WATER SYSTEM ANALYSIS FOR THE DICTIONARY HILLS APARTMENTS

January 16, 2003

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Job Number: 549-001

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January 16, 2003

549-001

Tait Consulting, Inc. 717 Pier View Way Oceanside, CA 92054

Attention:

Bruce Tait, Project Manager

Subject:

Dictionary Hill Apartments Water System Analysis

This letter-report provides an analysis of water system improvements necessary to provide service to the proposed Dictionary Hills Apartments. In particular, this study evaluates the improvements to the existing water system that are necessary to provide adequate fire protection service to the project.

The 101 unit Dictionary Hill Apartment Complex is proposed to be located at the intersection of Harness Street and Grand Avenue in Spring Valley. The property is within the boundaries of the Helix Water District for water service.

Design Criteria

To analyze the water facilities necessary to serve the project, a hydraulic computer model was setup using the KYPIPE program developed by the University of Kentucky. This program utilizes the Hazen-Williams equation for calculating headlosses in pipelines. A Hazen-Williams friction factor (c-value) of 120 was used in our analysis.

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The critical scenario in evaluating water system requirements for the project was the ability to meet a maximum day demand plus fire flow scenario while maintaining a minimum residual pressure of 20 psi. To estimate maximum day demands from the project, an average day demand factor of 400 gpd/unit was used and average day demands were converted to maximum day demands by multiplying by a factor of 2.0. The estimated maximum day demand for the Dictionary Hill Apartments is 80,800 gpd (56 gpm). This demand was included in the modeling of the system.

Existing Water System

The existing water system in the vicinity of the project consists primarily of 8-inch piping. There is an 8-inch line in Harness Street that has been extended to just west of the project. There are also 8-inch water lines in Presioca Street and Amys Street located west of the project. There are no existing water lines in Grand Avenue along the eastern boundary of the project. The existing water system in Grand Avenue located north of the project is operated by the Otay Water District.

Fire Flow Data

The available hydraulic gradeline in the vicinity of the project was based on fire flow data. We reviewed fire flow data for nearby hydrants dating as far back as 1973 and as recently as December 30, 2002. The data appeared to yield similar results where a hydrant was tested on more than one occasion so we opted to use the most recent testing performed on December 30, 2002 as the basis for our analysis. The fire flow data is included in Appendix A.

The December 30, 2002 fire flow tests were conducted on the hydrant at the east end of Amys Street and the hydrant in Harness Street near the southwest corner of the project. The results indicated that the maximum hydraulic gradeline in the system during static conditions is approximately 650 feet. The average residual gradeline in the system prior to the tests was 600 feet. The average estimated gradeline in the main line system during a fire flow test was approximately 555 feet. This latter value

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was calculated by converting the pitot pressure reading to a hydraulic gradeline and adding back in the estimated losses through the fire hydrant lateral and assembly. Based on the above, all computer modeling performed as a part of this study assumes a system hydraulic gradeline of 555 feet at the intersection of Harness Street and Presioca Street.

Computer Modeling Summary

The computer modeling output is included in Appendix B along with the corresponding node an pipe diagram. The system was modeled under two cases. The first case assumes an unlooped system with service from the water line in Harness Street only. The second case assumes a looped system where a connection is made between the lines in Harness Street and Amys Street. In both cases, two fire hydrants have been included onsite and the system has been evaluated with flow from each hydrant individually and with flow from both hydrants.

For the unlooped system, Table 1 summarizes the maximum estimated fire flows that can be achieved while maintaining a minimum residual pressure of 20 psi. With flow from a single hydrant, the maximum predicted fire flow is 1,050 gpm to 1,075 gpm. With flows from both hydrants, a maximum fire flow of 1,250 gpm is predicted.

ிர	ABLE 1			
	HILL APARTMENTS			
3.	NALYSIS SUMMARY			
UNLOO.	PED SYSTEM			
Fire Flow Location	Maximum Flow @ 20 ps			
Node 120	1,075 gpm			
Node 140	1,050 gpm			
Nodes 120 and 140	1,250 gpm			

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For the looped system, Table 2 summarizes the anticipated maximum fire flows. As shown, a fire flow of 1,425 gpm to 1,475 gpm is predicted from a single hydrant. A fire flow of 1,950 gpm is predicted when flows are taken from both hydrants.

\mathbf{T}_{A}	ABLE 2
DICTIONARY I	HILL APARTMENTS
FIRE FLOW AN	NALYSIS SUMMARY
WITH LOOP	TO AMY STREET
Fire Flow Location	Maximum Flow @ 20 psi
Node 120	1,425 gpm
Node 140	$1,475~\mathrm{gpm}$
Nodes 120 and 140	1,950 gpm

Conclusion

Based on our analysis, we estimate that the maximum reliable fire flow from an unlooped system is 1,250 gpm. With an 8-inch loop to the existing line in Amys Street, the maximum reliable fire flow is estimated to be 1,950 gpm.

We are available to discuss the contents of this study at your convenience. If you have any questions or require additional information, please let us know.

Dexter Wilson Engineering, Inc.

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Stephen M. Nielsen

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APPENDIX A

FIRE FLOW DATA

1		K	الله ا	elix.	Mater	Helix Water District					
			2	S T &	hant !	Hydrant Flow Test	:				
Date: December 30, 2002	j-: <u>!</u>				1			Testerd Bv-		品 () () () () () () () () () (
									1	Selection	
i.		中心	Press	100	Prescurette. Sq. In.	F.H. Jype &		Teust.	DESCRIPTION OF THE PROPERTY OF	Distribution of Pan	
Location	AN.IPM.	F Assituble	Static	Fessid.	Pite	* Model #	File Sta	Original Stars	Observed	-W. OC	
9211 Amys St., Spring Valley End of fine	2:45 A.M.	#500304			₹	LONG BEACH 430 (1) 4" 8 (Z) 2.5"	. G	24	1238.51404	. 2	
Gauged FH 350° 4-VMD Tested FH on Amys St.		16500305	-8	8	<u>.</u>	LOWG BEACH 430	ь.		0	0	9
				. 1	•		\$300		. ,~~~ 		
											No District
9236 Harnetes St., Spring Valley - End of libe	9240 A.M.	#227000	102	.75	8	RICH (1) 4° & (1) 25°	io	- 1	110084944	2162 4959	
St. approx, 150' S/O		· #5@i807	115	80		CLOW (1) 4" & (2) 25"	to		0		*))
-) ·			20				
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APPENDIX B

COMPUTER MODELING OUTPUT

CASE 1 - UNLOOPED SYSTEM

The following conditions were modeled:

- 1: Maximum Day Demands Plus 1,075 gpm at Node 120
- 2. Maximum Day Demands Plus 1,050 gpm at Node 140
- 3. Maximum Day Demands Plus 625 gpm each at Nodes 120 and 140.

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

	$_{ m PIPE}$	NO.	NODE	E NOS.	LENGTH	DIAMETER	ROUGHNE	iss i	MINOR LOSS	K	FIXED GRAI	DΕ
20					(FEET)	(INCHES)						
	1		0	2	500.0	8.0	120.	0	.00		555.00	
	3		2	4	170.0	8.0	120.	0	.00			
	5		4	6	200.0	8.0	120.	0	.00			
	7		6	8	140.0	8.0	120.	0	.00			
•	9		6	1.0	180.0	8.0	120.	0	.00			
	11	:	10	12	50.0	8.0	120.	0	.00			
	13	:	1.0	14	180.0	8.0	120.	0	.00			
	110		12 1	.20	38.0	6.0	120.	0	3.50			
	130	:	14 1	.40	38.0	, 6.0	120.	0	3.50	274		
				225								
JU	NCTION	IUM I	IBER	DEM	AND CINA	ELEVATION	CONNEC	TING	PIPES			
		2			.00	413.00	1	3	**			
		4		48	.00	448.00	3	5				
		6		11	.00	460.00	5	7	9			
	39	8		11	.00	460.00	7					
		.0		12	.00	462.00	9	11	13			
	1	.2		11	.00	468.00	11	110				
	1	4		11	. 0.0	464.00	1.3	130			ac.	

110

130

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

1075.00

.00

120

140

THIS SYSTEM HAS 9 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 1 FGNS

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00000

468.00

466.00

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS

MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH SERVICE FROM HARNESS STREET ONLY

FIRE FLOW FROM HYDRANT AT NODE 120 ONLY

549001A

PIPE NO.	NODE	NOS.	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	Ó	2	1131.00	13.31	.00	.00	7.22	26.61
3	2	4	1131.00	4.52	.00	.00	7.22	26.61
5	4	6	1131.00	5.32	.00	.00	7.22	26.61

7	6	8	11.00	.00	.00	.00	.07	.00
9	б	. 10	1109.00	4.62	.00	.00	7.08	25.66
11	10	12	1086.00	1.23	.00	.00	6.93	24.68
13	10	14	11.00	.00	.00	.00	.07	.00
110	12	120	1075.00	3.74	.00	8.08	12.20	98.33
130	14	140	.00	.00	.00	.00	.00	.00

JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2		.00	541.69	413.00	55.77
4		.00	537.17	448.00	38.64
6		11.00	531.85	460.00	31.13
8		11.00	531.85	460.00	31.13
10		12.00	527.23	462.00	28.27
12		11.00	525.99	468.00	25.13
14		11.00	527.23	464.00	27.40
120		1075.00	514.17	468.00	20.01
140		.00	527.23	466:00	26.53

THE NET SYSTEM DEMAND = 1131.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE
1 1131.00

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1131.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE	NO.	NODE	NOS.	LENGTH	DIAMETER	ROUGHNESS	MINOR LOSS	K	FIXED GRADE
				(FEET)	(INCHES)				
1		0	2	500.0	8.0	120.0	.00		555.00
3		2	4	170.0	8.0	120.0	.00		
5		4	6	200.0	8.0 .	120.0	.00		
7		6	8	140.0	8.0	120.0	.00		
9		б	10	180.0	8.0	120.0	.00		
11	1	10	12	50.0	8.0	120.0	.00		
13	1	10	14	180.0	8.0	_ 120.0	.00		
110	1	12 12	20	38.0	6.0	120.0	3.50		
130	1	L4 14	10	38.0	6.0	120.0	3.50		
			¥2						70

JUNCTION NUMBER	DEMAND	ELEVATION	CONNEC	TING	PIPES
2	:00	413.00	1	3	•
4	.00	448.00	. 3	. 5	
б	11.00	460.00	5	7	9
≅ 8	11.00	460.00	7		
10	12.00	462.00	9	11	13
12	11.00	468.00	11	110	
14	11.00	464.00	13	130	
120	.00	468.00	110		
140	1050.00	466.00	130		

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 9 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 1 FGNS

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00000

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS
MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH SERVICE FROM HARNESS STREET ONLY
FIRE FLOW FROM NODE 140 ONLY
549001B

PIPE NO	. NODE	NOS.	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	Ö	2	1106.00	12.77	.00	.00	7.06	25.53
. 3	2	4	1106.00	4.34	.00	.00	7.06	25.53
5	4	6	1106.00	5.11	.00	.00	7.06	25.53

7	6	· 8	11.00	.00	.00	.00	.07	.00
	6		1084.00	4.43	.00	.00	6.92	24.60
11	10	12	11.00	.00	.00	.00	.07	.00
13	10	14	1061.00	4.26	.00	.00	6.77	23.64
110	12	120	.00	.00	.00	.00	.00	.00
130	14	140	1050.00	3.58	.00	7.71	11.91	94.14

					13
JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2		.00	542.23	413.00	56.00
4		.00 ~	537.89	448.00	38.95
. 6		11.00	532.79	460.00	31.54
8		11.00	532.79	460.00	31.54
10		12.00	528.36	462.00	28.76
12		11.00	528.36	468.00	26.15
14		11.00	524.10	464.00	26.04
120		.00	528.36	468.00	26.15
140		1050.00	512.81	466.00	20.29

'THE NET SYSTEM DEMAND = 1106.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE 1 1106.00

THE NET FLOW INTO THE SYSTEM FROM'FIXED GRADE NODES = 1106.00

THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE	NO.	NODE	NOS.	LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNE	ess	MINOR	LOSS	K	FIXED	GRA	DE
1		0	2	500.0	8.0	120.	. 0		.00		555	.00	
3		2	4	170.0	8.0	120.	. 0		.00				
5		4	6	200.0	8.0	120.	0 ·		.00				
·. 7		6	8	140.0	8.0	120.	0		.00				
. , 9		6	10	180.0	8.0	120.	0		.00				721
11	1	.0	12	50.0	8.0	120.	0		.00				
13	1	.0	14	180.0	8.0	120.	0		.00				
110	1	.2 1	20	38.0	6.0	120.	0	3	.50				ħ
130	1	4 1	40	38.0	6.0	120.	0	3	.50				
											· §		
*0													
JUNCTION	MUM	BER	DEMZ	ND	ELEVATION	CONNEC	TING	PIPES					
	2	•	0 8	.00	413.00	1	3						
	4		-	.00	448.00	3	5			921		(₩)	
	6		11.	.00	460.00	5	7	9					
\$0	8		11.	.00	460.00	7							
1	0		12.	00	462.00	9	11	13					
1	2		11.	00	468.00	11	110						
1	4		11.	00	464.00	13	130						
12	0		625.	00	468.00	110							
14	0		625.	00	466.00	130							

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 9 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 1 FGNS

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00000

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS

MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH SERVICE FROM HARNESS STREET ONLY

FIRE FLOW FROM NODES 120 AND 140 549001C .

PIPE NO.	NODE	NOS.	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	.0.	2	1306.00	17.37	.00	.00	8.34	34.74
3	2	4	1306.00	5.91	.00	.00	8.34	34.74
5	4	6	1306.00	6.95	.00	.00	8.34	34.74

6	8	11.00	.00	.00	.00	.07	.00
6	10	1284.00	6.06	.00	.00	8.19	33.66
10	12	636.00	.46	.00	.00	4.06	9.16
10	14	636.00	1.65	.00	.00	4.06	9.16
12	120	625.00	1.37	.00	2.73	7.09	36.02
14	140	625.00	1.37	.00	2.73	7.09	36.02
	6 10 10 12	6 10 10 12 10 14 12 120	6 10 1284.00 10 12 636.00 10 14 636.00 12 120 625.00	6 10 1284.00 6.06 10 12 636.00 .46 10 14 636.00 1.65 12 120 625.00 1.37	6 10 1284.00 6.06 .00 10 12 636.00 .46 .00 10 14 636.00 1.65 .00 12 120 625.00 1.37 .00	6 10 1284.00 6.06 .00 .00 10 12 636.00 .46 .00 .00 10 14 636.00 1.65 .00 .00 12 120 625.00 1.37 .00 2.73	6 10 1284.00 6.06 .00 .00 8.19 10 12 636.00 .46 .00 .00 4.06 10 14 636.00 1.65 .00 .00 4.06 12 120 625.00 1.37 .00 2.73 7.09

77 74	and the second second				
JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2		.00	537.63	413.00	54.01
4	•	.00	531.73	448.00	36.28
6		11.00	524.78	460.00	28.07
8		11.00	524.78	460.00	28.07
10		12.00	518.72	462.00	24.58
12		11.00	518.26	468.00	21.78
14		11.00	517.07	464.00	23.00
120	27	625.00	514.16	468.00	20.00
140		625.00	512.97	466.00	20.35

'THE NET SYSTEM DEMAND = 1306.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE
1 1306.00

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1306.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

CASE 2 - WITH LOOP TO AMYS STREET

- 1. Maximum Day Demands Plus 1,425 gpm at Node 120
- 2. Maximum Day Demands Plus 1,475 gpm at Node 140
- 3. Maximum Day Demands Plus 975 gpm at Nodes 120 and Node 140

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE :	ЙΟ.	NOD	E NOS.	LENGTH	DIAMETER	ROUGHNE	ESS .	MINOR LOS	S K	FIXED	GRADE	3
				(FEET)	(INCHES)							
1		0	2	500.0	8.0	120.	. 0	.00		555.	00	
3		2	4	170.0	8.0	120.	0	.00				
5		4	6	200.0	8.0	120.	0	.00				
7		6	8	140.0	8.0	120.	0	.00				
9 ''		6	10	180.0		120.	0	.00				
11	1	LO	12	50.0	8.0	120.	0 .	:00				
13	1	LO	14	180.0	8.0	120.	0	.00				
15		0	14	1960.0	8.0	120.	0	.00		555.	00	
110	1	.2	120	38.0	6.0	120.	0	3.50				
130	1	4	140	38.0	6.0	120.	0	3.50		0.5	10)	
.000			3 y 8									
						10.00						
TUNCTION	NUM	IBER	DEMA	MD I	ELEVATION	CONNEC	TING	PIPES			5.4	
2	2			.00	413.00	1	3	•			70	
4	1			.00	448.00	3	5			*.		
. 6	5		11.	00	460.00	5	7	9				
8	3		11.	00	460.00	7						
10)		12.	00	462.00	9	11	13				
12	2		11.	00	468.00	11	110					
14	Ļ		11.	00	464.00	13	15	130				
120)		1425.	00	468.00	110						
140)			00	466.00	130						

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 10 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00040

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS

MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH LOOP TO AMY STREET

FIRE FLOW FROM HYDRANT AT NODE 120 ONLY

549001D

PIPE NO.	NODE	NOS.	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	882.09	8.40	.00	.00	5.63	16.79
3	2	4	882.09	2.86	.00	.00	5.63	16.79

5	4	6	882.09	3.36	.00	.00	5.63	16.79
7	6	8	11.00	.00	.00	.00	.07	.00
9	6	10	860.09	2.88	.00	.00	5.49	16.03
11	10	12	1436.00	2.07	.00	.00	9.17	41.41
13	10	14	-587.91	-1.43	.00	.00	-3.75	≠ -7.92
15	0	14	598.91	16.07	.00	.00	3.82	8.20
110	12	120	1425.00	6.30	.00	14.21	16.17	165.73
130	14	140	.00	.00	.00	.00	.00	.00

JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2		.00	546.60	413.00	57.89
. 4		.00	543.75	448.00	41.49
6		11.00	540.39	460.00	34.84
8		11.00	540.39	460.00	34.83
10		12.00	537.50	462.00	32.72
12		11.00	535.43	468.00	29.22
14	42.	11.00	538.93	464.00	32.47
120		1425.00	514.93	468.00	20.34
140		.00	538.93	466.00	31.60

THE NET SYSTEM DEMAND = 1481.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER FLOWRATE 882.09
15 598.91

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1481.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE	NO.	NODE	NOS.	LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	MINOR LOSS	K	FIXED GRADE
1		0	2	500.0	8.0	120.0	.00		555.00
3		2	4	170.0	8.0	120.0	.00		
5		4	6	200.0	8.0	120.0	.00		
7		6	8	140.0	8.0	120.0	.00		
9		6	10	180.0	8.0	120.0	.00		
11 ·	1	.0	12	50.0	8.0	120.0	.00		
13	1	.0 :	L4	180.0	8.0	120.0	⁷² .00		
15		0	L 4	1960.0	8.0	120.0	.00		555.00
110	1	2 12	20	38.0	6.0	120.0	3.50		
130	1	4 14	<u> 1</u> 0	38.0	6.0	120.0	3.50		

JUNCTION NUMBER	DEMAND		ELEVATION	CONNEC	TING	PIPES
2	.00	.55	413.00	1	3	
4	.00		448.00	3	5	
. 6	11.00		460.00	5	7	9
8	11.00		460.00	7		
10	12.00		`462.00	9	11	13
12	11.00		468.00	11	110	
14	11.00		464.00	13	15	130
120	.00		468.00	110		
140	1475.00		466.00	130	-	

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 10 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00002

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS

MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH LOOP TO AMY STREET

FIRE FLOW FROM HYDRANT AT NODE 140 ONLY

549001E

PIPE NO.	NODE	NOS.	FLOWRATE.	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	865.52	8.11	.00	.00	5.52	16.21
3	2	4	865.52	2,76	.00	.00	5.52	16.21

5	4	6	865.52	3.24	.00	.00	5.52	16.21
7	` 6	8	11.00	.00	.00	.00	.07	.00
9	6	10	843.52	2.78	.00	.00	5.38	15.46
11	10	12	11.00	.00	.00	.00	.07	.00
13	10	14	820.52	2.64	.00	00	5.24	14.69
15	0	14	665.48	19.53	.00	.00	4.25	9.97
110	12	120	.00	.00	.00	.00	.00	.00
130	14	140	1475.00	6.71	.00	15.22	16.74	176.66

JUNCTION NUMBE	ER DEMAND	GRADE LINE	ELEVATION	PRESSURE
2	.00	546.89	413.00	58.02
4	.00	544.14	448.00	41.66
6	11.00	540.89	460.00	35.05
8	11.00	540.89	460.00	35.05
10	12.00	538.11	462.00	32.98
12	11.00	538.11	468.00	30.38
14	11.00	535.47	464.00	30.97
120	.00	538,11	468.00	30.38
140	1475.00	513.53	466.00	20.60

THE NET SYSTEM DEMAND = 1531.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 1531.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE	NO.	NODE	NOS.	LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	MINOR L	oss	K	FIXED GRADE
1		0	2	500.0	8.0	120.0		00		555.00
3		2	4	170.0	8.0	120.0	_ 1	00		
5		4	6	200.0	8.0	120.0	_ (00		
7		6	.8.	140.0	8.0	120.0	_ (00		
9		6	L O	180.0	8.0	120.0	. (00		
11	1	.0	12	50.0	8.0	120.0	. (0.0		
13	1	0	L 4	180.0	8.0	120.0	. (0.0		
15		0 1	L 4	1960.0	8.0	120.0	₁₁ . (00		555.00
110	1	2 12	20	38.0	6.0	120.0	3.5	50		
130	1	4 14	Ŀ O	38.0	6.0	120.0	3.5	50		

JUNCTION NUMBER	DEMAND	ELEVATION	CONNEC	TING	PIPES
2	.00	413.00	1	3	K2
4	.00	448.00	3	5	
- 6	11.00	460.00	5	7	9
8	11.00	460.00	7		
10	12.00	462.00	9	11	13
12	11.00	468.00	11	110	
14	11.00	464.00	13	15	130
120	975.00	468.00	110		
140	975.00	466.00	130		

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

THIS SYSTEM HAS 10 PIPES WITH 9 JUNCTIONS , 0 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00024

DICTIONARY HILL APARTMENTS WATER SYSTEM ANALYSIS
MAXIMUM DAY DEMANDS PLUS FIRE FLOW WITH LOOP TO AMY STREET
FIRE FLOW FROM NODES 120 AND 140

549001F

PIPE NO.	NODE	NOS.	FLOWRATE	HEAD :	LOSS-	PUMP	HEAD	MINOR LOS	S VELOCITY	-HL/1000
1	0	2	1170.97	14.	19	,	.00	.00	7.47	28.38
3	2	4	1170.97	4.	82		.00	.00	7.47	28.38

5	4	6	1170.97	5.68	.00	.00	7.47	28.38
7	6	8	11.00	.00	.00	.00	.07	.00
9	б	10	1148.97	4.93	.00	.00	7.33	27.40
11	10	12	986.00	1.03	.00	.00	6.29	20.64
13	10	14	150.97	.11	.00	* .00	,96	.64
15	0	14	835.03	29.74	.00	.00	5.33	15.17
110	12	120	975.00	3.12	.00_	6.65	11.06	82.07
130	1.4	140	975.00	3.12	.00	6.65	11.06	82.07

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2	.00	540.81	413.Ò0	55.38
4	.00	535.98	448.00	38.13
6	11.00	530.31	460.00	30.47
8	11.00	530.31	460.00	30.47
10	12.00	525.38	462.00	27.46
12	11.00	524.34	468.00	24.42
14	11.00	525.26	464.00	26.55
120	975.00	514.58	468.00	20.18
140	975.00	515.49	466.00	21.45

THE NET SYSTEM DEMAND = 2006.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2006.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00