FINAL ENVIRONMENTAL IMPACT REPORT

Volume II

SCH #2004071095

West Haven Specific Plan

(PSP03-006)

APPENDIX G

City of Ontario Water Master Plan

URS Corporation

August 2000

Water Master Plan

Submitted to:

City of Ontario

BOYLE ENGINEERING CORPORATION

City of Ontario Water Master Plan

City of Ontario

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Glossary of Abbreviations

ABW	Automatic backwashing filters
ACWA	Association of California Water Agencies
AF	acre feet
AWWA	American Water Works Association
BAT	best available treatment
BMP	best management practices
BWW	Backwash water
CCWD	Cucamonga County Water District
cfs	cubic feet per second
CRP	Colorado River Project
DBCP	Dibromo-chloropropane
DBPR	Disinfection Byproducts Rule
DHS	Department of Health Services, State of California
FAR	floor area ratio
GIS	geographic information system
GP	General Plan
gpm	gallons per minutes
IEUA	Inland Empire Utilities Agency
IX	ion exchange
JCSD	Jurupa Community Services District
LMTP	Lloyd Michael Treatment Plant
MCL	maximum contaminant level
MF	Microfiltration

mgd	million gallons per day
MM	maintenance management
MMM	multimedia mitigation
MOA	Memorandum of Agreement
MWD	Metropolitan Water District of Southern California
MZ	Management Zone
NAS	National Academy of Science
NEMA	National Electrical Manufacturer's Association
NMC	New Model Colony
NO_3	nitrate
O&M	Operation and Maintenance
OBMP	Optimum Basin Management Plan
OCSD	Orange County Sanitation District
PF	peaking factor
PHG	Public Health Goal
PRV	pressure reducing valve
RO	reverse osmosis
RTP	regional treatment plant
RWQCB	Regional Water Quality Control Board
SARI	Santa Ana River Interceptor
SAWC	San Antonio Water Company
SAWPA	Santa Ana River Watershed Project Authority
SCAG	Southern California Association of Governments
SDWA	Safe Drinking Water Act
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TCE	tri-chloroethylene
TDS	total dissolved solids

TPM	total productive maintenance
TQM	total quality management
UBC	Uniform Building Code
UF	Ultrafiltration
VOC	volatile organic compound
WFA	Water Facilities Authority
WTP	water treatment plant

Executive Summary

Following is a brief summary of the findings from this Water Master Plan investigation. Explanation of approach/methodology, as well as detailed evaluation and results, are reserved for the main body of the report. This synopsis presents only the most significant conclusions and recommendations.

Characteristics of City

- Current population is approximately 148,000.
- 8,100 acre New Model Colony (NMC) will add about 6,000 acres of development to City's service area.
- Buildout of City (pre-NMC) is projected by 2015; NMC by 2025.

Water Requirements

- City current water use is approximately 40,000 acre feet/year (AF/yr) during average year; 43,000 AF/yr during dry year.
- Current maximum day rate of water use is about 90 cubic feet per second (cfs).
- Maximum month rate of use ranges from about 133 percent to 150 percent of average month.
- Maximum day rate of use ranges to as great as 167 percent of average day.
- "Unaccounted for" water (the difference between water produced and metered water use) is between 7 and 8 percent, or about 3,000 AF/yr.
- Residential water use accounts for nearly 60 percent of the total demands in City; commercial and industrial about 23 percent.
- Ultimate water demands at buildout are estimated to be about 82,000 AF/yr, an increase approximately of 39,000 AF/yr.
- NMC demands account for about 31,000 AF/yr (79 percent) of the projected growth in demands; the remainder is from infill and densification in the pre-NMC City.
- Timing of new water demands is largely dependent on the pace of development in the NMC–difficult to predict.

- Incremental additional demands are estimated at about 16.000 AF/yr by 2015, 39,000 AF/yr by 2025.

Water Sources

- The primary source of water is underlying Chino Basin; City has current groundwater rights totaling 18,717 AF/yr.
- Future groundwater rights, with NMC and agricultural conversions, are estimated to be about 31,200 AF/yr by 2020.
- Additional sources are owned capacity in the Water Facilities Authority (WFA) Treatment Plant in Upland (State Project Water), and a currently deactivated plant to treat Colorado River water.
- Future potential sources include:

  –Bunker Hill Water Through Baseline Feeder

  –Optimum Basin Management Plan (OBMP) wells and desalters in south Chino Basin

  –Recycled water through Inland Empire Utilities Agency (IEUA) outfalls

  –Untreated groundwater from existing agriculture wells delivered through future nonpotable pipelines in NMC
- Water Quality issues include:

  –TDS and Nitrates

  –Industrial contamination plumes

  –Newly regulated organic compounds

  –Arsenic/Radon/NPDES pending regulations

Existing Water System

- Production system includes 21 active wells with total of 41,500 gpm (92 cfs) capacity;
- Importation capacity consists of up to 26.1 cfs in expanded-capacity WFA plant (minor improvements and uprating required).
- System includes eleven storage reservoirs with a total of 55.2 million gallons (mg) of useable capacity.

- The distribution system serves four pressure zones and features about 352 miles of pipeline (4-inch to 36-inch diameter). 3 booster pump stations, and 15 pressure reducing stations.

Water Sources Management Plan

- Eleven possible sources of additional water to meet projected growth in demands are explored and comparatively evaluated.
- Alternative sources are rated according to the following factors:

  –potential volume/rate of delivery

  –cost (per unit)

  –water quality

  –City's ability to control

  –reliability

  –OBMP compatibility

  –timing
- Preferred new sources to meet growth in demands are as follows:

  –New City wells

  –Expanded WFA capacity

  –OBMP desalter water

  –IEUA recycled water

  –Bunker Hill water through Baseline Feeder

  –Galvin Plant reactivation (optional)
- Staged source development, comprised of combinations of sources, is detailed (Section 6) to keep pace with growth in demands.

System Analysis

- Hydraulic network simulation model is built on H^2O Net platform.
- Simulation runs are made for peak hour and maximum-day plus-fire demands for existing and ultimate conditions, with and without NMC, to test currently existing and improved systems.

- Storage and zone transfer analysis is conducted to determine appropriate amount/location of storage and booster pumping capacity to meet existing and ultimate needs.
- Storage criteria is evaluated to determine appropriate amount of regulation, fire, and emergency storage in each zone. Requirements are considerably less than proposed in previous Water Master Plan.
- Additional volume of storage to meet ultimate requirements in City (with NMC) is 40.2 mg.
- Condition analysis of existing system is performed to identify replacement/rehabilitation needs for wells, reservoirs, booster pumps, and pressure reducing stations.
- Seismic vulnerability analysis is conducted for existing reservoirs.
- Additional evaluations are conducted to identify the following:

  –Water quality regulatory requirements

  –Disinfection alternatives

  –Maintenance Management (MM) system options

Recommendations (Exclusive of Capital Facilities)

- Water Quality Regulatory Compliance

  –Initiate monitoring for DBP rule in 2001, and new constituents (Percholate, MTBE, NDMA),

  –Perform Arsenic monitoring and cost-of-compliance study for Arsenic Rule

  –Monitor efficiency of VOC treatment and nitrate blending

  –Monitor NPDES Permit program evolution and implications

  –Select, and if appropriate, implement alternative disinfectant program
- Maintenance Management

  –Incorporate suggested elements of comprehensive MM program as described in Section 6.9

–Invite representatives of primary MM software providers to conduct seminar; if appropriate, select and implement computerized system tied to City's GIS

–Conduct water audit to identify causes and reduce unaccounted-for water; could result in $500,000 - $750,000/year savings.

Capital Improvement Recommendations–Pre-NMC Service Area (timing and details as shown in Table 7-6)

- Construct 3 new wells and 7 replacement wells at locations and phased as shown. Total ultimate combined well capacity = 46,200 gpm. ($13,800,000 in 1999 $).
- Construct 2 blending facilities as shown in Table 7-6 ($360,000 in 1999 $).
- Acquire San Antonio Water Co. (SAWC) shares ($500,000 in 1999 $).
- Construct transmission main (24,000 feet of 24-inch) from 8th Street Zone Reservoir ($5,280,000 in 1999 $).
- Construct programmed pipeline replacements per annual defined program ($19,155,000 in 1999$).
- Construct new 8th Street Zone 8 mg reservoir, initial phase of Milliken 9 mg reservoir (underway) and additional reservoir improvements ($11,650,000 in 1999$).
- Implement "Miscellaneous Improvements," including engine generator sets and water services replacement ($5,800,000 in 1999$).

Capital Improvements for Development of NMC (timing and details as shown in Table 7-6)

- Construct 9 new Francis Street Zone wells; to total 22,500 gpm capacity ($12,600,000 in 1999$).
- Construct well collection systems to connect new wells to new Francis Zone reservoirs ($3,891,000 in 1999 $).
- Acquire property and construct two new reservoirs each at Cucamonga and Jurupa sites; 24 mg total capacity ($18,700,000 in 1999 $).

- Construct 2nd phase of Milliken Reservoir to serve NMC ($5,500,000 in 1999 $).
- Construct Transmission mains and backbone potable distribution system to serve NMC ($52,976,000 in 1999 $).
- Construct pressure reducing station and install three engine generator units ($1,000,000 in 1999 $).
- Install recycled water system including connections to IEUA outfalls, 3 pump stations, and nonpotable distribution pipeline network ($18,565,000 in 1999 $).

Total Cost of Capital Recommended Improvements

- Pre-NMC service area 1999 cost = $53,282,000.
- Pre-NMC service area inflated costs for 25 year program of 4 percent inflation rate = $66,132,000.
- NMC 1999 cost = $109,341,000.
- NMC inflated cost for 25 year program at 4 percent inflation rate = $164,147,000.
- Total 1999 cost of entire capital program = $165,886,000; total inflated costs of entire capital program = $236,450,000.

Section 1 Introduction

1.1 Authorization/Objective

The preparation of this City of Ontario (City) Water Master Plan is authorized by a contract between the City and Boyle Engineering Corporation (Boyle) dated July 28, 1998. The overall objective of the subject plan is summarized as follows:

> *To prepare a comprehensive Water Master Plan to guide the City in the management, operation, maintenance, upgrading and expansion of its water supply sources and distribution system to provide a cost effective, reliable supply for existing and future constituency.*

The Water Master Plan is to address the adequacy of the existing and planned future water sources and infrastructure to meet existing and projected future water demands to buildout. Specifically included is the approximately 8,100 acre "New Model Colony" (NMC) recently annexed to the City. Ultimate development (buildout) is projected to occur in year 2015 for the City proper, and in year 2025 for the NMC.

1.2 Scope

The scope of work includes the following primary tasks:

1) Evaluation of water requirements
    - Existing demands/patterns/trends.
    - Existing and future land use.
    - Projection of future demands.
    - Average/seasonal/peak/fireflow demands.
    - Geographic distribution of demands.
    - User water quality requirements.
    - Regulatory requirements.

2) Evaluation of sources of supply
    - Existing imported and groundwater sources.
    - Potential future sources.
    - Recycled water.

- Quantity, reliability and quality considerations.
- Production and storage.
- Institutional and regulatory considerations.

3) Water System Evaluation
   - Condition analysis of key facilities.
   - Seismic vulnerability.
   - Operation and energy efficiency analysis.
   - Repair and replacement needs.
   - Completion of GIS coverages.
   - Computer simulation model of distribution system.
   - Deficiency analysis of facilities.
   - Expansion of water infrastructure system to serve NMC.

4) Recommended Improvements
   - Sources of supply to meet demands – optimum mix for cost effectiveness.
   - Production components, modifications, additions.
   - Distribution system and storage (repair, replacement, upgrades, and expansion).
   - Estimated capital costs of improvement projects.
   - Prioritization and time-phased Capital Improvement/Capital Replacement Program (CIP/CRP).

5) Financial Analysis (separate document)
   - Revenue Study
   - Facilities financing.
   - Fiscal implications of recommended time phased CIP/CRP.
   - Adjustment of CIP/CRP.
   - Recommended rates and fees strategy.

6) Initial environmental Study (separate document)

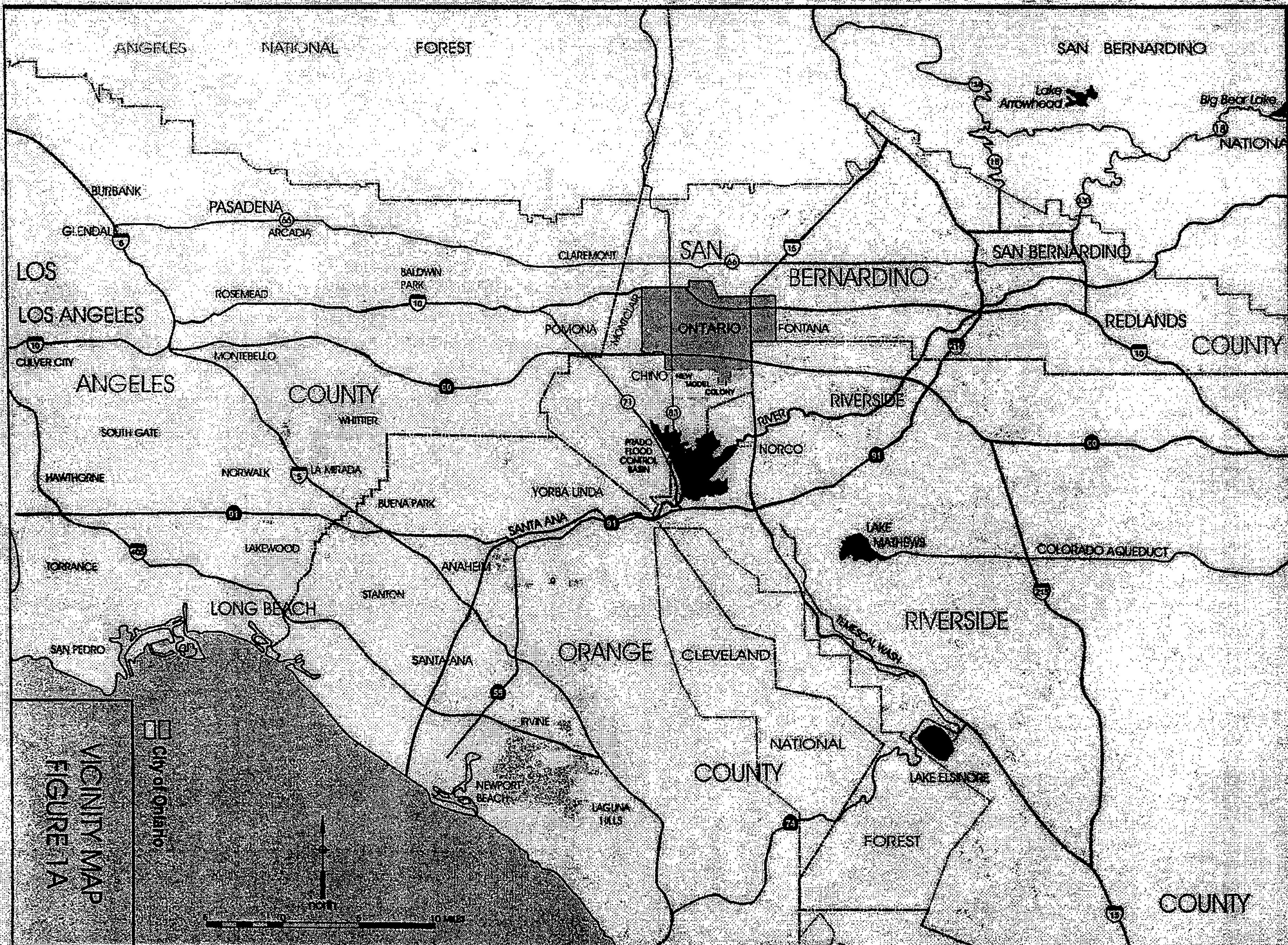
1.3 Setting

1.3.1 Characteristics of City and NMC

The City of Ontario is a rapidly growing community in the western portion of San Bernardino County (see Figure 1A). It sits astride three major freeways and is the home of the Ontario International Airport. With a current population of about 146,700, and extensive commercial and light industrial development, Ontario is one of the most influential cities in the Inland Empire. It is characterized by several major development hubs and has one of the most dynamic revitalization programs in California.

The City is bounded by the cities of Montclair to the west and Upland and Rancho Cucamonga to the north. To the southwest is the city of Chino. To the northeast is the city of Fontana, and to the southeast is the community of Jurupa. The south portion of the City is comprised of the 8,100 acre "New Model Colony" (NMC), which is currently an area of extensive agricultural activity—predominately dairy farming. Formerly of an agricultural preserve under the Williamson Act, the NMC area has been the subject of extensive study; an Environmental Impact Report (EIR) describing its projected transition to urban development was adopted in 1998. The NMC was formally annexed by the City on November 30, 1999 and is thus a major consideration in this Water Master Plan.

The City and NMC are situated on relatively flat terrain, which slopes gently upward to the north. Elevation ranges from about 550 feet above mean sea level at the southern boundary to about 1,200 feet at the northeastern corner of the existing City. The elevation of the NMC ranges from about 550 to 770 feet. Climate is typical of the inland areas of Southern California, often described as "Mediterranean" with warm to hot dry summers and generally mild, moist winters. Annual rainfall averages approximately 13.5 inches, with extreme variation seasonally and from year to year. For instance, precipitation during fiscal year 1997-1998 totaled approximately 31 inches, but only about 8 inches during the following year.



ANGELES NATIONAL FOREST
SAN BERNARDINO
Lake Arrowhead
Big Bear Lake
NATIONA
BURBANK
PASADENA
GLENDALE
ARCADIA
CLAREMONT
SAN
BERNARDINO
SAN BERNARDINO
LOS
LOS ANGELES
BALDWIN PARK
ROSEMEAD
POMONA
MONTCLAIR
ONTARIO
FONTANA
REDLANDS
COUNTY
CULVER CITY
MONTEBELLO
ANGELES
COUNTY
CHINO
NEW MODEL COLONY
RIVERSIDE
WHITTIER
RIVER
SOUTH GATE
PRADO FLOOD CONTROL BASIN
NORCO
HAWTHORNE
NORWALK
LA MIRADA
YORBA LINDA
BUENA PARK
SANTA ANA
LAKEWOOD
LAKE MATHEWS
COLORADO AQUEDUCT
TORRANCE
ANAHEIM
STANTON
LONG BEACH
TEMESCAL WASH
RIVERSIDE
SAN PEDRO
SANTA ANA
ORANGE
CLEVELAND
IRVINE
NATIONAL
COUNTY
LAKE ELSINORE
NEWPORT BEACH
LAGUNA HILLS
FOREST
COUNTY
City of Ontario
NORTH
10 MILES
VICINITY MAP
FIGURE 1A

1.3.2 Land Use/Trends

The City has grown rapidly, from a population of approximately 85,000 in 1980 to the current estimated population of 146,700. According to the City Planning Department, residential development has slowed dramatically from peak growth rates previously experienced. However, light industrial development is continuing at a rapid pace, with about 8 million square feet per year expected to be added in the near term. This pace would of course, diminish considerably during a recession such as occurred in the early 1990's. On the other hand, the "normal year" rate of development in the City's service area will accelerate greatly, now that the NMC annexation is complete and development approvals/financing are being secured.

Except for the NMC there is a minimal land available in the City for residential development. However, during the past few years several subdivision maps for single family homes have been approved in the southern part of the City. Commercial development has been dominated by the Ontario Mills shopping center and in the surrounding area adjacent to the Mills. Extensive industrial development has included predominately large-box warehouse and distribution structures in the eastern portion of the City near the airport and freeway interchanges.

1.3.3 Water Sources and Facilities

The City currently uses an average (during "normal" rainfall conditions of about 41,000-acre feet per year (AF/yr.) of water derived from a combination of imported State Project water and local groundwater. The State Project water is purchased from the Metropolitan Water District of Southern California (MWD), and conveyed from the jointly-owned Water Facilities Authority (WFA) water treatment plant located in the nearby city of Upland. Groundwater is produced primarily from City-owned wells. The water from these sources is conveyed to storage facilities and to customer connections through an extensive network of pipes, pump stations, and pressure reducing valves (PRVs) serving four separate pressure zones. The City's network of water distribution facilities presently includes approximately 356 miles of pipe in the hydraulic model ranging from 6 to 36 inches in diameter, 23 wells, 10 storage reservoirs totaling 51 million gallons (mg) of capacity, 12 booster stations, and 40 PRVs located at 15 pressure reducing stations.

In addition, the City owns a presently-deactivated 7 mgd water filtration plant (Galvin Plant) which, when operational, enabled the City to treat and deliver Colorado River water into its 4th Street zone.

A detailed description and analysis of the City's water sources and system are presented in Sections 3 and 4.

Section 2 Water Requirements

2.1 General Methodology

In a community such as Ontario, where substantial growth is expected, a reliable forecast of water requirements is essential to meaningful master planning of facilities. Analysis of past water use patterns and trends is useful where reliable water production and or consumption records are available. The City of Ontario Public Works Agency Utilities Department has provided a ten-year record of production data, which provides valuable insight into annual, seasonal, and daily water consumption. Also, the City Revenue Department has made available monthly-metered consumption records by pressure zone and customer category. This information is the basis for evaluation and development of demand coefficients and peaking factors. These coefficients, once subjected to a "reasonability" check against coefficients/factors used in other comparable master planning as well as predictable trends, are applied to projected future land use acreages to estimate ultimate water requirements on a geographic basis within the service area. Known large water users are considered separately where appropriate.

2.2 Historic Production and Consumption Patterns

2.2.1 Ten-Year Production Records

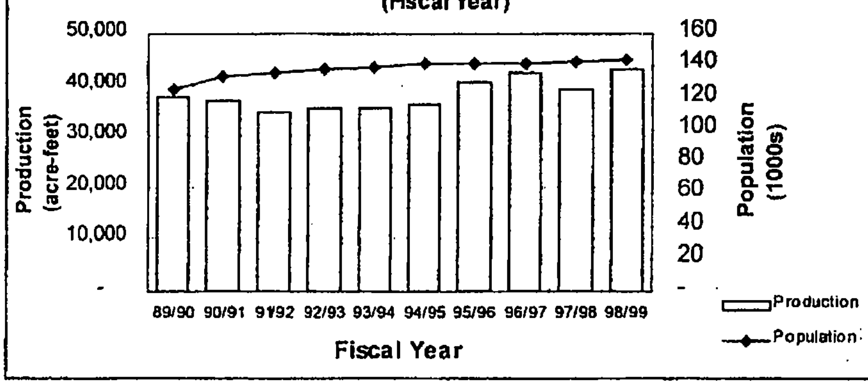
Table 2-1 summarizes the historic water production by month for the ten water years from 1989/90 through 1998/99. The graph reflects a temporary decline in the total annual production to a minimum volume of 34,749 acre-feet (AF) in 1991/92. This decline coincides with the drought of the late 1980's and early 1990's during which water conservation measures were in effect. In subsequent years, the total production has increased, and a historic high total of 43,033 AF was produced in 1998/99, an abnormally dry year. This trend is due primarily to growth, but may also reflect some "rebound" from the level of water conservation effectiveness achieved during the drought. The information in Table 2-1 also includes recorded peak demands for monthly and daily periods, with the calculated peaking factors for maximum month and maximum day production. Figure 2-A graphically depicts the ten-year production pattern, along with the City population, to show the relative impact of growth compared to climatological water conservation influences.

Table 2-1
City of Ontario Historic Water Production

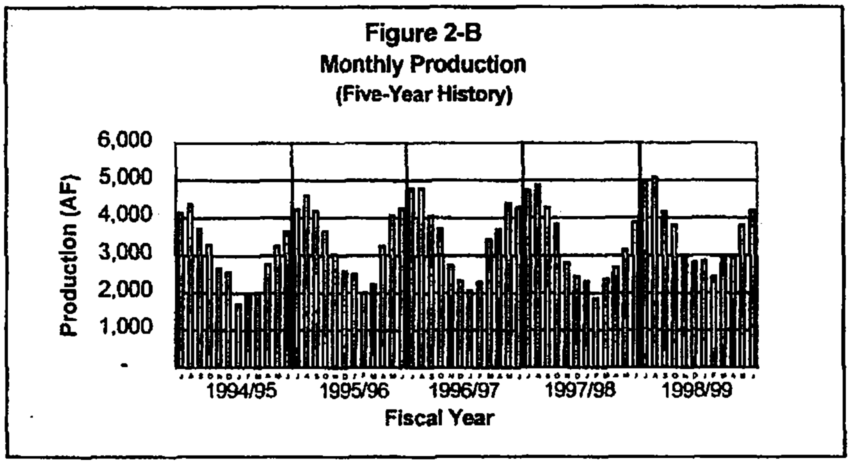
Month	Volume: AF (Data From Water Production Reports) 1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Average	% of Avg.
JUL	4,192.2	4,482.6	4,142.4	3,996.3	3,695.1	4,139.0	4,225.8	4,784.3	4,724.9	4,946.5	4,332.9	11.4
AUG	4,816.0	4,199.2	3,721.2	4,208.0	3,832.2	4,356.8	4,592.7	4,782.0	4,872.2	5,071.5	4,445.2	11.6
SEP	3,581.7	3,674.1	3,340.4	3,754.2	3,553.0	3,703.4	4,184.5	4,057.9	4,275.4	4,168.5	3,829.3	10.0
OCT	3,091.7	3,419.0	3,217.0	3,195.5	3,192.6	3,288.3	3,648.4	3,718.7	3,843.6	3,806.6	3,442.1	9.0
NOV	2,878.6	2,813.7	2,281.8	2,605.1	2,728.4	2,658.6	3,038.3	2,748.9	2,822.4	3,003.2	2,757.9	7.2
DEC	2,780.0	2,649.1	2,338.4	2,121.9	2,347.7	2,566.6	2,577.6	2,336.9	2,445.0	2,826.7	2,499.0	6.5
JAN	2,342.5	2,188.9	2,089.6	1,798.4	2,453.6	1,720.3	2,502.5	2,060.6	2,318.1	2,861.3	2,233.6	5.9
FEB	1,996.3	2,207.4	1,943.3	1,727.9	1,869.9	1,964.9	2,009.2	2,293.1	1,846.8	2,418.1	2,027.7	5.3
MAR	2,384.8	1,666.5	1,902.4	2,272.2	2,306.0	2,023.1	2,239.1	3,417.8	2,369.3	2,979.6	2,356.1	6.2
APR	2,645.9	2,421.8	2,570.0	2,903.1	2,570.7	2,759.1	3,256.2	3,691.1	2,686.6	2,942.7	2,844.7	7.5
MAY	3,393.8	3,228.0	3,451.6	3,578.9	2,904.1	3,262.2	4,072.1	4,386.7	3,142.4	3,810.1	3,523.0	9.2
JUN	3,736.3	3,984.3	3,750.5	3,166.7	3,909.3	3,626.1	4,256.8	4,282.4	3,882.6	4,198.6	3,879.4	10.2
Total	37,839.8	36,934.6	34,748.6	35,328.2	35,362.6	36,068.4	40,603.2	42,560.4	39,229.3	43,033.4	38,170.9	100
Avg. MGD	33.8	33.0	31.0	31.5	31.6	32.2	36.2	38.0	35.0	38.4	34.1	
Avg. GPM	23,450	22,890	21,530	21,890	21,910	22,350	25,160	26,370	24,310	26,670	23,650	
Max Month:												
Month	AUG	JUL	JUL	AUG	JUN	AUG	AUG	JUL	AUG	AUG		
AF	4,816.0	4,482.6	4,142.4	4,208.0	3,909.3	4,356.8	4,592.7	4,784.3	4,872.2	5,071.5		
MM/Avg.	1.53	1.46	1.43	1.43	1.33	1.45	1.36	1.35	1.49	1.42		
Max Day:												
Date			AUG 23	AUG 21	SEP 29	AUG 18	JUL 31	JUL 31	AUG 7	JUL 18		
MGD	n/a	n/a	42.4	49.0	43.0	48.2	50.2	54.8	58.6	58.2		
MD/Avg.			1.37*	1.55	1.36	1.50	1.39	1.44	1.67	1.49		

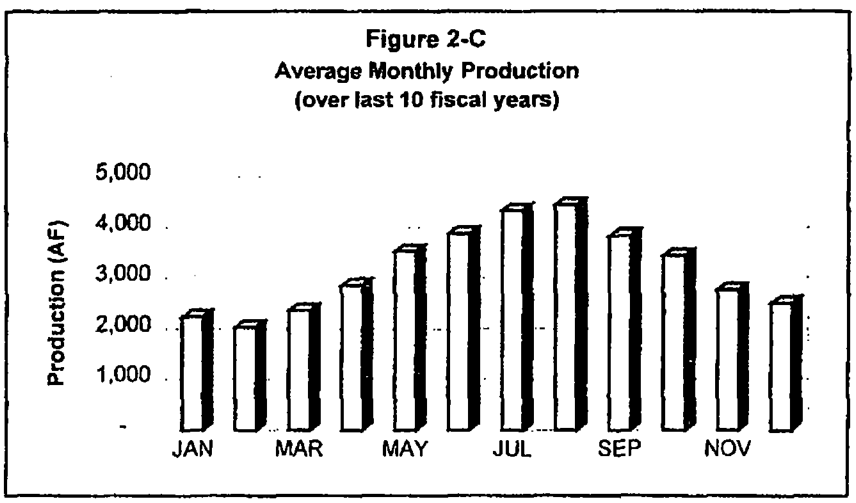
* *Erroneous value–cannot be less than maximum month.*

Figure 2-A
Ten-Year History of Water Production with Population
(Fiscal Year)



The seasonal production pattern is depicted by the following graph of five years of monthly production, and the subsequent graph showing the average monthly production of the past 10 years. Note that NMC water consumption's (mostly agricultural) is not included, since the area was not served by the City's system.





2.2.2 Consumption by Pressure Zone

The City of Ontario existing water system includes four pressure zones, known as the 13th Street, 8th Street, 4th Street, and Phillips Street Zones (see Figure 2-D). Based on research of the City's database for metered consumption during 1998/99, the following breakdown of consumption by pressure zone is estimated:

Table 2-2
Consumption by Pressure Zone

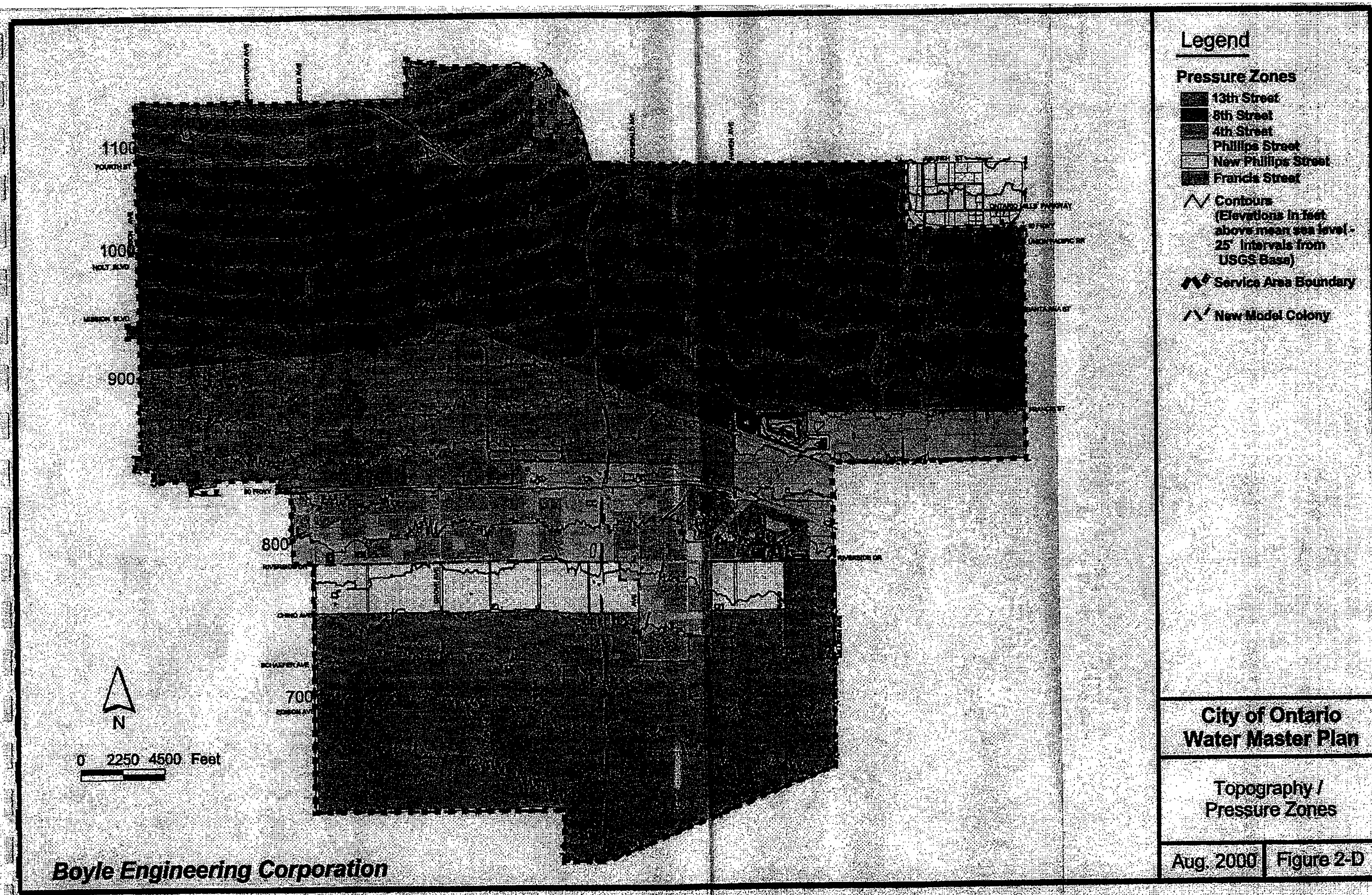
Pressure Zone	No. of Accounts	Consumption (AF)
13th Street	5,778	4,622
8th Street	12,714	18,121
4th Street	6,405	7,174
Phillips Street	8,503	8,028
Unassigned	1,128	1,748
Cucamonga CWD	579	31
Totals	**35,107**	**39,724**

The Cucamonga County Water District is an adjacent water agency to which small deliveries are sometimes made. If the unassigned consumption is prorated over the four zones, the following breakdown of consumption within the City is determined, along with the percentage used in each zone.

Table 2-3
Consumption by Pressure Zone with Proration of Unassigned

Pressure Zone	No. of Accounts	Consumption (AF)	% of Total
13th Street	5,973	4,835	12.2
8th Street	13,144	18,956	47.8
4th Street	6,621	7,504	18.9
Phillips Street	8,790	8,398	21.1
Totals	**34,528**	**39,693**	**100.00**

From the above, it is seen that the 8th Street Zone is the dominant zone in terms of consumption, requiring nearly half the total. Also, the average consumption per account is greater in the 8^{th} Street Zone due to the number of commercial/industrial accounts.



Legend
Pressure Zones
13th Street
8th Street
4th Street
Phillips Street
New Phillips Street
Francis Street
Contours (Elevations in feet above mean sea level - 25' intervals from USGS Base)
Service Area Boundary
New Model Colony
1100
1000
900
800
700
N
0 2250 4500 Feet
Boyle Engineering Corporation
City of Ontario
Water Master Plan
Topography / Pressure Zones
Aug. 2000
Figure 2-D

2.2.3 Unaccounted-for Water

Unaccounted-for water is the difference between the amount of water produced and the amount billed to customers. This water is "lost" through unmetered uses such as fire suppression and main flushing, as well as main breaks and system leakage. It can also be the result of inaccurate meters. As noted above, during the 1998/99 year, 43,033 AF of water was produced, and 39,724 AF was sold. This results in a difference of 3,309 AF, which is 7.7 percent of the total. Most water agencies operate with an unaccounted-for water value of 5 to 10 percent, so Ontario is considered within industry standards. However, measures should be taken (see Section 7) to reduce this number.

2.2.4 Large Water Users

The City has provided a list of the largest water users. Table 2-4 summarizes the top 25 users from that list. Depending on their relative significance, these values are superimposed onto the computed water system demands based on acreage/coefficients methodology, for the hydraulic network analysis.

Table 2-4
Top 25 Water Users

Name	Type	Consumption (units) *	Service Days	Annual Use Units	Annual Use gpm
Inland Container	Industrial	675,797	366	673,951	960
Country Meadows	Multi Family	150,304	397	138,189	197
Guasti Park	Irrigation	101,211	365	101,211	144
Lexco	Multi Family	73,637	367	73,236	104
City of Ontario	Inter Dept	63,511	365	63,511	90
D R T, Inc.	Irrigation	7,287	45	59,106	84
Yokley School	Pub Auth	58,291	365	58,291	83
Chino Basin Water	Pub Auth	49,980	365	49,980	71
Park Centre	Multi Family	45,329	365	45,329	65
Samoa Village #2	Multi Family	49,699	424	42,783	61
Coca Cola USA	Commercial	40,963	366	40,851	58
Coca Cola USA	Commercial	40,860	366	40,748	58
City of Ontario	Inter Dept	40,285	365	40,285	57
Sunkist Growers	Industrial	38,936	365	38,936	55
Rancho Ontario Corp.	Irrigation	38,606	365	38,606	55
BMCA Insulation Prod.	Industrial	38,290	364	38,395	55
Thomastown Builders	Multi Family	1,890	20	34,493	49
Westar Linen Services	Commercial	33,401	366	33,310	47
Presley - Mtn. Vista	Multi Family	16,291	182	32,672	47
City of Ontario	Inter Dept	29,111	332	32,005	46
Chaffey High School	Pub Auth	31,831	365	31,831	45
Transpark Business Ctr.	Commercial	29,648	364	29,729	42
Mtn. Shadows Owners	Multi Family	29,088	368	28,851	41
dba Guasti Plaza	Commercial	26,569	364	26,642	38
Raintree Apts.	Multi Family	26,751	369	26,461	38

**A unit is 100 cubic feet.*   Total = 2,590 gpm, or 4,180 AF/year

It is seen from the table that there is a huge drop-off from the largest to the second largest user (a nearly five-fold difference). Even the largest user, if "peaked" at a 2.0 factor, requires less than 2,000 gallons per minute (gpm), which is less than a typical non-residential fireflow requirement. Only the top four users average greater than 100 gpm. So, while the composite use by the top water users comprises a significant proportion of the City's water consumption (about 10 percent), the "point demands" on the delivery system are not a decisive hydraulic consideration.

2.2.5 Water Consumption by Land Use Category

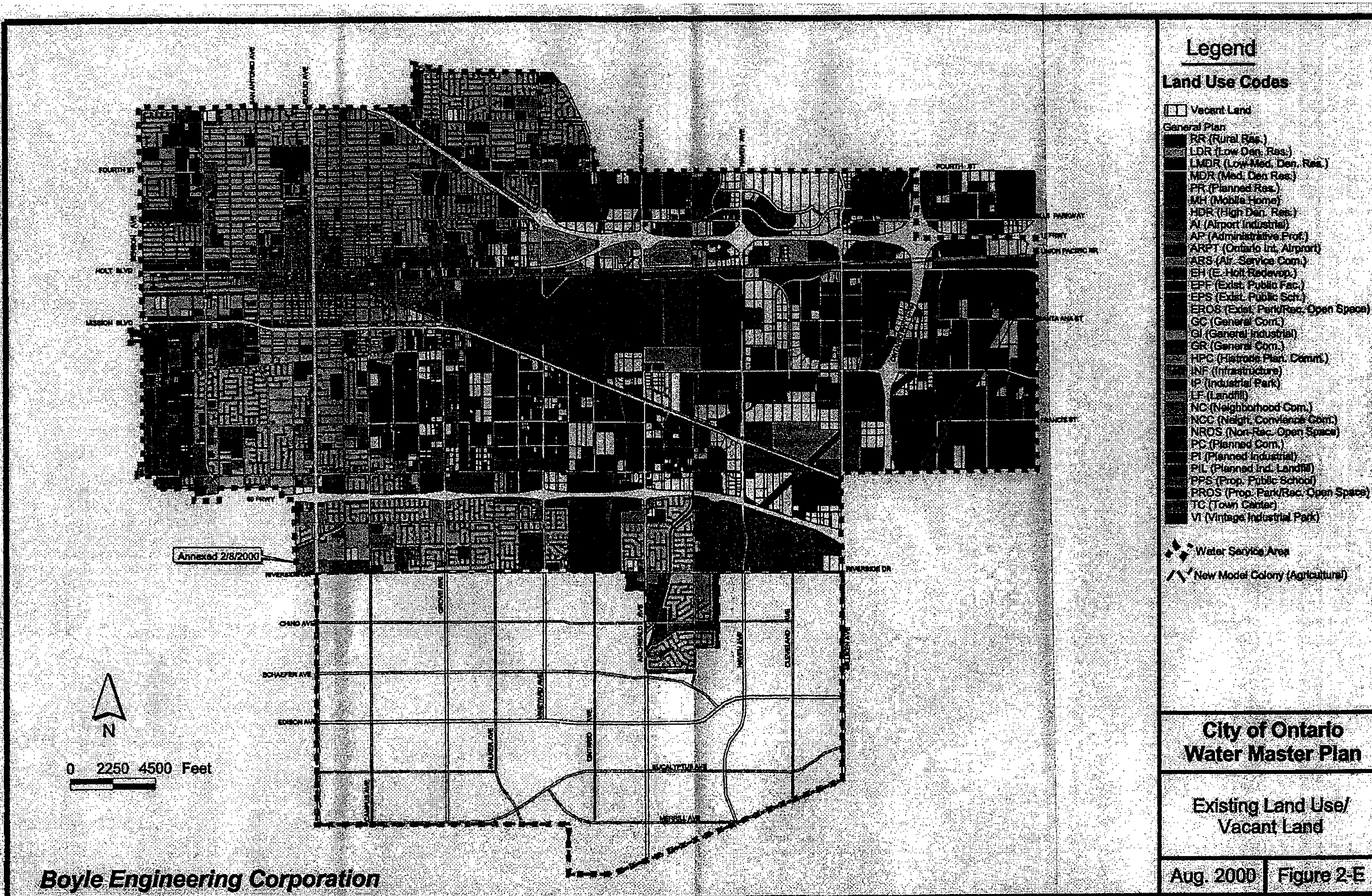
The recently-annexed NMC, as it undergoes development, will be served by the City's expanded water system. The NMC and another small annexation area west of Euclid and north of Riverside Drive, is now part of the City's water service area. The City's water sources and delivery facilities must be able to meet the demands of the NMC as well as additional growth within the pre–NMC service area. Further, to be able to ascribe system costs to the beneficiary, it is necessary to keep a separate accounting of demands and facilities required to serve the NMC and the pre–NMC service areas.

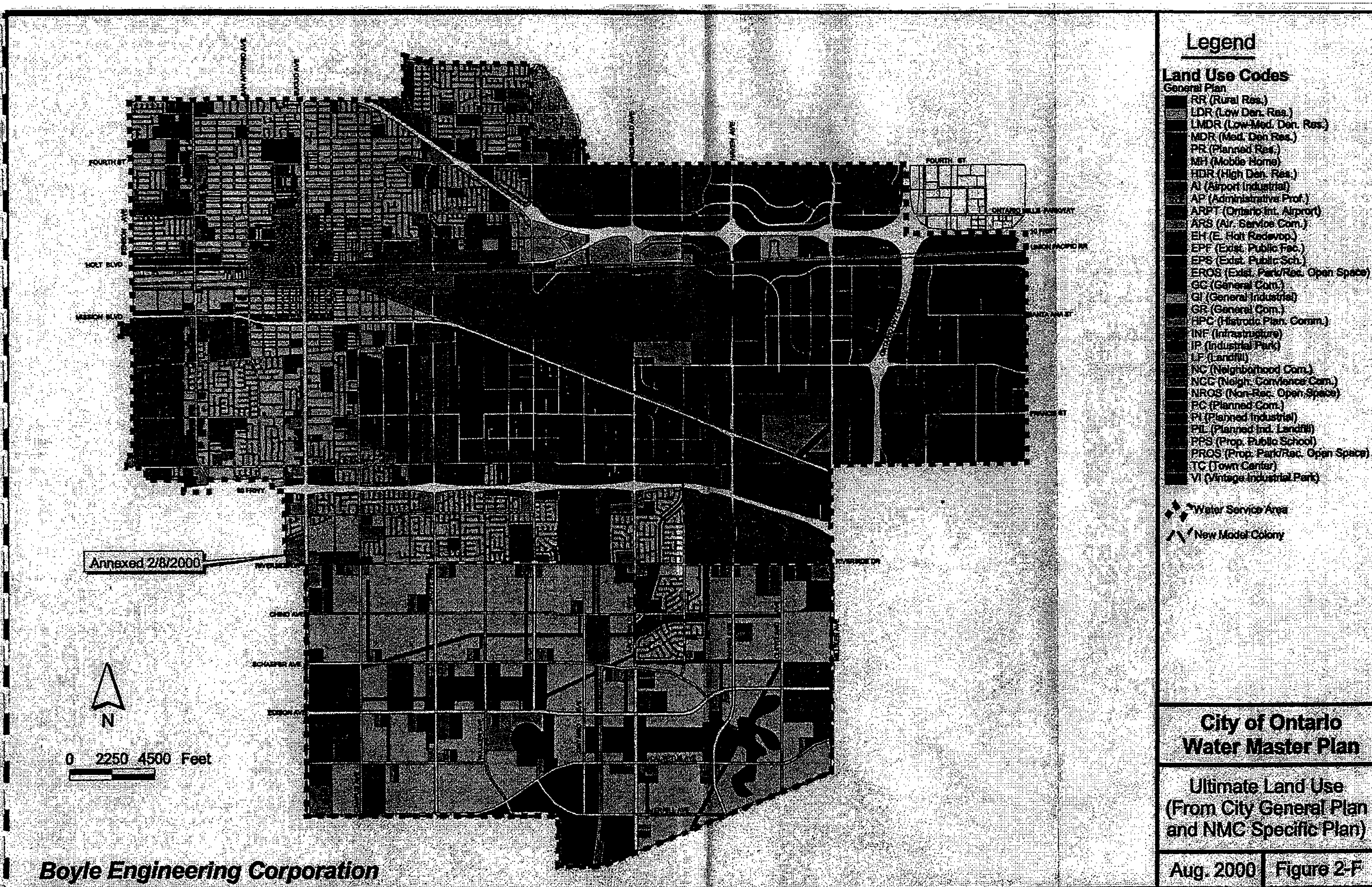
2.2.5.1 Existing and Ultimate Land Use (Pre - NMC)

Since land use serves as the basis for projecting water demands in the service area, it is necessary to be able to predict, within a reasonable degree of accuracy, future land use and to apply appropriate demand coefficients to the various land use classifications. Existing and future land use in Ontario is defined in the General Plan (GP), represented by a total of 31-land use or zoning categories.

Since the City pre-NMC contains a considerable amount of acreage that is still vacant (or undeveloped), the current "existing" land use is approximately represented by the GP zoning with vacant acreage subtracted out. Existing land use and vacant lands are depicted in Figure 2-E. A map showing the geographic distribution of land uses as defined by the City's GP, or "ultimate" land use, is shown on Figure 2-F.

The following lists the acreages of each of the 32 land use categories, as digitized from the GIS coverages, for both existing and ultimate conditions in each pressure zone within the pre-NMC service area.


Legend
Land Use Codes
Vacant Land
General Plan
RR (Rural Res.)
LDR (Low Den. Res.)
LMDR (Low-Med. Den. Res.)
MDR (Med. Den Res.)
PR (Planned Res.)
MH (Mobile Home)
HDR (High Den. Res.)
AI (Airport Industrial)
AP (Administrative Prof.)
ARPT (Ontario Int. Airport)
ARS (Air. Service Com.)
EH (E. Holt Redevop.)
EPF (Exist. Public Fac.)
EPS (Exist. Public Sch.)
EROS (Exist. Park/Rec. Open Space)
GC (General Com.)
GI (General Industrial)
GR (General Com.)
HPC (Historic Plan. Comm.)
INF (Infrastructure)
IP (Industrial Park)
LF (Landfill)
NC (Neighborhood Com.)
NCC (Neigh. Conviance Com.)
NROS (Non-Rec. Open Space)
PC (Planned Com.)
PI (Planned Industrial)
PIL (Planned Ind. Landfill)
PPS (Prop. Public School)
PROS (Prop. Park/Rec. Open Space)
TC (Town Center)
VI (Vintage Industrial Park)
Water Service Area
New Model Colony (Agricultural)
FOURTH ST
HOLT BLVD
MISSION BLVD
Annexed 2/8/2000
RIVERSIDE DR
CHINO AVE
SCHAEFER AVE
EDISON AVE
EUCALYPTUS AVE
MERRILL AVE
N
0 2250 4500 Feet
Boyle Engineering Corporation
City of Ontario
Water Master Plan
Existing Land Use/
Vacant Land
Aug. 2000
Figure 2-E



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Land Use Codes
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VI (Vintage Industrial Park)
Water Service Area
New Model Colony
FOURTH ST
HOLT BLVD
MISSION BLVD
ONTARIO MILLS PARKWAY
UNION PACIFIC RR
RIVERSIDE DR
CHINO AVE
SCHAEFER AVE
EDISON AVE
Annexed 2/8/2000
N
0 2250 4500 Feet
Boyle Engineering Corporation
City of Ontario
Water Master Plan
Ultimate Land Use
(From City General Plan
and NMC Specific Plan)
Aug. 2000
Figure 2-F

Table 2-5
Existing and Ultimate Land Use in City (Pre-NMC)

	Land Use		Area (acres)									
			13th		8th		4th		Phillips		Total	
			Exist.	Ult.	Exist.	Ult.	Exist.	Ult.	Exist.	Ult.	Exist.	Ult.
1	RR	Rural Residential			101	107	261	283			362	390
2	LDR	*Low Density Residential*	971	976	1278	1305	873	883	1091	1137	4213	4301
3	LMDR	Low-Medium Density Residential	19	21	82	95	7	11			108	128
4	MDR	Medium Density Residential	64	68	263	275	134	136	110	110	571	589
5	HDR	High Density Residential	50	52	98	98	3	3	2	3	152	156
6	PR	Planned Residential			77	77	6	6	307	312	390	395
7	MH	Mobile Home	49	49	8	8	81	81	55	55	193	193
8	GC	General Commercial	53	64	137	150	33	46	40	40	264	300
9	NC	Neighborhood Commercial	51	59	51	55	47	50	130	145	278	308
10	NCC	Neighborhood Convenience Commercial			2	2					2	2
11	AP	Administrative Professional	2	2	11	11	0	0			13	13
12	ARS	Airport Service Commercial			164	227					164	227
13	PC	Planned Commercial			699	1246		42	25	76	724	1364
14	HPC	Historic Planned Commercial			154	154					154	154
15	GI	*General Industrial*			312	375	0	0			312	375
16	IP	Industrial Park	17	23	45	63	1017	1322	14	14	1093	1422
17	VI	Vintage Industrial Park			796	870			419	480	1215	1349
18	PI	Planned Industrial			1247	1837	352	473	141	275	1741	2585
19	ARPT	Ontario International Airport			1394	1395					1394	1395
20	AI	Airport Industrial			77	96					77	96
21	PIL	Planned Industrial Landfill			36	145			177	189	213	335
22	EPF	Existing Public Facility	9	9	36	36	18	18	60	60	123	123
23	PPS	Proposed Public School	29	43	14	14	16	16	21	21	81	95
24	EPS	Existing Public School	116	116	70	70	84	84	52	52	322	322
25	EROS	Existing Park/Recreational Open Space	35	35	187	187	40	40	230	230	492	492
26	PROS	Proposed Park/Recreational Open Space			78	78	5	5	12	12	95	95
27	NROS	Non-recreational Open Space	27	29	341	362	81	82	255	264	704	736
28	TC	Town Center			219	229					219	229
29	EH	East Holt Blvd. Redevelopment Residential/Commercial			130	171					130	171
30	GR	Grove Avenue Corridor			3	7	151	210			153	216
31	INF	Infrastructure			213	217			12	12	225	229
32	LF	Landfill							134	135	134	135
33	ROW	Right of Way	503	503	2042	2051	766	767	832	833	4143	4154
34	V	Vacant	54		1648		582		337		2620	0
		TOTALS	**2049**	**2049**	**12014**	**12014**	**4559**	**4559**	**4455**	**4455**	**23076**	**23076**

2.2.5.2 *Ultimate Land Use in NMC*

The January 1998 adopted General Plan Amendment for the NMC contains a summary of ultimate land use projected for the 8,100 acre area, which is currently dominated by agriculture but proposed to convert to urban uses over the next 30 years. The "Land Use Plan" map contained in the General Plan Amendment presents only generalized boundaries of schools, community commercial, town center, and "major center" land uses. For purpose of this WMP analysis it is necessary to define specific locations and acreages of the water-consuming land uses. Thus, the information in the EIR including the land use map and land use acreages by Specific Plan subareas, as well as conversations with Planning Department officials, were utilized to create an ultimate land use map (see Figures 2-F and 6-A). Acreages of the various land use categories in the NMC, as defined by the above-referenced planning documents and more recent Planning Department input, are summarized in Table 2-6. This table presents ultimate (buildout) acreages for the City including the NMC, by land use category within each pressure zone.

Development of the NMC will require creation of a fifth pressure zone, the Francis Street Pressure Zone. Due to pressure considerations, the Phillips Street Zone will be extended southerly to Chino Avenue westerly of Cleveland Avenue ("New Phillips Zone").

Table 2-6
Summary of Ultimate Land Use in City and NMC
Area (Acres) Within Each Pressure Zone

Land Use	Pre-NMC Service Area 13th	8th	4th	PHLP	Sub-total	NMC NPHLP	FRAN	Sub-total	City with NMC Total
Rural Residential		107	283		390			0	390
Low Density Residential	976	1,305	883	1,137	4,301	901	3,363	4,264	8,565
Low-Medium Density Residential	21	95	11		128			0	128
Medium Density Residential	68	275	136	110	589	17	244	261	850
High Density Residential	52	98	3	3	156	38	288	325	481
Planned Residential		77	6	312	395			0	395
Mobile Home	49	8	81	55	193			0	193
General Commercial	64	150	46	40	300			0	300
Neighborhood Commercial	59	55	50	145	308	56	176	232	540
Neighborhood Convenience Commercial		2			2			0	2
Administrative Professional	2	11	0		13		29	29	42
Airport Service Commercial		227			227			0	227
Planned Commercial		1,246	42	76	1,364		191	191	1,555
Historic Planned Commercial		154			154		0	0	154
General Industrial		375	0		375		160	160	535
Industrial Park	23	63	1,322	14	1,422			37	1,458
Vintage Industrial Park		870		480	1,349			0	1,349
Planned Industrial		1,837	473	275	2,585		433	433	3,017
Ontario International Airport		1,395			1,395			0	1,395
Airport Industrial		96			96			0	96
Planned Industrial Landfill		145		189	335			0	335
Existing Public Facility	9	36	18	60	123			0	123
Proposed Public School	43	14	16	21	95	60	164	224	319
Existing Public School	116	70	84	52	322			0	322
Existing Park/Recreational Open Space	35	187	40	230	492			0	492
Proposed Park/Recreational Open Space		78	5	12	95	89	970	1,059	1,155
Non-recreational Open Space	29	362	82	264	736		192	192	928
Town Center		229			229			0	229
East Holt Blvd. Redevelopment Residential/Commercial		171			171			0	171
Grove Avenue Corridor		7	210		216			0	216
Infrastructure		217		12	229	14	137	151	380
Landfill				135	135	0	0	0	135
Right of Way	503	2,051	767	833	4,154	115	541	656	4,809
TOTAL	**2,049**	**12,014**	**4,559**	**4,455**	**23,076**	**1,290**	**6,923**	**8,213**	**31,289**

2.2.5.3 Metered Consumption

While the 34 land use types listed in Table 2-5 have utility in various planning functions, they represent an unwieldy number of categories and unknowns in terms of ascertaining representative water demands. Water consumption in the City is billed according to only a limited number of categories. Metered consumption by month for the past two years was evaluated to assist in development of demand coefficients.

2.2.5.4 Demand Coefficients and Peaking Factors

The most useful demand coefficients, for purposes of water system planning, are average annual rate of use and the ratios (or "peaking factors") for maximum month, maximum day, and peak hour consumption. Rates of use can be expressed in acre-feet per year or month (AF/yr., AF/mo.), gallons per minute (gpm), million gallons per day (mgd), or cubic feet per second (cfs). Peaking factors are used to compute storage volumes or rates of required water delivery under various conditions. For purposes of this investigation, the following units are used:

Average Demand	(gpm; AF/yr.)
Maximum Month Demand	(gpm; AF/month)
Maximum Day Demand	(gpm; mgd, cfs)
Peak Hour Demand	(gpm; mgd)

Peaking factors are applied to average demand rates to estimate maximum month, maximum day, or peak hour demands. These factors are based, where possible, on actual observed water use patterns.

It is significant that peaking factors, particularly maximum day and peak hour, are often more extreme in smaller entities, while larger service areas tend to exhibit somewhat moderated or dampened overall peaking. However, simple extrapolation of observed historical coefficients and peaking factors can lead to unrealistic estimated demands in transitional communities where changing circumstances may significantly alter water use patterns. Expected changes in demographic, climatological, and economic influences cannot be ignored in evaluation of water use trends and projections of future consumption.

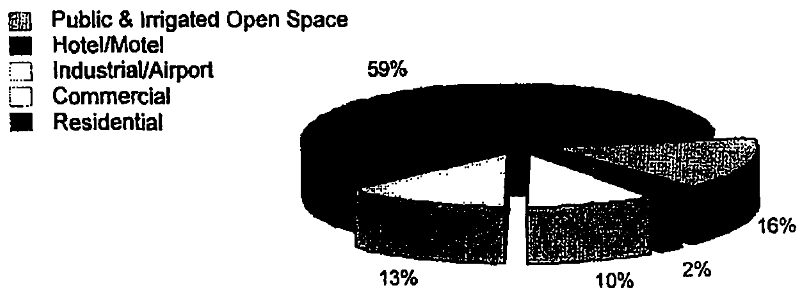
The following Table 2-7 shows monthly consumption for FY 1998-99 by "Account Category," based on the City's records. These land use categories, and the observed (billed) water use, are the basis for duty factors (demand coefficients). Since water users are billed monthly, seasonal peaking patterns and maximum month peaking factors can be estimated for the various user categories.

Figure 2-G graphically depicts the relative magnitude of the basic categories of water use in the City. It shows that residential uses represent the greatest demand—comprising nearly 60 percent of the total.

Table 2-7
1998/99 Monthly Consumption by Account Category (AF)

	Single Family Res.	Multi-Family Res.	Hotel/ Motel	Commercial	Industrial	Irrigation	Inter-Dept.	Hydrants	Totals
Jul-98	1,583	593	54	437	294	161	475	109	**3,706**
Aug-98	1,942	683	68	494	323	211	579	153	**4,452**
Sep-98	1,921	701	66	497	306	209	569	147	**4,415**
Oct-98	1,645	650	64	478	295	194	541	117	**3,984**
Nov-98	1,456	590	69	428	323	152	453	79	**3,551**
Dec-98	1,168	515	63	416	273	130	338	52	**2,956**
Jan-99	1,127	506	47	362	252	118	266	35	**2,715**
Feb-99	1,063	483	52	358	337	80	225	32	**2,630**
Mar-99	1,008	481	57	346	312	69	222	24	**2,519**
Apr-99	1,019	473	56	363	335	84	256	37	**2,624**
May-99	1,090	469	46	368	323	86	286	56	**2,725**
Jun-99	1,428	555	55	429	343	125	416	94	**3,447**
Total	**16,450**	**6,698**	**697**	**4,976**	**3,717**	**1,619**	**4,627**	**935**	**39,724**
Maximum Month Peaking Factor	*1.42*	*1.26*	*1.19*	*1.20*	*1.11*	*1.56*	*1.50*	*1.96*	

Figure 2-G
Current Water Use by Consolidated User Category



The monthly records reveal that seasonal variation in consumption, or the ratio of maximum month to average month, differs for each category. As would be expected, the user categories with a large proportion of outdoor (irrigation) use exhibit greater seasonal fluctuation. Note that the maximum month peaking factor for the various categories (excluding "hydrants") ranges from a low of 1.11 for industrial to 1.56 for irrigation.

Derivation of demand coefficients in units per acre requires the estimation of acreage for each category. Since the City's land use codes for the GP are much more detailed and numerous than the above account categories, it is necessary to determine which land use codes belong in which billing account categories. The following Table 2-8 shows the cross-indexed categories, assumed for purposes of derivation of coefficients.

Table 2-8
Cross-Index of User Categories

Account Category	GP Land Use Classification	Demand Category for WMP
Single Family Res.	RR+LDR LMDR+MDR+PR	Residential Low Residential Medium
Multi-Family Res.	MH+HDR	Residential High
Hotel/Motel	EH *	Hotel/Motel
Commercial	AP+ARS+GR+HPC +GC+NC+NCC+PC+TC +ARPT	Commercial
Industrial	AI+LF+PIL+PI+IP +VI+GI	Industrial
Inter-Department (Public)	EPF+EPS+PPS	Public Facilities/Schools
Irrigation	EROS+NROS+PROS	Irrigated Open Space

** = The East Holt (EH) redevelopment corridor has included a high level of hotel/motel development, but is in the process of revision.*

Metered consumption from these cross-indexed categories, along with the existing acreages, digitized from the GIS coverage, were used to derive demand coefficients and maximum month peaking factors. These numbers were then checked for reasonableness against data developed for similar land uses in other cities/water districts.

The final "touchstone" to fine-tune the factors is the computation of demands in each pressure zone, and comparison with actual zone production records. The various demand factors were adjusted slightly, where necessary, to achieve the best balance in all zones. The final coefficients generate computed demands within 5 percent of observed production in all pressure zones.

The derivation of maximum day peaking factors was accomplished by review of the ten-year production records (see Table 2-1). Since the City has kept track of maximum day production for the past eight years, it is possible to compute the ratio of the maximum day use rate compared to the average use rate during the maximum month in any given year. It is found that the maximum day has exceeded the average during the maximum month by up to 12 percent. Thus, the maximum day peaking factor is assumed to be 1.12 (applied to maximum month).

The City cannot reasonably measure the peak hour rate of demand, but based on industry standard curves for a water system serving an average of about 38 mgd, the overall peak hour factor is estimated to be 1.5 times maximum day.

The following Table 2-9 shows the demand coefficients and peaking factors used in the estimation of water demands and in the hydraulic simulation of the City's water distribution system.

Table 2-9
Demand Coefficients and Peaking Factors

Land Use Category	Avg. Day Demand (gpm/ac)	Max. Month PF (x AD) (1)	Max. Day PF (x MM) (2)	Peak hr. PF (xMD)
1. Residential				
a) Low (RR+LDR)	2.71	1.46	1.12	1.5
b) Med. (LMDR+ MDR+PR)	2.82	1.46	1.12	1.5
c) High (MH+HDR)	3.08	1.26	1.12	1.5
2. Commercial (AP+ARS+GR+ HPC+GC+NC+ NCC+PC+TC)	1.57	1.32	1.12	1.5
3. Industrial (AI+LF+PIL+PI+IP+VI+GI)	0.50	1.27	1.12	1.5
4. Airport (ARPT)	0.23	1.27	1.12	1.5
5. Hotel/Motel (EH)	4.50 (3)	1.37	1.12	1.5
6. Public Facilities & Schools (EPF+EPS+PPS)	1.58	1.68	1.12	1.5
7. Irrigated Open Space (EROS+NROS+ PROS)	2.37	1.56	1.12	1.5

(1). Based on highest value for FY 1997/1998/99.
(2). Based on 1997/98 observed max day.
(3). Conservative value based on predominantly hotel or high-FAR commercial.

2.2.6 Trends/Water Conservation Impacts

The appropriateness of extrapolating current water use factors, or demand coefficients, into the future must be addressed. The following relevant observations are made:

- Similar to most Southern California communities, the City experienced a significant reduction in per capita consumption during the recent prolonged drought (see Figure 2-A).
- Although some "rebound" has occurred, per capita consumption for residential users is not expected to reach its pre-drought levels, given the water conservation measures, water pricing and increased customer awareness of the value of water.
- The past year (1998-99) was one of the driest on record in Southern California, so water consumption and coefficients based on FY 1998-99 should reflect the "upper end" of the range of demand coefficients, an appropriately conservative view of estimated demands for water supply planning purposes.
- Some redevelopment will occur in the older parts of the City, and older high volume fixtures will be replaced with low volume toilets, showerheads, etc. However, a possible reduction in unit demands, while reasonably assumed, does not warrant the downward adjustment of factors, particularly since the actual location and character of redevelopment is not easily predicted.
- Development in the NMC will be mandated to employ the latest water conservation Best Management Practices (BMPs), which may render the actual demand coefficients to be somewhat less than those based on existing City consumption. However, given the uncertainties in the character/location of specific land uses and geographic dispersion of those uses in the NMC, the use of more conservative demand coefficients is prudent to ensure adequate supply and delivery capability.

2.3 Projected Future Water Demands

The "demand model" uses demand coefficients and digitized acreages of the GP land use codes to compute hypothetical future demands.

As previously discussed, the demand model coefficients (once calibrated against actual observed demands) applied to known acreages of the above land use categories, give a very close approximation of the measured City water production (consumption plus unaccounted-for water) in the past year.

After assessing potential trends in water consumption patterns, it is concluded that the unadjusted coefficients, which correlate well with actual observed dry year consumption rates, would serve the purpose of providing a conservative projection of future water demands.

2.3.1 Demands in City Pre-NMC

The "demand model" (which is actually the front-end of the hydraulic network model) facilitates a summary of the "ultimate" (assumed buildout) acreages and computed water demands for each GP land use category within the existing City limits, by pressure zone.

The forecasted demands are based on coefficients which, when applied to existing land use acreages, result in a computed current demand of 43,000 AF/yr.—almost identical to the 1998/99 water production rate for the City. As previously noted, this production rate is the highest on record, and reflects an extremely dry (although cooler than average) year. Thus, the coefficients and projections are intentionally conservative, representative of dry year demands. It is this demand scenario that the City's water system must be able to satisfy. Total demands for the City proper are presented in Table 2-10.

2.3.2 Demands in NMC

A similar computation is made based on the projected land uses within the NMC. Computation of total demands in the NMC is possible based on the summary of acreages of various land use categories and the previously derived demand coefficients. However, for distribution system modeling, an analysis of the geographic distribution land use in the NMC was necessary to allow computation of demands on a geographic basis (see Section 6). As previously discussed, the ultimate land use is as described in the adopted General Plan and EIR. Land use categories in the NMC are correlated with those in the City's GP, to allow use of common demand coefficients. Table 2-10 separates acreages and computed ultimate demands in the NMC.

2.3.3 Requirements for Additional Water

As demonstrated by the results of the demand model, the City's water requirements are expected to grow dramatically in the future.
Table 2-11 presents a summary of existing and ultimate demands, by consolidated land use category, for the City and NMC.

Table 2-10
Existing and Future Average Demands in City With and Without NMC

Land Use Category	Demand Factor Gpm/acre	Existing City Pre-NMC (acres)	Existing Demand (AF/yr.)	Ultimate City Pre-NMC (acres)	Ultimate City Pre-NMC (AF/yr.)	Ultimate NMC (acres)	Ultimate NMC Demand (AF/yr.)	Ultimate Total Demand (AF/yr.)
1. Residential								
a. Low (RR+LDR)	2.71	4,552	19,875	4,689	20,473	4,666	20,374	40,847
b. Medium (LMDR+MDR+PR)	2.82	1,026	4,666	1,094	4,976	200	910	5,886
c. High (MH+HDR)	3.08	344	1709	322	1,757	330	1,801	3,558
2. Commercial (AP+ARS+GR+HDC+GC+NC+NCC+PC+TL)	1.57	1,944	4,923	2,766	9,661	504	1,761	11,422
3. Industrial (AI+LF+PIL+PI+IP+VI+GI)	0.50	4,781	3,856	6,283	5,715	338	307	6,023
4. Airport (ARPT)	0.23	1,393	507	1,394	507	0	0	507
5. Residential Commercial (EH)	4.50	130	944	944	1,342	0	0	1,342
6. Public (public facilities/schools) (EPF+EPS+PPS)	1.58	526	1,339	540	1,375	876	2,231	3,607
7. Irrigated Open Space (EROS+NROS+PROS)	2.37	1,287	4,918	1,325	5,061	997	3,809	8,870
TOTALS		**15,983**	**42,735**		**50,867**		**31,193**	**82,060**

The City pre-NMC City service area is approaching buildout; thus, the growth in demands, from approximately 43,000 AF/yr. to about 50,900 AF/yr., represents a relatively modest 18 percent increase. Most of this projected increase is seen to be the commercial and industrial categories. The NMC demands are projected to be about 31,200 AF/yr. at buildout. Note that although current water use in the NMC area is estimated to be approximately 19,000 AF/yr. from private agricultural and domestic wells, it is assumed to be "zero" in terms of demands supplied from City sources.

Total demands to be supplied from the City's ultimate system (assumed to serve the entire City service area including the recently annexed NMC) are thus projected to nearly double—from the current 43,000 AF/yr. to about 82,000 AF/yr.

2.3.4 Time-Phased Demands

2.3.4.1 Development Phasing

The City Planning Department was consulted to provide insight into the timeframe of growth in the City and NMC. Information on buildout was provided, based on "SCAG/City TAZ Level Forecast Data, SCAG Forecast Data, and NMC General Plan." Near term development projections are based on the City's "18-Month Current Planning Project Activity Report."

Buildout for the City (pre–NMC) is assumed in year 2020, with population projected to increase from the present 146,700 to approximately 174,000. Development in the NMC is expected to begin in approximately 2003 or 2004, achieve a population of 65,900 by year 2015, and about 102,000 at buildout. No year is given for an NMC buildout timeframe, but estimates are that it will realistically occur sometime between 2025 and 2030. Given this 23 to 28 year development period, the Planning Department estimate of 65,900 population in year 2015 (only 11 or 12 years after startup), may be somewhat high.

For purposes of this water demand analysis, buildout water requirements for the pre-NMC City and NMC are conservatively assumed to occur in 2015, and 2025 respectively.

Near term development is forecasted (by Planning Department) for the pre–NMC City as follows:

	3-Year (sq. ft.)	5-Year (sq. ft.)
Commercial	3,796,000	6,327,000
Industrial	25,000,000	40,000,000
Residential	200,000	400,000

It can be seen from the above that industrial and commercial development is projected to occur at a rapid pace, with only modest residential increases.

Assuming an average floor area ratio (FAR) of 0.35 to 0.40, the City expects to add about 500 acres per year of commercial and industrial development over the next five years. This projection may be somewhat high, as it would result in buildout of all vacant commercial/industrial properties in a 5 to 10 year timeframe.

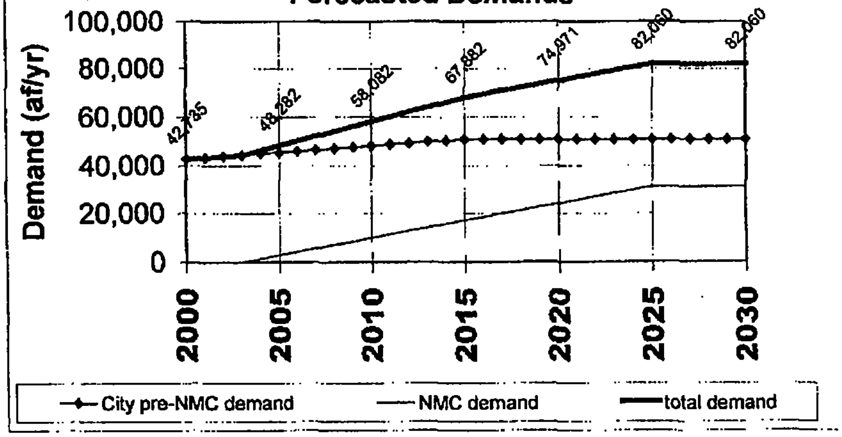
City Planning officials are understandably reluctant to attempt to predict the character or pace of initial development in the NMC. However, at the time of this report, there is speculation that the initial projects could be as follows:

- 86 acre residential development consisting of 396 units in north-central area of NMC.
- 562 acre residential development in the south-eastern portion of NMC, consisting of 2,530 units.
- 240 acre, 1,308 unit residential development in the southeast corner of NMC.

2.3.4.2 Demand Forecast

For the purposes of source-planning, annual demands are estimated in the City pre–NMC, NMC, and City (including NMC), from present to projected buildout. Demands are based on existing and planned ultimate acreages of the major land use categories. Average demand coefficients are applied to acreages to estimate annual demand in AF/year. Figure 2-H shows the resulting projections, based on assumed 2015 for the Pre-NMC service area and 2025 for the NMC. The 2015 and 2025 timeframes are the assumed years that the water system must be able to meet buildout, or ultimate, demand conditions.

Figure 2-H
Forecasted Demands



Section 3 Sources of Supply

3.1 Groundwater

3.1.1 Chino Basin

The primary source of water for the City of Ontario is the underlying groundwater basin. The Chino Basin, a major aquifer system in the Santa Ana River watershed, has a total groundwater storage capacity estimated at over 6 million acre feet with approximately 5 million acre feet currently in storage. The City of Ontario overlies the approximate geographic center of the basin. The saturated depth of water-bearing materials under the City ranges to over 1,000 feet. Groundwater production by the City over the past ten years has varied from a low of 21,108 AF in 1990/91, to a high of 34,586 AF in 1996/97. Groundwater production in recent years has constituted as low as 57 percent of the City's total water supply and as great as 88 percent.

The operation of the Chino Basin is governed by a 1978 court judgement and agreement among producers, whereby each is allotted a "base water right" to a certain percentage of the natural yield or "safe yield" of the basin. Prior to 1978, the Basin was in an overdraft condition. Under the judgement, entities can pump in excess of their allotted base right, but must pay a per-acre foot pump tax to cover the cost to replenish any overdraft. The water rights, or production allocations, are divided among three interest groups or "pools:" 1) overlying agricultural, 2) overlying non-agricultural, and 3) appropriative. The provisions of the Agreement and monitoring, replenishment and other obligations are presided over by a court-appointed Watermaster, who is obligated to file a report each year. The Chino Basin Municipal Water District (which has since changed its name to Inland Empire Utilities Agency [IEUA]) was the assigned Watermaster until the recent reassignment.

3.1.2 Water Rights Entitlement

The base water right of Ontario is 11,374 AF, which is 20.74 percent of the "initial share" of the appropriative pool rights. The judgement also set aside a large portion of the estimated safe yield for the overlying agricultural pool. As agricultural lands are converted to urban use, a portion of the production right associated with the converted land is transferred to the appropriative pool, and allocated among appropriators in proportion to their initial share. The City's current and projected water rights are as follows:

Table 3-1
City of Ontario Water Rights

	1999/2000 (AF/yr.)	Estimated 2019/2020 (AF/yr.)
Base Right in Judgement	11,374	11,374
Agricultural Conversion (current)	895	895
Agricultural Conversion (NMC)	0	12,000
Agricultural Conversion (Pool, current)	1,795	0
Agricultural Conversion (Pool, NMC)	0	0
Agricultural Conversion Transfer (a)	4,653	6,885
Operating Safe Yield (b)	18,717	31,154 (est)

a) Under-production by Ag (Ag Pool – 82,000-production-sum of conversion).

b) Watermaster Assessments, 1999/2000 (page 2).

The year 2019/2020 estimated entitlement reflects a base right that is scheduled to be slightly reduced by the judgement after year 2017 to eliminate overdraft. However, reevaluation of the estimated safe yield could conceivably lead to the conclusion that the number should be somewhat higher.

3.1.2.1 New Model Colony Allocation

With the NMC annexation to the City, the water rights appurtenant to the parcels within the NMC will be assigned at the rate of 2AF/acre of water to the appropriator providing water service to the converted land (City). Assuming 6,000 acres of the NMC is converted to urban use, 12,000 AF of water rights will be assigned to the appropriator, as shown in the above table.

As previously mentioned, the conversion rights may be reduced if future safe yield is found to be less than the current estimate. In such a case the appropriative pool rights/agricultural rights assignments/conversions may be used to satisfy lost safe yield. Based on information developed by Wildermuth Engineering for the Watermaster, if pumping in the southern portion of the basin is greatly reduced, losses in basin safe yield could be as high as 40,000 AF. City loss in safe yield would then be 20.7% of the total loss or up to about 8,300 AF.

Note that these NMC and other new conversions are in addition to existing conversions and in addition to the assignment of agricultural pool underpumping (after conversions are deducted) to the appropriative pool. It may also be expected that as conversions occur, the amount of underpumping may decrease, hence amount of assignment may decrease.

3.1.2.2 San Antonio Water Company Shares

The City also has production rights to approximately 850 AF/yr. of groundwater from shares of the San Antonio Water Company owned by the City. The water is produced from a well in the neighboring city of Upland and conveyed into the City's system through a connection near Eighth Street and San Antonio Avenue. Because this source has a high nitrate level, it is blended with water from the 8th Street and 13th Street pressure zones at the south side of I-10 and Campus Avenue.

3.1.3 Existing Production Wells

The City of Ontario has a total of 23 wells in its system; of these, 21 are currently active. Figure 4-A shows the location of City wells. Two wells have been off-line for some time, for water quality reasons: Well 33 has been off-line for approximately five years due to high TCE and chromium concentrations, attributed to industrial pollution plumes (see Section 3.1.4), and Well 30 has high TDS concentrations, attributed to the Kaiser Plume.

All wells except two pumps directly into the system. Wells 3 and 4 each pump directly to Reservoirs 8/9 at Galvin Park. Table 3-2 summarizes pertinent information regarding the City's wells. Note that nearly 60 percent of the well capacity is in the 8th Street Zone and approximately 36 percent are in the 4th Street Zone. Only one well serves the Phillips Street Zone, and there is no well capacity in the 13th Street Zone.

Table 3-2
Characteristics of Well Facilities

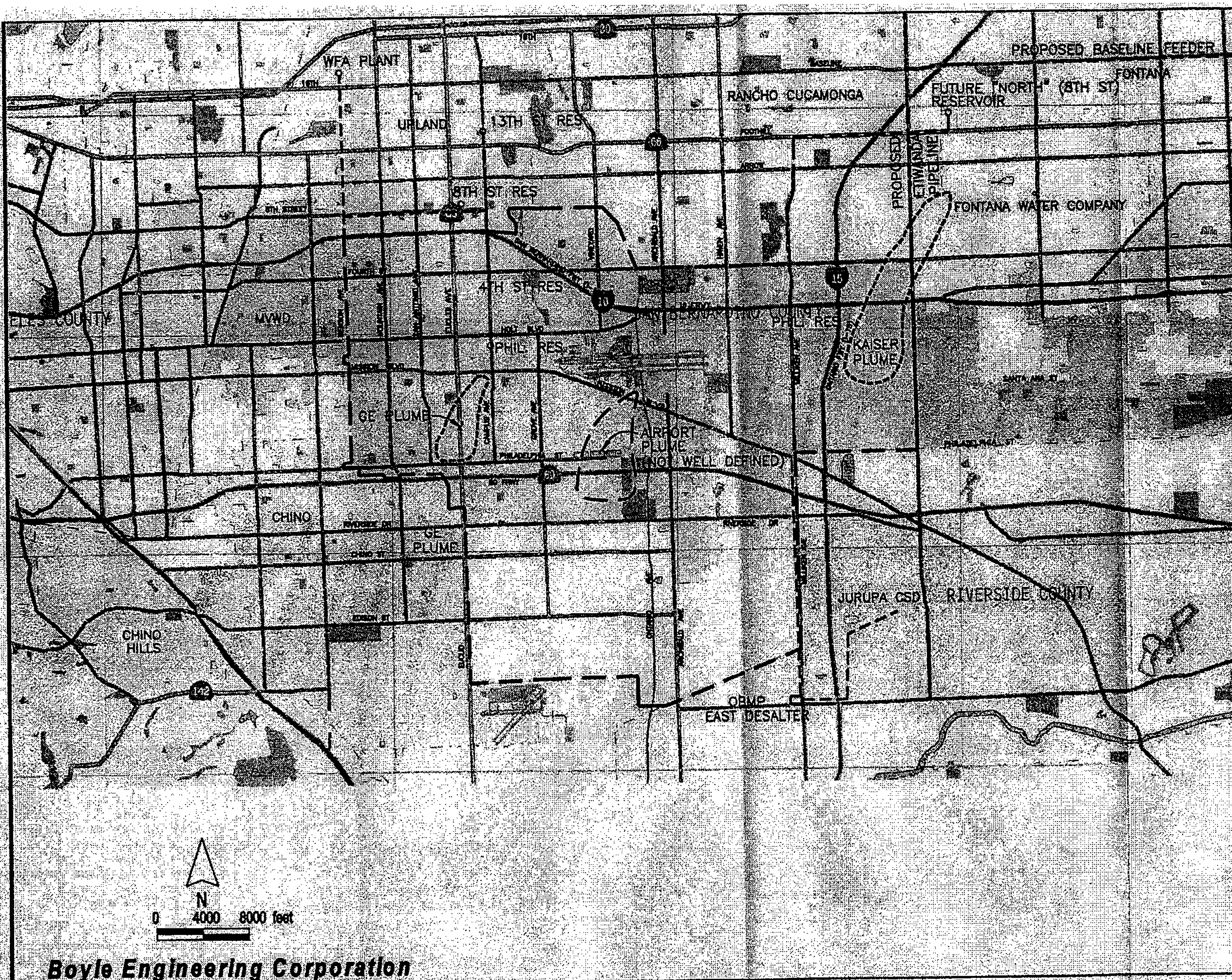
Well	Year Drilled	Depth Below Ground (ft.)	Motor Size (hp)	Pump Setting (ft.)	Latest SCE Test Data Capacity (gpm)	Power Input (kw)	Plant Eff'y (%)	Pumps to Zone
3	1962	1130	300	640	1080	196.6	64.2	4th St.
4	1958	940	350	562	1240	220.9	61.8	4th St.
9	1958	1204	400	635	1770	301.4	67.3	8th St.
11	1958	1100	300	431	1240	220.7	55.2	4th St.
15	1960	1000	300	425	1660	267	62.1	4th St.
16	1966	631	125	345	730	103	66.3	4th St.
17	1963	1040	300	518	1740	268.6	65.6	4th St.
18	1926	1035	250	521	1200	217.8	61.6	8th St.
19	1926	507	150	437	580	112.8	58.9	8th St.
20	?	693	300	480	770	144.5	68.9	8th St.
24	1969	1012	400	400	1880	301.4	69.4	8th St.
25	1926	903	250	498	1390	232	68.7	8th St.
26	1959	508	300	411	1270	230.5	64.4	8th St.
27	1961	702	250	361	1100	180.2	68.1	8th St.
29	1979	1120	500	489	2490	401.8	76	8th St.
30	1979	1100	600	442	3180	510.7	66.7	8th St.
31	1979	1000	600	389	3070	467	71.5	8th St.
33	1983	1195	500	470	2940	392.1	74.5	4th St.
34	1983	1210	500	470	2820	388.7	72.3	Phillips St.
35	1985	1070	400	499	1960	316.7	68.5	4th St.
36	1985	1320	350	427	1910	274.4	73.3	4th St.
37	1994	1014	600	360	3040	445.6	74.1	8th St.
38	1996	1020	500	423	2470	401.4	72.7	8th St.

Total Capacity	41,530	35,410	Active capacity (without wells 30 & 33)
4th Street Zone	14,500	11,560	
8th Street Zone	24,210	21,030	
Phillips Zone	2,820	2,820	

Well Capacities range from 580 gpm to 3,180 gpm. The oldest City wells are more than 70 years old, and are candidates for replacement (see Section 7).

3.1.4 Groundwater Quality

The quality of groundwater in the Chino Basin (underlying the City) is generally excellent. The total dissolved solids content (TDS) of water produced by the City's wells is normally around 200 to 250 mg/l. With a few notable exceptions, all of the constituents required to be monitored are below the "Maximum Contaminant Levels" (MCLs) established by the California Department of Health Services (DHS) in its "Primary Drinking Water Standards."



City of Ontario Water Master Plan

Regional Map Including Water Facilities Outside City Boundary

August 2000 | Figure 3-A

Several water quality issues are of concern to the City, including the prevailing water quality in the NMC. Future regulatory requirements could also result in new challenges. Following is a brief summary of water quality issues:

- **TDS and Nitrates**: Water quality in the Chino Basin transitions from generally excellent in the northern (primary recharge) areas to generally poor in the southerly part of the basin (see Figure 3-A). The primary concerns are total dissolved solids (TDS) and nitrates. Even within the City's service area, the quality differential between the northerly and southerly areas is notable. Although the City's production wells are located in the northern (better quality) areas, there is concern that significantly increased pumping in that area could modify prevailing gradients and draw poorer quality water into the production zone. Any wells constructed in the NMC would encounter water of inferior quality (see analysis, Section 5).

  Although high nitrate groundwater in the northerly portion of the City is an exception, pockets of nitrate–contaminated water from past agricultural activities are sometimes encountered. Several years ago, Wells 10 and 13 in the northwestern portion of the City were shut down due to excessive nitrates.

- **Industrial Contamination Plumes** have caused loss of wells in the past, and are of continuing concern. Specifically, three industrial plumes from past industrial activities are being closely monitored. One is the "GE Plume" emanating from the former clothes iron manufacturing facility at 234 East Main Street. This plume is nearly 3,000 feet wide and extends to the southwest. Its movement is being contained so that the southern limit of contamination will not extend beyond Philadelphia Street. Another concern is the plume from the GE test facility at 1923 East Avion. This plume, not well defined, is thought to be about 1,000 to 2,000 feet wide and extends southwesterly for about 8,000 feet. Both of these plumes contain Volatile Organic Compounds (VOCs), including the known carcinogen Trichloroethelene (TCE). Both are under close observation, and are the subject of legal action that may result in court-imposed mitigation. A third pollution plume, which poses a threat, is that emanating from the former Kaiser Steel plant in Fontana, northeast of the Ontario service area. The subject of a RWQCB cleanup and abatement order, this plume currently extends 17,000 feet southward, toward the northeast corner of Ontario.

Several years ago, Well 6 near Euclid and Phillips was lost due to TCE contamination. More recently, as previously noted, Well 30 was shut down due to high TDS and the Kaiser plume. Approximate locations of contamination plumes are shown in Figure 3-A.

- **Water Quality in the NMC** ranges from reasonably good to poor, in terms of TDS and nitrates. The groundwater quality reflects the NMC history of agriculture and more specifically, the large numbers of dairy cattle. Dairy waste contains extreme concentrations of TDS and nitrates. Research of existing water quality data reveals that water quality in the NMC is characterized by a very wide range of constituent concentrations. TDS measured in agricultural wells ranges from a low of 186 mg/l to a high of 1,774 mg/l. Nitrate samples demonstrate a similar broad range—from 8 mg/l to 298 mg/l. The results of this quality survey are shown in the Appendix TDS and NO_3 concentrations of wells were summarized within a particular Township/Range/Section, and a map was prepared which shows the prevailing measured quality at various locations in and near the NMC. The data suggests that "pockets" of good quality water exist in the NMC. However, some of the apparent quality variation from one geographic location to another may in reality reflect stratification and variation in groundwater quality with depth. Since little or no data exists on the aquifer depth at which each well is drawing, a quality-to-depth correlation is not possible at this time.

3.1.5 Basin Management Issues

Management strategies and policy governing the underground basin, from which the City obtains the majority of its supply, are being pursued on a regional basis through the Optimum Basin Management Plan (OBMP) process. This court-mandated planning process was to culminate in a consensus OBMP that considers water quality, quantity, and economics by October 28, 1998. Due to the complexity of the issues and often-divergent viewpoints, the evaluations/deliberations have been cumbersome and the deadline has been extended. However, progress is being made, and cooperative solutions being explored are promising. The OBMP Phase I Report was filed with the court on

September 30, 1999. Phase II (underway) includes groundwater recharge and basin yield maintenance memorandums of agreements (MOA), as well as a time-phased implementation plan, and is to be completed in June, 2000.

It should be pointed out that the evolving nature of the OBMP-related planning has posed a significant challenge in the development of alternative source scenarios in this Water Master Plan, and a similar planning challenge for other water purveyors overlying the basin. In particular, the comparative cost of alternative sources has been a "Moving Target".

Following is a brief discussion of issues of major consequence to the City of Ontario, and the "current" (March, 2000) status of each.

1. **Safe Yield/Maximum Groundwater Production.** Since the obvious lowest-cost choice to provide needed new supply for agencies overlying the Chino Basin is to drill new wells and increase production, the issue of an upper limit of acceptable production is a major OBMP consideration. *Safe Yield* is defined as the amount of water that can be withdrawn annually from a basin without producing an undesired result. The court deliberations in the governing judgement estimated safe yield quantities and assumed allocations among pumpers based on those quantities (Section 3.1.2). However, the estimates were considered tentative pending further investigation, and no limit was placed on the beyond-safe-yield extractions other than the requirement to purchase and replenish the basin with an equivalent amount of water. The primary limiting factors ultimately defining the amount of allowable extractions and accumulated overdraft are the ability of the formations to recharge and transmit water, and the threat of subsidence and fissuring, which is already taking place in "Management Zone" (MZ) 1.

   The MZ 1 subsidence issue is the subject of an "Interim Management Plan" and the focus of a special committee to develop additional facts and formulate a long-term management plan.

2. **Safe Yield Impact of Modified Pumping Patterns.** A significant conclusion of the OBMP basin management evaluations is that increased production in the southern part of the basin near the Santa Ana River would increase the percolation of River flows into the basin and thus tend to increase the safe yield. Conversely,

decreased production in this portion of the basin would cause a reduction in subsurface inflows and thus a reduction in safe yield. Since water quality in the southerly basin is poor due to overlying land uses basin activities (including extensive dairy farming). as well as the concentrating effects of uses in the upgradient areas of the basin, the propensity of producers is to place their wells further north in areas of better quality, higher yield, and higher elevation. Geohydrologic investigations have concluded that if the existing agricultural production in this area were replaced with municipal production further north, the entire basin would suffer a significant reduction in safe yield.

It is estimated that loss of production in the lower end of the basin would result in a reduction of up to 40,000 AF/yr in safe yield. The City of Ontario share (20.742%) would be an 8,297 AF/yr loss in water rights value or pumping entitlement worth about $2 million per year at today's market prices. It is further estimated by OBMP consultants that regional contractors would be obligated to achieve 38,000 tons/yr of salt mitigation at a cost nearly $4 million per year. Ontario would be responsible for its proportionate share of any such cost. A major effort in the OBMP has been to find ways to encourage production in the southern regions. The current plan is to construct several desalters and sell product water to agencies in the vicinity and to find equitable ways to finance the very substantial capitol and O&M costs.

3. **Water Quality Management.** Goal No. 2 of the OBMP is to "Protect and Enhance Water Quality." A major challenge is the need to ultimately redress the salt imbalance in the basin, wherein total salt inflows exceed outflows or exports by ten of thousands of tons per year. All users contribute to this problem through the importation of water and the concentrating effects of repeated use. Containment and extraction/treatment of known contaminant plumes is another area needing to be addressed. Of particular concern is the pollutant loading of the groundwaters in the southern portions of the basin, including the NMC, from decades of dairy farming. The huge concentrations of dairy cattle in the region (nearly 640,000) are estimated to generate approximately 2,000 tons of manure and 20 to 30 million gallons of wastewater per day. The IEUA and Orange County Water District (OCWD) are cooperating in a "Manure Salt Reduction Assistance" program

as part of IEUA's "Organics Management Strategy". removing over 150,000 tons of manure.

4. **Pricing of Desalted Water and Recycled Wastewater.** The Chino Basin water pricing challenge is a microcosm of the statewide situation. Source mix scenarios, which may be beneficial from a basin-wide perspective, require innovative financing/pricing to achieve equitability for individual agencies. In particular, increased extractions from the southern parts of the basin work to increase the yield of the entire basin. However, the generally poor quality of water in that area makes it impractical for nearby agencies to pump that water for municipal use. The OBMP challenge has been to find ways, through fair pricing or other incentives, to encourage nearby entities to extract and treat this water, or to purchase desalted water from regional facilities, in lieu of using other sources. The City of Ontario elucidated this challenge and City's position in a letter to the Watermaster (Tracy Stewart from Ken Jeske June 6, 1999-see Appendix).

   The most recent pricing strategy, taking into account prospective State and Federal funding assistance, contemplated a sale price of $375/AF for OBMP Desalter water. Previous estimates had ranged from about $450 to over $700/AF.

   A similar issue is the pricing of recycled water from the IEUA regional facilities. Recycled water from the RP1 and RP4 systems can be available to the City of Ontario service area. To be a viable alternative for Ontario, the cost must be competitive with other potential sources, taking into consideration the additional local costs of distributing recycled water through a separate nonpotable system. It now appears that IEUA will price the recycled water at $58/AF; a very attractive price and considerably less than the previously contemplated $280/AF.

5. **SAWPA Plan to Eliminate Importation During Drought.** The Santa Ana River Watershed Project Authority (SAWPA) has advanced a management concept which has, as it's principal goal the elimination of dependence on imported water during a prolonged (up to 3-year duration) drought. The plan would entail construction of extensive new wellfields, groundwater recharge facilities, and desalters. The vast groundwater storage capacities of the Chino Basin and Orange County Basin, as well as other

groundwater basins in the watershed, would be used to store up to 750,000 AF of water purchased and recharged during normal or wet periods. During severe droughts, this water would be extracted at up to 250,000 AF/year through several major wellfields, one of which is contemplated near the hydropower plant on Etiwanda (north of the easterly Ontario service area).

The proposed program would ostensibly free the over-stressed imported sources for use elsewhere in the state until normal hydrologic conditions resumed. The plan envisions up to $1.2 billion of State and Federal funding contributions and SAWPA management has succeeded in the first step of securing approval for $250 million in a bond issue, which was approved by voters in the March 2000 election. Initial planning envisions the wellfields and other facilities being operated by the local water purveyors. The implications of this plan, as it solidifies, must be considered in Ontario source scenarios, as it could impact the viability, timing, and cost of alternative water sources available to the City.

These OBMP planning considerations are further evaluated in the discussion of Ontario's source-mix options in Sections 5 and 7.

3.2 Imported Water

The City is using imported water both directly and indirectly. State Water Project (SWP) water is received through the SWP and Metropolitan Water District of Southern California (MET) conveyance systems and treated at the WFA/WTP in Upland. In addition, when the City produces groundwater in excess of its water rights entitlement, it is essentially causing the purchase of imported water to replenish the groundwater basin.

The potential additional sources of direct-use imported water, to augment the City's groundwater production are as follows:

1. Expanded WFA Plant Capacity (SWP Water).
2. Reactivated Galvin Plant (Colorado River Water).
3. Expanded Lloyd Michael Treatment Plant (LMTP)/Etiwanda Pipeline (SWP Water).

3.3 Other Sources

Additional potential sources, not falling into the category of "normal" groundwater production or imported water, are as follows:

1. Bunker Hill groundwater through Baseline Feeder.
2. OBMP wells and desalter at south end Chino Basin.
3. Recycled water from IEUA RTPs and Outfalls.
4. Treated groundwater from wells/treatment plant system (RO and/or IX) in NMC.
5. Untreated groundwater from existing agriculture wells in NMC in separate nonpotable systems.

These prospective sources are addressed in Section 5 "Source Evaluation" discussion.

The approximate locations of existing water facilities are shown on Figure 4-A.

Section 4 Existing System/Operation

Following is a general description of the City's production and distribution system and operational characteristics.

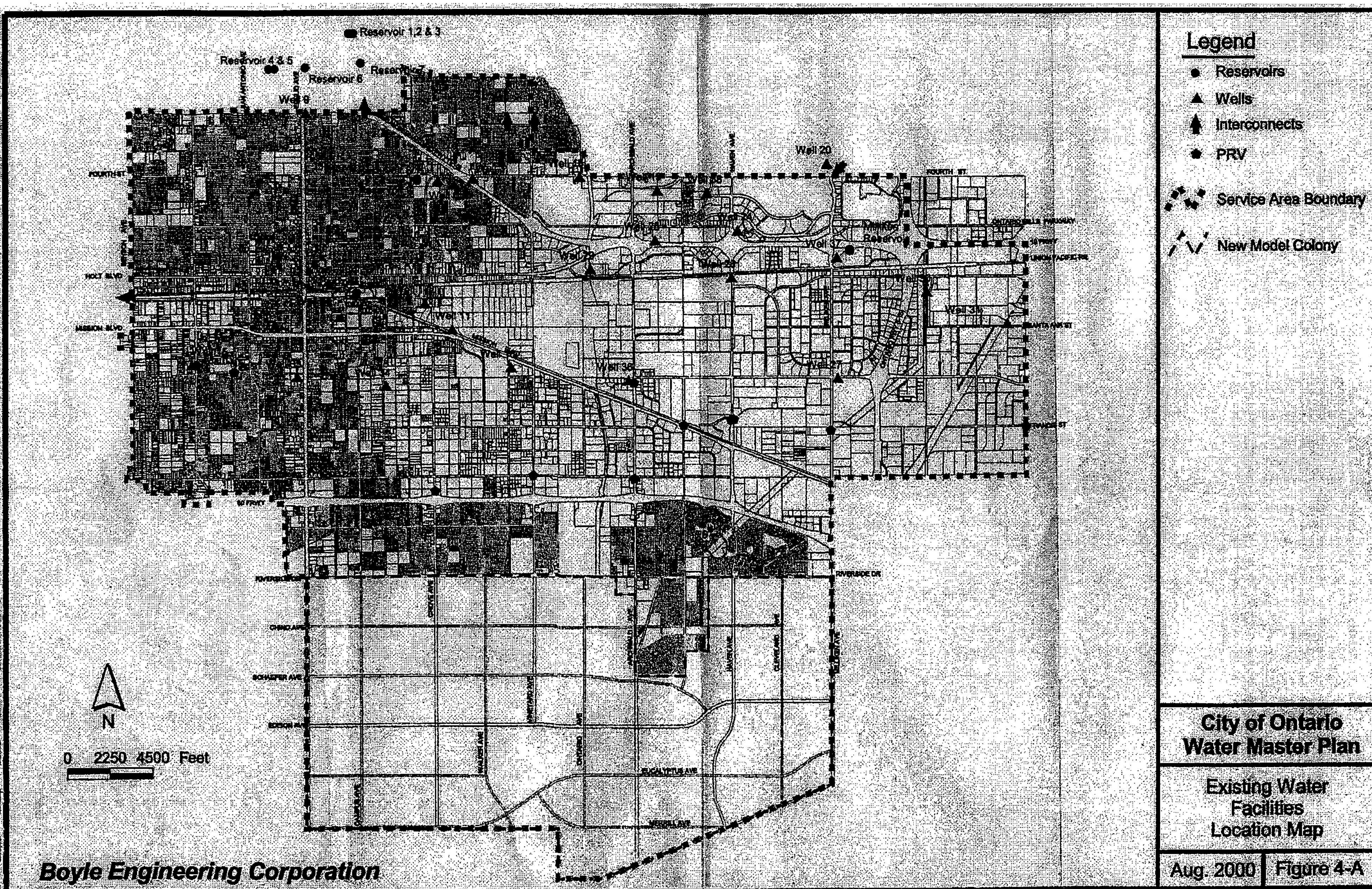
4.1 Pressure Zones

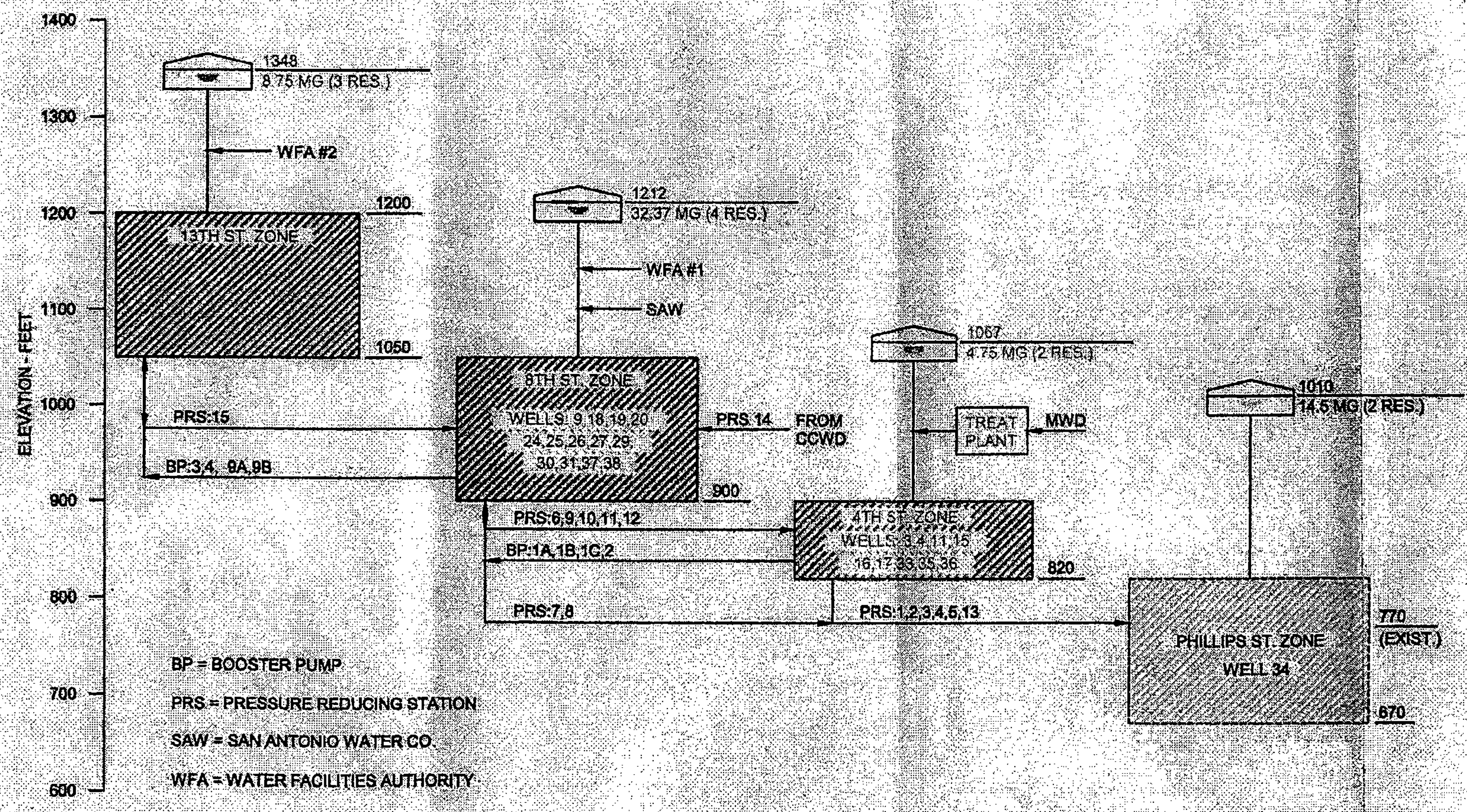
As previously noted, the current City of Ontario water system includes four pressure zones from highest to lowest the 13th Street, 8th Street, 4th Street and Philips Zones. The recently-annexed NMC will be served by an extension of the Phillips Zone and the new "Francis" Zone to the south (see Figure 2-D). The hydraulic gradient for each zone is set by reservoirs. Each zone is served by a combination of wells, booster pumps, pressure-reducing stations, imported supply connections, and interconnections with adjacent water agencies. Refer to Figure 4-A for a map showing major facilities, and to Figure 4-B for a hydraulic schematic of the City system. Figure 4-C shows the modeled backbone distribution system.

4.2 Source Inflow Points, Major Transmission Mains

As previously noted, the primary sources of water to the system are wells, which presently account for an average of about 80 percent of the supply. The remaining source is the WFA Plant, which treats State Project water. Two other sources, not used presently, are the City's MWD Colorado River supply connection through the currently-deactivated Galvin Water Treatment Plant, and San Antonio Water Company groundwater.

The topography of the City is such that the land slopes from north to south, which places the pressure zone boundaries approximately along east-west lines (see Figure 2-D). From Figure 4-A (map showing major water system components), note that all reservoir storage is located in the westerly one-third of the City. This requires major transmission mains to convey flows easterly from the reservoirs to meet peak requirements in the eastern portion of the service area. The primary west-to-east backbone transmission main is a relatively new 36-inch pipeline in the 8th Street Zone, extending along 8th, 5th, and 4th Streets. From this source, water is supplied to the south, where it is pressure-reduced to the 4th and Philips Street Zones.


Reservoir 1,2 & 3
Reservoir 4 & 5
Reservoir 6
Well 6
Well 20
Well 31
Well 36
Well 11
FOURTH ST
HOLT BLVD
MISSION BLVD
RIVERSIDE DR
CHINO AVE
SCHAEFER AVE
EDISON AVE
EUCALYPTUS AVE
MERRILL AVE
N
0 2250 4500 Feet
Legend
Reservoirs
Wells
Interconnects
PRV
Service Area Boundary
New Model Colony
City of Ontario
Water Master Plan
Existing Water
Facilities
Location Map
Aug. 2000
Figure 4-A
Boyle Engineering Corporation

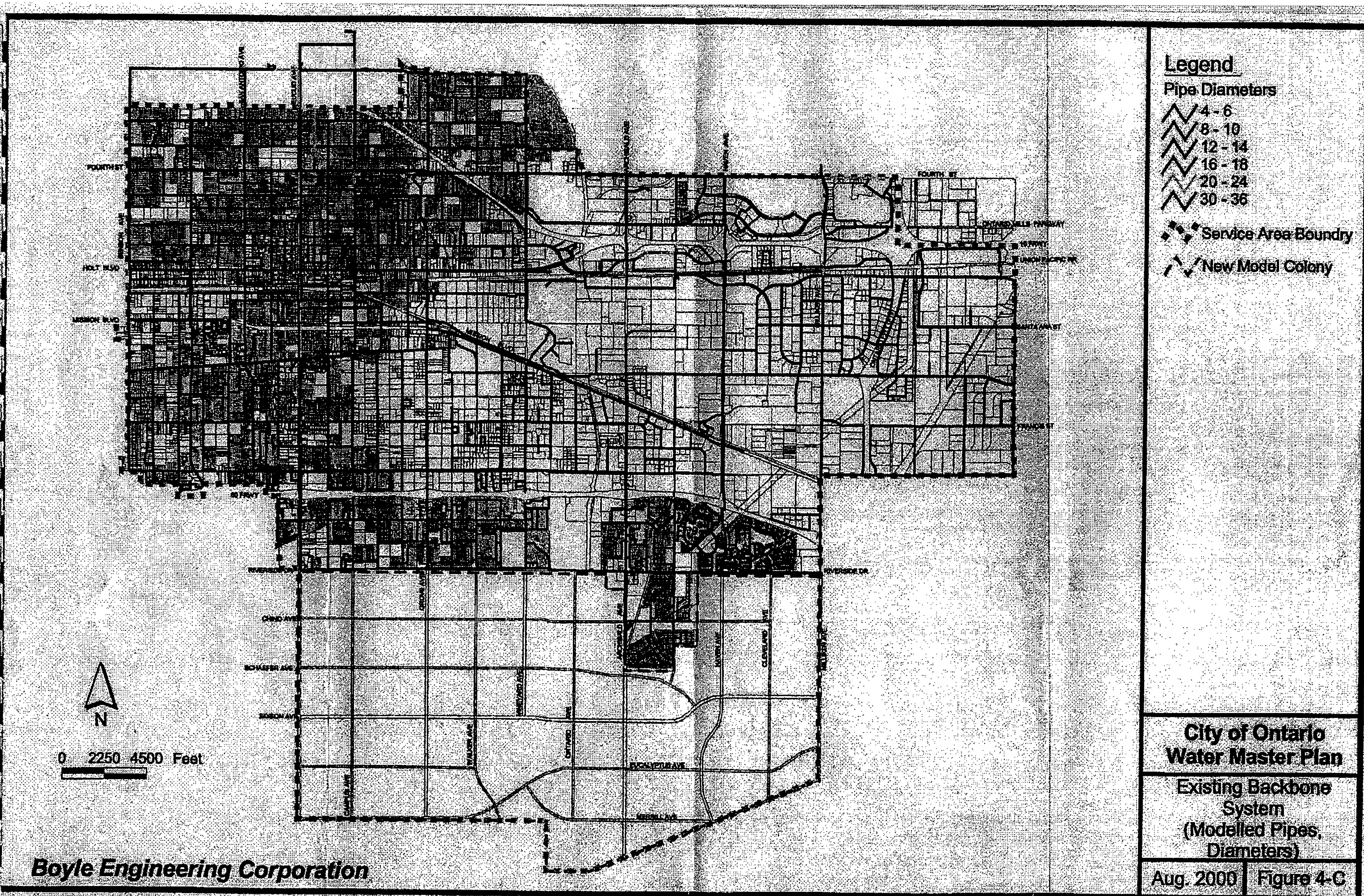


Boyle Engineering Corporation

City of Ontario
Water Master Plan

Schematic of
Existing Water System

Aug. 2000 | Figure 4-B


Legend
Pipe Diameters
4 - 6
8 - 10
12 - 14
16 - 18
20 - 24
30 - 36
Service Area Boundry
New Model Colony
FOURTH ST
HOLT BLVD
MISSION BLVD
RIVERSIDE DR
CHINO AVE
SCHAEFER AVE
EUCALYPTUS AVE
N
0 2250 4500 Feet
Boyle Engineering Corporation
City of Ontario
Water Master Plan
Existing Backbone System (Modelled Pipes, Diameters)
Aug. 2000
Figure 4-C

4.3 Booster Pump Stations

The water system includes three active booster pump stations (BPS), as summarized in Table 4-1. The 7-B booster is presently out of service and is scheduled for demolition. The Galvin BPS, with four pumps (Nos. 1 and 2) is located adjacent to the 4th Street Zone reservoirs. Boosters 3 and 4 are located adjacent to the 8th Street Zone Reservoir. The 9-A and 9-B pumps are located adjacent to Well No. 9. Each BPS operates in response to a low water level in the zone reservoir, and will turn off when the reservoir level is high.

Table 4-1
Booster Pumps

Booster Pump	Zone Transfer From	Zone Transfer To	Pump Type*	Plant Efficiency (%)**	Motor Size (hp)	Capacity (gpm)**
1-A	4th St.	8th St.	VT	66.7	350	4,670
1-B	4th St.	8th St.	VT	71.0	350	4,410
1-C	4th St.	8th St.	VT	73.5	350	5,200
2	4th St.	8th St.	VT	64.4	300	3,010
3	8th St.	13th St.	HSC	67.2	150	2,550
4	8th St.	13th St.	HSC	63.5	100	1,690
7-B ***	8th St.	13th St.	HSC	78.0	60	1,420
9-A	8th St.	13th St.	HSC	62.2	200	2,430
9-B	8th St.	13th St.	HSC	61.4	200	2,550
				ACTIVE TOTAL =		26,510
				To 8th St. Zone		17,290
				To 13th St. Zone		9,220

** Pump Type: VT = Vertical turbine. HSC = Horizontal split-case.*
*** Data per SCE testing.*
**** Station is out of service, scheduled for demolition.*

4.4 Reservoirs

There are currently ten reservoirs in the City system and another (Milliken) under construction. Reservoirs and their characteristics are summarized in Table 4-2. The water surface elevation in each reservoir controls the hydraulic gradient in the pressure zone. Each zone has some storage, varying from 9 to 63 percent of the City total. The 8th Street Zone is seen to have the preponderance of the City's reservoir capacity.

Table 4-2
Reservoirs

Number	Pressure Zone	Capacity (mg) Nominal	Capacity (mg) Usable *	Year Constr.	Elevation (ft.) O'flow	Elevation (ft.) Base	Constr. Material	Roof Material
1	13th St.	3.00	2.75	1972	1,347.9	1,328.0	Concrete	Concrete
2	13th St.	2.00	1.81	1955	1,348.0	1,328.0	Concrete	Concrete
3	13th St.	3.75	3.40	1958	1,348.0	1,328.0	Concrete	Concrete
4	8th St.	20.00	19.24	1959	1,212.0	1,187.5	Concrete	Concrete
5	8th St.	2.00	1.63	no data	no data	no data	Concrete	Aluminum
6	8th St.	0.37	0.30	no data	no data	no data	Concrete	Aluminum
7	8th St.	10.00	8.95	1926	unreadable plans		Concrete	Aluminum
8	4th St.	2.75	2.56	1978	1,073.9	1,054.0	Concrete	Concrete
9	4th St.	2.00	1.72	no data	no data	no data	Concrete	Concrete
10	Phillips St.	5.50	4.58	1982	1,009.6	980.0	Steel	Steel
11	Phillips St.**	9.00	8.25	u/c	1,010.0	980.5	Concrete	Concrete
	Totals	60.37	55.19	(60.37 with Reservoir No. 11).				
13th Street Zone			8.0				14.4%	
8th Street Zone			30.1				54.6%	
4th Street Zone			4.3				7.8%	
Phillips Street Zone			12.8				23.2%	

** Considers outlet piping configuration and that the reservoir is not filled to the overflow elevation.*
*** Under construction.*

4.5 Pressure Reducing Stations

There are 15 pressure-reducing stations (PRS) within the system. Refer to Table 4-3 for a summary of each PRS. Each station contains from one to five valves. Each valve within a PRS is set to come on at a different pressure, as the downstream pressure continues to decrease. Eight of the stations provide flow to the Phillips Street Zone. Since the only other source within that zone is a single well, the PRSs constitute the main supply.

Table 4-3
Pressure Reducing Stations

Station	Location	Pressure Zone From	Pressure Zone To	Ground Elev.	Valve Size (In.)	Set Press. (Psi)	Dnstr. HGL**
S1 *	Euclid n/o 60 Fwy	4th St	Phillips St.	840	4		
	(west side of Euclid)				6		
S2	Euclid n/o 60 Fwy	4th St.	Phillips St.	840	4	61	976
	(east side of Euclid)				8	58	969
					8	52	955
S3	Grove n/o 60 Fwy	4th St.	Phillips St.	834	4	65	979
					8	60	968
					8	55	956
S4	Vineyard @ Philadelphia	4th St.	Phillips St.	838	4	70	995
	(consists of 3 vaults)				4	65	983
					6	55	960
					10	50	949
					12	off	
S5	Archibald s/o Philadelphia	4th St.	Phillips St.	830	4	65	975
	(angle valves)				6	60	964
					8	50	941
S6	Well 36	8th St.	4th St.	893	6	65	1,038
					8	60	1,027
S7	Milliken s/o Francis	8th St.	Phillips St.	876	3	55	993
					4	50	982
					8	45	970
S8	Etiwanda @ Francis	8th St.	Phillips St.	878	4	55	1,000
					8	50	989
					12	40	965
S9	Well 15	8th St.	4th St.	920	4	65	1,065
					8	60	1,054
S10	Turner n/o Mission	8th St.	4th St.	856	4	89	1,057
					6	85	1,047
					10	70	1,013
S11	Cypress @ Phillips	8th St.	4th St.	918	4	62	1,056
					8	57	1,045
S12	Haven s/o Francis	8th St.	4th St.	866	4	79	1,043
	(west side of Haven)				6	73	1,030
					10	68	1,018
S13	Haven s/o Francis	8th St.	Phillips St.	866	4	54	986
	(east side of Haven)				6	49	974
	(has pressure relief valve)				10	44	963
S14	Well 20	CCWD	8th St.	1,040	4	45	1,139
	(above grade)				8	40	1,127
S15	San Antonio @ 4th	13th St.	8th St.	1,094	6	50	1,205

** Station is off-line, standby service.*
*** All valves assumed to be 5 feet below grade, except S7, which is 10 feet.*

4.6 Distribution System

The City's distribution system consists of about 352 miles of pipe, varying in size from 4 to 36 inches in diameter. For the computer hydraulic network analysis, only the "backbone" system consisting of pipes 8 inches and larger, plus some of the existing 6-inch pipe as necessary, were included in the model. The preponderance of modeled pipe is cement mortar lined steel, 8 to 12 inches in diameter. Figure 4-C shows the modeled system. A summary of the characteristics (size, material, year of installation) of the pipelines represented in the model is included in Section 6.

4.7 Interconnections

Five interconnections exist between the City of Ontario and adjacent water systems, as shown on Figure 4-A. All are metered. Only one, a 10-inch connection located on Milliken north of Fourth Street, provides a supply to the City of Ontario—from the Cucamonga County Water District (CCWD). The other four provide water to other agencies, as follows:

- Two 6-inch connections to CCWD, at Sixth Street/Corona Avenue and Sixth Street/Vineyard Avenue.
- An 8-inch connection to the City of Upland at Campus Avenue/Richland Street.
- A 10-inch connection to the City of Chino at Benson Avenue / State Street.

Section 5 Water Management Plan

5.1 Source Water Requirements

The City must be assured of the availability of adequate water sources to meet the foreseeable demands of its growing constituency. As seen from the demand analysis in Section 2, City service area demands are projected to increase dramatically from the current rate of about 43,000 AF/yr. to about 82,000 AF/yr. at projected buildout; a 90 percent increase. The composite mix of sources identified in this Water Management Plan must be able to reliably supply the annual quantities of water as well as the maximum day rates of delivery to accommodate the growth in demands projected for the City including the NMC. For purposes of financial equitability, it is necessary to keep a separate accounting of demands and sources attributable to the recently-annexed NMC.

A portion of the new demand in the NMC can potentially be met by nonpotable sources. If recycled water or subpotable well water can be made available at a competitive price, taking into account the very substantial cost of a separate non-potable distribution system, the majority of the NMC centralized irrigation requirements could be supplied in this manner. This would reduce the quantity of additional potable source water required by a like amount. Although these (central irrigation) demands could be met by either potable or non potable sources, they are separated to facilitate comparative evaluation of sources.

Following is a summary of the demands in the NMC, which could potentially be met with non-potable water. This includes parks, greenbelts, schoolgrounds, golf course, recreation lake, etc. that involve substantial acreage. Small landscape areas associated with residential or commercial development are assumed to be irrigated from the potable system.

The City's total water delivery capacity must be increased to provide water to the various pressure zones at a rate of 47.41 mgd, a portion of which (up to 8.56 mgd) may be met by nonpotable water. The timing of this forecasted increase in demand is addressed in Section 2 and also in Section 6, where a recommended source-mix scenario is defined.

5.2 Existing Source Limitations

The "Time Phased Demand Forecast" (Figure 2-H) shows that demands will rapidly increase when development in the NMC begins, which is projected to occur in the 2003 to 2004 timeframe. The City is evaluating numerous options to provide the needed supply in a timely and cost effective manner. Existing sources, comprised of imported water from the WFA plant and groundwater from the City's well system, are limited by ownership and facility capacity constraints.

Through 1993/94, the sources included imported MET (Colorado River) water through the Galvin Water Filtration Plant, and groundwater from San Antonio Water Company shares taken through an interconnection with Upland. From 1994/95 to the present, with the City taking water only from City wells and WFA, the well supply has averaged over 80 percent of the total. The following Table 5-3 presents a summary of water derived from each source in the past eleven years.

Table 5-3
Historic Water Production
(Volume in AF)

	Groundwater City Wells		Imported MWD *		Imported WFA/JPA		Groundwater San Antonio WC		Total Annual
Year	Volume	% Total	Volume	% Total	Volume	% Total	Volume	% Total	Volume
1988/89	23,214.3	62.6	9,539.6	25.7	2,458.5	6.6	1,894.3	5.1	37,106.7
1989/90	22,914.7	60.6	6,561.7	17.3	7,687.3	20.3	676.1	1.8	37,839.8
1990/91	21,108.4	57.2	4,075.6	11.0	10,202.2	27.6	1,548.4	4.2	36,934.6
1991/92	25,011.6	72.0	2,011.4	5.8	6,780.3	19.5	945.3	2.7	34,748.6
1992/93	22,689.2	64.2	4,859.4	13.8	6,719.6	19.0	1,060.0	3.0	35,328.2
1993/94	22,647.0	64.0	4,265.6	12.1	7,453.7	21.1	996.2	2.8	35,362.5
1994/95	29,046.9	80.5		--	7,021.5	19.5		--	36,068.4
1995/96	33,021.4	81.3		--	7,581.8	18.7		--	40,603.2
1996/97	34,586.0	81.3		--	7,974.4	18.7		--	42,560.4
1997/98	34,481.7	87.9		--	4,747.8	12.1		--	39,229.5
1998/99	36,038.8	83.7		--	6,994.6	16.3		--	43,033.4

** Galvin WTP*

Present Delivery capacity is as follows:

Wells Currently in Service	50.5	mgd
WFA Plant/Conveyance	16.1	mgd
	66.6	mgd

This provides a capacity only slightly above the existing maximum day demand rate of 65.4 mgd—shown in Table 5-2. However, to remedy this situation, the several projects are underway or budgeted in the near future, including new wells and expanded WFA capacity.

5.3 Source Redundancy Considerations

A certain amount of redundancy is desirable in any water supply system to allow for reasonable contingency scenarios. Contingency reductions or outages of supplies/delivery facilities might impact the City's ability to meet demands. Conceivable scenarios include the following:

- Contamination shutdowns of one or more wells.
- Water quality or contamination-related shutdowns of WFA Treatment Plant, Lloyd Michael Treatment Plant, IEUA, RPs or Galvin Plant (if reactivated).
- Earthquake damage to several City wells.
- Earthquake damage to Weymouth Plant, Rialto Pipeline or upstream facilities supplying WFA Plant.

Earthquake damage to OBMP Desalters, IEUA Recycled Water Facilities, Baseline Feeder, Lloyd Michaels Treatment Plant, Colorado River Aqueduct or Galvin Plant (if reactivated), or other regional sources.

- Planned shutdowns of above facilities for repair or rehabilitation.
- General power outage that could cause a shutdown of motor-driven wells, treatment plants, and pump stations.
- Prolonged drought, which could severely limit quantities of water available through the SWP or Colorado River Aqueduct systems.

The worst case scenario would be an extended emergency outage of a major source of supply during the peak demand season. Although it is impossible to predict the probability or duration of these possible outages, the combination of sources. delivery and storage/pumping capacity should be adequate to provide a reasonable measure of "padding" to accommodate a contingency source reduction.

The City of Ontario historically took pride in having adequate groundwater production capacity to withstand drought-related cutbacks in imported supplies. Ongoing advantage of having "surplus" well capacity is the ability to participate in "Seasonal Shift" and other similar Metropolitan Water District of Southern California (MET) subsidy programs designed to reduce seasonal or dry year peaking from their system. However, with growing demands and several wells out of service, the City well capacity now falls considerably short of the ability to meet maximum month demands.

The amount or degree of supply source redundancy to be provided is a matter of preference and affordability. The recommended source mix scenario (Section 7) will include a degree of redundant capacity considered appropriate for the City, taking into account the City's preferences and given the tradeoff between risk and cost.

If affordable, the City may wish to again provide enough well production capacity to be able to meet maximum day demands. As a minimum, the City should have the capability of meeting peak season (maximum month) demands with one of the principal sources (i.e. WFA Plant, 2 or 3 largest wells, OBMP Desalters, etc.) out of service for several weeks. Short-term deviations from the maximum north rate during emergency outages can be handled by enacting demands reductions or by borrowing from storage.

5.4 Evaluation of Alternative Sources

Potential new source options most of which were introduced in Section 3, to expand the City's supply capacity to meet projected additional demands in the City proper and NMC are as follows:

- Additional Wells in City or north of City.
- Expanded WFA Capacity.
- Additional San Antonio Water Company Shares.
- CCWD; LMTP/Etiwanda Feeder (SWP Water).
- Bunker Hill Groundwater through Baseline Feeder.

- Wells in NMC with NO_3 Treatment.
- Wells in NMC with Desalting.
- OBMP Desalters in southern Chino Basin.
- Galvin Plant Reactivation (Colorado River Water).
- Non-potable Supply from NMC High Nitrate Wells.
- Recycled Water from IEUA RPs/Outfalls.

A brief description of each of the major source alternatives is presented in the following paragraphs. Figure 3-A shows the approximate location of existing or planned regional facilities.

5.4.1 Additional Wells in City

Although the City is already producing groundwater well in excess of its base allotment, expanding groundwater production by constructing additional wells in the City or in adjacent jurisdictions is the most obvious choice for providing source capacity to meet increasing demands. Specific capacities are generally good in the central and northern areas of the City with yields of existing wells as great as 3,500 gpm. Outside of the contamination plumes, water quality is generally excellent, with TDS averaging around 250 mg/l. The cost of additional groundwater production (beyond safe yield) includes amortized new well facility costs, O&M costs, purchase of replenishment water, and replenishment costs paid to the Watermaster. Also to be taken into consideration are the availability and cost of well sites and the piping and appurtenances to tie into the City's storage and distribution facilities.

However, an increased concentration of wells and production could cause alteration of prevailing gradients and resulting movement of contaminated water toward the production depressions. This could cause future shutdowns or necessitate wellhead treatment.

5.4.2 Expanded Capacity WFA Plant

The WFA Water Treatment Plant in Upland has recently been uprated to a nominal capacity of 81 mgd. The City entitlement to this expanded WFA Plant capacity is 26.1 mgd. It may be possible to ultimately increase the nominal rated capacity of the plant to as great