Los Angeles Department of Water & Power

LARGE-DIAMETER PIPELINE REHABILITATION

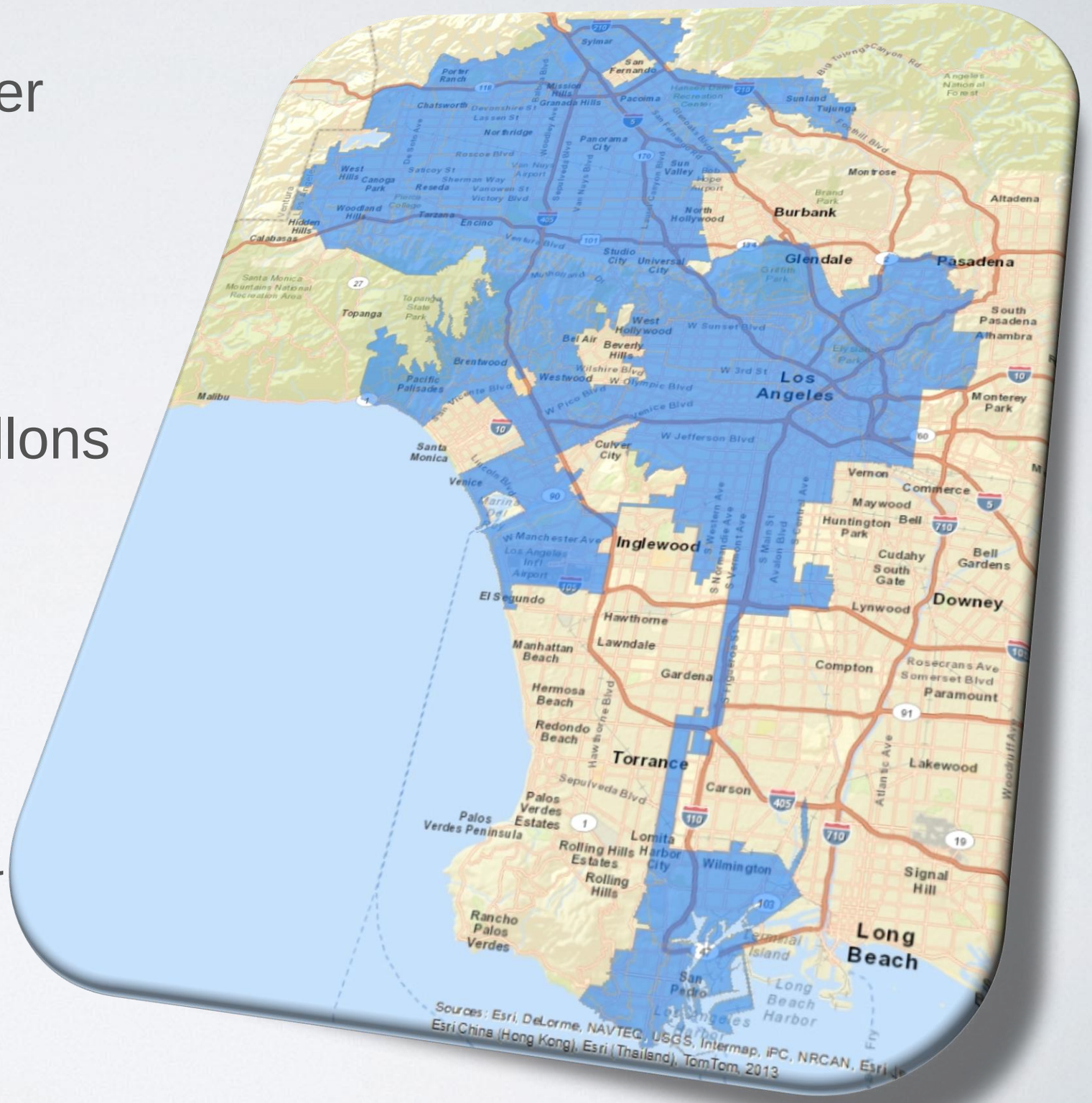
CHARLES NGO
TRUNK LINE DESIGN MANAGER
WATER ENGINEERING AND TECHNICAL SERVICES

AGENDA

- LADWP System Overview
- Asset Management
- Pipeline Rehabilitation

2015 WATER SYSTEM STATISTICS

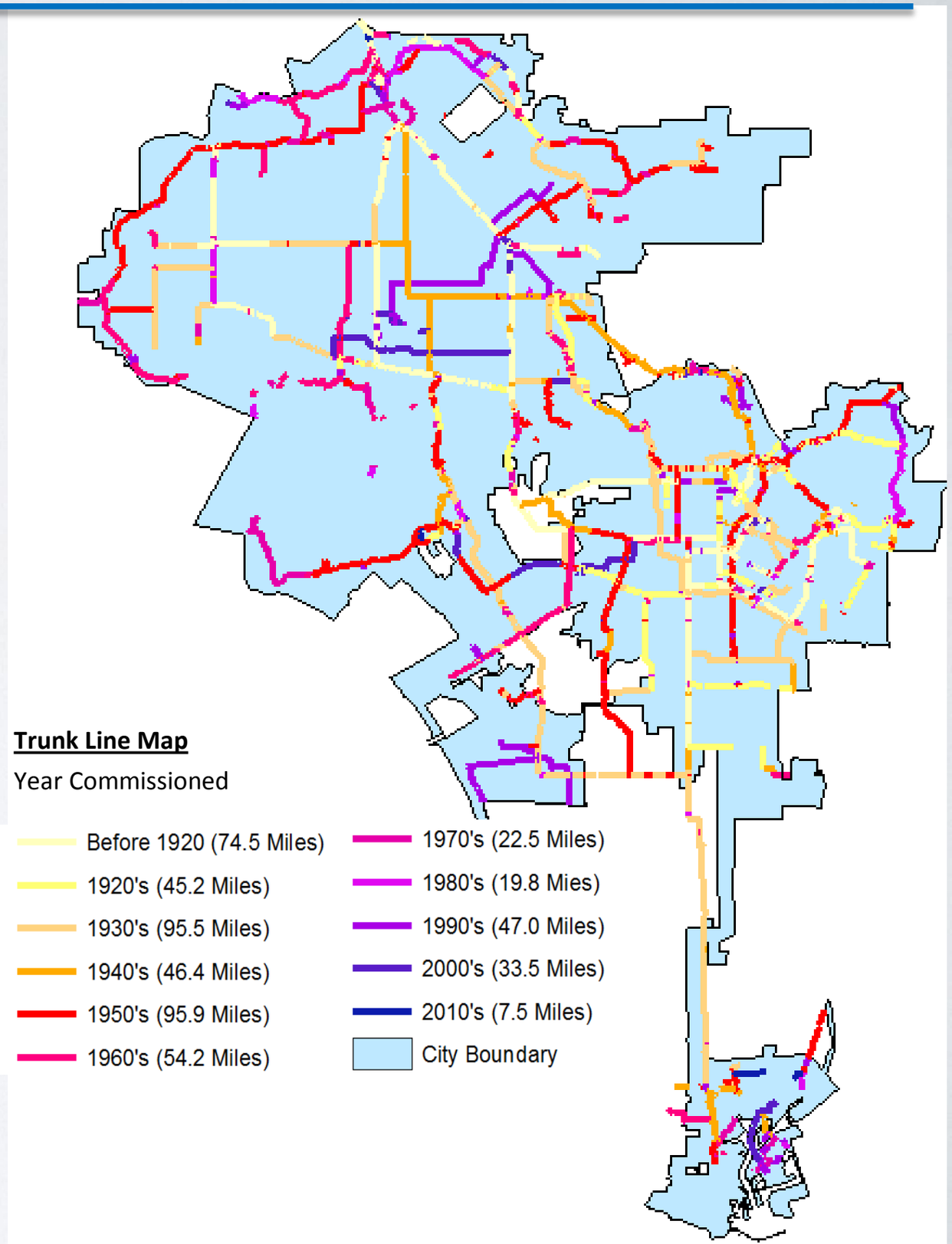
- 2nd Largest Municipal Water Utility in U.S.
- Serving 3.9 Million People
- Average Usage is 131 Gallons Per Day
- 473 Square Miles of Service Area
- 6,734 Miles of Mainlines & **542 Miles of Trunk Lines**



TRUNK LINE OVERVIEW

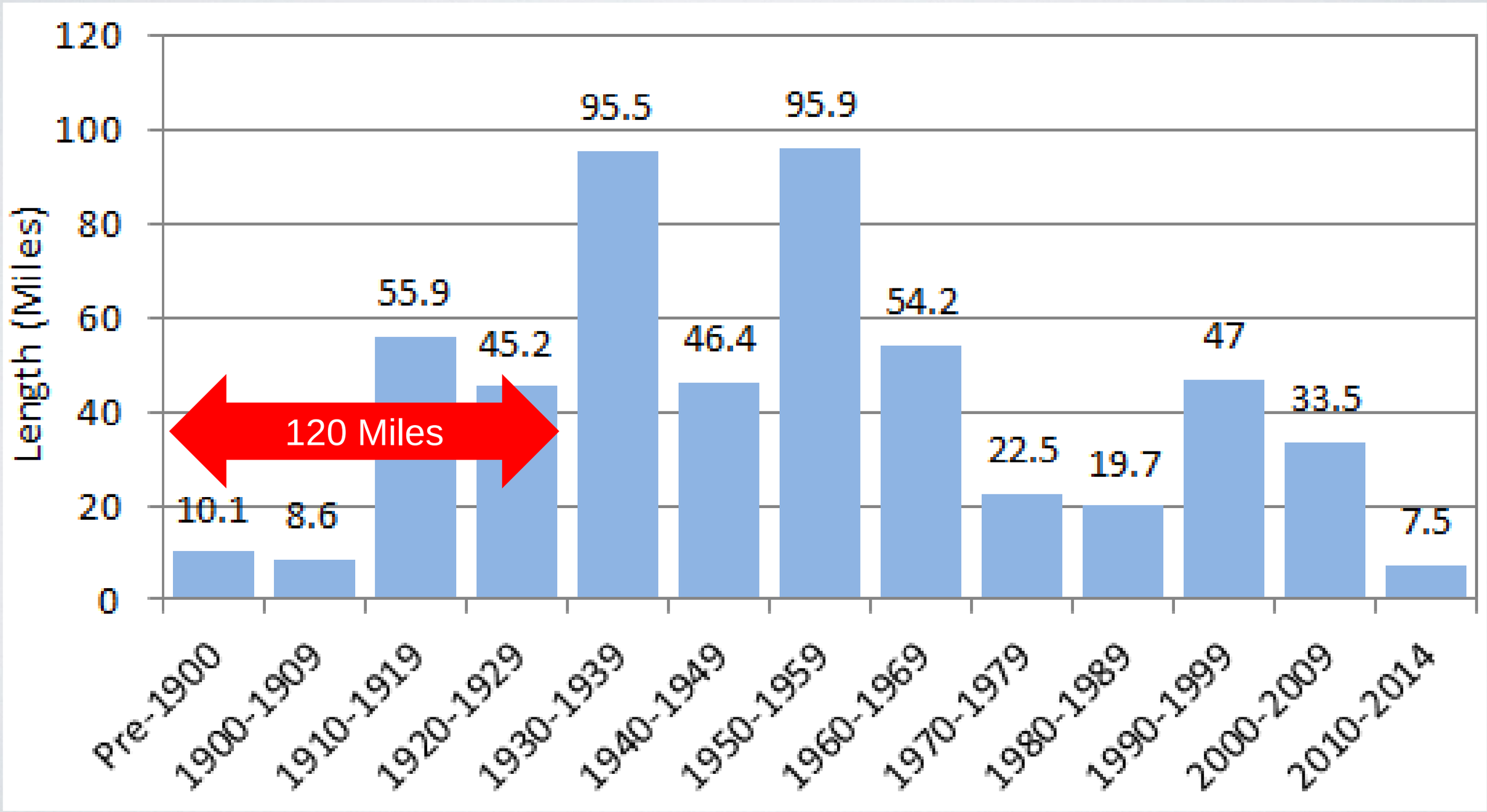
Overview:

- 24 in. diameter & greater
- 542 miles in total length
- In the next decade, 120 miles (22%) of TL's will reach their useful life of 100 years
- Average replacement rate from last 10 years is 2.6 miles per year
- At this rate, the replacement cycle is almost 210 years



TRUNK LINE OVERVIEW

Inventory by Decade



TRUNK LINE OVERVIEW

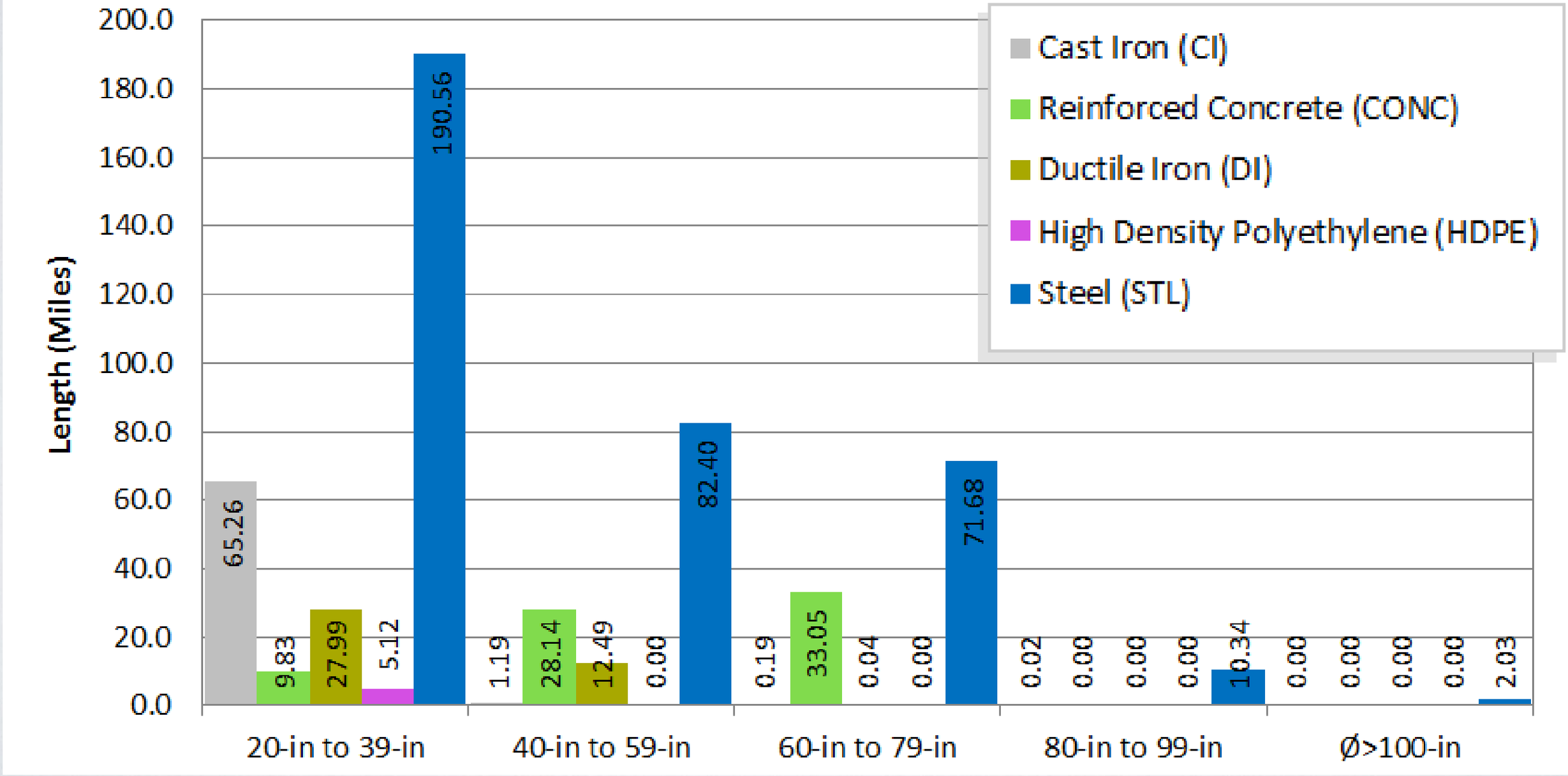
Table - LADWP Trunk Line Inventory

Material	Avg Life (yr)	Length (Miles)				
		20-in to 39-in	40-in to 59-in	60-in to 79-in	80-in to 99-in	Ø>100-in
Asbestos Concrete (AC)	60	0.00	-	0.01	-	-
Cast Iron (CI)	100	65.26	1.19	0.19	0.02	-
Reinforced Concrete (CONC)	60	9.83	28.14	33.05	0.00	-
Corrugated Metal (CM)	60	0.11	-	-	-	-
Ductile Iron (DI)	100	27.99	12.49	0.04	-	-
High Density Polyethylene (HDPE)	80	5.12	-	-	-	-
Steel (STL)	120	190.56	82.40	71.68	10.34	2.03
Unknown Materials (UNKN)	-	1.41	0.05	0.00	-	0.00
Total						

Last Update: 7/1/2014, Source: GIS Pipe Data

TRUNK LINE OVERVIEW

Inventory by Diameter & Material Types



ASSET MANAGEMENT

Likelihood of Failure (LOF) Factors

- ~~Leaks~~
- ~~Pipe Materials~~
- ~~Service Life~~
- ~~Soil Corrosivity~~
- ~~Water Pressure~~

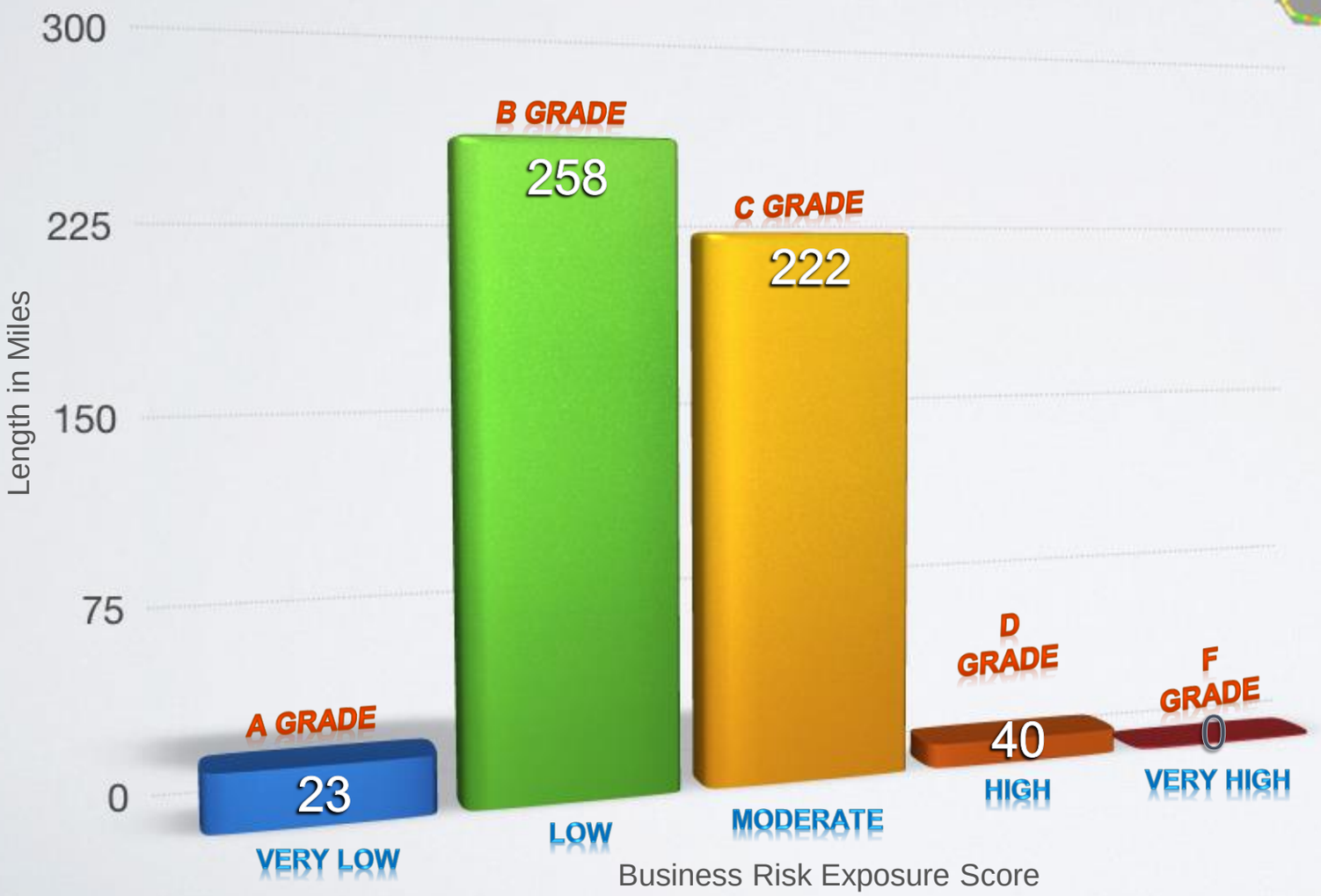
ASSET MANAGEMENT

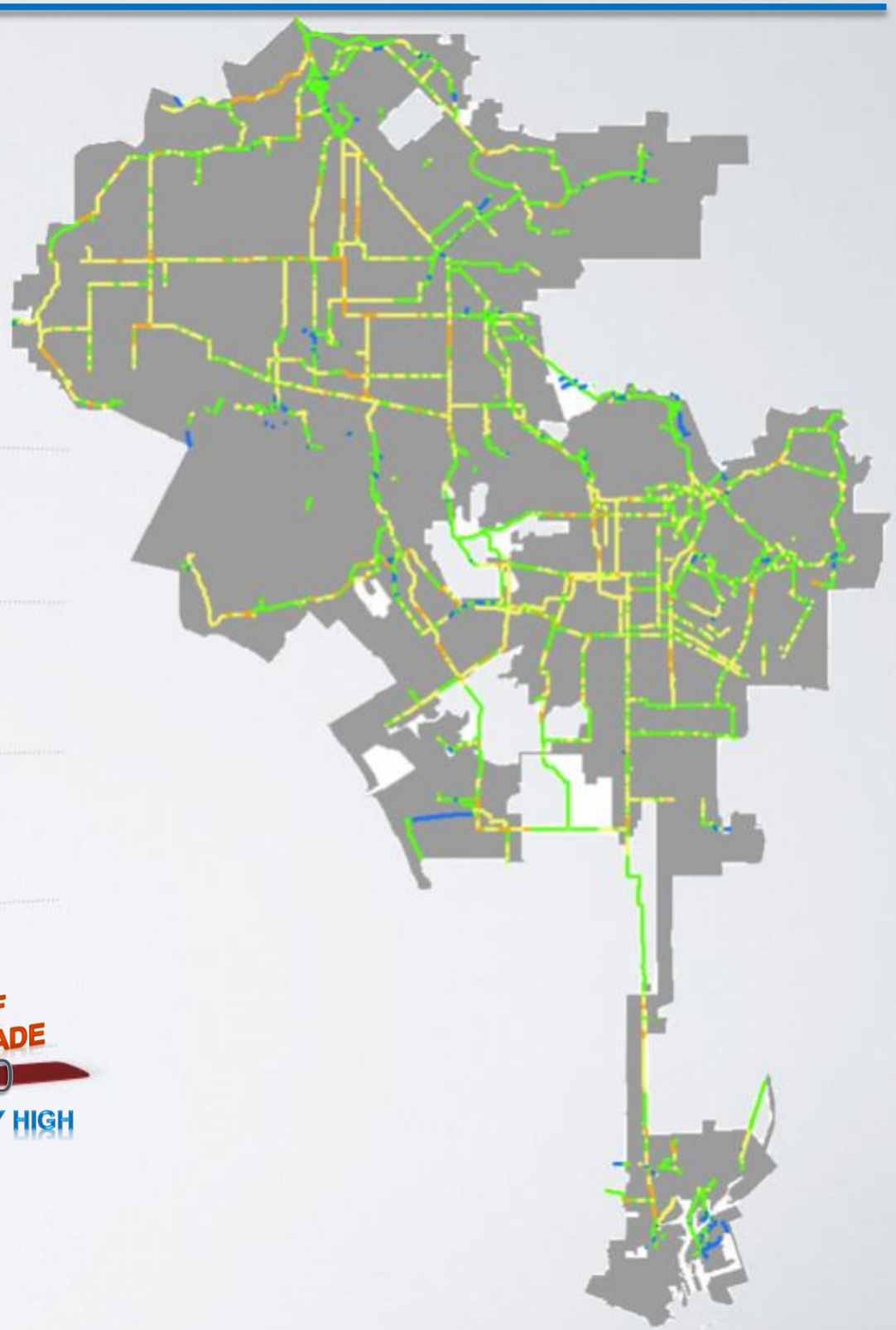
Consequences of Failure (COF) Factors

- Community Safety, Health, and Welfare
- Environmental and Traffic Impacts
- Repair Costs
- Lost Revenue
- Critical Customers

ASSET MANAGEMENT

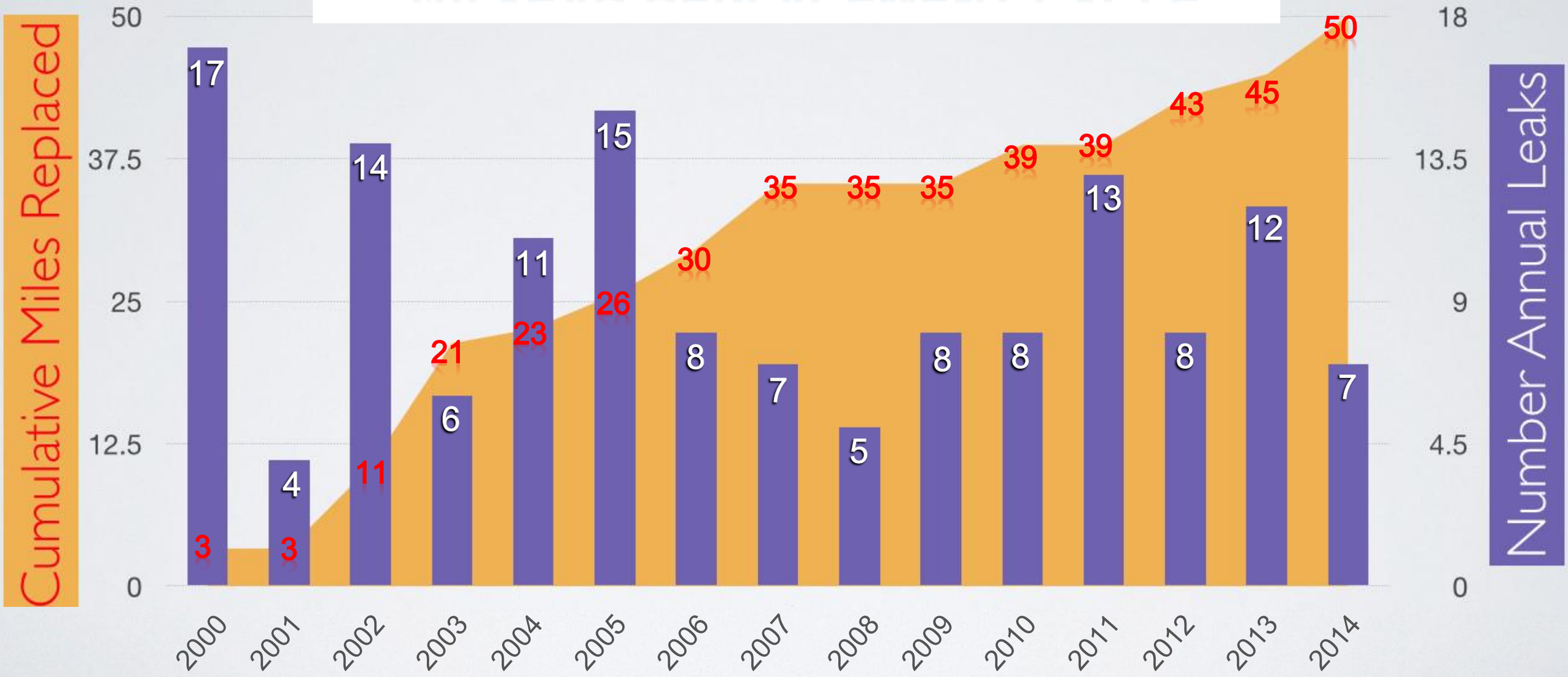
TRUNK LINE
BUSINESS RISK EXPOSURE





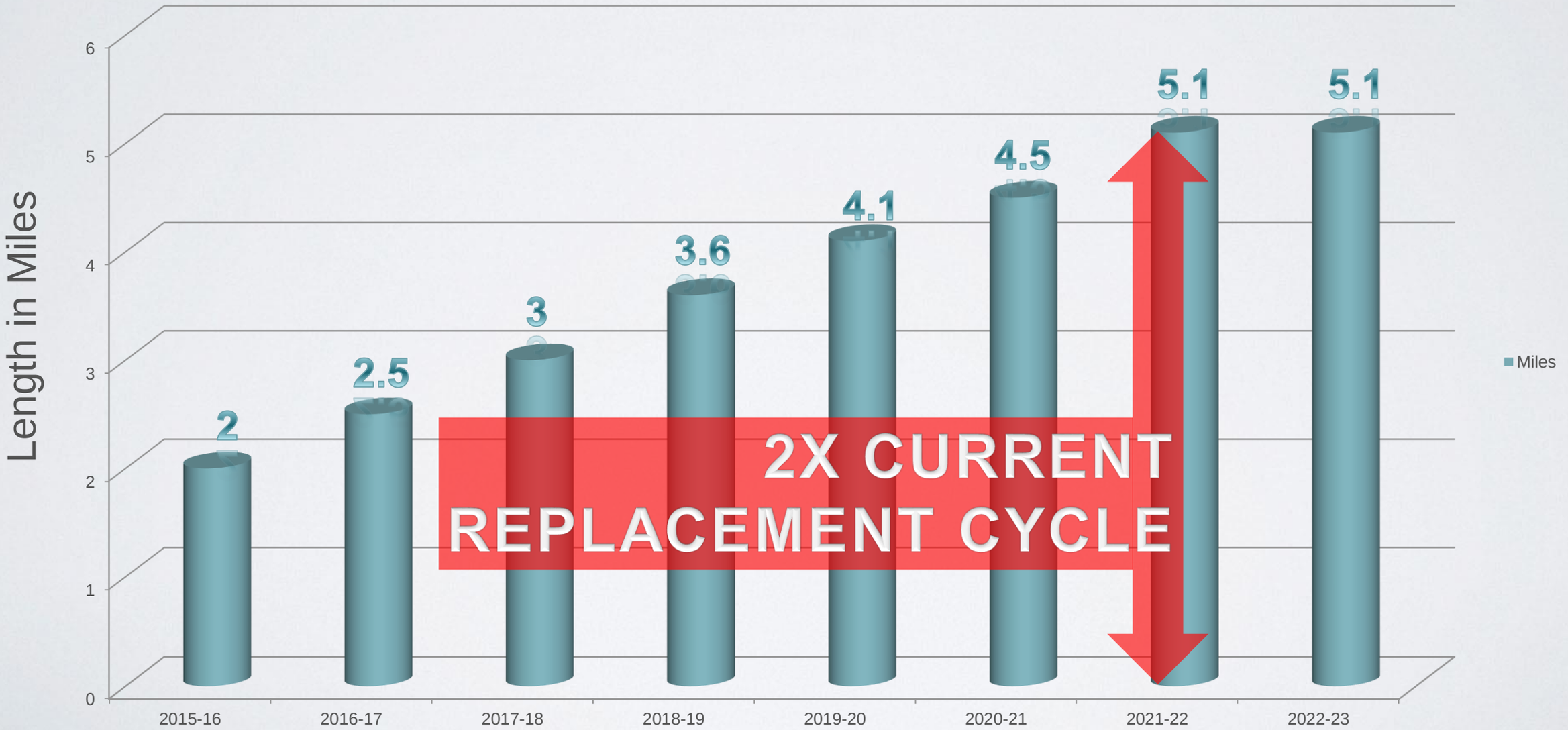
TRUNK LINE REPLACEMENT

AVERAGE IS 2.6 MILES PER YEAR
210 YEAR REPLACEMENT CYCLE



TRUNK LINE REPLACEMENT GOALS

AVERAGE IS 5.1 MILES PER YEAR
106 YEAR REPLACEMENT CYCLE

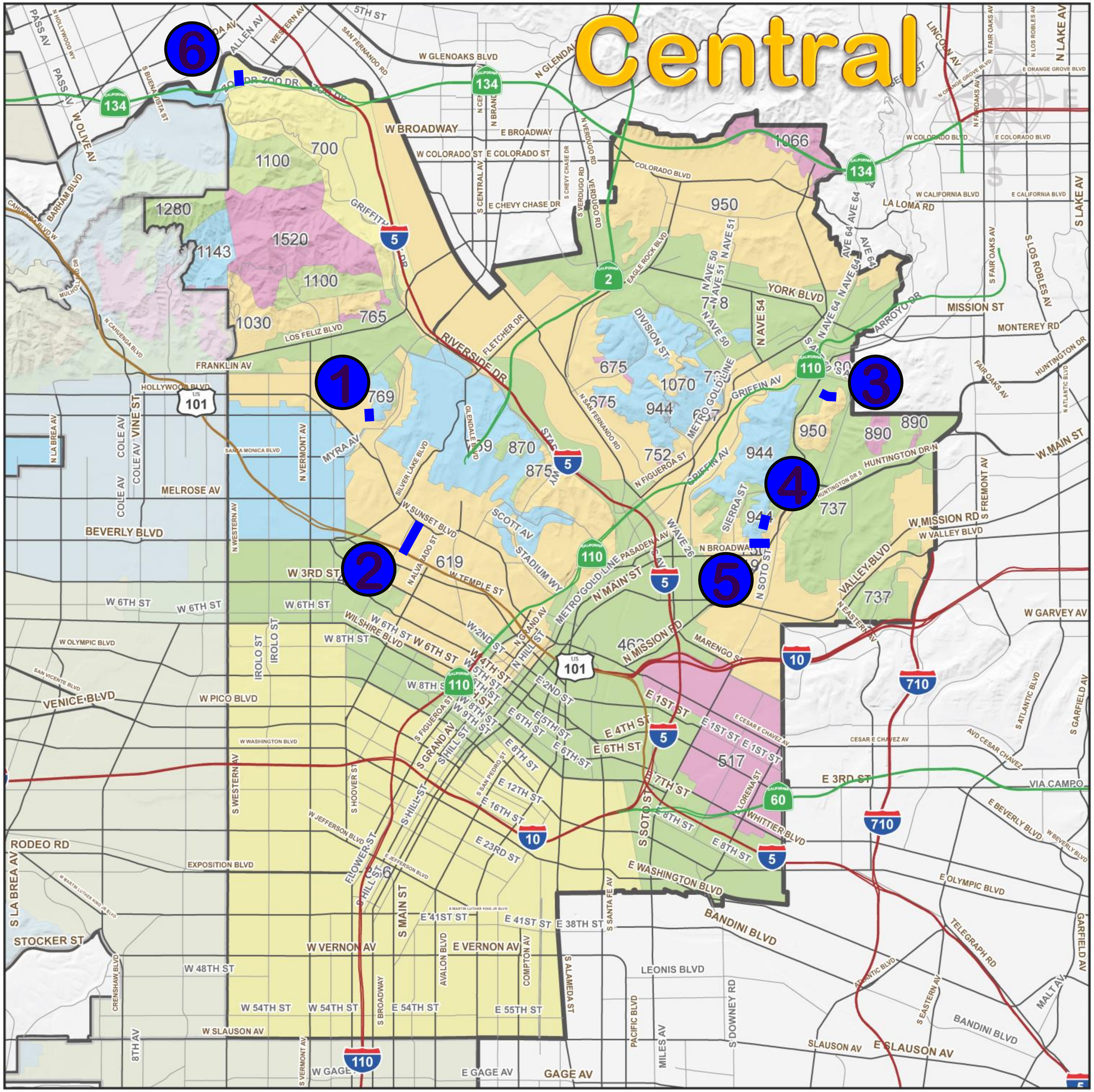


PIPE REHABILITATION

1950
TL Cement Lining
Program started

1990
Mainlines Cement Lining
Program

June 2007
Program completed


Central
1
2
3
4
5
6
W GLENOAKS BLVD
W BROADWAY
E BROADWAY
W COLORADO ST
E COLORADO ST
COLORADO BLVD
YORK BLVD
MISSION ST
MONTEREY RD
HUNTINGTON DR
LOS FELIZ BLVD
FRANKLIN AV
HOLLYWOOD BLVD
RIVERSIDE DR
FLETCHER DR
MELROSE AV
BEVERLY BLVD
W 3RD ST
W 6TH ST
W 8TH ST
W OLYMPIC BLVD
VENICE BLVD
W PICO BLVD
W SUNSET BLVD
W TEMPLE ST
WILSHIRE BLVD
N MISSION RD
N BROADWAY
W MISSION RD
W VALLEY BLVD
VALLEY BLVD
W MAIN ST
W GARVEY AV
E 1ST ST
E 4TH ST
E 6TH ST
E 3RD ST
WHITTIER BLVD
E 8TH ST
E WASHINGTON BLVD
BANDINI BLVD
E OLYMPIC BLVD
TELEGRAPH RD
EXPOSITION BLVD
RODEO RD
STOCKER ST
W VERNON AV
E VERNON AV
E 41ST ST
W 48TH ST
W 54TH ST
E 54TH ST
E 55TH ST
W SLAUSON AV
E SLAUSON AV
W GAGE AV
E GAGE AV
GAGE AV
LEONIS BLVD
S MAIN ST
S LA BREA AV
1100
700
1280
1520
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1030
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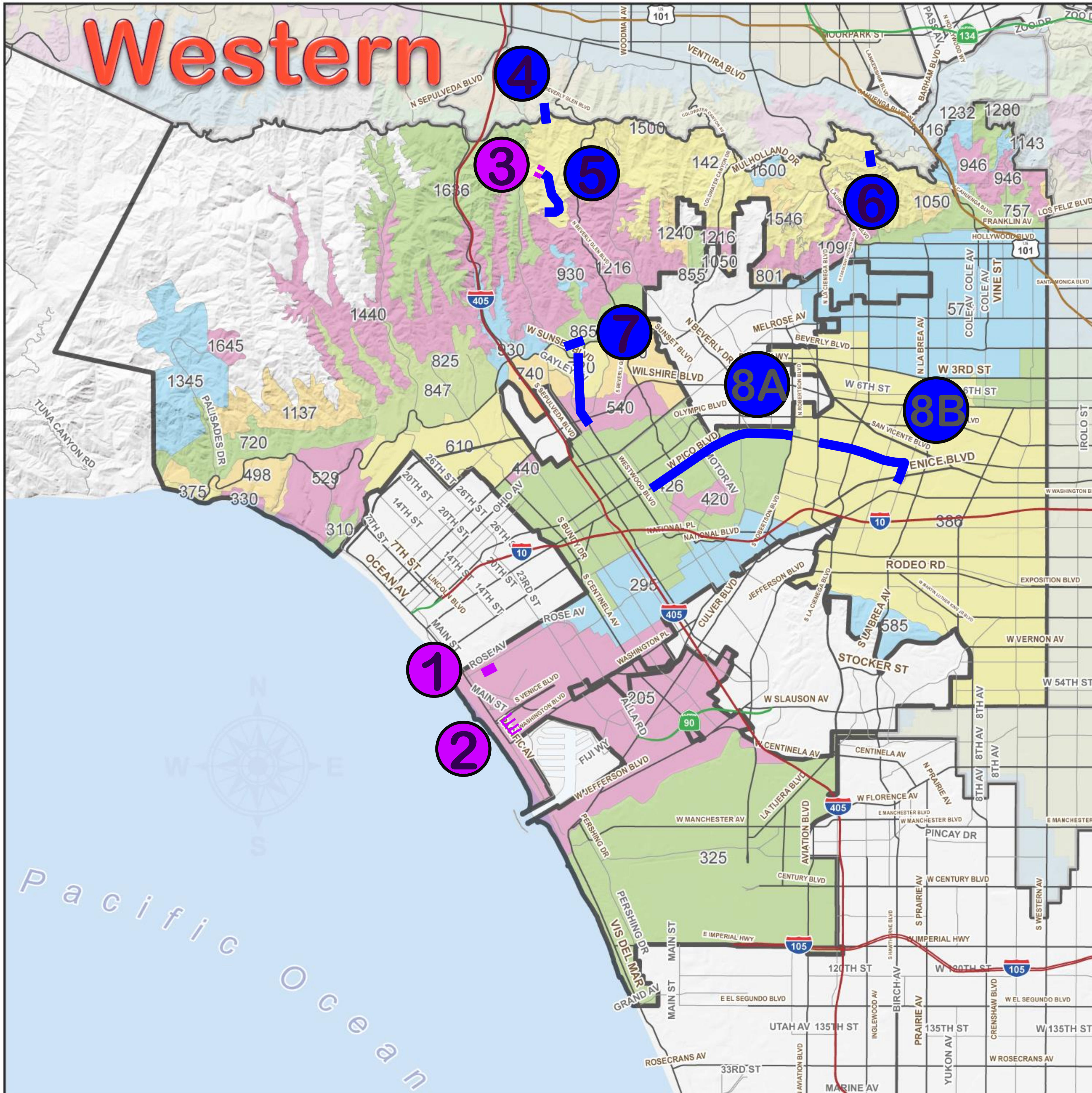
890
870
875
752
737
619
517
1100


Western
1
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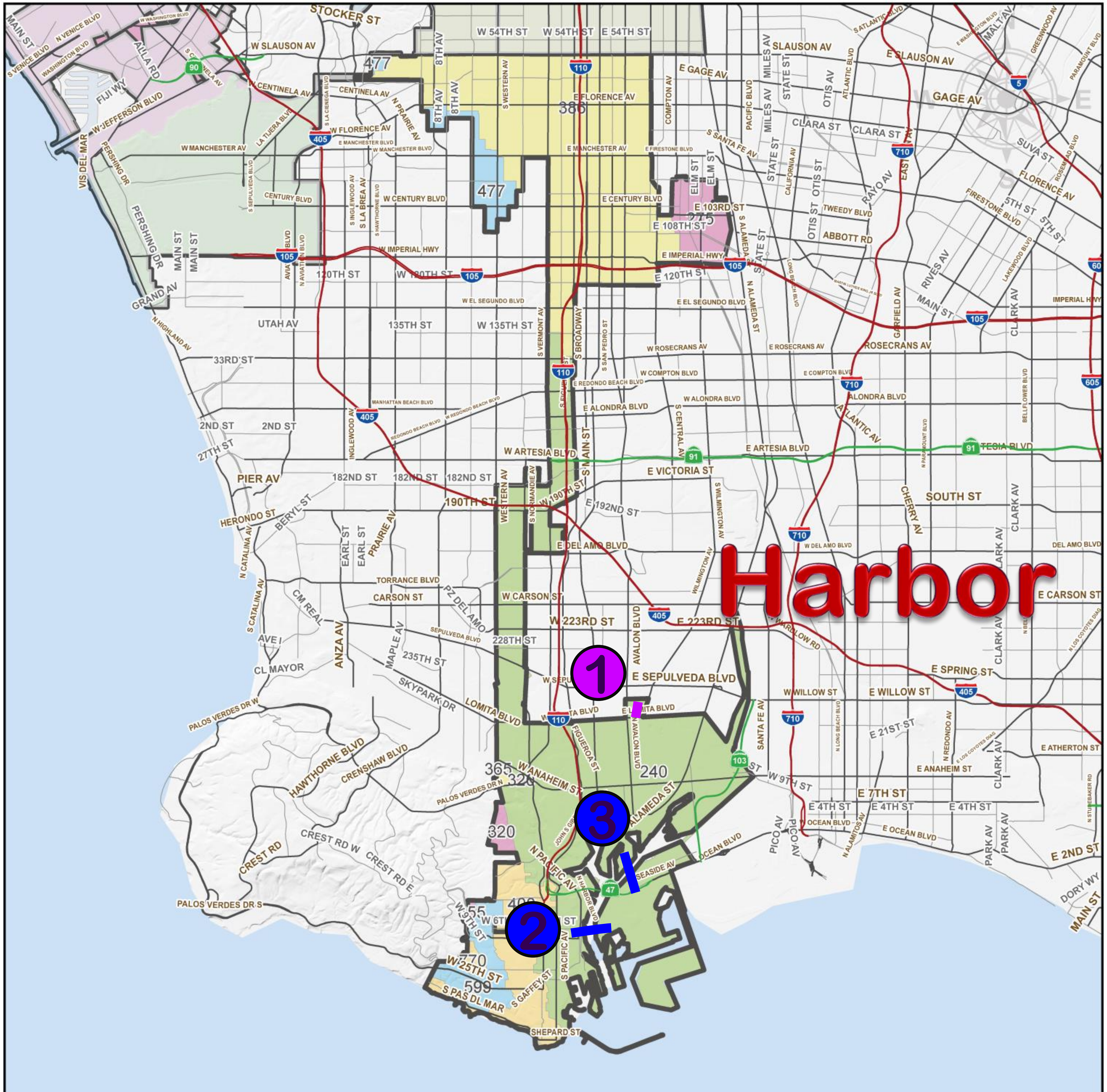
7
8A
8B
Pacific Ocean


Harbor
1
2
3
240
320
365
386
477
275
400
55
770
599
STOCKER ST
W 54TH ST
W 54TH ST
E 54TH ST
W SLAUSON AV
SLAUSON AV
E SLAUSON AV
E GAGE AV
GAGE AV
E FLORENCE AV
W FLORENCE AV
CENTINELA AV
W CENTINELA AV
W MANCHESTER AV
E MANCHESTER AV
CENTURY BLVD
W CENTURY BLVD
E CENTURY BLVD
E 103RD ST
E 108TH ST
W IMPERIAL HWY
E IMPERIAL HWY
120TH ST
W 120TH ST
E 120TH ST
W EL SEGUNDO BLVD
E EL SEGUNDO BLVD
UTAH AV
135TH ST
W 135TH ST
W ROSECRANS AV
E ROSECRANS AV
ROSECRANS AV
33RD ST
W COMPTON BLVD
E COMPTON BLVD
E ALONDRA BLVD
W ALONDRA BLVD
ALONDRA BLVD
2ND ST
2ND ST
27TH ST
W ARTESIA BLVD
E ARTESIA BLVD
PIER AV
182ND ST
182ND ST
182ND ST
E VICTORIA ST
190TH ST
W 190TH ST
E 192ND ST
SOUTH ST
HERONDO ST
BERYL ST
E DEL AMO BLVD
W DEL AMO BLVD
DEL AMO BLVD
TORRANCE BLVD
CARSON ST
W CARSON ST
E CARSON ST
W 223RD ST
E 223RD ST
228TH ST
235TH ST
CL MAYOR
E SEPULVEDA BLVD
E SPRING ST
W WILLOW ST
E WILLOW ST
LOMITA BLVD
SKYPARK DR
PALOS VERDES DR W
HAWTHORNE BLVD
CRENSHAW BLVD
W ANAHEIM ST
E ANAHEIM ST
PALOS VERDES DR N
E 21ST ST
E ATHERTON ST
W 9TH ST
E 7TH ST
E 4TH ST
E 4TH ST
E 4TH ST
OCEAN BLVD
E OCEAN BLVD
CREST RD
CREST RD W
CREST RD E
SEASIDE AV
PALOS VERDES DR S
W 6TH ST
W 9TH ST
W 25TH ST
S PAS DL MAR
S GAFFEY ST
SHEPARD ST
E 2ND ST
DORY WY
MAIN ST
N PACIFIC AV
S PACIFIC AV
ALAMEDA ST
FIGUEROA ST
AVALON BLVD
WESTERN AV
S VERMONT AV
S BROADWAY
S MAIN ST
CLARK AV
PARK AV
PICO AV
CHERRY AV
SANTA FE AV
ANZA AV
MAPLE AV
EARL ST
PRAIRIE AV
INGLEWOOD AV
PERSHING DR
VIS DEL MAR
GRAND AV
W JEFFERSON BLVD
FIJI WY
ALLA RD
S VENICE BLVD
N VENICE BLVD
WASHINGTON BLVD
MAIN ST
CLARA ST
CLARA ST
OTIS AV
OTIS ST
ELM ST
STATE ST
MILES AV
COMPTON AV
PACIFIC BLVD
RAYO AV
TWEEDY BLVD
ABBOTT RD
FIRESTONE BLVD
FLORENCE AV
SUVA ST
5TH ST
RIVES AV
MAIN ST
GARFIELD AV
ATLANTIC AV
IMPERIAL HWY
8TH AV
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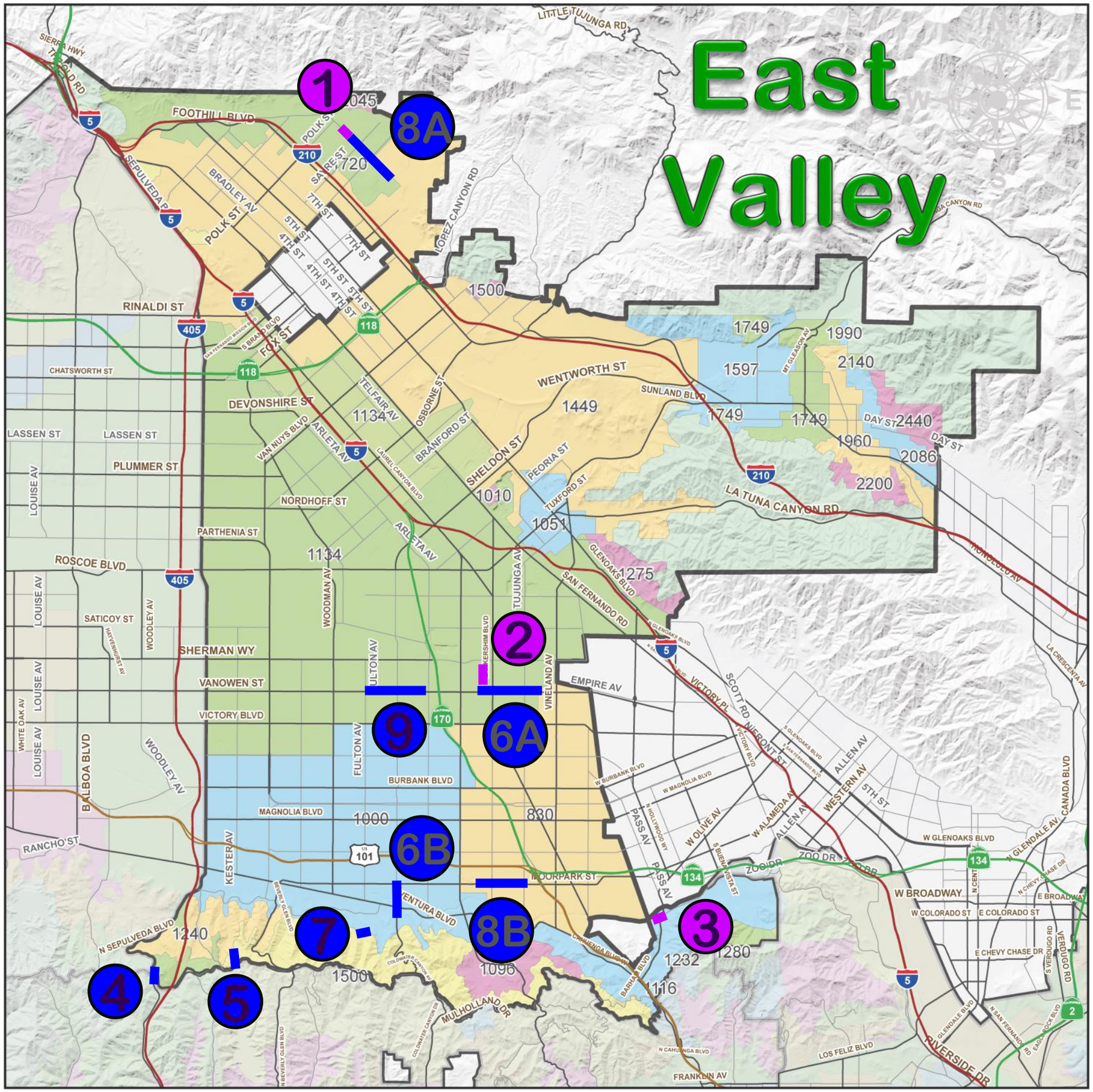
105
405
710
605
5
90
91
47
103


East Valley
1
8A
2
9
6A
6B
7
8B
3
4
5
LITTLE TUJUNGA RD
SIERRA HWY
FOOTHILL BLVD
POLK ST
SAN FERNANDO RD
BRADLEY AV
SEPULVEDA BLVD
LOPEZ CANYON RD
7TH ST
5TH ST
4TH ST
RINALDI ST
FOX ST
S BRAND BLVD
CHATSWORTH ST
DEVONSHIRE ST
TELFAIR AV
OSBORNE ST
WENTWORTH ST
SUNLAND BLVD
MT GLEASON AV
DAY ST
LASSEN ST
PLUMMER ST
VAN NUYS BLVD
ARLETA AV
BRANFORD ST
SHELDON ST
PEORIA ST
TUXFORD ST
LA TUNA CANYON RD
LOUISE AV
NORDHOFF ST
PARTHENIA ST
LAUREL CANYON BLVD
ROSCOE BLVD
WOODMAN AV
TUJUNGA AV
GLENOAKS BLVD
SATICOY ST
WOODLEY AV
HAYVENHURST AV
SHERMAN WY
VANOWEN ST
KERSHIM BLVD
VINELAND AV
EMPIRE AV
VICTORY BLVD
FULTON AV
SCOTT RD
NIERONT ST
VICTORY PL
WHITE OAK AV
BURBANK BLVD
W BURBANK BLVD
W MAGNOLIA BLVD
ALLEN AV
WESTERN AV
5TH ST
CANADA BLVD
BALBOA BLVD
MAGNOLIA BLVD
PASS AV
W OLIVE AV
W ALAMEDA AV
RANCHO ST
KESTER AV
VENTURA BLVD
MOORPARK ST
S BUENA VISTA ST
ZOO DR
W GLENOAKS BLVD
N GLENDALE AV
W BROADWAY
E BROADWAY
W COLORADO ST
E COLORADO ST
E CHEVY CHASE DR
VERDUGO RD
N SEPULVEDA BLVD
BEVERLY GLEN BLVD
COLDWATER CANYON DR
MULHOLLAND DR
CAHUENGA BLVD
BARHAM BLVD
LOS FELIZ BLVD
GLENDALE BLVD
N SAN FERNANDO RD
EAGLE ROCK BLVD
RIVERSIDE DR
FRANKLIN AV
1045
720
1500
1749
1990
2140
1597
1449
1749
1749
2440
1960
2086
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1134
1134
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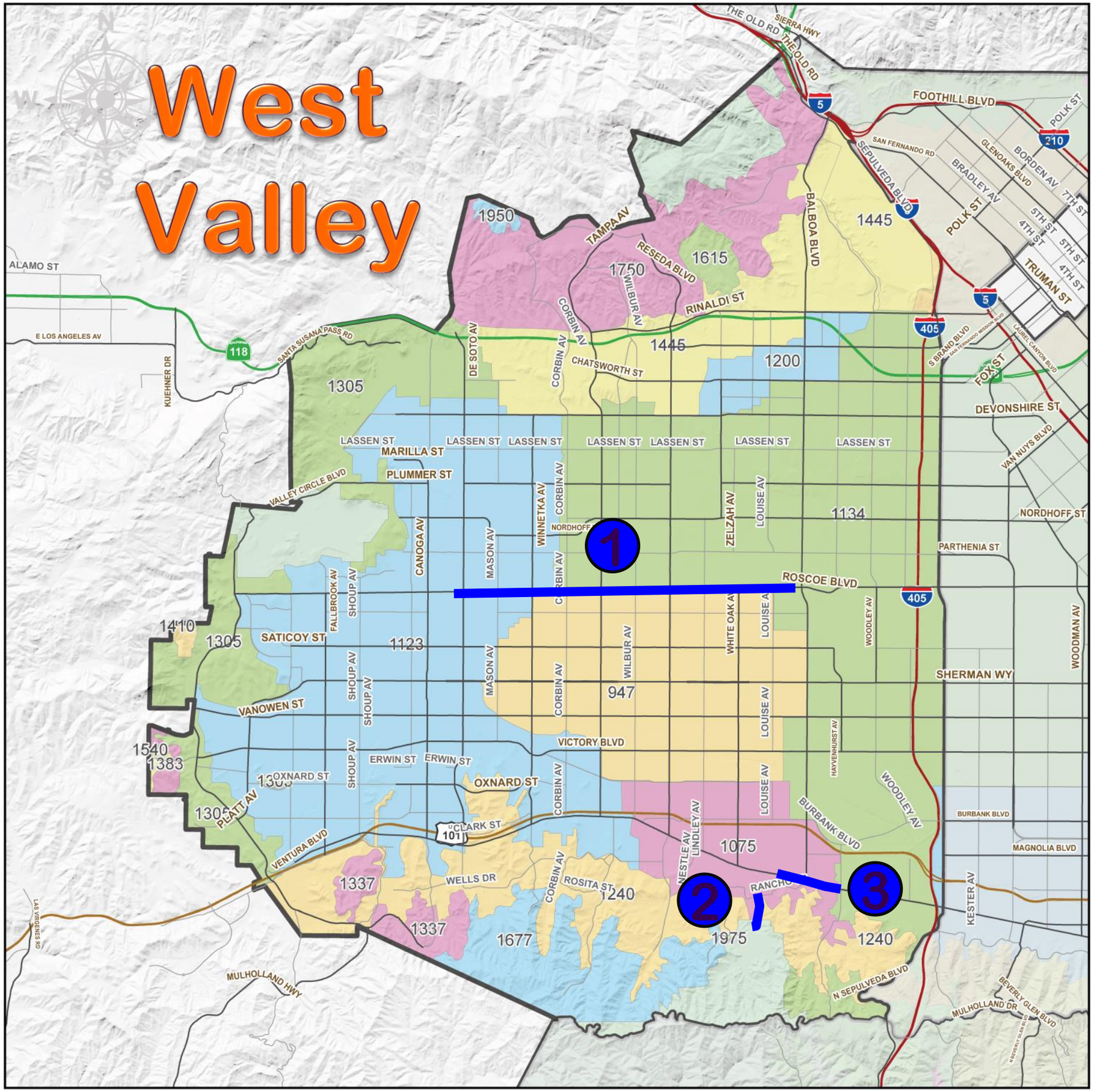
1096
1232
1280
1116

West Valley


1
2
3
SIERRA HWY
THE OLD RD
FOOTHILL BLVD
POLK ST
SAN FERNANDO RD
GLENOAKS BLVD
BORDEN AV
7TH ST
BRADLEY AV
SEPULVEDA BLVD
BALBOA BLVD
1445
1950
TAMPA AV
RESEDA BLVD
1615
1750
WILBUR AV
RINALDI ST
TRUMAN ST
ALAMO ST
E LOS ANGELES AV
KUEHNER DR
SANTA SUSANA PASS RD
DE SOTO AV
CORBIN AV
CHATSWORTH ST
1200
S BRAND BLVD
FOX ST
DEVONSHIRE ST
1305
LASSEN ST
MARILLA ST
PLUMMER ST
VALLEY CIRCLE BLVD
VAN NUYS BLVD
CANOGA AV
MASON AV
WINNETKA AV
NORDHOFF ST
ZELZAH AV
LOUISE AV
1134
PARTHENIA ST
ROSCOE BLVD
1410
SATICOY ST
FALLBROOK AV
SHOUP AV
1123
WHITE OAK AV
WOODLEY AV
WOODMAN AV
SHERMAN WY
947
VANOWEN ST
HAYVENHURST AV
1540
1383
VICTORY BLVD
ERWIN ST
OXNARD ST
PLATT AV
CLARK ST
101
VENTURA BLVD
BURBANK BLVD
1075
MAGNOLIA BLVD
NESTLE AV
LINDLEY AV
1337
WELLS DR
ROSITA ST
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1677
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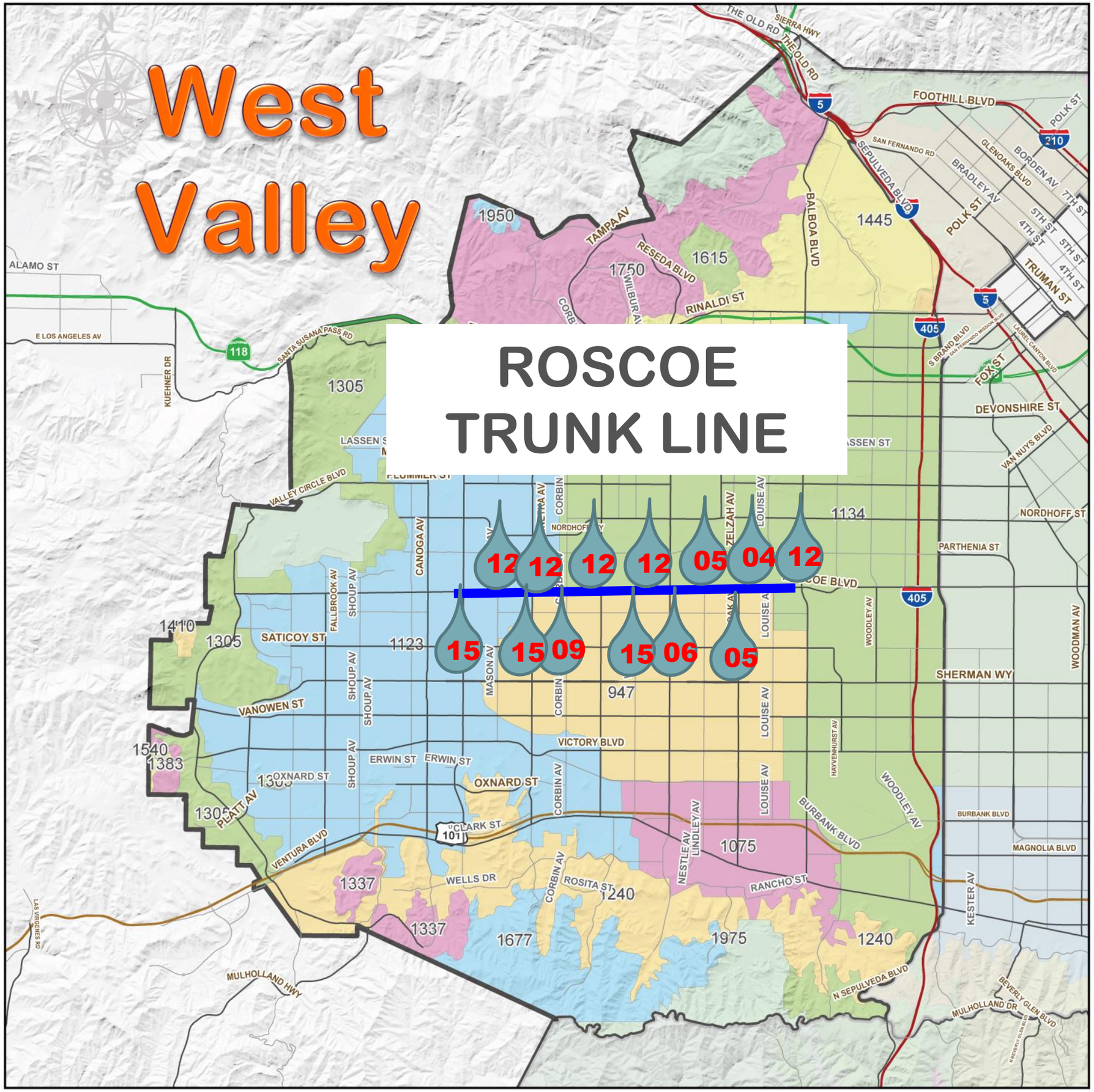
KESTER AV
LAS VIRGENES RD
MULHOLLAND HWY
N SEPULVEDA BLVD
BEVERLY GLEN BLVD
MULHOLLAND DR


West Valley
ROSCOE TRUNK LINE
12
12
12
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05


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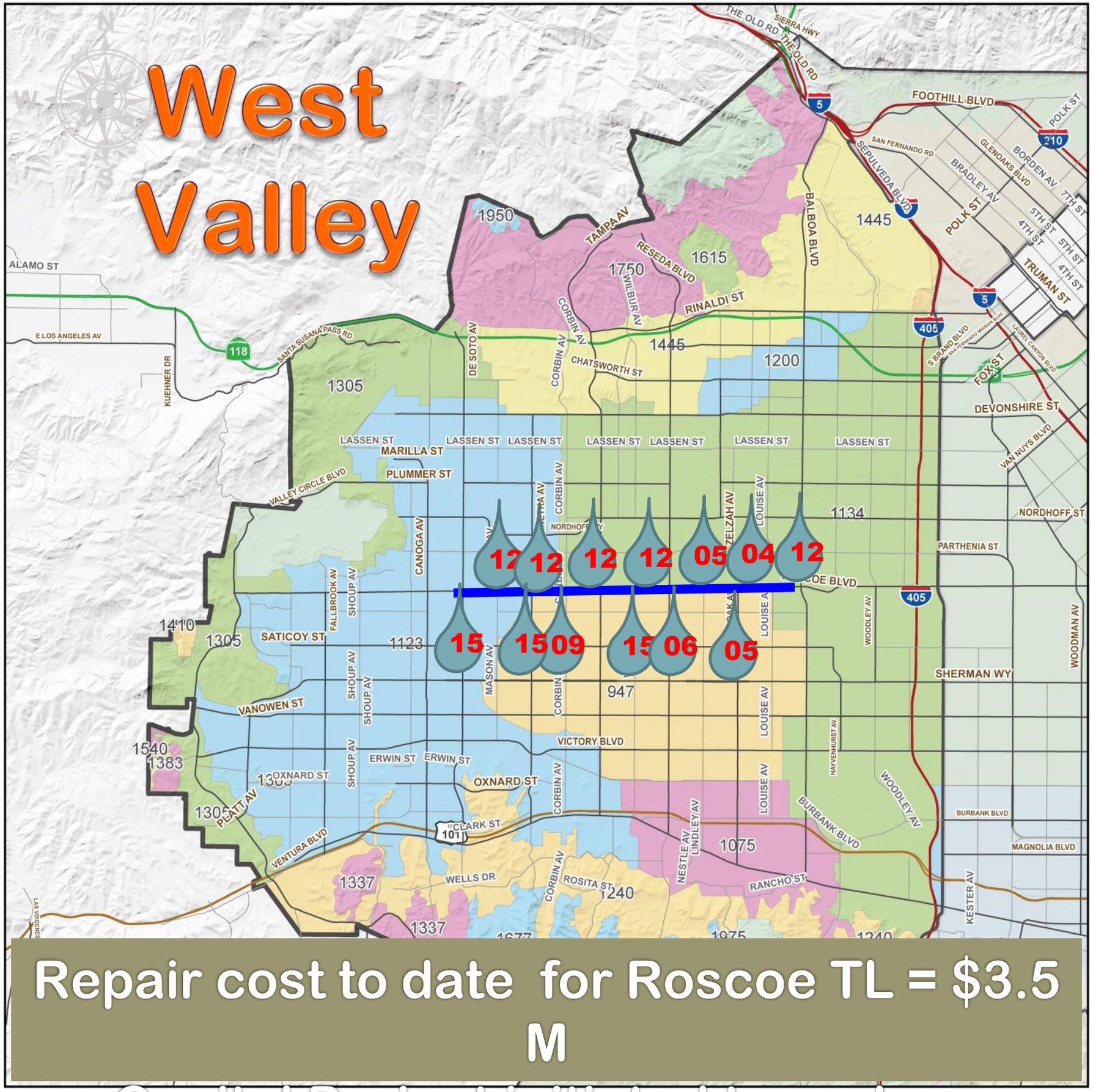
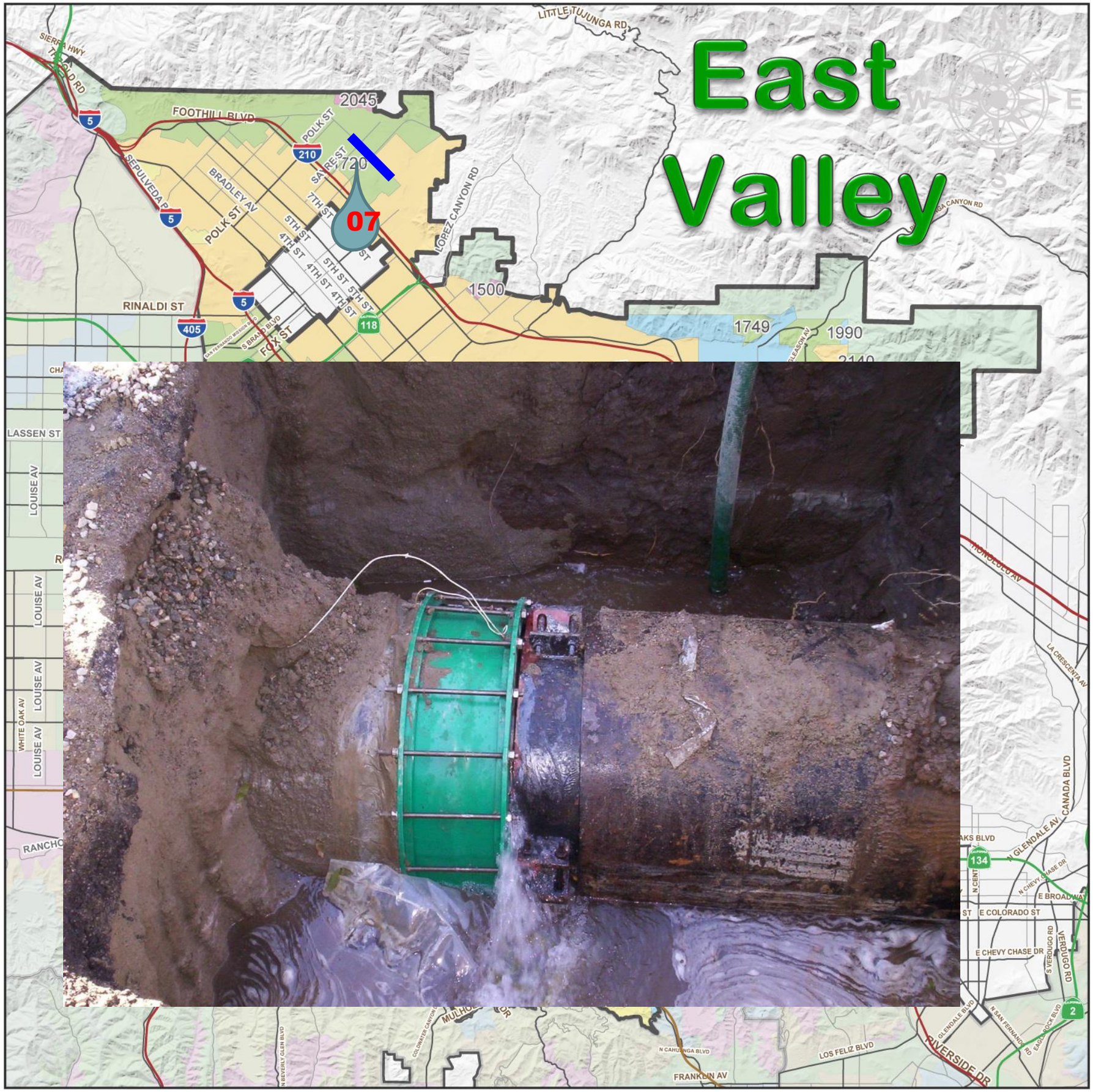
02.23.2009



Capital Project initiated to replace


East
Valley
07
2045
720
1500
1749
1990
FOOTHILL BLVD
POLK ST
BRADLEY AV
SEPULVEDA P
RINALDI ST
LITTLE TUJUNGA RD
LOPEZ CANYON RD
LASSEN ST
LOUISE AV
WHITE OAK AV
RANCHO
CANADA BLVD
E BROADWAY
E COLORADO ST
E CHEVY CHASE DR
VERDUGO RD
LOS FELIZ BLVD
FRANKLIN AV
RIVERSIDE DR
N CAHUENGA BLVD

PIPE REHABILITATION

1. Coldwater Canyon Trunk line
2. City Trunk Line North
3. Roscoe Trunk Line

CHALLENGES AHEAD

Pipe Rehabilitation and/or Replacement:

1. 40 miles of D-graded pipe in next 10 years
2. Extended period of shutdown are difficult for in-city trunk lines
3. Cost of pipe rehabilitation over its service life vs. replacement pipe service life
4. Quality control of pipe installation & certification
5. Reliable service life for rehabilitated pipes
6. Leak detection inside host pipes
7. Seismic Resiliency System Consideration

LARGE-DIAMETER PIPELINE REHABILITATION

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