DATE: April 1, 2014

TO: Mayor and City Council

CC: Brian Olson P.E., Chad Millner P.E.

FROM: Ross Bintner P.E. - Environmental Engineer RTB

RE: **Water, Sanitary, and Stormwater System Planning**

This memo describes domestic water, sanitary sewer, and storm sewer systems, system resilience and capacity for future growth in the Grandview district and southeast Edina.

Executive Summary

This memo provides a summary of water, sanitary and stormwater utility services, and reflects the state of the practice in managing city utilities to sustain the existing service and react to growth in service demand. Key infrastructure and information needs, project recommendations, and process improvement opportunities are called out.

Water, sanitary and stormwater public utilities provide critical public health and public safety service. These services are primarily provided by pumps, pipes and electronic control systems, and are increasingly dependent on and constrained by energy and natural water resources systems. The infrastructure providing these utility services are aging. While continual repair and renewal of this infrastructure is taking place, it is sometimes reactionary. Service level is sometimes undefined, and performance metrics do not reflect customer service. Non-project recommendations drive toward integrated project scope decisions and better asset management process.

Growth in service demand in southeast Edina and the Grandview are expected, and our initial review show need for increased water treatment and trunk sanitary capacity in southeast Edina in the next decade. Schedule for trunk sewer capacity additions in the Pentagon Park neighborhood are heavily dependent on Met Council action. This initial capacity review also revealed an immediate need for demand reduction or additional sanitary capacity in the Hwy 100 / Cahill industrial area, limited capacity in the 65th / Xerxes trunk line, and good sanitary capacity for future growth in the Grandview district.

Background

Development that initially drove construction of Edina's infrastructure proceeded from the northeast to the southwest. This phased development is shown in Figure 1 – Residential Periods of Construction and Figure 2 – Age of Buildings. A portion of northeast Edina was constructed in the 1940s and earlier. The majority of infrastructure in the City of Edina was constructed in the 1950s and 1960s. Minor infill development occurred in the 1970s and 1980s.

With the bulk of its infrastructure in the 1950s and 1960s cohorts, the City has begun reconstructing significant portions of its streets and portions of its pipe infrastructure to maintain service reliability as the systems age. Figure 3 – Local Bituminous Street Reconstruction History shows areas of street reconstruction over the past

17 years. Figure 4 – Anticipated Local Bituminous Street Reconstruction shows potential areas of reconstruction over the next five years.

The City of Edina operates a public utility providing water, sanitary and stormwater services. These utility services provide:

1) Clean and reliable drinking water to:
    a. promote public health, and
    b. waters to suppress fire for public safety.
2) The collection, treatment and disposal of sanitary sewer waste to:
    a. prevent disease, and
    b. promote public health.
3) Management of flood waters and floodplain to:
    a. promote public safety, and
    b. protect property.
4) Management of stormwater runoff to:
    a. prevent pollution,
    b. promote the public health, and
    c. improve the health of local water bodies and the environmental services they provide.

Summary of Infrastructure

The water, sanitary, and stormwater public utility services are provided using extensive physical infrastructure and modest programmatic efforts. Each utility is planned, operated, maintained, expanded, replaced, and managed by professional staff in the City's Public Works and Engineering departments. Engineers and system operators use a process called "asset management" to set service levels, assess the present condition of the infrastructure, judge system performance, plan for future upgrades, and assess risks.

The tools, methods and processes used to manage aging infrastructure are becoming increasingly data intensive. Also increasing management complexities are the better scientific understanding of both the chemical, physical and biological processes acting on the systems and the infrastructure's interaction with the natural systems on which each utility service depend. Changing methods of construction including trenchless installation and robotic pipe rehabilitation technology also have changed project scope choices, and continue to lower overall cost of repair.

The following is a brief description of each of the utilities in the City of Edina including:

1) Description of service: An overview of the service(s) provided, system extents and critical design considerations.
2) Infrastructure summary: A description of major components of the system, scale of system and current estimated replacement value (not including potential restoration costs such as pavement or sod.)
3) System understanding: List of the most recent plans, review of the key design variables, reliability and risks.
4) Function and condition assessment: Review of methods to assess system and overview of issues with age and existing materials.

Water

1) Water production and distribution infrastructure is built to provide uninterrupted service of clean drinking water citywide, and is made available in abundance for firefighting. Water is supplied from groundwater aquifers through wells spread throughout the community and distributed via a network of pipe. Some wells are connected to water filtration plants and are used to provide water in normal use periods. The remaining wells are unfiltered and rotate into service during peak use periods. A small portion of the City is served by Eden Prairie, Bloomington, Saint Louis Park or Minneapolis water supply.

2) The domestic water system is made up of two parts. The first is a water distribution system that includes: 220 miles of pressure water main ranging from 4-16" in diameter, nearly 5000 main valves, 2000 hydrants, and 13500 service connections, valves and meters. The second is a water production and treatment system that includes: 18 wells, 4 treatment plants, 4 water towers, and 1 reservoir. The estimated 2013 total replacement value of this infrastructure is over $140 million.

3) The current system understanding is based on the 2002 Water Distribution System Analysis by SEH and the 2013 Wellhead Protection Plan by Source Water Solutions. The City also has a current InfoWater model that describes the distribution system, and regional agencies maintain a variety of regional groundwater models used to understand and assess groundwater risk and supply. Modeling projects that enhanced the system understanding include a 2013 Water System Demand and Capacity Analysis for Water Treatment Plan 5 (WTP5). The water distribution system is sized based on geometric constraints, system wide supply and demand, design pressure, and fire flow capacity. Supply systems include reliable power backup, to keep the distribution system under constant pressure to meet supply and keep contaminants out. The production system is designed to meet peak day and peak week demands, assuming the largest well in the system is out of service.

4) The current method of condition assessment is through maintenance records, continuity comparison between pumped and metered flow, and visual inspection of the main during water main repair work. The water system is remotely controlled by a data collection and control (SCADA) system, and this system also provides insight into system function. System age affects service reliability as spot repairs are made due to water main and service breaks. Figure 5 – Watermain and Service Breaks shows recent repair density across the city. Cast iron pipe material type is considered in higher need for replacement or rehabilitation. Figure 6 – Water Pipe Material Distribution shows material type distribution citywide. Some areas of northeast Edina have had full pipe replacement with new high-density polyethylene (HDPE). Additional looped connection pipes are considered to raise service levels in areas with low pressure or stagnant water complaints.

Sanitary

1) Sanitary collection system infrastructure is built to transmit peak flows without surcharge and reduce risk of human exposure. Wastewater is collected and routed via private service connections to lateral and trunk sanitary pipes and then on to the regionally operated Met Council system. There it is conveyed to either St. Paul Pig's Eye or Eagan Seneca treatment plants for treatment and disposal of waste. The system functions via gravity flow, with intermittent pump lift stations and sanitary force main when needed.

2) The sanitary system is made up of three parts. The first includes privately owned service pipes. The second is a City-owned collection system that includes: 195 miles of gravity main ranging from 4-33" in diameter, over 5000 maintenance access manholes, 5 miles of force main, and 23 lift stations. The third is a regional trunk conveyance and treatment system owned and operated by the Met Council, to which the City pays fees based on use. The estimated 2013 total replacement value of the City portion of infrastructure is $70 million. System costs for the Met Council systems are prorated metro area wide by metered flow volume.

3) The current system understanding is based on a 2006 XP-SWMM model by Barr and a 1997 Sanitary System Evaluation by TKDA. The collection system was designed based on expected total and daily peak flow, estimated based on land use, density, average population per household, average per capita water use, and an allowance for inflow and infiltration during storm events. Modeling and meter calibrated flows were conducted in 2006 to predict system capacity. Reducing inflow of floodwaters through manholes, basement foundations, parking garages, and other structure flooding can increase reliability and reduce costs. Reducing infiltration of stormwater though pipe and service lining can reduce treatment costs.

4) The current method of condition assessment is through closed circuit televising of lines, maintenance records, and visual inspection of manholes. Sanitary lift stations are remotely controlled by a SCADA system, and this system also provides insight into system function. Lining of clay pipe (VCP) is considered a high priority to increase reliability and reduce infiltration. Figure 7 – Sanitary Pipe Material Distribution shows the majority of the system as VCP, with three of the four major trunk lines primarily made of reinforced concrete (RCP). Locations of cast in place (CIPP) liner, and PVC and HDPE show the extend of pipe rehabilitation work.

Stormwater

1) Storm sewer conveyance system infrastructure is built to carry the water from a storm with a 10% chance of occurring in a given year for neighborhood and lateral systems, and water from a storm with a 1% chance of occurring in a given year for trunk and regional systems. Floodplain is managed to minimize damage and maintain flood storage and conveyance capacity. Stormwater treatment infrastructure is built to meet regulation defined pollutant removal targets, and is complemented by programmatic pollution prevention techniques and system maintenance such as street sweeping, stormwater education, illicit discharge enforcement and sediment trap manhole cleaning.

2) The stormwater system includes over 127 miles of gravity main ranging from 12-84" in diameter, 6200 manholes, 900 outlets, 24 miles of sump drain, 11 stormwater lift stations, one-half mile of stormwater force main, 150 ponds and wetlands, and numerous sediment trap structures. The estimated 2013 total replacement value of this infrastructure is $60 million.

3) The current system understanding is based on the 2011 Comprehensive Water Resources Management Plan by Barr. The collection system is designed to provide drainage and manage flood risk. Recent upward revisions to storm frequency probability (NOAA Atlas 14) mean portions of the system previously meeting design standards are now considered under sized, and flood storage areas now have higher peak flood elevations. Treatment systems are designed to meet pollutant removal standards set by the State and

Watershed Districts. Clean water service demand due to water body specific Total Maximum Daily Load (TMDL) regulation is increasing. There is no reliable estimate for future liability.

4) The current method of condition assessment is through visual inspection of storm manholes and outlets and some closed circuit televising of lines where needed. System function is checked with a calibrated computer model and though visual inspection after large storm events. Pollution removal is estimated with an uncalibrated computer model.

Comprehensive Plan and Service Demand Trend

Some areas of the City are being considered for future redevelopment. These areas include the Grandview Area, Southeast Edina, and 50th and France. In anticipation of this redevelopment, staff completed various infrastructure system studies for those areas. These studies allow staff to plan future improvements in anticipation of the system needs identified in these specific areas. In addition to those system studies referenced above, the conclusions in this memo and project recommendations are informed by the following studies, and will be further refined during the development of the 2015-2019 CIP.

Water

1. Hydraulic Modeling Results - Water Treatment Plant #6 and Southdale Development (July 3, July 13 2012 SEH Engineering)
2. Water System Demand and Capacity Analysis – Water Treatment Plan #5. (October 23, 2013 SEH Engineering)
3. Grandview Area Water Distribution System Analysis (February 21, 2014 SEH Engineering)
4. TH 62 and Concord Water Main Break Analysis (March 10, 2014 SEH Engineering)

Sanitary

1. FilmTec Flow Analysis (April 5, 2013 Barr Engineering)
2. Sanitary Sewer Model Recalibration (November 22, 2013 Barr Engineering)
3. Southeast Edina SAC Availability Analysis (July 23, 2013 Barr Engineering)
4. Edina SAC Availability Analysis – Fairview Southdale (July 23, 2013 Barr Engineering)
5. Trunk Sanitary Sewer Infiltration Study (December 5, 2013 Bolton and Menk)
6. Grandview Area Sanitary Sewer Analysis (February 21, 2014 Barr Engineering)
7. WTP #4 Sewer Analysis (forthcoming 2014 Barr Engineering)

The Edina Comprehensive Plan was updated in 2008. In acknowledgement of the continued pressure to redevelop to mixed uses around existing commercial and office districts and the increase in development density envisioned in Chapter 4, Chapter 8 describes broad trends in system capacity and the ability of the existing infrastructure to meet future service demand.

Two development scenarios were reviewed for sanitary and water capacity during the development of the plan; Scenario 1 included Met Council estimates for growth in population and employment and Scenario 2 describes an ultimate possible development density. The Met Council estimate in Scenario 1 assumed a change from 48,500 residents and 52,100 jobs in 2010 to 50,000 residents and 57,400 jobs in 2030. The ultimate development density assumed in Scenario 2 was 70,149 residents and 70,000 jobs. Both scenarios assume the bulk of growth will occur in the southeast quadrant of the City in existing commercial areas. The new 2030 population and job projections due out this year appear to be falling on the mid to low side of the range of

these two scenarios. The following is a more detailed review of each utility, with a focus on growing areas in southeast Edina:

Water

Comprehensive Plan Chapter 8 describes trends and challenges to the public water supply. Generally, the City has a resilient water system that can produce clean, safe and plentiful water for public use. The increasing occurrence of groundwater quality issues and contamination (vinyl chloride and radium) has led to increased treatment needs. Providing water for the peak demand is also a concern. The demand for water increases in the evenings due to in-home use and in the summer due to irrigation systems. The average daily demand in Edina is between 7 and 8 million gallons per day (mgd). The peak demand is between 14.5 and 22 mgd, which is about three times higher than the average daily demand. This is known as the peaking factor, and Edina (with a peaking factor of 3.0) is in the high end of the range that is typical for similar suburban communities.

Under Scenario 1, two additional wells and no additional water storage would be needed assuming no decrease in the peaking factor, or one additional well with a reduction in the peaking factor resulting from conservation efforts. Under Scenario 2, even with aggressive conservation efforts and a corresponding reduction in the peaking factor from 3.0 to 2.75, an additional 7 wells or equivalent supplementary sources will be needed. No major upgrades to the distribution system are required for either scenario assuming aquifer capacity is available and water supply is sources by local wells. Upgrades to the distribution system may be required under Scenario 2 if water purchase agreements with nearby communities were pursued. Additional filtration capacity is desirable under both scenarios.

Sanitary

System flow in the water and sanitary systems are closely linked. In general, declining trends in system flow were noted in the sanitary sewer between 1980 and 2000, with a flat trend between 2000 and 2010. Reasons for decreased demand include changing demographics (fewer people per household) and increasing retrofit of buildings to include efficient modern fixtures and appliances. Reasons for increasing demand on system use include redevelopment and leaky aging pipes. The Met Council expects to see continued pressure for redevelopment along the 494 corridor, and has improved regional trunk sewer conveyance capacity as a result. This additional capacity is extended to the City boundary at Xerxes and 75th and can be extended into the southeast quadrant of the City with additional trunk infrastructure investment.

Both the 2006 XP-SWMM analysis and 2008 Comprehensive Plan concluded that Scenario 1 could be accommodated without major trunk line upgrades but Scenario 2 would require major system upgrades, dependent on redevelopment density and pattern. In 2013, the Engineering Department directed Barr Engineering to review the sanitary sewer model for flow capacity constraints in southeast Edina. Figure 8 – BARR South East Edina Sanitary Sewer Capacity (Barr Figure 1) shows and overview of the system flow capacity available in the sanitary conveyance system in the project area. In general Southeast Edina is well served in the near term with some excess capacity available for growth. The review shows most lateral lines have excess capacity, and trunk lines are running nearer to design capacity. The review also shows a trunk line serving western Edina and the Hwy 100 / Cahill industrial area running at capacity. The portion of southeast Edina that serves the hospital and flows to MCES RF-490 (65th/Xerxes trunk) has limited remaining capacity.

Stormwater

Storm system flows are linked to hydrologic, geologic and geometric attributes such as the connectivity in a drainage area, the percent of a site that is impervious, condition of the soil, and vegetation. In general, the service demands for clean water and flood protection are growing based on increased understanding of natural systems and regulation by state and local watersheds to remediate and protect local waters. While Nine Mile Creek capacity in southeast Edina show some flooding risk, infrastructure used to provide local flood protections is generally robust, and soil conditions in much of the area are favorable to reducing runoff. There is an increasing pressure on flow due to redevelopment at higher densities, but local controls require much of the flow and water quality treatments to happen on-site for large lot and commercial development. This trend will lead to less utilization of city infrastructure for small storm events, and a continued reliance for large storm events. Residential redevelopment runs counter to this trend because treatment and control is not required for lots less than one acre in size.

Additional demand analysis was conducted for the Grandview area, and aside from minor sanitary lift station and looped water recommendations, the area is well served to meet future demand. Demand analysis for the Gateway/Pentagon park area was studied in detail in the June 2013 Update to the September 26, 2007 Alternative Urban Areawide Review (AUAR) by WSB Engineering. Demand growth in this area will require the improvement of flow capacity at a Met Council lift station, and additional local sanitary capacity in Edina and Bloominton.

Opportunities

As the Engineering Department completed this review, we looked for opportunities to improve project efficiencies and decision-making. Priority areas include project scope decisions and the neighborhood street reconstruction program and asset management process. Non-project recommendations contained in this memo, and the upcoming 2015-2019 CIP will address these two priority areas.

Neighborhood Street Reconstruction Program

The City's neighborhood street reconstruction program provides a cost effective project delivery method to bundle a variety of system improvements. This concept should be expanded to increasingly combine street and infrastructure decisions, and major maintenance and capacity increase decisions. Bundling of street and utility system improvements, and capacity increase and system maintenance improvements reduces fixed expenses such as project bid, contractor mobilization and restoration. This type of integrated project scope decision requires more work up front, and high quality data linking system needs and service.

Asset Management

The tools, methods and processes used to manage aging infrastructure are becoming increasingly data intensive. Engineering and Public Works share geographical information system (GIS) records, and collaborate on the development of the Cityworks service request, work order and asset management system (AMS) software. Development and staff training supporting these software tools enable increasingly efficient records management, workflow tracking and process improvement, and trend and system analysis. The current rate of growth of these information systems limit our ability to enable increasingly complex street reconstruction decision making, track reliability trends, and provide annual reporting on outages, repair costs, and performance metrics.

Conclusions and Recommendations

Water, sanitary and stormwater public utilities provide critical public health, sanitation and public safety services. These services rely on aging infrastructure systems, the operations, maintenance, engineering and design of which support their continual function. This memo provides a summary of the physical infrastructure and reflects the state of the practice in managing city utilities to sustain the existing service and react to growth in service demand. Key infrastructure and information needs, project recommendations, and process improvement opportunities are described above and are summarized in the following recommendations:

<u>Decision-making and personnel</u>
2014 GIS/IS study
2015 Sanitary and storm sewer service definition and performance metrics
2016 Domestic water service definition and performance metrics

<u>Studies and preliminary engineering</u>
2015 Trunk sewer televising (project areas 8, 9, 12, 13, 14)
2015 Sanitary capacity summary
2015 72nd Street trunk sanitary capacity alternatives
2016 Southeast Edina trunk sanitary capacity alternatives
2016 Water Treatment Plant 5, storage and well 21 scoping
2017 Gateway area sanitary capacity

<u>Infrastructure</u>
2015 Arden Park trunk sewer lining (project area 3 and 4)
2016 Minnehaha trunk sewer lining (project area 5)
2017 Northwest area sanitary rehabilitation
2018 Well 21 and raw water
2018-2019 Water Treatment Plant 5 and storage
2019 Southeast Edina trunk sanitary capacity

Appendix

Figure 1: Residential Periods of Construction
Figure 2: Age of Buildings
Figure 3: Reconstruction Program History
Figure 4: Anticipated Local Bituminous Street Reconstruction
Figure 5: Watermain and Service Breaks
Figure 6: Water Pipe Material Distribution
Figure 7: Sanitary Pipe Material Distribution
Figure 8: South East Edina Sanitary Sewer Capacity (Barr Figure 1)

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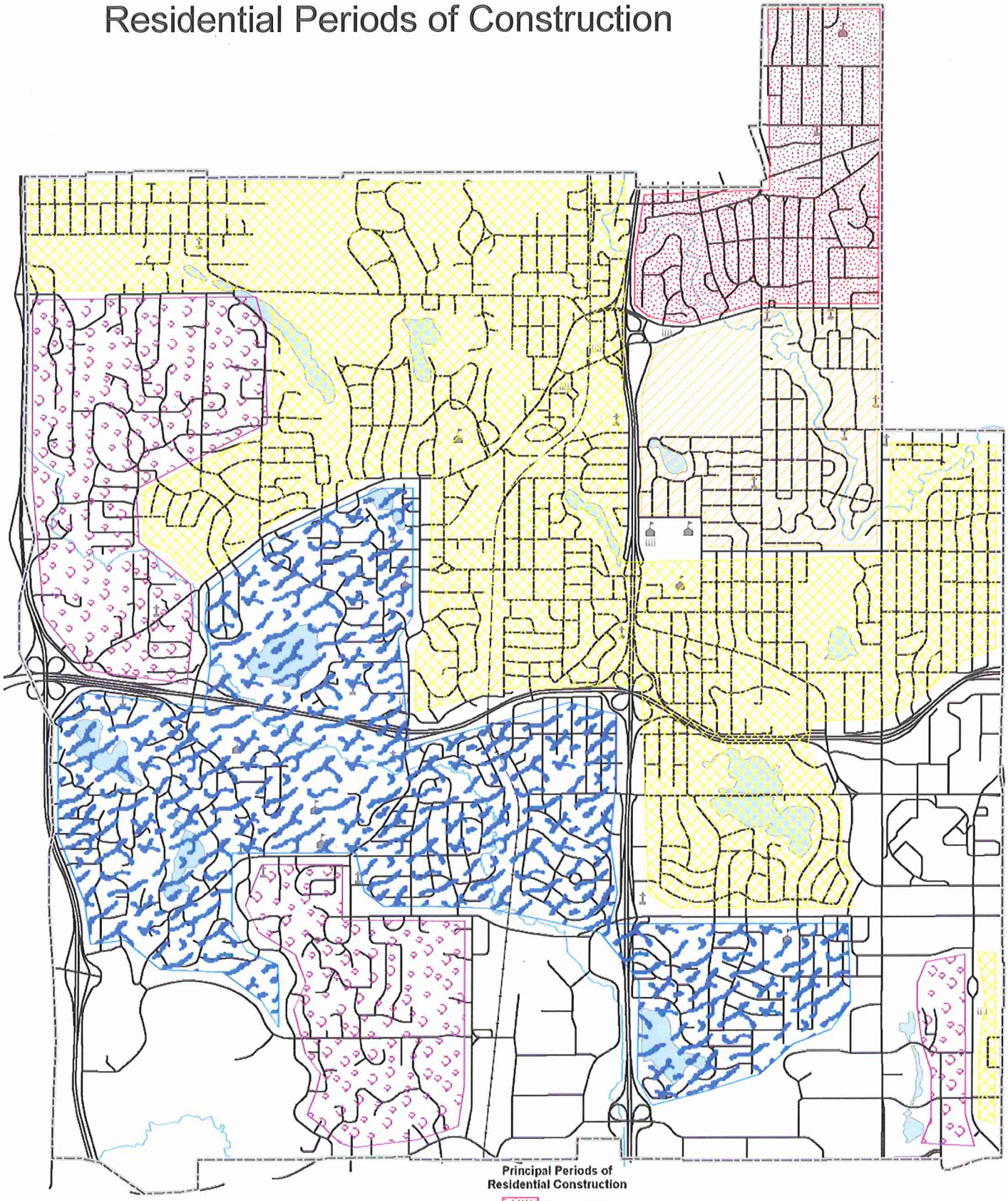
Figure 1: Residential Periods of Construction
Engineering Department, June 2006

Residential Periods of Construction



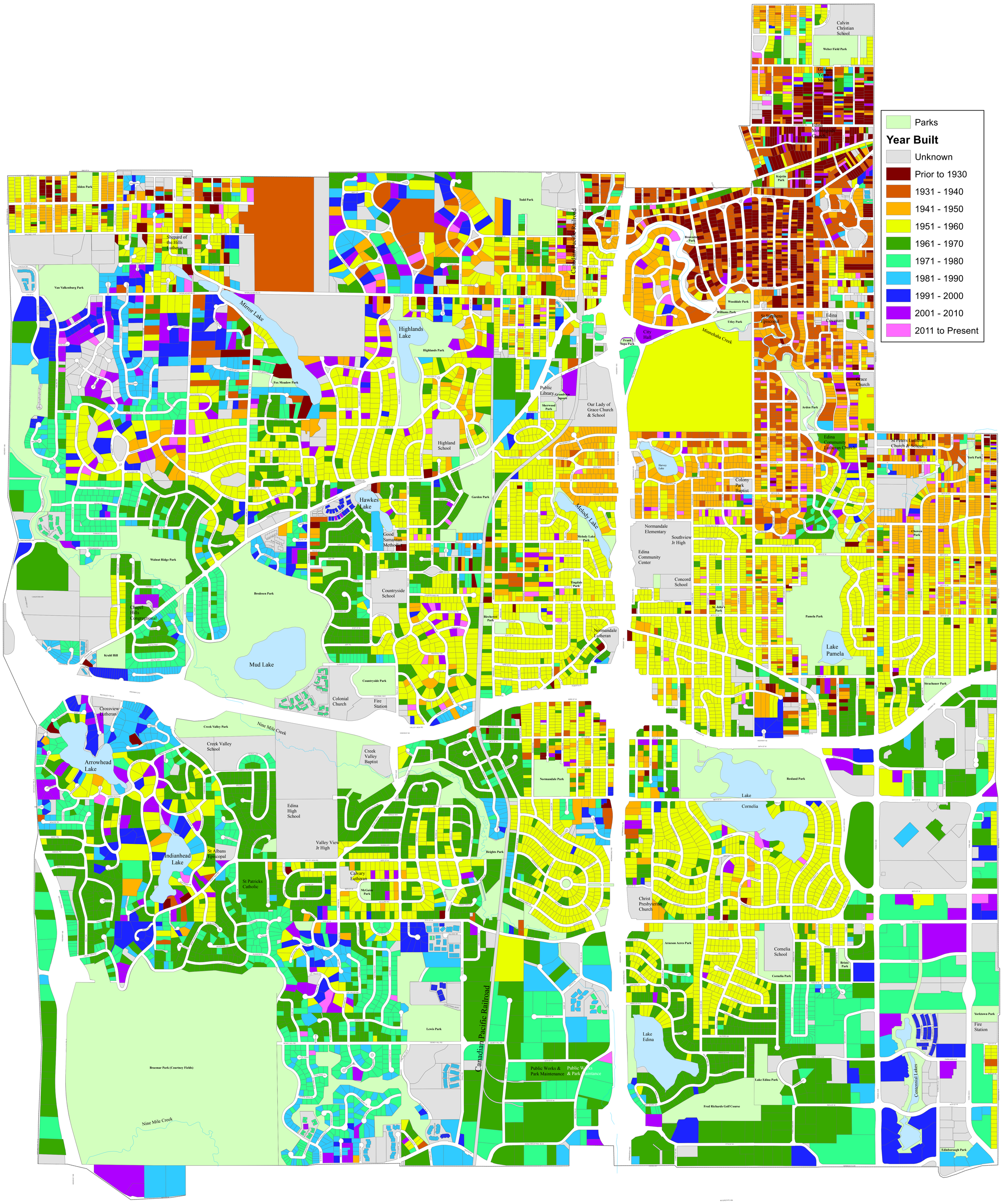
Principal Periods of Residential Construction

- Before-1940
- 1940-1949
- 1950-1959
- 1960-1969
- 1970-Present

N
W E
S

Engineering Dept
June, 2006

Figure 2: Age of Buildings
Engineering Department, July 2013



Age of Buildings

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W E
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Engineering Dept
July, 2013

Figure 3: Local Bituminous Street Reconstruction History
Engineering Department, November 2013

City of Edina
Local Bituminous Street Reconstruction History

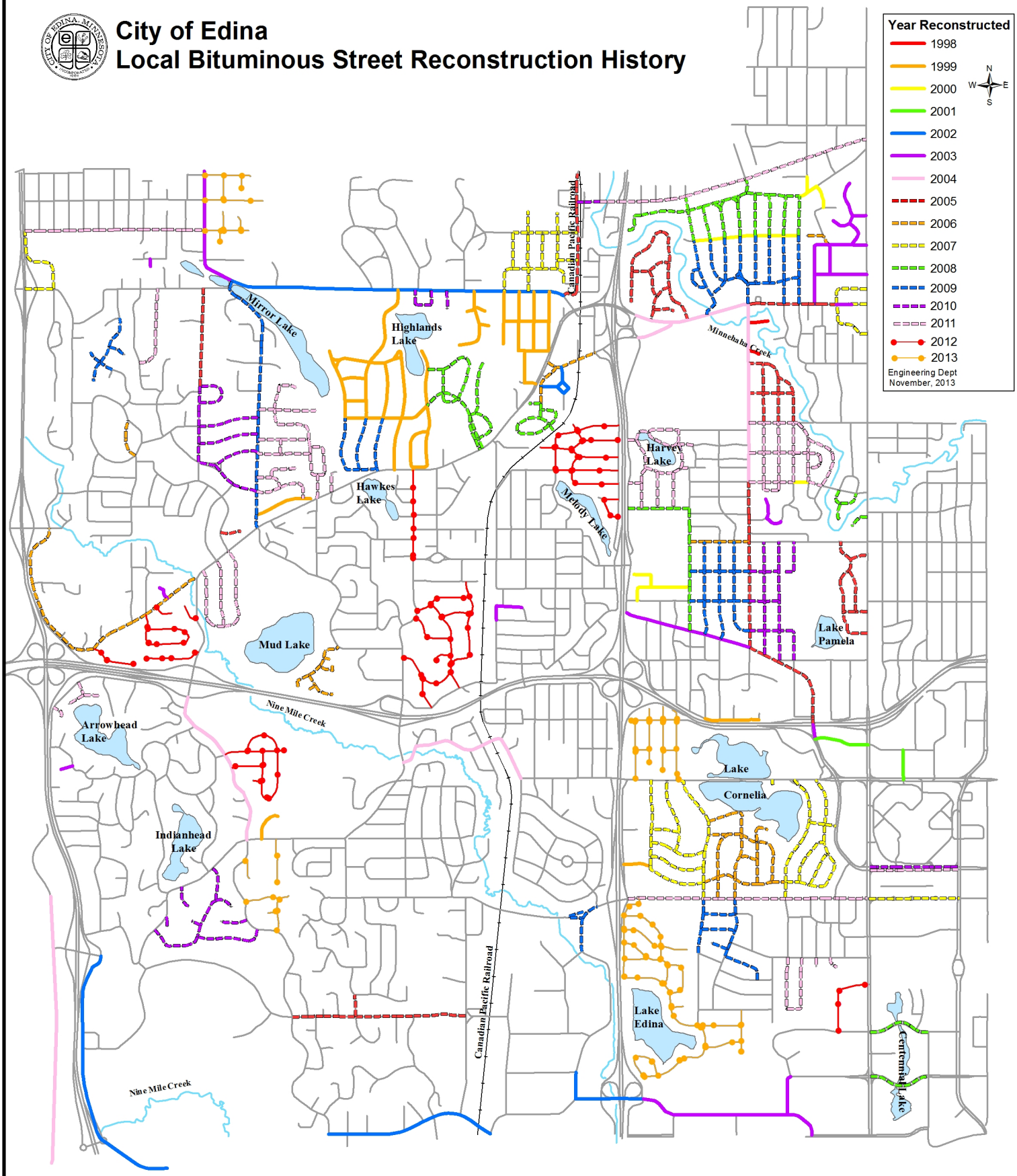
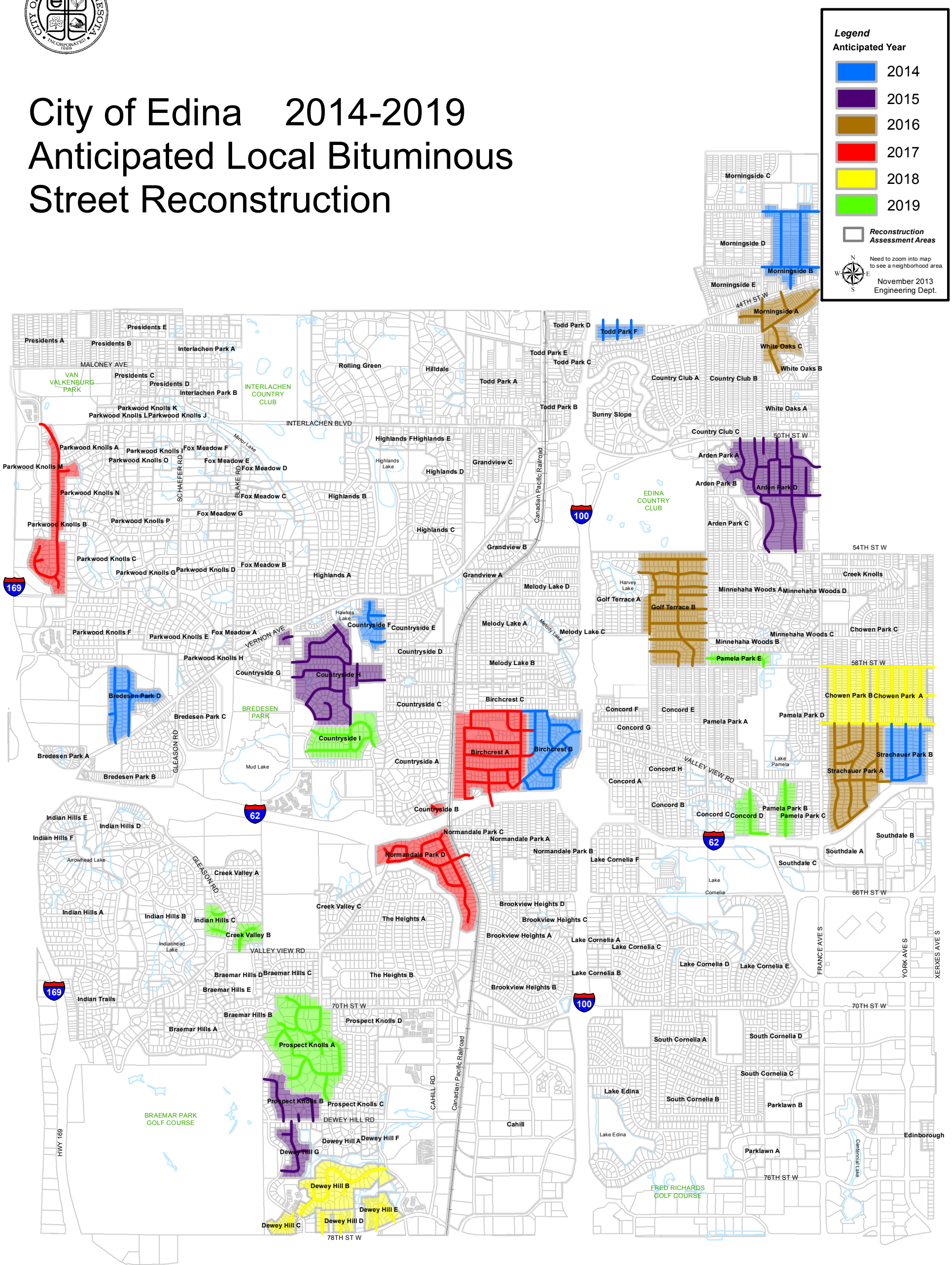


Figure 4: Anticipated Local Bituminous Street Reconstruction
Engineering Department, November 2013

City of Edina 2014-2019 Anticipated Local Bituminous Street Reconstruction



Note/Disclaimer

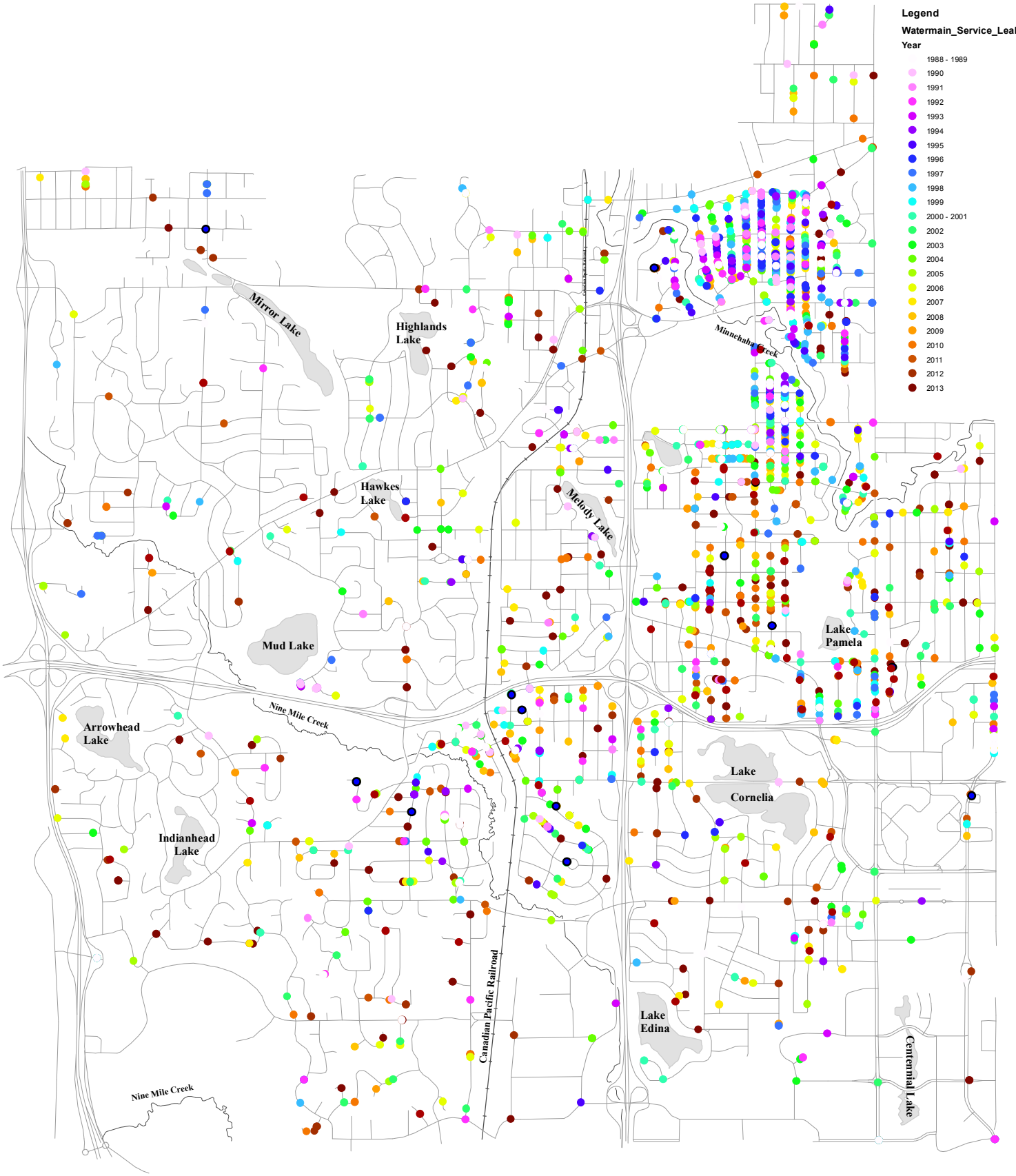
The dates shown on the map represent the anticipated years of construction and are subject to change based on budgetary issues, adjacent projects, resident input and other factors. Not all bituminous roadways within the City are shown. If a road is not highlighted then the potential reconstruction date is beyond the City's long term planning process.

The City of Edina's street improvement policy is to assess residents for a portion of the roadway reconstruction costs. Public utility improvements are paid for from the City's utility fund.

Extensive evaluation regarding the condition of the bituminous pavement, sanitary sewer, storm sewer and water main were used to set the priority of roadway improvements.

This map only addresses local bituminous streets and does not address State-Aid routes or concrete streets within the City.

Figure 5: Watermain and Service Breaks
Engineering Department, February 2014



Watermain Breaks and Service Leaks

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Engineering Dept
February 2014

Figure 6: Water Pipe Material Distribution
Engineering Department, July 2013

Water Pressurized Main Pipe Material Distribution

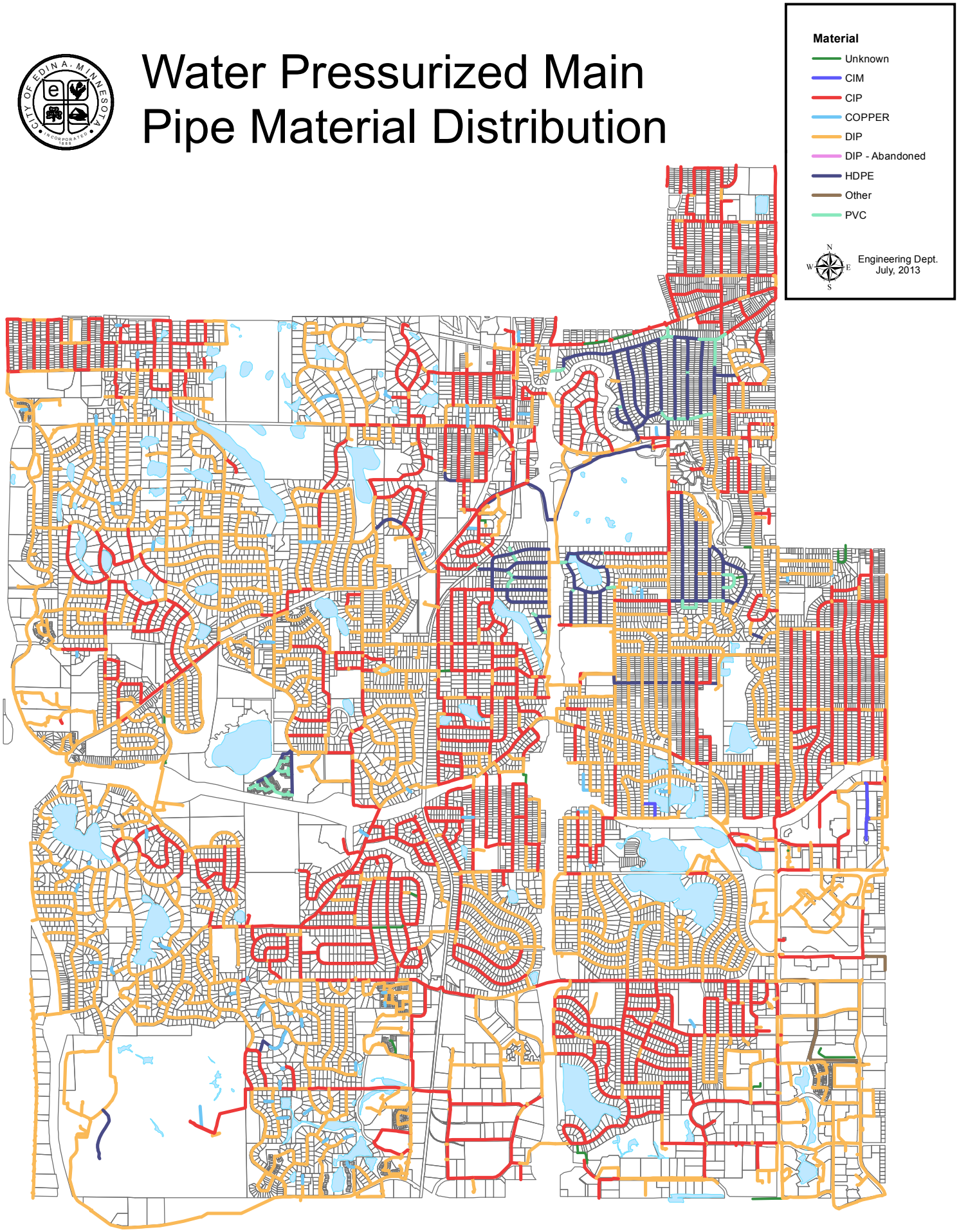


Figure 7: Sanitary Pipe Material Distribution
Engineering Department, July 2013

Sanitary Sewer Gravity Main Pipe Material Distribution

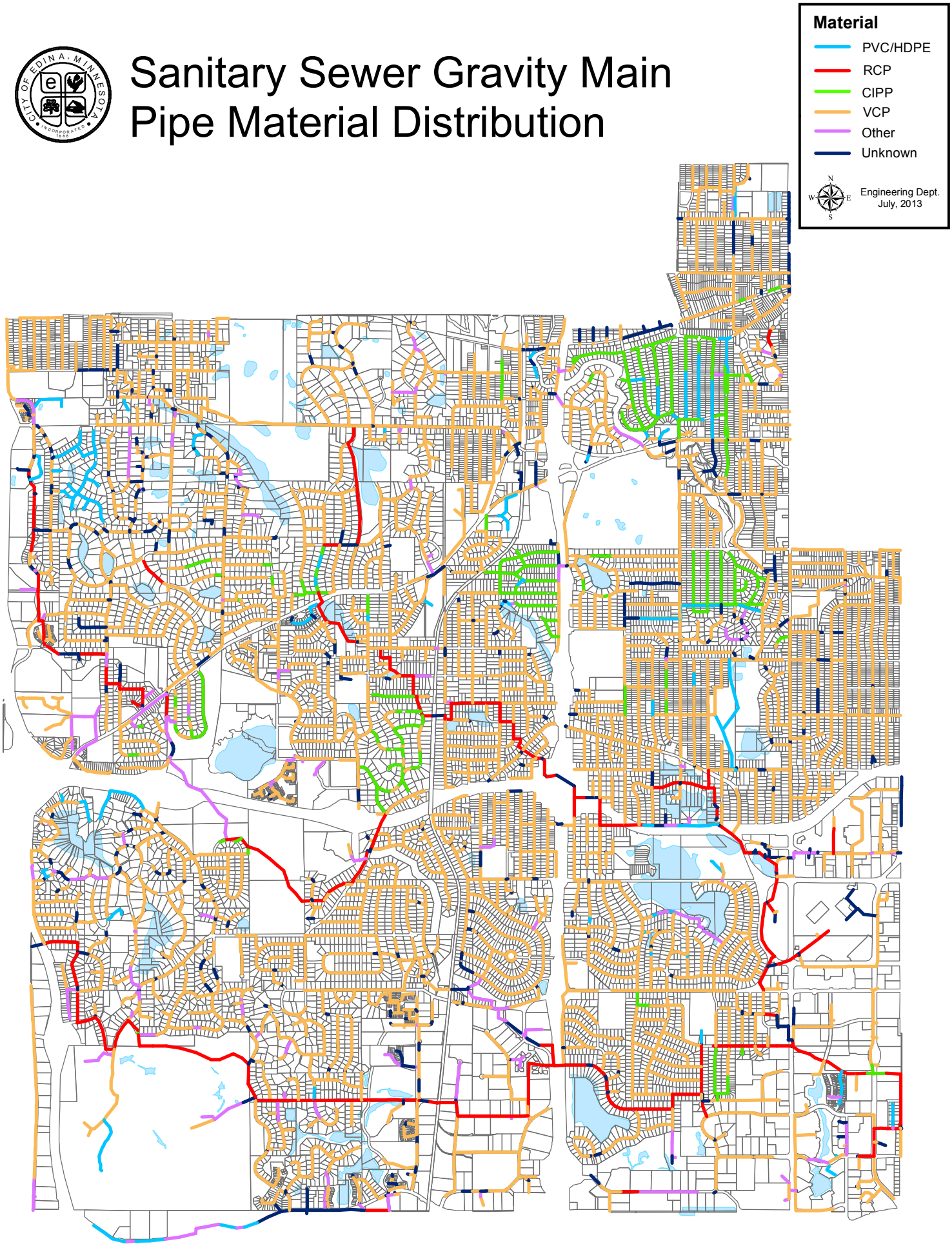
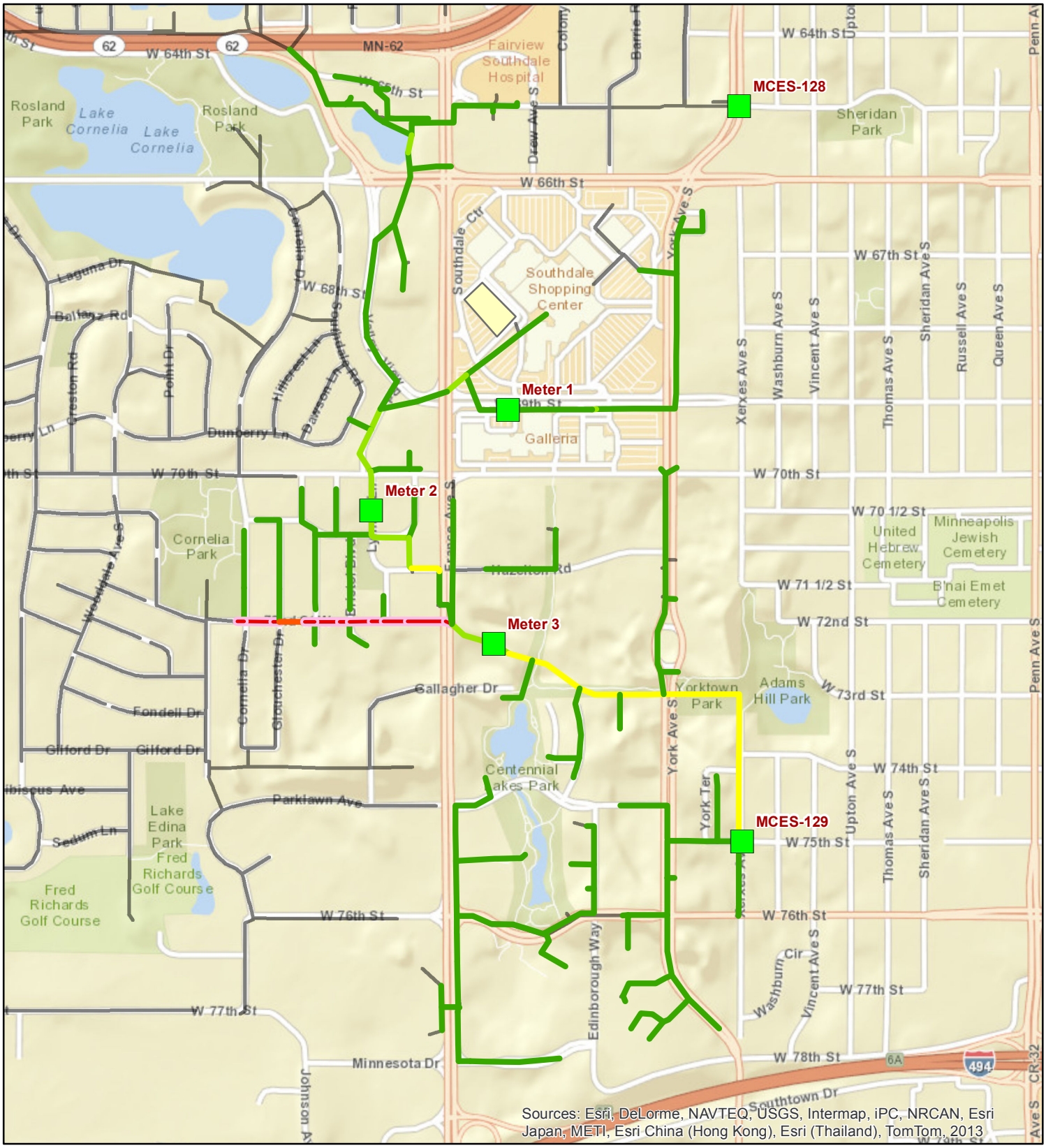


Figure 8: South East Edina Sanitary Sewer Capacity (Barr Figure 1)
Barr Engineering, June 2013



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Barr Footer: ArcGIS 10.1, 2013-06-05 12:48 File: C:\Users\mbm\Desktop\Edina Sanitary Sewer\Sanitary053113.mxd User: mbm

Pipe Capacity Filled (%)

- 0-60
- 60-80
- 80-90
- 90-95
- 95-100
- >100
- Sanitary Sewer Not Included in Analysis
- Meter Location

Feet

0 600 1,200 1,800

Meters

0 250 500 750

1 inch = 1,200 feet

BARR

Figure 1

SOUTH EAST EDINA
SANITARY SEWER CAPACITY
SE Edina SAC Availability Study
City of Edina, MN