**
	Plastic item		1	**1**
	Wire		5	**5**
	Wood	10		**10**
	Unidentifiable material		1	**1**
Fuel	Coal	3	4	**7**
Waste	Clinker	26		**26**
	Slag	17		**17**
Personal				
Clothing Accoutrements	Metal military button	2		**2**
	Ceramic Prosser button	6		**6**
Social Drugs - Tobacco	Clay pipe		1	**1**
Structural				
Hardware	Bolt	4		**4**
	Cut nail	40	3	**43**
	Indeterminate nail	102	6	**108**
	Indeterminate spike	1		**1**
	Nut	1		**1**
	Screw	3		**3**
	Wire nail	17	3	**20**
Materials	Asphalt		3	**3**
	Brick	3	23	**26**
	Concrete		1	**1**
	Dry wall	2		**2**
	Linoleum		3	**3**
	Mortar	2	1	**3**
	Plaster		2	**2**
	Roofing slate	3	8	**11**
	Window glass	12	27	**39**
	Wire-reinforced safety glass	1	2	**3**
Native American				
Tool	Chert scraper fragment		1	**1**
Totals		**388**	**114**	**502**

MT = Mechanical Trench F = Feature TU = Test Unit RP = Round Probe
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

Table 10-3. Temporally Diagnostic Artifacts from Site 45CL916.

Provenience	Item Description	Dateable Characteristics	Date/ Date Range	Reference
MT1 F8 TU-A L1	Window glass fragments (n=2)	0.057 and 0.066 inch thick	1845–1855[1]	Roenke (1978:116)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-B L1	Window glass fragments (n=2)	0.067 and 0.070 inch thick	1845–1855[1]	Roenke (1978:116)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-C L1	Window glass fragments (n=2)	0.069 inch thick; 0.111 inch thick	1845–1855[1]	Roenke (1978:116)
	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-C L2	Window glass fragment	0.064 inch thick	1845–1855[1]	Roenke (1978:116)
MT1 F8 TU-D L2	Ceramic 4 hole-sew-through buttons (n=6)	Prosser technology	1840–mid-1900s	Sprague (2002:111–127)
	Window glass fragment	0.078 inch thick	1845–1855[1]	Roenke (1978:116)
	Metal General Service button fragments (n=2, 1 button)	Symmetrical Spread Eagle, Lined Shield, 3 piece; manufactured by Allien & Co. (established 1876)	1876–ca. 1880	Wycoff (1984: 88–89); Edwards & Critten (1885:168)
MT1 F8 TU-E L1	White improved earthenware body fragment, undecorated, unidentified vessel form	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=3)	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-F L1	Window glass fragment	0.099 inch thick	1845–1855[1]	Roenke (1978:116)
MT1 F8 TU-G L1	Window glass fragment	0.069 inch thick	1845–1855[1]	Roenke (1978:116)
	Wire nails (n=8)	Readily available	Since ca. 1884	Adams (2002)
	Wire-reinforced safety glass	Technology introduced	Since 1890s	Smart Glass (2009)
MT1 F8 TU-H L1	Black glass bottle fragments (n=4)	Used for containers	Pre-1800 to ca. 1880s	SHA (2009)
	Window glass fragment	0.086 inch thick	1855–1885	Roenke (1978:116)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-I L1	Wire nail	Readily available	Since ca. 1884	Adams (2002)
MT1 F8 TU-J L1	Window glass fragment	0.083 inch thick	1845–1855[1]	Roenke (1978:116)
MT1 F8 TU-L L1	Wire nail	Readily available	Since ca. 1884	Adams (2002)
RP1 L4	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)

Table 10-3. Temporally Diagnostic Artifacts from Site 45CL916 (*continued*).

Provenience	Item Description	Dateable Characteristics	Date/ Date Range	Reference
RP1 L6	Wire nail	Readily available	Since ca. 1884	Adams (2002)
RP1 L7	Window glass fragments (n=2)	0.119 and 0.120 inch thick	1924+[2]	Roenke (1978:116); Weiland (2009:30)
RP2 L6	Window glass fragment	0.130 inch thick	1924+[2]	Roenke (1978:116); Weiland (2009:30)
RP3, L4	White improved earthenware body fragment, undecorated, unidentified vessel form	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
RP4 L2	Colorless bottle fragment Wire nail	Glass decolorization Readily available	Common since ca. 1870s Since ca. 1884	SHA (2009) Adams (2002)
RP4 L3	Wire nail	Readily available	Since ca. 1884	Adams (2002)
RP4 L4	Window glass fragments (n=2)	0.080 inch thick; 0.131 inch thick	1855–1885; 1924+[2]	Roenke (1978:116); Weiland (2009:30)
RP4 L5	Linoleum fragment	Linoleum invented	Since 1860	Bellis (2010)
RP5 L5	Wire-reinforced safety glass fragment	Reinforced safety glass introduced	Since 1890s	Smart Glass (2009)
RP5 L7	Wire-reinforced safety glass fragment	Reinforced safety glass introduced	Since 1890s	Smart Glass (2009)
RP7 L1	Window glass fragments (n=2)	0.106 inch thick; 0.137 inch thick	1900–1915; 1924+[2]	Roenke (1978:116); Weiland (2009:30)
RP7 L4	Window glass fragment Linoleum fragment	0.078 inch thick Linoleum invented	1850–1865[2] Since 1860	Roenke (1978:116) Bellis (2010)
RP7 L5	Linoleum fragment Window glass fragment	Linoleum invented 0.120 inch thick	Since 1860 1915+	Bellis (2010) Roenke (1978:116)
RP8 L5	Window glass fragments (n=3)	1 @ 0.086 inch thick; 2 @ 0.126 inch thick	1855–1885; 1915+[2]	Roenke (1978:116); Weiland (2009:30)
RP9 L11	Window glass fragments (n=3)	2 @ 0.063 inch thick, 1 @ 0.065 inch thick	1845–1855[2]	Roenke (1978:116)
RP9 L15	Window glass fragment	0.088 inch thick	1855–1885[2]	Roenke (1978:116)
RP9 L16	Window glass fragment	0.120 inch thick	1915+[2]	Roenke (1978:116)
RP11 L4	Window glass fragment	0.111 inch thick	1915+[2]	Roenke (1978:116)

RP = Round Probe MT = Mechanical Trench TU = Test Unit F = Feature L = Level

[1] When combined, the 12 window glass fragments from MT1 Feature 8 have a primary mode of 0.065 and the date range presented for all MT1 Feature 8 entries reflects this mode; however, this small an assemblage does not necessarily yield a reliable result.

[2] Window glass thickness modes (Roenke 1978) are not presented for fill proveniences, as counts are low and the deposits are mixed and may be from off-site locations. The date ranges presented reflect the modes into which the individual measurements would fall if part of a larger sample.

generally classified as structural hardware, it is likely, considering the presence of the horseshoes and the proximity to the former blacksmith shops, that at least some of the smaller cut specimens are horseshoe nails associated with one or more of these establishments. Unfortunately, most are too rusty for a firm identification. Many other metal fragments from items of undetermined function (most were too rusty and/or too small to identify) were noted in the test units, as were a few chunks of coal and numerous pieces of melted slag and clinkers. These artifacts and fire-related materials are probably related to blacksmithing activities as well. Additional hardware items in the assemblage are nuts and bolts, screws, spikes, wire, and a hook. Structural materials consist of a few fragments of brick, mortar, roofing slate, dry wall, and window glass (including a single piece of wire-reinforced safety glass). A few pieces of wood in the assemblage may also be structural, but the fragments were too small to be definitive.

The remaining items from the test units in Feature 8 are of a domestic or personal nature or could not be classified as to function. Ceramic fragments (most likely from tablewares) and bottle and jar fragments are the most numerous. The 25 ceramic fragments are all very small. Of these, 19 are from stoneware utilitarian vessels, 2 are undecorated earthenware body fragments, 1 is an undecorated white improved earthenware body fragment, and 3 are hand-painted porcelain body and base fragments. Additional pieces of glass are also probably from bottles or jars, but they are too small to type. Six undecorated, ceramic Prosser buttons from articles of clothing were recovered, as were two fragments from a metal military button.

Most of the temporally diagnostic items from the test units in Feature 8, with the notable exception of the window glass, indicate use of the building associated with this deposit during the last quarter of the nineteenth century and possibly into the early years of the twentieth century. Since machine-cut nails outnumber the wire nails in this assemblage, deposition probably took place before wire nails began to dominate the market. Wire nails would have been accessible as of 1884; however, they apparently were not commonly used for construction at Vancouver Barracks until ca. 1900. In addition, machine-cut nails are still used for horseshoes. Prosser buttons were introduced in 1840 and continued in production until the mid-1900s. White improved earthenware was commercially imported to the United States beginning in the 1840s and is still made. A few bottle fragments are of "black" glass, which was commonly used for containers from before 1800 through the 1880s. The fragments are too small to determine whether they are from free-blown or mold-blown bottles.

The military button is probably the most helpful in dating this deposit. This item is a three-piece General Service button embossed with a symmetrical spread eagle and a lined shield, a style in use from 1847(?) to ca. 1880 (Wycoff 1984:88–89). The back is stamped with the name Henry V. Allien & Co., which was not established until 1876. Therefore, this button was manufactured sometime between 1876 and ca. 1880. Although it might have been discarded at a later date, it could not have been deposited prior to 1876.

The window glass assemblage from Feature 8 contains only 12 fragments. Although applying Roenke's Pacific Northwest glass dating formula to an assemblage this small could yield unreliable results, the calculation was run. A thickness mode of 0.065 inch for this assemblage yields a possible construction date of sometime between 1845 and 1855. A few other pieces may be indicative of later construction (1850–1885). If the 1845–1855 date can be trusted, it is possible that these fragments are from panes of glass from the original blacksmith's shop or another early building that were salvaged and reused in the one of the later shops.

The single piece of wire-reinforced safety glass recovered from one of the Feature 8 test units could have been made as early as the 1890s, when this product was introduced. While this date is not beyond the possible date range for Feature 8 materials, the recovery of more pieces of the same type of safety glass from the overlying fill just to the south suggests that its presence in the test unit reflects intrusion from the fill above.

Fill Artifacts

The fill deposits in RP1 through RP11 contained historical artifacts possibly associated with U.S. Army buildings at nearby Vancouver Barracks. Just over half of the 114 items are brick, roofing slate, and window glass fragments. Other structural materials collected include wire and machine-cut nails, wire-reinforced safety glass, linoleum flooring, plaster, mortar, and asphalt. Nonstructural items include bottle or jar fragments, pieces from ceramic items (most likely tableware), an unmarked clay pipestem fragment, and chunks of coal. Of note was a horseshoe fragment, which may be associated with one of the blacksmith shops discussed above. This fragment was found in RP4, situated in the fill above Feature 8. Window glass is the most common temporally diagnostic item in the fill assemblage (n=27). Over half the pieces are too thick to use in Roenke's Pacific Northwest glass dating formula (1979:116) and may represent modern glass (1924+). Most of the few remaining fragments have thicknesses consistent with construction between 1845 and 1885, if Roenke's formula can be applied to such a limited collection. The other datable items indicate manufacture any time since the mid-1800s.

ANALYSIS AND INTERPRETIVE RESULTS

Archaeological discovery investigations involving both manual and mechanical excavations verified the results of the GPR reconnaissance, confirming that fill materials cover W9A to considerable depths. The fill was 120 cm deep overlying the black-stained sediments of Feature 8 at the north end of MT1. Farther south, the fill was 160 cm deep overlying Pleistocene gravels (possibly redeposited) in RP9.

The A horizon, in which evidence of prehistoric and historic occupation might most likely be found, appears to have been removed as a result of cutting and filling during previous highway construction. The northern portion of the Feature 8 black-stained sediments was underlain by Bw soil, but beginning with the three southernmost units and continuing to the south end of W9A, the Bw soil was not found. Pleistocene gravels, which underlie the CRC project area on the Washington Shore, were reached in only one probe (RP9). A bucket auger was successfully used to excavate through the fill and into these gravels which, as noted above, exhibit indications of mixing or redeposition.

With the exception of RP9, the manually-excavated round probes were excavated to 70 cmbs, which is generally the maximum depth reachable in probes of this size (30-cm diameter). As determined by the mechanical trenching, this depth was not sufficient to penetrate the thick fill deposits found to be present along the eastern margin of I-5. As a result, all of the cultural materials recovered from the probe excavations are from fill deposits, not from intact cultural strata. With the exception of a few recent items (e.g., plastic and Styrofoam) and a range of window glass fragments dating from as early as the 1840s and 1850s, the cultural materials appear to represent items excavated from historical contexts dating to the 1880s and later that were redeposited as fill material alongside I-5.

A narrow remnant of archaeological deposits associated with a blacksmith shop at the Quartermaster's Depot was uncovered in the north end of MT1. Test unit excavations spanning the length of the Feature 8 black-stained sediments were successful in recovering cultural materials from this deposit (Figures 10-11 and 10-12). The few temporally diagnostic artifacts found suggest that this cultural deposit is associated not with the earliest blacksmith shop (built in 1851), but with one of the later blacksmith shops constructed at more or less the same location.

The remnant archaeological deposits were bracketed on both sides by trenches for previously installed pipes. The pipe on the east side of MT1 may be the one installed in 1982 during monitoring in Operation 52C by Thomas and Hibbs (1984:409–420). The test unit excavations removed most of the evidence of the blacksmith shop exposed in the floor of MT1. No other cultural features were encountered during discovery probe and mechanical trench excavations in W9A.

NRHP ELIGIBILITY

Site 45CL916 is in a WSDOT parcel (W9A) on the east side of I-5 adjacent to FHWA property. Historically, W9A was on the western margin of the U.S. Army's Quartermaster's Depot at Vancouver Barracks. W9A was not included within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007).

The results of archaeological discovery probing and trenching in W9A indicate that the A horizon soils, in which evidence of prehistoric and/or historic occupation might most likely be found, were removed during previous highway construction. As suggested by the GPR reconnaissance and confirmed by the discovery probing and trenching, the preservation potential for archaeological deposits in W9A is low due to extensive cut-and-fill activities during previous highway construction, which extended more or less right up to the existing WSDOT/FHWA fence.

Although one cultural feature, the black-stained sediments associated with a blacksmith shop, was found below the fill deposits, this stratum is situated between two pipe trenches and was entirely removed during the test excavations. Further evidence of a blacksmith shop may be present across the fence to the east on FHWA property, although limited testing by NPS in 2009 was not successful in finding any (O'Rourke et al. 2010:93). As a whole, then, there appear to be little, if any, intact cultural deposits remaining in W9A. Any remaining archaeological evidence that might have survived previous highway construction almost certainly is not sufficient to warrant recognition of site 45CL916 as a significant archaeological site.

The cultural deposits at site 45CL916 exhibit the characteristics of historical archaeological properties that the National Park Service has indicated are *not eligible* for the National Register, namely "temporally diverse cultural material found in undifferentiated/mixed stratigraphic contexts or disturbed spatial associations and the absence of classifiable archaeological features" (Townsend et al. 1993:29–30). Site 45CL916 clearly lacks the integrity (level of preservation and quality of information contained in the deposits) of a significant archaeological site (Little et al. 2000:31–44). Accordingly, site 45CL916 is not considered eligible for inclusion in the National Register under criterion d.

Site 45CL916 also does not meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5, and the massive amount of earth-moving during highway construction resulted in the widespread

Figure 10-11. View south, during excavation of the black-stained sediments in Feature 8 at the north end of MT1, site 45CL916 (Columbia River bridges in background).

Figure 10-12. View north, during excavation of the black-stained sediments in Feature 8 at the north end of MT1, site 45CL916 (I-5 on left, WSDOT/FHWA property fence on right).

destruction of the historic setting. As a result, the site does not meet the integrity standards for National Register eligibility under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

Site 45CL916 is in a WSDOT parcel (W9A) situated within the former area of the U.S. Army Quartermaster's Depot at Vancouver Barracks. Archaeological testing was conducted on the FHWA property adjacent to the east side of 45CL916 in 2009 (O'Rourke et al. 2010). The FHWA property corresponds to the southern portion of VNHR Area #2 investigated by the NPS. Three exploratory backhoe trenches, one test unit, and one shovel test were excavated on the west side of the FHWA property near the WSDOT/FHWA fence in the area of the former blacksmith shop (O'Rourke et al. 2010:85).

Trench 2-14, excavated "in the previous location of the 1850s Blacksmith Shop," contained nine different fill episodes (O'Rourke et al. 2010:87). Two artifacts recovered from the trench as a "grab sample" were not specifically identified, but may have been "butchered and unworked bone" (O'Rourke et al. 2010:93).

Shovel test ST2-06 was also described as "within the previous location of the 1851 Blacksmith Shop," but it is shown on the project map as about 8.0 m to the north of the building's projected footprint. This shovel test encountered "a large amount of construction rubble and cobbles," requiring a backhoe to be used to extend the excavation from 40 to 150 cmbs. A tile sewer pipe was exposed at the base of the excavations, but "no buried cultural layer was observed" in the trench (O'Rourke 2010:88). Fifteen artifacts were collected, most of which "appear to represent architectural debris related to historical and modern construction and demolition activities within the area" (O'Rourke et al. 2010:93).

The NPS archaeologists summarized their findings by stating that "no archaeological evidence of the 1851 Blacksmith Shop was observed within ST2-06 and Trench 2-14" (O'Rourke et al. 2010:93).

Five more backhoe trenches and one test unit were excavated farther south on the FHWA property across the WSDOT/FHWA fence from the southern portion of W9A. Trench ST2-15 contained three fill layers overlying B horizon soil at 170 cmbs; no artifacts were observed. Trench ST2-16, placed next to the WSDOT/FHWA fence in "the previous location of several 19th-century Workshops" contained at least four fill layers over "a discontinuous buried cultural layer at 94 cm" (O'Rourke et al. 2010:87).

TU2-01, placed on the south end of this trench, contained seven fill layers over the thin discontinuous buried cultural layer. Although a large number of 19th-century artifacts were recovered, "mottled sediments and the presence of 20th-century artifacts to a depth of 204 cm indicated that these deposits are disturbed" (O'Rourke et al. 2010:88). The large number of artifacts found in TU2-01 consisted for the most part of materials that "appear to represent architectural debris related to" the 1859 workshops located on the north side of present-day 5th Street (O'Rourke 2010:97).

Three more backhoe trenches were excavated in East 5th Street. Trench 2-17 and Trench 2-18 placed in "the previous location of several 19th-century Workshop buildings" both encountered multiple fill layers overlying B horizon soils at 102 cm and 130 cm below surface, respectively.

Trench 2-19, situated to the south "in the previous location of an 1851 Carpenters Shop and Store Room," contained four fill layers overlying B horizon soil at 160 cm (O'Rourke 2010:87-88).

The subsurface conditions on the FHWA property to the east of site 45CL916 were summarized by the NPS archaeologists as follows:

> The sediments in the southern portion of VNHR Area #2 reflect many episodes of disturbance, the most recent of which occurred during the 1950s construction of the Interstate 5 freeway. Intact 19th-century deposits appear to have been largely obliterated in this area. As many as nine different fill episodes were observed, reaching 170 cm deep in places, with considerable local variation. (O'Rourke et al. 2010:86)

This summary description is consistent with the nature of the deposits encountered during the discovery probing and trenching by HERITAGE at site 45CL916 on the adjacent WSDOT property in the I-5 corridor.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL916 as not National Register eligible, no further archaeological investigations are recommended at W9A. However, there is always a possibility that previously unidentified and potentially significant evidence of prehistoric or historic occupation or activity may be exposed during construction-related earthmoving. Considering its location within the former area of the Quartermaster's Depot at Vancouver Barracks, monitoring by an archaeologist is recommended during any earthmoving in this area during construction for the CRC project.

11. WASHINGTON AREA 9B (45CL917)

Located on the east side of I-5, Washington Area 9 (W9) is a narrow strip of WSDOT land bounded on the east by the WSDOT property fence and on the west by the north-bound lanes of I-5. Based in part on landownership, W9 is divided into two parts: (1) W9A, a northern area, is bounded on the east by FHWA land; and (2) W9B, a southern area, is bounded on the east by U.S. Army land. These two areas are divided by the former location of 5th Street which, before construction of I-5, connected the military reservation and the City of Vancouver. This chapter describes the procedures and results of discovery investigations and testing in W9B (Figure 11-1).

Data recovery excavations to mitigate impacts from construction during an earlier reconfiguration of the I-5/SR 14 interchange were undertaken within the area of present-day W9B in 1974 (Chance and Chance 1976). Afterwards, massive construction excavations were conducted through this area in connection with emplacement of the SR 14 ramp connecting to northbound I-5. The existing WSDOT/U.S. Army boundary fence has been in place since the mid-1970s (see Chance and Chance 1976:38), providing a clear separation of the former construction zone on WSDOT property from the U.S. Army property which was not affected by highway construction.

In order to determine if any significant archaeological deposits are still present, archaeological discovery probing and trenching were undertaken in W9B between March 24 and April 2, 2009. Beneath deep, compacted fill materials introduced during previous highway construction, cultural deposits and features associated with the site of the U.S. Army Quartermaster's Depot stable/corral complex at Vancouver Barracks were found. The archaeological remains in W9B have been recorded with DAHP as site 45CL917.

Site 45CL917 is on WSDOT property situated within the former area of Kanaka Village at HBC Fort Vancouver and the U.S. Army Quartermaster's Depot at Vancouver Barracks. The designation 45CL300, originally applied to Kanaka Village, was expanded in 1984 to subsume all Kanaka Village and U.S. Army related archaeological resources in this area, including the WSDOT parcel in which site 45CL917 has been recorded (Thomas and Hibbs 1984:2). W9B was not included within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et a. 2007).

HISTORICAL SETTING

W9B is located northwest of Kanaka Village at HBC Fort Vancouver. Although no village structures are known to have been located in this area, it is possible that evidence of activity by the residents of Kanaka Village could be present.

W9B lies along the western edge of the U.S. Army military reservation. A map entitled "Pre ca. 1860 Archaeological Features and Structures" shows a number of early buildings south of present day East 5th Street in proximity to W9B (Thomas and Hibbs 1984:725). These buildings, associated with the Quartermaster's Depot, were located varying distances east of the current

Figure 11-1. View north, showing the setting of WSDOT parcel W9B between I-5 (left) and the WSDOT/U.S. Army boundary fence. Photograph taken near end of fieldwork with backfilled trench and units indicating location and extent of investigations.

WSDOT/U.S. Army property fence, and included (from north to south) a carpenter's shop, clerk's mess, and two stables built before and after 1856 on approximately the same footprint. All of these early buildings were situated east of the WSDOT property fence that forms the eastern boundary of W9B.

The two early stables, located east of the south end of W9B, were later expanded into a stable/corral complex at the Quartermaster's Depot that continued in use into the twentieth century. This later stable/corral complex extended westward into the area of present-day I-5, with the result that associated archaeological remains straddle the WSDOT/U.S. Army fence.

Situated east of the City of Vancouver, W9B generally falls outside the area covered by Sanborn fire insurance maps. The 1907 and 1911 Sanborn editions are important exceptions, as they show buildings at the Quartermaster Stables in the vicinity of present-day W9B in considerable detail. These Sanborn maps are consistent with maps of Vancouver Barracks prepared before and after 1911, specifically in 1904 and 1914 (see Thomas and Hibbs 1984:783, 785). The 1911 Sanborn map provides a useful reference for interpreting the results of discovery investigations at W9B.

PREVIOUS ARCHAEOLOGY

Archaeological investigations carried out in 1974 by the University of Washington in connection with the first reconfiguration of the I-5/SR 14 interchange extended northward along I-5 into present-day W9B (Chance and Chance 1976). Archaeological investigations in the early 1980s by Eastern Washington University in connection with the second configuration of the I-5/SR 14 interchange were carried out on U.S. Army land to the east but apparently did not extend into W9B (Thomas and Hibbs 1984). However, additional archaeological probing was carried out in W9B in 1994 in connection with a proposed pedestrian undercrossing under SR 14 (Thomas 1994).

University of Washington Investigations

In connection with the first reconfiguration of the I-5/SR 14 interchange, in 1974 the University of Washington's Operations 3 and 4 were conducted within W9B (Chance and Chance 1976). Excavations in Operation 3, located toward the south end of W9B and adjacent to the present WSDOT/U.S. Army fence,

> revealed a system of heavy wood sills lying close together in shallow trenches dug to receive them. Both large cut and wire nails were found in the timbers and trenches, superficially suggesting a late 19th-century date. These sills are believed to have underlain the northern end of the west wing of the Quartermaster barn complex. The closeness of the sills to each other suggests that a heavy floor was laid over them, probably to withstand the weight of horses. The sills may date from as early as the 1860s, when a stable first appeared in this location, while the wire nails may represent a later repair of the floor. Overlying this feature was a thick layer of brick and mortar rubble containing cut square nails exclusively. This rubble, probably applied to the surface as a sort of paving or cover, may have been laid early in this century, and must have come from a demolished middle or late 19th-century building elsewhere on the post (Chance and Chance 1976:25).

Operation 4 was located to the north, toward the middle of W9B, and may now lie under the easternmost lanes of I-5. Excavations in Operation 4 exposed

> a wooden drain 0.9 feet wide with its base 4.15 feet below the present surface. Running northwest to southwest, it consisted of three very poorly preserved planks, two planks serving for sides and the third lying on them for a cover. They had been fastened together with cut square nails. The absence of organic material in the sand on the bottom of the drain suggested it was used to convey runoff rather than sewage. A 20th-century Army map showed this as an abandoned drain. It probably served the 19th-century Quartermaster shops, located just south of the present Federal Highway Administration Building (Chance and Chance 1976:25).

Pedestrian Undercrossing Project

In connection with a proposed pedestrian undercrossing under SR 14, 19 shovel probes were excavated at intervals "in the narrow strip of right-of-way between the chainlink fence that marks the U.S. Army and WSDOT property boundary and the highway" (Thomas 1994:8). The shovel probes were spaced at 20 or 40 ft intervals beginning where the north side of the pedestrian crossing was to be located, and proceeding west and then north along the fence.

The northernmost seven shovel probes excavated for the Pedestrian Undercrossing project were located in present-day W9B (other probes excavated for this project fall within present-day W5A and W5B). Shovel probes 23, 24, 25, 26 28, 30, and 32 were placed at intervals along the straight stretch of the WSDOT/U.S. Army fence between the deep cut for the I-5 Exit 1B ramp on the south and East 5th Street on the north (Thomas 1994).

According to Thomas (1994:8), "fill material, usually imported bark dust and sand and gravel, was observed in all of the probes.... The fill material had been placed directly onto native sediments which were generally characterized as dark to light brown gravelly loam." A graph providing data on the "maximum depth of fill per shovel probe" indicates that the fill in the probes in W9B ranged from approximately 80 to 230 cm below surface (Thomas 1994:9). Data on the maximum depth of excavation reached in these probes was not provided. A total of 266 artifacts were recovered during this project, but data relating the artifacts to the particular probes in which they were found was not provided.

A brick pier encountered in Probe 25 was further exposed by excavation of a single 5 × 5 ft unit. Constructed of American common brick laid in a common bond, the feature was exposed at 1.7 ft and extended to a depth of 2.8 feet. According to Thomas (1994:12),

> the position of Feature 1, 80 feet north of the right-of-way corner of the I-5 off-ramp to C Street, placed the brick foundation where historic and archaeological maps locate a western extension of the Quartermaster's Depot Stable in 1874 and 1888. If this is the case, then highway construction may have already removed parts of this building site.

The portion of this stable complex on U.S. Army land east of W9B was investigated as Operation 60 in 1980, at which time extensive evidence relating to the first major renovation of the stable and subsequent occupation from 1856 to 1879 was documented (Thomas and Hibbs 1984:635–694).

GPR RECONNAISSANCE

The GPR reconnaissance begun in W9A continued southward into W9B. As described in the preceding chapter on W9A, four GPR profiles were surveyed using high-power 200 MHz antennae. CRC Lines 10, 11, 12, and 13 extended north to south and were spaced west to east 3.0 m line separation distance in W9. The total line distance for the 200 MHz profiles in W9 was 439.25 m. A repeat of CRC Line 11 undertaken using 500 MHz shielded antennae was recorded as CRC Line 221.

Three of the four initial GPR lines extended the full length of W9, so that the northern portions of the GPR lines relate to W9A, and the southern portions of the GPR lines relate to W9B. CRC Line 11 began south of the former location of East 5th Street and, therefore, relates entirely to W9B.

Resistive fill reflections were found to at least 20 nanoseconds (ns) (1.0 m below surface) in all GPR profiles. Based on these representative profiles, it was predicted that fill covers 100 percent of W9. The depth of resistive fill ranges from 20 ns (1.0 m below surface) to 60 ns (3.0 m below surface). The average depth of fill in W9 suggested by the GPR profiles is 40 ns (2.0 m below surface).

Buried conductive layers (later verified as Pleistocene Bw soil layers) were found in the profiles along CRC Line 10, CRC Line 11, and CRC Line 12. Top-truncated inclined reflections (Pleistocene gravels) were not found north of 5th Street in W9A, but were present farther south in W9B. This situation indicates that the fill materials that cover the surface are relatively thicker in W9A than in W9B, with fill depths decreasing to less than 1.0 m in the southern portion of W9B.

Three large anomalies in the CRC Line 10 profile reflected buried cultural features uncovered during the archaeological investigations: (1) at 100.0 m distance a brick wall/concrete sidewalk (MT2 Feature 6); at 145.0–150.0 m distance a brick cistern (MT2 Feature 1); and (3) at 155.0–165.0 m distance a concrete foundation corner (Feature 1). The last two anomalies were very well defined in an adjacent 200 MHz profile (CRC Line 11) and in a 500 MHz repeat profile (CRC Line 221).

FIELD INVESTIGATIONS

W9B begins on the south side of the former location of East 5th Street and continues south along the east side of I-5 to the deep cut made for the Exit 1B off-ramp from I-5 to the City of Vancouver. The area in which archaeological investigations could be conducted in W9B is very narrow, consisting of a strip of ground between the toe of the slope extending down from the I-5 northbound travel lanes on the west and the chain-link WSDOT/U.S. Army fence on the east. The available work space in W9B ranged from as little as 2.2 m to a maximum of 6.2 m wide.

Manual Excavations

Archaeological probing that began in W9A continued southward into W9B with a line of discovery probes spaced at 10-m intervals. The discovery probes along this line in W9B included seven round probes (RP) measuring 30 cm in diameter, numbered RP12 through RP17 and RP19, and two shovel probes (SP) measuring 50 × 50 cm, numbered SP1 (expanded from RP18) and SP2. These were generally placed 2.0 m west of the chain-link property fence to avoid impacts to electrical irrigation boxes along the fence (Figure 11-2).

Seven of the discovery probes in W9B were excavated to depths of 70 to 110 cmbs (Table 1). The exceptions were RP15 and RP16, stopped at 30 cm and 20 cm, respectively, where an asphalt surface, apparently from a former roadway, was encountered. The two relatively uniform layers of fill material encountered in W9A continued to be identifiable in RP12, RP13, and RP14. South of RP15 and RP16, the two fill layers were not as easily distinguished, at least in part because of disturbance from construction of cultural features in this area.

The fill layers contained structural debris from historic buildings (e.g., concrete, bricks, window glass, and nails) and other cultural materials, which, together with the small size of the probes, made it difficult to distinguish introduced fill from intact cultural deposits. A horizon soils were identified below fill in RP14 and RP19. Bricks and other cultural materials found from 90 to 110 cmbs in RP12 may be related to the brick wall/concrete sidewalk recorded as MT2 Feature 6. Structural remains and other cultural material found in SP1 were associated with the concrete foundation corner recorded as Feature 1.

Concrete Foundation Corner Exposure

Following completion of the discovery probe excavations at 10-m intervals along the length of W9B, a series of test units was excavated that resulted in the exposure of a concrete foundation corner recorded as Feature 1. These excavations were prompted by the discovery of structural remains in SP1, and began with an attempt to relocate the brick pier found during archaeological testing in 1994 in conjunction with the proposed Pedestrian Undercrossing project. This feature had been uncovered from 1.7 to 2.8 feet below surface "80 feet north of the right-of-way corner

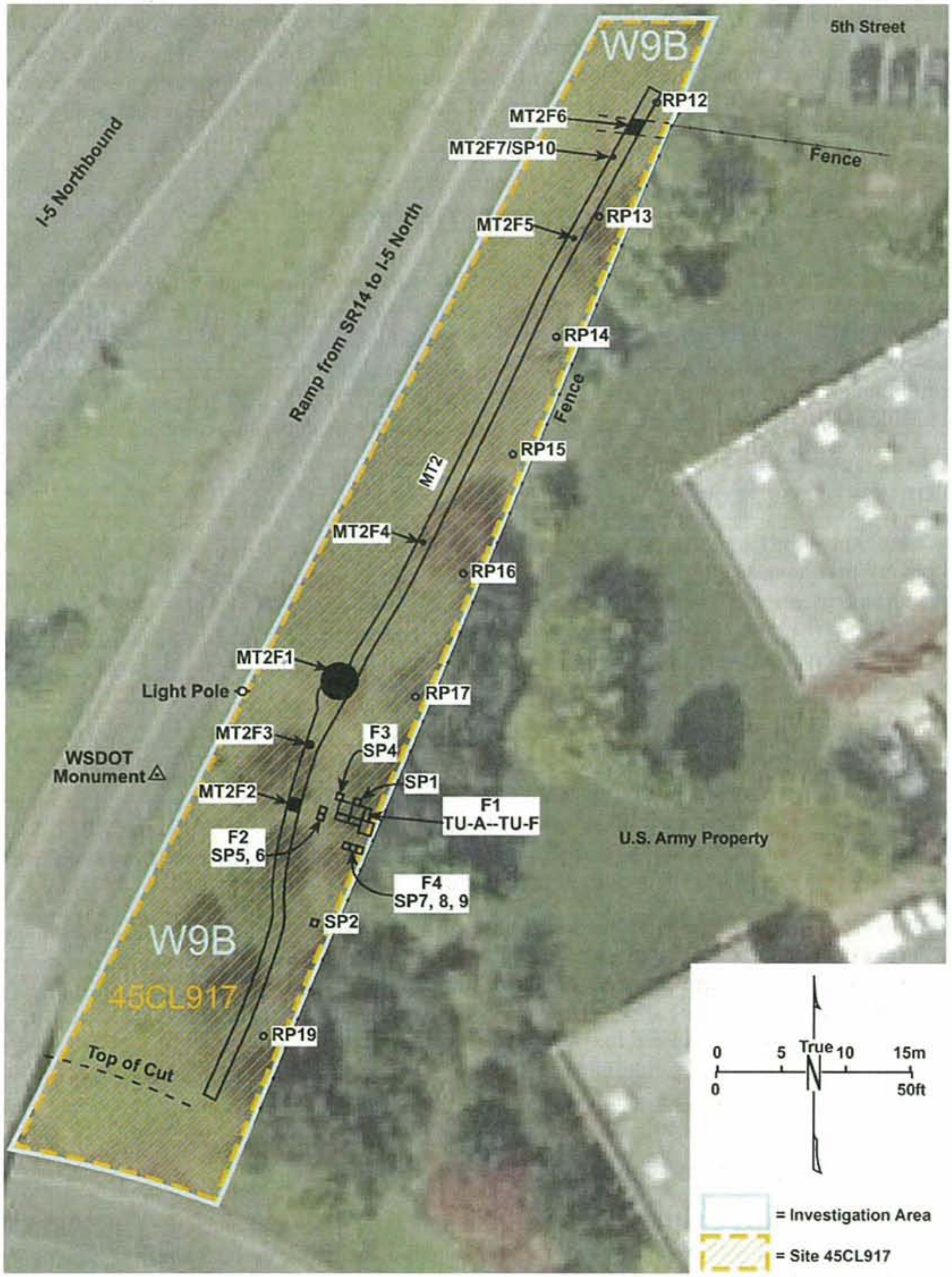

Figure 11-2. Locations of round probes (RP), shovel probes (SP), test units (TU), mechanical trench (MT), cultural features (F), and site 45CL917 in WSDOT parcel W9B on aerial photograph (Terrain Navigator Pro 2002).

Table 11-1. Summary of Discovery Probe Excavations at Site 45CL917.[1]

Probe No.	Level/ Stratum	Depth Below Surface (cm)	Sediment Description	Cultural Material[2]
RP12	1-2/1	0-20	Dark brown organic very coarse sandy loam with primarily rounded gravels (Fill)	None
	3/2	20-30	Light brown loamy very coarse sand with abundant rounded gravel (Fill)	1 metal fr, 1 flat glass fr
	4/2	30-40	Same (Fill)	2 nail fr
	5/2	40-50	Same (Fill)	1 metal military button, 2 amber glass fr, miscellaneous metal fr
	6/3	50-60	Dark gray brown sandy clay loam with rounded granules, pebbles, cobbles (Fill)	1945 Penny; nail fr
	7-8½/4	60-75	Dark gray brown sandy clay loam with red silt peds; same gravel as previous level (Fill)	1 composite fr, possible flake
	8½-10/5	75-90	Medium brown sandy clay loam; same gravel as previous level (Fill)	Trace roofing slate (fallen from above?)
	10/6	90-100	Abrupt change to light yellow-brown sandy clay loam; noticeably less gravel (Fill)	2 aqua glass fr
	11/6	100-110	Same (Fill)	27 aqua glass fr
	12/6	110-120	Same (Fill)	Brick at 120 cmbs; glass fr
RP13	1/1	0-10	Dark brown organic very coarse sandy loam with primarily rounded gravels (Fill)	None
	2/1	10-20	Same (Fill)	1 slate fr, 1 amber glass fr
	3/1	20-30	Same (Fill)	8 small slate fr
	4/1	30-40	Same (Fill)	None
	5/1	40-50	Same (Fill)	1 small black glass fr
	6/1	50-60	Same (Fill)	None
	7/2	60-70	Lighter brown sandy clay loam (Fill)	1 small colorless glass fr, 1 earthenware fr
	8/2	70-80	Same (Fill)	Trace brick
	9/2	80-90	Same (Fill)	None
RP14	1/1	0-10	Dark brown organic very coarse sandy loam with primarily rounded gravels (Fill)	None
	2/2	10-20	Gray-brown compact gravelly sandy loam, rounded gravels (road-related Fill)	Concrete chunk, trace brick, trace slate
	3/2	20-30	Same; drier and increasingly sandy (Fill)	1 wire nail
	4/2	30-40	Same; becoming light yellow-brown toward bottom of level (Fill)	None
	5/3	40-50	Same (Fill)	None
	6/3	50-60	Same (Fill)	Concrete, brick, mortar, 3 porcelain fr, 3 white improved earthenware fr, 13 glass fr, 1 wire nail & 2 nail fr, 1 slate fr, trace asphalt, 5 window glass fr
	7/4	60-70	Reddish-brown loamy gravel with subrounded pebbles and cobbles (A horizon)	1 Chinese porcelain fr
RP15	1/1	0-10	Dark brown organic very coarse sandy loam with primarily rounded gravels (Fill)	1 slate fr
	2/1	10-20	Same (Fill)	Trace brick
	3/1	20-30	Same on asphalt layer (Fill)	1 metal washer
RP16	1/1	0-10	Dark brown organic very coarse sandy loam with primarily rounded gravels (Fill)	1 slate fr
	2/2	10-20	Compacted gravels on asphalt layer (Fill)	1 wire nail, 2 window glass fr
RP17	1-4/1	0-40	Gray-brown compact loam, subrounded gravels, occasional cobbles (road-related Fill)	None
	5/1	40-50	Same (Fill)	Horse shoe, 1 cut nail
	6/1	50-60	Same (Fill)	None
	7-9/2	70-90	Yellow-brown sandy clay loam, looser, with rounded granules and pebbles (Mixed/redeposited Bw)	None

Table 11-1. Summary of Discovery Probe Excavations at Site 45CL917[1] (*continued*).

Probe No.	Level/ Stratum	Depth Below Surface (cm)	Sediment Description	Cultural Material[2]
SP1 (RP18)	1/1	0-10	Dark brown organic gravelly sandy clay loam (Fill)	Trace brick, concrete, coal, slate, 1 amber glass fr
	2/2	10-20	Light brown, same texture (Fill)	Trace brick, concrete, slate 1 wire nail, 2 metal fr, 3 window glass fr
	3/2	20-30	Same (Fill)	Brick, mortar, slate
	4/2	30-40	Same (Fill); two intact bricks laying horizontal at 33-35 cmbs; concrete chunks in sidewalls; round probe expanded to 50 x 50 shovel probe	Brick, mortar, concrete
	5-6/2	40-60	Same (Fill); exposed disturbed structural remains	Brick, metal
	7/3	60-70	Light brown sandy loam (Fill)	Brick, 4 metal fr, 3 coal fr, 1 wire nail, 2 nail fr, 1 mortar fr, 2 sheetrock fr, 1 wood fr
	8/3	70-80	Same (Fill)	Brick, 1 colorless glass fr, 1 cut nail, 2 nail fr, paper
SP2	1/1	0-10	Gray-brown compact loam, some subrounded pebbles (road-related Fill)	9 slate fr, 1 amber glass fr,
	2/1	10-20	Same (Fill)	1 brick fr, 2 slate fr, 1 earthenware fr
	3/1	20-30	Same, with a few cobbles (Fill)	2 brick fr, 1 wire nail, slag, 6 asphalt fr
	4/1	30-40	Same, with increased cobbles (Fill)	Brick, concrete, slate
	5/1	40-50	Same, with clay inclusion in south half (Fill)	Brick, metal, slate, 1 window glass fr, 1 coal fr, 2 cut nails, 3 nail fr
	6/2	50-60	Predominantly gray clay (Fill)	1 brick fr, 4 nail fr, 1 possible flake, 1 charred bone fr, charcoal
	7/3	60-70	Yellow-brown loam, loosely compacted, with some subrounded gravel (Mixed fill/Bw)	2 nail fr, 2 green glass fr, 1 possible flake
	8-11/3	70-110	Same (Bw?)	None
RP19	1/1	0-10	Dark brown organic gravelly sandy loam with subangular to rounded gravels (Fill)	Trace slate, trace concrete
	2/1	10-20	Lighter brown gravelly sandy loam (Fill)	Trace brick, 1 slate fr
	3/1	20-30	Light brown very gravelly sandy loam (Fill)	4 slate fr
	4/1	30-40	Light brown extremely gravelly sandy loam (Fill)	Slate, 1 nail fr, 1 window glass fr, 8 bone fr
	5/1	40-50	Medium brown extremely gravelly sandy loam (Fill)	Trace brick
	6/1	50-60	Same (Fill)	Trace brick, 1 window glass fr
	7/1	60-70	Same (Fill)	1 window glass fr
	8/2[3]	70-80	Red-brown very gravelly silty clay loam (A horizon?)	None
	9/2[3]	80-90	Same (A horizon?)	Trace charcoal
	10/2[3]	90-100 cm	Same (A horizon?); reached clast-supported gravels suggesting Pleistocene gravels	Larger charcoal chunks

[1] Probes are listed as placed north to south at 10-m intervals
[2] Includes cultural materials observed (but not collected) as well as those recovered
[3] Excavated by auger with 20 cm-diameter bore

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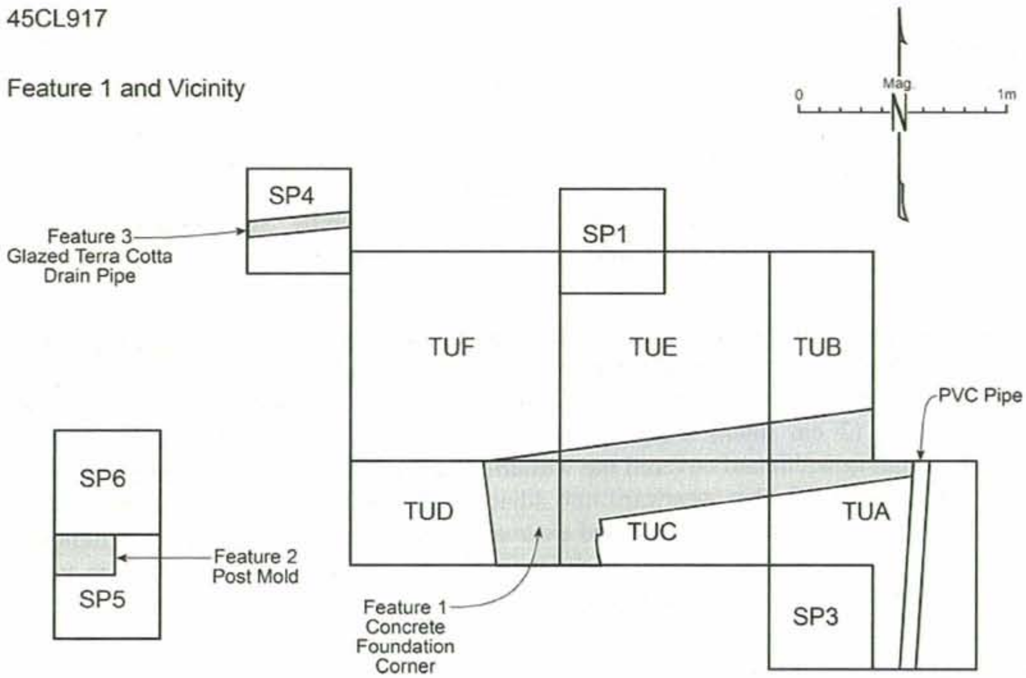


Figure 11-3. Plan map of excavation units around the Feature 1 stable foundation corner at site 45CL917.

of the I-5 off-ramp to C Street" (Thomas 1994:12). A sketch map of this feature showed a PVC irrigation pipe in a trench situated between the brick pier and chain-link fence. The brick pier at this location was interpreted as evidence of "a western extension of the Quartermaster's Depot Stable" that stood in this area between 1874 and 1888 (Thomas 1994:10–12).

The attempt to relocate this brick pier began with excavation of SP3, placed 1.5 m southeast of SP1 and within 1.0 m of the fence, which uncovered additional structural remains in the form of brick and concrete rubble to 70 cmbs (Figure 11-3). SP4, placed 1.0 m west of SP1, was excavated through building rubble to a maximum depth of 90 cmbs, working around a glazed terra-cotta drain pipe at 73 cmbs recorded as Feature 3. In an effort to determine the extent of the structural remains, SP5 was placed 3.5–4.0 m west of SP3. This probe was excavated through structural remains to the top of a clay-like surface at 67 cmbs. Removal of a pocket of loose soil in the northwest corner of the probe exposed a rectangular post mold excavated into the A horizon that was recorded as Feature 2. SP6, placed adjacent on the north side of SP5, was excavated to 90 cmbs without encountering any further evidence related to this post mold or other cultural features.

SP3 was then expanded to the north and incorporated into TU-A, the first of six test units of various sizes (100 × 50 cm and 100 × 100 cm) excavated to determine the nature of the structural remains in this area. At 40 cmbs, the top of what was later determined to be a concrete foundation was exposed along the northern edge of TU-A. The PVC irrigation pipe between the brick pier and fence observed in 1994 was exposed in the eastern portion of TU-A, where it extended northward within a cut through the concrete foundation.

Although the brick pier found in 1994 was not relocated, the six units (TU-A through TU-F) excavated in a block exposed the northwest corner of the Feature 1 concrete foundation (Figures 11-4 and 11-5). Surrounding the concrete foundation was a dense rubble deposit containing concrete, bricks, and other structural remains. Some of this rubble may have been backfilled into the trench in which this foundation was poured, while portions of the rubble at greater distances from the foundation may have been spread around the area during this structure's demolition. The rubble deposit extended to depths ranging from 60 to 70 cmbs. Sediments that appeared to correspond to the A horizon were reached in TU-A at 70–90 cmbs, and in TU-B and TU-C at 70–80 cmbs.

Near the conclusion of the field investigations in this area, three shovel probes (SP7, SP8, and SP9) were placed in a line to the south of the block excavation in an attempt to intercept the projected location of the concrete foundation's west wall. At 15 cmbs, the top of a section of concrete veneer (2 cm thick) was exposed in SP7 and recorded as Feature 4. This veneer measured 50 cm in width and covered the western 40 cm of this 50 × 50 cm probe. The concrete veneer did not extend farther westward into adjacent SP8, but it did extend 10 cm into adjacent SP9 on the east before ending. Continued excavation on either side of the feature indicated that the concrete veneer rested on a 9-cm-thick layer of light-colored sediment, which in turn rested on a dark-colored deposit of brown silt loam with gravel.

Mechanical Trench Excavation

As in W9A, the discovery probe excavations in W9B established the presence of deep and compact fill deposits along the east side of I-5. The presence of historical materials in the fill further complicated the identification of intact cultural deposits below the fill. This situation underscored the importance of mechanical trenching to ensure the identification of any significant cultural remains present below the fill deposits.

A backhoe with a 3-foot-wide bucket was employed to excavate a mechanical trench designated MT2 from south to north through W9B (MT1 was in W9A). The trench width varied somewhat, but was generally about 1.1 m wide, and had a total length of 82.0 m. The trench was generally excavated to 110–120 cmbs. The trench began on the south, about 2.0 m north of the deep cut for the I-5 Exit 1B off-ramp into downtown Vancouver (Figure 11-6). It extended northward to end a short distance north of where East 5th Street formerly extended westward into the City of Vancouver (Figure 11-7).

MT2 was excavated slightly deeper at its south end to expose Pleistocene gravels at 160 cmbs. This basal deposit was overlain by the Bw horizon, a thin A horizon, and fill. This depositional sequence was not nearly as clear farther north, due to disturbance from construction of cultural features by the U.S. Army and from more recent impacts related to construction of I-5.

During the course of the excavation of MT1, seven cultural features were exposed in the trench walls. To distinguish them from the cultural features concurrently under investigation elsewhere in W9B, the features exposed in the mechanical trench were recorded with the prefix MT2. These features included a brick cistern (MT2 Feature 1), a glazed terra-cotta drain pipe (MT2 Feature 2), a wood post set in concrete (MT2 Feature 3), a piece of wood resting on the Pleistocene gravels (MT2 Feature 4), a brick pier/concrete footing (MT2 Feature 5), a brick wall/concrete sidewalk (MT2 Feature 6), and a post hole (MT2 Feature 7).

Figure 11-4. View south, showing the concrete foundation corner (Feature 1) exposed at site 45CL917.

Figure 11-5. View east, showing the concrete foundation corner (Feature 1) exposed at site 45CL917.

Figure 11-6. View north, showing MT2 excavation underway at south the end of WSDOT parcel W9B. Backhoe is approaching area of Feature 1 concrete foundation currently under excavation (background right).

Figure 11-7. View south, showing excavated MT2 in WSDOT parcel W9B, with SR 14 ramp to northbound I-5 and superstructure of Columbia River bridges in background.

Although not recorded as a cultural feature, it is worth noting that the asphalt surface encountered in RP15 (at 20–30 cmbs) and RP16 (at 20 cmbs) first appeared in the trench about 3.0 m south of RP16, and from there extended northward almost to RP14. The asphalt surface, which presumably represents a former roadway, thus was visible in the walls of MT2 over a total distance of about 23.0 m.

DESCRIPTION OF DEPOSITS

The surface of W9B was covered by compacted fill deposits. As noted above, the two relatively uniform layers of compacted fill material encountered in W9A continued to be identifiable in the northern portion of W9B. The upper fill layer consisted of dark brown, more organic, very course sandy loam with primarily rounded gravel, pebbles, and cobbles in the uppermost 20 cm. The lower fill layer consisted of light brown, loamy, very coarse sand with abundant, primarily rounded, gravel. These two fill layers comprised the bulk of the sediments removed from the discovery probes.

The fill deposits decreased slightly in thickness from north to south. Fill materials apparently extended to 120 cmbs in RP12 (although this may be due to a feature-related disturbance), and to 90 cmbs in RP13, in the northern portion of W9B. Fill to a depth of 90 cmbs was also encountered in RP17, but in other probes in the southern portion of W9B the fill extended only to 70 or 60 cmbs.

The excavation of backhoe trench MT2 was important in clarifying the extent of the fill deposits overlying intact soil horizons in W9B. A profile recorded at the south end of MT2, where excavations extended slightly deeper to expose the Pleistocene gravels, provided a view of the deposits in a relatively undisturbed portion of the site (Figure 11-8). The four strata discernable in this profile are (1) fill to 80 cmbs, (2) an A horizon from 80 to 110 cmbs, (3) the Bw horizon from 110 to 160 cmbs, and (4) a sharp transition from Bw to the oxidized C horizon (Cox) of the Pleistocene gravels at 160 cmbs.

The A horizon exposed at the south end of MT2 was characterized as dark brown (7.5 YR 3/2 to 3/3), gravelly, silty clay loam with primarily sub-rounded pebbles, minor granules, and trace cobbles. Farther north in W9B, the color of the A horizon was characterized as more reddish-brown. From the south end of the trench, the A horizon continued to be visible below fill in the trench profile as far north as RP15. The Bw horizon was characterized as dark yellow-brown (10 YR 4/4), very gravelly, sandy, clay loam, increasingly clast-supported with depth.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural Features

Feature 1

An approximately 2.2-m-long section of the north wall of a concrete foundation was exposed adjacent to the WSDOT/U.S. Army fence in the southern portion of W9B. A short, 50-cm-long

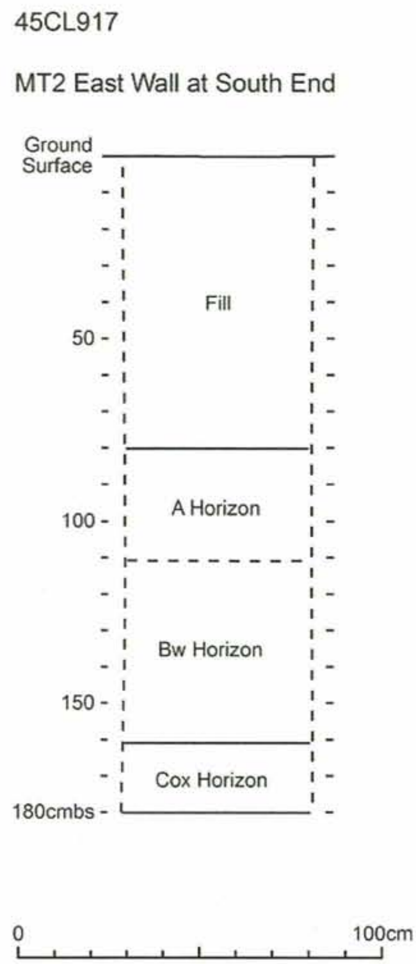


Figure 11-8. Soil profile in east wall at south end of MT2 at site 45CL917.

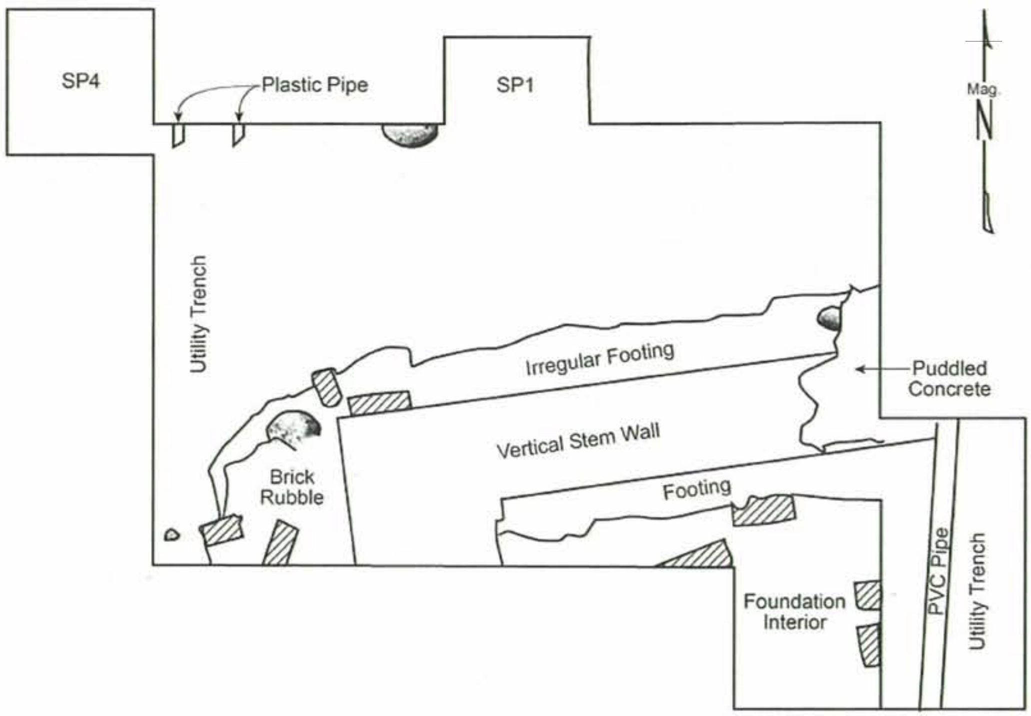
section of the west wall also was exposed, sufficient to establish the northwest corner of this structure (Figure 11-9).

This concrete foundation, first encountered in TU-A and exposed further in TU-B through TU-F, was constructed in two stages within a trench that was at least 75 cm (ca. 30 inches) wide. The lower portion, or footing, measuring up to 70 cm (ca. 28 inches) wide and about 15 cm (6 inches) high, has irregular edges, apparently as a result of the pouring of the concrete directly into the construction trench without supporting forms. The upper portion, or stem wall, about 30 cm (12 inches) wide and 30 cm high, was poured with forms on both sides. As a result, the upper walls of the foundation have smooth faces.

After the forms were removed, the trench in which the foundation was poured was backfilled with building rubble, which included whole and fragmentary bricks (including some with the HIDDEN brand). Careful excavations established that most, if not all, of the bricks exposed around the foundation were within the rubble used to backfill the construction trench rather than being structural elements related to the foundation.

45CL917

Feature 1 Plan View



Feature 1 South Wall

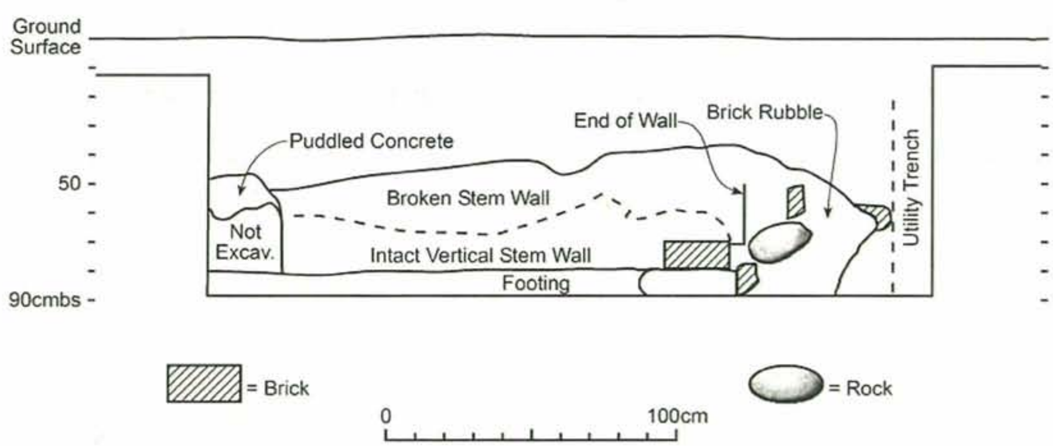


Figure 11-9. Plan (above) and profile (below) views of Feature 1 at site 45CL917.

Although the brick pier found in 1994 was not relocated, it presumably is nearby. Both features are situated along the west side of the WSDOT/U.S. Army fence, and the same PVC irrigation pipe was exposed during excavations conducted at both features.

The Feature 1 concrete foundation was associated with the Quartermaster's Depot stable/corral complex. Initially constructed in 1850–1851 this stable complex was in use through "a number of repair and expansion phases that changed its shape, dimensions, and perhaps function," until it was torn down in 1935 (Thomas and Hibbs 1984:635–636; Thomas 1994:12). Thomas (1994:12) suggested that the brick pier uncovered during the Pedestrian Underpass project related to a western extension of the stable in 1874 and 1888. The use of concrete in the construction of the Feature 1 foundation corner suggests that this feature was likely associated with one of the later versions of this building complex, perhaps with repairs made during the interval from 1879 to 1914 (Thomas and Hibbs 1984:680).

Feature 2

A rectangular post mold was found in the northwest corner of SP5. This shovel probe was excavated into fill containing structural remains and other materials to a depth of 65 to 70 cmbs, below which a more compact gray-brown clay loam occupied most of the unit. Below this deposit, a pocket of loose sediments was discovered in the northwest corner of the probe beginning at about 80 cmbs. The loose sediments turned out to be a second fill deposit within a rectangular post mold surrounded by a matrix consisting of medium reddish-brown, gravelly, loamy coarse sand (A horizon?). The post mold measured 22 cm north–south by 31 cm east–west. The bottom of the post mold was at 86 cmbs. SP6, placed on the north side of SP5, reached the medium reddish-brown, gravelly, loamy coarse sand without finding additional evidence of this feature.

Feature 3

A section of glazed terra-cotta drain pipe was exposed at the bottom of SP4. This shovel probe was excavated into fill containing structural remains and other materials to a depth of 63 cmbs, where a more compact, gray-brown, clay loam was exposed along the north wall. Wood fragments were present on top of the clay loam in the northwest corner and additional wood was present below the clay in the northeast corner of the probe. The top of the glazed terra-cotta drain pipe was exposed at 73 cmbs within the gray clay loam deposit. The pipe, which trended in a northeast–southwest direction, appeared to measure 15 cm (6 inches) in diameter.

Feature 4

SP7 and adjacent SP9 placed 3.9 m south of TU-A in an effort to intersect the north-south wall of the Feature 1 concrete foundation exposed a section of thin concrete veneer at 15 cmbs. The concrete veneer occupied the westernmost 40 cm of SP7, and continued eastward into adjacent SP9 for 10 cm, giving it a total width of 50 cm (ca. 20 inches). The veneer did not extend westward into SP8. The veneer was about 2 cm thick and appeared to have been poured directly on a surface of brown silt loam with gravel. Although apparently not directly connected, the Feature 4 concrete veneer is close enough to the Feature 1 concrete foundation corner that it almost certainly was associated in some way with the Quartermaster Depot stable/corral complex.

MT2 Feature 1

The top of a cistern constructed of bricks roughly in the shape of a beehive (a round/oval base rising to a domed top) was uncovered in MT2 (Figure 11-10). The outer portion was covered by a thin coat of plaster or concrete. Upon first exposure, the opening in the top was plugged by bricks set on end. This brick closure later collapsed, exposing an irregular opening measuring about 90 cm north–south by 56 cm east–west. The dimensions of the top of the cistern exposed in the trench measured 275 cm north–south by 135 cm east–west (slightly more than the trench width). The inside of the cistern held water, which, together with the unstable condition of the overlying fill in the trench walls, prevented further exposure of this feature. A similar method of construction was observed in a sewer manhole located in the East Barracks area north of East 5th Street at Vancouver Barracks (Figure 11-11).

MT2 Feature 2

A section of glazed terra-cotta drain pipe trending east–west was exposed at 110 cmbs in both walls of the mechanical trench. The pipe appeared ovoid in profile (apparently due to compaction from the weight of the overlying fill), measuring 18 cm wide and 10 cm high. About 1 m to the north, the remains of a second glazed terra-cotta pipe, this one measuring 10 cm in diameter, crossed the trench floor at 120 cmbs. These pipes were exposed a few meters west of the Feature 1 concrete foundation near the WSDOT/U.S. Army fence and probably relate in some way to the nineteenth century Quartermaster's Depot stable/corral complex.

MT2 Feature 3

Two pieces of dimensional lumber oriented vertically, visible from 60 to 90 cmbs in the west trench wall, apparently represent the remains of a wood post. Abutting the wood on the north side was a chunk of concrete that appeared to be faced on both sides. A cavity in the trench wall on the south side of the wood may indicate where concrete fell away during the trench excavation. The view available in the trench wall suggested that this feature represented a post set in concrete.

MT2 Feature 4

A chunk of wood was exposed at the contact between the Bw horizon and the underlying Pleistocene gravels in the west trench wall to the west of RP16. The wood chunk, which was definitely not a root, was situated at 115 cmbs, just above the trench floor. Although fill deposits occupied the top of the trench profile, the Bw sediments appeared intact. In an attempt to establish the age of the contact between the Bw horizon and the Pleistocene gravels, the wood was submitted for AMS radiocarbon dating. The wood returned a measured age of 60 ± 40 BP, and a conventional age of 70 ± 40 BP (Beta-260170). The essentially modern age of this wood, which somehow was introduced into sediments deep below the modern ground surface, appears to be a further indication of the extent to which the sediments along the east side of I-5 have been disturbed as a result of previous highway construction.

MT2 Feature 5

A brick pier set on top of a concrete footing was exposed toward the north end of MT2. The pier, which consisted of five courses of common red bricks (8¼ × 4 × 2½ inches) attached with mortar,

Figure 11-10. View west, showing brick cistern (MT2 Feature 1) at 45CL917.

Figure 11-11. View of a brick manhole in the East Barracks area at Vancouver Barracks.

measured 45 cm north–south by 43 inches east–west and was 30 cm high (additional brick courses may have been removed during previous construction). The underlying concrete footing measured 90 cm north–south by at least 75 cm east–west (it extended into the west trench wall) and was roughly 20 cm thick. The dimensions of the footing were irregular rather than sharp, reflecting poorly poured concrete. The brick pier was 10.0 m south of MT2 Feature 6, and had roughly the same orientation as that brick wall/concrete sidewalk (see description below), suggesting they were associated with the same structure.

MT2 Feature 6

A section of brick wall on a concrete footing bordered by a concrete sidewalk was uncovered near the north end of MT2 (Figures 11-12 and 11-13). The wall was made of bricks measuring 8½ × 4 × 2¼ inches and was three courses wide (Figure 11-14). Excavation into the trench floor on the south side of the feature established that the surviving portion of the wall is 11 courses high. At the bottom of the excavation into the trench floor, a concrete footing 50 cm (ca. 20 inches) thick was exposed on which the brick wall was constructed. The sidewalk adjoining the brick wall on the north is 90 cm (ca. 3 feet) wide. The east–west orientation of this feature is aligned with the south side of East 5th Street (Figure 11-15). This structure appears on maps of Vancouver Barracks from 1906, 1914 (on which it is identified as a Wagon Shed), and 1935 (Thomas and Hibbs 1984:783, 785, 787).

MT2 Feature 7

An oval-shaped area of black-stained sediments exposed in the trench floor at approximately 100 cmbs was interpreted to represent a post hole. The oval-shaped area measured roughly 40 cm north–south by 25 cm east–west. A shovel probe (50 × 50 cm) placed over the black-stained sediments was excavated through gray-brown sediments to a depth of 25 cm, where yellow-brown sediments were exposed. A significant amount of charcoal was recovered from the probe, but no fire-cracked rock suggestive of a fire pit was present. No artifacts were found in the probe, but artifacts recovered from the trench in proximity to the black-stained sediments include a door knob, a few bottle glass fragments, and a rifle cartridge. The probe, and the oval-shaped feature within it, were approximately 1.75 m south of the MT2 Feature 6 brick wall/concrete sidewalk, and presumably were associated with the same structure.

Artifacts

The artifact assemblage from 45CL917, totaling 933 items (a total reflecting few complete objects, mostly fragments of varying sizes), consists for the most part of items from fill (78.3 percent) rather than intact cultural deposits or feature associations (21.7 percent). Slightly less than half of the assemblage (48.9 percent) was recovered from fill deposits around the Feature 1 concrete footing, and another substantial portion was recovered from fill deposits sampled in the discovery probes (29.5 percent).

Artifacts were recovered from A horizon soils in three test units around Feature 1 (n=48) and in the lower levels of a few of the discovery probes (n=7). Most of the 131 items recovered from four different MT2 features are from MT2 Feature 6 (n=94). Although not directly associated with features, 10 fragments from two bottles collected as isolates are included with this group of artifacts because they were recovered below fill deposits in the trench.

Figure 11-12. View south, showing brick wall/concrete sidewalk (MT2 Feature 6) at site 45CL917. Brick pier (MT2 Feature 5) is visible in trench in background.

Figure 11-13. Concrete footing supporting brick wall (MT2 Feature 6) at site 45CL917.

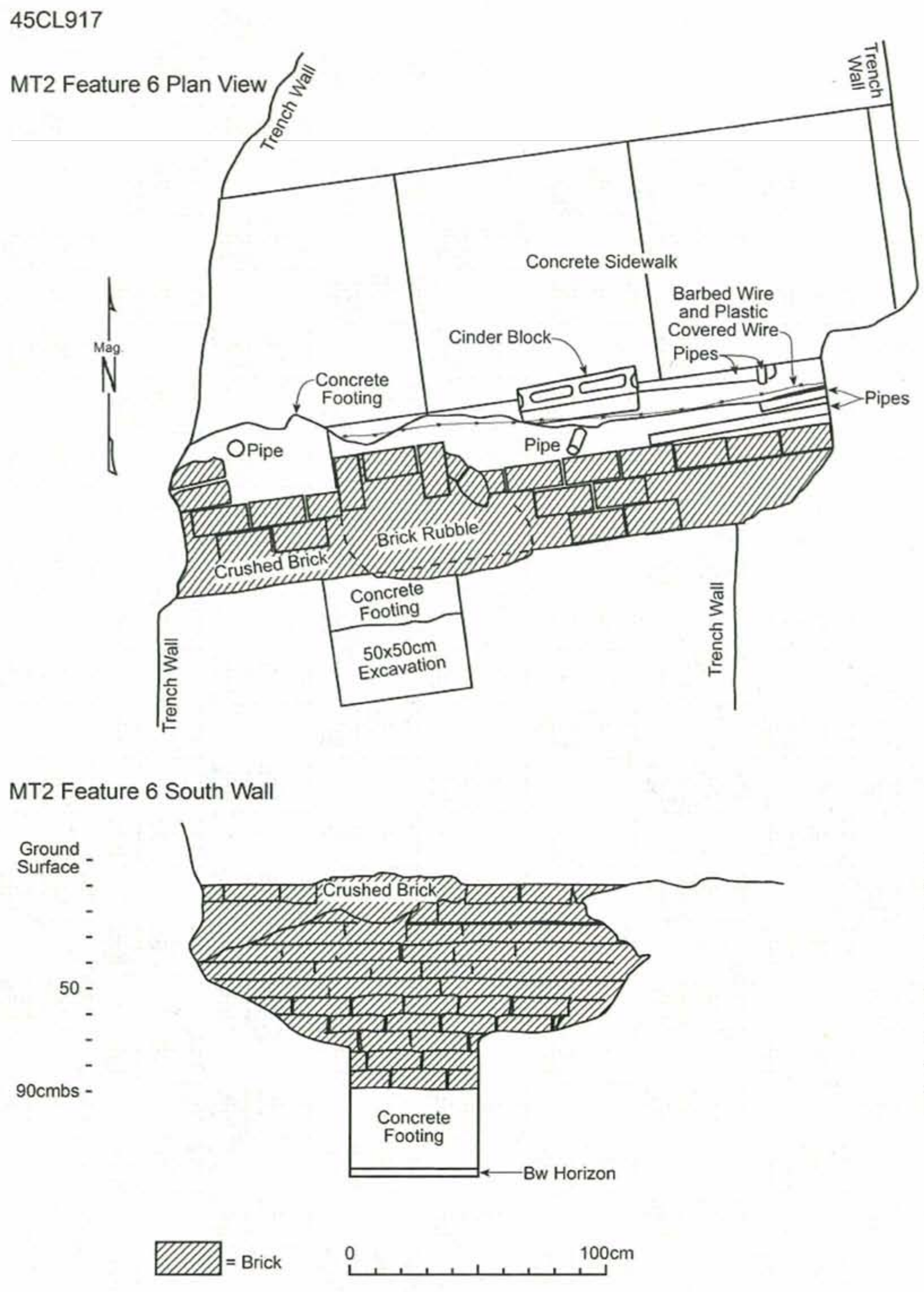


Figure 11-14. Plan (above) and profile (below) views of Feature 6 at site 45CL917.

Figure 11-15. View east, showing the alignment of the brick wall/concrete sidewalk (MT2 Feature 6) with the south side of East 5th Street at site 45CL917.

A summary of the artifact assemblage recovered is presented in Table 11-2. Dates or date ranges for manufacture of temporally diagnostic ceramics, glass, and metal items are summarized in Table 11-3. Only artifacts recovered from the A horizon or associated with cultural features are described in detail. In view of the fact that the origins of the artifacts recovered from the introduced fill are unknown, only a brief summary of these items is provided.

A Horizon Artifacts

The 70 artifacts from A horizon contexts are not particularly useful in dating these deposits, and because of their highly fragmentary and fire-damaged condition, most are not illustrated here. The only ceramic items are two burned fragments from blue transferwares (one earthenware and one white improved earthenware), one undecorated earthenware fragment, one fragment from a Chinese porcelain straight-sided teapot, and three small undecorated porcelain fragments. The two transferware fragments are too small for pattern identification, and although the pattern on the teapot was tentatively identified as a carp, no date can be assigned to this piece. The white improved earthenware transferware could date from the mid-1800s through the 1920s.

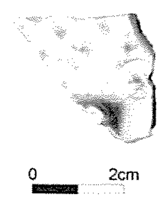


Figure 11-16. Chinese teapot fragment.

Most of the few bottle fragments are nondiagnostic, consisting largely of very small body fragments exhibiting no mold seams or other manufacturing characteristics. Seams indicating mold-blown production in a cup-bottom mold are visible on two mending colorless base fragments from what may have been an olive or pickle jar. Cup-bottom molds were used as early as the 1850s; however the majority of bottles from these molds were made between the mid- to late 1880s and late 1910s. Three additional colorless glass fragments are present in the A-horizon assemblage. One is from a bottle or jar; the other two are nondiagnostic body fragments that are probably also from glass containers. It is likely that the colorless glass bottles/jars were produced sometime after the 1870's. Large-scale production of colorless glass containers did not occur until the 1870s and 1880s. It should be noted, however, that colorless container glass has been recovered from significantly earlier contexts at Fort Vancouver.

A few machine-cut nails (n=6) and wire nails (n=4) were identified; however, far more (n=17) were too rusty to type. None of the machine-cut nails appear to be of early British manufacture. Wire nails were available to U.S. markets by the mid-1880s, although machine-cut nails apparently continued to be used for construction at Vancouver Barracks until the early 1900s, based on an examination of extant buildings dating from the late nineteenth century. Three fragments of window glass have thicknesses of 0.045, 0.050, and 0.081 inch. If these figures represented thickness modes in a larger assemblage and could reliably be used in Roenke's (1978:116) Pacific Northwest window glass dating formula, it might suggest construction between 1830 and 1840, between 1810 and 1835, and between 1855 and 1885, respectively. However, an assemblage of three fragments is too small to yield a reliable date estimate.

MT2 Feature Artifacts and Isolates

Artifacts were recovered in association with MT2 Feature 1 (brick cistern), MT2 Feature 5 (brick pier/concrete footing), MT2 Feature 6 (brick wall/concrete sidewalk), and MT2 Feature 7 (post hole). In addition, as noted above, fragments from two bottles were collected as isolates from a location in the trench wall not associated with a specific feature.

Table 11-2. Artifact Summary for Site 45CL917.

Artifact Group/ Category	Artifact Types	A Horizon and Feature-Associated Artifacts								Artifacts from Fill			Totals
		RP/SP A Hzn	F1 A Hzn	F2 A Hzn	MT2 F1	MT2 F5	MT2 F6	MT2 F7	MT2 Isolates	RP/SP Fill*	SP Fill/ Bw Hzn	Fill Around F1*	
Activities													
Ammunition	Centerfire cartridge case							1					**1**
Animal Husbandry	Horseshoe											3	**3**
Commerce	Lincoln penny (1945)									1			**1**
Toy	Glass marble						1						**1**
	Wooden arrow shaft											1	**1**
Domestic													
Food	Soda-pop bottle						1						**1**
Food Preparation & Consumption	Ceramic plate											1	**1**
	Ceramic saucer									3			**3**
	Chinese teapot	1											**1**
	Unident. ceramic tableware				1					2		2	**5**
	Glass drinking vessel		1									1	**2**
	Metal pot/pan											1	**1**
Furnishings	Glass lamp globe											1	**1**
	Porcelain doorknob							1					**1**
Faunal													
Mammal	Cattle											2	**2**
	Deer											1	**1**
	Large mammal									1			**1**
	Unidentifiable mammal	1		1			7			7		2	**18**
Bird	Chicken											1	**1**
Indefinite													
Fuel	Coal		2							1		9	**13**
Containers	Bottle/jar		1	1			44	17	1	60	2	35	**161**
	Stoneware container									1			**1**
Container closures	Glass bottle stopper									1			**1**
Indefinite	Ceramic item	3	3		3		4	1		5		5	**24**
	Glass item	1	1				1						**3**
	Metal bar				2							1	**3**
	Plastic item						1			2			**3**
	Pressed glass vessel											1	**1**
	Rope and tarp						6						**6**
	Rubberized cloth									1			**1**
	Unidentifiable metal item/ fragment						1			3		10	**14**
	Wood		4				1			5		30	**40**
Waste	Charcoal											2	**2**

Table 11-2. Artifact Summary for Site 45CL917 (*continued*).

Artifact Group/ Category	Artifact Types	A Horizon and Feature-Associated Artifacts								Artifacts from Fill			Totals
		RP/SP A Hzn	F1 A Hzn	F2 A Hzn	MT2 F1	MT2 F5	MT2 F6	MT2 F7	MT2 Isolates	RP/SP Fill*	SP Fill/ Bw Hzn	Fill Around F1*	
	Slag/clinker			1								10	**11**
	Stone drill core									3			**3**
Personal													
Accoutrements	Ceramic button						1						**1**
	Metal military button									1			**1**
Clothing	Leather shoe heel						1			2			**3**
Grooming/Health	Medicine bottle		2					1				2	**5**
Social Drugs - Alcohol	Alcoholic beverage bottle								9	1		1	**11**
	Flask							3					**3**
	Demijohn									1			**1**
	Glass beer bottle						9					1	**10**
Social Drugs - Tobacco	Clay pipe											1	**1**
	Metal cigarette lighter						1						**1**
Structural													
Electrical	Metal utility tag									1			**1**
	Electrical wire						1						**1**
	Electrical wire end cap						2						**2**
Hardware	Bolt											1	**1**
	Counterweight											1	**1**
	Cut nail		6				2			8		29	**45**
	Eye screw											1	**1**
	Metal hook											3	**1**
	Metal ring				1					1		1	**3**
	Metal washer									1			**1**
	Nail—type indeterminate		17	1			4	1		15	2	144	**184**
	Screw											1	**1**
	Unident. metal hardware											1	**1**
	Wire nail		4				3			21		69	**97**
Materials	Asphalt									7			**7**
	Brick		1			3				19		25	**48**
	Concrete											1	**1**
	Mortar		2							13		6	**21**
	Plaster											4	**4**
	Plastic pipe											2	
	Roofing slate		1	1				1		38		5	**46**
	Sheetrock/drywall											15	**15**
	Safety glass				1								**1**

Table 11-2. Artifact Summary for Site 45CL917 (*continued*).

Artifact Group/ Category	Artifact Types	A Horizon and Feature-Associated Artifacts								Artifacts from Fill			Totals
		RP/SP A Hzn	F1 A Hzn	F2 A Hzn	MT2 F1	MT2 F5	MT2 F6	MT2 F7	MT2 Isolates	RP/SP Fill*	SP Fill/ Bw Hzn	Fill Around F1*	
	Terra-cotta pipe	1								11		1	13
	Window glass		2	1			3			26		18	48
Native American													
Lithic debitage	Flake/angular debris									7	1		8
Other	Split chert nodule									1			1
Totals		7	48	6	8	3	94	26	10	270	5	456	933

RP = Round Probe SP = Shovel Probe F = Feature MT = Mechanical Trench Hzn = Horizon
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments
*Artifacts from SP1 and SP3 are tallied with materials from fill around Feature 1

Table 11-3. Temporally Diagnostic Artifacts from Site 45CL917.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	Reference
F1 TU-A L8 A horizon	Colorless bottle/jar fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=2)	Readily available	Since ca. 1884	Adams (2002)
F1 TU-B L8 A horizon	Window glass fragments (n=2)	0.045 inch thick; 0.081 inch thick	1830–1840; 1855–1885[1]	Roenke (1978:116)
F1 TU-C L8 A horizon	Colorless glass fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Colorless bottle fragments (n=2 from 1 item)	Cup-bottom mold production	ca. 1880s to ca. 1910s	SHA (2009)
	Wire nail (n=2)	Readily available	Since ca. 1884	Adams (2002)
SP1 L2–L8 fill around F1	Window glass fragments (n=3)	0.077, 0.083, and 0.090 inch thick	1855–1885; 1870–1900[2]	Roenke (1978:116)
	Colorless bottle/jar fragments (n=4)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=2)	Readily available	Since ca. 1884	Adams (2002)
	Amber beer bottle fragment	Stubbie style shoulder ring	Since 1935	SHA (2009)
SP3 L3–L7 fill around F1	Window glass fragment	0.089 inch thick	1855–1885; 1870–1900[2]	Roenke (1978:116)
	Wire nails (n=4)	Readily available	Since ca. 1884	Adams (2002)
TU-A L2–7 fill around F1	Window glass fragments (n=7)	0.044–0.098 inch thick	1855–1885; 1870–1900[2]	Roenke (1978:116)
	Colorless bottle/jar fragments (n=2)	Glass decolorization	Common since ca. 1870s	SHA (2009)

Table 11-3. Temporally Diagnostic Artifacts from Site 45CL917 (*continued*).

Provenience	Provenience	Provenience	Provenience	Provenience
	Amethyst glass fragment	Sun-colored amethyst indicates manganese dioxide used in decolorization process	ca. 1870s–ca. 1920	SHA (2009)
	Wire nails (n=23)	Readily available	Since ca. 1884	Adams (2002)
	Colorless condiment? bottle/jar fragment	Mold blown w/ tooled finish	mid-1870s to early 1920s	SHA (2009)
	Green bottle/jar fragments	"7-Up Green" color	Since ca. 1900	SHA (2009)
TU-B L1–7 fill around F1	Black glass bottle fragment	Use of black glass for containers	Pre-1800 to ca 1880s	SHA (2009)
	Window glass fragments (n=4)	0.044–0.091 inch thick	1855–1885; 1870–1900[2]	Roenke (1978:116)
	Wire nails (n=6)	Readily available	Since ca. 1884	Adams (2002)
TU-C L6–7 fill around F1	Colorless bottle/jar fragments (n=2)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Colorless condiment bottle/jar fragment	Mold blown w/ tooled finish	mid-1870s to early 1920s	SHA (2009)
	Wire nails (n=4)	Readily available	Since ca. 1884	Adams (2002)
	Window glass fragments (n=2)	0.086 inch thick; 0.153 inch thick	1855–1885; 1870–1900[2]	Roenke (1978:116); Weiland (2009:30)
TU-D L6 fill around F1	Wire nail	Readily available	Since ca. 1884	Adams (2002)
TU-E & TU-F L1–L6 fill around F1	White improved earthenware fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Common red brick fragments (n=2, 2 bricks)	Brand from Hidden Brick Co.	1871–1992	Gurcke 1987:88-89); Caldbick (2009)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
TU-E L7–L8 fill around F1	White improved earthenware fragments (n=2)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle fragments (n=8)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=19)	Readily available	Since ca. 1884	Adams (2002)
TU-F L7 fill around F1	White improved earthenware tableware fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle/jar fragments (n=8)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Window glass fragment	0.144 inch thick	1855–1885; 1870–1900[2]	Weiland (2009:30)
Grab sample rubble fill around F1	Amber bottle fragment	Bare iron pontil scar	1830s to early 1870s	SHA (2009)
	Common red brick fragments (n=2, 1 brick)	Brand from Hidden Brick Co.	1871–1992	Gurcke 1987:88-89); Caldbick (2009)
	Wire nails (n=6)	Readily available	Since ca. 1884	Adams (2002)
F2 SP5 L8 A horizon	Window glass fragment	0.050 inch thick	1810–1835[1]	Roenke (1978:116)
	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)

Table 11-3. Temporally Diagnostic Artifacts from Site 45CL917 (*continued*).

Provenience	Provenience	Provenience	Provenience	Provenience
MT2 F1	White improved earthenware fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Wire-reinforced safety glass	Introduced	1892	Miller et al. (2000)
MT2 F6	Black glass fragment	Use of black glass for containers	pre-1800s to 1880s	SHA (2009)
	Black glass bottle finish fragment	Mineral finish paired with black glass	1820s–1880s	SHA (2009)
	White improved earthenware fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Porcelain button	Prosser technology	1840–mid-1900s	Sprague (2002:111)
	Window glass fragment	0.069 inch thick	1845–1855[1]	Roenke (1978:116)
	Flow blue earthenware tableware fragment	Flow blue design	Mid-1800s–1920s	Snyder (2007)
	Colorless glass bottle fragments (n=30)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=3)	Readily available	Since ca. 1884	Adams (2002)
	Aqua and colorless bottle fragments (n=6)	Mold seams indicate automatic bottle machine production	Since ca. 1905	SHA (2009)
	Amber & colorless bottle fragments (n=2)	Mold seams indicate automatic bottle machine production; crown finish	Since ca. 1910	SHA (2009)
	Colorless bottle neck/finish fragments (n=2)	External-thread finish	Since ca. 1920	SHA (2009)
	Regens chrome cigarette lighter	U.S. Patent No. 1896140	1933 to ca. 1940s	Brinsfield (2001); U.S. Patent and Trademark Office (2009)
	Colorless bottle base fragments (n=2 fragments from 1 bottle)	Owens-Illinois Glass Co. mark, stippling on base	1940–ca. 1958	Lockhart (2006)
	Amber & colorless bottle base fragments (n=3)	Stippling on base	Since 1940	SHA (2009)
	Amber Stubbie beer bottle	Owens-Illinois Glass Co. mark w/ 3 date code paired with the Stubbie style	1943	Lockhart (2006)
	Amber beer bottle base	Mark from Northwestern Glass Co.	1949	Whitten (2009)
	Colorless Orange Crush soda-pop bottle	Owens-Illinois Glass Co. mark, 58 date code	1958	Lockhart (2006)
MT2 F7	Colorless medicine bottle fragments (n=11)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Colorless flask fragments (n=3 from 1 item)	Mold blown in a cup-bottom mold	early1880s to early 1920s	SHA (2009)
	Colorless patent medicine bottle fragment	Embossed mark from Palisade Manufacturing Co., Yonkers, N.Y.; cup-bottom mold production	ca. 1890s to late1910s	Odell (2007a); SHA (2009)
RP12 L3–L6 fill	Metal General Service button	"Great Seal" device; back stamp 1965?	1902–1965	Wycoff (1984:92)
	Window glass fragment	0.143 inch thick	1924+[1]	Weiland (2009:30)
	Lincoln penny	Mint date 1945	1945	N/A
RP13 L5–L7 fill	Black glass bottle fragment	Use of black glass for containers	pre-1800 to ca 1880s	SHA (2009)
	Colorless bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)

PRELIMINARY

Table 11-3. Temporally Diagnostic Artifacts from Site 45CL917 (*continued*).

Provenience	Provenience	Provenience	Provenience	Provenience
RP14 L3–L6 fill	Window glass fragments (n=5)	0.053–0.94 inch thick	1810—1900	Roenke (1978:116)
	White improved earthenware fragments (n=3)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Colorless bottle fragments (n=4)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=2)	Readily available	Since ca. 1884	Adams (2002)
RP16 L2 fill	Window glass fragments (n=2)	0.080 inch thick; 0.91 inch thick	1855–1888; 1870–1900[1]	Roenke (1978:116)
	Wire nail	Readily available	Since ca. 1884	Adams (2002)
RP19 L4–L7 fill	Window glass fragments (n=3)	0.089 inch thick; 0.094 inch thick; 0.122 inch thick	1855–1888; 1870–1900; 1924+[1]	Roenke (1978:116); Weiland (2009:30)
SP2 L3 fill	Wire nail	Readily available	Since ca. 1884	Adams (2002)
SP4 L3–L7 fill	Leather shoe or boot fragments (n=2 fragments from 1 shoe)	Pegged heel	1854–1870s	Anderson (1968:59); Huddleson & Watanabe (1990); Stevens & Ordonez (2005)
	Window glass fragments (n=7)	Thickness mode 0.085	1855–1885	Roenke (1978:116)
	Colorless bottle/jar fragments (n=2)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=2)	Readily available	Since ca. 1884	Adams (2002)
SP5 L3–L7 fill	Window glass fragments (n=3)	0.078 inch thick; 0.088 and 0.089 inch thick	1850–1865; 1855–1885[1]	Roenke (1978:116)
	Colorless bottle fragment (n=5)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nails (n=15)	Readily available	Since ca. 1884	Adams (2002)
SP6 L1–L2 fill	Window glass fragments (n=4)	0.057 inch thick; 0.116–0.145 inch thick	1810–1835; 1924+[1]	Roenke (1978:116); Weiland (2009:30)
	Olive bottle fragment	Mouth-blown based on stretch marks	Until early 1920s	SHA (2009)
	Colorless jar fragment	Mold seams indicate automatic bottle machine production	Since ca. 1905	SHA (2009)
SP6 L9 A horizon	Colorless glass fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
SP7 @10 cmbs fill	White improved earthenware chamber pot? fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)

F = Feature   L = Level   MT = Mechanical Trench   RP = Round Probe   SP = Shovel Probe   TU = Test Unit

[1] Window glass thickness modes (Roenke 1978) are not presented for many these proveniences, as counts are low and the most of the fill deposits are mixed and may be from off-site locations. The date ranges reflect the modes into which the individual measurements would fall if part of a larger sample. Refer to the text for discussions of window glass dates for each provenience.

[2] When combined, the 18 window glass fragments from fill around Feature 1 have a primary mode of 0.085 and a secondary mode of 0.095, and the date ranges presented for these entries reflects these modes; however, this small an assemblage does not necessarily yield a reliable result.

7965

Items from MT2 Feature 1, the brick cistern, are limited to earthenware fragments likely from tableware, wire-reinforced safety glass, and pieces of metal hardware. White improved earthenware was patented in England in 1813. By the 1840s it was being imported commercially to the United States. The one fragment from MT2 Feature 1 is undecorated, and a more precise date cannot be determined. The two other ceramic artifacts from MT2 Feature 1 are small, nondiagnostic, undecorated earthenware fragments. Wire reinforced safety glass was introduced in 1892 and continues to be manufactured today.

Three brick fragments mend to form a complete brick from MT2 Feature 5, the brick pier and concrete footing. Although identified as an American made common red brick, the specimen is not branded. Therefore, an estimate of the date of construction of this feature must be based on historical sources rather than artifactual evidence

Numerous artifacts (n=94) were recovered in association with MT2 Feature 6, the brick wall and concrete sidewalk. Much of this assemblage is domestic and/or personal in nature (earthenware, beverage bottles and other glass containers, a button, a toy marble, a shoe fragment, and a metal cigarette lighter). Structural materials and hardware items (window glass, wood, wire and machine-cut nails, and electrical wire) are also present. One very small fragment of earthenware is decorated with an unidentifiable flow blue pattern. Flow blue was a popular British import from the mid-1800s through the first quarter of the twentieth century. Several bottle fragments can be dated based on glass color, manufacturing techniques, or embossing. A few of the bottles likely date to the 1880s or earlier, such as those made from black glass (which was being phased out as container glass at that time). Significantly more, however, tend to be later containers produced in automatic bottle machines, with some having manufacture dates well into the twentieth century. Two bottles made by the Owens-Illinois Glass Co. bear date codes for 1943 and 1958 and a stubbie style beer bottle has a mark from Northwest Glass Co. dating to 1949. The stippling present on several of the bases is a feature introduced in 1940. The wire nails place construction sometime after the mid-1880s, or possibly after the early 1900s (see comments about wire nails above). This wide range of dates for cultural materials found in association the brick wall and concrete sidewalk suggests extensive disturbance to the deposits around this feature.

The small assemblage (n=26) recovered from around MT2 Feature 7, the post hole presumed to be associated with the same structure as MT2 Feature 6, is a mix of domestic and personal objects (a piece of earthenware and several bottle fragments) and structural materials and hardware (a porcelain doorknob, a piece of roofing slate, and a nail too rusty to type). Also present is a cartridge case, but it is not identifiable as to manufacturer or caliber. Although the earthenware fragment is nondiagnostic (being small and undecorated), the bottle fragments provide a few manufacturing dates. Most are colorless glass; colorless bottles were being made in large quantities by the 1880s. Two are bases are from bottles blown into cup-bottom molds, a production technique most common from the early 1880s to the early 1920s. One of these bases is embossed with the name of the Palisade Manufacturing Company of Yonkers, New York, which appears to have marketed three patent medicines between the 1890s and the late 1910s. These items seem consistent with the ages of the earlier items in the MT2 Feature 6 assemblage.

Fill Artifacts

Almost half of the artifacts from fill deposits are from sediments that were backfilled around the Feature 1 concrete foundation after its construction (n=456). A large portion of the fill assemblage is structural in nature, including fragments of bricks and mortar, concrete, roofing slate, sheetrock, wood, and window glass, as well as hardware such as machine-cut and wire nails, screws, bolts, hooks, wire, and a metal pipe fragment.

In addition to the structural items, fragments from medicine and alcoholic beverage bottles have been identified. Other glass items are fragments from a pressed-glass drinking vessel, a globe-style lamp shade, and a milk glass item of unidentifiable shape. A very small number of ceramic fragments, representing what were likely pieces of tableware, were recovered. None are decorated with temporally diagnostic design elements, nor are marks present on any of the fragments. A clay pipe stem fragment was also collected, but it, too, is unmarked.

The remaining items in the Feature 1 fill assemblage are a complete horse shoe and fragments from two others (likely from the Quartermaster's Depot stable), a piece from a toy arrow, an assortment of burned and unburned mammal bone (some with butchering marks), pieces of coal and clinkers/slag, and a few unidentifiable metal objects.

In general, manufacturing dates for the artifacts found in the fill around the Feature 1 concrete foundation suggest that these items were used and deposited sometime during the later years of the Quartermaster's Depot stable/corral complex. Many of the artifacts could not have been produced before the 1870s or 1880s, suggesting affiliation with later renovations of the facility. The window glass fragments have a dual primary thickness mode of 0.085 and 0.095 inch, suggesting association with building construction between 1855 and 1900 (Roenke 1978:116). A secondary mode of 0.045 inch, with a date of 1830–1840, suggests reuse of earlier panes in some of the renovations.

Other artifacts recovered from mixed fill deposits across the site probably are the result of general land-filling and contouring episodes not related to structural features. Most of these items are of a structural, domestic, or personal nature. Also found were seven pieces of lithic debitage and a split chert cobble associated with the Native American occupation of the area. For the most part, manufacturing dates for the historical artifacts in these fill deposits range from the mid-1800s to the early 1900s, although many easily could have been produced considerably later. Mixed in with these items, however, are artifacts that date specifically to the mid-1900s, indicating the disturbed nature of these deposits.

ANALYSIS AND INTERPRETIVE RESULTS

The results of the archaeological discovery investigations in W9B are consistent with those from W9A to the north, establishing that substantial cut-and-fill activity occurred along the east side of I-5 during previous highway construction. In contrast to the situation in W9A, however, manual and mechanical excavations established that numerous cultural features are preserved beneath fill deposits in W9B.

As suggested by the GPR profiles, the surface at W9B is covered by fill deposits that range in thickness from approximately 120 cm in the north to 60 cm in the south (Table 11-4). The cut-and-fill activity during previous highway construction did not remove soils in the area adjacent to the roadway to a uniform depth, as several of the cultural features recorded were encountered relatively close below the surface. For example, the top of the Feature 4 concrete veneer was at 15 cmbs and the top of the MT2 Feature 6 brick wall/concrete sidewalk was at 20 cmbs. Cut-and-fill activity apparently extended deeper below the present ground surface in other areas. Evidence of deep disturbance appears to be present at MT2 Feature 4, where a piece of wood was

Table 11-4. Summary of Manual Excavations at Site 45CL917.

Excavation Unit	Size	Thickness of Fill	A Horizon	Maximum Depth
RP12	30 cm diameter	110 cm	Not represented	110 cmbs
RP13	30 cm diameter	90 cm	Not represented	90 cmbs
RP14	30 cm diameter	60 cm	60-70 cmbs	70 cmbs
RP15	30 cm diameter	30 cm*	Not reached	30 cmbs
RP16	30 cm diameter	20 cm*	Not reached	20 cmbs
RP17	30 cm diameter	90 cm	Not represented	90 cmbs
RP19	30 cm diameter	70 cm	70-100 cmbs	100 cmbs
SP1	50 x 50 cm	80 cm	Not represented	80 cmbs
SP2	50 x 50 cm	60 cm	Not represented**	110 cmbs
SP3	50 x 50 cm	70 cm	Not reached	70 cmbs
SP4	50 x 50 cm	90 cm	Not represented	90 cmbs
SP5	50 x 50 cm	70 cm	70-80 cmbs	80 cmbs
SP6	50 x 50 cm	70 cm	70-90 cmbs	90 cmbs
SP7	50 x 50 cm	20 cm	Not reached	20 cmbs
SP8	50 x 50 cm	40 cm	Not reached	40 cmbs
SP9	50 x 50 cm	30 cm	Not reached	30 cmbs
SP10	50 x 50 cm	25 cm	Not represented	25 cmbs
TU-A	100 x 50 cm	70 cm	70-90 cmbs	90 cmbs
TU-B	100 x 50 cm	70 cm	70-80 cmbs	80 cmbs
TU-C	100 x 50 cm	70 cm	70-80 cmbs	80 cmbs
TU-D	100 x 50 cm	60 cm	Not reached	60 cmbs
TU-E	100 x 100 cm	80 cm	Not represented	80 cmbs
TU-F	100 x 100 cm	80 cm	Not represented	80 cmbs

* Excavation stopped by asphalt layer
** Sediments at 60-70 cmbs appear to be mixed fill/Bw horizon; 70-110 cmbs probably Bw horizon

encountered resting on Pleistocene gravels at 115 cmbs. A sample from the wood submitted for radiocarbon dating returned an essentially modern age.

The considerable depth and compactness of the introduced fill materials, the presence of historical materials within the fill, and the small size of the manual excavation units made it difficult to identify the A horizon soil in W9B. A horizon soils were identified in seven excavation units: RP14 (60–70 cmbs), RP19 (70–100 cmbs), SP5 (70–80 cmbs) and SP6 (70–90 cmbs), TU-A (70– 90 cmbs), and TU-B and TU-C (70–80 cmbs). However, several other areas contained sediments that may represent the A horizon after modification by disturbance. Further investigations, especially block excavations in sizable areas, most likely would expose additional areas of remnant A horizon soil.

Table 11-5. Summary of Cultural Features at Site 45CL917.

Excavation Units	Feature No.	Description	Association
SP1, SP3, TU-A–TU-F	F1	Concrete foundation corner	Quartermaster Depot Stable/Corral Complex
SP5	F2	Rectangular post mold	
SP4	F3	Glazed terra-cotta drain pipe	
SP7, SP9	F4	Concrete veneer	
MT2	MT2 F2	Glazed terra-cotta drain pipes	
MT2	MT2 F3	Wooden post	
MT2	MT2 F1	Brick cistern	Quartermaster Depot infrastructure
MT2	MT2 F5	Brick pier/concrete footing	Quartermaster Depot Wagon Shed
MT2	MT2 F6	Brick wall/concrete sidewalk	
MT2	MT2 F7	Post hole	
MT2	MT2 F4	Wood sample on Pleistocene gravels	Modern radiocarbon date reflects cut and fill to 115 cmbs

Despite the apparent removal of much of the A horizon in W9B, a sizable number of cultural features are preserved below the fill deposits (Table 11-5). At least three of these features appeared as chaotic reflectors in concave anomalies in the GPR profiles: the Feature 1 concrete foundation corner, the MT2 Feature 1 brick cistern, and the MT2 Feature 6 brick wall/concrete sidewalk. With the exception of the wood resting on the Pleistocene gravels (MT2 Feature 4), the recorded cultural features are structural in nature. These features were associated with three different structures at the Quartermaster's Depot (Table 11-3).

The Feature 1 Concrete Foundation Corner is associated with the Quartermaster's Depot stable/corral complex at Vancouver Barracks. Inspection of the 1907 and 1911 Sanborn fire insurance maps indicates that the Feature 1 concrete foundation corner is in proximity to the former location of the east wall of the west wing of the U-shaped stable/corral complex (Figure 11-17). The Feature 2 post mold, the Feature 3 section of glazed terra-cotta drain pipe, and the Feature 4 concrete veneer, all located in proximity to the foundation corner, are almost certainly also associated with the stable/corral complex in some way. Two nearby features encountered in MT2—the MT2 Feature 2 glazed terra-cotta pipe and MT2 Feature 3 wooden post—were probably associated with this complex as well.

This stable/corral complex appears on many maps of Vancouver Barracks, notably including those prepared in 1871, 1874, 1888, 1904, 1906, and 1914 ((Chance and Chance 1976:14; Thomas and Hibbs 1984:777, 779, 781, 783, 785). The 1904 Haman map identifies the stable as Building 73 (Chance and Chance 1976:14). The University of Washington's Operation 3 encountered evidence of the floor of the stable (Chance and Chance 1976:25). A photograph with the caption "The west wing of the Quartermaster Depot stables, Building No. 73" appears in the report of the University of Washington's 1974 investigations (Chance and Chance

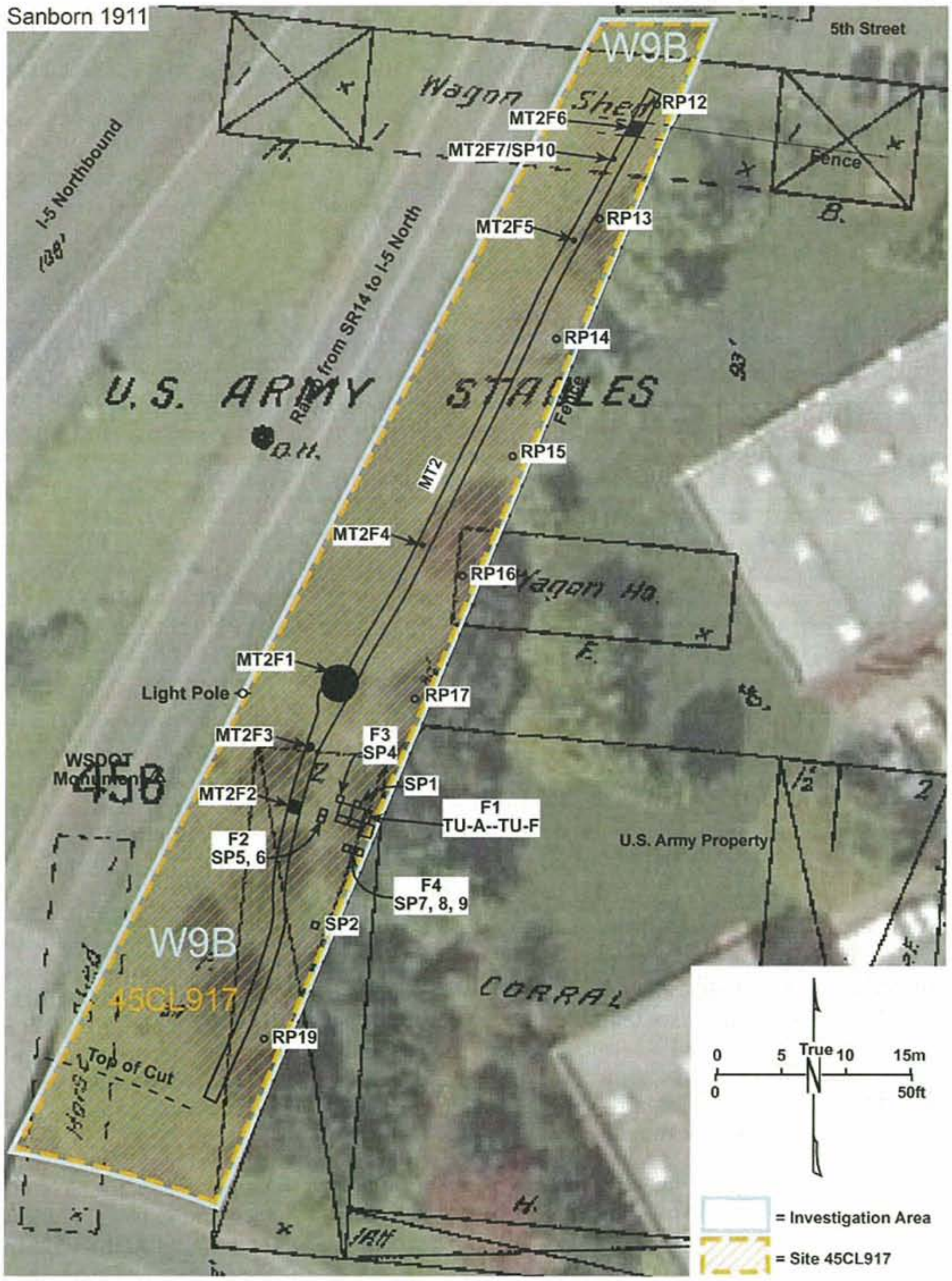


Figure 11-17. WSDOT parcel W9B (site 45CL917) superimposed on the 1911 Sanborn fire insurance map.

1976:53). This building, identified as the Quartermaster Stables, was demolished on January 25, 1935 (Cope 1935).

The brick cistern recorded as MT2 Feature 1 appears to represent a type of feature not previously described in the historical archaeological literature from Vancouver Barracks. This cistern does not appear to be part of a proposed water system at Vancouver Barracks depicted on the maps prepared in 1888, which depicts a water line through the "Depot Stables" east of the location of this feature (Chance and Chance 1976:13; Thomas and Hibbs 1984:781). This situation suggests that the MT2 Feature 1 cistern probably postdates 1888. The age of this feature may be determinable through additional historical research.

The similarly constructed manhole in the East Barracks area north of East 5th Street at Vancouver Barracks stands about 0.75 cm above the ground surface, measures about 150 cm in diameter (see Figure 11-11). Like the cistern at W9B, this small manhole was constructed of bricks that are covered by a thin coat of plaster or concrete. The opening in the top of the manhole, which measures about 70 cm in diameter, is covered by a round iron plate bearing the letters Q.M.D. U.S.A. on top. A 6-inch-diameter glazed terra-cotta drain pipe protrudes at ground level on the southwest side of the manhole. This manhole appears to provide access to a sewer.

The MT2 Feature 6 brick wall/concrete sidewalk, aligned with the south side of East 5th Street, is a remnant of another building at the Quartermaster's Depot. Construction of this building occurred after 1888, as maps of a proposed water system prepared that year do not show a structure at this location (Chance and Chance 1976:12; Thomas and Hibbs 1984:781). A long building identified as 111-A is shown at this location on a 1906 map (Thomas and Hibbs 1984:783). This building is identified as a Wagon Shed on the 1907 and 1911 Sanborn maps (see Figure 11-17). A 1914 map shows the same building (but identified as 111-B) and confirms its use as a Wagon Shed (Thomas and Hibbs 1984:785). This building continues to appear on maps of Vancouver Barracks from 1935 and 1944 (Thomas and Hibbs 1984:787, 789).

Additional information about this building has been provided by NPS archaeologists. According to O'Rourke et al. (2010:104), "The June 30, 1928 Vancouver Barracks building inventory lists this structure as a 'Wagon Shed & Vet. Isolation Hospital.' The building was destroyed in the 1962 Columbus Day Storm and torn down in 1963." This building is readily identifiable in a 1955 aerial photograph of the recently constructed I-5 (Figure 11-18).

NRHP ELIGIBILITY

Site 45CL917 is in a WSDOT parcel (W9B) on the east side of I-5 adjacent to U.S. Army land. Historically, W9B was on the western margin of the U.S. Army Quartermaster's Depot at Vancouver Barracks. W9B was not included within the boundary of the Vancouver National Historic Reserve Historic District placed on the National Register of Historic Places in 2007 (Owens et al. 2007).

As suggested by the GPR reconnaissance and confirmed by the discovery investigations and testing, numerous cultural features associated with the Quartermaster's Depot at Vancouver Barracks are preserved beneath the fill deposits in W9B. This situation is somewhat surprising, as it appears that much of the A horizon soil representing the ground surface at the time of occupation was removed as a result of cut-and-fill activity during previous highway construction.

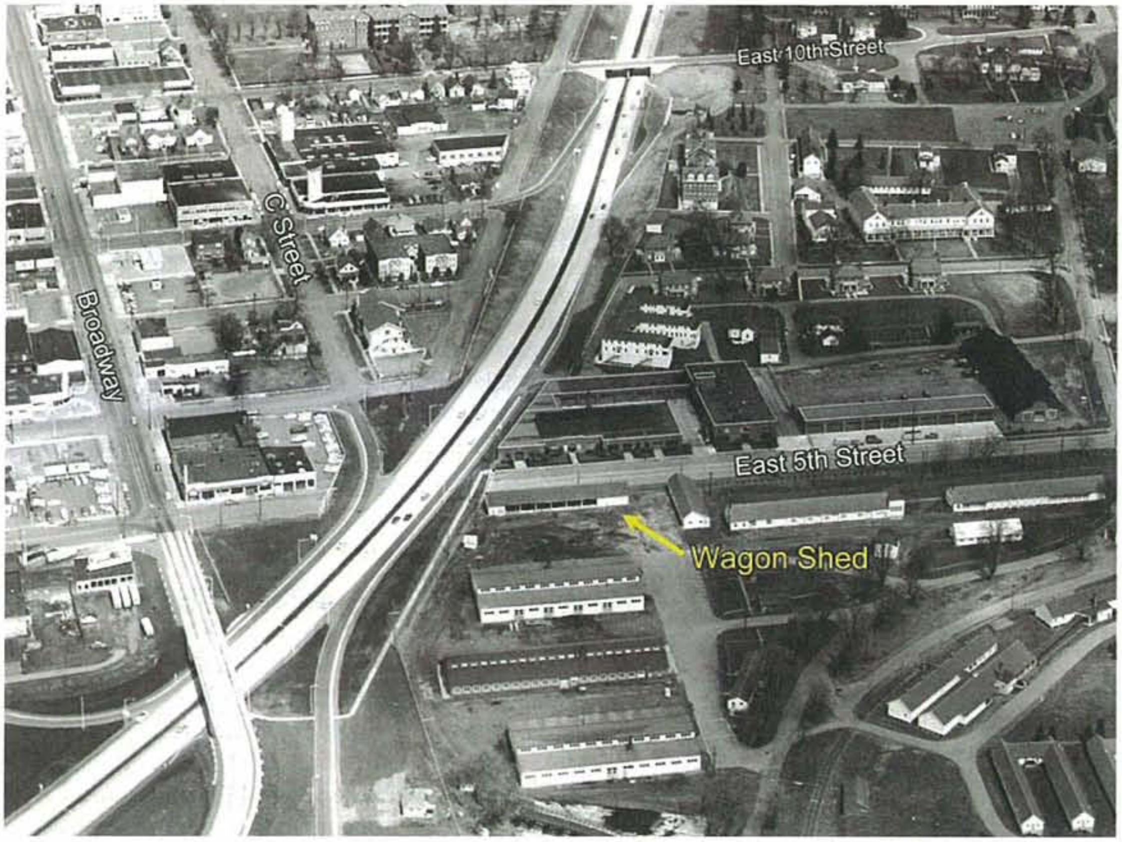


Figure 11-18. Aerial view to the north, showing recently constructed I-5 with Wagon Shed on U.S. Army property visible south of East 5th Street (Photo PSH1 155 taken April 15, 1955; courtesy of WSDOT).

In this respect, W9B represents an important example of the unpredictable manner in which archaeological resources may be preserved even in areas subjected to significant ground disturbance.

Archaeological data recovery excavations were previously conducted in the portion of the Quartermaster's Depot stable/corral complex situated on the east side of the WSDOT/U.S. Army fence (Thomas and Hibbs 1984:635–694). In 1994 shovel probe excavations on the WSDOT side of the fence uncovered a brick pier thought to have been part of the stable foundation. According to Thomas (1994:12):

> The interpretation that Feature 1 is a foundation component of the Stable is based upon its right-angle location and distance from the eastern section of the same building defined by Thomas and Hibbs (1984). The Stable was built in 1850 and therefore one of the first buildings constructed by the U.S. Army in Vancouver. It stood until 1935 when it was torn down. During this time the Stable underwent a number or repair and expansion phases that changed its shape, dimensions and perhaps function. Archaeological excavations can document these changes; therein lies the significance of the site, which is likely to yield information about the Stable buildings, its relationship to the Quartermaster's Depot and Vancouver Barracks for the eighty-five year period it was in existence.

Considering the presence of structural remains and cultural deposits below the fill, site 45CL917 has the potential to contribute important information about the Quartermaster's Depot stable/corral complex at Vancouver Barracks. It is reasonable to expect that additional cultural features and associated cultural deposits remain to be discovered in W9B. As a result, W9B appears to be a significant archaeological site that is eligible for listing on the National Register under criterion d.

Site 45CL917 does not appear to meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. The site is situated in the construction zone of I-5, and the massive amount of earth-moving during highway construction resulted in the widespread destruction of the historic setting in the I-5 corridor. As a result, the site does not meet the integrity requirement for National Register eligibility under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

Site 45CL917 is in a WSDOT parcel (W9B) situated within the former area of the U.S. Army Quartermaster's Depot at Vancouver Barracks. Archaeological testing was conducted on the U.S. Army property adjacent on the east side of site 45CL917 in 2009 (O'Rourke et al. 2010). The U.S. Army property corresponds to VNHR Area #3 investigated by the NPS.

In the northern subarea of VNHR Area #3, three exploratory backhoe trenches and one test unit were excavated on the west side of the U.S. Army property near the WSDOT/U.S. Army fence corner (O'Rourke et al. 2010:126). The first three trenches (3-36, 3-37, and 3-38) all encountered four to five fill layers overlying B horizon sediments. No buried cultural layers were found and no artifacts were collected (O'Rourke et al. 2010:129).

Trench 3-39, placed "next to the East 5th Street chainlink fence near its junction with the Interstate 5 right-of-way fence," similarly encountered four fill layers, with no cultural layer found; but a brick wall/foundation was exposed on the north side of the trench and a grab sample of "mainly 19th-century artifacts" was collected. TU3-22, excavated on the south side of the trench, reached a buried cultural layer at 146 cmbs from which "a large number of predominantly 19th-century artifacts" were collected (O'Rourke et al. 2010:129).

This artifact concentration was interpreted as originating in a "trash deposit" associated with the U.S. Army Wagon Shed or earlier U.S. Army buildings formerly present in this area (O'Rourke et al. 2010:137). The concentration was located immediately east of the brick wall on a concrete footing recorded as MT2 Feature 6 on the adjacent WSDOT property. A layer of plastic exposed in TU3-22 was interpreted to be from Operation 52B, excavated in 1981 (Thomas and Hibbs 1984:405–410).

In the central subarea of VNHR Area #3, immediately east of the south end of W9B, one exploratory trench and one test unit were excavated. Trench 3-33 placed "in the freeway right-of-way fence corner" encountered "at least four fill episodes," below which was found the top of a brick footing at 114 cmbs. A grab sample of artifacts from the trench "consisted of a large number of mainly 20th-century artifacts" (O'Rourke et al. 2010:128).

TU3-20, placed on the east side of the trench, encountered four fill layers overlying "a thin lens buried cultural layer" that began at 120 cm and from which mainly 19th-century artifacts were recovered. The NPS archaeologists added, "The presence of wire nails to a depth of 138 cm, however, indicates that these sediments are disturbed, probably during one of many building renovation episodes" (O'Rourke et al. 2010:136).

The brick footing exposed in Trench 3-33 "is most likely an 1879 foundation element from the western [wing] of the Quartermaster's Stable buildings" (O'Rourke et al. 2010:136). Another brick footing, found to the south in Trench 3-32 and further exposed in TU3-19, was situated on U.S. Army property to the east of the north end of WSDOT parcel W5A.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL917 as a significant historical archaeological site, the CRC project has the option of (1) avoiding any use of W9B that might result in impacts to site 45CL917, or (2) mitigating any impacts to site 45CL917 through data recovery excavations. Any further archaeological field investigations undertaken should be conducted in conjunction with thorough historical research of past uses and developments to maximize the interpretation of the historical archaeological record at W9B.

12. WASHINGTON AREA 17 (45CL918)

Located on the west side of I-5, Washington Area 17 (W17) consists of a narrow strip of WSDOT land bounded by the on-ramp to the southbound lanes of I-5 on the east and the private property of the Academy on the west. On the north, W17 begins where 12th Street dead-ends at the top of the cut-slope leading down to I-5, and from that point it extends south to the Evergreen Boulevard overpass crossing I-5 (Figure 12-1).

The Academy, formally known as the House of Providence, is a three-story brick masonry structure that opened as a boarding school for girls in 1874. Outbuildings on the Academy parcel included an octagon-shaped water tower (recently demolished) and the boiler building. Pumps supplied water to the boilers, which converted the water into steam for heat. The boiler building's steam also heated the old St. Joseph's Hospital, which stood on adjacent land to the north. After the school closed in 1966, the Academy and St. Joseph's Hospital were purchased by the Hidden Family. The hospital was later demolished, but the main Academy buildings still stand. The Academy was listed on the National Register of Historic Places in 1978 (Lentz 1978) and was recorded as site 35CL152H in 1979 (Anonymous 1979).

Archaeological discovery investigations were conducted at W17 from February 10 to 17, 2009. These investigations documented widespread evidence of ground disturbance across W17. Concentrations of cultural materials were found in only two areas, an ash-filled pit and a horizontal ash deposit, both of which are along the boundary fence with the Academy in the northern portion of W17. The classes of cultural materials found strongly suggest that these ash deposits represent secondary refuse deposits from the Academy. The archaeological remains at W17 have been recorded with DAHP as site 45CL918.

HISTORICAL SETTING

Historically, the area encompassed by W17 was on the northeast margin of the Historic City of Vancouver, adjacent on the east side of a private establishment known as the Academy. The Academy, identified on Sanborn fire insurance maps as the "House of Providence Sisters of Charity" (1888, 1890, 1892) and as the "House of Providence (Catholic) Academy, Orphanage, Day & Boarding School for Boys & Girls" (1907, 1911, 1928, and 1949), opened in 1874. The Academy was apparently too far north of the urban core to be included on the 1884 Sanborn map, but it was shown in detail beginning with the 1888 edition.

The main building at the Academy, a three-story brick masonry structure whose symmetry reflects Georgian inspiration, was listed on the National Register in 1978. Other structures on the property include the boiler building, laundry/dormitory, and an octagonal water tower or tank house (the latter was demolished in 2009). In terms of the building complex as whole, the maximum development at the Academy is shown on the 1907 and 1911 Sanborn maps (Figures 12-2 and 12-3). No archaeological investigations have been conducted on the Academy property (Thomas 1992:89).

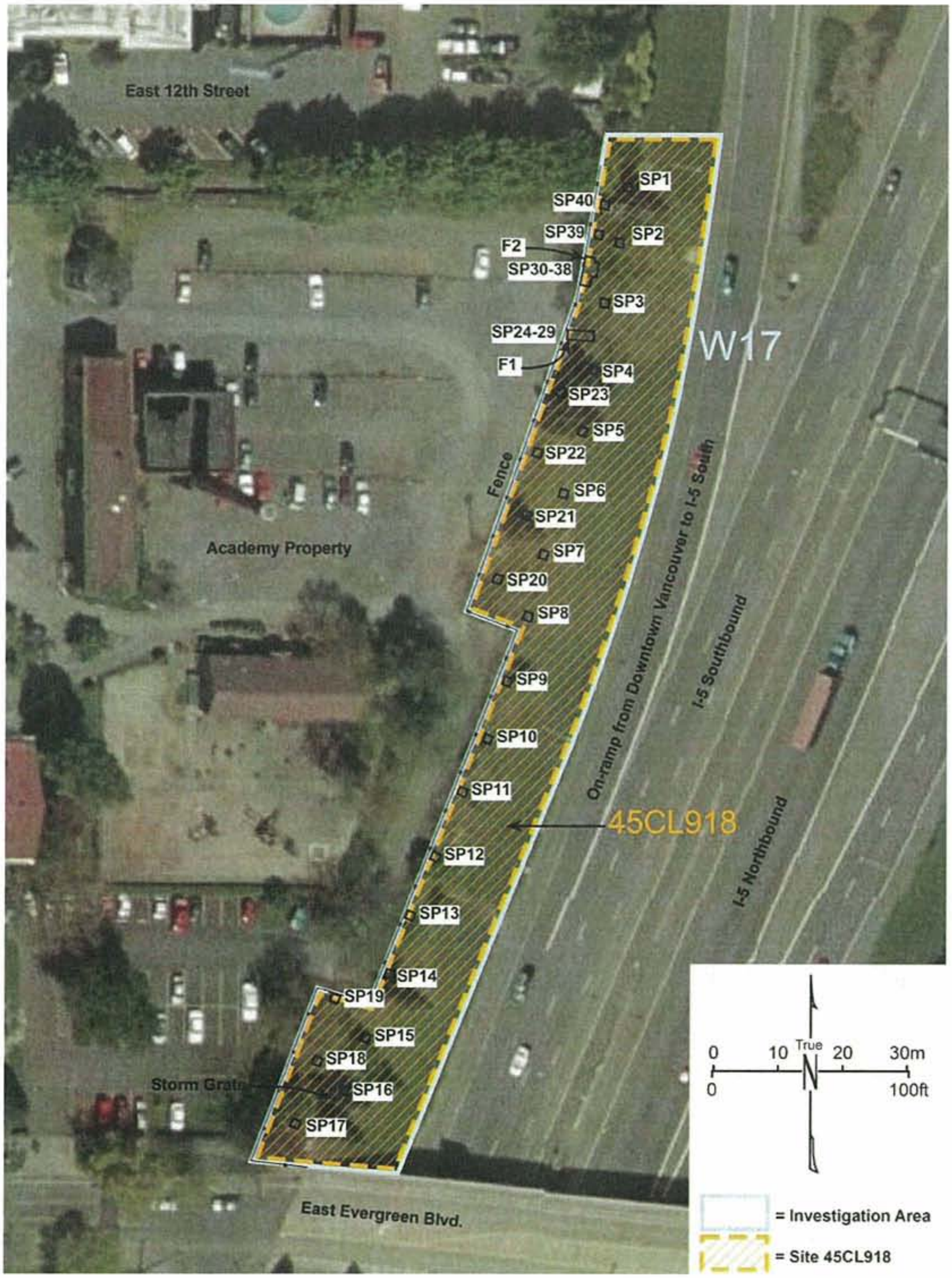


Figure 12-1. Locations of shovel probes (SP), cultural features (F), and site 45CL918 in WSDOT parcel W17 on aerial photograph (Terrain Navigator Pro 2002).

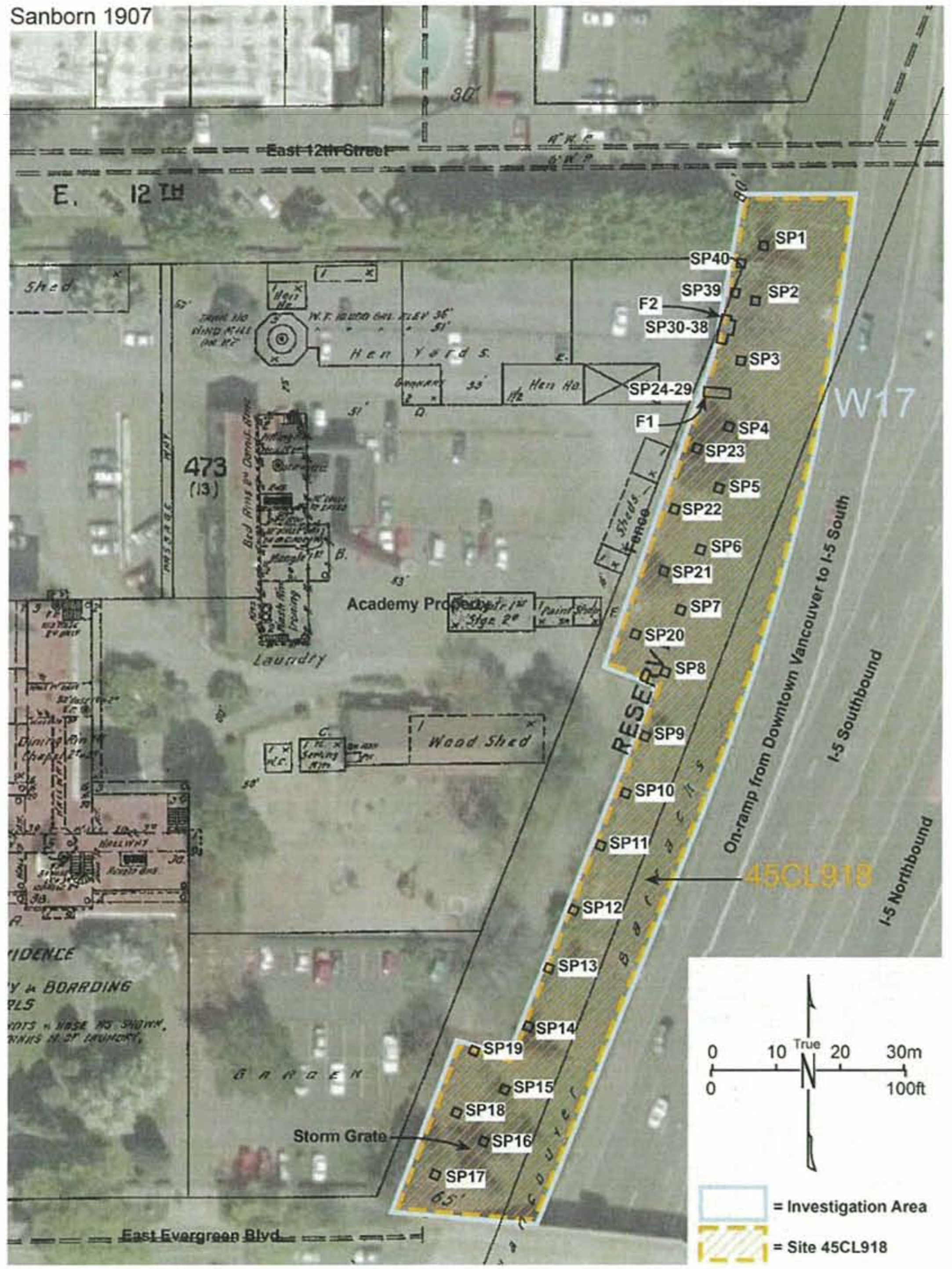


Figure 12-2. WSDOT parcel W17 (site 45CL918) superimposed on the 1907 Sanborn fire insurance map.

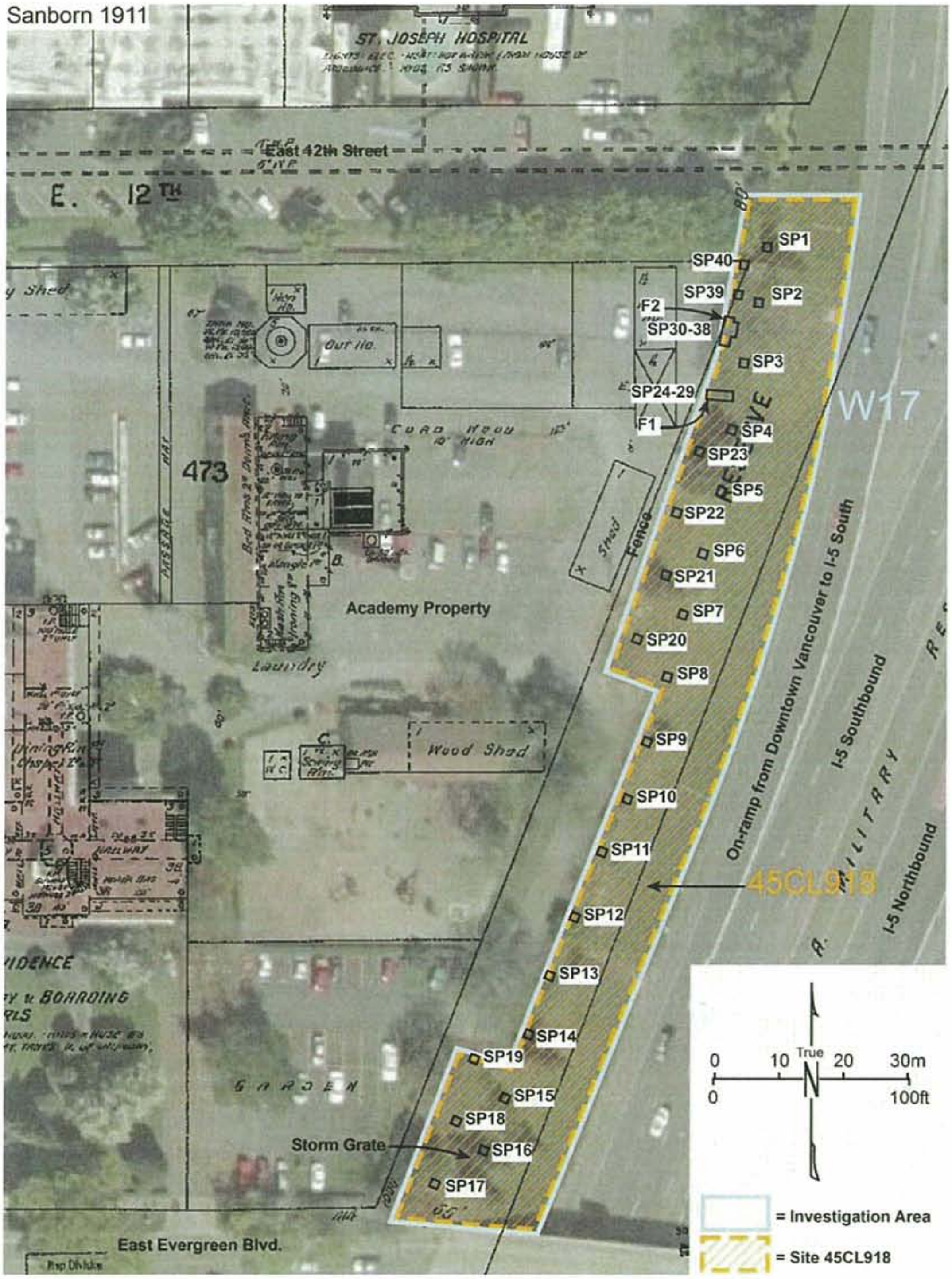


Figure 12-3. WSDOT parcel W17 (site 45CL918) superimposed on the 1911 Sanborn fire insurance map.

The Academy was bounded on the east by Reserve Street (later W. Reserve Street), which formed the boundary between the City of Vancouver and the military reserve to the east. A remnant of Reserve Street is still in use on the Academy property east of the south half of W17. Historic maps and aerial photographs indicate that W. Reserve Street formerly covered much, if not most, of the ground surface at W17 (Figure 12-4).

Historical maps indicate that the section of W. Reserve Street at W17 formed the western boundary of a military cemetery at Vancouver Barracks. This cemetery has been referred to as the "first military cemetery" (Thomas (1998:10) and as the "Old Post Cemetery" (O'Rourke et al. 2010:26).The cemetery's presence at this location first appears labeled as a "graveyard" on an 1855 map of the military reservation (O'Rourke et al. 2010:30; Thomas and Hibbs 1984:769). The cemetery continues to be shown on the northwest periphery of the military reserve as late as the 1874 Ward map of Vancouver Barracks (Thomas and Hibbs 1984:779).

In 1882, the burials at the first military cemetery were disinterred and moved to a new military cemetery, three-quarters of a mile to the north, at Fourth Plain Boulevard. On the 1888 and 1890 Sanborn maps, the labels "Government Reserve" and "Fir Grove" appear adjacent to the east side of Reserve Street at W17. On the 1907 Sanborn map, the label "Vancouver Barracks" appears at that position on the map. Evidence has subsequently come to light that not all of the human remains from burials at this cemetery were located and removed (Thomas 1998:10; O'Rourke et al. 2010:43-44). Consequently, there was some concern that human remains might be present at W17.

GPR RECONNAISSANCE

The GPR reconnaissance at W17 began with the survey of six lines using high-power 200 MHz antennae. CRC Lines 6 through 9, 18, and 31 ran north–south, spaced 3.0 m apart. The total distance for the 200 MHz lines at W17 was 446.0 m. The GPR documented top-truncated inclined reflections (Pleistocene gravels) at 15–20 ns (0.75 m below surface) on CRC Lines 6, 8, 9, 18, and 31.

For greater resolution in the shallow fill adjacent to the I-5 cut-slope at W17, CRC Lines 6 through 9 were repeated using 500 MHz shielded antennae and recorded as CRC Lines 209 through 212, respectively. The total distance for the 500 MHz lines was 237.75 m. The resulting higher-resolution profiles were used to estimate fill depth at W17. Resistive fill materials extend to a depth of about 0.5 m along the full lengths of CRC Lines 209, 210, and 212. Based on these representative profiles, it is estimated that fill covers 100 percent of W17. The depth of resistive fill ranges from 6 ns (0.3 m below surface) to 12 ns (0.6 m below surface). The average depth of fill recorded in the W17 profiles is 10 ns (0.5 m below surface).

One large anomaly with chaotic internal reflections was recorded at a corrected distance of 140.0 to 150.0 m on CRC Line 6. The anomaly corresponded to a large drain vault, drain pipes, and metal grate, as observed in an archaeological shovel probe (SP16) excavated to investigate this anomaly. No anomalies of potential archaeological interest were identified during the GPR surveys.

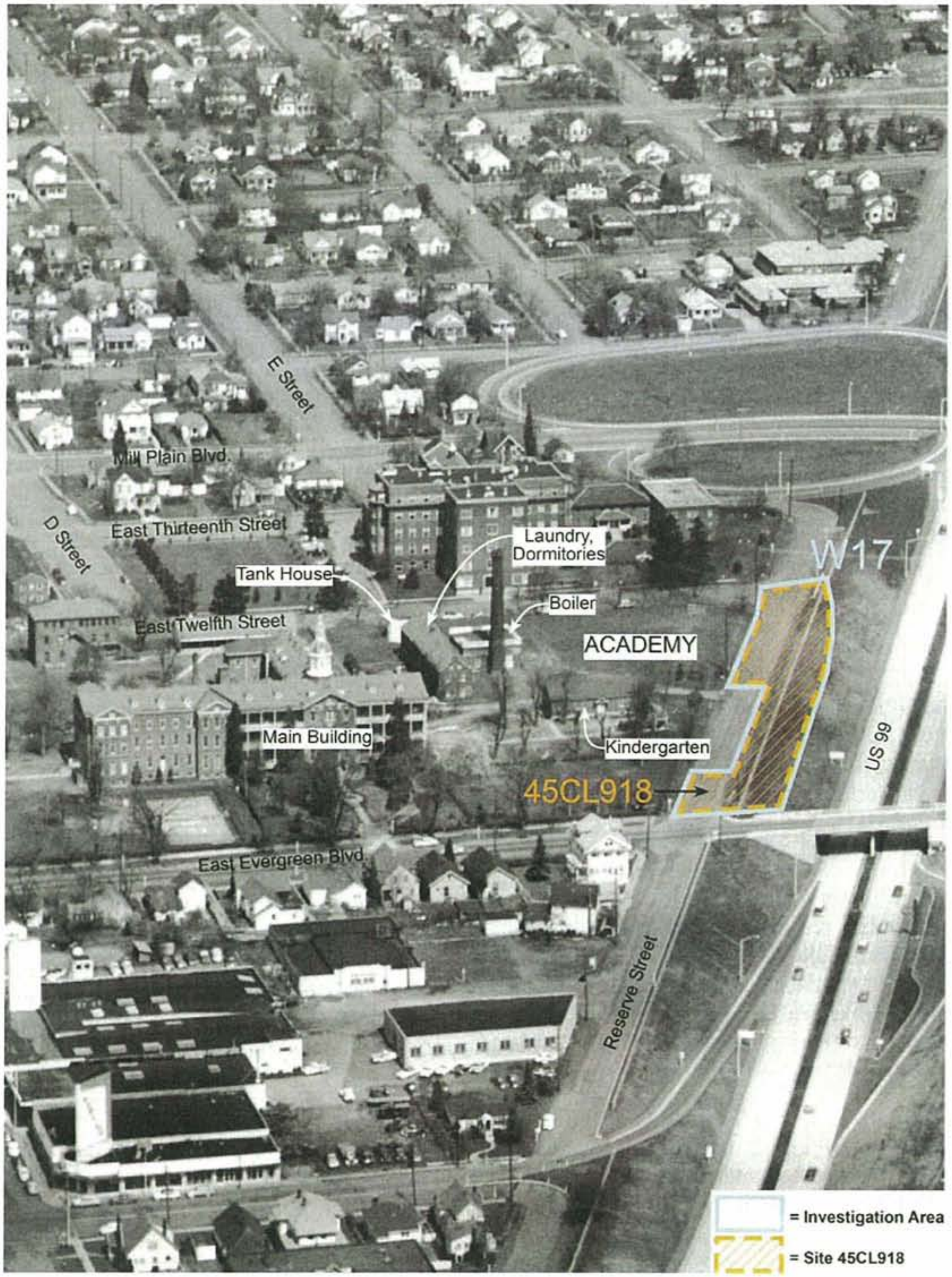


Figure 12-4. View north on 1955 WSDOT aerial photograph, showing relationship of WSDOT parcel W17 (site 45CL918) to the Academy building complex and Reserve Street.

FIELD INVESTIGATIONS

As a result of previous I-5 construction, the actual area at W17 in which archaeological resources might be found is a narrow strip of ground ranging from 3.0 to 9.0 m wide. A remnant of the original landform, this strip was left high above the freeway when I-5 was constructed through a deep cut in the Pleistocene gravels south of Mill Plain Boulevard. This strip is situated between the top of the cut-slope above the interstate on the east and the chain-link boundary fence separating WSDOT and Academy property on the west. The ground surface in this area is currently covered by ivy, grass, bushes, and trees introduced as landscaping.

Manual Excavations

Discovery probing at W17 involved excavation of 40 shovel probes (SP) measuring 50 × 50 cm. These units were excavated in 10-cm levels subdivided according to strata, with the sediments screened through ⅛-inch mesh. These shovel probes were distributed with the objective of systematically sampling the sediments within the project area (see Figure 12-1).

SP1 through SP16 were spaced roughly 10 m apart in a line that extended along the outer (east) edge of the terrace. A second line of shovel probes, also spaced approximately 10 m apart, was placed to the west, close to the WSDOT/Academy fence. The southernmost shovel probes in this west line were separated from those to the north by a driveway on Academy property that appears to be a remnant of W. Reserve Street. SP17 through SP19 were south of this driveway, and SP20 through SP23 were north of this driveway.

North of SP23, concentrations of cultural materials were encountered that led to the excavation of shovel probes into two groups. SP24 through SP29 were aligned in a trench 50 cm wide by 3.0 m long, perpendicular to the WSDOT/Academy fence, to expose and sample a trash disposal burn pit recorded at Feature 1 (Figure 12-5). SP30 through SP36 were aligned in a trench 50 cm wide by 3.5 m long parallel and adjacent to the WSDOT/Academy fence, and SP37 and SP38 were located adjacent (to the east) to this trench, to expose and sample the contents of an ash deposit recorded as Feature 2 (Figure 12-6). To the north, beyond these two groups, the west line of shovel probes was completed with the excavation of SP39 and SP40 adjacent to the WSDOT/Academy fence.

DESCRIPTION OF DEPOSITS

Of the 40 shovel probes excavated, 31 were terminated when they reached what were thought to be intact Pleistocene gravels. Subsequent inspection of the profiles suggests that some of these deposits actually consisted of mixed or redeposited Pleistocene gravels. Asphalt pavement or road base gravels, apparently associated with W. Reserve Street, were encountered in nine probes (terminating excavation in four probes). One probe exposed a concrete slab (at 50 cmbs), three probes encountered utility trench fill deposits, and excavation in one probe was stopped by a dense root wad.

The deposits encountered during the shovel probe excavations at W17 generally reflected the presence of one or more layers of introduced fill material directly overlying either (1) asphalt

Figure 12-5. View northeast, showing excavation in progress in SP24 through SP29 at site 45CL918 (I-5 in background).

Figure 12-6. View southeast, showing excavation in progress in SP30 through SP38 at site 45CL918 (I-5 in background).

pavement and/or road base gravels, or (2) mixed, redeposited, or intact Pleistocene gravels. The nature of the deposits at W17 is illustrated in stratigraphic profiles from the areas where the cultural features were found.

The Feature 1 trash pit, exposed in the trench composed of Shovel Probes 24 through 29, was buried below (1) a layer of dark brown organic loam, and (2) medium brown loam with rounded pebble- to cobble-size gravels (Figure 12-7). Some of these gravels were coated in manganese oxide, suggesting that this gravel layer represents redeposited Pleistocene gravels. The trash pit corresponded with a dark gray ashy loam deposit with abundant artifacts, underlain by a light gray ash lacking cultural material. On the west side of the trash pit was a deposit of asphalt and road gravel. Underlying all these strata were Pleistocene gravels (Cox) in a coarse sand matrix.

The Feature 2 ash deposit, exposed in the trench composed of Shovel Probes 30 through 36 (and the adjacent SP37 and SP38), was buried beneath a single layer of introduced fill consisting of dark brown organic loam (Figure 12-8). The ash deposit corresponded with a layer of dark gray ashy loam that contained abundant artifacts. The ash deposit was underlain by Pleistocene gravels in a coarse sand matrix.

No evidence of an A horizon soil, in which evidence of human occupation and activity might mostly likely be found, was observed during the probe excavations. The Bw soil horizon that characteristically overlies the Pleistocene gravels in the CRC project area was encountered in only one probe (SP2). This situation indicates that the A horizon soil and almost all of the Bw horizon were removed in this area, probably during construction of W. Reserve Street.

ARCHAEOLOGICAL RESOURCES IDENTIFIED

Cultural materials of mostly recent manufacture were found widely scattered in low density in the shovel probes excavated across W17. Two exceptions to this situation were encountered where cultural materials occurred in sufficient concentrations to warrant recording as cultural features. Both of the features recorded were associated with trash disposal/burn activities. For ease of presentation, descriptions of the features and the artifacts recovered during their excavation are provided together. Artifacts from fill deposits that are not feature-related are briefly considered in a separate section below. Summaries of the 1,850 artifacts recovered from all contexts during the archaeological testing in W17 are provided in Table 12-1. Temporally diagnostic artifacts are listed in Table 12-2.

Feature 1

Description

Feature 1 was an ash deposit containing a concentration of artifacts exposed in the trench composed of SP24 through SP29. (the feature did not extend eastward into SP29). The trench wall profiles indicate that the ash was deposited in a pit that measured roughly 150 cm long east–west. The north–south extent of the pit was not established, but it was exposed in both trench walls, where it was approximately 25 cm thick. The ash pit was bounded on the east by asphalt and road base gravels that were probably associated with W. Reserve Street.

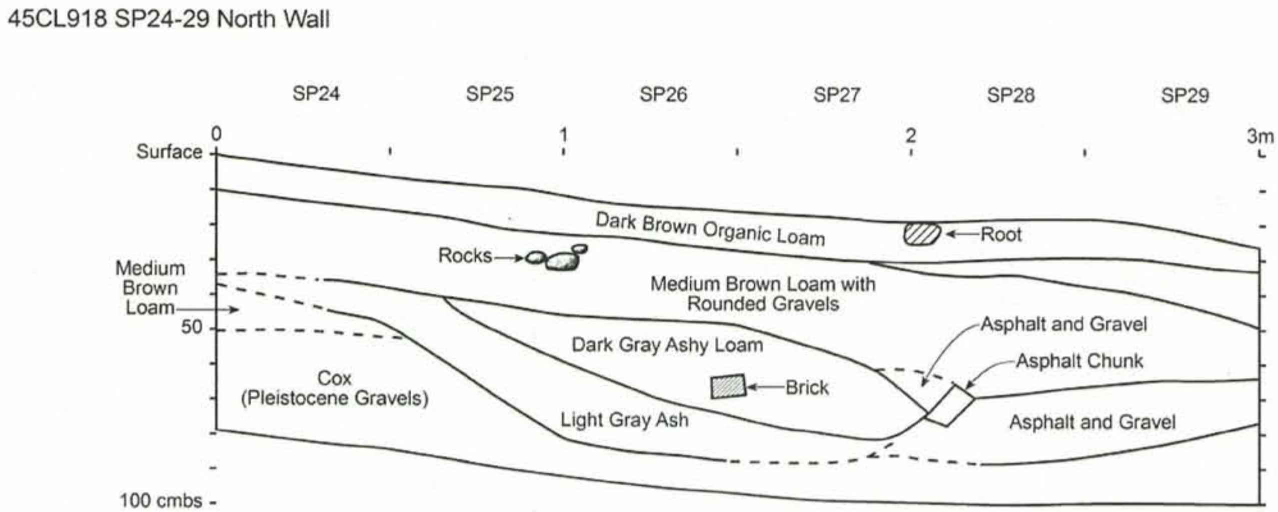


Figure 12-7. Stratigraphic profile of trench composed of SP24–SP29, showing dark gray ashy loam in the Feature 1 trash pit at site 45CL918.

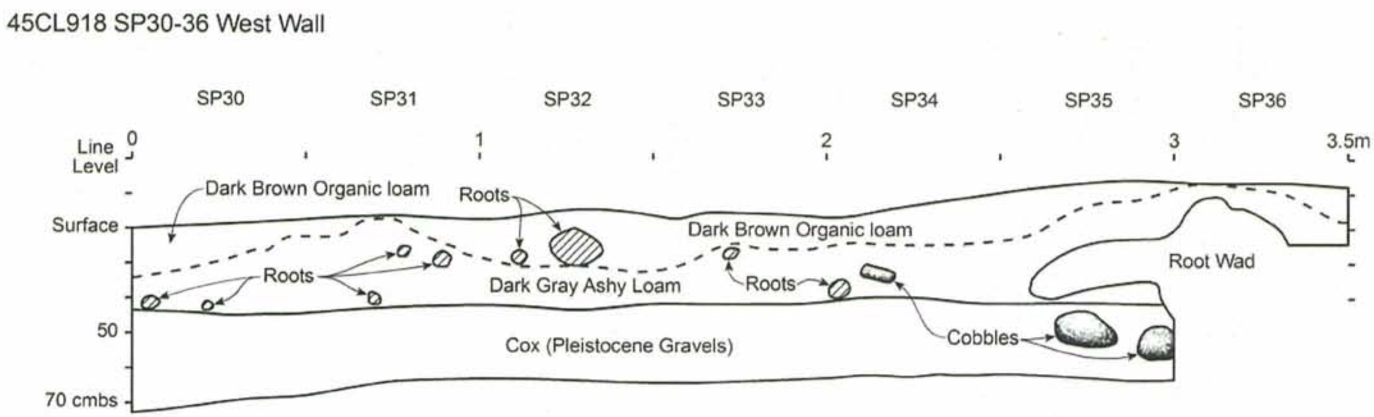


Figure 12-8. Stratigraphic profile of trench composed of SP30–SP36, showing the dark gray ashy loam deposit recorded as Feature 2 at site 45CL918.

Table 12-1. Artifact Summary for Site 45CL918.

Artifact Group/ Category	Artifact Types	SP24–SP28 F1	SP24–SP29 Fill	SP30–SP38 F2	SP1–SP23, SP39–SP43 Fill	Totals
Activities						
Commerce	Lincoln penny			2	1	3
Communication	Ink bottle			2		2
	Plastic & cork ink bottle stopper			1		1
	Pencil lead			19		19
	Pencil eraser ferrule			13		13
Firearms/ammunition	Cartridge case				1	1
Toys	Clay marble			1		1
	Glass marble			4		4
	Porcelain doll	1				1
	Propeller			1		1
Transportation	Lamp lens	1				1
	Sparkplug	1				1
Domestic						
Food	Foil wrapper	13		1		14
	Label			2		2
	Lid/cap			2		2
	Jelly Tumbler			1		1
Food Preparation & Consumption	Ceramic bowl	1		3		4
	Ceramic cup			2	1	3
	Ceramic plate			11		11
	Ceramic saucer		1	1		2
	Indeterminate ceramic tableware	1		32	9	42
	Glass drinking vessel			8		8
	Metal flatware handle			1		1
Food Storage	Stoneware crock				1	1
Furnishings	Bisque figurine			1	1	2
	Glass furniture top			1		1
Heating/Lighting	Brass lamp burner			5		5
	Lamp chimney			28		28
Faunal						
Mammal	Cattle			12	2	14
	Sheep	1		4		5
	Pig	1		9		10
	Even-toed ungulates			3		3
	Large mammal	3		29	1	33
	Unidentified mammal	59	4	172	11	246
Bird	Chicken			1		1
	Ducks, geese, swans			1		1
	Unidentified bird			9		9
Vertebrate	Unidentified vertebrate			1		1
Indefinite						
Fuel	Coal			1		1
Containers	Bottle/Jar	76	9	54	15	154
	Bottle cap	1				1
	Bottle cap liner			1		1
Indefinite	Bone artifact			1		1
	Ceramic item	2		80	6	88
	Fabric			1		1
	Foil			6		6
	Glass item	271	13	99	56	439
	Metal item/fragment	4		33	6	43
	Metal coil			1		1
	Metal ring	1		2		3
	Metal rod			1		1
	Plastic item	1		1		2
	Pressed-glass item			8		8
	Rubber			2		2
	Unidentifiable object/material	6		1		7
	Wicker			1		1

Table 12-1. Artifact Summary for Site 45CL918 (*continued*).

Artifact Group/ Category	Artifact Types	SP24–SP28 F1	SP24–SP29 Fill	SP30–SP38 F2	SP1–SP23, SP39–SP43 Fill	Totals
Waste	Slag/clinker			128	4	**132**
Personal						
Accoutrements	Brass military helmet insignia			1		**1**
	Glass bead			2		**2**
	Metal cufflink			1		**1**
	Metal purse frame/clasp	4				**4**
Clothing	Metal button				3	**3**
	Metal rivet			1	1	**2**
	Prosser button			4		**4**
	Shell button			1		**1**
	Shoe/clothing grommet			7		**7**
Clothing Maintenance	Safety pin			1		**1**
Grooming & Health	Medicine bottle			1		**1**
	Toothbrush			1		**1**
Religious	Silver crucifix			1		**1**
Social Drugs - Alcohol	Alcoholic beverage bottle			9		**9**
	Flask	1				**1**
	Hemp bottle stopper			1		**1**
	Whiskey bottle w/ metal lid	1				**1**
	Wine/champagne bottle			2		**2**
Social Drugs – Tobacco	Cellophane cigarette package wrapper	2		1		**3**
Structural						
Electric	Porcelain insulator			1	2	**3**
Hardware	Brad	1				**1**
	Cut nail	5		27		**32**
	Metal cable guide			1		**1**
	Nail, indeterminate type			37	6	**43**
	Screw			2		**2**
	Spike			3		**3**
	Staple			4		**4**
	Washer	1		1		**2**
	Wire				1	**1**
	Wire nail	2	1	29	7	**39**
Materials	Common red brick	8	1	89	10	**108**
	Firebrick			1	2	**3**
	Mortar			5	1	**6**
	Terra-cotta water pipe	1	2		3	**6**
	Window glass	2	1	153	4	**160**
Totals		**472**	**32**	**1,191**	**155**	**1,850**

SP = Square Probe F = Feature
Note: Artifact types are given as complete items; however, most artifacts in the assemblage are fragments

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Table 12-2. Temporally Diagnostic Artifacts from Site 45CL918.

Provenience	Item Description	Dateable Characteristics	Date/Date Range	Reference
SP24–SP28 Feature 1	White improved earthenware fragment	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Window glass fragments (n=2)	0.063 and 0.093 inch thick	1845–1855 1870–1900*	Roenke (1978:116)
	Colorless bottle/jar fragments (n=6)	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Wire nail fragments (n=2)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
	Crown cap	Bottle cap designed	Since 1892	SHA (2009)
	Colorless flask fragment	Seams indicate production using automatic bottle machine	Since 1905	SHA (2009)
	Spark plug	AC brand	1908–1974	Bowman (2009)
	Aluminum foil fragments (n=13)	Produced in U.S. for candy and gum wrappers	Since 1913	Wikipedia (2009b)
	Cellophane cigarette package wrapper fragments (n=2)	Use of cellophane for cigarette packaging	Since 1931	Dionisio (2008); Famous Why (2010)
	Colorless whiskey bottle fragment with Bakelite cap	Calvert (whiskey) embossed on screw cap (produced by the Maryland Distillery, Baltimore)	Since 1927	SHA (2009); Sullivan (2005)
	Colorless bottle/jar base fragments (n=3)	Anchor Hocking mark with 42 date code	1942	Cole (2007)
SP24–29 Fill	Common red brick	HIDDEN brand from Hidden Brick Co., Vancouver	1871–1992	Gurcke (1987:246); Caldbick (2009)
	Wire nail	Wire nail technology	Readily available since ca. 1884	Adams (2002)
SP30–38 Feature 2	Black glass alcoholic beverage bottle fragments (n=11)	Black glass used for container glass	Pre-1800–ca. 1890s	SHA (2009)
	Green bottle fragment	Flared finish	1820s–ca. 1870	SHA (2009)
	White improved earthenware plate fragment	British royal arms design	Since 1837	The Potteries (2009)
	White improved earthenware fragments indeterminate vessels (n=65)	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Prosser buttons (n=4)	Prosser technology	Since 1840	Sprague (2002:111)
	Safety pin	Invention patented	Since 1849	Bellis (2009)
	Can lids (n=2)	External friction style	Since 1850s	Rock (1989)
	Colorless bottle/jar fragments (n=16)	Glass decolorization	Common since ca 1870s	SHA (2009)
	Amethyst bottle/jar fragments (n=2)	Sun-colored amethyst indicates use of manganese dioxide in decolorization process	1870s–ca. 1920	SHA (2009)
	Amethyst glass fragment	Sun-colored amethyst indicates use of manganese dioxide in decolorization process	1870s–ca. 1920	SHA (2009)
	Colorless Sanford's ink bottle fragment	Glass decolorization	Common since ca. 1870s	SHA (2009)
	Colorless bottle fragment	Embossed [SQ]UIB[B]	1858–1895	Toulouse (1971:481–482)

Table 12-2. Temporally Diagnostic Artifacts from Site 45CL918 (*continued*).

Provenience	Item Description	Dateable Characteristics	Date/Date Range	Reference
	Earthenware tableware fragments (n=10)	Decorated with gold gilt paint	Since ca. 1880	Polk and Phillips (2005)
	Brass infantry dress helmet insignia	Stamped eagle pattern	1881–ca. 1903	Brinkerhoff (1972:18–19); Emerson (1996:44–45)
	Wire nails (n=29)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
	Aqua bottle fragment	Applied finish	Until mid-1890s	SHA (2009)
	Amber alcoholic beverage bottle fragment	Crown finish	Since 1892	SHA (2009)
	Colorless bottle finish	Seams indicate production using automatic bottle machine; patent finish	ca. 1905–ca. 1940s	SHA (2009)
	Colorless bottle fragments (n=2)	Seams indicate production using automatic bottle machine	Since ca. 1905	SHA (2009)
	Colorless bottle fragment	Seams indicate production using automatic bottle machine; small-mouth, patent finish	ca. 1905–1940s	SHA (2009)
	Aluminum foil fragment	Produced in U.S. for candy and gum wrappers	Since 1913	Wikipedia (2009b)
	Sheaffer's Skrip ink bottle stopper	Cork-style closure	1920s–1930s	Conner (2005)
	Earthenware tableware fragments (n=2)	Mark from W. S. George Pottery	1920s–1940s	DeBolt (1994:52–53)
	Cellophane cigarette package wrapper fragment	Use of cellophane for cigarette packaging	Since 1931	Dionisio (2008); Famous Why (2010)
	Earthenware plate base fragments (n=2)	IONA mark from Taylor, Smith & Taylor	ca. 1925	Kovel & Kovel (1986:29)
	Colorless tumbler fragments (n=3)	Mark from Federal Glass Co.	Since 1932	Whitten (2009)
	Lincoln penny	Mint date 1974	1974	N/A
	Lincoln penny	Mint date 1999	1999	N/A
SP1–23, SP39–43 Fill	White improved earthenware fragment indeterminate vessel	Hard, white, nearly non-porous paste	Patented in England in 1813; imported to the U.S. since ca. 1840s	The Potteries (2010)
	Metal rivet	Stamped L.S. & Co. -SF- ; Levi Strauss patent for clothing rivet	Since 1873	Levi Strauss (2009)
	Earthenware tableware fragments (n=2)	Decorated with gold gilt paint	Since ca. 1880	Polk and Phillips (2005)
	Wire nails (n=7)	Wire nail technology	Readily available since ca. 1884	Adams (2002)
	Earthenware tableware fragment	Mark from Homer Laughlin China Co.	1900–1960	Gates & Ormerod (1982:136)
	Lincoln penny	Mint date 1996	1996	N/A

SP = Shovel Probe

* A window glass thickness mode (Roenke 1978) is not presented for the glass from Feature 1, as only two fragments were found. The thicknesses of these pieces are listed, and the date ranges provided reflect the modes into which the individual measurements would fall if a modal analysis was being conducted.

Artifacts

The assemblage from Feature 1 does not conform to those from typical domestic or commercial environments. Well over half of the 472 items from Feature 1 are glass fragments. Only 2 of those could be identified as being from specific types of bottles (both contained alcoholic beverages) and 76 exhibit characteristics indicating they are definitely from bottles or jars. The remaining 271 glass fragments (except window glass, which is discussed below), while not positively identifiable as such, are very likely also from containers, as no other glass artifact types are represented and the nondiagnostic fragments most likely reflect the identifiable portion of this assemblage.

The next most numerous artifact type is faunal remains. Most of the 64 specimens are quite fragmentary in nature. Sheep and pig were each represented by one complete bone; the remaining items can only be classified as unidentified mammal. None of these remains show evidence of butchering.

An assortment of structural materials (8 common red brick fragments, and 2 pieces of window glass, 1 terra-cotta pipe fragment) and metal hardware (5 machine-cut and 2 wire nails, 1 brad, and 1 washer) suggest association with a building, but nothing more specific can be surmised. A smattering of miscellaneous items (1 porcelain doll part, 4 fragments from the metal frame and clasp from a small purse, 1 automobile spark plug and 1 plastic taillight cover, 1 crown cap, 1 brass ring, 4 unidentifiable metal fragments, 1 unclassifiable piece of plastic, 13 pieces from aluminum foil wrappers, 2 cellophane cigarette package wrappers, and 6 small pieces of unidentifiable material) add little to the understanding of this feature.

The near absence of ceramic items (2 undecorated earthenware fragments, 1 white improved earthenware fragment with a molded design, and 1 undecorated porcelain fragment) in the assemblage is unexpected. The diverse nature of the assemblage suggests that Feature 1 is probably associated with the Academy, and the high percentages of container glass (possibly food jars and bottles) and mammal bone suggests a link to a kitchen/dining facility. However, in such an environment, one would expect a significant amount of broken dinnerware, which is not the case in this situation. It is possible, that for some reason, broken ceramic items were disposed of elsewhere.

The presence of ash, coal clinkers, and slag (noted during excavation, but not collected) suggests intentional burning prior to deposition. The cultural material from this feature was probably refuse burned in a furnace or fireplace, then dumped in this location, near the Academy property boundary, during a cleaning episode.

The few temporally diagnostic items from Feature 1 indicate manufacture in the first half of the twentieth century. In particular, aluminum foil was introduced for use as candy and gum wrappers in 1913 and cellophane was used to seal cigarette packages beginning in 1931, the Calvert whiskey bottle could have been made any time after 1927, and a bottle/jar was produced in 1942 by Anchor Hocking Glass Corp. The two window glass fragments collected from Feature 1 measure 0.063 and 0.093 inch thick. Two specimens compose far too small a sample for statistical accuracy; however, if these were part of a larger sample, they would fall into Roenke's (1978) Pacific Northwest window glass dating modes of 0.065 and 0.095, suggesting use for construction from 1845 to 1855 and from 1870 to 1900, respectively.

Although manufacturing date ranges for several items are very broad (e.g., white improved earthenware and wire nails), extending back into the nineteenth century as well as into the twentieth century, their association with the demonstrably later materials suggests that they are contemporary with these later items. Refer to Table 12-2 for a complete list of the diagnostic items from this feature.

Feature 2

Description

Feature 2 was a similar ash deposit containing a concentration of artifacts exposed in the block created by the excavation of SP30 through SP38. Instead of a discrete pit, however, the Feature 2 ash deposit occurred as a relatively horizontal stratum that extended for 3.5 m, the full length of the trench. The ash stratum was 25 cm thick.

Artifacts

The composition of the assemblage from Feature 2 is generally similar to that from Feature 1. However, the artifact count is considerably greater (n=1,191), and the assemblage does contain a large number of ceramic fragments, as well as an assortment of items more consistent with a boarding school environment (fragments from ink bottles and pencils, clothing accoutrements, and more toys; see Figure 12-9).

Nonstructural glass items in the Feature 2 assemblage (n=219) are from assorted bottles and jars, table- or serving wares, lamp chimneys, furniture, beads, and marbles. While 11 bottle fragments are identifiable as being from vessels having contained alcoholic beverages, 1 as being from a medicine bottle, and 2 as from an ink bottle, most bottle/jar fragments (n=55) could not be classified as to contents. In addition, most of the 99 fragments from unidentifiable glass items are very likely from bottles and jars, based on thickness and contour. Drinking glasses are represented by 8 fragments and 8 pressed glass pieces are probably from tablewares (likely drinking glasses and stemware), although some could be from small serving vessels such as candy or condiment dishes. A rim from a jelly tumbler was also identified. Items of a more personal nature are 2 glass beads and 4 glass marbles. Such small pieces easily could have been lost and later swept up and disposed of with more mundane trash.

The faunal remains actually outnumber the glass fragments from Feature 2, with a total of 241 items. Cut marks indicative of butchering were noted on 26 pieces, indicating that these specimens, and likely the bulk of the faunal assemblage, represent food preparation and consumption activities at the Academy.

Also related to food are a piece of foil, pieces from a food label (n=2), and can lids (n=2). In addition, the metal handle from what appears to be a piece of flatware was recovered.

Ceramic fragments have been identified as being from bowls (n=3), plates (n=11), cups (n=2), a saucer, and indeterminate tableware pieces (n=32), as well as from items that cannot not be positively classified as tableware (n=80) (as opposed to other ceramic forms, such as decorative or toiletry vessels). It is assumed, however, that most do come from tablewares. Also present is a vitreous china marble and a piece of bisque ware that was probably part of a figurine.

Items more personal and activity related include pencil fragments (n=32), the ink bottle fragments (n=2), and a plastic stopper from another ink container (n=1). The propeller from what is assumed

Figure 12-9. Selected artifacts from the Feature 2 trash deposit: pencil eraser ferrules and lead (top left); ink bottle fragment and Sheaffer's Skrip ink bottle stopper (middle left); possible Japanese cup fragment and IONA mark from Taylor, Smith & Taylor (bottom left); glass marbles (top right); glass bead and porcelain buttons (upper-middle right); cuff link and crucifix fragment (lower-middle right); U.S. Army dress helmet insignia (bottom right).

to have been a toy or model airplane or boat was recovered, as were the vitreous china marble and the four glass marbles mentioned above. Clothing items and personal accoutrements consist of porcelain Prosser (n=4) and shell buttons (n=1), shoe/clothing grommets (n=7), a metal rivet, a metal cufflink, and a safety pin. A bone toothbrush fragment was also found. A small, silver Jesus figure from a crucifix, possibly from a rosary is the only religious item identified.

Miscellaneous items not discussed previously include a hemp bottle stopper (likely from a wine bottle) and a metallic bottle cap liner, brass fragments from the burner element for an oil or kerosene lamp, a piece of wicker (possibly from a basket of piece of furniture), a piece of fabric, various unidentifiable metal pieces, a metal coil, metal rings, a metal rod, plastic and rubber fragments, the cellophane wrapper from a cigarette package, and a shaped bone item.

Disposal of building materials is represented by this assemblage. Structural materials and hardware items account for 353 of the artifacts from Feature 2. Present are fragments from common red bricks (n=89) and firebrick (n=1), mortar (n=5), and window glass (n=153). Hardware items are machine-cut (n=27) and wire nails (n=29), nails that could not be typed because of the amount of rust and/or deterioration (n=37), as well as an assortment of screws (n=2), spikes (n=3), staples (n=4), a washer, and a metal cable guide. A porcelain insulator was also recovered.

The presence of a piece of coal and many clinkers and pieces of slag (n=128) indicate intentional burning, perhaps in a furnace of some kind at the Academy. The burned refuse was then likely disposed of in this location, near the Academy property boundary, when the furnace was periodically emptied.

Of particular note, yet of an undetermined relationship to an assemblage assumed to have originated at the Academy, is a brass Army dress helmet insignia. It is the stamped eagle pattern (an eagle with outstretched wings and a shield on its breast) introduced in 1881 and in use until ca. 1903. This specimen bears the infantry's crossed rifles and was made in a single piece, indicating use by an enlisted man (officers' insignia were cast in two pieces—the eagle and the shield). The regimental number is missing, but the holes for attachment are visible.

Also recovered from Feature 2 are two Lincoln pennies dating to 1974 and 1999. These coins were likely tossed or dropped in this area by passersby in recent years and are intrusive to the Feature 2 deposit.

The dateable items from Feature 2 indicate the potential for trash disposal to have occurred in this area for a considerable period of time; however, lack of significant depth to the feature suggests that the disposal was also intermittent, not regular. Earlier artifacts include a medicine bottle that was manufactured between 1858 and 1895, bottles with finishes no longer common after the 1870s and 1890s, black glass bottles rarely manufactured after the 1890s, and the Army helmet insignia, which dates between 1881 and 1903. Later items are sun-colored amethyst glass dating from the 1870s until the 1920s, machine-made bottles dating anytime after ca 1905, the cork from an ink bottle dating to the 1920s or 1930s, a glass tumbler manufactured sometime after 1932, ceramic tableware dating from the 1920s through the 1940s, aluminum foil used for candy and gum wrappers beginning in 1913, and a cellophane wrapper introduced in 1931.

Using Roenke's (1978:116) Pacific Northwest window glass dating formula, the numerous window glass fragments (n=153) have a primary thickness mode of 0.095 inch, a secondary mode of 0.085 inch, and a tertiary mode of 0.075 inch. These modes suggest construction between 1870 and 1900, between 1855 and 1885, and between 1850 and 1865, respectively. These figures are generally consistent with the 1874 construction date for the Academy. The fragments that contribute to the slightly earlier tertiary mode are probably from glass manufactured in the years leading up to construction, but not used immediately. The presence of a few fragments having thicknesses indicating manufacture even earlier may have been salvaged from earlier buildings in the area or acquired from a source that had older glass on hand. The small number of thicker, probably later, fragments may represent construction in subsequent years as more buildings were added to the campus. Refer to Table 12-2 for a complete list of dateable items from this feature.

Fill Artifacts

The remaining 187 items were collected from the fill deposits in the shovel probes placed the length of W17. Most of this material appears to be randomly scattered trash that accumulated in this area over time. This varied assemblage contains ceramic fragments most likely from tableware, food storage vessels, or decorative items (n=19); bottle and jar fragments (n=24) as well as nondiagnostic glass fragments that are also probably from containers (n=69); an assortment of animal bone (n=18); clothing items such as buttons (n=3) and a Levi Strauss rivet; a brass cartridge case; a recent (1996) Lincoln penny; and several unidentifiable metal fragments (n=6). Also present is structural debris, such as brick (n=13) and mortar (n=1) fragments, window glass (n=5), and terra-cotta pipe fragments (n=5), and hardware such as wire nails (n=8) and some that could not be classified as wire or machine-cut because of heavy rust (n=6), wire (n=1), and porcelain insulator fragments (n=2). A few clinkers (n=4) were also recovered.

Temporally diagnostic artifacts from the fill include a fragment of white improved earthenware, patented in England in 1813 and commercially imported to this country beginning in the 1840s; a piece of earthenware tableware manufactured by Homer Laughlin China Co. between 1900 and 1960; earthenware fragments decorated with liquid gold, which was introduced in 1880; and a rivet from an article of clothing produced by Levi Strauss sometime after 1873. Also present are a brick with the HIDDEN brand manufactured by the Hidden Brick Co. sometime between 1871 and 1992; wire nails, which have been readily available in retail outlets in this country since around 1884; and the 1996 penny. In general, then, considering this mix, most of the fill was probably deposited in relatively recent years and is not historically significant.

ANALYSIS AND INTERPRETIVE RESULTS

W17 was the first CRC area in which the results of the GPR reconnaissance were ground-truthed through excavations. The discovery probing confirmed the GPR results, establishing that W17 is covered by fill deposits ranging from 0.3 to 0.8 m deep, with an average depth of 0.5 m. Despite the presence of these fill deposits, which often consisted of compacted road gravels associated with W. Reserve Street, most of the probes reached the underlying native soils. The contacts between fill and prehistoric soils included 1 Bw soil contact and 27 Pleistocene gravel (Cox) soil contacts. The nature of these fill contacts suggests that no buried A horizon soil, and very little of the Bw horizon, survived the cut-and-fill activities associated with construction of W. Reserve Street.

Most of the 1,850 artifacts (a total reflecting a few complete objects, but mostly fragments of varying sizes) recovered during discovery probe excavation in W17 are from Feature 1, the ash pit (n=472), and Feature 2, the ash stratum (n=1,191), situated along the WSDOT/Academy property fence (Figure 12-10). These features contained mixtures of older (e.g., machine-cut nails, nineteenth century container glass, a military helmet insignia) and younger materials (e.g., foil cellophane, recent glass containers).

Figure 12-10. View east, showing excavations in progress along the WSDOT/Academy boundary fence in WSDOT parcel W17 (SP30 through SP38, where the Feature 2 ash stratum was found, on left; SP24 through SP29, where the Feature 1 ash pit was found, on right; I-5 in background).

In addition, scattered cultural items (n=187) were encountered in probes outside of these two trash deposits (Table 12-1). These cultural materials tended to be of relatively recent manufacture and generally occurred in fill deposits that postdate the time when W. Reserve Street was in use.

Judging from the nature of the cultural materials represented, these ash deposits probably originated in fireplaces or furnaces at the nearby Academy, and their present location reflects the practice of disposal of the ash and associated debris in the northeast corner of the Academy property, in the area now bisected by the WSDOT/Academy property fence. If not from the main Academy building, the ash deposits may be from the boiler building, which stands approximately 50 m west of the WSDOT boundary fence. In addition, the 1907 and 1911 Sanborn maps show an assortment of outbuildings (e.g., stables, sheds, hen houses) appearing and disappearing over time on the Academy property just west of the two cultural features. None of these structures, however, is of the type that might yield the kinds of artifacts recovered.

NRHP ELIGIBILITY

Much, if not most, of site 45CL918 was formerly covered by W. Reserve Street. Most of the discovery probing at this site involved excavations into fill deposits associated with this road. Excavations through the fill documented the complete absence of an A horizon soil, the near absence of Bw soil, and extensive disturbance into the top of the underlying Pleistocene gravels. Cultural materials of relatively recent manufacture were found to be widely scattered across the site in fill deposits that postdate the time when W. Reserve Street was in use.

The two trash disposal features found in the northwest corner of site 45CL918 represent exceptions to this situation. Judging from the nature of the cultural materials represented, these ash deposits probably originated in fireplaces or furnaces at the nearby Academy. The present location of these features probably reflects the practice of disposal of the ash in the northeast corner of the Academy property now bisected by the WSDOT/Academy boundary fence.

The cultural materials recovered from these ash features include a mixture of older (e.g., machine-cut nails, nineteenth century container glass, a military helmet insignia) and younger items (e.g., foil, cellophane, and recent glass containers). The presence of these more recent cultural materials suggests that either (1) the ash concentrations containing these artifacts are not particularly old (e.g., they are only as old as the most recent artifacts), and/or (2) the ash concentrations have been disturbed by later activities, so that artifacts of different ages have become mixed together in the same sediments.

Although a substantial number of artifacts were recovered during discovery probing and evaluative testing, these cultural materials are of widely varying ages and occur in fill deposits and/or in mixed depositional contexts. Site 45CL918 thus lacks the integrity (level of preservation and quality of information contained in the deposits) of an archaeological site that is National Register eligible under criterion d (Little et al. 2000:31–44).

Site 45CL918 also does not appear to meet the requirements for significance under criteria a, b, or c due to the loss of the integrity of its setting. This site is situated in the construction zone of I-5, and now sits on a remnant landform above the deep cut along which I-5 extends through the City of Vancouver. The massive amount of earthmoving during highway construction resulted in the widespread destruction of the historic setting in the I-5 corridor. As a result, site 45CL918 does not meet the integrity standard required for National Register eligibility under criteria a, b, or c.

RELATIONSHIP TO ADJACENT RESOURCES

Situated along the former alignment of W. Reserve Street, site 45CL918 is located between the Academy on the west and the former area of the first post cemetery at Vancouver Barracks on the east. As previously noted, the burials at the cemetery were supposedly removed in 1882 and reinterred at the military cemetery on Fourth Plain. Some evidence has subsequently been found indicating that not all of the human remains from burials at this cemetery were located and removed (O'Rourke et al. 2010:43–44; Thomas 1998:10).

A sense of the cemetery's location in relation to the Historic City of Vancouver and Vancouver Barracks is provided by reminiscences and a map pertaining to the 1880s and 1890s (Figure 12-11). The cemetery was situated northwest of the 10th Street Gate, the main entrance to the northern portion of Vancouver Barracks, known as the Upper Garrison. In reminiscing about the appearance of this area in the 1880s and 1890s, Clarabelle Haven Gillogly described this area as follows:

> The 10th Street Gate was an imposing entrance of high brick and cement posts, with the Guard House and sentry just inside. A well kept graveled driveway curved to the north and east, and one to the south and east. To the north of the 10th Street Gate was a thickly wooded grove of firs, whose branches grew low and made this spot always cool and dark looking. Oregon grape and ferns grew there, and there were a few moss covered mounds and a few dozen headstones of old marble. This was one of the two first cemeteries in the Barracks. These graves and markers were later moved to the present Military Cemetery, north and west of the Reserve. (Gillogly 1964:15)

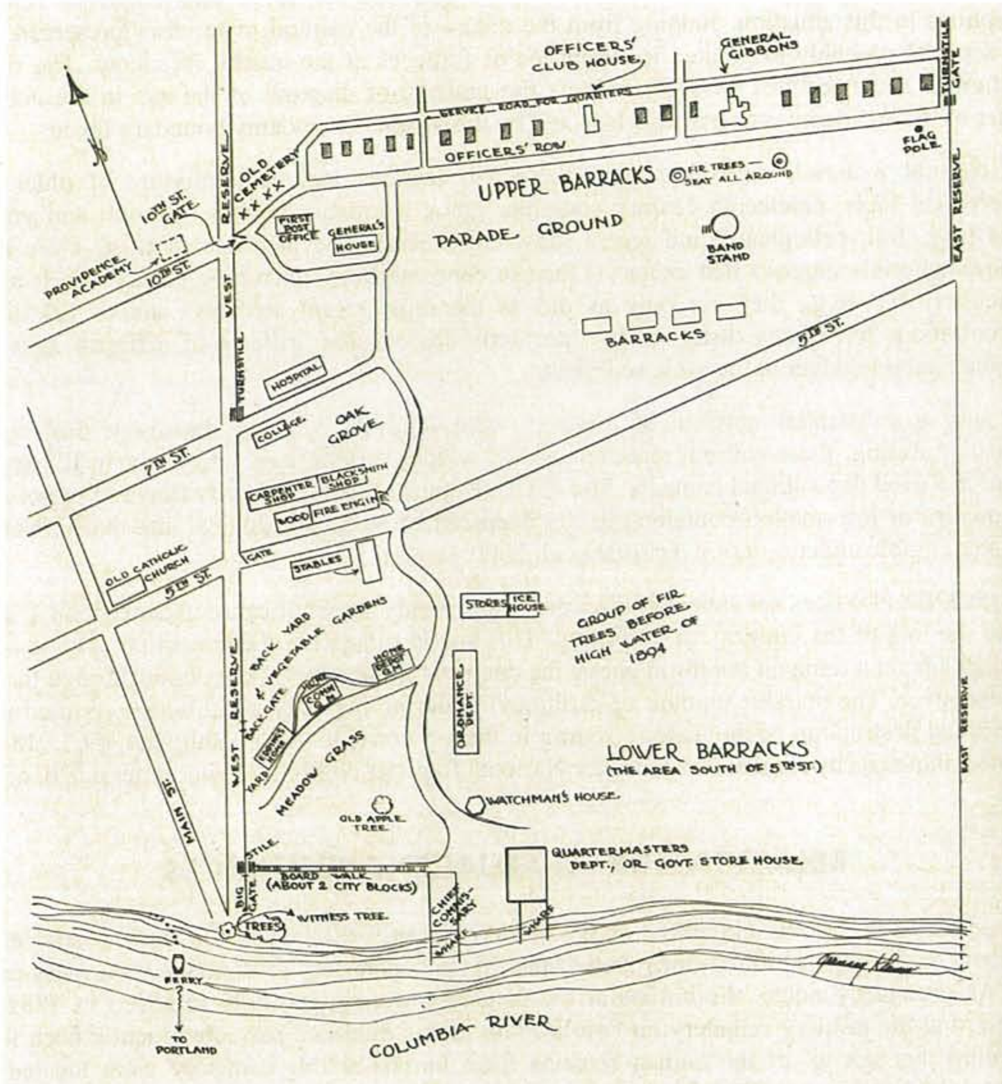

Figure 12-11. Map showing the "Old Cemetery" across West Reserve Street from WSDOT parcel W17 in relation to the Historic City of Vancouver and Vancouver Barracks (from Gillogly 1964:16).

In terms of today's landscape, the 10th Street Gate was immediately south of site 45CL918, where Evergreen Blvd (formerly 10th Street) begins to cross the overpass above I-5. As discussed above, virtually all of site 45CL918 above the I-5 cut was within W. Reserve Street, and the portion of the site below the cut was removed during construction of I-5. Thus, site 45CL918 is not expected to include any areas in which human remains from the military cemetery might be found. On the west, site 45CL918 is bounded by the Academy property, which was placed on the National Register in 1978. As noted above, the cultural materials in the ash concentrations along the WSDOT/Academy property fence almost certainly reflect refuse disposal from residents of the Academy. Although archaeological investigations have not yet been conducted on the Academy property, Sanborn maps document numerous structures with which archaeological deposits and features are likely associated (see Figures 12-2–12-3). In addition to the other qualities that led the Academy to be listed on the National Register, the Academy property almost certainly contains significant historical archaeological resources.

FUTURE MANAGEMENT OPTIONS

In view of the assessment of site 45CL918 as not National Register eligible, there appear to be no restrictions on construction at W17 during the CRC project. However, there is always a possibility that previously unidentified and potentially significant evidence of prehistoric or historic occupation or activity may be exposed during construction-related earthmoving. Accordingly, monitoring by an archaeologist is recommended during any earthmoving in this area associated with construction for the CRC project.

13. WASHINGTON AREA 18A (45CL919)

Washington Area 18 (W18) is a WSDOT parcel along the western margin of I-5, extending from the Evergreen Boulevard overpass southward to a point immediately east of the intersection of 6th and C streets in the city of Vancouver. This chapter describes the procedures and results of archaeological discovery investigations in the northern portion of W18. W18A is a narrow section along the WSDOT fence, high above the I-5 travel lanes, that extends from Evergreen Boulevard south to 7th Street.

Undertaken on May 5 and 6, 2009, archaeological discovery investigations in W18A involved a combination of manual excavation of shovel probes and mechanical trenching. These excavations encountered introduced fill materials in some areas and disturbed natural soils in others. Historical artifacts were recovered from fill and/or disturbed soils in eight different probes. These archaeological remains have been recorded with DAHP as site 45CL919.

HISTORICAL SETTING

W18A is on the eastern margin of the City of Vancouver, where Reserve Street formed the boundary between the city and the military reserve to the east. A remnant of Reserve Street still exists between 8th Street (relocated slightly north of the original 8th Street in the block between C Street and Reserve Street) and Evergreen Boulevard (formerly 10th Street) (Figure 13-1). The northern end of W18A is situated along the east edge of Reserve Street. Heading south, the area begins to angle slightly more to the west than did Reserve Street, thus crossing to the west side of the original roadway by the time it intersects the east end of 7th Street.

Initial settlement and development in the Historic City of Vancouver began on the north bank of the Columbia River and gradually proceeded northward. Covington's 1846 map of Fort Vancouver shows the W18A area as divided into claim-like parcels (Thomas and Hibbs 1984:775). An 1855 map entitled "Fort Vancouver and Environs" and Harney's 1859 map of the military reservation show the W18A area as platted in the city's grid, but do not indicate development (Thomas and Hibbs 1984:769, 773).

The earliest Sanborn map of Vancouver, published in 1884, does not extend far enough to the north and east to show development in the W18A vicinity. The 1888, 1890, and 1892 Sanborn maps show Reserve Street extending along the eastern margins of Blocks 33, 34, and 14 between 7th and 10th streets. By the time the 1907 Sanborn map was published, the city blocks in Vancouver had been renumbered, so that on the 1907 and subsequent issues of the maps (1911, 1928, and 1949) Reserve Street extends along the eastern margins of Blocks 455, 454, and 453, respectively.

The Sanborn maps indicate that a variety of dwellings and larger structures came and went on the blocks immediately west of W18A over the years (Figures 13-2–13-4). Several of the buildings along Reserve Street between 7th and 10th streets were dwellings; however a large facility identified on the 1888, 1890, and 1892 maps as the Sisters Hospital, on the 1907 and 1911 maps as St. Joseph's Hospital, and on the 1928 map as the Blanchet Home for the Aged (the building

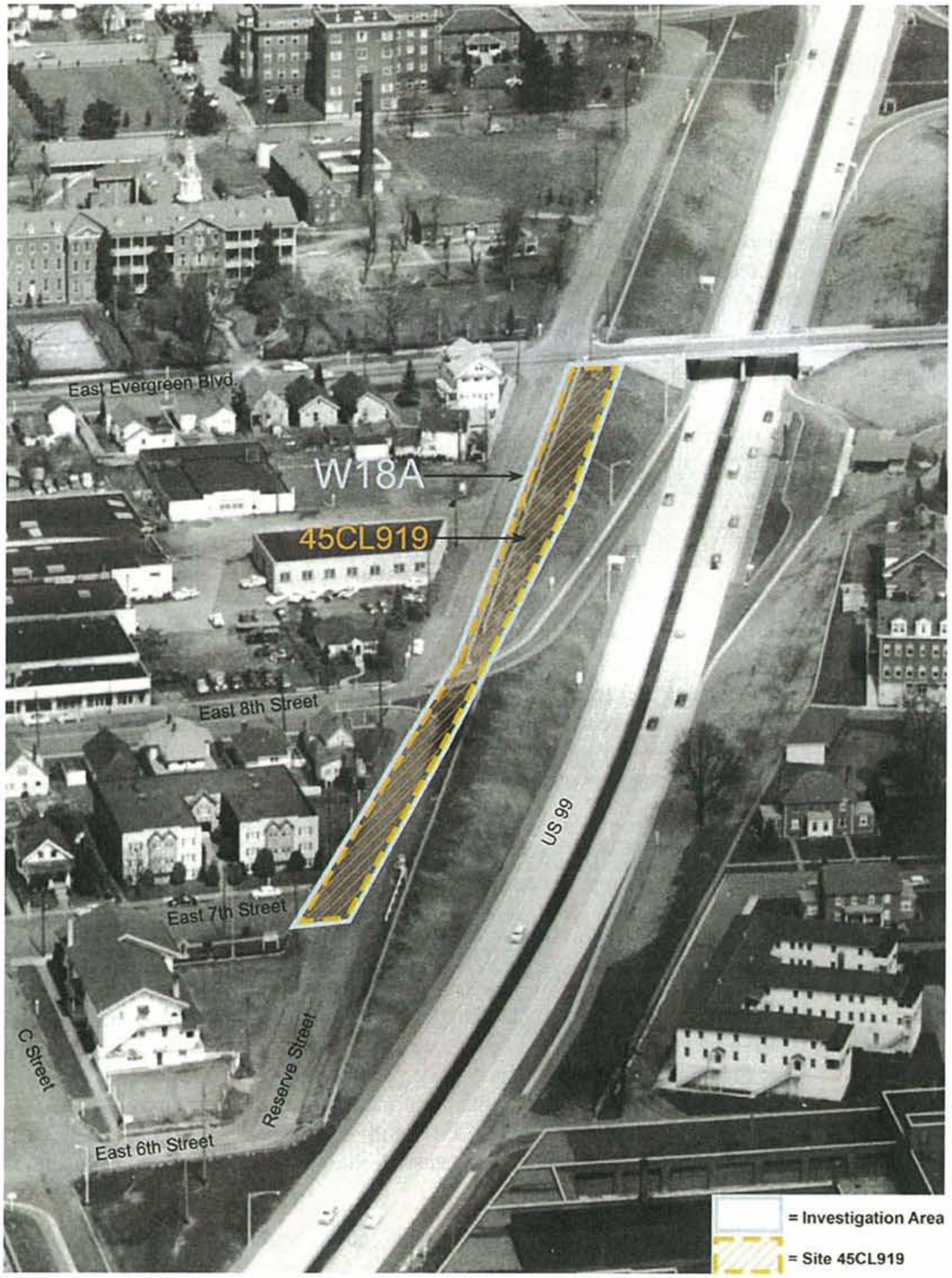

Figure 13-1. View north on 1955 WSDOT aerial photograph showing the relationship of WSDOT parcel W18A (site 45CL919) to Reserve Street.