



CITY of NOVI CITY COUNCIL

Agenda Item 1
November 24, 2008

SUBJECT: Approval of Resolution adopting the Water System Master Plan report

SUBMITTING DEPARTMENT: Engineering *BJ*

CITY MANAGER APPROVAL: *[Signature]*

BACKGROUND INFORMATION:

One of City Council's goals is to improve infrastructure by continuing to inspect and maintain existing water and sewer infrastructure. At its February 25, 2008 meeting, City Council awarded an engineering contract to Stantec Consulting Michigan to conduct a water distribution study and master plan. The purpose of this project is to prepare a comprehensive water system master plan that addresses City Council's goals as well as the State's requirements to ensure that the long-term water supply needs of the City are addressed.

The Water System Master Plan, which has been prepared by Stantec with extensive Engineering, Water & Sewer, and Finance staff collaboration, is completed and the Executive Summary is attached. The comprehensive report, which was provided to City Council on November 13, 2008, discusses and presents findings as a result of a thorough analysis of the existing water distribution system and the future system at the time of build-out.

The report finds that the system is in good condition and benefits the city's water customers with: a well developed trunk system and extensive looping, above average supply pressures from the Detroit Water & Sewerage Department (DWSD), the capability to provide adequate pressures, and adequate fire flow availability. The city's water distribution system does have some minor challenges to address, including: localized high pressures, short-term/intermittent below average supply pressures from DWSD, inefficient pressure reducing valve (PRV) operations, localized fire flow availability, inefficient pump station operations, and a lack of community water storage facilities. The report makes several recommendations to enhance the existing system's strengths and address system challenges.

The attached Resolution acknowledges the value of the Water System Master Plan and adopts the Water System Master Plan as a planning tool for the water distribution system.

RECOMMENDED ACTION: Approval of Resolution adopting the Water System Master Plan report

	1	2	Y	N
Mayor Landry				
Mayor Pro Tem Capello				
Council Member Crawford				
Council Member Gatt				

	1	2	Y	N
Council Member Margolis				
Council Member Mutch				
Council Member Staudt				



**RESOLUTION OF AUTHORIZATION
WATER SYSTEM MASTER PLAN FOR THE CITY OF NOVI**

WHEREAS, the City of Novi has undertaken a comprehensive study of the City of Novi water distribution system, including an evaluation of existing conditions and future capacity needs; and,

WHEREAS, the resulting Water System Master Plan includes the examination of future water system demands, planned or contemplated, based on the current Master Plan for Land Use, and the potential impact of such development; and,

WHEREAS, a water distribution model has been developed and calibrated by Stantec Consulting Michigan, Inc. for the current water distribution system that demonstrates the system is in generally good condition; and,

WHEREAS, the City will use the Master Plan as a guide in site plan review and application for private and public improvements to the system; and,

WHEREAS, the Water System Master Plan identifies several capital improvement projects that the City of Novi will endeavor to implement through annual review of the Capital Improvement Program with the goal of meeting storage, pressure and fire flow requirements for the anticipated needs at the time of build-out.

NOW, THEREFORE, BE IT RESOLVED that the Mayor and City Council acknowledge the value of the information contained in the Water System Master Plan Report and hereby adopts the Water System Master Plan as a tool for the short-term and long-term planning for the improvement of the City of Novi Water Distribution System.

CERTIFICATION

I hereby certify that the foregoing is a true and complete copy of a resolution adopted by the City Council of the City of Novi at a regular meeting held this 24th day of November, 2008

Maryanne Cornelius
City Clerk

CITY COUNCIL

Mayor
David B. Landry

Mayor Pro Tem
Kim Capello

Bob Gatt

Terry K. Margolis

Andrew Mutch

Kathy Crawford

Dave Staudt

City Manager
Clay J. Pearson

City Clerk
Maryanne Cornelius



cityofnovi.org

MEMORANDUM

TO: CLAY PEARSON, CITY MANAGER

FROM: ROB HAYES, P.E., CITY ENGINEER *RH*

SUBJECT: WATER SYSTEM MASTER PLAN

DATE: NOVEMBER 12, 2008

11/12/08

To Mayor and City Council Members

For future discussion

Attached is the Water System Master Plan, which has been prepared by Stantec with extensive Engineering, Water & Sewer, and Finance staff collaboration. The comprehensive report discusses and presents findings as a result of a thorough analysis of the existing water distribution system and the future system at the time of build-out.

The report finds that the system is in good condition and benefits the city's water customers with: a well developed trunk system and extensive looping, above average supply pressures from the Detroit Water & Sewerage Department (DWSD), the capability to provide adequate pressures, and adequate fire flow availability. The city's water distribution system does have some minor challenges to address, including: localized high pressures, short-term/intermittent below average supply pressures from DWSD, inefficient pressure reducing valve (PRV) operations, localized fire flow availability, inefficient pump station operations, and a lack of community water storage facilities. The report makes several recommendations to enhance the existing system's strengths and address system challenges.

The report serves as the basis for recommending a number of capital improvement projects. The projects have been placed into three different tiers based on their overall priority. In order to further refine and prioritize the projects; staff has evaluated each project based on 7 criteria:

1. Promotes more efficient operation of the system (works to reduce energy/maintenance costs)
2. Works to reduce peak hour usage
3. Improves system reliability (added loops and increase in pressure)
4. Improves service to existing customers
5. Improves service to new customers
6. Potential completion with other CIP projects (roads, sidewalk, etc)
7. Potential installation by development (deduction from score)

The attached spreadsheet shows how each project was scored to establish its priority for inclusion in the forthcoming FY 2009/2010 capital improvement program requests. The report's capital project recommendations will also be used in upcoming DWSD contract negotiations.

We look forward to formally presenting the Water System Master Plan report at the November 24th City Council meeting. In the meantime, please let me know if you need any further information or have any questions or comments in regard to the report.

cc: Pam Antil, Assistant City Manager
Brian Coburn, Civil Engineer
Tim Sikma, Water & Sewer Director
Kathy Smith-Roy, Finance Director

WATER SYSTEM CAPITAL IMPROVEMENT PROJECT PRIORITIZATION MATRIX

CIP No.	Project	Promotes more efficient operation of the system (works to reduce energy/maintenance costs)	Works to reduce peak hour usage	Improves System Reliability (added loops and increase in pressure)	Improves Service to EXISTING customers	Improves system to service NEW customers	Potential completion with other CIP items (road, sidewalk, etc)	Potential installation by development	Total Score
091-09	Construct 8 Million gallon storage tank	0	10	10	10	10	0	0	40
091-07	PRV Survey and Adjustment	10	0	10	5	3	10	0	38
091-05	Installation of SCADA on Water System	10	3	10	7	7	0	0	37
091-02	West Park Booster Station Upgrade	10	0	10	10	5	0	0	35
091-03	Grand River Isolation PRV	10	0	5	10	10	0	0	35
091-04	Island Lake Booster Study and Upgrades	10	0	10	10	5	0	0	35
091-06	New PRV on 13 Mile to re-align pressure district in Section 1	7	0	10	7	5	0	0	29
091-24	12" Water main along Garfield from Tuscaro to Nine Mile	0	0	7	10	10	0	0	27
091-13	12" Water Main along 12 Mile Wixom to Napier	0	0	10	10	10	3	-7	25
091-25	16" Water main along Nine Mile from Center to Nowi Road	0	0	7	5	3	10	0	25
091-11	New DWSD Connection at Haggerty Booster	0	0	10	7	7	0	-3	21
091-08	Replace Nine Mile/Cenemara PRV	0	0	10	10	0	0	0	20
091-26	12" Water main along 8 Mile from Club Lane to Cambridge	5	0	7	7	0	0	0	19
091-23	12" Water main along Napier Road from Park Place to 8 Mile	0	0	5	0	10	0	0	-5
091-16	12" Water Main along 14 Mile from Haverhill to Maules	0	0	10	10	0	0	-5	15
091-15	12" Water main to fill gap on 11 Mile at Taft	0	0	7	10	7	0	-10	14
091-01	Meadowbrook 16" water main under I-95	0	0	3	10	0	0	0	-3
091-10	Extend 24-inch water main along Cabot from MacKenzie to Haggerty Booster	0	0	7	7	7	0	-10	11
091-22	12" Water main along 10 Mile Road from Wixom to Terra Del Mar	0	0	7	3	10	0	-10	10
091-18	12" Water Main along 11 Mile from Meadowbrook to Sooley	0	0	7	5	0	0	-5	10
091-20	12" Water main to fill gaps on Taft Road at 11 Mile	0	0	7	7	0	0	-5	9
091-14	12" Water Main along Nine Mile/Napier from Provincial Glade to Park Place	0	0	3	0	5	0	0	8
091-21	24" Water main on 10 Mile Road from Beck to Lynwood	0	0	5	7	5	0	-10	7
091-15	12" Water Main along Eight Mile from Tuscaro to Napier	0	0	5	0	10	0	-10	5
091-28	12" Water main cross-country from Ten Mile to Provincial Glades including PRV	0	0	3	0	10	0	-10	2
091-12	Upgrade 16" water main at Grand River and Beck to 24" watermain	0	0	5	3	0	0	-10	-2
091-17	12" Water Main along 11 Mile from Delwal to existing water main to the west; incl	0	0	5	3	0	0	-10	-2

Updated 11/12/08
Brian Coburn



**WATER SYSTEM MASTER PLAN
FOR
THE CITY OF NOVI**

NOVEMBER 2008

Prepared By:

Stantec Consulting Michigan Inc.
3959 Research Park Drive
Ann Arbor, Michigan 48108-2219

November 2008

Project No.: 2075109800

EXECUTIVE SUMMARY

The City of Novi is a community in Oakland County, Michigan, facing the challenges of operating and maintaining a municipal infrastructure in the face of ongoing development and expansion. To help meet this challenge and to assess the long term adequacy of the water system, Stantec Consulting Michigan Inc. (Stantec), was retained to perform a water system master plan. The purpose of this study is to evaluate the ability of the water system to provide adequate pressures and fire flows for existing and future conditions, provide improvement recommendations and costs, and fulfill the compliance documentation of a reliability study for the Michigan Safe Drinking Water Act, 1976 PA 399, as amended.

SUMMARY

This study was performed by collecting all necessary and available background information on the City water system and developing a hydraulic model. The hydraulic model includes all major water mains within the water system. Development of the hydraulic model involved creating a computer representation of the water system using the WATERGEMS software package from the City GIS database. **Figure 2-1** depicts the existing water system model schematic. Water demands were allocated at model junctions based on City parcel locations, parcel water billing records and land use zoning. The hydraulic model was calibrated against field flow tests to determine water main friction factors associated with aging pipe. Results of the calibration indicated that the existing water mains are generally in good condition.

Existing System Hydraulic Analysis Results

The model was used to evaluate the available pressures for the existing system under average day, maximum day, peak hour and fire flow conditions. **Figures 4-1** through **4-3** depict the existing average day pressures, peak hour pressures, and peak hour pressures during minimum Detroit Water & Sewerage Department (DWSD) supply pressure periods, respectively, overlaid on a system map. Existing fire flows overlaid on a system map are depicted **Figure 4-4**. Overall, modeling results indicate that the existing water system has no significant problems in terms of capacity or pressure, but could be improved from an operational efficiency perspective. Below is a summary of the findings for the existing system:

- The existing system demands are as follows:

EXISTING WATER DEMANDS

AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
6.80	17.24	32.48

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- Existing average day pressures range from 50 psi to 120 psi while existing peak hour pressures range from 45 psi to 117 psi. The Michigan Department of Environmental Quality (MDEQ) requires that water systems provide a minimum pressure of 35 psi and 20 psi during normal and emergency conditions, respectively.
- The City's existing water supply is solely supplied from DWSD. Additionally the City currently has no storage facilities and relies on DWSD to supply both peak hour and fire flow demands.
- Fire flows were evaluated for the existing distribution system and were found to be adequate when compared to ISO and City recommended values with the exception being some dead end mains of 8-inch diameter or less. The fire flow demands utilized for this analysis are as follows:

RECOMMENDED FIRE FLOW

ZONED LAND USE	ISO RECOMMENDED FIRE FLOW	ISO RECOMMENDED DURATION	CITY OF NOVI RECOMMENDED FIRE FLOW
Single Family Residential	1,500 gpm	2 hours	2,000 gpm
Multiple Family Residential	2,500 gpm	2 hours	3,000 gpm
Industrial, Commercial, and Office	3,500 gpm	3 hours	4,000 gpm
Special Cases Based on Evaluations	>3,500 gpm	4 hours	

- Reported high pressures at the Lower Pressure District PRVs appear to be due to the West Park Pump Station pumps turning on as a result of low supply pressures from DWSD and staying on when DWSD pressures return to normal.

Future System Hydraulic Analysis Results

A hydraulic analysis of the water distribution system was performed in order to evaluate the capability of the system to meet future water demands. Data indicates that the City will experience a projected total growth of approximately 9% over the next twenty years. The model was used to evaluate the hydraulic adequacy of the water system to serve future needs. Proposed water mains to accommodate future growth areas were added to the distribution system. Overall, the analysis of the future water system showed that the existing distribution system is adequate to convey the growth needs within the water service district. Future demand deficiencies were primarily due to supply and storage requirements. Below is a summary of the future system analysis:

- The future system demands are as follows:

FUTURE WATER DEMANDS

AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
7.45	18.63	37.25

- Future average day pressures are projected to range from 50 psi to 120 psi while future peak hour pressures range from 45 psi to 115 psi. The Michigan Department of Environmental Quality (MDEQ) requires that water systems provide a minimum pressure of 35 psi and 20 psi during normal and emergency conditions, respectively.
- Future fire flows were evaluated for the future distribution system and were projected to be adequate when compared to ISO and City recommended values (as listed in the existing conditions analysis) with the exception being some dead end mains of 8-inch or less.

Analysis Discussion

During the development of this project, an investigation of system deficiencies and needs was performed by conducting interviews with engineering, operations, and maintenance staff. Based upon these investigations and modeling analyses, several system improvements were reviewed. These included water main looping, pump station operations, system redundancy, storage and alternative sources.

During the review of possible system improvements, it was estimated that the cost of developing a new water source would have a minimum start-up cost of \$151 million and had many unknown variables without in-depth investigations. A detailed discussion of the review is provided in a technical memo in **Appendix B**.

The review of storage for the City indicates that there would be a cost savings in providing storage for peak hour demands under the new DWSD contract agreements. The review determined that based upon the proposed language in the DWSD model contract, there could be a savings of \$66.9 million if a ground storage and booster pumping station alternative was implemented in the vicinity of the Walled Lake-Novu Waste Water Treatment Plant.

The cost savings are a result of the difference in water rates proposed by DWSD should the City require demands at a maximum day demand rate rather than a peak hour demand rate. The resulting rate savings are then compared against construct, operation and maintenance costs of the new storage and pumping facilities. It was assumed that the DWSD rates and operations and maintenance costs would increase annually at 5.0% and 4.5%, respectively, and a construction loan rate of 5% would be achieved. A detailed discussion is provided in **Section 6** and a cost analysis is provided in **Appendix C**.

RECOMMENDATIONS

Stantec has generated several recommendations based on the review and analysis of the water system. Recommended improvements were developed with the goal of meeting storage, pressure and fire flow requirements for existing conditions and build-out conditions. Additional recommendations are provided based on issues that were identified during data collection and system calibration. The recommendations are provided based upon a 3 tier system as follows:

TIER LEVEL	PRIORITY
Tier 1	High Priority projects with immediate achievable benefits to operations and maintenance of the system or necessary to meet Tier 2 recommendations.
Tier 2	Medium Priority projects with achievable benefits to operations and maintenance of the system but require additional feasibility studies and/or longer term financial planning or provide moderate flow, water quality improvements and system redundancy.
Tier 3	Lower Priority projects that are growth driven and can be provided by development, provide future development support, or provide some flow and water quality improvements.

These tiered recommendations are shown in **Figure E-1** and summarized below with their corresponding Capitol Improvement Plan (CIP) numbers.

Tier 1

PRV Improvements

Estimated Cost \$706,000

CIP# 091-07 Perform a survey of all system PRV transducer elevations, review the hydraulic grade line required to maintain proper system pressures within each pressure district and redevelop pressure settings for each individual PRV. Estimated cost for this improvement is \$4,000.

- Establish a hydraulic grade line of 1,091 feet at the High/Intermediate Pressure District boundary. An estimated cost for this improvement is not provided since it can be completed by City Staff.
- Establish a hydraulic grade line of 1,025 feet at the Intermediate/Lower Pressure District boundary. An estimated cost for this improvement is not provided since it can be completed by City Staff.

CIP# 091-08 Upgrade 9 Mile Road and Connemara Drive PRV from a 2-inch PRV to a larger PRV. PRV size to be determined during design phase. Estimated cost for this improvement is \$351,000.

CIP# 091-06 Install a PRV on 13 Mile Road just west of Novi Road. The PRV should maintain downstream hydraulic grade line of approximately 1,091 feet. This will eliminate the need for a PRV at Cabot Road and the PRV at 12 Mile Road and Meadowbrook Road will no longer be required. Estimated cost for this improvement is \$351,000.

Water Main Improvements Estimated Cost \$130,000

CIP# 091-05 Installations of Supervisory Control and Data Acquisition (SCADA) on water system. Estimated cost for this improvement is approximately \$130,000.

Pump Station Improvements Estimated Cost \$595,000

CIP# 091-02 Enhance the West Park Pump Station with new controls to operate the station to maintain a set discharge pressure and to turn off in response to high discharge pressures rather than a minimum flow through the station. The VFD controls can be set to seek a discharge pressure until their speed is low enough to shut the pumps off and utilize the pressure reducing valves (PRV). Estimated cost for this improvement is \$65,000.

CIP# 091-03 Install a PRV at Grand River Avenue just west of Lanny's Road. The PRV should allow water to flow towards the West Park Pump Station. This will allow West Park Pump Station to better maintain pressures on the west side of the system. This location is preferred because it prevents creating a dead end 16-inch water main with no demands on it. By utilizing a PRV rather than an isolation or check valve, the PRV direction provides redundancy to the west automatically if the West Park Pump Station or the West Park I-96 crossing fails and still has the option to reverse its flow direction with controls should the Novi Road crossing ever fail. Estimated cost for this improvement is \$351,000.

CIP# 091-04 Perform a review and upgrade of Island Lake Pump Station VFD controls, operations and equipment to identify inefficiencies in station settings and controls that are causing pressure fluctuations while trying to maintain discharge pressures. Estimated cost for this improvement is \$39,000.

CIP# 091-04 Rehabilitate Island Lake Pump Station jockey pump motor with a VFD and revised controls and operation procedures of the station to supply a constant discharge pressure of 80 psi during low flow time periods. Estimated cost for this improvement is \$130,000. The rehabilitation should include:

- Possibly upgrading the jockey pump capacity to operate with a VFD at the required low flow rates.

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CITY OF NOVI

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- Replacement of the existing jockey pump check valve with a properly sized valve to meet pump performance requirements.
- As future demands increase, develop a study of the Island Lake Pressure District to identify operational and cost benefits of supplying the north end of the district from the Intermediate Pressure District and expanding the existing district to the south where there are higher ground elevations as future demands develop. Estimated cost for this improvement is \$10,000.

Water Conservation Measures

Review water conservation measures to encourage water demand reduction during peak hour demand periods through community education and City ordinances. An estimated cost for this improvement is not provided since it can be completed by City Staff.

New Storage

Estimated Cost \$10,000

CIP# 091-30 Develop a Financial/Feasibility study to supply storage for peak hour demand purposes. An estimated cost for this recommendation is \$10,000.

Tier 2

New Storage

Estimated Cost \$21,023,000

CIP# 091-09 Provide storage for the purposes of becoming a Maximum Day Demand customer from DWSD, rather than a Peak Hour Demand Customer. A detailed discussion is provided in Section 6 and a cost analysis is provided in **Appendix C**.

- Install an 8 million gallon (MG) ground storage tank with an 18.6 million gallon per day (MGD) pump station on available property near the Walled Lake-Novı Waste Water Treatment Plant on the north side of the City near West Park Drive. Estimated cost for this improvement is \$17,550,000.
- Install a new 24-inch water main approximately 700 feet from the ground storage tank location to the west to the existing 24-inch water main on West Park Drive. Estimated cost for this improvement is \$191,000.
- Install a new 24-inch water main approximately 6,700 feet from the ground storage tank location to the east to the existing 24-inch water main at 12 ½ Mile Road and Dixon Road. Estimated cost for this improvement is \$1,829,000.
- Install a PRV on Dixon Road. Estimated cost for this improvement is \$351,000.

- Install a 24-inch connection from the high pressure side of the PRV at Novi Road and 12 ½ Mile Road to the existing 24-inch water main in 12 ½ Mile Road. Estimated cost for this improvement is \$49,000.
- Install flow control valves (FCV) at all DWSD connections on the north side of the City. Costs in **Table 7-1** include the proposed connection on the northeast side of the City. Estimated cost for this improvement is \$1,053,000.

New Looping Water Mains

Estimated Cost \$3,321,000

CIP# 091-24 Install a 12-inch water main on Garfield Road from 9 Mile Road to Chianti Drive (Entrance to Tuscany Development). This will include approximately 3,840 feet of water main. Estimated cost for this improvement is \$599,000.

CIP# 091-13 Extend a 12-inch water main approximately 4,100 feet from the existing 12-inch water main at Sloan Street and East Bourne Terrace to the east along 12 Mile Road to the 12-inch water main near Wixom Road and Grand River Avenue. This installation will also include a PRV as it will cross the Island Lake Pressure District boundary. The final location of the PRV should be identified in the proposed Island Lake Pressure District study. Estimated cost for this improvement is \$991,000.

CIP# 091-25 Extend a 16-inch water main approximately 2,400 feet from the existing 16-inch water main on 9 Mile Road west of Center Street to the east along 9 Mile Road to the existing 12-inch water main at Novi Road and 9 Mile Road. Estimated cost for this improvement is \$499,000.

CIP# 091-26 Extend a 12-inch water main approximately 1,300 feet from the existing 12-inch water main on 8 Mile Road at Club Lane to the east to the existing 12-inch water main on 8 Mile Road east of Cambridge Drive. Estimated cost for this improvement is \$203,000.

CIP# 091-23 Extend a 12-inch water main approximately 5,700 feet from the proposed 12-inch water main at Napier Road and Park Place Drive to the south along Napier Road to 8 Mile Road thence east to the proposed 12-inch water main on 8 Mile Road. Estimated cost for this improvement is \$889,000.

CIP# 091-16 Extend a 12-inch water main approximately 900 feet from the existing 12-inch water main west of Kingswood Boulevard on 14 Mile Road to the existing 12-inch water main off of the northeast loop of Columbia Drive. It should be noted that this loop will increase area fire flows by over 1,000 gallons per minute (gpm). Estimated cost for this improvement is \$140,000.

New DWSD Connection

Estimated cost \$1,191,000.

CIP# 091-11 Install a new master meter connection to DWSD with a PRV. Estimated cost for this improvement is \$481,000.

CIP# 091-10 Extend a 24-inch water main from the existing 24-inch water main at Cabot Road and Mackenzie Drive north approximately 2,600 feet to the existing DWSD stub south of DWSD's Haggerty Booster Station. It should be noted that future demands along this water main can be satisfied with a 12-inch water main therefore, it is likely that there will be a cost sharing with a developer for this project. Estimated cost for this improvement is \$710,000.

Tier 3

It is assumed that the City will review new growth and looping water mains in conjunction with development activities and that some of these recommended projects will occur with future development projects.

New Looping Water Mains

Estimated cost \$4,562,000.

CIP# 091-19 Complete the 12-inch water main on 11 Mile Road from Beck Road to Taft Road. This will include approximately 4,000 feet of 12-inch water main and approximately 200 feet of 8-inch water main tie-in connections. The last segment of the installation on the east end should not be completed until it can be looped with proposed Taft Road water mains. **Note:** Extending the water main further eastward to the existing 16-inch water main on 11 Mile Road will negate the impacts of the isolation valve recommended in Section 7.3.1. Estimated cost for this improvement is \$650,000.

CIP# 091-01 Install approximately 2,000 feet of 16-inch water main along Meadowbrook Road underneath I-96 and install a PRV on the north side of I-96. This improvement will allow for a second redundant connection crossing of I-96 for a total of three (3) crossings and is important because, 95% of the City's water demands are supplied through the north side master meters along the 14 Mile Road/Pontiac Trail corridor. Estimated cost for this improvement is \$489,000.

CIP# 091-22 Connect the existing 12-inch water main at Wixom Road and 10 Mile Road to the existing 12-inch water main east of Terra Del Mar Drive on 10 Mile Road with approximately 2,700 feet of 12-inch water main. Estimated cost for this improvement is \$421,000

CIP# 091-18 Extend a 12-inch water main approximately 1,500 feet from the existing 12-inch water main at Seeley Road and 11 Mile Road to the west along 11 Mile Road to the existing 12-inch water main east of Meadowbrook Road. Estimated cost for this improvement is \$819,000.

CIP# 091-20 Install a 12-inch water main on Taft Road from Grand River Avenue to the south to the existing 12-inch water main at Jacob Drive. This project will include approximately 3,000 feet of water main. Estimated cost for this improvement is \$468,000.

CIP# 091-21 Extend a 24-inch water main approximately 1,300 feet from the existing water mains at Beck Road and 10 Mile Road to the west along 10 Mile Road to the existing 24-inch water main east of Lynwood Drive. Estimated cost for this improvement is \$355,000.

CIP# 091-28 Extend a 12-inch water main approximately 3,000 feet from the existing 12-inch water main west of Terra Del Mar Drive on 10 Mile Road cross country to the south to the existing 12-inch at Avery Lane and Glades Court West. This installation will also include a PRV as it will cross the Island Lake Pressure District boundary. The final location of the PRV should be identified in the proposed Island Lake Pressure District study. Estimated cost for this improvement is \$819,000.

CIP# 091-17 Extend a 12-inch water main approximately 400 feet from the existing 12-inch water main east of Town Center Drive on 11 Mile Road to the east along 11 Mile Road to the existing 12-inch water main east of Delwal Road. This installation will also include a PRV west of Delwal Road as it will cross the Lower Pressure District boundary. Estimated cost for this improvement is \$413,000.

CIP# 091-31 Extend a 12-inch water main cross-country in commercial district east of M-5, south of Lewis Road and North of 12 Mile Road. Estimated cost for this improvement is \$128,000.

New Growth Water Mains

Estimated cost \$1,107,000

CIP# 091-14 Extend a 12-inch water main approximately 2,400 feet from the existing 12-inch water main at 9 Mile Road and Provincial Drive to the west along 9 Mile Road and then south on Napier Road to Park Place Drive. Estimated cost for this improvement is \$374,000.

CIP# 091-15 Extend a 12-inch water main approximately 4,700 feet from the existing 12-inch water main at 8 Mile Road and Barola Drive to the west along 8 Mile Road. Estimated cost for this improvement is \$733,000.

These recommendations are shown on **Figure E-1**.

Water Main Improvements

Estimated cost \$31,000.

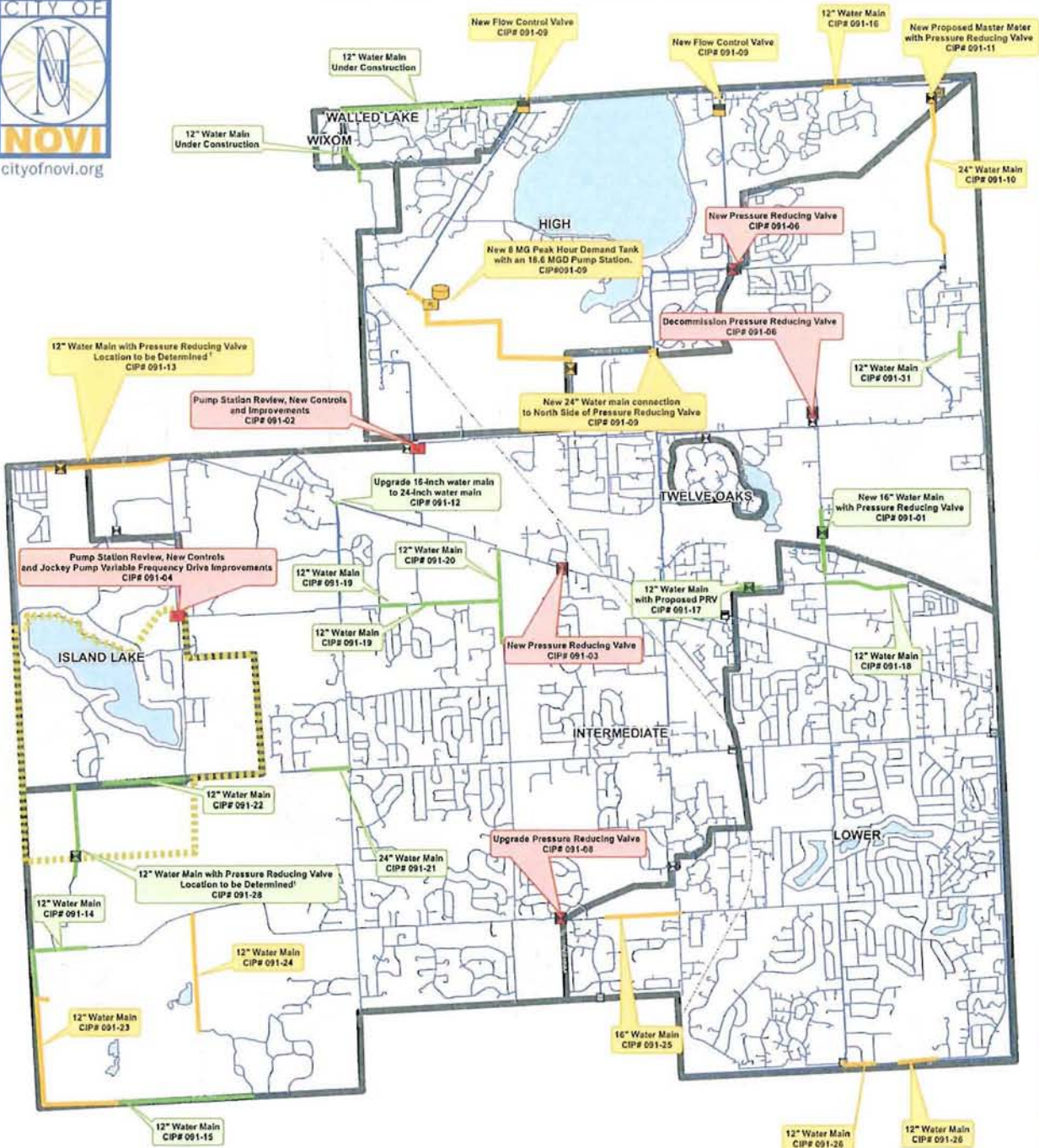
CIP# 091-12 Complete upgrade of 150 feet of 16-inch water main to a 24-inch water main at Beck Road and Grand River Avenue when development allows. Estimated cost for this improvement is \$31,000.

General

- Perform a risk assessment of the City water system's reliability to define the City of Novi's policy on redundant supply to maintain distribution system integrity in the event of a north side supply failure from DWSD. The policy should include whether to plan for a single day or multiple days of supply at maximum day demands or average day demands. The assessment should include cost/benefit analysis of

additional system storage at one or two locations and an evaluation of the water quality impacts on the volume of storage required. An estimated cost for this improvement is not provided since it can be completed by City Staff.

- Continue to review opportunities to complete 8-inch water main loops and eliminate dead end mains to improve system reliability and water quality. An estimated cost for this improvement is not applicable.
- Replace any existing 6-inch public water mains with 8-inch water mains where appropriate. A quantity for this improvement could not be provided as the GIS water main data does not identify all water mains as public or private. An estimated cost for this improvement is not applicable.



- Tier 1**
- Perform Island Lake Pump Station review. CIP# 091-04
 - Develop a study of the Island Lake Pressure District. CIP# 091-04
 - Survey and review pressure relief valve settings by hydraulic grade line. CIP# 091-07
 - Establish hydraulic grade line of 1,090 feet at the High/Intermediate Pressure District.
 - Establish hydraulic grade line of 1,025 feet at the Intermediate/Low Pressure District.
 - Develop a Financial/Feasibility study to supply storage for peak hour demand purposes. CIP# 091-30
 - Install SCADA control system. CIP# 091-05

- General**
- Perform a risk assessment of the City and Detroit Water Sewer District water system reliability to define the City of Novi's policy on redundant supply to maintain distribution system integrity due to a north side failure from Detroit Water Sewer District.
 - Continue to review opportunities to complete 8-inch water main loops and eliminate dead end mains to improve system reliability and water quality.
 - Replace any existing 6-inch public water main with 8-inch water main when

* Final Locations to be determined based on recommendations of proposed Island Lake Pressure District study

Legend

Tier	Water Features	Future Pressure District study area	Water Pressure Districts
Tier 1 (High Priority)	Pressure Relief Valve	Proposed Future Pressure District based on GIS modeling	Pressure District
Tier 2 (Medium Priority)	Water Main		Water Main
Tier 3 (Low Priority)	Water Main		Water Main
	Water Main		Water Main
	Water Main		Water Main
	Water Main		Water Main

City of Novi reviewed the water model distribution system and provided comments on missing watermain information from the City GIS data. This data was added to GIS mapping based on approximate locations.

