Operations Review of the Public Works Department

CITY OF CEDAR RAPIDS, IOWA

matrix consulting group

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1. INTRODUCTION AND EXECUTIVE SUMMARY

This first chapter introduces the analysis – outlining principal objectives and how the analysis was conducted – and presents an executive summary

1. SCOPE AND OBJECTIVES OF THE MANAGEMENT STUDY

The Matrix Consulting Group conducted a comprehensive organization and management analysis of the Department's existing operations, service levels, infrastructure management, and staffing levels. The analysis was fact based and included all aspects of services provided by the Department. The scope of the operations review was comprehensive. It included the following issues:

- **Service Delivery Structure -** In-house vs. contract operations, relationships with associated City departments and agencies, and regional relationships;
- **Management Practices –** The management philosophy, effectiveness of the senior management team, management and supervisory practices, and project management;
- **Organization –** The organizational structure, and reporting relationships;
- **Staffing –** The number and allocation of staff, job descriptions, and workforce planning;
- **Operations Management -** Operational planning, resource availability and capabilities (facility, equipment, tools, supplies, personnel), work scheduling, work reporting, quantity and quality of work produced, efficiency, and performance measures; and
- **Human Resource Management** – The hiring process, turnover, employee development and training, labor management relations, and employee satisfaction.

The objective of this assessment was to identify opportunities for improvement in the operational and economic efficiency of the Department and practical opportunities for enhancing the quality of its product and services.

2. PROJECT METHODOLOGIES

The Matrix Consulting Group utilized a fact-driven data collection and analytical process in conducting the operations review of the Public Works Department. The methodologies are summarized below.

- The Matrix Consulting Group conducted preliminary data collection for the operations review to ensure a clear understanding by the Public Works Department of the scope of the project, obtained the views and perspectives at all levels of the department, and obtained an initial understanding of the Public Works Department including mission, goals, objectives, business processes, service level targets, performance indicators, and initial issues and opportunities for improvement.

- The Matrix Consulting Group conducted interviews at all levels of the organization of the Public Works Department. The purpose of these interviews was to develop a detailed understanding of the Public Works Department including how services are delivered, staffed, managed, and the costs associated with the delivery of those services.

- The Matrix Consulting Group collected data regarding service delivery by the Public Works Department including organization of services, the structure and functions of the department, budgets, workload data, management systems, inventory of the infrastructure, etc.

- The Matrix Consulting Group compared the practices and programs of the Public Works Department to the American Public Works Association *Public Works Management Practices Manual*, standards developed by the National Transportation Operations Coalition, asset management practices promulgated by the Federal Highway Administration, benchmarking performance indicators developed by the American Water Works Association and the Water Environment Association, etc., and the experience of the Matrix Consulting Group.

The following section provides examples of the strengths of the Public Works Department.

3. THE PUBLIC WORKS DEPARTMENT EMPLOYS A NUMBER OF BEST PRACTICES.

An organizational and management analysis, by its nature, focuses on opportunities for improvement. However, there are a number of strengths in the Public Works Department. Examples of these strengths are portrayed below.

- The administrative staff conducts monthly surveys of a random sample of residents who have called in the previous month. Respondents are asked to rate the services they received on a 5-point scale.
- The number of management layers within Department does not exceed 4 (the number of layers required to reach the Director).
- An inventory has been developed for some of the assets maintained by the Department such as the sanitary sewer collection system
- The Public Works Department conducts regular condition assessments of the sanitary sewer collection system and the sidewalk system. It is currently conducting a condition assessment of its street system.
- In the past 3 years (2011, 2012 and 2013), the City has replaced or rehabilitated 24.1 miles of sanitary sewer for an annual average of 8 miles (1.2% annual average).
- The City has been recognized as a “Tree City USA” for 38 straight years.
- Traffic Engineering began the maintenance in CY 2014 of a traffic collision database, tied to GIS, that can be used to identify high accident intersections.
- Approximately 60 of the City’s 225 intersections have automated traffic counters using the detection equipment at these signalized intersections.
- A project cost accounting system is utilized to enable comparisons of planned versus actual staff hours for the design and inspection of capital projects by the Engineering Division.

These strengths provide a sound basis for further enhancement.

4. SEVEN-POINT AGENDA FOR CHANGE

The assessment of the Public Works Department identified over 250 recommendations for improvement that the Matrix Consulting Group believes should provide the basis for change in the Public Works Department in the coming years. These recommendations fall into seven major improvement areas including:

- Management systems;
- Administrative and management structure;
- Preventive maintenance of the infrastructure;
- Project management of capital projects;
- Traffic engineering program delivery;
- Culture and leadership; and
- Cost effective service delivery.

Each of these major points in the improvement agenda are briefly summarized below.

(1) Management Systems

The driving force behind any high performing organization is clear direction and the management systems that communicate and translate policy into action. The Public Works Department has made initial efforts to provide that direction and the management systems such as EnerGov. Overall, however, managers and supervisors have little information with which make key service delivery and budgetary decisions. The Public Works Department faces a number of challenges to use its resources more efficiently and effectively, and more importantly, to redirect resources and invest in maintenance and preservation of the City's infrastructure. The department is limited in its ability to address these challenges as a result of the lack of management systems.

The management of the Public Works Department needs to enhance the management systems within the department. A summary of the steps required is described in the paragraphs below.

- **Development of a strategic or corporate plan for the department as a whole.** Strategic planning is process of defining the departments' strategy, and making decisions on allocating its resources to pursue this strategy, including its capital and people. In order to determine where it is going, the Public Works Department needs to know exactly where it stands (strengths, weaknesses, opportunities, threats), then determine where it wants to go and how it will get there. The resulting document is called the 'strategic plan."

- **Deployment of asset management systems.** An asset management system uses asset information to enable decisions regarding the condition, performance, and other needs with a long-term view of the preservation and renewal of these assets. This includes the development of policies and procedures, assigning accountability for management of the assets (e.g., the Sewer Superintendent would be the asset manager for the sanitary sewer and the stormwater collection systems), collecting inventory data for each of the assets entrusted to the Public Works Department, and the development of long-term master plans for the preservation of these assets (e.g., sanitary sewer collection system, stormwater collection system, traffic signal and streetlight system, street system, etc.).

- **Implementation of EnerGov**. EnerGov should be fully implemented in Street Operations, Sewer Operations, Forestry, and Signal – Streetlight Maintenance as a maintenance management system for the City's infrastructure. EnerGov should be used to plan, schedule, and report accomplishments. EnerGov should be utilized to ensure that assets are preventively maintained at appropriate levels.

- **Development of goals, objectives, performance measures and reporting systems for the department.** The goals, objectives, and performance measures in the City's operating budget cannot reasonably be expected to provide the breadth and width required for each program within the Public Works Department (e.g., sanitary sewer collection, stormwater sewer collection, traffic signal and streetlight maintenance, etc.). The department, independently of the City's operating budget, should establish goals and objectives for each program, set priorities for funding, allocate resources based upon the priorities, implement plans and strategies to optimize the accomplishment of the priorities, and collect performance data and measure progress.

The Public Works Department should employ these management systems to make the department a place where clear direction communicates and translates policy into action, serving to drive its operations.

(2) Administrative and Management Structure

The Matrix Consulting Group evaluated the plan or organization of the Public Works Department from a number of vantage points including resource utilization, communication and coordination, agility and flexibility, human capital, and clarity of accountability.

The recommended adjustments to the plan of organization of the Public Works Department are summarized in the paragraphs below.

- The Public Works Director / City Engineer would be reclassified as the Public Works Director.
- The Engineering Manager should be reclassified as the City Engineer.
- The Sewer Superintendent should report directly to the Public Works Director.
- The Public Works Operations Superintendent should be reclassified as the Street Superintendent, and report directly to the Public Works Director.
- The Public Works Maintenance Manager position should be re-purposed within the City organization.
- The Engineering Division should be reorganized with three Supervising Civil Engineers and a Supervising Construction Inspector functioning as middle managers. One of the Supervising Civil Engineers should be allocated to the management of engineers and the design of capital projects for roads and bridges including LOST. A second Supervising Civil Engineer should be allocated to the management of engineers and the design of capital projects for sanitary and storm sewers. A third Supervising Civil Engineer should be allocated to management of engineers and the design of capital projects for flood control including GRI. A Supervising Construction Inspector should supervise construction inspection and report to the City Engineer.
- The Construction Engineering Manager should be reclassified as a Supervising Construction Inspector and report to the City Engineer.

- The vacant Associate Traffic Engineer position in the Traffic Engineering Division should be reclassified as a Supervising Civil Engineer. This position should be utilized to supervise all of the engineering staff in the Traffic Engineering Division including the Project Engineer II – Traffic, the Traffic Engineer Project Coordinator, the Project Engineer I, and the Engineering Technician.

- One of the six traffic signal / streetlight maintenance and repair positions should be upgraded to a Senior Traffic Signal Specialist. This position should function as a leadworker for the Traffic Signal Technicians and the Traffic Engineering Electrical Specialist I's.

- The five Traffic Control Maintenance Worker positions, presently located in the Street Operations Division, should be reallocated to the Traffic Engineering Division, and one of the five positions upgraded to Senior Traffic Control Maintenance Specialist. This position should function as a leadworker for the other Traffic Control Maintenance Workers. The City Traffic Engineer is more knowledgeable regarding the ***Manual on Uniform Traffic Control Devices***. This knowledge is necessary to effectively manage the maintenance of pavement legends, street striping, and regulatory signs.

- Forestry Operations should be reallocated to the Parks and Recreation Department, and report to the Parks Superintendent. This should include the Forestry Operations Supervisor position and the Urban Forester I / II positions.

- The Arborist / Landscape Architect position, currently located in the Engineering Division, should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent.

- The responsibility for the mowing of rights-of-way should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent. This should include the Streets Supervisor position, three Area Driver positions, three Light / Heavy Equipment Operator positions, and two Driver positions.

- The two Erosion Control Specialist positions in the Sewer Operations Division should be reallocated to the Engineering Division and reclassified as Civil Engineering Construction Inspectors. These two positions are responsible for (1) ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit related to construction site stormwater runoff control and construction site review and inspection program, and (2) ensuring that contractors abate concrete washouts, silt fences, make terraces to prevent runoff, have erosion control plans on site, etc. This duplicates the responsibilities of the Civil Engineering Construction Inspectors for off-site improvements and the City's building inspectors for on-site improvements. To make this transition, the City's Civil Engineering Construction Inspectors and building inspectors would need training in the City's NPDES permit enforcement and inspection.

- The City is moving towards the centralization of development services within the Development Services Department. It has not yet completed that centralization; there are a number of positions within the Public Works Department whose role and responsibility is the processing of development-related permits. The remaining responsibilities for receiving, processing and issuing permits within the Public Works Department should be reallocated to the Development Services Department. This would include the positions below.

  – The Plats and Zoning Specialist position responsible for the plan checking of site, grading specification, utility placement, erosion and sediment control, storm water system, sidewalk, trails, roadway and future development plans to ensure compliance with City ordinances and development plans.

  – The Traffic Engineering Project Administrator responsible for issuance of permits for special events, plan checking encroachment permits on City right-of-way (e.g., parking lots, signs, etc.), sidewalk café renewals (e.g., seating and tables on City sidewalks), etc.

  – The Real Estate Coordinator in the Real Estate Section responsible for processing excavation permits (e.g., permitting of sewer taps) encroachment permits (e.g., retaining walls proposed to be constructed in the City right-of-way), urban agriculture permits, etc.

  The Development Services Department should also issue large load and demolition permits, presently performed on a part-time basis by the Administrative Assistant I / II's in the Administrative Services Division.

The recommendations offered in this chapter are essential to moving the organization of the Public Works Department to a new level of performance over the next few years. It is important to consider the recommendations within the context of the LOST and GRI programs and the critical need to build capacity within the Public Works Department to effectively respond to and manage these initiatives.

The extensiveness of the recommended changes in the plan of organization for the Public Works Department should not be underestimated due to the essential preparation and planning that will be required to successfully implement these changes.

(3) Preventive Maintenance of the Infrastructure

Cedar Rapids taxpayers have a significant investment in streets, sidewalks, traffic signals, signs, sewer collection systems, and stormwater collection systems. Preserving these assets prolongs their useful life and reduces the long-term maintenance and rehabilitation costs. This is the primary objective of preventive maintenance.

While the sewer collection system receives preventive maintenance at levels that meet or exceed that recommended by the Matrix Consulting Group, the department is not delivering appropriate levels of preventive maintenance for the other asset types. The Public Works Department should pursue a managed and comprehensive effort to ensure the efficient and effective preventive maintenance of those assets assigned to the department. A summary of the steps required is described in the paragraphs below.

- **Development and installation of a preventive maintenance system for the City's street system**. The Engineering Division should utilize the dTIMS pavement management software on an ongoing basis to manage the preventive maintenance of the City's street system; this should include an evaluation of the pavement condition of the City's streets on a three year cycle, the identification of necessary maintenance and capital project needs, the issuance of work orders to the Street Operations Division for the necessary maintenance work, and the development of budget requests for the necessary capital projects. The Division should utilize seal coats and thin overlays on an ongoing annual basis for preventive maintenance treatments. The Division should utilize dTIMS to make the best use of available funding through data-driven decision-making and improve the overall condition of streets. Preventive maintenance of streets is less costly; the cost per centerline mile to reconstruct a street is 30-times more expensive than the cost to crack seal and seal coat.

- **Development and installation of a preventive maintenance system for the City's traffic signal and streetlight systems.** The Traffic Engineering Division should develop and install a preventive maintenance system for the City's traffic signal and streetlight systems. The Division has sufficient staff for this preventive maintenance. The preventive maintenance should include twice annual cabinet maintenance; inspection of one-half of the signalized intersections annually; painting of one-half of the traffic signal poles, mast arms, signal heads, control

cabinet, and electrical service cabinet annually; etc. The preventive maintenance should also include, every five years, (1) conducting City-owned streetlight inspection, testing, cleaning, lubricating and performing of minor repairs on all streetlight system components including luminaires, lighting brackets, wiring, poles, frangible and safety bases, pads and footings; and (2) visually inspecting and repairing all grounding and bonding connections and terminations, checking that all connections and terminations are tight, wires are not corroded, frayed, or broken, and testing ground resistance.

- **Development and installation of a preventive maintenance system for the City's stormwater collection system.** The Sewer Operations Division has sufficient staff for this preventive maintenance. The preventive maintenance should include annual inspection and cleaning of catch basins, televising the collection system, etc.

- **Enhance the construction inspection of public improvements constructed as part of private development**. The construction inspection of public improvements constructed as part of private development is ineffective. As a result, the City is acquiring public improvements that have not been built to the City's standard specifications. The Engineering Division should ensure that public improvements constructed as part of private development receive proper construction inspection. This should be possible with the reallocation of the two Erosion Control Specialist positions in the Sewer Operations Division to the Engineering Division and their reclassification as Civil Engineering Construction Inspectors.

- **Enhance the management of utility cuts**. Problems associated with the performance of utility cuts have been a concern to cities for many years. Cities have sponsored engineering analysis and these studies indicate that the life expectancy of a street are reduced by utility cuts. The City is ineffectively managing utility cuts: this needs to change. The City Engineer should serve as the chairperson of the City's underground utilities coordinating committee. The Engineering Division should enforce the 5-year moratorium on utility cuts on all new pavement surfaces. The Engineering Division should establish a utility cut pavement degradation fee for utility cuts. The Engineering Division should ensure that public and private utility cuts receive proper construction inspection.

Preventive maintenance improves an asset's operating efficiency, prevents premature replacement, and avoids interruptions in service for residents. Preventive maintenance reduces long-term costs by maximizing the operating capacities of an asset, minimizing downtime, and avoiding breakdowns that would otherwise lead to higher repair costs later.

The effective preventive maintenance of these assets must be an essential goal of the Public Works Department – one that should be utilized to judge the effectiveness of the department's management.

(4) Cost Effective Service Delivery

The Public Works Department faces a number of challenges including fiscal limitations and aging infrastructure. The effective response of the department to these challenges requires that the department transform the way it does its business by enhancing the efficiency of its service delivery, installing accountability systems for managers and supervisors, and reengineering work processes.

A summary of the steps required is described in the paragraphs below.

- The Engineering Division should enhance the efficient use of its professional and paraprofessional engineers. There are a number of positions that are underutilized.

- The Public Works Department should utilize a project team approach to the design and construction inspection of capital projects with the team containing a mix of professional engineers and paraprofessional engineers with the flexibility to assign members of the project team to construction management and inspection during the construction season from spring through fall and to assign members to design activities and preparation for bidding during the off-season in late fall and winter. It should not "silo" engineers in a different division than construction inspectors.

- The Street Operations Division should reduce the crew size for street sweeping from four three-person crews to four one-person crews operating a street sweeper. In addition, one Light / Heavy Equipment Operator would be necessary for the operation of a Load-All truck to collect sweeper material dumped by street sweeper operators at locations such as City parks. Six Light / Heavy Equipment Operators assigned to street sweeping for the operation of water trucks and the Load-All trucks should be utilized for other tasks within the Street Operations Division.

- The two positions allocated to the land survey crew - a Civil Engineering Survey Party Chief and a Civil Engineering Senior Aide - should be re-purposed within the City. These positions are underutilized.

- The Traffic Engineering Division should immediately assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Project Engineer II – Traffic and the Traffic Engineering Coordinator. These two positions are underutilized.

- Two vacant positions in the Street Maintenance Division – two Public Works Laborer Extra Drivers – should be re-purposed within the City. The level of authorized staffing within the Street Maintenance Division exceeds metrics utilized by the Matrix Consulting Group.

The Department should leverage these opportunities to enhance the cost effectiveness of its service delivery.

(5) Project Management of Capital Projects

The State legislature approved the Growth Reinvestment Initiative (GRI) to fund eligible projects to help mitigate the risk of flooding. The GRI allows Cedar Rapids to keep 70% of the increase in State Sales Tax over the base year (2014) to a maximum of $15 million annually. GRI will supplement federal funding and be used to mitigate and better control future storm events.

The voters of Cedar Rapids also approved a “Paving for Progress” Local Option Sales tax (LOST) sales tax initiative in November 2013. This local sales tax initiative is an additional sales tax levy for ten years starting July 1, 2014. The initiative did not include a specific list of projects. The funding can only be used for street capital improvements. The existing intent is that the “Paving for Progress” funding only be used on street capital improvements from curb to curb. The Finance Department has estimated that LOST / Paving for Progress revenues will approximate $18 million per year.

The City issued bonds in the past several years to fund the City’s non-utility capital improvements projects. It is anticipated that the issuance of further bonds will be

very limited given the revenue generated by LOST and GRI and the organization's finite capacity to manage capital improvement projects. The City does have $13.1 million in unspent bond proceeds through FY 2014 that can also be utilized for capital projects.

The City's capital budget for the next five years, as shown in the FY 2015 adopted budget, for Streets, Storm Sewer, Bridge, Traffic, Downtown, and Sanitary Sewer Improvements is presented in the table below.

Capital – Infrastructure	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Street Improvements	$35,267,128	$39,229,882	$27,127,620	$19,635,000	$19,670,000
Storm Sewer Improvements	$1,654,675	$975,000	$775,000	$1,850,000	$2,450,000
Bridge Improvements	$1,909,000	$100,000	$120,000	$960,000	$100,000
Traffic Improvements	$1,727,585	$330,000	$560,000	$860,000	$1,160,000
Downtown Improvements	$100,000	$100,000	$100,000	$100,000	$100,000
Sanitary Sewer Improvements	$7,880,000	$9,650,000	$5,050,000	$3,650,000	$3,550,000
TOTAL	**$48,538,388**	**$50,384,882**	**$33,732,620**	**$27,055,000**	**$27,030,000**

Overall, there is a significant amount of workload demand for the design and construction management / inspection of capital improvement projects over the next five years.

The Engineering Division should enhance its project management practices to match this increase in workload. A summary of the steps required is described in the paragraphs below.

- The Engineering Division should enhance and expand its *Capital Improvement Projects Development and Management Handbook*.
- The City Engineer should develop a formal written policy and procedure that clarifies responsibility for managing all of the engineering aspects of the delivery of the City's capital projects from "cradle to grave" as being assigned to the Engineering Division. This is not to minimize the critical role of Civil Engineering Construction Inspectors in managing capital projects.

- The Engineering Division should utilize a rigorous process to properly schedule each phase of the design and the construction of capital projects, from planning and studies up front, through close out of the construction contract and the overall project.

- The Engineering Division should utilize Microsoft Project to generate various reports including such reports as a Master Summary Report, Construction Phase Only, Design Look-Ahead, Construction Look-Ahead, Project Plan Check, Future Work Advertise dates, and ad hoc reports. The reports should be reviewed in monthly meetings of the City Engineer, the Supervising Civil Engineers, the project managers, the Supervising Construction Inspector, the Real Estate Services Manager, and the City Traffic Engineer.

- The Engineering Division should expand its project plans to include an expanded project description, financing, budget, responsibility for completing the various components of the capital project, extent of coordination necessary with external agencies, measures of success, a risk assessment, communication plan for external and internal communication, how the quality of the project will be achieved, and how the project will be transitioned to Streets or Sewer Operations upon completion.

- The Supervising Civil Engineers should be held accountable for involving Real Estate Services in the development of the project work plan and in the development of an internal scope of work agreement.

- The Engineering Division should utilize cost of construction guidelines to determine the staffing requirements for each capital improvement program project in terms of person hours required for design and construction inspection.

- The Engineering Division should prepare a bi-monthly capital improvement program project status report i.e., every two months.

- The Supervising Civil Engineers, prior to the beginning of each fiscal year, should prepare a resource loaded project schedule for all of the capital projects that will be designed and inspected during that fiscal year.

- The City should delegate limited change order authority to the Public Works Director, City Engineer, and Supervising Civil Engineers.

- The Engineering Division should routinely and consistently conduct 30% / 60% / 90% design plan and specification reviews with Construction Management and Inspection and the “Asset Manager”.

- The Engineering Division should use different and simpler approaches for the design of small capital projects (<$72,000 in construction costs).

- The Engineering Division should develop and utilize an on-call consultant request for qualifications on an annual basis for consulting contracts whose estimated value will be less than $100,000 (estimated by the project manager in the Engineering Division).

- A total of four existing authorized professional-level engineering positions and a Supervising Civil Engineer should be assigned to the Streets and Bridges Section, and assigned responsibility for the management and / or design of capital projects. In addition, an Engineering Technician should be assigned to the Streets and Bridges Section. The Engineering Technician should assume responsibility for the sidewalk condition assessment and repair program, although this is not and will not be a full-time year-round workload. The Civil Engineer I that has been assigned to the sidewalk condition assessment and repair program should be utilized as a project manager for capital projects in the Streets and Bridges Section.

- A total of five existing authorized professional-level engineering positions and a Supervising Civil Engineer should be assigned to the Stormwater and Wastewater Section, and assigned responsibility for the management and / or design of capital projects. The responsibility for the initial response to drainage complaints should be assigned to the Sewer Operations Division. This is presently assigned to a Project Engineer II; this Project Engineer II should be assigned responsibility for the management and / or design of capital projects.

- An additional two positions should be authorized for the Real Estate Services Section. One of these two positions should be a journey-level position. After training of the two positions, the contract with Stanley Consultants should be terminated.

The organization and the project management practices of the Engineering Division should be enhanced to enable the Public Works Department and the City to effectively meet the workload demands associated with the increased valuation of capital projects.

(6) Traffic Engineering Service Delivery

There are simply large gaps in the traffic engineering programs and services. Some of these gaps are due to vacant positions, and some due to ineffective management. The City should immediately fill the vacant positions in the Traffic Engineering Division. In the meanwhile, the City Traffic Engineer should take a number of steps to enhance the traffic engineering programs as summarized below.

- The Traffic Engineering Division should review its accident records on an annual basis and identify the ten intersections or locations with the highest number of accidents. The Division should conduct a traffic study of each of these ten intersections on an annual basis including the use of collision diagramming software. The Division should assign its traffic engineering staff to observe conditions in the field at these ten locations and develop site-specific recommendations to reduce accidents at these ten intersections or locations including the development of capital improvement projects and work orders for its signal maintenance and sign / striping maintenance staff.

- The Traffic Engineering Division should initiate an annual traffic counting program to evaluate the need for road improvements, traffic signal installations, traffic signal modifications, guard rail installations, flashing beacon installations for bicycle and pedestrian projects, and transportation planning.

- The Traffic Engineering Division should conduct, on an ongoing basis, traffic improvement studies to proactively design and implement low cost traffic system management measures on an annual basis to reduce traffic congestion and travel time delay.

- The Traffic Engineering Division should begin the task of retiming the signals at the 65 intersections that will not be part of the Intelligent Transportation System utilizing the signal optimization software for calculating signal timing and evaluating alternative phasing. The previous citywide signal timing optimization occurred in 1987.

Effective traffic engineering is essential to the safe and efficient movement of pedestrians, bicycles, and vehicles through Cedar Rapids. The Traffic Engineering Division does not effectively fulfill this role.

(7) Culture and Leadership of the Public Works Department.

Culture is not a “soft” issue created by cheerleading, posters or picnics. Culture develops out of tangible actions within a Public Works Department. Culture has implications for the performance of the Public Works Department that are real and can be substantial.

The Matrix Consulting Group administered an employee survey as part of the operations review. The respondents expressed concern regarding the department’s

ability to promote new ideas and innovation. The respondents expressed concern regarding the performance of the department as it pertains to supervisors dealing with poor performers and holding managers and supervisors accountable for their job performance. The respondents expressed concern regarding managers and supervisors communicating information in a timely manner. The respondents expressed concern regarding opportunities for career advancement.

In meetings with the Matrix Consulting Group, employees frequently described the culture and the ways managers and supervisors worked together in the department in less than flattering terms.

These challenges all stem from the culture and the leadership of the Public Works Department. While many factors influence culture, the single most important is leadership - what leaders do and say, in that order, consistently over time.

The Matrix Consulting Group made a number of recommendations to enhance the culture and leadership of the Public Works Department including the definition of cultural values for the department (that build upon the Citywide values), enhancing employee involvement, etc. Most importantly, the Public Works Director must be willing to practice “management by walking around” - spending some part of his time listening to problems and ideas of the staff of the Public Works Department, while wandering around both floors of the City Service Center. The Public Works Director should communicate at all levels of the organization in informal ways, like just hanging around in the office and chatting with them.

5. SUMMARY OF RECOMMENDATIONS

The table on the following page summarizes the improvement opportunities identified by the Matrix Consulting Group in the operations review of the Public Works Department. The chapters within this report should be read for a detailed discussion and analysis of each recommendation.

Before the City begins implementing this study, we suggest that it take the following actions:

Recommendation #1: The operations review of the Public Works Department should be distributed to the managers and supervisors of the Department for review and input.

Recommendation #2: The executive and middle management team of the Public Works Department should review the proposed plan of implementation and the summary of recommendations contained in this report, modify the plan of implementation as appropriate, and submit the revised plan of implementation to the Office of the City Manager. This should include the responsibility and the timing for implementation of each recommendation.

Recommendation #3: After acceptance of the report and the implementation plan by the Office of the City Manager, a semi-annual status report outlining implementation progress should be provided to the Office of the City Manager by the Public Works Department.

It is essential that a project manager be assigned to the successful implementation of the recommendations contained in this report. While the executive and middle management team in the Public Works Department should be held accountable for successful implementation, the executive and middle management team do not have sufficient available time and hours in the day, beyond managing the department, to propel the implementation of these recommendations through the organization.

Summary of Recommendations

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2	The executive and middle management team of the Public Works Department should review the proposed plan of implementation and the summary of recommendations contained in this report, modify the plan of implementation as appropriate, and submit the revised plan of implementation to the Office of the City Manager. This should include the responsibility and the timing for implementation of each recommendation.	18
3	After acceptance of the report and the implementation plan by the Office of the City Manager, a semi-annual status report outlining implementation progress should be provided to the Office of the City Manager by the Public Works Department.	18
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5	In the development of an asset management policy and procedure, the Public Works Department should clarify accountability for the management of each of the assets under its stewardship.	44
6	The Public Works Department should establish a departmental asset management committee to facilitate a coordinated departmental asset management approach.	44
7	The Public Works Department should designate the managers within the department that are accountable for managing each specific type of asset assigned to the Department. Each asset manager should be responsible for the development of an asset management strategy and plan for those assets assigned to their management.	44
8	The role of the Engineering Division should be to develop an asset management strategy template and an asset management plan template, and to quality control the development of the asset strategy and plan by each asset manager.	44
9	The Public Works Department should collect asset inventory data for each of the assets it is responsible for maintaining and repairing.	45
10	The Public Works Department should update asset inventory information on an ongoing basis.	47
11	The responsibility for updating of the asset inventory information should be assigned to each asset manager within the Public Works Department in a written policy and procedure.	47
12	The Public Works Department should conduct periodic asset condition assessments of the assets under its stewardship.	48
13	The Public Works Department should prepare a long-term plan for the renewal and replacement of the assets assigned to the Department's stewardship. These long-term plans for the renewal and replacement of assets should be developed for the storm water collection system, sanitary sewer collection system, traffic signal system, regulatory signs, etc.	48
14	The long-term plans for the renewal and replacement of the assets assigned to the Department's stewardship should be prepared by the Engineering Division with the advice and consultation of the asset managers.	48
	Chapter 3 - Analysis of Maintenance Management	
15	The Public Works Department should collect and enter asset data for those assets entrusted to its care into the EnerGov asset management module on a phased-in basis.	58

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16	The Public Works Department should begin with those types of assets that have already been inventoried and utilize those types of assets as the initial point of data entry into the EnerGov asset management module.	58
17	Before beginning the initial asset inventory, the Department should develop a plan for how to integrate the data within GIS.	58
18	The Department should utilize the inventory data collection tools developed by ESRI for street signs, traffic signals, streetlight, bridges and sidewalks.	58
19	The Public Works Department should work with the Information Technology Department to install the EnerGov Service Request Management module.	59
20	The existence of the EnerGov Service Request Management module should be noticed in the City's newsletter.	59
21	The first line supervisors in the Public Works Department should be held accountable for the verification of the completeness and the validity of the data in each work order prior to closure of each work order in the EnerGov Work Order / Maintenance Management module. This should be accomplished the same day as the work associated with the work order is completed.	61
22	If the crews in the Public Works Department continue to make errors in completing work orders, remedial training in the use of the EnerGov Work Order / Maintenance Management module should be provided. If the errors continue despite the remedial training, then employees should be held accountable.	61
23	All of the materials used by the crews in their maintenance and repair work should be entered into work orders n the EnerGov Work Order / Maintenance Management module.	62
24	The Administrative Services Supervisor, Public Works Department should complete written procedures regarding the day-to-day use of EnerGov by the staff of the Department.	63
25	The Administrative Services Supervisor, Public Works Department should provide the staff of the Public Works Department with copies of the policies and procedures, provide training in their use and application, and provide the opportunity to answer questions. The Public Works Director and the middle managers of the Department should then hold the staff accountable for compliance.	63
26	The Public Works Department should "go live" with the Inventory Manager module, with the complete deployment of the module to record equipment and materials.	63
27	The management of the Public Works Department should work with the first-line supervisors of the Department to define the work activities including the activity, the activity description, and the unit of measure.	65
28	The management of the Public Works Department should work with the first-line supervisors of the Department to define the service level standards for the work activities performed by the Department.	66
29	The Public Works Department should work with the first-line supervisors of the Department to develop performance standards for the work activities performed by the Department.	68
30	The management of the Public Works Department should work with the first-line supervisors of the Department and with the Information Technology Department to develop an annual work program for each section and division within the Public Works Department that uses EnerGov, and to develop reporting systems to report budget to actual.	70
31	The management within the Public Works Department should work with the first-line supervisors of the Department and the Information Technology Department to develop and deploy formal work planning and scheduling systems using EnerGov.	72

Rec. #	Recommendation	Page Number
32	The management within the Public Works Department should work with the first-line supervisors of the Department and with the Information Technology Department to develop and deploy a monthly performance report comparing planned versus actual performance and costs. This monthly report should be developed using EnerGov.	75
33	The Public Works Director should work with the Information Technology Department to develop a budget proposal for fiscal year 2015-16 to acquire and deploy laptops sufficient for all of the vehicles used everyday by the crews of the Department.	77
34	The Public Works Department should establish a Steering Committee to provide governance for implementation of EnerGov in the Department.	78
35	The Administrative Services Supervisor should be assigned responsibility for coordination of the ongoing organization, establishment, and installation of the EnerGov and the associated maintenance management system in support of the steering committee.	79
36	The Public Works Department should appoint division liaisons for the installation of EnerGov and the maintenance management system.	80
37	The Information Technology Department should be held accountable for the installation and deployment of EnerGov computerized maintenance management systems in the Public Works Department in accordance with the schedule developed by the Information Technology Department.	81
38	The Information Technology Department should work with the Public Works Department (and the Development Services Department) to document the work processes required for data entry and permit issuance for EnerGov, and simplify the data entry and permit issuance processes.	82
Chapter 4 - Analysis of the Plan of Organization		
39	The Public Works Director / City Engineer would be reclassified as the Public Works Director.	98
40	The Engineering Manager should be reclassified as the City Engineer.	99
41	The Sewer Superintendent should report directly to the Public Works Director.	99
42	The Public Works Operations Superintendent should be reclassified as the Street Superintendent, and report directly to the Public Works Director.	99
43	The Public Works Maintenance Manager position should be re-purposed within the City organization.	99
44	The Engineering Division should be reorganized with three Supervising Civil Engineers, a Supervising Construction Inspector, and a Real Estate Services Manager functioning as middle managers.	99
45	The Building Facilities Capital Project Manager, Consultant Contract Administrator, and Sewer Utility Engineering Manager should be allocated to the Supervising Civil Engineer Classification.	99
46	The Construction Engineering Manager should be reclassified as a Supervising Construction Inspector and report to the City Engineer.	99
47	The vacant Associate Traffic Engineer position in the Traffic Engineering Division should be reclassified as a Supervising Civil Engineer. This position should be utilized to supervise all of the engineering staff in the Traffic Engineering Division including the Project Engineer II – Traffic, the Traffic Engineer Project Coordinator, the Project Engineer I, and the Engineering Technician.	99
48	One of the six traffic signal / streetlight maintenance and repair positions should be upgraded to a Senior Traffic Signal Specialist. This position should function as a leadworker for the other Traffic Signal Technician and Traffic Engineering Electrical Specialist positions.	99

Rec. #	Recommendation	Page Number
49	The five Traffic Control Maintenance Worker positions, presently located in the Street Operations Division, should be reallocated to the Traffic Engineering Division, and one of the five positions upgraded to Senior Traffic Control Maintenance Specialist. This position should function as a leadworker for the other Traffic Control Maintenance Workers.	99
50	Forestry Operations should be reallocated to the Parks and Recreation Department, and report to the Parks Superintendent. This should include the Forestry Operations Supervisor position and all of the Urban Forester I / II positions.	99
51	The transfer of Forestry Operations to the Parks and Recreation Department should be accompanied by a memorandum of agreement regarding snow control in which the staff of Forestry Operations will be assigned to snow control during snow control events.	100
52	The Arborist / Landscape Architect position, currently located in the Engineering Division, should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent.	100
53	The responsibility for the mowing of rights-of-way should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent. This should include three (3) Area Driver positions, three (3) Light / Heavy Equipment Operator positions, two (2) Driver positions, and a Streets Supervisor position.	100
54	The two Erosion Control Specialist positions in the Sewer Operations Division should be reallocated to Construction Management and Inspection and reclassified as Civil Engineering Construction Inspectors. The Civil Engineering Construction Inspectors in Construction Management and Inspection, Public Works Department should assume the responsibility for ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit for off-site public improvements after receiving training. The building inspectors of the Development Services Department should assume the responsibility for ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit for on-site private development after receiving training.	100
55	The remaining responsibilities for receiving, processing and issuing permits within the Public Works Department should be reallocated to the Development Services Department. This should include the reallocation of the Plats and Zoning Specialist position, the Traffic Engineering Project Administrator position, and the Real Estate Coordinator position in the Real Estate Section.	100
Chapter 5 - Analysis of the Engineering Division		
56	The professional-level classification series used in the Public Works Department should be simplified. The classification series should include a City Engineer, Supervising Civil Engineer, Civil Engineer II and Civil Engineer I.	106
57	The salary range for Civil Engineer II and Civil Engineer I should not be based upon the existing salary range given the range of classifications and salary ranges currently utilized.	106
58	The incumbents in the positions of Capital Improvement Project Manager, Project Engineer II, Project Engineer I, Civil Engineer I, Plats and Zoning Specialist, Project Engineer II - Traffic, and Associate Traffic Engineer should be allocated to the Civil Engineer II and Civil Engineer I classifications.	107
59	The classifications of Building Facilities Capital Project Manager, Consultant Contract Administrator, Capital Improvement Project Manager, Sewer Utility Engineering Manager, Project Engineer II, Project Engineer I, Plats and Zoning Specialist, Project Engineer II - Traffic, and Associate Traffic Engineer should be eliminated.	107
60	A 15% gap should be maintained between the top end of the salary range for the Supervisory Civil Engineer classification and the Civil Engineer II classification.	107

Rec. #	Recommendation	Page Number
61	The traffic engineering classifications should be included in the Civil Engineering classification series, with specific roles and responsibilities and knowledge skills and abilities included in those classification descriptions for traffic engineering.	107
62	The City Engineer should delegate responsibility to the Supervising Civil Engineers to supervise the capital program.	109
63	The Supervising Civil Engineers should be given the authority to plan, supervise, train, and review the work of an assigned section in the Engineering Division.	109
64	The Supervising Civil Engineers should receive general direction from the City Engineer.	109
65	The Supervising Civil Engineers should sign and approve the capital project plans and specifications, not the Public Works Director or the City Engineer.	109
66	The Public Works Director or City Engineer should not be reviewing the plans, specifications, and estimates for capital projects except in unusual circumstances.	109
67	The Engineering Division should enhance and expand its *Capital Improvement Projects Development and Management Handbook*.	113
68	The Engineering should develop an on-line version of its *Capital Improvement Projects Development and Management Handbook* (i.e., the guide should be published to the Division's Intranet).	113
69	The Supervising Civil Engineers should provide training of Engineering Division professional-level engineers to strengthen their project management skills in delivering the City's design and construction programs on schedule, within budget and within scope.	115
70	The project management training should be required of the professional-level engineers in the Engineering Division.	115
71	The City Engineer should develop a formal written policy and procedure that clarifies responsibility for managing all of the engineering aspects of the delivery of the City's capital projects from "cradle to grave" as being assigned to the Engineering Division.	116
72	The Engineering Division should utilize a rigorous process to properly estimate how long it will take to perform each phase of the design and the construction of each capital project, from planning and studies up front, through close out of the construction contract and the overall project.	120
73	The Engineering Division should prepare these schedules for each capital project using Microsoft Project.	120
74	The Engineering Division project manager should update the schedule monthly, <u>but the baseline (original) schedule should not be modified to enable a comparison to the actual to the baseline (original) schedule</u>.	120
75	The Engineering Division should utilize Microsoft Project to generate various schedule reports should be produced directly from Microsoft Project, including a *Master Summary Report*, *Construction Phase Only*, *Design Look-Ahead*, *Construction Look-Ahead*, *Project Plan Check*, *Future Work Advertise dates*, and ad hoc reports.	120
76	The Engineering Division should load the costs of each project into Microsoft Project. The project managers should also track actual total cost versus the original project budget and the prior month's forecast. The variance between original (or baseline) and latest forecast budget should be used as a key performance indicator.	121
77	The Division should conduct a project planning status meeting for each project that includes the City Engineer, the Supervising Civil Engineers, the appropriate project manager, the Supervising Construction Inspector, the Real Estate Services Manager, and the City Traffic Engineer.	121

Rec. #	Recommendation	Page Number
78	The Engineering Division should expand its project plans to include an expanded project description, financing, budget, responsibility for completing the various components of the capital project, extent of coordination necessary with external agencies, measures of success, a risk assessment, communication plan for external and internal communication, how the quality of the project will be achieved, and how the project will be transitioned to Streets or Sewer Operations upon completion.	123
79	The Supervising Civil Engineers should be held accountable for involving Real Estate Services in the development of the project work plan and in the development of an internal scope of work agreement.	129
80	The Supervising Civil Engineers should develop an internal scope of work agreement with Real Estate Services before the commencement of a project that defines the project scope of work, the Real Estate Services scope of work, the schedule, the work requirements, the cost estimate for Real Estate Services (or the budget), the risks, assumptions and constraints, and the Real Estate Services contact person.).	129
81	The Engineering Division should utilize cost of construction guidelines to determine the staffing requirements for each capital improvement program project in terms of person hours required for design and construction inspection.	129
82	"Billability" targets should be established for staff of the Engineering Division.	130
83	As part of the development of these "billability" targets, principles should be developed by the Finance Department and the Engineering Division for what is chargeable to capital projects and what is to be included in the hourly rates charged to capital projects.	130
84	The PeopleSoft project accounting system should be utilized to monitor the performance of the staff of the Engineering Division against these targets.	130
85	The Engineering Division should prepare a bi-monthly capital improvement program project status report i.e., every two months.	132
86	The monthly capital improvement program project status report should be updated and posted to the Public Works Department web site each month.	132
87	The Supervising Civil Engineers should prepare a resource loaded project schedule for all of the capital projects that will be designed and inspected during that fiscal year.	134
88	The City should delegate limited change order authority to the Public Works Director, City Engineer, and Supervising Civil Engineers.	136
89	The change order process should be based upon a threshold: the Supervising Civil Engineer should be able to approve construction change orders below a certain dollar or % threshold. Once the construction change order reaches that certain dollar or % threshold, it should require the approval of the City Engineer. The Public Works Director should approve construction change orders once it exceeds another and higher dollar or % threshold.	136
90	The Public Works Department should not be able to approve any change orders in excess of the contingency. Those change orders should require the approval of the City Council.	136
91	The Department of Public Works should formalize the delegated change order authority in a policy and procedure approved by the Office of the City Manager.	136
92	The Engineering Division should routinely and consistently conduct 30% / 60% / 90% design plan and specification reviews with Construction Management and Inspection and the "Asset Manager".	138
93	The Engineering Division should develop a policy and procedure for the conduct of the 30% / 60% / 90% design plan and specification reviews with Construction Management and Inspection and the "Asset Manager".	138

Rec. #	Recommendation	Page Number
94	The Engineering Division should use different and simpler approaches for the design of small capital projects (<$72,000 in construction costs).	141
95	The Engineering Division should utilize pre-qualified contractors for the small capital projects based upon task orders issued by the Division. The Sewer Operations Division or the Street Operations Division should manage these projects.	141
96	The *Project Manual Preparation Request Form* should be eliminated.	143
97	A final report should be prepared for capital projects by each project manager upon completion of construction and acceptance of the improvements.	144
98	The *Capital Improvement Projects Development and Management Handbook* should be expanded to provide guidelines regarding (1) when consultants should be utilized versus the in-house engineers of the Engineering Division, and (2) the specific processes to be used and documentation generated regarding the selection of consultants.	149
99	The Engineering Division should develop and utilize an on-call consultant request for qualifications on an annual basis for consulting contracts whose estimated value will be less than $100,000 (estimated by the project manager in the Engineering Division).	149
100	The Engineering Division, in consultation with the Purchasing Division, should develop a formal written policy and procedure regarding how to select a consulting engineer and the basis for selection of consulting engineers.	149
101	A total of four existing authorized professional-level engineering positions, and a Supervising Civil Engineer, should be assigned to the Streets and Bridges Section, and assigned responsibility for the management and / or design of capital projects.	151
102	The Engineering Technician should be assigned to the Streets and Bridges Section. The Engineering Technician should assume responsibility for the sidewalk condition assessment and repair program, although this is not and will not be a full-time year-round workload.	151
103	The Civil Engineer I that has been assigned to the sidewalk condition assessment and repair program should be utilized as a project manager for capital projects in the Streets and Bridges Section.	152
104	A total of five existing authorized professional-level engineering positions, and a Supervising Civil Engineer, should be assigned to the Stormwater and Wastewater Section, and assigned responsibility for the management and / or design of capital projects.	153
105	The responsibility for evaluation of drainage complaints should be assigned to the Storm Water Coordinator in the Sewer Operations Division. The Engineering Division should only be involved in these complaints if these complaints evolve into a capital project. The Project Engineer II allocating a significant proportion of his time to drainage complaints should be allocated on a full-time basis to managing capital project design.	153
106	Given the revenue estimates by the Finance Department, additional positions should not be authorized for the flood control project beyond the Supervising Civil Engineer.	155
107	An additional two positions should be authorized for the Real Estate Services Section. One of these two positions should be a journey-level position. After training of the two positions, the contract with Stanley Consultants should be terminated.	158
108	These additional positions should be authorized within the context of a newly established Right-of-Way Officer classification series. The Real Estate Disposition Coordinator, the Real Estate Officer, and the two new positions should be included in this classification series. The series should run the gamut from entry level to journey level (e.g., Right-of-Way Agent I, Right-of-Way Agent II, Right-of-Way Agent III).	158

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109	The Real Estate Disposition Coordinator should be converted to permanent. There is sufficient right-of-way acquisition workload to assign to the position, should disposition workload decrease, and consultants are presently being utilized to assist in this acquisition. The use of the Real Estate Disposition Coordinator for right-of-way acquisition would displace consultants.	159
110	The support for title / closing / condemnation activities should continue to be provided by the Engineering CIP Coordinator in the short-term; in the long-term, this responsibility should be transferred to the staff of the Real Estate Services Section when the two additional positions have been filled and the staff trained.	159
111	The Public Works Department should outsource land survey data collection.	160
112	The two positions allocated to the Survey crew - a Civil Engineering Survey Party Chief and a Civil Engineering Senior Aide - should be re-purposed within the City.	160
113	The City Engineer and the Supervising Civil Engineers should review the capital projects that will require design in FY 2015-16, and develop a plan for the consideration of the Public Works Director and the Office of the City Manager that would effectively balance the use consulting firms and the in-house professional-level engineers for the design of capital projects.	162
114	Additional professional-level engineers will be required to enhance the capacity of the Engineering Division to design capital projects with its own professional-level engineers. . It will <u>not</u> require a net increase in the number of authorized positions of the Public Works Department. Rather, it will require a re-allocation of vacant positions internally within the Department to the Engineering Division and their reclassification as professional-level engineers.	162
115	The design of the installation of ADA-compliant curb ramps should be based upon a design developed by the Engineering Technician. It should be based upon a customization of a standard drawing and specifications for ADA-compliant curb ramps so that a new design does not have to be developed for each intersection.	165
116	The Street Operations Division should dedicate its own staff resources to removal and replacement of concrete for ADA-compliant curb ramps as a top priority of the Division.	166
117	The Engineering Division should ensure that seal coats and Thin Overlays (0.75 to 1.50 inches thick) with a bonded wearing course are part of the mix of preventive maintenance strategies that are used by the City. These treatments will need to be applied in an ongoing basis (e.g., every 5 to 7 years) to ensure the preservation of streets that are in <u>good</u> condition, and subsequently delay the need for reconstruction of the streets.	167
118	The City Engineer should serve as the chairperson of the City's underground utilities coordinating committee.	170
119	The Engineering Division should enforce the 5-year moratorium on utility cuts on all new pavement surfaces.	170
120	All public and private utilities should be required to coordinate their long-term undergrounding plans with the City.	170
121	The Engineering Division should establish a utility cut pavement degradation fee for utility cuts. All public and private utilities should be required to pay a pavement degradation fee, unless the pavement has exceeded its useful life and is rated by a pavement condition inspection as needing reconstruction or overlay.	170
122	The Engineering Division should ensure that utility cuts receive proper construction inspection, and that all utilities – public and private – request inspection of utility cuts.	170
123	The Engineering Division should develop a master plan for the wastewater collection system.	172

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124	The Engineering Division should develop a watershed stormwater drainage master plan.	172
	Chapter 6 - Analysis of the Traffic Engineering Division	
125	The number of authorized positions for traffic signal and streetlight maintenance and repair is sufficient to preventively maintain and repair the City's traffic signal system and its streetlight system. The number of authorized positions should not be increased.	174
126	The City Traffic Engineer should develop and install a preventive maintenance system for the City's traffic signals and streetlights.	176
127	The Traffic Engineering Division should perform preventive maintenance on traffic signal controllers / cabinets twice annually.	176
128	The Traffic Engineering Division should perform inspections of signalized intersections once every two years.	176
129	The Traffic Engineering Division should paint traffic signal poles, mast arms, signal heads, control cabinet, and electrical service cabinets / controllers once every five years.	176
130	The Traffic Engineering Division, every five years, should conduct City-owned streetlight (1) inspecting, testing, cleaning, lubricating and performing minor repairs on all streetlight system components including luminaires, lighting brackets, wiring, poles, frangible and safety bases, pads and footings; and (2) visually inspecting and repairing all grounding and bonding connections and terminations, checking that all connections and terminations are tight, wires are not corroded, frayed, or broken, and testing ground resistance.	176
131	The Traffic Engineering Division should develop a formal work planning and scheduling system using EnerGov for the staff assigned to traffic signal and streetlight maintenance and repair.	178
132	The City should replace traffic signal controllers on a fifteen (15)-year schedule.	181
133	The Traffic Engineering Division should identify the signal controllers being replaced as part of the Intelligent Transportation System, and then identify the age of the remaining signal controllers. Any whose age exceeds 15 years should be requested for replacement as part of the City's capital improvement program. Thereafter, the Division should continue to request replacement of signal controllers as the controllers reach the interval of fifteen years.	181
134	The Traffic Engineering Division should evaluate the City's signalized intersections and develop a 5-year capital improvement plan for replacement of outdated and worn out components, Uninterruptible Power Supply for each of the City's signalized intersections, and Interconnect for each signalized intersection to the Traffic Operations Center.	181
135	The Traffic Engineering Division should prepare a master plan for the City's regulatory signs. This should be based upon the completion of a sign inventory.	185
136	The Traffic Engineering Division should use staff that have been trained how to conduct nighttime visual retroreflectivity assessments. If the Department has not already done so, the Matrix Consulting Group recommends the purchase of an Avery Dennison Minimum Retroreflectivity Compliance Kit.	185
137	The Traffic Engineering Division should document the results of the nighttime visual sign inspections. The Matrix Consulting Group recommends that the information should include sign identification or inventory number, Address, Inspection Date, GPS Coordinates, MUTCD Sign Designation Code, Visibility, and Sign Condition. This inspection process could be automated using an iPad and Tap Forms software that would be linked to EnerGov.	185

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138	The Traffic Engineering Division should develop a streetlight master plan. The first purpose of the streetlight master plan should be to designate street lighting standards throughout the City for all of the City's streetlights regardless of whether the City owns the streetlights or Alliant Energy. The second purpose should be to develop a schedule for the replacement of streetlight equipment and associated components that the City owns, and develop proposed ongoing budget requests for the five-year capital improvement program budget.	186
139	The Traffic Engineering Division should develop a plan to replace the high-pressure sodium streetlights that the City owns with LED fixtures over the next five to seven years by developing a proposed budget request for the five-year capital improvement program budget.	187
140	As development occurs, the City should require the dedication of streetlight poles and fixtures to the City as City-owned streetlights.	188
141	The Traffic Engineering Division should identify those signalized intersections that have not been converted to LED's, and develop a proposed capital improvement project for fiscal year 2015-16 to replace the traffic signal lamps at intersections that have not been converted to LED's.	189
142	The Traffic Engineering Division should experiment with alternative pavement markings for street striping and pavement legends, particularly for high traffic volume streets.	190
143	The Traffic Engineering Division should develop traffic safety performance measures and report annually the results of these measures to the Public Works Director and the Office of the City Manager. These should include such measures as traffic fatalities, serious traffic injuries, pedestrian fatalities, number of vehicular accidents, etc.	192
144	The Traffic Engineering Division should review its accident records on an annual basis and identify the ten intersections or locations with the highest number of accidents. The Division should conduct a traffic study of each of these ten intersections on an annual basis including the use of collision diagramming software. The Division should assign its traffic engineering staff to observe conditions in the field at these ten locations and develop site-specific recommendations to reduce accidents at these ten intersections or locations including capital improvement projects and work orders to its signal maintenance and sign / striping maintenance staff.	192
145	The Traffic Engineering Division should initiate an annual traffic counting program to evaluate the need for road improvements, traffic signal installations, traffic signal modifications, guard rail installations, flashing beacon installations for bicycle and pedestrian projects, and transportation planning.	193
146	The Traffic Engineering Division should collect and report the traffic count information generated by its traffic signals on an annual basis for each of the signalized intersections where such information is available.	193
147	The Traffic Engineering Division should establish an annual traffic counting program using pneumatic hose counters. The City will need to acquire some 30 traffic counting devices to initiate this program The cost of these devices approximates $1,000 to $1,500 each.	193
148	The Traffic Engineering Division should written policies and procedures regarding the calculation of (1) vehicle clearance intervals that reflect the differences in traffic characteristics at intersection approaches; and (2) pedestrian clearance intervals that reflect the intersections at which pedestrians have special needs (e.g., children, elderly, handicapped, etc.).	194

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149	The Traffic Engineering Division should conduct, on an ongoing basis, traffic improvement studies to proactively design and implement low cost traffic system management measures on an annual basis to reduce traffic congestion and travel time delay.	195
150	The Traffic Engineering Division should begin the task of retiming the signals at the 75 signalized intersections that will not be part of the *Intelligent Transportation System* immediately utilizing the signal optimization software (Synchro) for calculating signal timing and evaluating alternative phasing.	197
151	All of the professional-level positions allocated to the Traffic Engineering Division, other than the City Traffic Engineer, should be allocated to the civil engineering classification series.	198
152	The Traffic Engineering Division should develop a comprehensive database of approved signal phasing and timing settings for each intersection. This database should be developed outside of the Actra traffic signal software. The database should be updated each time controller operation is modified, including all changes in phasing, type of control, timing, or intersection geometrics.	199
153	The Traffic Engineering Division should be provided the opportunity by the Engineering Division to plan check the design of traffic signal, streetlight, and pavement legend and street striping improvements at 30%, 60% and 90% complete when the design of capital projects is accomplished by consulting engineers.	200
154	The Traffic Engineering Division should design the traffic signal, streetlight, and pavement legend and street striping improvements when design of capital projects is insourced.	200
155	The Traffic Engineering Division should enhance the effective utilization of its professional-level engineering positions.	202
156	The Traffic Engineering Division should immediately fill the vacant Associate Traffic Engineer position as a Supervising Civil Engineer.	202
157	The Traffic Engineering Division should immediately fill the Project Engineer I position as a Civil Engineer I. The position should be assigned responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies.	202
158	The Traffic Engineering Division should immediately assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Project Engineer II. The position should continue to function as a bicycle coordinator for the City, but that responsibility should not require more than 25% of available work hours.	202
159	The Traffic Engineering Division should immediately assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Traffic Engineering Coordinator. The responsibility for the duties currently performed by the Traffic Engineering Coordinator should be re-assigned to the Engineering Technician since many duplicate those cited by the Engineering Technician.	202
Chapter 7 - Analysis of the Construction Management and Inspection Division		
160	The Civil Engineering Construction Inspectors should be assigned responsibility for the ongoing construction inspection of development-related public improvements.	209
161	The Public Works Department should develop a written policy and procedure for the consideration of the City Council regarding the construction inspection of development-related public improvements. This policy and procedure should require a pre-construction conference; and inspections for clearing and temporary erosion / sedimentation control; utility and storm drainage installation; utility and storm drainage backfill and compaction; sub-grade completion; curb, gutter and sidewalk forming; curb, gutter and sidewalk placement; crushed surfacing placement; crushed surfacing placement; paving; signing, striping, and pavement markings; structural; punch-list inspection; final inspection; and final warranty inspection.	209

Rec. #	Recommendation	Page Number
162	The two Erosion Control Specialist positions in the Sewer Operations Division, transferred to Construction Management and Inspection, should be reclassified as Civil Engineering Construction Inspectors, trained in Construction Management and Inspection, and assigned responsibility for construction inspection of development-related public improvements associated with development.	209
163	Based upon cost of construction guidelines used by the Matrix Consulting Group and an eight-month construction season, the workload for 2014 would indicate a need for additional Civil Engineering Construction Inspectors.	211
164	The Matrix Consulting Group does not recommend the addition of Civil Engineering Construction Inspector positions. The Civil Engineering Construction Inspector has a seven-month construction season. The positions cannot be effectively utilized during the off-season, generally November through March. Instead, the City should outsource the excess inspection workload.	211
165	Construction Management and Inspection should balance the workload among its Civil Engineering Construction Inspector positions. Two positions are clearly underutilized. A third position, in which the incumbent is retiring, should be filled several months before the construction season begins to allow for training.	212
166	The Construction Management and Inspection staff should be re-located to the 2nd floor in close proximity to the Engineering Division engineers managing the capital projects.	214
167	The specific interaction between the Civil Engineering Construction Inspectors and the Engineering Division project managers should be formally defined in a departmental policy and procedure developed by the City Engineer.	214
168	The Public Works Department should utilize a project team approach to the design and construction inspection of capital projects with the team containing a mix of professional engineers and paraprofessional engineers with the flexibility to assign team members of the project team to construction management work during the construction season from spring through fall and to assign team members to design activities and preparation for bidding during the off-season in late fall and winter.	216
169	The City should develop multiple classification levels of Engineering Technician to reflect the knowledge and skills required to multi-task (design and construction inspection), and reclassify the Civil Engineering Construction Inspectors within this series when the incumbents demonstrate the requisite knowledge and skills.	216
170	The length of the maintenance bond for pavement should be lengthened from two years to four years. This longer period of time is necessary to assure that adequate compaction has been provided and that premature failure does not occur.	216
171	Construction Management and Inspection should develop a policy and procedure, for the consideration of the Office of the City Manager and City Council, that maintenance bonds should not be accepted until the public improvements have been accepted by the City Council. In other words, the four-year length of maintenance bonds should not begin until public improvements have been accepted by the City Council.	217
172	The Construction Management and Inspection staff should inspect each utility cut (public and private) prior to patching to assure proper compaction and use a dynamic cone penotrometer to assess compaction.	221
173	The public and private utilities should only be allowed to make temporary patches of utility cuts. The staff of the Street Operations Division should be utilized to replace the temporary patch with a permanent patch to allow time for the fill in the utility cut to settle, and, upon removal of the temporary patch, to insert additional fill and compact, if necessary. The costs of providing the permanent patch should be integrated into the excavation permit.	221

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174	The joint of the utility patch should also be sealed by the Street Operations Division at the time a permanent patch is made using a tack coat to keep water and other materials from infiltrating.	221
175	Construction Management and Inspection and the Development Services Department should meet with Alliant Energy and Mid-America Gas to inform them of the requirements for requesting inspections for utility cuts.	221
176	The City should cross check *Iowa One Call* locate requests to excavation permits in EnerGov and any One Call locate requests lacking permits should be inspected by the Construction Management and Inspection staff. The Information Technology Department should automate this process of cross-checking *Iowa One Call* against EnerGov.	221
177	Construction Management and Inspection should assess a penalty for unpermitted work within the public right of way or work performed without a request for inspection as required by adopted City policy and procedure. This will require an enabling ordinance.	221
178	Public and private utilities should pay a fee sufficient to reimburse the City for the costs of construction inspection by Construction Management and Inspection.	221
179	The Public Works Department should develop a standard detail for utility cuts that includes the pavement patching.	221
	Chapter 8 - Analysis of the Street Operations Division	
180	The Grounds Maintenance Section should prepare route sheets for each maintenance route defining the mowing work performed by the staff assigned to each route.	224
181	The Street Operations Division should identify and analyze the differences in job performance between the three areas.	227
182	The Street Operations Division should conduct training sessions of the staff of the Street Operations Division in the most efficient and effective methods to perform its primary work activities.	227
183	The Street Operations Division should reduce the crew size for street sweeping from a three-person crew to a single street sweeper with designated locations in each area where the street sweeper operators could dump their debris for later collection by a Load-All truck and operator.	230
184	The Street Operations Division should reduce crew sizes to the levels recommended by the Matrix Consulting Group.	231
185	Given the relatively high levels of staffing in the Street Operations Division versus the metric used by the Matrix Consulting Group, the Matrix Consulting Group recommends that the City immediately re-purpose the two vacant positions of Public Works Laborer Extra Driver.	231
186	A metric should be established for street sweeper operators of 22 to 28 curb miles per 8-hour workday, and the street sweeper operators should be expected to meet this metric. The extent of curb miles swept per street sweeper operator would be lower during the first sweeping in the spring, but any subsequent sweepings should be held to this metric.	232
187	Over time, the Street Operations Division should convert its street sweeper fleet to a mix of mechanical broom sweepers and regenerative air sweepers.	234
188	The Street Operations Division should enhance its pothole patching methodology for asphalt streets in fair to good condition by square cutting and tack coating the pothole, applying the asphalt in lifts as necessary, and compacting the pothole with a vibratory plate or roller as necessary.	235

Rec. #	Recommendation	Page Number
189	The pothole patching crews should be assigned to repair potholes in specific areas in the City (e.g., snow plow routes). The areas or routes should be assigned on a rotating basis, and all streets within the City covered within a two-week period. The crews should cover these routes looking for potholes that need to be patched, regardless of receipt of a service request. This will probably not be necessary year-round; this may only be necessary at the beginning of the construction season when potholes are most prevalent.	235
190	Streets that are planned for microsurfacing or seal coating should be crack sealed one year prior to the microsurfacing or seal coating; this will require coordination with the Engineering Division. Streets constructed, seal coated, or overlaid 3 to 5 years previously should also be crack sealed. In addition, the Street Maintenance Supervisors should conduct condition assessments of the streets in their assigned geographical areas and identify streets that need crack sealing. Generally, streets should be crack sealed on a 5 to 7 year cycle, the same cycle as used for seal coats.	237
191	The Engineering Division, as part of its physical inspection of the City's sidewalks on a 4-year cycle, should be to identify sidewalks that need grinding. This list of sidewalks that need grinding should be provided to the Street Operations Division. The Street Operations Division should utilize that list to assign work orders to its crews to grind these sidewalks.	238
192	The Street Operations Division should use a 1-person crew for sidewalk grinding. Accomplishing the reduction of crew size will require that a pickup truck be modified with a tommy lift to enable the lowering and raising of the sidewalk grinder into the bed of the pickup truck.	239
193	The supervisor for concrete maintenance and repair should be held accountable for generating a formal written plan and schedule in more detail regarding the concrete work to be done. The supervisor should plan the work of the concrete crews three to six months at a time at a time, planning what, how and a time estimate for a job. The supervisor should schedule the work, scheduling when and who will do the job a week at a time, using EnerGov.	241
194	The Engineering Division should work with the Street Operations Division to develop work activity guides for concrete maintenance and repairs that will identify when each maintenance and repair strategy will be employed. The Engineering Division should arrange for the provision of training in the application of maintenance and repair techniques other than joint sealing, panel replacement, and replacement of the street (curb-to-curb).	242
195	The classification series utilized for the Street Operations Division should be simplified and the number of classifications reduced. The revised series should also include a crew leader classification.	243
196	With the reclassification of the supervisors in the Street Operations Division into a single classification, the Street Operations Division should initiate a program of rotation of these supervisors among the different sections.	244
197	The Street Operations Division should develop and install a formal work planning and scheduling system using EnerGov.	247
198	The work method for pick and delivery of asphalt hot mix should be altered. The equipment operator responsible for picking up the asphalt hot mix from the asphalt plants should begin their work day one hour earlier than the Street Operations Division staff assigned to asphalt repair of streets. This would result either in the equipment operator finishing their shift one hour earlier than the other staff assigned to asphalt repair of streets or the conversion of the position to a 4 / 10 hour shift for those months the Division is repairing streets.	247

Rec. #	Recommendation	Page Number
199	The Public Works Operations Superintendent should develop a policy and procedure for the traffic control for street maintenance jobs performed by the Street Operations Division, in consultation with the Traffic Engineering Division. Upon development of the policy and procedure, the Public Works Operations Superintendent should coordinate the training of all of the staff in the Street Operations Division in the application of this policy and procedure.	248
200	Once the policy and procedure has been developed and training provided, the staff of the Street Operations Division should provide traffic control signage setup and take down for their jobs, and not rely on the Traffic Maintenance Workers.	248
Chapter 9 - Analysis of the Sewer Operations Division		
201	The Sewer Operations Division should begin a program of televising approximately 7% to 8% of its stormwater collections system on a 12-year cycle until it has completed an inspection of the entire system.	251
202	The Sewer Operations Division should clean catch basins using a 1-person crew and a manual cleaning process, with a jet vactor only scheduled if there is a presence of 5 cubic yards of debris or heavy debris in a catch basin.	253
203	The Sewer Operations Division should inspect and clean catch basins on an annual basis.	253
204	The Sewer Operations Division should prepare and implement a grease, fat, and oil source control program to reduce the amount of these substances discharged to the sewer collection system.	254
205	The Sewer Operations Division should use the *Pipeline Assessment and Certification Program* rating system, which was developed by the *National Association of Sewer Service Companies,* to code defects either by infrastructure or maintenance defect.	255
206	The classification of Collection System Maintenance Worker III – Televisor is unnecessary. The classification should be eliminated.	255
207	The incumbent of the Collection System Maintenance Worker III – Televisor classification should be reassigned to the Collection System Maintenance Worker IV classification.	255
208	When the Street Operations Division is replacing a concrete panel or the entire street (curb to curb), the Street Operations Division should order, place, and finish the concrete for manhole rings.	256
209	The Sewer Operations Division, itself, should order, place, and finish the concrete for manhole rings when the Division is repairing or reconstructing manholes when the Division is repairing or reconstructing manholes as a single and separate job.	256
210	The Sewer Operations Division should develop and install a formal work planning and scheduling system using EnerGov.	258
211	The City should authorize a third GIS position for the Public Works Department. The position should be funded by the general fund, but be placed under the supervision of the GIS staff in the Sewer Operations Division.	261
212	The two Utilities Infrastructure Management Specialist positions within the Public Works Department should be reallocated to the GIS Analyst classification series.	262
213	The Utilities Infrastructure Management Specialist classification series should be eliminated.	262
214	The Sewer Superintendent should develop a multi-year training plan for the GIS staff in the Public Works Department in consultation with the GIS Manager with the Information Technology Department.	263
215	A total of approximately 800 hours of summer interns should be authorized to assist in the collection of data so that these layers can be developed for the Public Works Department. The cost of the interns would approximate $8,000 to $10,000 annually.	264

Rec. #	Recommendation	Page Number
	Chapter 10 - Analysis of the Forestry Section	
216	The Forestry Section should trim mature street trees in Cedar rapids on a five to seven year cycle using a block-by-block trimming approach.	268
217	The Public Works Department should acquire a fourth aerial tower and brush chipper for the Forestry Section. The one-time capital outlay cost will approximate $200,000.	268
218	The Public Works Department should outsource stump removal.	268
219	Boom tree trimming and ground tree trimming should be assigned greater emphasis and the Forestry Section should assign one crew to each quadrant, with each crew allocated an aerial tower and chipper truck.	269
220	The Forestry Operations Supervisor should prepare a budget request for fiscal year 2015-16 to request funding for the seasonal labor necessary to water young trees once a week during the growing season.	270
221	The Forestry Section should water newly planted trees immediately after planting. During the first two growing seasons, the newly planted trees should be watered once a week during the growing season.	270
222	The Forestry Section Supervisor should inspect all of the service requests before the development of a work order for the service requests.	272
223	The Forestry Section Supervisor should develop a formal written priority system for the assignment of service requests in a written policy and procedure for the consideration of the Office of the City Manager.	272
224	The Forestry Section Supervisor should prepare a three to six month long-term schedule using EnerGov.	272
225	The Forestry Operations Supervisor should prepare a weekly schedule using EnerGov.	272
226	The Forestry Operations Supervisor and the Public Works Operations Superintendent should identify the proper location for dumping of brush and logs by the staff of the Street Operations Division, develop a written memorandum regarding its resolution, and provide the information to the staff of the Street Operations Division regarding the approved locations for dumping of brush and logs.	273
227	The City should conduct an inventory of its street trees.	276
228	The Arborist / Landscape Architect should be directed to immediately revise the proposed emerald ash borer plan for the City to include treatment for ash trees that are in good health with good structure, treating those street trees for a number of years while other trees are removed on the block, replaced, and allowed time to develop a replacement canopy.	277
	Chapter 11 - Analysis of the Administration Division	
229	The Administrative Services Supervisor should conduct a study of the utilization of the Public Works Department motorized equipment and develop recommendations for elimination of pieces of equipment.	281
230	The Public Works Department and the Fleet Services Division should establish a Specifications Committee. The Specifications Committee should meet on an ad hoc basis to discuss specifications for upcoming acquisitions, discuss concerns with existing equipment and their features and specifications, and explore ways to tighten the specifications to protect City's interests and deliver equipment that effectively and efficiently meets the functional requirements of the end user.	282
231	The Fleet Services Manager should chair the Specifications Committee.	282
232	The Specifications Committee should include representatives from all levels of the Public Works Department, but its membership should be limited to five to seven staff.	282

Rec. #	Recommendation	Page Number
233	The Fleet Services Division should prepare a five-year replacement plan for the review of the Public Works Department for the equipment assigned to the Public Works Department.	284
234	The five-year replacement plan for the equipment assigned to the Public Works Department should be reviewed with the Public Works Department Specification Committee.	284
235	The Public Works Department should develop an equipment operator-training program for the proper and safe use of heavy equipment.	285
236	The Public Works Department should develop a clearly written, five-year minimum, Strategic Plan.	287
237	The Administrative Services Supervisor should be responsible for coordinating the development and implementation of the Department's strategic plan.	287
238	The Public Works Department should develop goals, objectives, and performance measures beyond those contained in the City's operating budget.	289
239	The Administrative Services Supervisor should be assigned responsibility for coordinating the provision of training and technical assistance to the Department's division managers and first-line supervisors in the development of goals, objectives, and performance measures.	289
240	The Administrative Services Supervisor should be assigned responsibility for coordinating the necessary training and technical assistance required for collecting performance data.	289
241	The Public Works Department should develop a career development program.	291
242	The Administrative Services Supervisor should be assigned responsibility for coordinating the provision of training and technical assistance to the Department's division managers and first-line supervisors in the development of career development plans.	291
243	The Administrative Assistants in the Administration Division should be periodically rotated and cross-trained.	292
244	The Administrative Services Supervisor should develop desk manuals for the different "posts" that the Administrative Assistants are assigned to.	292
	Chapter 10 - Analysis of Culture and Leadership	
245	The Public Works Director should set the expectations about the necessity for the change of the culture within the Public Works Department, the type of new culture required in the Public Works Department, and how it will result in a more successful Public Works Department.	299
246	The executive and middle-level managers of the Public Works Department should develop and adopt the cultural values for the Public Works Department (based upon values already developed by the City) and "live" them in their day-to-day actions, so that the cultural values of the Public Works Department can take root.	300
247	The Public Works Director should build a culture of employee involvement in the Public Works Department that includes empowering employees, building a team-orientation, and continually developing employee skills and knowledge.	302
248	The Public Works Director should develop a culture in the department of adaptability that includes a culture of embracing change, a customer focus, and departmental learning from failure, mistakes, and from best practices.	304
249	The Public Works Director should build a culture of core values, the systems to constructively reconcile differences among the different divisions of the department, and common perspectives to enable different work groups in the department to work together cooperatively.	306

Rec. #	Recommendation	Page Number
250	The Public Works Director should work cooperatively with employees at all levels of the organization in the development of a purpose and mission for the department, and providing a clear long-term direction for the department.	308
251	The Public Works Director should practice "management by walking around" spending some part of his time every day listening to problems and ideas of the staff of the Public Works Department, while wandering around both floors of the City Service Center. The Public Works Director should communicate at all levels of the Public Works Department organization in informal ways, like just hanging around in the office and chatting with them.	310

2. ANALYSIS OF ASSET MANAGEMENT

Asset management focuses on the facts about the infrastructure assets, their performance, their preservation, and their anticipated longevity. Effective asset management in Cedar Rapids is important for a number of reasons as noted below.

- The value of the City's assets is significant. The City's CAFR for FY 2013 indicated that:
  - Road, bridges and sidewalks assets have a value of $376.2 million;
  - Traffic control and safety assets have a value of $11.9 million; and
  - Flood recovery assets have a value of $191.1 million.
- The City's infrastructure is aging, and much of it exceeds its life span.
- The population of the City of Cedar Rapids will experience substantive growth over the next several decades. The Corridor MPO has experienced a growth in population from approximately 150,000 in 1980 to 200,000 in 2010. Based upon forecasts from the Iowa Data Center, the Iowa DOT, and the Corridor MPO, the population of the Corridor MPO may grow to approximately 290,000 by the year 2040.
- The funding for some aspects of the City's asset renewal and rehabilitation has been insufficient.
- The risks and liability posed by aging infrastructure are significant.
- The safety and serviceability of assets is an increasing challenge.

Effective asset management uses accurate asset information to enable decisions regarding condition, performance, and other needs with a long-term view of the preservation and renewal of these assets.

The American Public Works Association has developed a *Guidance Position Statement for Public Works Infrastructure Asset Management*.[1] The Statement of

[1] Guidance Position Statement for Public Works Infrastructure Asset Management, American Public Works Association, 2003

Position states, "*The American Public Works Association is committed to the principle that public works facilities and their management organizations are valuable assets and should be managed to provide the highest possible return on the public's investment*. *Reliable public works services are crucial to a safe, healthful, and productive civil society. Each generation inherits the complex system of infrastructure that facilitates these services, develops and operates this system to meet our current demands and aspirations, and then passes the system on as a legacy to future generations. These valuable assets—sewers, streets, storm-water facilities, parks, waste management systems, public buildings, and the like - should be managed to get the highest possible return for the public*."

The framework for an asset management plan can be described in terms of seven questions.

- What do you have and where is it? (Inventory)
- What is it worth? (Costs/replacement rates)
- What is its condition and expected remaining service life? (Condition and capability analysis)
- What is the level of service expectation, and what needs to be done? (Capital and operating plans)
- When do you need to do it? (Capital and operating plans)
- How much will it cost and what is the acceptable level of risk? (Short- and long-term financial plan)
- How do you ensure long-term affordability? (Short- and long-term financial plan)

This chapter evaluates the asset management practices within the Public Works Department.

1. THERE ARE A NUMBER OF STRENGTHS AND OPPORTUNITIES FOR IMPROVEMENT IN THE ASSET MANAGEMENT PRACTICES OF THE PUBLIC WORKS DEPARTMENT.

In evaluating the asset management practices of the Public Works Department, a number of strengths were evident. This include the following:

- The acquisition and installation of the EnerGov computerized maintenance management system;
- The availability of inventory data for some types of assets such as some of the traffic signal system, streets, the City's sidewalks, the sanitary sewer system, etc.; and
- Recent condition assessments for some types of assets have been or are being developed such as City streets and the City's sidewalks.

On the other hand, there are a number of opportunities for improvement. These opportunities include the following:

- The lack of an asset management policy;
- The lack of long-term asset preservation strategies and plans for managing assets under the care of the Department;
- The lack of clarity regarding the responsibility for management of asset preservation and renewal;
- The lack of a unified set of asset management principles, processes, and procedures; and
- The lack of up-to-date asset inventory databases for the assets maintained by the Department.

These strengths provide a sound foundation for the improvement of asset management practices within the Public Works Department.

2. THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP AN ASSET MANAGEMENT POLICY AND PROCEDURE FOR THE CONSIDERATION OF THE OFFICE OF THE CITY MANAGER AND THE MAYOR AND THE CITY COUNCIL.

The Public Works Department should develop and adopt an asset management policy. The policy should be based on a systems approach, such as the approach suggested in the exhibit on the following page.

The asset management policy is the starting point for unifying asset management practices across the Department. Without this, alignment and consistent management control is not possible.

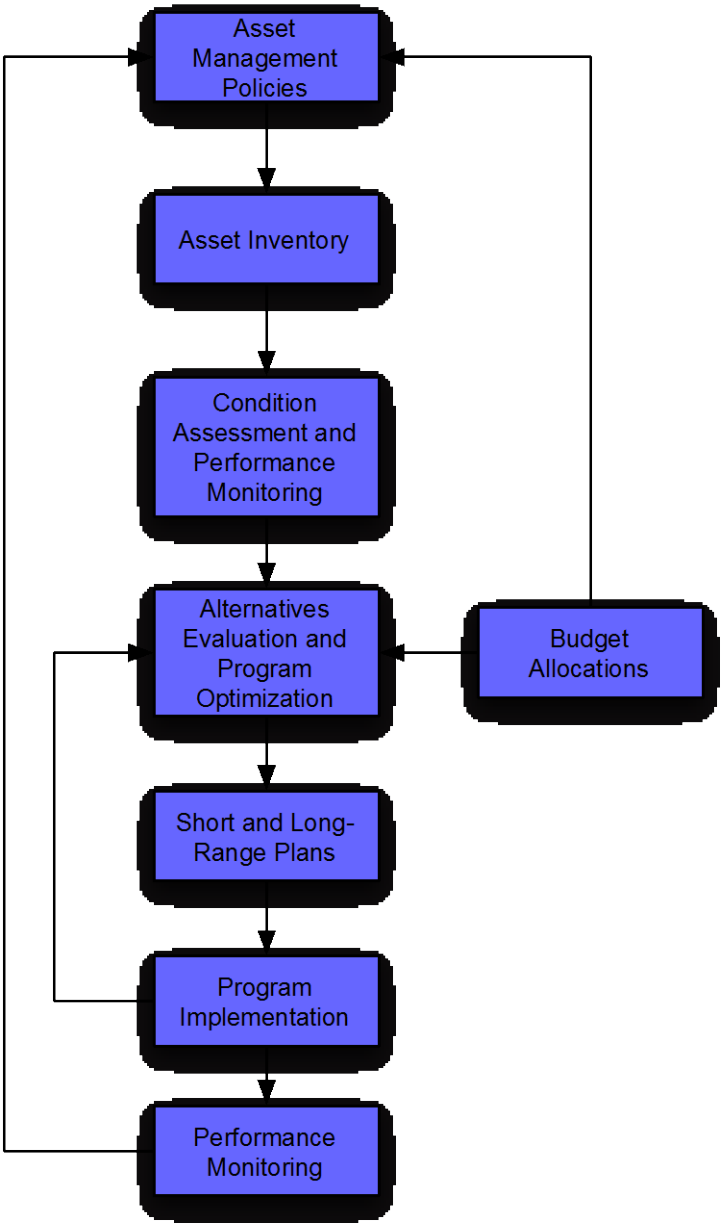
The Department lacks such a unifying, Department-wide policy to coordinate the management of assets across the major categories (sanitary sewer, stormwater collection, streets, traffic signals, regulatory signs, sidewalks, etc.).

The Department should develop a formal, written policy and procedure regarding asset management that is related to clear goals, objectives, and measures of performance. The policy should define organizational roles and responsibilities in the implementation of the asset management policy and procedure. The specific aspects of this policy and procedure are presented below.

- Goals and objectives reflect a comprehensive, long-term view of asset management.
- Policy goals and objectives are comprehensive, and integrated with other City policy objectives, and supported by quantitative and measurable performance measures or criteria.
- Principles of good asset management are articulated in the policy and procedure and clearly recognized as the driving force for resource allocation and utilization.
- The goals and objectives support the preservation of existing infrastructure assets.

Exhibit 1

Asset Management Systems Approach



Key Questions

What are the asset policies and goals?

What is included in the inventory of assets?
What is the value of the assets?
What are their functions?
What services do they provide?

What was the past condition of assets?
What is the current condition and predicted future condition?

How can we preserve, maintain, or improve the assets to ensure the useful life and provide acceptable service to the public?

What financial resources are available?
What is the projected level of future funding

What financial options have been identified within and among asset classes?
What are the costs and benefits of the options?

Which option or combination of options is "optimal"

What are the consequences of not maintaining our assets?
How can we communicate the impact of the condition and performance of our assets on the system and end user?

How do we monitor the impact of our decisions?
How do we adjust our decision-making when indicated?

How can we best manage our assets in order to least inconvenience the customer when we repair or replace these facilities?

- Goals and objectives embody the perspective of life-cycle economic analyses of asset performance and cost, and encourage strategies with long-term benefits.

- The goals and objectives recognize the importance of reliable information on asset inventory and condition.

- The policy should encourage the development and updating of long-range asset management plans (e.g., sanitary sewer master plan) to provide clear and specific guidance for the capital program development process.

- The policy includes criteria for allocating resources, setting program priorities, and selecting projects consistent with stated policy goals and objectives and defined performance measures.

- The policy should require the regular, ongoing collection of information on the condition of assets.

- The policy should require the use of information on changes in asset condition over time to develop and improve forecasts of asset life and deterioration.

The Department's asset management policies and goals will define its most important priorities with regards to allocation of scarce financial resources.

There are a number of other cities that have developed such an asset management policy that can serve as a model. These include such cities as Portland, Oregon, and Seattle, Washington. The American Association of State Highway Officials has also developed extensive information regarding asset management.

Recommendation #4: The Public Works Department should develop an asset management policy and procedure for the consideration of the Office of the City Manager, Mayor and City Council.

3. THE PUBLIC WORKS DEPARTMENT SHOULD BE ASSIGNED ACCOUNTABILITY FOR MANAGEMENT OF THE ASSETS UNDER ITS STEWARDSHIP.

In the development of the asset management policy and procedure, the Department should clarify accountability for the management of each of the assets under its stewardship. This would include such assets as sanitary sewer collection,

stormwater collection, traffic signals, streetlights, streets, sidewalks, etc. The Department should designate a specific manager for each asset. Each of these different classes of assets should have a separate asset manager.

For example, the City's Traffic Engineer should be the asset manager for traffic signals, streetlights, signs and pavement markings. The City's Street Operations Superintendent should be the asset manager for the City's streets and sidewalks. The City's Sewer Superintendent should be the asset manager for the City's sanitary and stormwater collection system. These asset managers should develop an asset strategy and plan for the assets assigned to their management.

The role of the Engineering Division should be to develop an asset management strategy template and an asset management plan template, and to quality control the development of the asset strategy and plan by each asset manager.

The clarification of the accountability should consider the following elements:

- Each asset manager would be responsible for the development of the Department's asset strategy for that specific asset;
- Each asset manager would be responsible for coordinating asset management of that specific asset across the Department;
- Each asset manager would be responsible for the preparation of an asset plan for that asset; and
- Each asset manager would be responsible for continuous improvement in the Department's approach for evaluating capital projects for that specific asset.

These asset managers, designated for each specific asset, are responsible for development of asset management plans; implementing asset management strategies and enabling tools; and evaluating asset performance and condition.

The Department should establish a departmental asset management committee

to facilitate a coordinated departmental asset management approach. The committee should be comprised of each asset manager, the Engineering Services Manager, and the Public Works Director. This asset management committee should develop a position description that clarifies the roles and responsibilities of an asset manager, and develop an asset management policy and procedure for consideration of the Office of the City Manager, Mayor and City Council.

Recommendation #5: In the development of an asset management policy and procedure, the Public Works Department should clarify accountability for the management of each of the assets under its stewardship.

Recommendation #6: The Public Works Department should establish a departmental asset management committee to facilitate a coordinated departmental asset management approach.

Recommendation #7: The Public Works Department should designate the managers within the department that are accountable for managing each specific type of asset assigned to the Department. Each asset manager should be responsible for the development of an asset management strategy and plan for those assets assigned to their management.

Recommendation #8: The role of the Engineering Division should be to develop an asset management strategy template and an asset management plan template, and to quality control the development of the asset strategy and plan by each asset manager.

4. THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP ASSET INVENTORIES FOR THE ASSETS ASSIGNED TO THE DEPARTMENT FOR MAINTENANCE AND REPAIR.

While it will not be easy, the Public Works Department should develop a comprehensive inventory of its assets. To develop this comprehensive inventory, the Department should take the steps summarized below (and more fully explained in the following chapter).

- Identify the objectives of the EnerGov maintenance management system including how the asset inventory data will be utilized to maintain and repair these assets.

- Identify the sources of asset inventory data.
- Determine who will collect and enter the initial asset inventory data into EnerGov.
- Assign responsibility for updating the asset inventory data in EnerGov.
- Consider how the information will be collected and transferred to the EnerGov maintenance management system.
- Document specific asset inventory data to be collected as well as the quality control procedures.
- Establish a timeline for data collection on a department-wide basis.
- Before beginning the initial asset inventory, install and familiarize the data collection team with software and hardware tools, the required data and data collection and entry procedures.
- Conduct a pilot program.

Collecting asset inventory data doesn't necessarily require a large up-front investment of time and money. Instead of collecting all asset inventory data from the beginning, a phased approach allows the Public Works Department to start small and gradually grow their inventory. A phased approach allows an organization to adopt a system and procedures that are affordable and effectively meet immediate goals, but is also flexible enough to grow with the changing needs of both the organization and the industry.

Recommendation #9: The Public Works Department should collect asset inventory data for each of the assets it is responsible for maintaining and repairing.

5. THE PUBLIC WORKS DEPARTMENT SHOULD UPDATE THE INVENTORY OF THE ASSETS UNDER ITS STEWARDSHIP ON AN ONGOING BASIS.

An effective asset management system requires objective, high-quality data, presented to decision-makers and other stakeholders as understandable, useful

information. The Department lacks accurate and complete asset inventory data for much of the assets assigned to its care.

Keeping asset information, such as construction dates and costs, features, location, maintenance and inspections, up-to-date, accessible and understandable is a significant challenge in asset management. This asset information is a virtual representation of the assets in the field. For the data to be useful, this "virtual inventory" must be kept up-to-date to match the state of the "physical inventory," or the actual assets in the field. Monitoring the data on a regular basis is the key to keeping this virtual inventory current. The maintenance of this "virtual inventory" will require:

- The capturing and entry of asset information on any unrecorded assets discovered during regular maintenance by the staff of the Public Works Department;
- Entry of new records for assets as they are added to the system and the immediate incorporation of these assets into the maintenance schedule that is part of EnerGov;
- Updating the results of asset condition inspections and assessments;
- Removal of assets from active duty when taken out-of-service, and archiving the information in the database; and
- The addition of other geographic information system layers not yet developed within the asset inventory.

In addition, the Public Works Department should periodically audit the data contained within the geographic information systems to assure the accuracy and consistency of the data. These could consist of spot checks to confirm the virtual data against the physical data, and the checking of the asset libraries for duplicates or inconsistent data.

Two of the reasons for the failure of computerized maintenance management systems result from problems with asset inventory data as noted below.

- **Bad asset inventory data**. The quantity of data is not as important as the quality of data. Too much data can be a hindrance—and inaccurate or inconsistent data cannot be processed or utilized effectively. Start with the most crucial elements and determine the standards for recording this information. The system can be expanded in the future by collecting additional fields of data.

- **Inventory data is not maintained**. A system can't remain effective if it fails to receive periodic maintenance of inventory data. Relying on a single person to carry the ongoing weight of keeping the system up and running is also a mistake. It is necessary that all levels within the organization accept and adopt this new system and assist in updating the asset inventory data. Without this commitment, the system will ultimately fall short of the defined goals due to incomplete or inaccurate inventory data.

The Public Works Department should not stop inventory maintenance once the collection process is completed. This is an ongoing process that will require attention involving any physical changes to an asset.

Recommendation #10: The Public Works Department should update asset inventory information on an ongoing basis.

Recommendation #11: The responsibility for updating of the asset inventory information should be assigned to each asset manager within the Public Works Department in a written policy and procedure.

6. THE PUBLIC WORKS DEPARTMENT SHOULD CONDUCT CONDITION ASSESSMENTS OF ITS ASSETS ON A PERIODIC ONGOING BASIS.

Condition assessments must be made at regular intervals. The condition assessment must be updated as assets age, and should be based upon formal quantitative models. For most assets, there are good models available for condition assessment – the NASSCO sewer pipe condition rating system is one such example[2]. Additionally, paving condition assessment methodologies are quite mature. The pavement condition assessment methodology being utilized by Iowa DOT on behalf of the City should be utilized, on an ongoing basis, to evaluate the condition of the City's streets on an ongoing basis.

[2] Manual of Sewer Condition Classification, National Association of Sewer Contractors

It is important to determine how "condition" is defined for each type of asset. In many cases, the condition is simply a surrogate for its useful life. In these cases – for example air handling units in the City's buildings - it may be more expedient to directly estimate the useful remaining life of the asset than it is to say it is in "fair" or "poor" condition.

Recommendation #12: The Public Works Department should conduct periodic asset condition assessments of the assets under its stewardship.

7. THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP LONG-TERM ASSET PRESERVATION PLANS FOR THE ASSETS UNDER ITS STEWARDSHIP.

Long-range asset management planning, and priority programming of resources based upon these plans, should be central to the Department's resource allocation decisions. Asset preservation plans are being developed for streets, but are largely lacking or out-of-date for all of the other assets under the stewardship of the Department (e.g., storm sewer collection system, sanitary sewer collection system, traffic signals, regulatory signs, etc.).

The Public Works Department should develop asset preservation plans for each of the assets under its stewardship. These long-term plans for the renewal and replacement of assets should be developed for the storm water collection system, sanitary sewer collection system, traffic signal system, regulatory signs, etc.

Recommendation #13: The Public Works Department should prepare a long-term plan for the renewal and replacement of the assets assigned to the Department's stewardship. These long-term plans for the renewal and replacement of assets should be developed for the storm water collection system, sanitary sewer collection system, traffic signal system, regulatory signs, etc.

Recommendation #14: The long-term plans for the renewal and replacement of the assets assigned to the Department's stewardship should be prepared by the Engineering Division with the advice and consultation of the asset managers.

3. ANALYSIS OF MAINTENANCE MANAGEMENT

This chapter presents an analysis of maintenance management practices for the Public Works Department. This analysis includes the following:

- The adequacy of maintenance management systems employed; and
- The deployment of the EnerGov system to manage the maintenance of these assets.

In performing this study, the Matrix Consulting Group compared current maintenance management systems in the Department to best practices as defined by professional associations such as the American Public Works Association, the American Association of State Highway and Transportation Officials, etc.

Effective maintenance management systems use accurate information to enable efficient deployment of staff, materials, and capital resources to cost-effectively maintain assets.

1. IMPLEMENTATION OF ENERGOV IS ESSENTIAL TO THE EFFECTIVE MANAGEMENT OF THE MAINTENANCE OF THE CITY'S ASSETS BY THE PUBLIC WORKS DEPARTMENT.

EnerGov is an ArcGIS server extension web-based application that can be used to track service requests, work orders, inspections, and provide search and report capability.

EnerGov can serve as the basis for maintenance management by the Department. Maintenance management is basically a management-by-objective approach to planning, organizing, directing and controlling work. This approach has three primary goals: increased productivity, effective management of levels of maintenance and repair service, and management of the City's assets.

The use of EnerGov as a maintenance management suite would enable the

Department to accomplish a best practice defined by the *American Public Works Association* in its *Management Practices Self-Assessment.* Management Practice 10.14 states "infrastructure maintenance activities are managed using dedicated work order systems to track requests, work orders, and costs of maintaining various infrastructure assets."

The management of the maintenance and repair of assets to optimize their useful life and reduce maintenance costs is an ongoing challenge for the Department. However, the Department must shift its management process for the entire range of its assets to one of managing and delivering a proactive, managed system of preventive maintenance, renewal, and rehabilitation, and not a reactive system. The Sewer Operations Division does an excellent job of proactively managing the preventive maintenance, renewal, and rehabilitation of the sanitary sewer system. Other divisions and other assets lack this managed and proactive approach.

What is the benefit of a maintenance management system in accomplishing this change? These benefits are noted in the paragraphs below.

- **Are maintenance procedures working?** The management of the Public Works Department should be able to determine the total employee hours, grouped by work type or asset, and compare the amount of work performed to the amount of work scheduled. A key metric is amount of work accomplished that was scheduled versus unscheduled.

- **Are maintenance activities adequate?** The management of the Public Works Department should be able to look at the number of scheduled work orders grouped by work type or asset, and compare the amount of work that was scheduled to be performed based on pre-determined service levels to the amount of work actually performed. For example, the planned frequency with which sanitary sewers are cleaned can be compared to the actual frequency to determine whether assets are appropriately preventively maintained.

- **Where are my problems and where should limited resources focus?** The management of the Public Works Department should be able to look at the total

cost for work type or class and sort the work requests by asset, and sort by location. This will identify by asset where all the time and associated costs are being accumulated. This is typically referred to as the "Top 10" list or "Bad Actors" report. By example, such information can be used to justify replacement of a sewer main or overlay of a street as opposed to re-investing efforts in continued corrective maintenance.

- **Where is maintenance focusing their efforts?** The management of the Public Works Department should be able to look at the total employee hours grouped by work type or class. Depending on the established work types, this will identify the type of work that the maintenance organization is accomplishing. This is critical to ensure true maintenance work is being accomplished in support of service level goals and targets. For example, are staff being used for repairs of assets (replacing a concrete street), while preventive maintenance of these assets is not being adequately accomplished (e.g., crack sealing of these streets)?

- **What is the profile of our work backlog?** The management of the Public Works Department should be able to look at the backlog of all requested work, assuring that there is no less than 2 weeks and no more than 4 weeks of lower priority backlog. For example, what is the backlog of concrete streets that need to be replaced?

- **How efficient is our maintenance staff?** The management of the Public Works Department should be able to review the labor hours per employee and per work order and compare these to developed benchmarks (e.g. the curb miles of streets swept per sweeper operator per day). These efficiency and effectiveness measures can be used to justify existing and future desired staffing levels.

- **How much money are we spending on maintenance services?** This includes parts, material and supply costs, contractor costs, and maintenance labor costs. The management of the Public Works Department should be able to review the unit costs for work accomplished by the Department and trends in those unit costs.

In summary, it is clear that a well-implemented and properly utilized EnerGov will generate several important benefits contributing to improved business processes and enhanced management decision-making.

The City has been working on the full and complete implementation of EnerGov as a permitting and land management system. However, installation for maintenance management in the Public Works Department has only begun recently: it has been

installed in Traffic Engineering and is utilized for traffic signal and streetlight maintenance and repair.

As the Public Works Department moves forward with the implementation of EnerGov, the installation should adhere to a number of important best management practices for maintenance management systems.

2. ENERGOV SHOULD BE UTILIZED AS A MAINTENANCE MANAGEMENT SYSTEM, NOT MERELY AS A WORK ORDER SYSTEM.

The Public Works Department should utilize EnerGov as a maintenance management system to enable the identification of the services provided (e.g., wastewater collection system preventive maintenance), the levels of service (e.g., 100% of the City wastewater mains shall be cleaned every 36 months), the outputs of each of these services (e.g., the linear feet of wastewater collection mains cleaned per crew day), and the costs of those service in terms of the total cost and the cost per unit of output.

This maintenance management system needs to be installed within all maintenance units of the Public Works Department.

The components of a successful maintenance management system are presented below.

- **The Department should fully document the number and type of maintenance features (physical assets) is a major factor in determining the kinds and amounts of work needed**. An inventory of such maintenance features (physical assets) should be prepared for streets, urban forestry, sanitary sewer, storm sewer, traffic signals, etc.

- **The Department should develop activity guides for its maintenance management work activities**. Work activities should be defined for the significant activities representing the maintenance work to be performed. Definitions shall include and activity code, title, description, work unit and inventory unit. Such complete descriptions of activities are referred to as Activity

Guidelines and provide standards of performance for individuals and crews by setting forth the quality and quantity of results anticipated from each activity.

- **The Department should develop an annual work program and budget**. The activity-based work program and budget represents the product of the planning process and summarizes the kinds and amounts of work planned, the productivity of the work force, and the costs of the planned work. It also provides the basis for managing the annual work effort.

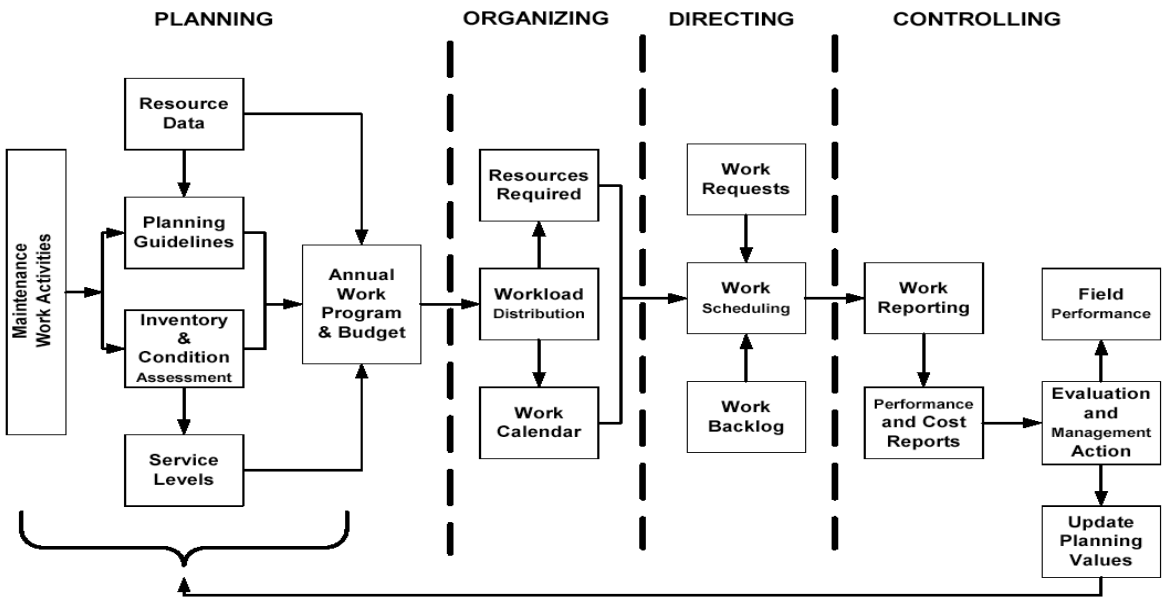
- **The Department should prepare an annual work calendar showing the monthly distribution of planned maintenance activities**. Labor, equipment and material resource requirements needed to accomplish the planned workload are also identified.

- **The Department should document the resources needed to accomplish the annual work program**. By organizing the labor, equipment and material resources, cities can ensure that planned maintenance can be accomplished with the available budget. Preparation of an annual work calendar and a monthly distribution of work can help document resource needs.

- **The Department should require that all first-line supervisors prepare formal weekly work schedules using EnerGov**. The preparation of annual, seasonal and short-term schedules, as well as weekly plans, can provide guidance in achieving annual work program goals.

- **The Department should prepare reports that compare the planned work output to actual**. Reports that will enable showing work accomplishment and cost data and a comparison of planned and actual work program accomplishment should be prepared.

The basic flow of this maintenance management system is presented in the chart below.



The steps that need to be accomplished before the maintenance management system in EnerGov can be effectively utilized are presented below.

(1) All of the Assets Maintained and Repaired by the Public Works Department Should Be Input Into the Asset Registry Module of EnerGov.

The Matrix Consulting Group recommends that inventory data regarding assets be collected and entered into the asset management module for EnerGov on a phased-in basis.

Effective asset management requires a complete and accurate inventory of the assets. There are a number of reasons why this asset information is important in the cost effective life cycle management of these assets.

- **The Department, over the past several years, has been asked to do more with fewer resources**. Staffing levels have been reduced. This places more importance on the need to have comprehensive asset data to prioritize and manage maintenance and repair activities and resources.

- **A comprehensive asset inventory will provide better information for the Mayor and City Council to make informed resource allocation decisions**. The Mayor and City Council, with a comprehensive asset inventory, can make sounder decisions regarding how tax dollars should be used, particularly as it

concerns funding for renewal and rehabilitation of existing assets versus the construction of new assets.

- **Governmental accounting standards are requiring enhanced and more consistent inventory information**. GASB 34 is a relatively new action that requires enhanced and more consistent information on infrastructure assets than has been required in the past. Local governments require better asset inventory data to meet these standards.

- **EnerGov relies on comprehensive asset inventory data**. Automating the once manual system of managing assets does more than increase the speed and efficiency of the process; it also ensures that the maintenance and repair of these assets are more effectively managed.

While it will not be easy, the Department should complete the inventory of its assets. It has already begun this effort for traffic signals, though apparently that effort is only half-completed.

The Department should begin with those types of assets that have already been inventoried and utilize those types of assets as the initial point of data entry into EnerGov.

To develop this comprehensive inventory, the Department should take the steps noted below.

- **Identify how the asset inventory data will be utilized in EnerGov to maintain and repair these assets**. This is to avoid collecting information that will not be utilized for maintenance management (e.g., assets that will be maintained as the sum of their parts). Understanding how the asset inventory data will be utilized is necessary to identify the data to collect. Data could initially be utilized to establish a preventive and corrective maintenance program. Not all data needs to be collected initially. Some may be essential to the initial phase of EnerGov, while others, such as current replacement value, can be collected during later phases. The Department should start with the most important data and expand the data within the system over time.

- **Identify sources of pertinent data.** Once the required data for EnerGov is defined, the Department must determine how to obtain the data and how it will be entered into the new system. Necessary data is currently in paper records or must be documented and collected.

- **Determine who will collect and enter the initial asset inventory**. The collection of data is time intensive and costly. Data collection is typically collected in-house or through outsourcing. Evaluating the merits of these two options lies primarily with the costs associated with each. Using current personnel who are not devoted specifically to data collection will take them away from present duties. On the other hand, outsourcing requires that the cost be incorporated into the Department's budget. The asset manager should be responsible for the coordination of the collection of asset inventory for the assets entrusted to their care.

- **Assign responsibility for updating the asset inventory data**. The time and expense of collecting this asset inventory data will be wasted unless the inventory is kept current. The responsibility for updating this asset inventory needs to be clearly assigned. The responsibility for coordinating the updating of the asset inventory data should be assigned to the Utility Infrastructure Management Specialist III.

- **Consider how the information will be collected and transferred to EnerGov**. Consider if forms should be created. A potential source of how the information should be collected is EnerGov itself.

- **Document specific asset inventory data to be collected as well as the quality control procedures.** In addition to identifying the data entry and collection staff, determine how this data will be quality controlled. Data validation must ensure accuracy, and identify inconsistencies and potential problems, particularly during the early stages of the data collection. Examples of the types of specific data that could be collected are presented below.

Installed Date	Asset Cost
Asset Class ☐	Remaining Life in %
Recommended Renewal Strategy ☐	Recommended Renewal Date
Renewal Cost Estimate	Yearly Cost Estimates
Estimated Effective Life of the Asset ☐	Residual Life in Years

- **Establish a timeline for data collection and a project manager responsible for managing data collection**. The Department should develop a schedule for data collection and clearly assign responsibility for managing this process.

- **Before beginning the initial asset inventory, install and familiarize the data collection team with software and hardware tools, the required data and data collection and entry procedures**. The Department should provide training to all team members. Since the initial inventory will involve manual data collection, the Department should develop forms to gather the information in the field.

- **Before beginning the initial asset inventory, the Department should develop a plan for how to integrate the data within GIS.** Spatial location is

typically the one common aspect among all of the data at a Public Works Department. The spatial location presents the relationship between customers and assets by their spatial location and interconnection. When a Public Works Department spatially enables its asset inventory data, it can use the analytical power of GIS to gain a better understanding of how our assets are performing and how they affect its level of service and our customers. GIS is consistently the gateway where large amounts of asset data enter a Public Works Department and where its basic characteristics (location, size, installation date, material, etc.) is maintained. So maps from GIS are the place to visualize, analyze and explore many pieces of asset related data and also enable you to propose ways to manage your assets better (maintenance, rehabilitation or replacement) and understand the impact. Modern maintenance management systems always have a GIS integration component that includes a toolbar in desktop GIS to keep assets in sync between the GIS and the maintenance management system and also uses server-based GIS to give a spatial view of assets and work orders to Public Works Department staff that are scheduling and managing work orders. So the way maintenance management systems are integrated with GIS underscores the concept that maintenance management is about utilizing the best information from each system that stores data about assets.

- **Conduct a pilot program.** Completing a pilot program is an important part of making sure the asset inventory data collection meets needs and expectations. The assets selected for the pilot program should represent the assets as a whole and be limited in size. Once pilot program data is in the system, both the data and the process should be reviewed and quality controlled. Based upon the findings of the pilot project, the Department should revisit the timeframe for collecting the asset inventory data.

- **Develop a timeline for the collection of inventory data.** Each division manager should be held accountable for developing a schedule for the collection and input of asset inventory data for those assets assigned to the manager.

The inventory should <u>not</u> include a condition assessment; that would only delay the collection of the data. It should include the number and location of the assets.

ESRI has developed tools with which to collect inventory data for some asset types including street signs, traffic signals, streetlight, bridges and sidewalks. These applications would enable the City to utilize a configuration of ArcGIS Online and Collector for ArcGIS application that can be used by public works operations staff to inventory

Recommendation #15: The Public Works Department should collect and enter asset data for those assets entrusted to its care into the EnerGov asset management module on a phased-in basis.

Recommendation #16: The Public Works Department should begin with those types of assets that have already been inventoried and utilize those types of assets as the initial point of data entry into the EnerGov asset management module.

Recommendation #17: Before beginning the initial asset inventory, the Department should develop a plan for how to integrate the data within GIS.

Recommendation #18: The Department should utilize the inventory data collection tools developed by ESRI for street signs, traffic signals, streetlight, bridges and sidewalks.

(2) The EnerGov Service Request Management Module Should Go Live.

The EnerGov Service Request Management module is designed for the citizen and the business providing an efficient way to shift traditional counter services that normally arrive through phone, fax, or email to using the Internet. This service provides an easy and convenient online access to contact the Public Works Department concerning service requests.

Citizens and businesses can choose a self-service option to place a request using the same workflow available to the Public Works Department. A service request can be organized by pull down menus or keyword searches. A location, along with a description, can be added to provide the information that is fitting to the service request.

The EnerGov Service Request Management module uses web services to interface directly to the EnerGov service request. Once the citizen or business has submitted the service request online, it is automatically saved to the EnerGov Service Request Management module database where the Public Works Department can manage the request as they would any other request. Citizens and businesses can view

the status of their request at any time by returning to the Service Request Management module and entering their own service request ID. This enables citizens and businesses to quickly find information without having to call the Public Works Department, reducing the burden on staff.

The existence of the EnerGov Service Request Management module should be noticed in the City's newsletter.

Recommendation #19: The Public Works Department should work with the Information Technology Department to install the EnerGov Service Request Management module.

Recommendation #20: The existence of the EnerGov Service Request Management module should be noticed in the City's newsletter.

(3) All of the Labor Hours that Crews Work Completing Work Orders Should Be Recorded To the Work Order / Maintenance Management Module in EnerGov.

It is typically problematic to ensure that labor hours are being consistently recorded to work orders by the staff of the Department. In other words, some staff will have difficulty grasping the importance of recording all of their work hours – their entire shift – in work orders in the EnerGov Work Order / Maintenance Management module.

Work orders, upon completion by the crews of the Public Works Department, should be reviewed for validity of the data and the completeness by the first line supervisor in the EnerGov Work Order / Maintenance Management module. The first line supervisor for each section should be held accountable for the quality control of the work orders completed by the staff of the section in the EnerGov Work Order / Maintenance Management module. The suggested procedure for completing this review is presented in the exhibit following this page: the completing work order business process.

Exhibit 2

Completing Work Order Business Process

Activity	Description	Perform / Accountable	Consult	Comments
1. Query for work orders that have been completed	This activity is to ensure that all data is accurate before proceeding to the next steps. A Query will be conducted in EnerGov for all work orders completed for each Section by each Section's first line supervisor	Section first line supervisor	Section Manager	Performing Queries and making changes to a work order is found in the Work Order Procedure
2. Review WO	Work Orders are then reviewed to ensure accuracy and completeness of data *(all fields in the* EnerGov *WO screen must be completed)*. If information is incomplete or inaccurate, the field crew will be requested to make necessary corrections and/or updates.	Section first line supervisor	Section Manager	Performing Queries and making changes to a work order is found in the Work Order Procedure
3. Complete Work Order	When the work is completed, the WO status is change to (complete).	Section first line supervisor	Section Manager	See Work Order Procedure
4. Make Corrections	All information needed must be available to make necessary corrections to the WO.	Section first line supervisor	Section Manager	See Work Order Procedure
5. Return WO to field crew	Crew is notified if WO is incomplete or inaccurate for necessary corrections.	Section first line supervisor	Section Manager	See Work Order Procedure

Recommendation #21: The first line supervisors in the Public Works Department should be held accountable for the verification of the completeness and the validity of the data in each work order prior to closure of each work order in the EnerGov Work Order / Maintenance Management module. This should be accomplished the same day as the work associated with the work order is completed.

Recommendation #22: If the crews in the Public Works Department continue to make errors in completing work orders, remedial training in the use of the EnerGov Work Order / Maintenance Management module should be provided. If the errors continue despite the remedial training, then employees should be held accountable.

(4) All of the Materials Used By Crews in their Maintenance and Repair Work Should Be Entered to Work Orders in the EnerGov Work Order / Maintenance Management module.

The maintenance staff of the Public Works Department should be held responsible for performing the work detailed through the work order, charging labor hours and the types and amounts of material in the work order. This should include entering the parts and inventory consumed as part of the work order into the EnerGov Work Order / Maintenance Management module as noted below.

- Access the part number in the EnerGov Work Order / Maintenance Management module using draw down menus;
- Enter the date the part or inventory was issued;
- Enter the name of the crew leader the part or inventory was issued to using a draw down menu; and
- Enter the quantity of parts or inventory issued.

The unit price of the part would already be included in EnerGov. The total cost of the parts or inventory issued would be calculated by EnerGov and entered to the work order. However, if the crew is picking up a part not issued by the Department's stockroom(s) (e.g., from Home Depot or Lowe's), then the crew should write the work order number on the receipt and enter that data into the work order in EnerGov.

Recommendation #23: All of the materials used by the crews in their maintenance and repair work should be entered into work orders n the EnerGov Work Order / Maintenance Management module.

(6) The Administrative Services Supervisor, Public Works Department, Should Develop Formal Written Policies and Procedures for the Use of EnerGov.

To ensure that the staff of the Public Works Department understand their roles and responsibilities in working with EnerGov, the Administrative Services Supervisor, Public Works Department should complete written procedures regarding the day-to-day use of EnerGov by the staff of the Department. These procedures should include the following:

- Receiving a service request, and assigning the request for work to a specific section or division (e.g., Forestry, Streets, Sewers, etc.);
- Creating a corrective maintenance or service request work order;
- Creating a preventive maintenance work order;
- Scheduling and assigning a work order to a crew;
- Completing a work order (by the crew leader);
- Reviewing and quality controlling a work order (by a first-line supervisor);
- Closing a work order (by a first-line supervisor); and
- Recording materials used to a work order.

The Administrative Services Supervisor, Public Works Department should provide the staff of the Public Works Department with copies of the policies and procedures, provide training in their use and application, and provide the opportunity to answer questions. The Public Works Director and the middle managers of the Department should then fold the staff accountable for compliance.

Recommendation #24: The Administrative Services Supervisor, Public Works Department should complete written procedures regarding the day-to-day use of EnerGov by the staff of the Department.

Recommendation #25: The Administrative Services Supervisor, Public Works Department should provide the staff of the Public Works Department with copies of the policies and procedures, provide training in their use and application, and provide the opportunity to answer questions. The Public Works Director and the middle managers of the Department should then hold the staff accountable for compliance.

(7) The EnerGov Inventory Manager Module Should "Go Live" Including the Stockroom Inventory.

The Public Works Department should "go live" with the Inventory Manager module. The Inventory Manager module is integrated with the work order module so that associated time and costs for personnel, crews, contractors, vendors, equipment, and other items pulled from inventory can be tracked. This module:

- Enables the addition and tracking of equipment and materials to work orders; and
- Enables real time inventory tracking with alerts for low inventory.

Without the complete deployment of the Inventory Manager module, it will not be possible for the Public Works Department to fully cost out its work activities – labor, equipment, and parts.

Recommendation #26: The Public Works Department should "go live" with the Inventory Manager module, with the complete deployment of the module to record equipment and materials.

(8) Activity Guides Should Be Developed for the Work Activities Performed by the Public Works Department.

Different employees can interpret and define work activities differently. Differences in interpretation can result in unreliable data within the maintenance management system.

It is essential that work activities be defined consistently. This requires the development of complete descriptions of maintenance activities… the what, where, when, why, how and how much of maintenance activities. These should be defined in activity guides.

The Public Works Department should define the work activities performed by their units and to develop activity guides.

The supervisors need only assure that all of the primary work activities that consume the majority of staff work hours are defined. This would include all forms of leave. All 2,080 staff hours for each employee should be included within the system.

The work activities need to be carefully defined to assure that the same terminology is used for the work performed by all staff. Each of these work activities should define the unit of measure. An example of a work activity and unit of measure are provided below.

Work Activity	Activity Description	Unit of Measure
Traffic signal cabinet preventive maintenance	Traffic signal cabinet preventive maintenance includes the inspection, testing, cleaning and adjustments made to the traffic signal electronic equipment cabinet.	Traffic signal cabinet

A complete list of work activities should encompass about 90% of the workload. This typically involves the top 20 to 30 activities in each unit (i.e., Forestry, Streets, Sewer etc.). The remaining 10% of the work includes a large number of miscellaneous activities, which may be defined as a group under an "other" or "miscellaneous" category.

Recommendation #27: The management of the Public Works Department should work with the first-line supervisors of the Department to define the work activities including the activity, the activity description, and the unit of measure.

(9) The Department Should Define the Levels of Service to be Provided In Maintaining Assets.

Levels of service should vary depending on the type of facility, intensity of use, and local standards. For the purposes of maintenance management, service levels must be specific. Examples of specific service-level standards are:

- Asphalt Base repair shall be performed when the asphalt surface becomes badly cracked and does not adhere to the base (surface failure) or where there is evidence of base failure (such as alligator cracking, rolling, pumping, etc.); and

- Crack and joint sealing shall be performed whenever cracks in asphalt reach 1/4-inch to 2 inches in width.

Some judgment, of course, may be needed in applying these standards, but they do provide specific and useful guidelines – in terms of what maintenance should be performed and what maintenance should be deferred. These standards are useful in determining the amount of work needed to attain desired levels of service.

In some cases, these standards will need to be expressed as quantitative standards as well. For example, a service level for cleaning of storm drain inlets could be annual inspection and cleaning.

The service level standards could be expressed as historical annual averages for such work activities as responding to service requests.

The management of the Public Works Department should work with the first-line supervisors of the Department to define the service level standards for the work activities performed by the Department.

Recommendation #28: The management of the Public Works Department should work with the first-line supervisors of the Department to define the service level standards for the work activities performed by the Department.

(10) The Department Should Develop Performance Standards for Each Work Activity.

The next step in deploying a maintenance management system is to define the work to be done. The work must be identified in unmistakable terms that are measurable and that can be related to resource requirements on a consistent basis. The work activities are identified by name (such as emergency service requests).

These standards are used to define the best way to accomplish each activity. The optimum crew and equipment complement is specified, along with the major materials needed and the preferred procedure for doing the work. Also, the expected amount of work to be accomplished each day is specified, based on using the standard over a period of time under average conditions.

Each standard should include at least six elements as noted below.

- A brief description of the specific work involved – the work that is to be performed by the crew;
- The frequency with which the work should be performed (or the level of service) and the criteria for scheduling the work;
- The crew size required for the job;
- The equipment, material, and tools needed;
- The performance expectations for each job or average daily productivity; and
- The recommended procedures for completing the job.

A sample performance standard for traffic cabinet preventive maintenance is presented in the exhibit following this page.

Exhibit 3

Sample Performance Standard

ACTIVITY NO:	ACTIVITY NAME:	DATE:
101	Cabinet Maintenance	Jan 15

ACTIVITY DESCRIPTION:
Cabinet maintenance includes the inspection, testing, cleaning and adjustments made to the traffic signal electronic equipment cabinet.

PERFORMANCE CRITERIA:

PRIORITY SERVICE
☞ Preventative maintenance activity to be scheduled

SCHEDULED MAINTENANCE
☞ Cabinet Maintenance will be performed once annually

TYPICAL CREW SIZE:
☞ 1 Person

WORK METHOD:
- Test conflict monitor with computerized tester, record results.
- Vacuum cabinet, open controller door, blow out controller
- Check timing on controller
- Spray cabinet with bug spray
- Check condition of cabinet documentation, replace as necessary
- List cabinet equipment on inventory sheet
- Check operation of vehicle loop detectors, tune if necessary
- Visually inspect loops and test pedestrian pushbuttons
- Check operation of cooling fan, set to 100°F
- Lubricate door locks

EQUIPMENT:

Hand tools Conflict monitor tester	Vacuum Cleaner or compressed air bottle	1 pickup truck

MATERIAL:

Non-conductive bug spray	Timing sheets	Checklists

PRODUCTION STANDARDS:

♦ UNIT OF MEASUREMENT:	Cabinets
♦ AVERAGE DAILY PRODUCTION:	10
♦ MAN HOURS PER WORK UNIT:	1.0

The management of the Public Works Department should work with the first-line supervisors of the Department to develop performance standards for the work activities performed by the Department.

Recommendation #29: The Public Works Department should work with the first-line supervisors of the Department to develop performance standards for the work activities performed by the Department.

(11) The Department Should Develop An Annual Work Program and Calendar.

The development of an annual work program would enable the Public Works Department to accomplish a best practice defined by the *American Public Works Association* in its *Management Practices Self-Assessment.* Management Practice 4.5 states "a system is established to determine the cost of providing individual services or service levels. Costs are generally categorized into capital, operations, and maintenance. Identifying a unit cost of service is essential to guide the allocation of resources and project workloads. Cost of service should be based on full-cost allocation including general overhead and administrative expenses."

An annual work program does not need to tie to the City's annual operating budget. It should be based upon the costs within the annual budget, however. And it should be developed within EnerGov.

The annual work program is designed to answer questions that cannot be answered based upon the information readily available in the City's line-item budget. For example, how much does the City spend on street sweeping annually? What is the cost per curb mile swept? How many curb miles were swept in fiscal year 2013-14? What would it cost to increase the level of service for residential street sweeping? These are questions that are difficult to answer with a line-item budget. These are

questions that are easy to answer with an annual work program that uses activity-based costing.

To develop an annual work program, the Department should first develop unit costs labor, equipment, and materials so that the cost of performing the work can be determined. The unit costs can then be applied to the standard list of resources for each performance standard developed to determine the average daily cost for performing each activity. With the inventory, standards, and unit costs in hand, the annual work program may be determined. By applying the standards to the inventory values, the annual workloads by activity are determined.

Applying the standards to the workload provides the amount of labor, equipment, and materials required to accomplish the work.

After development of the annual work program, the next step is to develop an annual calendar. To accomplish the work program efficiently, the workload must be evenly distributed throughout each month of the year. Seasonal influences on the work must be taken into account first such as snow control. Then, the remainder of the workload must be distributed to achieve as level a workload as possible.

With the workload spread out over the year on a monthly basis, an annual work calendar can be developed to guide the development of short-term schedules. Specific requirements for labor, equipment, and materials on a monthly basis will be known well in advance so that no shortages should occur when the work is ready to be done.

The annual work program estimates the kind and amount of work to be done in the next fiscal year. The managers and supervisors should prepare the annual work

plans as part of the budgetary preparation process. The development of an annual work program takes into consideration two major questions:

- What amount of work is needed to provide the desired levels of service to the public?
- What required levels of staff, equipment, and materials will be needed to provide that level of service and at what cost?

The annual work program is prepared once a year and serves as a planning document that establishes objectives for the coming fiscal year in terms of the specific work activities to be performed, the service levels to be provided, and the allocation of staff in the provision of these services.

The development of this annual work plan will fundamentally change the focus of managers and supervisors in the Department from their current roles of day-to-day supervision to that of management of resources in order to ensure conformance with the annual work plans.

The Department should develop the annual work program and report on the planned and accomplished work on a monthly and annual basis using EnerGov.

A sample of an annual work program is presented in the exhibit following this page. It presents a partial annual work program for Street Maintenance.

Recommendation #30: The management of the Public Works Department should work with the first-line supervisors of the Department and with the Information Technology Department to develop an annual work program for each section and division within the Public Works Department that uses EnerGov, and to develop reporting systems to report budget to actual.

Exhibit 4

Sample Annual Work Program for Street Maintenance

Work Activity	Inventory Quantity	Inventory Unit	Annual Work Quantity	Annual Work Unit	ADP*	ADP Unit*	Annual Crew Days	Crew Size	Annual Labor Days	Annual Labor $	Annual Equip. $	Annual Material $	Annual Total $
Vacation	2,200	Labor Hour	2,200	Labor Hour	24	Labor Hour	91.7	3	275	$68,750	$0	$0	$68,750
Other Time Off	800	Labor Hour	800	Labor Hour	32	Labor Hour	25	4	100	$25,000	$0	$0	$25,000
Sick	800	Labor Hour	800	Labor Hour	28.5	Labor Hour	28.1	3.6	101.1	$25,263	$0	$0	$25,263
Meetings /Training	850	Labor Hour	850	Labor Hour	30	Labor Hour	28.3	3.7	104.8	$26,208	$1,784	$0	$27,992
Program Totals									***580.9***	***$145,221***	***$1,784***	***$0***	***$147,005***
Cold Patching	420	Lane Mile	252	Tons	2.8	Tons	90	2	180	$45,000	$19,008	$19,548	$83,556
Remove/ Replace Base	420	Lane Mile	2,520	Sq. Yds	62.5	Sq. Yds	40.3	3	121	$30,240	$13,862	$10,777	$54,879
Skin Patching	420	Lane Mile	23,100	Sq. Yds	218	Sq. Yds	106	3	317.9	$79,472	$59,315	$52,830	$191,617
Crack Sealing	420	Lane Mile	2,100	Lbs. Sealant	350	Lbs. Sealant	6	3	18	$4,500	$3,586	$1,775	$9,861
Program Totals									***636.8***	***$159,212***	***$95,771***	***$84,930***	***$339,913***

* ADP represents average daily productivity

(12) The Department Should Develop Formal Work Planning and Scheduling Systems.

This task would involve the development of formal work scheduling systems for the sections and divisions within the Public Works Department within EnerGov.

After the annual work program and budget is approved, managers and supervisors must have a simple method of authorizing and scheduling work to ensure that the work program is carried out as planned. Usually bi-weekly schedules should be prepared, using the annual work calendar as a guide within EnerGov.

To the extent possible, the planned work should be carried out and every effort should be made to stay on schedule. If activities such as storm damage repairs and cleanup turn out to be greater than planned, the work program will have to be adjusted.

To ensure that field crews perform only the authorized work, work-orders should typically be prepared within EnerGov by the first-line supervisor to authorize work on a day-to-day basis. Each work order should authorize a crew to perform a specific amount of work on a specific activity.

The preparation of these bi-weekly schedules and work orders should be accomplished within EnerGov. The management within the Public Works Department to work with the first-line supervisors in the Department and with the Information Technology Department to develop and deploy the formal work planning and scheduling systems within EnerGov.

Recommendation #31: The management within the Public Works Department should work with the first-line supervisors of the Department and the Information Technology Department to develop and deploy formal work planning and scheduling systems using EnerGov.

(13) The Department Should Develop A Monthly Performance Report Using Information Contained Within EnerGov.

This last step in the deployment of EnerGov involves the development of a work reporting system. Laptops and the Work Order module in EnerGov should be used to track labor, equipment, and materials used for maintenance activities. These work orders should also be used to report the amount of work done and the locations of work as well as the resources used. Normally, these are completed at the end of each day, or at the end of each job if more than one activity is performed during the day.

The first-line supervisors of the units in the Department should promptly review the daily work reports to ensure that they were completed properly and to determine if the performance standards were substantially followed. Significant variations should be followed up to determine the cause and, if necessary, take corrective action.

A system should be developed in EnerGov to summarize the daily work reports on a monthly basis and produce performance reports.

An example of a monthly report is provided in the exhibit following this page.

These monthly reports should be used to evaluate the performance of the sections and divisions in the Department, and monitor progress toward accomplishing the annual work program for each section and division. Again, significant deviations from the planned work program and budget should be investigated and appropriate follow-up action taken.

Exhibit 5

Sample Monthly Performance Report

Year-to-Date Work Progress Report for Street Maintenance
Period: July 1, 2013 – July 31, 2013

Work Activity	Labor Days		Amount of Work		Total Cost		Productivity	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Program: 08 – Pavement Maintenance								
Cold Patching	15	18	42 tons	40 tons	$6,963	$7,862	2.8 tons per crew day	2.4 tons per day
Skin Patching	10	26	210 Sq. Yds.	456 Sq. Yds.	$4,573	$9,602	62 ½ Sq. Yds. Per crew day	68 ½ Sq. Yds. Per crew day

Without evaluation and control to ensure that the plan is followed, the entire maintenance management effort will be in vain. The performance measurement data generated by this report would include:

- A comparison of planned versus actual staff hours per work activity for the previous month and year-to-date for each work activity;
- A comparison of actual versus planned work output (miles of curbs swept by street sweepers) per month and year-to-date for each work activity;
- A unit cost analysis that compares the planned versus actual unit costs for each work activity per month and year-to-date; and
- A comparison of actual productivity (work output per staff hour) versus the expected productivity as stated in the performance standards.

The intent of the monthly performance report is to report actual accomplishments against the annual work plan.

Recommendation #32: The management within the Public Works Department should work with the first-line supervisors of the Department and with the Information Technology Department to develop and deploy a monthly performance report comparing planned versus actual performance and costs. This monthly report should be developed using EnerGov.

(14) The Department Should Acquire Handheld Devices To Enable Crews To Report The Work Accomplished.

Tracking the work accomplished is another important part of an effective maintenance management system. This is unfortunately, a time intensive task given the number of staff involved. Handheld devices can, however, diminish the time and resources required. The use of handheld devices is a common practice in instances in which a computerized maintenance management system has been deployed. This has already occurred within the Traffic Signal / Streetlight Maintenance and Repair Section of the Public Works Department.

With handheld devices, the staff of the Forestry, Street Maintenance, and Sewer

Operations can become mobile, and paperless. This will ensure the ability to manage work orders and other data electronically, and synchronize on demand or automatically on a periodic basis via a wireless network. If the handheld device has scanning capability, the bar coding function could increase accuracy and productivity even further by scanning bar codes on pre-printed asset types or labor, material and equipment codes to eliminate manual data entry. Other features and functionality of these handheld devices include the following:

- Download/upload assigned work orders with priority;
- Track the time worked on an assignment using an automatic start and stop feature;
- Transfer completed work order information (comments, labor, material, other charges) to the EnerGov database directly from the handheld device;
- Update lookup data on the handheld device;
- Create new inventory records for areas and equipment on the handheld device, and transfer this data directly to the EnerGov database;
- Create new work orders from the handheld device while performing facility inspections;
- Conduct inventories and update the parts records from the handheld device directly to the EnerGov database;
- Issue parts and upload all data from the handheld device at the end of the day;
- Increase efficiency and accuracy utilizing bar coding technology that quickly scans bar codes representing parks, golf courses, or physical assets;
- Display preventive maintenance task sheets on the handheld device; and
- Use a detailed preventive maintenance checklist and record the results directly on the handheld device.

When considering hardware options that can increase system efficiency, wireless technology is an area to consider.

Recommendation #33: The Public Works Director should work with the Information Technology Department to develop a budget proposal for fiscal year 2015-16 to acquire and deploy laptops sufficient for all of the vehicles used everyday by the crews of the Department.

3. THE PUBLIC WORKS DEPARTMENT SHOULD WORK WITH THE INFORMATION TECHNOLOGY DEPARTMENT TO DEVELOP A FORMAL WRITTEN PLAN OF IMPLEMENTATION FOR ENERGOV.

One of the most important misconceptions of maintenance management planning is that it is an engineering process driven by computerized information systems. This is one of the reasons that maintenance management systems become overly expensive to deliver and fail to meet their goals. Like all management and planning processes, maintenance management is multi-disciplinary in nature, and is process and information driven. Information technology has the potential to improve the management of information, but the processes to be automated must be well understood and supported across the breadth of the Public Works Department organization.

The Matrix Consulting Group recommends a number of steps be taken by the Public Works Department to enhance the likelihood of successful installation of EnerGov as a maintenance management system. These steps are presented below.

(1) Establish a Steering Committee within the Public Works Department to Provide Governance for Implementation of EnerGov in the Department.

It is important that the Public Works Department demonstrate its commitment to successful implementation of EnerGov as a maintenance management system through the establishment of the steering committee. The Public Works Director should chair this committee. The Public Works Director should be tasked with promoting the benefits of maintenance management and EnerGov in an enthusiastic way and to obtain the buy-in from the different divisions of the Department.

The Steering Committee should be made up of representatives from divisions that are directly involved in the implementation of EnerGov in the Department, the Engineering Services Manager, and the Information Technology Department.

The objectives of the steering committee should be established at its inception and should be reviewed on a regular basis to ensure that they remain relevant to current conditions. The objectives for the Steering Committee would be as follows:

- The formulation of the Department's maintenance management system objectives and policies including the deployment of EnerGov;
- Communication with and education of stakeholders on maintenance management-related issues;
- Coordination of internal and external inventory data collection efforts;
- Establish the structure of the inventory database and consideration of linkages between Divisions and to other City information applications e.g., PeopleSoft, ESRI, etc.;
- Consideration of the establishment of work activity definitions, service levels, performance standards, annual work programs, reporting systems, etc.;
- Recommendation of the staff and computer resources necessary for the successful and timely installation of the maintenance management system, and the subsequent resources to ensure its routine operations; and
- Review and approval of the maintenance management proposed work plan, and guiding metrics.

Recommendation #34: The Public Works Department should establish a Steering Committee to provide governance for implementation of EnerGov in the Department.

(2) The Administrative Services Supervisor Should Be Assigned Responsibility for Coordination of the Installation of EnerGov and the Maintenance Management System.

The Administrative Services Supervisor should be directly charged with the coordination of the organization, establishment, and installation of the EnerGov and the

associated maintenance management system in support of the steering committee. The initial one to two years will require a significant amount of direct effort to establish a fully functional maintenance management program, and will require ongoing leadership and management of a project manager. That should be the Administrative Services Supervisor. Specifically, the Administrative Services Supervisor will need to coordinate the following:

- Implementation of EnerGov in the Public Works Department with the assistance of the Information Technology Department;
- Development of the initial inventory data collection plans;
- The design of a range of asset management related reports;
- Training of the staff in the Public Works Department that are expected to contribute to the asset management plan; and
- Training for Department staff and stakeholders regarding the EnerGov and the maintenance management system (in association with Information Technology Department).

Once EnerGov and the maintenance management system are installed, this role and the associated workload should diminish. The Administrative Services Supervisor will work with the various divisions and the division managers in the Public Works Department to coordinate the installation of EnerGov and the maintenance management system, with the approval of the Steering Committee.

Recommendation #35: The Administrative Services Supervisor should be assigned responsibility for coordination of the ongoing organization, establishment, and installation of the EnerGov and the associated maintenance management system in support of the steering committee.

(3) The Public Works Department Should Appoint Division Liaisons for the Installation of EnerGov and the Maintenance Management System.

Even though the Administrative Services Supervisor will be responsible for coordinating the department-wide installation of EnerGov and the maintenance management system, it is recommended that each division manager (e.g., Sewer Superintendent) that will utilize EnerGov and the maintenance management system be responsible for installation of EnerGov and maintenance management system in their own division. This includes ensuring that all work is being properly captured in the EnerGov – inventory data and work order data.

EnerGov and maintenance management system related tasks for each division liaison would include elements of the following (these will likely require specific training in each area):

- Developing and maintaining division-level asset inventories, valuations, and estimates of remaining asset life;
- Ensuring that maintenance data developed by staff of the Divisions is accurate e.g., work orders, materials used data, equipment utilization data, etc.;
- Developing work activities, performance standards, scheduling system work activity definitions, service levels, performance standards, annual work programs, reporting systems; and
- Ensuring the active use of EnerGov as a maintenance management system e.g., to plan and schedule work, to achieve the objectives and service levels identified in the annual work program, that employees use work orders to record their work for their entire shift, etc.

Most of the above tasks would not be considered overly technically challenging or time consuming (once adequate training has been provided), and should be included in the annual department planning process.

Recommendation #36: The Public Works Department should appoint division liaisons for the installation of EnerGov and the maintenance management system.

4. THE INFORMATION TECHNOLOGY DEPARTMENT SHOULD BE HELD ACCOUNTABLE FOR THE INSTALLATION OF ENERGOV ACCORDING TO THE SCHEDULE THAT IT DEVELOPED.

The Information Technology Department has developed a schedule for the installation of the EnerGov computerized maintenance management systems within the Public Works Department. That schedule is presented in the table below.

Date Task is Completed	Task
3-Oct-14	Sanitary/Storm Sewer Configuration Data Collection
10-Oct-14	Configuration Work
17-Oct-14	Configuration Review/Testing
25-Nov-14	Data Migration from Lucity
8-Dec-14	User Acceptance Testing
29-Dec-14	Issue Resolution Completed from User Acceptance Testing
11-Jan-14	User Training Prep Completed
23-Jan-14	User Training Completed
1-Feb-14	Go Live

The Information Technology Department should be held accountable for the installation and deployment of EnerGov computerized maintenance management systems in the Public Works Department in accordance with this schedule.

Recommendation #37: The Information Technology Department should be held accountable for the installation and deployment of EnerGov computerized maintenance management systems in the Public Works Department in accordance with the schedule developed by the Information Technology Department.

5. THE INFORMATION TECHNOLOGY DEPARTMENT SHOULD WORK WITH THE PUBLIC WORKS DEPARTMENT TO SIMPLIFY DATA ENTRY FOR ENERGOV.

At the present time, some of the data entry processes for EnerGov appear to be byzantine. The exhibit at the end of this chapter, for example, presents the steps required to enter an excavation permit into EnerGov (and not issue the permit). The process to enter an excavation permit requires 84 separate steps. To the extent that the

process is excessively complicated and cumbersome, staff will stop using the system, not enter permits into the system, or perform incomplete work.

The Information Technology Department should work with the Public Works Department (and the Development Services Department) to document the work processes required for data entry and permit issuance for EnerGov, and simplify the data entry and permit issuance processes.

Recommendation #38: The Information Technology Department should work with the Public Works Department (and the Development Services Department) to document the work processes required for data entry and permit issuance for EnerGov, and simplify the data entry and permit issuance processes.

Exhibit 6 (1)

EnerGov Data Entry Requirements for an Excavation Permit

Highlight the EnerGov "e"
Select permit mgmt.
Select permit viewer
Select permit
Select new
Use the drop-down arrow in the Permit Type box to select "Right of Way Excavation"
Use the drop-down arrow in the Work Class box to select the type of work (sidewalk, utilities, etc.)
Click the pencil/pad symbol next to the description box
Type in pertinent data for the excavation permit
Click OK to close data box
Select Additional Info
Type in reason for excavation
Select drop-down arrow in Excavation Type box to select the type of excavation (sidewalk, utilities, etc.)
Select drop-down arrow in Work Location box to select work location (ROW, street, etc.)
Select drop-down arrow in Material Type box to select material (concrete, grass, etc.)
Click on all applicable boxes pertaining to permit (e.g. pavement and sanitary sewer)
Put number in Utilities (non-city) box or Utilities (city-owned) box if applicable
Highlight permit details to return to main page of permit details
Click on Addresses
Click on Search Addresses
Type in address number in Address Line 1
Type in street name in Address Line 2
Select Search
When search is complete, click on folder matching requested address
If address has not been used for a past EnerGov permit, you will need to fill in information on parcel owner copy window – using CAPITAL letters. Use the information provided here, not what is on your permit. (Sometimes the mailing address is different from the permit location address.)

- Type in first name
- Type in last name
- Use the drop-down arrow in Contact Preference box to select "Address"
- Use the drop-down arrow in Address Type box to select "Mailing"

Type in Address Line 1 (house number)
Type in Street name
Using the drop-down arrow, select street type (street, avenue, etc.)
Using the drop-down arrow, select post direction (SW, NW, etc.)
Type in city name
Using the drop-down arrow, select state abbreviation
Type in postal code
Select Save. You will get a message saying who the parcel owner is.

- Select OK if you want the information on the permit.

Select Cancel if you don't want the information to show on the permit. (e.g., water work being done for the city does not need to have the parcel owner listed.
Select Contacts
If you have hit OK, you will see the parcel owner's name. Use the drop-down arrow in the Contact Type to select contact type (e.g. property owner, applicant, contractor, etc.)

Exhibit 6 (2)

Select Add Contact box to add a contact
- Fill in company or contact information.
- Hit Search
- When search is complete, click on folder matching requested contact information.
- Using the drop-down arrow, select contact type (property owner, contractor, etc.)

In the box under Billing Contact, click in the box next to the contact who is responsible for payment.
Select Save to store your data.
Hitting Save in the prior step, populates the excavation permit number.
Click on Fees box **only** if payment has already been received. Some contractors are invoiced at the end of the month.
Select Pay Now box. This populates payment box with the billing contact listed.
Using the drop-down arrow, select Payment Method (e.g. cash, check)
Fill in payment amount
Type in Payment Notes or Transaction Notes if you want (e.g. receipt #8888 by shh)
Type in check number if applicable
Select Save. This changes the Payment box to a Transaction box.
Close the transaction box.
You are back in the permit.
Hit "Refresh". The payment Status will change from DUE to Paid in Full.
In the left column, select Workflow Details
Under Review v.1, right click on "Create Excavation Permit Review v.1" and select Create
When the Geo Rules has quit spinning, select Save. This creates the Plan number box.
Go back to the excavation permit button
Select Save
Select Refresh (you will note the Create Excavation Permit Review v.1 has changed from gray to blue
Go back to the Plan box
Select Workflow Details again.
Right click on Right of Way Excavation Reviews v.1 to Receive Submittal
Engineering and PW Maintenance have been assigned as reviewers. If they the right reviewers, you do nothing. If they are wrong, use the drop-down arrow under Assigned User to select the appropriate reviewer.
Click on Plan Details in the left column.
In the Assigned To box, use the drop-down arrow to select the appropriate person, if not already right.
In the left column, select Documents.
Select Attachments
Select Add Attachment
Select File to Upload
Browse to find the file(s) to upload
Select open
Select Save to keep the attachment(s)
Close out the Plan File
In the Permit File, right-click on Create/Link Bond/Insurance v.1
Select either create, link, or skip. (bonds are linked, home owners insurance is skipped)
If skipped, fill in box with explanation (e.g. N/A – homeowners insurance)
Hit Save
Close out Permit

4. ANALYSIS OF THE PLAN OF ORGANIZATION

This section of the report presents the recommended long-term plan of organization for the Public Works Department.

1. IN EVALUATING THE PLAN OF ORGANIZATION FOR THE PUBLIC WORKS DEPARTMENT, A NUMBER OF PRINCIPLES SHOULD BE CONSIDERED.

Evaluating the sustainability and the effectiveness of the plan of organization for the Public Works Department necessitates consideration of a number of principles. These principles are presented in the paragraphs below.

- **Organization structure** The criterion for this dimension includes whether there are clear lines of accountability, the management / supervisory layers and spans of control are appropriate (based upon the nature of the work, business processes involved, and interactions required for decision-making), and if like processes and functions are grouped together efficiently and effectively (functional cohesion).

- **Communication and Coordination** - The criterion for this dimension includes the number of handoffs / exchanges required, physical / virtual proximity importance, shared knowledge/ understanding within divisions and units and channel clarity (are there clear and consistent lines of communication?).

- **Resource Utilization -** The criterion for this dimension includes total headcount comparison, administrative overhead, workload management distribution, process efficiency / standardization and resource sharing capacity.

- **Service Quality and Responsiveness -** The criterion for this dimension includes cycle times, stakeholder input / user friendliness, performance management, quality control / number of checks and balances, and consistency of policy / procedure application.

- **Agility and Flexibility -** The criterion for this dimension includes the scalability to manage peaks and valleys and adaptability to offer cross-functional capabilities.

- **Human Capital -** The criterion for this dimension includes enhanced career development opportunities, training, recruiting, and retaining capabilities.

Reorganization efforts that ignore these broader principles could create new, unintended consequences for the Public Works Department in the future.

2. THESE MEASURES FOCUSED THE ANALYSIS OF ALTERNATIVES TO THE EXISTING ORGANIZATIONAL STRUCTURE FOR THE PUBLIC WORKS DEPARTMENT.

These measures were then converted into a matrix to enable the Matrix Consulting Group to develop and evaluate alternatives to the existing plan of organization for the Public Works Department. The primary purpose of the matrix was to focus the project team on the alternatives and to evaluate each of those alternatives using each of these criteria.

ORGANIZATIONAL EVALUATION CRITERIA
Organization and Structure
• Clear lines of accountability
• Spans of control / number of management layers
• Functional cohesion
Communication and cohesion
• Hand-offs/exchanges (internal / external)
• Physical/virtual proximity
• Shared knowledge/understanding
Resource Utilization (Cost)
• Administrative overhead
• Workload management (even distribution)
• Process efficiency/standardization
• Resource sharing
Human Capital
• Career development
• Training
• Recruitment and retention
Agility and Flexibility of the Organization
• Scalability (ability to manage peaks and valleys)
• Adaptability (cross functional capability)
Service Quality and Responsiveness
• Customer service
• Performance management
• Quality control checks and balances
• Consistency of policy/procedure application

Alternatives were developed using these criteria, and a set of arguments for and against was then constructed that led to a specific recommendation.

4. EVALUATION OF THE EXISTING PLAN OF ORGANIZATION OF THE PUBLIC WORKS DEPARTMENT

An evaluation of the existing plan of the plan of organization for the Public Works Department using the six previously mentioned measures is provided below.

- **Organization and Structure**. In evaluating the organization and structure of the existing ("As Is") plan of organization, the Matrix Consulting Group considered whether there were clear lines of accountability, spans of control were reasonable, and if like processes were grouped together efficiently and effectively (functional cohesion).

  The advantages of the "As Is" plan of organization, as it pertains to organization and structure, are as follows:

  – The lack of excessive hierarchy in terms of management and supervisory layers (a flat organizational structure);

  – The "unity of command" principal is emphasized with a single accountable departmental director responsible for the City's day-to-day public works (non-water utility) related activities;

  – The combination of functions into single work groups (e.g., engineering, traffic engineering, street maintenance, etc.) facilitates cooperation, reduces "finger pointing" and creates shared ownership of results; and

  – The concentration of core competencies and strong organizational cohesion of highly related functions.

  However, there are a number of disadvantages to the "As Is" plan of organization as it pertains to organization and structure. These disadvantages are presented below.

  – The Public Works Director / City Engineer functions as the departmental director and the City Engineer, yet the day-to-day demands of the management of the design and construction of the City's capital improvement program (non-water utility) – particularly with the local option sales tax (LOST) and the Growth Reinvestment Initiative (GRI) – exceed the capacity of the Public Works Director / City Engineer to be the City Engineer and the Public Works Director.

  – The span of control of the Engineering Services Manager exceeds best practices.

- The responsibility for the management of capital projects is split in two between the Engineering Division and the Construction Management Division. This split of responsibility is contrary to the best practice for "cradle to grave" project management of capital projects. This split of responsibility creates the potential for blurred accountability for management of capital projects (e.g., who is responsible for change orders: is it bad design or bad construction management). This split of responsibility impedes the ability to coordinate the totality of the City's capital improvement program (excluding the water utility). This split of responsibility is unlike that found in other cities; other cites typically consolidate responsibility for management of capital projects – design and construction inspection / management – in a single division or department.

- The Public Works Maintenance Manager supervises two middle managers (the Street Operations Superintendent, the Forestry Operations Supervisor, and the Sewer Superintendent) and a first line supervisor. This is a limited span of control. It is an unnecessary level of supervision for the two middle managers.

- Forestry Operations and grounds maintenance are located in the Public Works Department. These functions, in other cities, are typically located in parks and recreation departments given the compatibility of the services provided and given the department's more effective and efficient use of seasonal labor. These positions are used for snow control during the winter, and any organizational reallocation of these staff would require an ongoing commitment to snow control.

- There are two Erosion Control Specialist positions in the Sewer Operations Division. These two positions are responsible for ensuring conformance by construction contractors with sections D and E of the National Pollutant Discharge Elimination System permit program related to construction site stormwater runoff control and construction site review and inspection program. The responsibility of these two Erosion Control Specialists overlaps the responsibility of the Civil Engineering Construction Inspectors in the Construction Management and Inspection Division for off-site inspection and building inspectors in the Development Services Department for on-site inspection. These Erosion Control Specialist positions are utilized as specialists; these positions could best be used as Civil Engineering Construction Inspectors. Responsibility for ensuring conformance by construction contractors with construction site stormwater runoff control and construction site review and inspection program should be assigned to the Civil Engineering Construction Inspectors in the Public Works Department for off-site inspection of public improvements (e.g., streets, sidewalks, etc.) and to building inspectors for on-site inspection (e.g., residential development).

- The responsibility for plan check of permits is fragmented throughout the Public Works Department including an Engineering Technician and Plats and Zoning Specialist in the Engineering Division, the Real Estate Coordinator in the Real Estate Section, Administrative Assistant I / II positions in the Administrative Services Division, and the Traffic Engineering Program Coordinator in the Traffic Engineering Division. This fragmentation is at cross-purposes with the City's efforts to consolidate plan check and issuance of permits in the Development Services Division.

- An Associate Traffic Engineer supervises Traffic Signal Technicians and Traffic Signal Electrical Specialists. An Associate Traffic Engineer will not possess the knowledge, skills, and abilities to effectively supervise traffic signal and streetlight maintenance and repair.

- The responsibility for traffic operations maintenance is fragmented between two organizations: Street Operations Maintenance (sign, legend painting, and striping maintenance) and Traffic Engineering (traffic signal and streetlight maintenance). This change is designed to enable the City Traffic Engineer to focus more time and attention on managing the programs of the Division.

- The organizational structure for the Traffic Engineering Division is fragmented with the City Traffic Engineer responsible for managing all aspects of traffic engineering with the exception of signal / streetlight maintenance and repair. This limits the ability of the City Traffic Engineer to manage the division.

- The Arborist / Landscape Architect is located in the Public Works Department. The roles and responsibilities of the position are primarily focused on managing the urban forest including reforestation, I-380 beautification, monitoring and managing the wetlands in the City e.g., Wilson Avenue. The position is also responsible for plan checking permits as it pertains to street landscape, street trees, and inspecting these improvements in the field. This position, in other cities, is typically located in a parks and recreation department given the compatibility with the services provided by those departments and co-location with the urban forestry operations.

- **Communication and Coordination**. In evaluating the communication and coordination of the existing ("As Is") plan of organization, the Matrix Consulting Group considered the number of handoffs / exchanges required, physical / virtual proximity importance, shared knowledge / understanding within divisions and channel clarity (are there clear and consistent lines of communication).

  The advantages to the "As Is" plan of organization as it pertains to communication and coordination are presented below.

- The Public Works Department is located in one facility: the City service center, which will facilitate shared knowledge / understanding within divisions.

- Peer-to-peer communication, cross-functional knowledge sharing, and coordination is enhanced by commonality of organizational boundaries for street maintenance and sewer maintenance since both are located in the Public Works Department.

- Peer-to-peer communication, cross-functional knowledge sharing, and coordination is enhanced by commonality of organizational boundaries for civil and traffic engineering since both are located in the Public Works Department.

- With all public works related personnel linked within the same department, capital improvement programming, development, coordination, and project delivery functions are more closely aligned.

- Assigning responsibility for who does is more easily communicated with all public works related personnel linked within the same department.

- Fewer handoffs will occur, with like engineering and maintenance functions being together. The consolidation of engineering functions and maintenance functions produces an enhanced ability to create, share and use knowledge within these functions.

- Specialized equipment used in streets and sewer maintenance are more easily shared across functional units.

However, there are a number of disadvantages to the “As Is” plan of organization as it pertains to communication and coordination. These disadvantages are presented below.

- A permit applicant (e.g., an applicant that wants to build a single family home) will likely need to work with multiple sections and divisions in the Public Works Department and outside the Public Works Department in processing their permit application. This will inevitably result in “message mixing” and a lack of channel clarity (are there clear and consistent lines of communication) with the permit applicant receiving different messages regarding the City’s development services philosophy. It will also result in confusion for the permit applicant in terms of “who does what.”

- The responsibility for construction inspection of on-site and off-site privately financed public improvements is fragmented between the Sewer Operations Division, the Construction Management and Inspection

Division, and the Development Services Department. This will inevitably result in "message mixing" and lack of and channel clarity (are there clear and consistent lines of communication) with the construction contractors receiving different messages regarding the City's development services philosophy. It will also result in confusion for the construction contractor in terms of "who does what."

– The fragmentation of management of capital improvement projects between the Engineering Division and the Construction Management and Inspection Division inevitably leads to "handoffs" of responsibility between the divisions and adds complexity to the management of capital improvement projects.

- **Resource Utilization**. In evaluating resource utilization in the existing ("As Is") plan of organization, the Matrix Consulting Group considered the total headcount comparison, administrative overhead, workload management distribution, process efficiency / standardization and resource sharing capacity.

  The advantages to the "As Is" plan of organization as it pertains to resource utilization are presented below.

  – Significant administrative / overhead reductions have been achieved by the consolidation of "general" administrative support staff in the Administrative Support Division.

  – The standardization of common administrative practices, processes and procedures is facilitated by the consolidation of "general" administrative support staff in the Administrative Support Division.

  – The sharing of scarce or specialized resources, including people and equipment, is more easily accommodated among street maintenance and sewer maintenance since both are co-located at the City service center and are consolidated within the Public Works Department.

  – The ability to manage the routine deployment of street maintenance and sewer maintenance resources based on seasonal, weather related effects is improved since both are co-located at the City service center and are consolidated within the Public Works Department.

  However, there are a number of disadvantages to the "As Is" plan of organization as it pertains to resource utilization. These disadvantages are presented below.

  – The Public Works Maintenance Manager has a small span of control, supervising only two managers and a first-line supervisor: the Sewer Superintendent, the Public Works Operations Superintendent, and the Forestry Operations Supervisor.

- An Associate Traffic Engineer is utilized to supervise traffic signal and streetlight maintenance and repair, despite the need to significantly enhance the traffic engineering programs and services.

- The Public Works Department does not utilize a project team approach to the design and construction inspection of capital projects with a team containing a mix of professional engineers and paraprofessional engineers. The use of this project team provides greater flexibility to assign members of the project team to construction management and inspection during the construction season from spring through fall and to assign members to design activities and preparation for bidding during the off-season in late fall and winter. At the present time, the Civil Engineering Construction Inspectors experience some proportion of idle time during the winter when construction is not possible.

• **Service Quality and Responsiveness**. In evaluating service quality and responsiveness in the existing ("As Is") plan of organization, the Matrix Consulting Group considered the cycle times, stakeholder input / user friendliness, performance management, quality control / number of checks and balances, and consistency of policy / procedure application.

The advantages to the "As Is" plan of organization as it pertains to service quality and responsiveness are presented below.

- Consolidating street and sewer maintenance functions in the Public Works Department creates a single organizational point of contact for the majority of the City's public works issues and inquiries.

- The development of comprehensive measures of performance for closely related functions is enhanced with the consolidation of much of the City's maintenance and engineering functions in the Public Works Department.

- Opportunities to avoid conflicting and / or incompatible responses to service issues are enhanced with the consolidation of much of the City's maintenance and engineering functions in the Public Works Department.

- Single department accountability for a larger number of service quality and responsiveness issues is enhanced with the consolidation of much of the City's maintenance and engineering functions in the Public Works Department.

- Stormwater / drainage management programs are better integrated with the street maintenance program.

However, there are a number of disadvantages to the "As Is" plan of organization as it pertains to resource utilization. These disadvantages are presented below.

– A permit applicant may be confused since an appropriate starting place for submitting permit applications will not be clear to external customers, given the fragmentation of development services in the Public Works Department and external to the Public Works Department.

– The responsibility for construction inspection of on-site and off-site privately financed public improvements is fragmented between the Sewer Operations Division, the Construction Management and Inspection Division, and the Development Services Department. This may be confusing to construction contractors as an appropriate starting place for inspection will not be clear given the involvement of Erosion Control Specialists from the Sewer Operations Division. The involvement of the Erosion Control Specialists in construction inspection of duplicates the off-site inspection responsibilities of the Civil Engineering Construction Inspectors and the on-site inspection responsibilities of the building inspectors of the Development Services Department.

- **Agility and flexibility**. In evaluating agility and flexibility in the existing ("As Is") plan of organization, the Matrix Consulting Group considered the scalability to manage peaks and valleys and adaptability to offer cross-functional capabilities.

The advantages to the "As Is" plan of organization as it pertains to agility and flexibility are presented below.

– The scalability (the ability to grow and/or shrink in response to workload / is improved for stormwater / drainage and the street maintenance program with their consolidation in the Public Works Department. It is also improved for the Engineering Division and the Traffic Engineering Division.

– Rapid cross-unit resource shifting and workload balancing is made easier among stormwater / drainage and the street maintenance program and the Engineering Division and the Traffic Engineering Division.

However, there are a number of disadvantages to the "As Is" plan of organization as it pertains to resource utilization. These disadvantages are presented below.

– Decision-making tends to be slower in larger, more layered and hierarchical organizations.

– Over time, larger organizations tend to develop an "inertia" that makes the future introduction of change more difficult than in smaller organizations.

- The fragmentation of engineering and construction inspection results in the underutilization of the Civil Engineering Construction Inspectors in the off-season. The agility and flexibility to efficiently utilize the Civil Engineering Construction Inspectors in the off-season is limited.

- The fragmentation of the responsibilities for construction inspection of on-site and off-site privately financed public improvements impedes the ability of the City to shift resources based upon workload peaks and valleys. The Civil Engineering Construction Inspectors may be busy when the Erosion Control Specialists are not. The building inspectors may be busy when the Erosion Control Specialists are not.

• **Human Capital** In evaluating human capital in the existing ("As Is") plan of organization, the Matrix Consulting Group considered the enhanced career development opportunities, training occurrences and recruiting and retaining capabilities.

The advantages to the "As Is" plan of organization as it pertains to human capital are presented below.

- There are increased opportunities for multi-disciplinary training within the existing unified public works structure

- There are increased career advancement and professional development potential within the existing unified public works structure.

- The existing unified public works structure creates strong "communities of practice," especially for the professional engineers, enhancing opportunities for personal growth and professional development.

- There is an increased capacity for cross-functional training in both professional and maintenance / technical job classes.

However, there are a number of disadvantages to the "As Is" plan of organization as it pertains to resource utilization. These disadvantages are presented below.

- The executive level skills required to lead a large and diverse department, such as the Public Works Department, are substantial and scarce.

- The executive level skills required to create and sustain a consistent organizational culture and operational philosophy, congruent with those of the executive leadership and policy makers, are substantial and scarce.

The current organization of the Public Works Department has many advantages.

There are, however, substantive disadvantages.

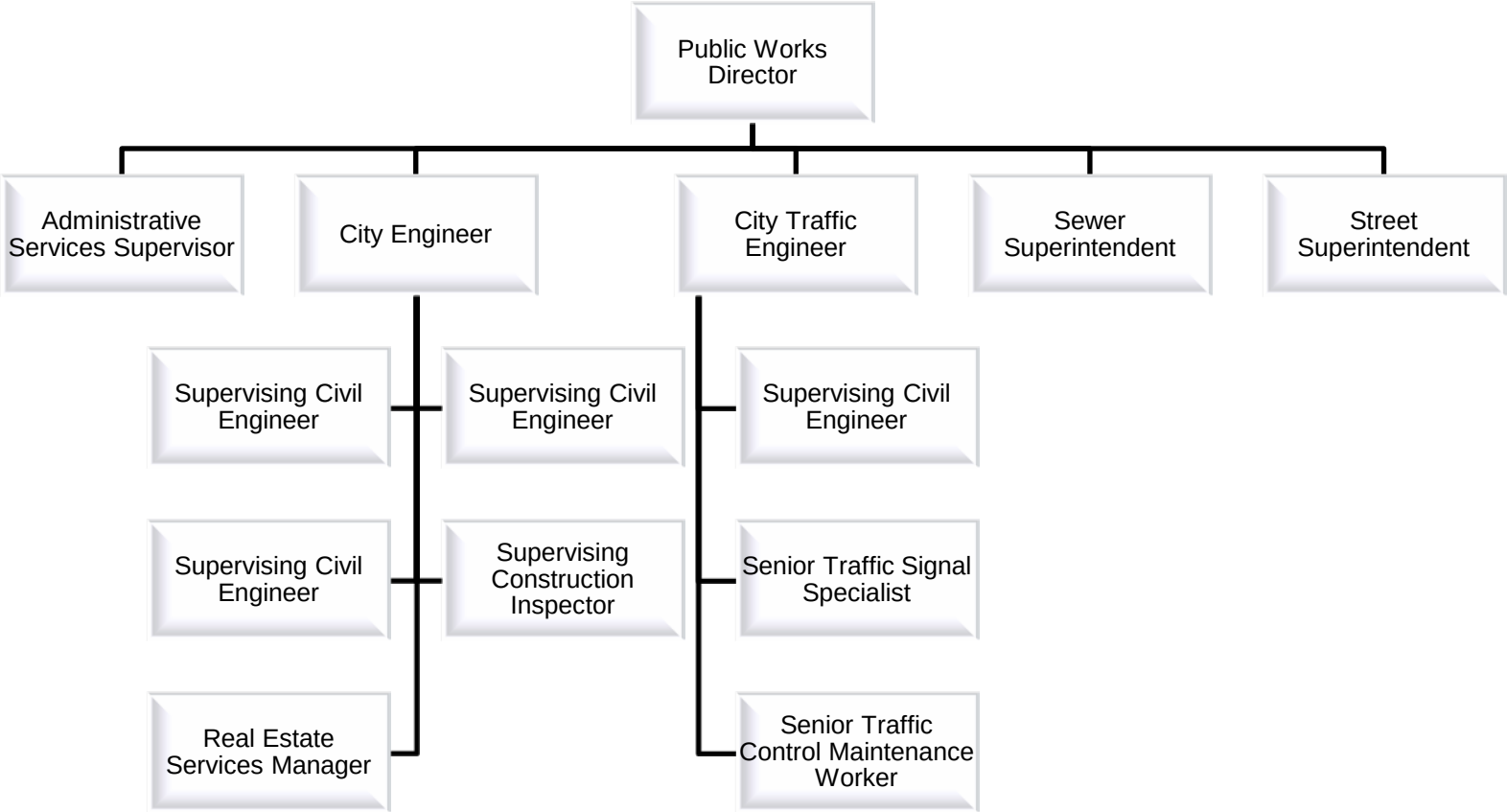
5. RECOMMENDED PLAN OF ORGANIZATION OF THE PUBLIC WORKS DEPARTMENT

A graphic depiction of the recommended plan of organization is presented in the exhibit following this page. Important points to note regarding the recommended plan are presented below.

- The Public Works Director / City Engineer would be reclassified as the Public Works Director.
- The Engineering Manager should be reclassified as the City Engineer. The City Engineer should focus his attention on leading the Division as a coordinated team and being a project management systems champion to develop, mature, and enforce the use of standardized project management tools.
- The Sewer Superintendent should report directly to the Public Works Director.
- The Public Works Operations Superintendent should be reclassified as the Street Superintendent, and report directly to the Public Works Director.
- The Public Works Maintenance Manager position should be re-purposed within the City organization.
- The Engineering Division should be reorganized with three Supervising Civil Engineers, a Supervising Construction Inspector, and a Real Estate Services Manager functioning as middle managers. One of the Supervising Civil Engineers should be allocated to the management of engineers and the design of capital projects for roads and bridges including LOST. A second Supervising Civil Engineer should be allocated to the management of engineers and the design of capital projects for sanitary and storm sewers. A third Supervising Civil Engineer should be allocated to management of engineers and the design of capital projects for flood control including GRI. A Supervising Construction Inspector should supervise construction inspection and report to the City Engineer.
- The Construction Engineering Manager should be reclassified as a Supervising Construction Inspector and report to the City Engineer.
- The vacant Associate Traffic Engineer position in the Traffic Engineering Division should be reclassified as a Supervising Civil Engineer. This position should be utilized to supervise all of the engineering staff in the Traffic Engineering Division including the Project Engineer II – Traffic, the Traffic Engineer Project Coordinator, the Project Engineer I, and the Engineering Technician.

Exhibit 7

Recommended Plan of Organization of the Public Works Department



- One of the six traffic signal / streetlight maintenance and repair positions should be upgraded to a Senior Traffic Signal Specialist. This position should function as a leadworker for the other Traffic Signal Technician and Traffic Engineering Electrical Specialist positions.

- The five Traffic Control Maintenance Worker positions, presently located in the Street Operations Division, should be reallocated to the Traffic Engineering Division, and one of the five positions upgraded to Senior Traffic Control Maintenance Specialist. This position should function as a leadworker for the other Traffic Control Maintenance Worker positions. The City Traffic Engineer is more knowledgeable regarding the ***Manual on Uniform Traffic Control Devices***. This knowledge is necessary to effectively manage the maintenance of pavement legends, street striping, and regulatory signs.

- Forestry Operations should be reallocated to the Parks and Recreation Department, and report to the Parks Superintendent. This should include the Forestry Operations Supervisor position and all of the Urban Forester I / II positions.

- The Arborist / Landscape Architect position, currently located in the Engineering Division, should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent.

- The responsibility for the mowing of rights-of-way should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent. This should include three (3) Area Driver, three (3) Light / Heavy Equipment Operator, two (2) Driver positions, and a Street Supervisor.

- The two Erosion Control Specialist positions in the Sewer Operations Division should be reallocated to Construction Management and Inspection and reclassified as Civil Engineering Construction Inspectors. These two positions are currently responsible for (1) ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit related to construction site stormwater runoff control and construction site review and inspection program, and (2) ensuring that contractors abate concrete washouts, silt fences, make terraces to prevent runoff, have erosion control plans on site, etc. The Civil Engineering Construction Inspectors should assume these responsibilities for off-site public improvements after receiving training. The building inspectors of the Development Services Department should assume these responsibilities for on-site private development after receiving training. This is a prevailing practice.

- The City is moving towards the centralization of development services within the Development Services Department. It has not yet completed that centralization; there are a number of positions within the Public Works Department whose role and responsibility is the processing of development-related permits. The

remaining responsibilities for receiving, processing and issuing permits within the Public Works Department should be reallocated to the Development Services Department. This would include the positions below.

- The Plats and Zoning Specialist position responsible for the plan checking of site, grading specification, utility placement, erosion and sediment control, storm water system, sidewalk, trails, roadway and future development plans to ensure compliance with City ordinances and development plans.

- The Traffic Engineering Project Administrator responsible for issuance of permits for special events, plan checking encroachment permits on City right-of-way (e.g., parking lots, signs, etc.), sidewalk café renewals (e.g., seating and tables on City sidewalks), etc.

- The Real Estate Coordinator in the Real Estate Section responsible for processing excavation permits (e.g., permitting of sewer taps) encroachment permits (e.g., retaining walls proposed to be constructed in the City right-of-way), urban agriculture permits, etc.

The Development Services Department should also be responsible for the issuance of large load and demolition permits, presently performed on a part-time basis by the Administrative Assistant I / II's in the Administrative Services Division.

The recommendations offered in this chapter are essential to moving the organization of the Public Works Department to a new level of performance over the next few years. It is important to consider the recommendations within the context of the LOST and GRI programs and the critical need to build capacity within the Public Works Department to effectively respond to and manage these initiatives.

The extensiveness of the recommended changes in the plan of organization for the Public Works Department should not be underestimated due to the essential preparation and planning that will be required to successfully implement these recommendations.

Recommendation #39: The Public Works Director / City Engineer would be reclassified as the Public Works Director.

Recommendation #40: The Engineering Manager should be reclassified as the City Engineer.

Recommendation #41: The Sewer Superintendent should report directly to the Public Works Director.

Recommendation #42: The Public Works Operations Superintendent should be reclassified as the Street Superintendent, and report directly to the Public Works Director.

Recommendation #43: The Public Works Maintenance Manager position should be re-purposed within the City organization.

Recommendation #44: The Engineering Division should be reorganized with three Supervising Civil Engineers, a Supervising Construction Inspector, and a Real Estate Services Manager functioning as middle managers.

Recommendation #45: The Building Facilities Capital Project Manager, Consultant Contract Administrator, and Sewer Utility Engineering Manager should be allocated to the Supervising Civil Engineer Classification.

Recommendation #46: The Construction Engineering Manager should be reclassified as a Supervising Construction Inspector and report to the City Engineer.

Recommendation #47: The vacant Associate Traffic Engineer position in the Traffic Engineering Division should be reclassified as a Supervising Civil Engineer. This position should be utilized to supervise all of the engineering staff in the Traffic Engineering Division including the Project Engineer II – Traffic, the Traffic Engineer Project Coordinator, the Project Engineer I, and the Engineering Technician.

Recommendation #48: One of the six traffic signal / streetlight maintenance and repair positions should be upgraded to a Senior Traffic Signal Specialist. This position should function as a leadworker for the other Traffic Signal Technician and Traffic Engineering Electrical Specialist positions.

Recommendation #49: The five Traffic Control Maintenance Worker positions, presently located in the Street Operations Division, should be reallocated to the Traffic Engineering Division, and one of the five positions upgraded to Senior Traffic Control Maintenance Specialist. This position should function as a leadworker for the other Traffic Control Maintenance Workers.

Recommendation #50: Forestry Operations should be reallocated to the Parks and Recreation Department, and report to the Parks Superintendent. This should

include the Forestry Operations Supervisor position and all of the Urban Forester I / II positions.

Recommendation #51: The transfer of Forestry Operations to the Parks and Recreation Department should be accompanied by a memorandum of agreement regarding snow control in which the staff of Forestry Operations will be assigned to snow control during snow control events.

Recommendation #52: The Arborist / Landscape Architect position, currently located in the Engineering Division, should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent.

Recommendation #53: The responsibility for the mowing of rights-of-way should be reallocated to the Parks and Recreation Department and report to the Parks Superintendent. This should include three (3) Area Driver positions, three (3) Light / Heavy Equipment Operator positions, two (2) Driver positions, and a Streets Supervisor position.

Recommendation #54: The two Erosion Control Specialist positions in the Sewer Operations Division should be reallocated to Construction Management and Inspection and reclassified as Civil Engineering Construction Inspectors. The Civil Engineering Construction Inspectors in Construction Management and Inspection, Public Works Department should assume the responsibility for ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit for off-site public improvements after receiving training. The building inspectors of the Development Services Department should assume the responsibility for ensuring conformance by construction contractors with Sections D & E of the City's NPDES permit for on-site private development after receiving training.

Recommendation #55: The remaining responsibilities for receiving, processing and issuing permits within the Public Works Department should be reallocated to the Development Services Department. This should include the reallocation of the Plats and Zoning Specialist position, the Traffic Engineering Project Administrator position, and the Real Estate Coordinator position in the Real Estate Section.

5. ANALYSIS OF THE ENGINEERING DIVISION

This chapter presents an analysis of the Engineering Division. This includes an analysis of staffing, project management practices, and other aspects of the Division.

1. THERE ARE A NUMBER OF POSITIVE ASPECTS TO THE ENGINEERING DIVISION.

Operations reviews of any department will focus on the opportunities for improvement. However, it is important to recognize that the Engineering Division already has a number of positive aspects. Examples of these positive aspects are presented below.

- A five-year capital improvement program has been developed and adopted by the City Council and integrated into the City's annual operating budget.
- The Division has developed a Capital Improvement Projects Development and Management Handbook.
- A project cost accounting system in the City's financial system is utilized by the staff of the Engineering Division to charge their staff hours allocated to the design of capital improvement projects.
- The staff that design capital improvement projects are, by and large, highly billable to these projects during 2013-14 as the table below indicates.

Class Title	Hours Charged to Capital Projects	Hours Not Charged to Capital Projects	Total Hours	% Total Hours Charged to Capital Projects
Consultant Contract Administrator	$70,475	$1,400	$71,875	98%
Civil Engineer I	$49,536	$3,624	$53,160	93%
Capital Improvement Program Coordinator	$73,386	$6,656	$80,042	92%
Sewer Utility Engineering Manager	$71,198	$15,477	$86,675	82%
Project Engineer I	$55,544	$15,786	$71,330	78%
Engineering Technician	$41,222	$11,576	$52,798	78%
Engineering Designer	$39,763	$18,597	$58,360	68%
Project Engineer II	$48,530	$31,015	$79,545	61%

The positive aspects provide a sound basis for the improvement of the Engineering Division.

2. OVER THE NEXT SEVERAL YEARS, THE ENGINEERING DIVISION WILL RECEIVE AN INFUSION OF ADDITIONAL FUNDING FOR CAPITAL PROJECTS.

The Cedar River reached a record high of 31.12 feet on June 13, 2008. The previous record was 20 feet. 1,126 city blocks were flooded, or more than 10 square miles, 561 city blocks were severely damaged, on both banks of the Cedar River. This is 14% of the city's total area. There were a total of 7,749 flooded properties that had to be evacuated, 5,900 were homes, and 310 were city facilities including City Hall, Central Fire Station, Main Public Library, Ground Transportation Center, Public Works building, and Animal Control building. It is estimated 1,300 properties have or will be demolished in the Cedar Rapids area because of the flood.

The State legislature approved the Growth Reinvestment Initiative (GRI) to fund eligible projects to help mitigate the risk of flooding. The GRI allows the City to keep 70% of the increase in State Sales Tax over the base year (2014) to a maximum of $15 million annually. GRI will supplement federal funding and be used to mitigate and better control future storm events. The Army Corp of Engineers, based upon their cost benefit analysis, will be installing a flood wall / flood control structures on one side of the Cedar River. One of the major projects the City has elected to pursue is to construct corresponding flood control devices on the other side of the river. Estimates of revenues for the Growth Reinvestment Initiative for the next seven years, provided by the Finance Department, are presented in the table below.

Fiscal Year	Estimated Annual Funding
FY 2014	$ 2,499,988
FY 2015	$ 5,062,477
FY 2016	$ 7,689,027
FY 2017	$10,381,241
FY 2018	$13,140,760
FY 2019	$15,000,000
FY 2020	$15,000,000

The "Paving for Progress" Local Option Sales tax (LOST) sales tax initiative was approved in November 2013. This local sales tax initiative is an additional sales tax levy for ten years starting July 1, 2014. The initiative did not include a specific list of projects. The funding can only be used for street capital improvements. The existing intent is that the "Paving for Progress" funding only be used on street capital improvements from curb to curb. The Finance Department has estimated that LOST / Paving for Progress revenues will approximate $18 million per year.

The City issued bonds in the past several years to fund the City's non-utility capital improvements projects. It is anticipated that the issuance of further bonds will be very limited given the revenue generated by LOST and GRI and the organization's finite capacity to manage capital improvement projects. The City does have $13.1 million in unspent bond proceeds through FY 2014 that can also be utilized for capital projects.

The City's capital budget for the next five years, as shown in the FY 2015 adopted budget, for Streets, Storm Sewer, Bridge, Traffic, Downtown, and Sanitary Sewer Improvements is presented in the table below.

Capital – Infrastructure	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Street Improvements	$35,267,128	$39,229,882	$27,127,620	$19,635,000	$19,670,000
Storm Sewer Improvements	$1,654,675	$975,000	$775,000	$1,850,000	$2,450,000
Bridge Improvements	$1,909,000	$100,000	$120,000	$960,000	$100,000
Traffic Improvements	$1,727,585	$330,000	$560,000	$860,000	$1,160,000
Downtown Improvements	$100,000	$100,000	$100,000	$100,000	$100,000
Sanitary Sewer Improvements	$7,880,000	$9,650,000	$5,050,000	$3,650,000	$3,550,000
TOTAL	**$48,538,388**	**$50,384,882**	**$33,732,620**	**$27,055,000**	**$27,030,000**

Overall, there is a sizable increase in the amount of workload demand for the design and construction management / inspection of capital improvement projects over the next five years.

3. THE CLASSIFICATION STRUCTURE OF THE ENGINEERING DIVISION AND THE TRAFFIC ENGINEERING DIVISION SHOULD BE SIMPLIFIED.

The classification structure for the professional-level engineering positions in the Engineering Division and the Traffic Engineering Division is unnecessarily complicated. It includes a high proportion of single position and duplicative classifications. This is amply demonstrated in the table below.

Position Title	No. of Authorized Positions	Salary Grade	Beginning Step Annual salary	Top Step Annual Salary
Engineering Manager	1	20	$87,380	$120,078
Building Facilities Capital Project Manager	1	17	$71,968	$98,758
Sewer Utility Engineering Manager	1	17	$71,968	$98,758
Capital Improvement Project Manager	1	17	$71,968	$98,758
Consultant Contract Administrator	1	16	$68,515	$94,078
Project Engineer II	3	16	$68,515	$94,078
Project Engineer II - Traffic	1	16	$68,515	$94,078
Associate Traffic Engineer	1	15	$65,208	$89,606
Project Engineer I	2	14	$62,129	$85,321
Civil Engineer I	2	12	$53,684	$73,756

Position Title	No. of Authorized Positions	Salary Grade	Beginning Step Annual salary	Top Step Annual Salary
Plats and Zoning Specialist	1	11	$51,147	$70,241

There are a number of issues with this allocation of positions and the classification structure as noted below.

- Excluding the Engineering Manager, a little more than one-half of the professional-level engineering positions in the Engineering Division and Traffic Engineering Division are concentrated in a salary range, at top step, of $94,078 to $98,758. This represents a problem with salary compaction.

- Excluding the Engineering Manager, there are six unique professional-level engineering classifications in the Engineering Division and Traffic Engineering Division that are filled by one employee. This includes the Building Facilities Capital Project Manager, the Consultant Contract Administrator, the Capital Improvement Project Manager, the Sewer Utility Engineering Manager, the Associate Traffic Engineer, and the Plats and Zoning Specialist.

- The City has four overlapping engineering classifications: Project Engineer, Civil Engineer, Project Engineer-Traffic, and Associate Traffic Engineer.

- In one instance, a manager is allocated to the same salary range and the same classification as a non-supervisory engineer. The Sewer Utility Engineering Manager is allocated to the same salary grade as the Capital Improvement Project Manager. This represents a problem with salary compaction. In fact, the Capital Improvement Project Manager is allocated to a salary grades that is higher than another professional-level engineer that is supervising this employee: the Consultant Contract Administrator.

- In other instances, the supervisors – the Sewer Utility Engineering Manager and the Consultant Contract Administrator - (are allocated to a salary range that is only 5% more than employees that they supervise. The Sewer Utility Engineering Manager, for example, supervises three employees – a Project Engineer II, and two Project Engineer I's. The Sewer Utility Engineering Manager is allocated to a salary range that is 5% more than the Project Engineer II and 15% more than the Project Engineer I. This represents a problem with salary compaction versus the Project Engineer II.

- Excluding the Engineering Manager, there are ten (10) different professional engineering classifications in use in the Engineering Division and Traffic Engineering Division for thirteen (13) positions: Building Facilities Capital Project Manager, Consultant Contract Administrator, Capital Improvement Project Manager, Sewer Utility Engineering Manager, Project Engineer II, Project

Engineer I, Civil Engineer I, Plats and Zoning Specialist, Project Engineer-Traffic, and Associate Traffic Engineer.

- The Project Engineer classification is only used on one other department besides the Public Works Department: the Development Services Department. It is not used in the Utilities Department. The Civil Engineer classification is only used in the Public Works Department.

The number of professional-level classification series used in the Public Works Department should be reduced. Given the number of positions involved, the classification series is unnecessarily complex. The classification series should include a City Engineer, Supervising Civil Engineer, Civil Engineer II and Civil Engineer I (the salary range for Civil Engineer II and Civil Engineer I should not be based upon the existing salary range given the range of classifications and salary ranges currently utilized). The incumbents should be allocated to these classifications based upon the proposed plan of organization in the previous chapter, and their existing roles and responsibilities. A 15% gap should be maintained between the top end of the salary range for the Supervisory Civil Engineer classification and the Civil Engineer II classification. The traffic engineering classifications should be included in the Civil Engineering classification series, with specific roles and responsibilities and knowledge, skills, and abilities included in those classification descriptions for traffic engineering.

Recommendation #56: The professional-level classification series used in the Public Works Department should be simplified. The classification series should include a City Engineer, Supervising Civil Engineer, Civil Engineer II and Civil Engineer I.

Recommendation #57: The salary range for Civil Engineer II and Civil Engineer I should not be based upon the existing salary range given the range of classifications and salary ranges currently utilized.

Recommendation #58: The incumbents in the positions of Capital Improvement Project Manager, Project Engineer II, Project Engineer I, Civil Engineer I, Plats and Zoning Specialist, Project Engineer II - Traffic, and Associate Traffic Engineer should be allocated to the Civil Engineer II and Civil Engineer I classifications.

Recommendation #59: The classifications of Building Facilities Capital Project Manager, Consultant Contract Administrator, Capital Improvement Project Manager, Sewer Utility Engineering Manager, Project Engineer II, Project Engineer I, Plats and Zoning Specialist, Project Engineer II - Traffic, and Associate Traffic Engineer should be eliminated.

Recommendation #60: A 15% gap should be maintained between the top end of the salary range for the Supervisory Civil Engineer classification and the Civil Engineer II classification.

Recommendation #61: The traffic engineering classifications should be included in the Civil Engineering classification series, with specific roles and responsibilities and knowledge skills and abilities included in those classification descriptions for traffic engineering.

3. THE CITY ENGINEER SHOULD DELEGATE AUTHORITY TO THE SUPERVISING CIVIL ENGINEERS TO SUPERVISE THE CAPITAL PROGRAM.

The plan of organization of the Engineering Division has been flat, and the spans of control for the Engineering Manager ridiculously broad. With the adoption of the recommended plan of organization for the Public Works Department and the recommended classification structure for the Engineering Division, the spans of control for the City Engineer and the Supervising Civil Engineers will be practical.

With these practical spans of control, the City Engineer should delegate responsibility to the Supervising Civil Engineers to supervise the capital program. The Supervising Civil Engineers will have a greater impact on the performance of the Engineering Division than any other part of the Public Works Department. Certainly executive management plays a significant role in setting the overall direction of the Department, but executive management does not have a big part in deciding how

capital projects are executed, in deciding how resources are allocated among projects, in developing project plans. For a lot of knowledge-based industries such as engineering – it is all about the middle managers such as the Supervising Civil Engineers.

The Supervising Civil Engineers should be given the authority to:

- Plan, supervise, train, and review the work of an assigned section in the Engineering Division;
- Plan, direct, and review the work of subordinate engineers;
- Assume responsibility for a variety of personnel actions for their subordinate engineers including selection, promotion, performance evaluation, disciplinary action, and dismissal;
- Quality control preliminary and final design plans, specifications, and estimates and provide guidance to subordinate engineers and consulting engineers;
- Serve as the project manager in charge of large, more complex capital improvement projects;
- Coordinate design work with different consultants and agencies to assure an orderly design process and obtain necessary approval and permits from other agencies;
- Negotiate and authorize change orders and extra work orders for construction projects;
- Prepare staff reports and make presentations to the City Council; and
- Serve as the City Engineer in his or her absence.

The Supervising Civil Engineers should receive general direction from the City Engineer.

In fact, the Supervising Civil Engineer should sign and approve the capital project plans and specifications, not the Public Works Director or the City Engineer. The Public Works Director or City Engineer should not be reviewing the plans, specifications, and estimates for capital projects except in unusual circumstances.

Recommendation #62: The City Engineer should delegate responsibility to the Supervising Civil Engineers to supervise the capital program.

Recommendation #63: The Supervising Civil Engineers should be given the authority to plan, supervise, train, and review the work of an assigned section in the Engineering Division.

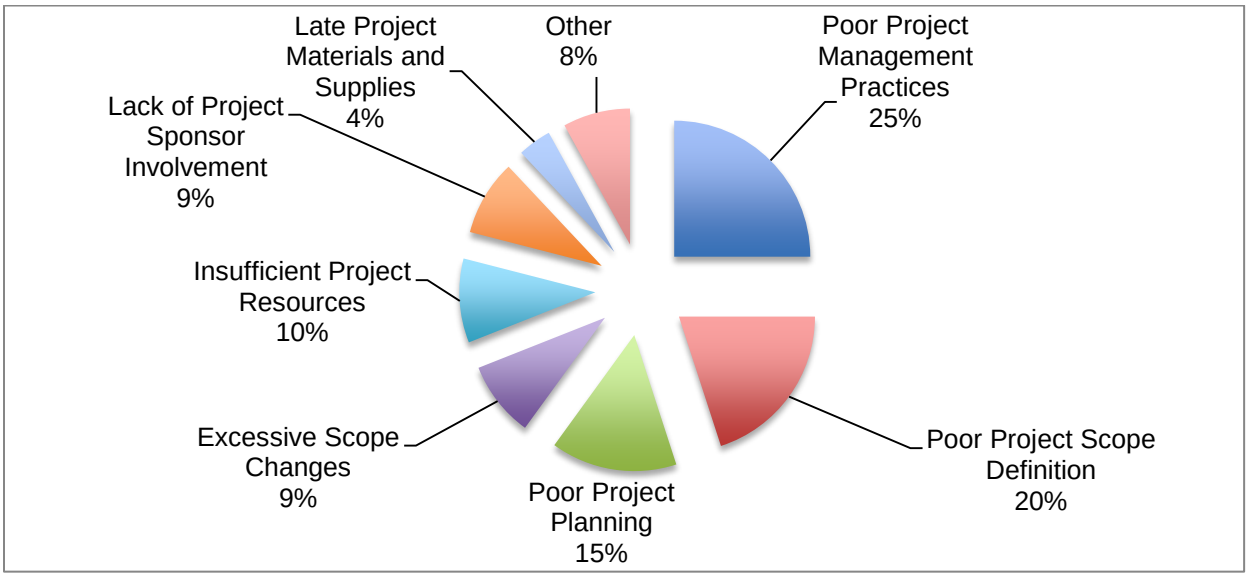
Recommendation #64: The Supervising Civil Engineers should receive general direction from the City Engineer.

Recommendation #65: The Supervising Civil Engineers should sign and approve the capital project plans and specifications, not the Public Works Director or the City Engineer.

Recommendation #66: The Public Works Director or City Engineer should not be reviewing the plans, specifications, and estimates for capital projects except in unusual circumstances.

4. THE PROJECT MANAGEMENT PRACTICES OF THE ENGINEERING DIVISION SHOULD BE IMPROVED.

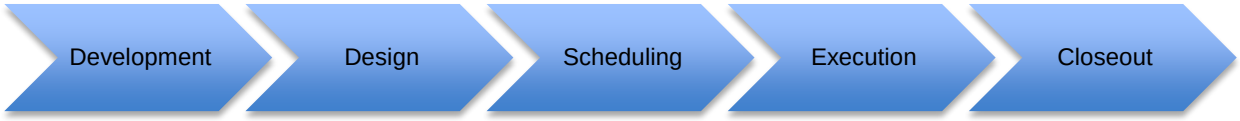
Typical management critiques of project management results for a wide variety of project types indicate the following sources for project failures as noted in the chart below.[3] This chart represents typical problems found in cities, not just Cedar Rapids.



[3] The source of the data contained within the chart in the chart above was the Construction Industry Institute

Overall, the process for managing capital projects is the cause of 69% of project failures. This includes such processes as ineffective project planning, ineffective project management, etc.

In evaluating the project management practices used by Engineering Services, the Matrix Consulting Group used a system approach as depicted in the chart below.



Development of the initial project scope	Complete detailed project designs	Build resource loaded project schedule	Monitor project mobilization activities	Monitor project demobilization activities
Management of scope additions	Long lead-time materials ordering	Integrate project schedule with other concurrent activities	Monitor work performance	Monitor punch-list items close-out progress
Development of the project execution plan	Track project plan implementation activities	Develop earned value or other cost and schedule metrics	Monitor actual schedule and cost versus plan	Documentation closed out
Development a project work breakdown structure	Develop project risk points and mitigation plans	Complete development of work packages	Conduct progress status meetings and develop progress status reports	Monitor progress in design drawings updates with as-built field changes
Development and monitoring of a project readiness measurement process or tool	Develop project QA / QC program	Integrate schedule activities into work management process	Monitor project scope changes	Documentation closed-out
			Monitor project risk mitigation triggers	

Some of the elements of project management noted in the previous chart are not present in Cedar Rapids. The Matrix Consulting Group recommends a number of enhancements in the project management practices utilized by the Engineering Division. These enhancements are discussed below.

(1) The Engineering Should Enhance Its *Capital Improvement Projects Development and Management Handbook*.

The American Public Works Association has developed a Public Works Management Practices Manual that presents recommended practices identified by "nationally recognized experts in the field of public works." Practice 1.4 states "the organization's policies, practices, and procedures are periodically reviewed and / or updated to reflect actual practices. Definitive guidelines are provided to employees to accomplish their assigned tasks."[4]

The Engineering Division has developed a *Capital Improvement Projects Development and Management Handbook*. This manual includes a number of topics including Budget and Concept Report, Preliminary Design Plans, Property Acquisition and Final Plans, Bid and Contract Award Phase, etc. However, the manual does not comprehensively address how Engineering Division should manage capital projects.

The *Capital Improvement Projects Development and Management Handbook* should address the process to be utilized for managing projects and the technical aspects of project and construction management. The process aspects that should be included in the policies and procedures manual are presented below.

- **Initiating and aligning the project team that will be utilized for project delivery**. This includes developing a clear understanding of the purpose and goals of the project, developing a project description, identifying the members of the team, the major milestones, the boundaries of the project (scope control), the team roles and responsibilities, the measures of success for the project, and operating guidelines. The deliverable would be a project initiation and alignment worksheet.

- **Planning the work of the project.** This would involve the development of the project plan. The project plan should include a work breakdown structure based upon a master deliverable list developed for the City's project delivery (i.e., project definition, consultant request for proposals, project finance plan,

[4] American Public Works Association, Public Works Management Practices Manual, 2004.

construction cost estimate, project management plan, design development, value engineering, etc.), development of a risk management plan (deciding how to approach, plan, and execute risk management activities), developing a communication plan, developing a change management plan (for scope control), developing a quality plan, and developing a transition and control plan. The project plan should be scalable based upon the size of the project.

- **Endorsing the plan**. This involves gaining the commitment to the project management plan by the project team, and City management.

- **Working the plan**. This involves actively managing the execution of the project in terms of design, construction management, and construction inspection. It includes managing the scope, the schedule, and the budget, the risks associated with the project, change, and communicating progress with the project.

- **Transition and closure**. This involves acceptance of the work, demobilization, financial closure, development of a written "lessons learned," and development of "as built" drawings and archiving.

While it is important for the policies and procedures manual to describe the process of managing a capital project, the manual also needs to address the technical aspects of managing a project. This should include such aspects as noted below.

- Design consultant selection.

- Design consultant contract administration;

- Design coordination and review;

- Developing construction cost estimates;

- Advertising and award of construction projects;

- Constructability review of designs by Construction Management and Inspection;

- Initial guidance to the construction contractor (i.e., pre-construction meeting, submittals, pay requests, etc.);

- Public relations during construction;

- The Construction Inspectors daily report;

- Construction quality control;

- Materials testing;
- Project files;
- Project acceptance; and
- Project warranty procedures.

By including these policies and procedures within the *Capital Improvement Projects Development and Management Handbook*, it creates a reference tool for training of City staff.

The Engineering Division should expand its capital improvement program project management manual to assure the capital projects are managed efficiently, the necessary resources to accomplish the projects' objectives are allocated, and the potential for cost or schedule overruns is minimized.

Recommendation #67: The Engineering Division should enhance and expand its *Capital Improvement Projects Development and Management Handbook*.

Recommendation #68: The Engineering should develop an on-line version of its *Capital Improvement Projects Development and Management Handbook* (i.e., the guide should be published to the Division's Intranet).

(2) Upon Updating of the *Capital Improvement Projects Development and Management Handbook*, the Supervising Civil Engineers Should Provide Project Management Training to the Professional-Level Engineers of the Engineering Division.

The Project Management Institute published a Guide to the Project Management Body of Knowledge (PMBOK Guide). Principle 9.3.2.2 indicates that among the generally recognized good practice for project management includes "training. Training includes all activities designed to enhance the competencies of he project team members."[5]

[5] Project Management Institute, A Guide to the Project Management Body of Knowledge, 2008.

This training is designed to strengthen the project management skills of Engineering Division management and professional-level engineers in delivering the City's design and construction programs on schedule, within budget and within scope.

This training should consist of the following elements:

- **The value of capital project management.** Confirm the increasing focus, impact and value of good project management to the City. This would include the role of project management in the City's capital improvement program, and the fundamentals to assure project management effectiveness, value and success factors. Review the essential elements of project management process and life cycle.

- **An overview of the City's capital project management process.** Discuss the City's project management process, best management practices, demonstration of the capital project management on-line guide and an update of the City's capital projects status and activities.

- **Capital project scope, schedule, and budget**. Describe the City's requirements for planning, executing, monitoring and reporting of its capital projects. This should include the use of a project management software system.

- **Capital project budget estimating**. Discuss the process used for construction cost estimating. The discussion should include assuring that the cost matches the scope, that unit prices have been utilized to develop the budget and that these unit process are valid, contingencies have been identified, and that risk costs have been identified.

- **Managing the delivery of the City's capital improvement projects**. Discuss the requisite core competencies and skill sets of a successful project manager, and the interfaces between different work units in managing a capital project that the City's project manager must understand and navigate in order to plan and deliver a project successfully.

- **Contract negotiations**. The art of negotiating contracts and the important part that it plays in a project manager's life including the key elements in successful negotiating.

- **Risk management**. Discuss the methods employed to manage and monitor risks update risk management plans on a regular basis, complete with cost and schedule impacts.

- **Project management reporting**. Discuss the development and deployment of easily accessible, transparent, consistent and accurate capital project status

information to provide departmental managers with tools to assist them in managing capital project scope, schedule and cost. This project status information should be provided in a bi-monthly report as noted later in this chapter.

To assure consistency in the management of projects, it is important that all of the Engineering Division project managers use these methods. This can only be accomplished through the expansion of the project management manual, and the provision of training to its staff in the application of the procedures in this manual.

Recommendation #69: The Supervising Civil Engineers should provide training of Engineering Division professional-level engineers to strengthen their project management skills in delivering the City's design and construction programs on schedule, within budget and within scope.

Recommendation #70: The project management training should be required of the professional-level engineers in the Engineering Division.

(3) The Responsibilities of the Engineering Division in the Management of Capital Projects Should be Clearly Spelled Out In a Formal Written Policy and Procedure

The *American Public Works Association* has developed a *Public Works Management Practices Manual* that presents recommended practices identified by "nationally recognized experts in the field of public works." Practice 11.1 states "organizational policies assign engineering design responsibilities for infrastructure. Agencies may be organized in various ways, ranging from individual functions to departments with a range of responsibilities. Policies should state who is responsible for design and define when professional consultants are utilized. "[6]

The proposed roles and responsibilities for the Engineering Division in the management of capital projects are presented below.

[6] American Public Works Association, Public Works Management Practices Manual, 2004.

- Preparation of plans and specifications for capital projects, either with their own staff or through consulting engineers retained and managed by Engineering Services;

- Managing the design of the capital projects including preparation of project scoping plans, critical path method schedules, staffing plans for the design and construction management of the projects, monitoring the performance of consulting engineers, processing the payment requests of consulting engineers, etc. so that the design occurs within the budget and schedule defined within the project scoping plans;

- Coordination of the design review at 30% / 60% / 90% design completion by Construction Management, the capital project owner, etc. for technical accuracy, constructability, compliance with the master plan, etc.;

- Coordination with Administrative Services Division staff for the advertising and award of construction contracts and with the Real Estate Section for the acquisition of right-of-way;

- Managing the construction of capital projects working with Construction Management and Inspection including providing initial guidance to contractors through pre-construction meetings, review of product submittals from construction contractors, review of construction contractor progress payment requests after the requests are approved by the construction inspector assigned to the capital project, reviewing the daily reports, final on-site inspection before acceptance of the project from the construction contractor, coordination of warranty repair requests made to the construction contractor, etc.

These responsibilities are summarized in the exhibit following this page.

These roles and responsibilities should be published in a formal policy and procedure developed by the Engineering Division, reviewed with the Office of the City Manager, and adopted as a departmental policy and procedure, and "posted" or published to the Department's intranet.

Recommendation #71: The City Engineer should develop a formal written policy and procedure that clarifies responsibility for managing all of the engineering aspects of the delivery of the City's capital projects from "cradle to grave" as being assigned to the Engineering Division.

Exhibit 8

Management Requirements For Capital Projects

Component of the Capital Improvement Process	Requirement
Planning and Organizing the CIP	Preparation of project scoping plan for each CIP project to define the financing, description, scope, design considerations, and the necessary coordination with outside agencies.
	Preparation of a network schedule for each project, including duration time for each task, and earliest and latest start and finish times.
	Preparation of bar chart schedules for the entire CIP for a 2-year period showing projected timing of planned projects by major project component (e.g., design, bid, award, construction, etc.).
	Projection of staffing requirements to handle planned, prioritized projects for next fiscal year, including workload loading on a monthly basis.
	Leveling of resources to enable the development of schedules based on available staffing.
Project Management	Management of capital improvement projects in accordance with the project scoping plan.
Project Monitoring and Reporting	Reporting via the time accounting system of actual staff-hours by skill level and position type on CIP projects to provide the basis for: • Monitoring of staff and contractor performance against guidelines during each phase of the process; • Monitoring actual versus projected staff needs; and • Development of a database to utilize in refining project workload estimates. Time accounting system includes an hourly rate that accounts for indirect time and Division-wide overhead.
	Reporting of the project status on a monthly basis, including status of staff hours planned vs. actual.
	Reporting of financial and schedule status of each project showing expenditures and schedule to-date versus the project scoping plan.
	Recommending within the monthly status report steps that can be taken to enable completion of projects on schedule and within budget.
	Communication to top management, within the monthly status report, of CIP projects that will not be completed on schedule and within budget, along with estimated completion dates and budgets for each of these projects.

(4) The Division Should Enhance the Scheduling of Its Capital Projects – for both Design and Construction – Using Microsoft Project.

The *Capital Improvement Projects Development and Management Handbook* mentions the need to develop a project schedule for capital projects, in general, and not specifically. The Division should develop a policy and procedure that provides specifics regarding the development of a schedule for each capital project.

The Engineering Division should utilize a rigorous process to properly estimate how long it will take to perform each phase of the design and the construction of each capital project, from planning and studies up front, through close out of the construction contract and the overall project. These schedules should be developed using Microsoft Project.

The Division should develop a template for the scheduling of each capital project. Each project manager should use the template in developing the schedule for each project. To develop a new project, the project manager (the Civil Engineer assigned responsibility for managing a project) should open the Microsoft Project schedule template, and then customize it to the new project by imposing a new start date and adjusting activity durations. The template should follow distinct phases including design, bid, and construction. Project phases should be further broken down into specific milestones and deliverables, as follows:

- Design
  - Master Planning (if required)
  - Project Initiation
  - Feasibility/Pre-design
  - Design 15% / 50% / 100% / Final
  - Bid
- Bid and Award

- Construct
  - Construction
  - Project Closure
  - Warranty / Maintenance

Microsoft Project should then be utilized to roll up the detail to a summary bar for each project with color coding that represents various phases of work. The schedule should be configured to color code to the Division's organization (Real Estate, Deign, Construction Management and Inspection, etc.).

The project manager should update the schedule monthly, but the baseline should not be modified so that a comparison can be made to the original (baseline) schedule. To update the schedule, the project manager should meet with appropriate staff (design, real estate, construction management, etc.) to get actual start and finish dates and percentages complete. Once the update is complete, the project manager then overwrites the previous month's schedule data, but saves the original (baseline) baseline. This update should not adversely impact the ability of the Division to do a historical comparison of the current schedule or report on schedule variance.

Once the monthly status update is complete, various schedule reports should be produced directly from Microsoft Project, including a *Master Summary Report*, *Construction Phase Only*, *Design Look-Ahead*, *Construction Look-Ahead*, *Project Plan Check*, *Future Work Advertise dates*, and ad hoc reports.

The project schedules should be cost loaded by the project managers. Microsoft Project has this capacity. The costs should include City staff, consultants, and construction contracts. The cost loading of the schedule should occur at the phase

level and using the dates to produce cash flow curves that are automatically updated each month as schedule dates change. This technique should be utilized to avoid under- or over-budgeting of the annual capital plan. The project managers should also track actual total cost versus the original project budget and the prior month's forecast. The variance between original (or baseline) and latest forecast budget should be used as a key performance indicator.

The Division should conduct a monthly project status workshop for each project that includes the City Engineer, the Supervising Civil Engineers, appropriate project manager, the Supervising Construction Inspector, the Real Estate Services Manager, and the City Traffic Engineer. This should be a collaborative "full wall" scheduling session (e.g., the schedule is attached to the wall for review). The meeting should adjust the schedule and the budget as the discussion is ongoing and display it on a wall so participants can see the results of their statements, make adjustments, and perform what-if analyses.

Recommendation #72: The Engineering Division should utilize a rigorous process to properly estimate how long it will take to perform each phase of the design and the construction of each capital project, from planning and studies up front, through close out of the construction contract and the overall project.

Recommendation #73: The Engineering Division should prepare these schedules for each capital project using Microsoft Project.

Recommendation #74: The Engineering Division project manager should update the schedule monthly, <u>but the baseline (original) schedule should not be modified to enable a comparison to the actual to the baseline (original) schedule</u>.

Recommendation #75: The Engineering Division should utilize Microsoft Project to generate various schedule reports should be produced directly from Microsoft Project, including a *Master Summary Report*, *Construction Phase Only*, *Design Look-Ahead*, *Construction Look-Ahead*, *Project Plan Check*, *Future Work Advertise dates*, and ad hoc reports.

Recommendation #76: The Engineering Division should load the costs of each project into Microsoft Project. The project managers should also track actual total cost versus the original project budget and the prior month's forecast. The variance between original (or baseline) and latest forecast budget should be used as a key performance indicator.

Recommendation #77: The Division should conduct a project planning status meeting for each project that includes the City Engineer, the Supervising Civil Engineers, the appropriate project manager, the Supervising Construction Inspector, the Real Estate Services Manager, and the City Traffic Engineer.

(5) The Engineering Division Should Expand its Project Work Plans.

The *Construction Industry Institute* has defined a number of best practices for managing capital improvement programs.[7] Among these best practices is pre-project planning.

The Engineering Division prepares a project work plan, known as a CIP Statement Form. This is utilized for pre-project planning. It includes a number of features including:

- CIP number;
- CIP project title / description;
- Project goal;
- Types of work (e.g., asphalt paving, bridge replacement, sanitary sewer, etc.);
- A task breakdown with task – start month and task – end month;
- Right-of-way acquisition requirements; and
- Environmental impacts.

This project work plan should be expanded to include the following features:

- An expanded project description, including a narrative summary description of the project, specific physical improvements included, the location of the project, and the relationship to master plans.

[7] CII Best Practice Guide: Improving Project Performance, Version 3.1, Construction Industry Institute, 2011.

- The financing, including the source of funds and appropriation status.

- A budget covering the project broken down by design staffing, construction inspection staffing, right of way staffing, etc.), appropriate consultants, utility relocation, etc., by major expenditure component. The budget should identify the staff hour requirements by work breakdown structure and the costs (staff-related, consulting, permits, planting, etc.).

- The responsibility for completing the various components of the capital project including the following:

  – Design by in-house staff or by consulting engineer;
  – Construction inspection by in-house staff or by consulting engineer;
  – Design survey and construction staking by staff or consulting engineer;
  – Environmental evaluation required;
  – Right-of-way acquisition required and, if so, the number of parcels and their locations and assessor parcel numbers;
  – Utilities that need to be relocated, problems with relocation and timing issues; and
  – Other key responsibilities that need to be assigned and/or accomplished.

- The extent of coordination necessary with external agencies such as the Iowa Department of Transportation, identifying who the coordination will be required of during the planning, design and construction of the capital project, the nature of the coordination, and the key contacts.

- The preliminary schedule for completing the planning, design and construction of the capital project including the schedule for planning, design, bid package preparation, advertise / award, right-of-way acquisition, and construction and including the dates of important events such as approval of the award of construction contract by the City Council. This preliminary schedule should be prepared using a work breakdown structure via Microsoft Project.

- The measures of success for the project in terms of what the project manager must accomplish for the project to be successful and the measures of success for the team (e.g., bringing the project in on schedule and on budget).

- A risk assessment to identify the risks or threats associated with the execution of the project, the response strategy, and how the risk would be monitored and tracked.

- A communication plan for external and internal communication regarding the project including the responsibilities and mechanisms for the communication and when the communication should occur.

- How the quality of the project will be achieved including the standards, methods of verification that standards are met during construction, constructability reviews during design, etc.

- How the project will be transitioned to Streets or Sewer Operations upon completion of construction and how the project will be closed out upon completion of construction (e.g., as-built designs, archiving of records, acceptance of work completed by the construction contractor, etc.).

The project plans should be expanded. The project plan should define the project deliverables, schedule and budget plans, and the management methods used by the Engineering Division.

Recommendation #78: The Engineering Division should expand its project plans to include an expanded project description, financing, budget, responsibility for completing the various components of the capital project, extent of coordination necessary with external agencies, measures of success, a risk assessment, communication plan for external and internal communication, how the quality of the project will be achieved, and how the project will be transitioned to Streets or Sewer Operations upon completion.

(6) Real Estate Services Should Be Involved In The Development Of The Project Plans for Capital Projects.

At the present time, Real Estate Services are not consistently and meaningfully involved in project work planning, schedule development and maintenance, and endorsement of the project plan.

The Supervising Civil Engineers should be held accountable for involving Real Estate Services in the development of the work plan and in the development of an internal scope of work agreement. This internal scope of work agreement should define the project scope of work, the Real Estate Services Section scope of work, the schedule, the work requirements, the cost estimate for Real Estate Services (or the budget), the risks, assumptions and constraints, and the technical services contact person.)

A sample internal scope of work is provided in the exhibit following this page.

Recommendation #79: The Supervising Civil Engineers should be held accountable for involving Real Estate Services in the development of the project work plan and in the development of an internal scope of work agreement.

Recommendation #80: The Supervising Civil Engineers should develop an internal scope of work agreement with Real Estate Services before the commencement of a project that defines the project scope of work, the Real Estate Services scope of work, the schedule, the work requirements, the cost estimate for Real Estate Services (or the budget), the risks, assumptions and constraints, and the Real Estate Services contact person.).

(6) Cost of Construction Guidelines Should Be Utilized to Document Resource Requirements for the Design and Inspection of Capital Improvement Projects.

The Project Management Institute published a *Guide to the Project Management Body of Knowledge* (PMBOK Guide). Principle 3.41 indicates that among the generally recognized good practice for project management includes the development of a work breakdown structure, activities, activity resources, an estimate of costs, and a budget."[8]

Cost of construction guidelines should be used as a budgeting tool to determine the number of staff hours required for design and construction inspection and to evaluate whether projects are being managed and executed efficiently.

The second exhibit presented following this page presents an example of cost of construction guidelines for the design and inspection of capital improvement projects as a percentage of construction costs.

[8] Project Management Institute, A Guide to the Project Management Body of Knowledge, 2008.

Exhibit 9 (1)

Internal Scope of Work Agreement

Internal Scope of Work Agreement *"This Scope of Work Agreement is focused on results, not methods. It gives people a choice of method and makes them responsible for results."*
This agreement is between **ENGINEERING DESIGN** and **REAL ESTATE SERVICES** for
Project: **[ENTER PROJECT NAME HERE]**
Project Scope of Work: (Describes the work the project team is assigned to perform.)
"[Type details here.]" [INSTRUCTIONS: Use the project description from the work plan to describe what work must be done to accomplish the assigned scope of work. Describe what the results will look like, and by when they will be accomplished.]
Real Estate Services Scope of Work: (Creates a clear, mutual understanding of what needs to be accomplished by Real Estate Services. Visualize the desired result.)
"[Type details here.]" [INSTRUCTIONS: Describe what the results will look like and the work Real Estate Services must accomplish.]
Schedule: (Identifies the deliverables/activities produced by the Real Estate Services and when they will be accomplished.)
"[Type details here.]" [INSTRUCTIONS: Identify the deliverables and/or activities, their durations, predecessors and successors, milestones and constraints. Engineering Design and Real Estate Services should determine the naming conventions and level of detail to be documented in the schedule. The planned value may be established at any level in the project schedule; either at the phase level, WBS, deliverable, individual activities or a combination of those. Upon endorsement of the work plan (schedule) identify start, finish and milestone dates.]
Work Requirements: (Identifies the products required by Real Estate Services to accomplish the work and when they are needed.)
"[Type details here.]" [INSTRUCTIONS: List items Real Estate Services requires from the Engineering Design project manager to accomplish the above scope of work. Identify the party responsible for its delivery and when the items must be provided by; e.g. right of way is required from Real Estate Services before Engineering can begin design work and provide an accurate estimate.]
Cost Estimate/Budget Development: (The costs for the deliverables/activities produced by Real Estate Services.)
"[Type details here.]" [INSTRUCTIONS: Estimate the costs (planned value) with the same level of detail as agreed to with the project schedule. The planned value may be established at WBS level. Allocate the project costs to the WBS activity resources. This is accomplished by assigning a number of hours by role to specific activities.]

Exhibit 9 (2)

Risks, Assumptions and Constraints: (Identifies issues that may influence decisions and the ability to accomplish the work.)	
"[Type details here.]" [INSTRUCTIONS: Identify current or potential risks, constraints or assumptions that may affect the technical services ability to accomplish the work within the agreed upon project scope, schedule or budget.]	
Resources: (identifies human, financial, technical or organizational resources to draw on to accomplish the desired results)	
"[Type details here.]" [INSTRUCTIONS: Identify the Engineering Design project manager and Real Estate Services points of contact and other resources to accomplish the desired results.]	
Endorsement: (Identify the appropriate authority to endorse this internal scope of work agreement and its inclusion in the work plan.)	
Engineering Design Project Manager: "[Type name and phone number here.]"	Date Endorsed: Click here to enter a date.
Real Estate Services unit: "[Type name and phone number here.]"	Date Endorsed: Click here to enter a date.

Exhibit 10

Allocation of Staff Resources for Design and Inspection As A Median Percentage of Net Construction Costs

Type of Project	Street Construction				Street Reconstruction				Traffic Control		Wastewater			
Level of Complexity	Above Average		Average		Above Average		Average		Average		Above Average		Average	
Construction Cost (+/-)	$0.25 million	$1 million	$0.25 million	$1 million	$0.25 million	$1 million	$0.25 million	$1 million	$0.25 million	$1 million	$0.25 million	$1 million	$0.25 million	$1 million
Planning and Scoping	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Design Development	10%	8%	9%	7%	13%	11%	10%	8%	8%	6%	9%	8%	8%	6%
Design Survey	1 ½%	1%	1 ½%	1%	1 ½%	1%	1%	½%	1 ½%	½%	1%	½%	1%	½%
Design Administration	2%	2%	1 ½%	1 ½%	2%	2%	1 ½%	1 ½%	1 ½%	1 ½%	1½%	1½%	1 ½%	1 ½%
Construction Survey	3%	2 ½%	2 ½%	2%	2%	1 ½%	1 ½%	1%	0.1%	0.1%	2½%	2%	2½%	2%
Construction Inspection	5%	5%	4%	4%	5%	5%	4%	4%	3%	3%	4%	4%	4%	4%
Construction Management	3%	3%	2%	2%	3%	3%	1 ½%	1 ½%	2%	2%	3%	3%	2%	2%
Project Closure	0.4%	0.1%	0.4%	0.1%	0.4%	0.1%	0.4%	0.1%	0.4%	0.1%	0.4%	0.1%	0.4%	0.1%
Total	25.4%	22.1%	21.4%	18.1%	27.4%	24.1%	20.4%	17.1%	17%	13.7%	21.9%	19.6%	19.9%	16.6%

Capital projects are most amenable to effective cost management in the early stages of the project and the least in the construction stage. If budgets are not well defined early, project costs will increase as the project progresses. A consistent approach to budgeting practices throughout the various phases in the life of a project can reduce or help manage the uncertainties in project development that can increase project costs.[9]

Percentage of construction cost has been widely used for determining the cost of design and inspection of various works. The following points should be noted concerning this cost of construction guideline.

- Two different levels of complexity are noted: average and above average. An above average level of complexity should be based upon the need to deal with other agencies (e.g., Iowa DOT), the design complexities of the project, or problems with planning and construction determining the compensation of consulting engineers on assignments where the principal responsibility is the design of various works, and the preparation of drawings, specifications, and other contract documents as necessary.

- These guidelines are customized to fit the different types of construction jobs such as street construction, street reconstruction, traffic control, and sewer.

- These guidelines were developed to "fit" the different types of work activities in each capital project. These include planning and scoping, design development, design survey, design administration, construction survey, construction inspection, construction management, and project closure.

- The guidelines are expressed as a percentage of construction (e.g., the cost of staffing as a percentage of construction). To determine the number of staff hours required, divide the cost of the work activity based upon the cost of construction guidelines by the current loaded hourly cost for engineering staff.

- The guidelines identify resource requirements for each work activity associated with a project. These include design development, design administration, etc.

[9] City of Seattle, Washington, Capital Improvement Program Study of Seattle Transportation, 2001.

- If a consulting engineer is accomplishing the design, the project manager in the Engineering Division would utilize the guideline for design administration, and not design development.

The project managers within the Engineering Division should determine the staffing requirements for each project in terms of person hours required for design and construction inspection utilizing the cost of construction guidelines. This should be accomplished in the preparation of the project work plan. The Supervising Civil Engineers should utilize the cost of construction guidelines in the preparation of the staffing requirements before each fiscal year to determine workload capacity of staff versus the workload represented by the capital projects.

Recommendation #81: The Engineering Division should utilize cost of construction guidelines to determine the staffing requirements for each capital improvement program project in terms of person hours required for design and construction inspection.

(7) "Billability" Targets Should Be Established for the Engineering Division Staff.

To assure that the staff of the Engineering Division are efficiently utilized, the Supervising Civil Engineers should set "billability" targets for staff assigned to the design and construction management / inspection of capital projects. These targets would represent that proportion of their work time that these staff should charge to projects each month. These staff should be "billable" to projects for not less than 125 hours per month or 1,500 hours annually.

As part of the development of these "billability" targets, principles should be developed by the Finance Department and the Engineering Division for what is chargeable to capital projects and what is to be included in the hourly rates charged to capital projects. For example, it should be recognized by the Finance Department and

the Public Works Department that the City Engineer will not routinely charge time to capital projects; the City Engineer should be treated as overhead and the costs of the City Engineer built into the hourly rates. Similarly, the Supervising Civil Engineers should not be expected to charge more than one-half of their available work hours to capital projects; the available work hours not charged to capital projects should be treated as overhead and the costs built into the hourly rates. Similarly, a proportionate share of department-wide overhead (e.g., the Administrative Assistants) and other indirect costs should be built into the hourly rates.

The project accounting system should be utilized to monitor the performance of these staff against these targets.

Recommendation #82: "Billability" targets should be established for staff of the Engineering Division.

Recommendation #83: As part of the development of these "billability" targets, principles should be developed by the Finance Department and the Engineering Division for what is chargeable to capital projects and what is to be included in the hourly rates charged to capital projects.

Recommendation #84: The PeopleSoft project accounting system should be utilized to monitor the performance of the staff of the Engineering Division against these targets.

(8) The Engineering Division Should Develop A Bi-Monthly Capital Project Status Report.

The Project Management Institute published a *Guide to the Project Management Body of Knowledge* (PMBOK Guide). Principle 10.5 indicates that among the generally recognized good practices for project management includes the reporting of performance. "Report performance is the process of collecting and distributing performance information including status reports, progress measurements, and forecasts. The performance reporting process involves the periodic collection and

analysis of baseline versus actual data to understand and communicate the project progress and performance as well as to forecast the project results."[10]

The Engineering Division should prepare a bi-monthly capital improvement program project status report. The report should include a number of data regarding each project including the following:

- Charge number;
- Project number;
- Project title;
- Project description;
- Total budget amount including the original budget and the current revised budget;
- Design budget;
- Design expenditures to date separately identifying staff expenditures from consulting expenditures;
- Construction management expenditures to date separately identifying contract administration, construction inspection, and consulting engineering expenses;
- Construction cost as budgeted;
- Current construction cost as estimated by the project manager responsible for construction management.
- Design project manager;
- Construction project manager;
- Design start date – original and revised;
- Design completion date – original and revised;
- Construction start – original and revised:
- Construction end – original and revised; and

[10] Project Management Institute, A Guide to the Project Management Body of Knowledge, 2008.

- Comments.

  These reports should be developed on a bi-monthly basis.

Recommendation #85: The Engineering Division should prepare a bi-monthly capital improvement program project status report i.e., every two months.

Recommendation #86: The monthly capital improvement program project status report should be updated and posted to the Public Works Department web site each month.

(9) The Engineering Division Should Prepare a Resource-Loaded Project Schedule For Each Fiscal Year.

The Project Management Institute published a *Guide to the Project Management Body of Knowledge* (PMBOK Guide). Principle 6.5 indicates that among the generally recognized good practices for project management includes the development of a project schedule. The development of a schedule "is the process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule. Entering the activities, durations, and resources into the scheduling tool generates a schedule with planned dates for completing project activities. Schedule development can require the review and revision of duration estimates and resource estimates to create an approved project schedule that can serve as a baseline to track progress."[11]

A resource-loaded schedule is designed to ensure that the Engineering Division is capable of meeting its commitments – the completion of the design of funded capital projects.

Before the beginning of each fiscal year, the Supervising Civil Engineers should prepare a resource loaded project schedule for all of the capital projects that will be

[11] Project Management Institute, A Guide to the Project Management Body of Knowledge, 2008.

designed and inspected during that fiscal year. The intent of the resource loaded project schedule is to make sure that sufficient staff or consultant resources are available to complete these projects or, if not, to adjust schedules to accommodate the resources available.

An example of the application of cost-of-construction guidelines for the construction management and inspection of one capital project is provided in the table below.

1. Project Title	Langsford Road, Todd George to old City Limits
2. Project Description:	This project involves the construction of Langsford Road including a four-lane arterial roadway, curbs and gutters, sidewalks, and major drainage structures.
3. Construction Cost:	$3,600,000
4. Construction Duration (Months):	15.61
5. Start Date	01-Apr-015
6. Finish Date:	28-Oct-15
7. Complexity:	Average
8: Cost of Construction Guidelines:	
• Construction Inspection	4%
• Construction Management	2%
9. Staff Hours Required	
• Construction Inspection ($70 / hour)	2,057.14
• Construction Management ($90 / hour)	800.00
• Total Construction Staff Hours	2,857.14

This analytical effort would need to be completed for each project that would be designed or inspected during the upcoming fiscal year. The total staff hours would need to be loaded on a project-by-project basis for the months that the project will be designed or inspected during that fiscal year (although the project could extend beyond the end of that fiscal year). In the example noted above, the project would need to be loaded for the months beginning April 2015 through the end of the fiscal year or June 2015 (although the project would continue until the end of October 2015). A total of 2,057 hours would need for construction inspection to be loaded over a 15 plus month

construction schedule or approximately 132 staff hours per month. This indicates that this project would likely require a full-time Construction Inspector for the duration of this project.

Recommendation #87: The Supervising Civil Engineers should prepare a resource loaded project schedule for all of the capital projects that will be designed and inspected during that fiscal year.

(10) The Construction Contract Change Order Authority Should Be Simplified.

Change order authority has been delegated as 10% of the project amount not to exceed $25,000. Any amount in excess of that requires the approval of the City Council.

The City should amend the change order process, raise the threshold to the maximum allowable by Iowa Code, and delegate limited authority to the Public Works Director, City Engineer, and the Supervising Civil Engineers.

As part of this revised policy and procedure, authority should be delegated to the Supervising Civil Engineer up to a set dollar limit for construction change orders, and to the City Engineer up to a set dollar limit that is higher than that of the Supervising Civil Engineer. The change order process should be based upon a threshold: once the construction change order reaches a certain dollar or % threshold, it should require the approval of the City Engineer. The Public Works Director should approve construction change orders once it exceeds another and higher dollar or % threshold. The Public Works Department should not be able to approve any change orders in excess of the contingency. Those change orders should require the approval of the City Council.

This delegation of authority should be formalized in a policy and procedure developed by the Engineering Division and adopted by the Office of the City Manager.

However, the change order authority should be accompanied with a number of check and balances as noted below.

- **The project manager in the Engineering Division should be responsible for the total project budget and schedule and should, therefore, be one of the signatures on the change order.** The project manager in the Engineering Division should have the authority to reject the change order. For any disputed changes, the Civil Engineering Construction Inspectors and the Construction Contract Specialist should prepare a written negotiating position on merit and cost and submit it to the project manager in the Engineering Division and to other key stakeholders prior to negotiation. The project manager in the Engineering Division and Civil Engineering Construction Inspectors and the Construction Contract Specialist should attempt to mutually agree upon the position within an established period of time. They should also resolve as many issues as possible at their level so that only a small percentage is elevated. If there is an internal disagreement, that matter should be immediately elevated to the Supervising Civil Engineers and the City Engineer. Once a decision is made, the Civil Engineering Construction Inspectors and the Construction Contract Specialist should commit the reasoning underlying the decision in writing. The Civil Engineering Construction Inspectors and the Construction Contract Specialist should include this document in the construction contract file.

- **The project manager in the Engineering Division should be involved early in the change order process.** The Civil Engineering Construction Inspectors and the Construction Contract Specialist should work with the project manager in the Engineering Division in evaluating the merits and processing of the change order.

- **An independent cost estimate should be required for contractor-proposed change orders exceeding $10,000** (based on the original proposed changed order submitted by the contractor and exclusive of any credit from other line items).

- **If work is done on a time and materials basis, justification should be documented** by Construction Management and Inspection.

- **Time extensions should be substantiated with a Time Impact Analysis / schedule analysis**, including delay-related costs (e.g., extended overheads), and a liquidated damages analysis.

- **The change orders should go through a contract compliance review by the Civil Engineering Construction Inspectors and the Construction Contract Specialist** designed to verify that all steps in the process are being followed. This review should include a critical evaluation of the merit justification and pricing justifications if there is an obviously questionable cost item. The contract

compliance review should occur in concert with the review of the change order request and should include a detailed analysis of merit or pricing.

- **The causes of the change orders should be identified by type**. This should include such types as "errors and omissions in plans, specifications, and estimates", or "Nondiscretionary Changes", etc.

Each of the items noted above should be included in the change order policy and procedure. The project manager in the Engineering Division should ultimately be responsible for enforcement of the construction contract in a fair, but firm manner.

Recommendation #88: The City should delegate limited change order authority to the Public Works Director, City Engineer, and Supervising Civil Engineers.

Recommendation #89: The change order process should be based upon a threshold: the Supervising Civil Engineer should be able to approve construction change orders below a certain dollar or % threshold. Once the construction change order reaches that certain dollar or % threshold, it should require the approval of the City Engineer. The Public Works Director should approve construction change orders once it exceeds another and higher dollar or % threshold.

Recommendation #90: The Public Works Department should not be able to approve any change orders in excess of the contingency. Those change orders should require the approval of the City Council.

Recommendation #91: The Department of Public Works should formalize the delegated change order authority in a policy and procedure approved by the Office of the City Manager.

(11) The Engineering Division Should Consistently Provide Construction Management And Inspection and the "Asset Manager" With The Opportunity To Provide 30%, 60%, and 90% Submittal Reviews For Constructability And Maintainability.

Construction Management and Inspection and the "Asset Manager" (e.g., the Sewer Operations Manager) are not consistently being provided with the opportunity to conduct constructability reviews of design plans and specifications for capital projects.

Construction Management and Inspection and the "Asset Manager" should be consistently provided with the opportunity to provide 30%, 60%, and 90% submittal

reviews for constructability and maintainability as noted below.

- **First / Schematic Submittal Review - 30% design complete**. During the first review, a constructability review of the design should be required. The project manager from the Engineering Division should provide Construction Management and Inspection and the "Asset Manager" with the opportunity to review the plans at 30% completion to cross check the construction plans with the specifications to determine if any conflicts, ambiguities, inaccuracies or deficiencies exist, and to identify construction requirements that are impossible or impracticable to build. A field check should be done to determine if the project can be built where located, and spot check existing topography with what is shown on plans.

  In conjunction with the first review, a field review should be held with Construction Management and Inspection and the "Asset Manager", and the project manager from the Engineering Division. The field reviews examine the preliminary design documents individually prior to jointly reviewing the design in the field. The field review verifies topographic data, adjacent property elevations, and the feasibility of the design relative to existing field conditions. The project manager from the Engineering Division should document the field review in writing, noting all comments of the reviewers.

- **Second / Design Development Submittal Review – 60% design complete**. The project manager from the Engineering Division provides Construction Management and Inspection and the "Asset Manager" with the opportunity to assure that all of the 30% review comments have been incorporated. This review ascertains whether the design is progressing in conformance with the project criteria.

- **Third / Construction Document Submittal Review - 90% design complete**. This submittal should provide the Construction Management and Inspection and the "Asset Manager" with the opportunity to review the final plans for the project. In conjunction with the final plan development during this phase, the project manager from the Engineering Division should begin finalizing any special provisions required to specify or clarify the construction work elements, completes permit applications and prepare a final quantity estimate, cost estimate and construction schedule, in conjunction with Construction Management and Inspection and the "Asset Manager".

  A complete set of documents marked "not for construction" should be provided to Construction Management and Inspection and the "Asset Manager". The review ascertains the accuracy and completeness of the design plans, specifications, quantities and cost estimate. The review also determines the adequacy and consistency of the plans and specifications as bidding documents.

The 30% / 60% / 90% reviews with Construction Management and Inspection and the

"Asset Manager" should be required as part of a policy and procedure.

Recommendation #92: The Engineering Division should routinely and consistently conduct 30% / 60% / 90% design plan and specification reviews with Construction Management and Inspection and the "Asset Manager".

Recommendation #93: The Engineering Division should develop a policy and procedure for the conduct of the 30% / 60% / 90% design plan and specification reviews with Construction Management and Inspection and the "Asset Manager".

(12) The Engineering Division Should Streamline the Project Delivery Methods Used For Small Capital Projects.

It is not unusual with small capital projects to experience costs of design and construction management / inspection staff and the costs of consulting engineers to exceed the cost of construction This reflects a project delivery approach that is largely the same, regardless of whether the project is small or large in terms of the project construction cost.

The Engineering Division has a number of small capital projects under design at the present time, as noted with the stormwater and wastewater capital projects listed in the table below.

Capital Project	Engineer's Estimated Construction Cost
6805 Brentwood Drive Sanitary Sewer Replacement	$60,000
13th St E/o 7th Ave Sanitary Sewer Replacement	$50,000
Detention Basin Improvements (CDBG)	$50,000
3rd Ave @ 6th St Storm Sewer Point Repair	$50,000
Brookland Drive East of Wenig	$50,000
Jefferson HS Area Storm Sewer	$50,000
Pleasant Run LS - Site No 1	$50,000
1018 9th Street	$40,000
Meadowbrook Drive SE from Forest to 26th	$35,000
7th St. N/ o 2nd Ave	$25,000
Backwater Valve Program	$12,000
31st w/ o Prairie Drive	$10,000

This issue is not unique to Cedar Rapids. The United States Army Corps of Engineers developed a Small Projects Team Initiative in response to the staff and consulting costs for capital projects being unacceptably high[12]. The candidates for these small projects included:

- Repetitive / routine work;
- Simple / uncomplicated construction work;
- Renovation / remodeling upgrades;
- Detail of the design is sufficient with simplified design measures;
- The preferred project costs less than $500,000; and
- The projects are largely "maintenance" projects.

The United States Army Corps of Engineers uses a small project design team for project delivery. This team produces simplified design documents that consist of photographs, written descriptions, a limited number of drawings, existing drawings with "pen and ink" changes, reduced size drawings that can be easily photocopied, sketches, etc. Each of these small projects is initiated with a two to four page project management plan that provides the capital project owner and the United States Army Corps of Engineers with a means to visualize the project in terms of schedule, costs, and concept. Upon approval by the capital project owner, a statement of work is generated regarding the scope of work to be completed. Then a procurement method is selected that can range from issuing a purchase order, a job order contract, indefinite delivery / indefinite quantity, etc. A formal bid process is not utilized.

[12] Anthony J. Reed, The Impact of Small Projects Team Initiative on Construction Projects Managed by the United States Army Corps of Engineers, 1998.

The Capital Projects Design Division should develop alternative project delivery approaches for these small capital projects (projects whose estimated construction cost is less than $72,000). This should include the approaches noted below.

- **The City should pre-qualify contractors on an annual basis for small construction projects**. These contractors would be requested to submit qualifications based upon design documents (e.g., standard specifications for sanitary sewer replacement) generated by the Engineering Division.

  The City of San Diego uses pre-qualified contactors that become a registered vendor and pre-qualify for small contract bids with the City. This is an example of simplification of the process for small construction contracts.

  Contracts (multiple) would be awarded to these pre-qualified contractors based upon a simplified design process. Requests for bids would be issued to these pre-qualified contractors using a simplified bidding process (e.g., issuance of statements of work and requesting bids based upon these statements of work). The pre-qualification of construction contractors would require the preparation and issuance of an annual request for qualifications. Once developed, the Division could re-issue the request for qualifications once a year, or, with appropriate provisions in the invitation for bid, once every three years. The initial preparation of the invitation for bids by the Division should require an estimated 40 to 60 staff hours by Engineering Services; subsequent re-issuance of the invitation for bid should require less than 8 hours. The purpose of the use of pre-qualified construction contractors is to avoid preparing formal design and bid documents for each and every small construction contract.

- **The Engineering Division should simplify the design processes used for small capital projects (<$72,000)**. The Division should utilize the types of design approaches utilized by the United States Army Corps of Engineers for small capital projects. This should include simplified design documents that consist of photographs, written descriptions, a limited number of drawings, existing drawings with “pen and ink” changes, reduced size drawings that can be easily photocopied, sketches, etc. These small projects should be initiated with a two to four page project management plan that provides the Engineering Division with a means to visualize the project in terms of schedule, costs, and concept. A statement of work should be generated regarding the scope of work to be completed. Then a purchase order could be issued based upon responses to simplified requests for bids. A formal bid process should not be utilized.

- **The Sewer Operations Division or the Street Operations Division should manage these projects**. Once pre-qualified construction contractors are selected, the Sewer Operations Division or the Street Operations Division should

be assigned responsibility for managing the construction contract and associated construction projects.

Overall, the process used for the design of small capital projects (<$72,000) must be greatly simplified. These small capital projects should move to construction with minimal engineering design effort. The Matrix Consulting Group recommends priorities for simplifying the capital project design process as follows:

- The Engineering Division should use different and simpler approaches for the design of small capital projects that includes the simplified design documents referenced previously, the project management plan and the statement of work, but not formal bids; and

- The Engineering Division should utilize pre-qualified contractors for the small capital projects based upon task orders issued by the Division. The City of San Diego uses pre-qualified contactors that become a registered vendor and pre-qualify for small contract bids with the City. This is an example of simplification of the process for small construction contracts.

These small capital projects should spend as little time in the Engineering Design Division as possible.

Recommendation #94: The Engineering Division should use different and simpler approaches for the design of small capital projects (<$72,000 in construction costs).

Recommendation #95: The Engineering Division should utilize pre-qualified contractors for the small capital projects based upon task orders issued by the Division. The Sewer Operations Division or the Street Operations Division should manage these projects.

(13) The Project Manual Preparation Request Form and Process Should Be Eliminated.

At the present time, each capital project requires the completion of a *Project Manual Preparation Request Form*. This process adds seven weeks to the process of completing a capital project and issuing a bid.

The *Project Manual Preparation Request Form* includes a variety of information that requires the review and approval of the project manager in the Engineering Division, the Real Estate Services Manager, the Utility Analyst and Public Works Financial Analyst in the Finance Department, and the Engineering Manager. This is excessively bureaucratic. It is a form that the Matrix Consulting Group has not observed in other cities.

The *Project Manual Preparation Request Form* should be eliminated.

The capital project manager in the Engineering Division should continue to ensure that right-of-way, and permanent or temporary easements have been acquired in coordination with the Real Estate Services Manager to the satisfaction of the Supervising Civil Engineer. This should be initiated at the beginning of and throughout the project; this should be a coordinative process with the Real Estate Services Section at the beginning of and throughout the project. It should not require a signature of the *Project Manual Preparation Request Form*.

The project manager in the Engineering Division should continue to ensure that funding is available and sufficient for the capital project in coordination with the Finance Department. This should be initiated at the beginning of and throughout the project; this should be a coordinative process with the Finance Department at the beginning of and throughout the project. It should not require a signature of the *Project Manual Preparation Request Form*.

The Engineering Manager should not review or sign the *Project Manual Preparation Request Form.* This is excessive and unnecessary involvement in detail that is inappropriate for the Engineering Manager.

The use and propagation of a *Project Manual Preparation Request Form* will not eliminate mistakes. Those mistakes will happen. The prevention of these mistakes can only occur when sufficient number of project managers are available and budgeted in the Engineering Division, and the Supervising Civil Engineers have sufficient time to supervise the capital project managers under the supervision. This is not the case at the present time.

Recommendation #96: The *Project Manual Preparation Request Form* should be eliminated.

(14) A Final Report Should Be Prepared Upon Completion of a Capital Project.

Without a formal analysis and distribution for review, the mistakes and weaknesses of one project will almost certainly be repeated on others. The final report should focus on analyzing the good and bad aspects of the completed project, the "lessons learned", transmitting that information to the staff of the Division, and providing a convenient summary of the project.

At the completion of the project, the project manager assigned to the project should complete a final report including:

- Project name, project number, and a description of the project.
- Construction costs – planned versus actual with an identification of all of the change orders, their costs and the reasons for those change orders;
- The staff hours allocated to the project - planned versus actual;
- The schedule for completion of the project - planned versus actual including whether drawings, specifications, schedules, and cost estimates were prepared consistently according to schedule;
- The design costs for the project - planned and actual including cost per sheet;
- Whether as-built plans have been completed; and

- Comments and discussion regarding the project as necessary including unusual conditions encountered during the project such as contractor deficiency, quantity difference, scope change, etc.

This report should be circulated to the other project managers, the Supervisory Civil Engineers, the Supervising Construction Inspector, the Civil Engineering Construction Inspector assigned to the project, the Construction Contract Specialist, and the City Engineer. After distribution of this status report, it should be the basis of a meeting to discuss and document in writing the "lessons learned".

Recommendation #97: A final report should be prepared for capital projects by each project manager upon completion of construction and acceptance of the improvements.

5. THE ENGINEERING DIVISION SHOULD ENHANCE ITS VENDOR MANAGEMENT PRACTICES.

The Engineering Division utilizes consultants, extensively, for the design of capital projects. In fiscal year 2013-14, the City Council awarded consulting contracts in a total amount of almost $3 million at the behest of the Engineering Division. The array of contracts awarded, by consulting firm, is presented in the exhibit following this page.

As the exhibit indicates, a total of fifteen consulting firms were awarded contracts. However, four of the firms were awarded 69% of the amount in terms of the value of the consulting contracts.

The Engineering Division should take a number of steps to enhance the management of vendors (consulting engineers).

Exhibit 11 (1)

Consulting Contracts Awarded in Fiscal year 2013-14

Department	Name	Awarded Amount	% of Total
301000	AECOM Technical Services Inc	$37,560.03	
	Sub-Total	**$37,560.03**	**1.1%**
301000	Ament Inc	$256,786.00	
	Sub-Total	**$256,786.00**	**7.8%**
655000	Anderson-Bogert Eng/Surveyors Inc	$133,006.00	
301000	Anderson-Bogert Eng/Surveyors Inc	$292,510.00	
301000	Anderson-Bogert Eng/Surveyors Inc	$60,322.20	
655000	Anderson-Bogert Eng/Surveyors Inc	$305,460.00	
301000	Anderson-Bogert Eng/Surveyors Inc	$1,440.00	
301000	Anderson-Bogert Eng/Surveyors Inc	$2,840.00	
301000	Anderson-Bogert Eng/Surveyors Inc	$1,840.00	
304000	Anderson-Bogert Eng/Surveyors Inc	$81,000.00	
	Sub-Total	**$878,418.20**	**26.7%**
301000	Brain Engineering Inc	$55,697.00	
	Sub-Total	**$55,697.00**	**1.7%**
301000	Foth Infrastructure & Environment LLC	$118,131.00	
301000	Foth Infrastructure & Environment LLC	$10,000.00	
301000	Foth Infrastructure & Environment LLC	$84,150.00	
301000	Foth Infrastructure & Environment LLC	$148,560.00	
304000	Foth Infrastructure & Environment LLC	$45,441.00	
304000	Foth Infrastructure & Environment LLC	$9,500.00	
	Sub-Total	**$415,782.00**	**12.6%**
306000	GBA Systems Integrators LLC	$6,500.00	
	Sub-Total	**$6,500.00**	**0.2%**
301000	Hall & Hall Engineers Inc	$55,710.00	
301000	Hall & Hall Engineers Inc	$4,850.00	
	Sub-Total	**$60,560.00**	**1.8%**
655000	HDR Engineering Inc	$349,179.00	
	Sub-Total	**$349,179.00**	**10.6%**
301000	Howard R Green Company	$91,667.00	
	Sub-Total	**$91,667.00**	**2.8%**
301000	McClure Engineering Co	$154,975.00	
325000	McClure Engineering Co	$78,590.00	
	Sub-Total	**$233,565.00**	**7.1%**
301000	Shoemaker & Haaland Professional Eng	$506,471.00	
305000	Shoemaker & Haaland Professional Eng	$22,300.00	
305000	Shoemaker & Haaland Professional Eng	$24,862.00	
305000	Shoemaker & Haaland Professional Eng	$74,208.00	
	Sub-Total	**$627,841.00**	**19.1%**
301000	Snyder & Associates Inc	$3,600.00	
301000	Snyder & Associates Inc	$200,764.00	
	Sub-Total	**$204,364.00**	**6.2%**
301000	TEAM Services Inc	$35,000.00	
	Sub-Total	**$35,000.00**	**1.1%**

Exhibit 11 (2)

Department	Name	Awarded Amount	% of Total
301000	Terracon	$4,950.00	
655000	Terracon	$4,000.00	
	Sub-Total	**$8,950.00**	**0.3%**
655000	Watersmith Engineering LLC	$31,784.00	
	Sub-Total	**$31,784.00**	**1.0%**
TOTAL		**$3,293,653.23**	**100.0%**

First, the *Capital Improvement Projects Development and Management Handbook* should be expanded to provide guidelines regarding (1) when consultants should be utilized versus the in-house engineers of the Engineering Division, and (2) the specific processes to be used and documentation generated regarding the selection of consultants.

The Supervising Civil Engineers should be responsible for preparing an analysis of whether sufficient staff exists to perform the required work in the timeframe in which it is needed. Consultants should be most commonly used when (1) additional capital activity is planned for a time period when adequate internal staff is not available to perform the required work or (2) and the internal staff does not have the expertise to perform the work. This should be clarified in a written policy and procedure developed by the City Engineer.

Second, the Engineering Division should develop and utilize an on-call consultant request for qualifications on an annual basis for consulting contracts whose estimated value will be less than $100,000 (estimated by the project manager in the Engineering Division).

The Engineering Division does not use on-call consulting. The Division issues a request for qualifications for each consulting award. It is very common in the industry (when a City is facing a capital program similar to that of Cedar Rapids) for the cities to hire three to five on-call consultants for each functional area; so, for example, the Engineering Division could have 3 to 5 on-call consultants for stormwater and wastewater; 3 to 5 on-call consultants for roads and bridges; and so on.

The City Engineer should prepare, in consultation with the Purchasing Division, Finance Department, a policy regarding the use of on-call consultants. The Division, on an annual basis, should issue a Request for Qualifications for on-call consultants. When the Division needs a consulting engineering firm, it should issue a task order solicitation. The lists should be rotational. Based upon the estimated value of the award (estimated by the project manager in the Engineering Division), the solicitation should be issued to the first consulting firm on the rotational list or the first three firms on the rotational list. Possible criteria that could be utilized to guide the extent of solicitation is provided in the table below.

Task Order Value	First Consultant on Rotational List	Top 3 Consultants on Rotational List
< $50,000	☐	
> $50,001 but less than $100,000		☐

Based on the value of the Task Order, the Division should decide whether the task order solicitation would be sent to only the first firm on the list, or the top three firms. With a rotational list, generally the selected consultant will be rotated to the bottom of the list after they are assigned the Task Order Solicitation.

Third, the Engineering Division should develop a formal written policy and procedure regarding how to select a consulting engineer and the basis for selection of consulting engineers. While the Engineering Division does have a form in its *Capital Improvement Projects Development and Management Handbook* – the Consultant Evaluation and Selection Form – the handbook contains no instructions regarding how to evaluate consultants in a selection. The City Engineer should develop a policy and procedure regarding how to make decisions regarding the selection of consulting engineers.

Recommendation #98: The *Capital Improvement Projects Development and Management Handbook* should be expanded to provide guidelines regarding (1) when consultants should be utilized versus the in-house engineers of the Engineering Division, and (2) the specific processes to be used and documentation generated regarding the selection of consultants.

Recommendation #99: The Engineering Division should develop and utilize an on-call consultant request for qualifications on an annual basis for consulting contracts whose estimated value will be less than $100,000 (estimated by the project manager in the Engineering Division).

Recommendation #100: The Engineering Division, in consultation with the Purchasing Division, should develop a formal written policy and procedure regarding how to select a consulting engineer and the basis for selection of consulting engineers.

6. THE NUMBER OF POSITIONS ASSIGNED TO EACH SUPERVISING CIVIL ENGINEER FOR THE DESIGN AND PROJECT MANAGEMENT OF CAPITAL PROJECTS FOR ROADS AND BRIDGES, STORMWATER AND WASTEWATER SHOULD BE INCREASED, BUT NOT THE NUMBER OF AUTHORIZED POSITIONS FOR THE ENGINEERING DIVISION.

The Matrix Consulting Group worked with the Supervising Civil Engineers for the Streets and Bridges Section and the Stormwater and Wastewater Section to assess the existing design workload including the following:

- The fund number, project number, project name, and whether funding was approved;
- The name of the project manager;
- Whether the project was being designed by in-house staff or consulting engineers;
- The design begin date, the estimated % design complete, and the estimated design completion date;
- The Engineers estimated construction cost; and
- The cost of construction guideline utilized to estimate the staff hour requirements for the design of capital projects.

This is a “snapshot of existing workload for the currently assigned capital projects.

(1) Streets and Bridges Section

The completion of this evaluation of the design workload results in a number of conclusions for the Streets and Bridges Section that are presented below.

- The Section is managing consulting engineers that are designing 18 capital projects.
- The Section is only designing 1 capital project itself with in-house staff: all other projects are being designed by consulting engineers. This is simply shocking.
- Consulting engineers are being utilized to design 95% of the total of 19 capital projects that the Section is currently working on.
- The total estimated Engineer's construction cost for these 19 capital projects is $28,000,000, with a range from $100,000 to a high of $4,500,000. The average Engineer's construction cost is $1,473,000: these are <u>not</u> large projects.
- 7 of these 19 capital projects will have the design completed by the end of 2014, 2 in the 1st quarter of calendar year 2015, 4 in the 2nd quarter of calendar year 2015, and 6 in fiscal year 2014-15 or later.
- Eight of the projects are assigned to the Engineering Manager as the project manager. This assignment is obviously impractical and inappropriate.
- Four of the projects are being managed by the Capital Improvement Project Manager. The Capital Improvement Project Manager has sufficient workload to keep him productive for 16% of expected billable work hours.
- Six of the projects are being managed by the Consultant Contract Administrator.
- One project is being managed by a Project Engineer I. This particular Project Engineer I has a 10% utilization rate. In other words, this Project Engineer I has sufficient workload to keep him productive for 10% of expected billable work hours.
- The Consultant Contract Administrator, who is supposed to be the supervisor of the Section, has a 102% utilization rate. In other words, this Consultant Contract Administrator has sufficient workload to keep him productive for 102% of expected billable work hours. This assignment is obviously impractical and inappropriate. The Consultant Contract Administrator, a supervisor, does not have anytime to supervise.
- The Section needs a total of five authorized positions: the Supervising Civil Engineer and four professional-level engineers, given current workload.

Altogether, the current design and project management workload of the Streets and Bridges Section requires the Supervising Civil Engineer and four professional-level level engineers, as long as the Section continues to outsource the design of almost all of the capital projects.

In addition, the Engineering Technician should be assigned to this Section. The Engineering Technician works mostly on the sidewalk condition assessment and repair program (e.g., assisting with the supervision of the summer interns, answering phone calls and meeting with property owners who are replacing their sidewalks, assisting residents with technical issues, taking general calls on sidewalk related questions, answering questions related to sidewalk for residents who come to the front counter; etc.). The Engineering Technician should assume responsibility for the sidewalk condition assessment and repair program, although this is not and will not be a full-time year-round workload.

The Civil Engineer I that has been assigned to the sidewalk condition assessment and repair program should be utilized as a project manager for capital projects, as one of the four professional-level engineers, in addition to the Supervising Civil Engineer.

Recommendation #101: A total of four existing authorized professional-level engineering positions, and a Supervising Civil Engineer, should be assigned to the Streets and Bridges Section, and assigned responsibility for the management and / or design of capital projects.

Recommendation #102: The Engineering Technician should be assigned to the Streets and Bridges Section. The Engineering Technician should assume responsibility for the sidewalk condition assessment and repair program, although this is not and will not be a full-time year-round workload.

Recommendation #103: The Civil Engineer I that has been assigned to the sidewalk condition assessment and repair program should be utilized as a project manager for capital projects in the Streets and Bridges Section.

(2) Stormwater and Wastewater Section

The completion of this evaluation of the design workload results in a number of conclusions for the Stormwater and Wastewater Section that are presented below.

- The Section is managing consulting engineers or designing with its own in-house engineers a total of 51 capital projects.

- 36 (or 70%) of these capital projects are being designed with consulting engineers, while 15 are being designed with in-house engineers. Almost all of the projects being designed with in-house staff are small projects (<$67,000).

- The total estimated Engineer's construction cost for these 51 capital projects is $48.6 million, with a range from $50,000 to a high of $14,500,000. The average Engineer's construction cost is $953,570 and the median is $210,000: these are <u>not</u> large projects.

- 7 of these 51 capital projects will have the design completed by the end of 2014, 15 in the 1st quarter of calendar year 2015, 8 in the 2nd quarter of calendar year 2015, and 21 in fiscal year 2014-15 or later.

- 7 of the projects are being managed by the Sewer Utility Engineering Manager. The Sewer Utility Engineering Manager has sufficient workload to keep him productive for 184% of expected billable work hours. Obviously with this level of workload, the Sewer Utility Engineering Manager will be hard pressed to effectively supervise the staff of his Section.

- 26 of the projects are being managed or designed by a Project Engineer I. The Project Engineer I has sufficient workload to keep him productive for 144% of expected billable work hours.

- 1 project is being managed by another Project Engineer I. This particular Project Engineer I has a 15% utilization rate. In other words, this Project Engineer I has sufficient workload to keep him productive for 15% of expected billable work hours.

- 17 of the projects are being managed by a third Project Engineer I. This particular Project Engineer I has a 232% utilization rate. In other words, this Project Engineer I has sufficient workload to keep him productive for 232% of expected billable work hours.

- The Section needs a total of six authorized positions: the Supervising Civil Engineer and five professional-level level engineers.

Altogether, the current workload of the Stormwater and Wastewater Section requires a Supervising Civil Engineer and five professional-level level engineers, as long as the Section continues to outsource the design of the preponderance of the capital projects.

A Project Engineer II is presently allocating a significant proportion of his time to drainage complaints. The responsibility for evaluation of drainage complaints should be assigned to the Storm Water Coordinator in the Sewer Operations Division. The Engineering Division should only be involved in these complaints if these complaints evolve into a capital project. The Project Engineer II allocating a significant proportion of his time to drainage complaints should be allocated on a full-time basis to managing capital project design.

Recommendation #104: A total of five existing authorized professional-level engineering positions, and a Supervising Civil Engineer, should be assigned to the Stormwater and Wastewater Section, and assigned responsibility for the management and / or design of capital projects.

Recommendation #105: The responsibility for evaluation of drainage complaints should be assigned to the Storm Water Coordinator in the Sewer Operations Division. The Engineering Division should only be involved in these complaints if these complaints evolve into a capital project. The Project Engineer II allocating a significant proportion of his time to drainage complaints should be allocated on a full-time basis to managing capital project design.

* * * * * *

Altogether, these two Sections require a total of ten positions: two Supervising Civil Engineers and nine professional-level engineers based upon current workload and the current use of consulting engineers. There are currently nine professional-level engineering positions, in addition to the two Supervising Civil Engineers. These nine

authorized and budgeted professional-level engineering positions are presented in the table below.

Classification Title	Number of Authorized Positions
Civil Engineer	3
Project Engineer II	2
Project Engineer I	3
Capital Improvement Project Manager	1

These nine positions should be assigned to the two Supervising Civil Engineers: five to the Supervising Civil Engineer for the Stormwater and Wastewater Section, and four to the Supervising Civil Engineer for the Streets and Bridges Section.

7. THE ASSIGNMENT OF A SUPERVISING CIVIL ENGINEER TO THE MANAGEMENT OF THE FLOOD CONTROL PROJECT SHOULD BE SUFFICIENT FOR THE NEXT TWO FISCAL YEARS.

Estimates of revenues for the Growth Reinvestment Initiative for the next seven years, provided by the Finance Department, are presented in the table below.

Fiscal Year	Estimated Annual Funding
FY 2014	$ 2,499,988
FY 2015	$ 5,062,477
FY 2016	$ 7,689,027
FY 2017	$10,381,241
FY 2018	$13,140,760
FY 2019	$15,000,000
FY 2020	$15,000,000

If these revenue estimates are accurate, there is hardly sufficient workload for the Supervising Civil Engineer for the next two fiscal years. The Supervising Civil Engineer should manage the two consulting firms selected for the design of the flood control project. Additional staff should not be authorized for the project management of this capital project.

Recommendation #106: Given the revenue estimates by the Finance Department, additional positions should not be authorized for the flood control project beyond the Supervising Civil Engineer.

8. TWO ADDITIONAL POSITIONS SHOULD BE AUTHORIZED FOR THE REAL ESTATE SERVICES SECTION.

The City contracts with Stanley Consultants for right-of-way acquisition services. The contract compensates Stanley Consultants at a rate of $113 per hour with a budget of $235,040 annually. The contract has enabled the Real Estate Services Section to obtain the skilled services of one (1) journey-level right-of-way agent.

While this is of value in the short-term, it is an expensive way to obtain this talent in the long-term. A Real Estate Officer at top step of the salary grade for the classification would cost the City approximately $102,000 annually, including fringe benefits.

The Real Estate Services Section is authorized five positions including two temporary positions. One of the two temporary positions is the Real Estate Coordinator, a position that was funded by flood recovery funds with the position funding ending at the conclusion of November 2014. In addition, the Real Estate Disposition Coordinator is temporary as well. The position is funded by revenue generated from street vacations and dispositions; the position exists as long as the revenue is sufficient to offset the costs of the position. A third position – the Real Estate Coordinator – is recommended for a transfer to the Development Services Department. This position is responsible for processing excavation permits (e.g., permitting of sewer taps) encroachment permits (e.g., retaining walls proposed to be constructed in the City right-of-way), urban agriculture permits, etc.

With the ending of one temporary position and the transfer of another position to the Development Services Department, the Real Estate Services Section would only be funded for two permanent positions (the Real Estate Services Manager and the Real Estate Officer), and one temporary position: the Real Estate Disposition Coordinator. The Real Estate Disposition Coordinator is not funded for nor is the position responsible for right-of-way acquisition. The position assists in the disposition of City-owned real estate including right-of-way, streets and alleys, etc., through vacation of the City-owned real estate.

The reality is that the Section is only allocated two positions for right-of-way acquisition: the Real Estate Services Manager and the Real Estate Officer. Yet, there is a substantive right-of-way acquisition workload as indicated in the exhibit on the following page.

The exhibit is based upon the ROW Acquisition Project Tracking report for August 2014. The workload for August 2014 is sufficient to warrant four full-time positions, including the Real Estate Services Manager, and continued consulting assistance, albeit less than full-time. This assessment is based upon metrics utilized by the Matrix Consulting Group for negotiations for right-of-way acquisition and displacement assistance. And this excludes the consulting assistance for Collins Road.

Exhibit 12

Real Estate Services Workload – August 2014

CIP #	Project	Project Received	Agent	Total # of Parcels
301500	18th Street SW - Phase I (13th-16th Ave SW)	04-Feb-14	Stanley	9
301500	18th Street SW - Phase II (16th Ave to Wilson)	04-Feb-14	Stanley	21
3012062	4th Street RR ROW Corridor	18-Aug-10	Stanley	3
325042	Indian Creek Nature Center - Land Acquisition	NA	Stanley	1
3012074	Sidewalk Infill Project (Salem United Methodist)	see notes	Stanley	1
SSD103-11	SW Quad	23-Jul-13	Stanley	1
SSD013-03	East Side Interceptor Sewer Repair	06-Aug-14	Stanley	4
Total				**40**
301500	18th Street SW - Phase I (13th-16th Ave SW)	06-Aug-14	Rita	4
3302600006	Cedar River Floodwall (Quaker Foods)	15-May-14	Rita	1
331003	Northwest Flood Mitigation	17-Jun-14	Rita	19
325012	CEMAR Trail easement (Mt Mercy)	15-May-14	Rita	1
301446	C Avenue Improvement Project (total acq)	19-May-14	Rita	1
3012004-02	26th Street SW	15-Aug-14	Rita	2
Total				**28**
304361	34th Street SE - Indian Creek	01-Aug-11	Sarah	6
655996	Sanitary Sewer Improvement	12-Feb-12	Sarah	5
655028-07	Prairie Creek Trunk Sanitary Sewer	01-Oct-12	Sarah	5
SSD103-08	San Swr SW Quad Flood Repairs (Ament)	18-Sep-13	Sarah	2
301734	Oakland Road NE from Golf to Golfview Dr	30-Jan-14	Sarah	4/14 ten
301136	33rd Ave SW Crop damage	on going	Sarah	1
325008	Edgewood Road NW Multiuse Pathway	11-Jul-14	Sarah	13
655997	13th Street E of 7th Ave SW SS Repair	07-Jul-14	Sarah	1
305031	Bridge Replacement-McCloud Place NE	16-Jul-14	Sarah	4
Total				**41**
301500	18th Street SW - Phase I (13th-16th Ave SW)	04-Feb-14	Amy	2
RELOCATION ASSISTANCE				
301446	4531 C Avenue NE	19-May-14	Sarah	1
331003	1523 5th St NW (NW Flood Mitigation Project)	17-Jun-14	Sarah	1
301500	1732 Wilson Avenue SW (18th Street Project)		Sarah	1
OTHER DEPARTMENT PROJECTS				
611054	WPC - Ditch Land Acquisition	Nov 2013	Rita	1
4914039	CM Office-CR Dev Group Land Acquisition	05-May-14	Rita	2
521114	Solid Waste - O'Reilly Driveway	22-Jul-14	Sarah	1
2014067	F Ave NW Water Service Line	18-Aug-14	Sarah	10
MANAGING ROW CONSULTANT PROJECTS				
301446	Collins Road Improvement (JCG)	02-May-14	Rita	16
UPCOMING PROJECTS				
NW Quad Sewer Project		18-Aug-10		34
Complete Streets		NA		Numerous

An additional two positions should be authorized for the Real Estate Services Section. One of these two positions should be a journey-level position. After training of the two positions, the contract with Stanley Consultants should be terminated.

These additional positions should be authorized within the context of a newly established Right-of-Way Officer classification series. The Real Estate Disposition Coordinator, the Real Estate Officer, and the two new positions should be included in this classification series. The series should run the gamut from entry level to journey level (e.g., Right-of-Way Agent I, Right-of-Way Agent II, Right-of-Way Agent III).

In addition, the Real Estate Disposition Coordinator should be converted to permanent. There is sufficient right-of-way acquisition workload to assign to the position, should disposition workload decrease, and consultants are presently being utilized to assist in this acquisition. The use of the Real Estate Disposition Coordinator for right-of-way acquisition would displace consultants.

It should be understood that the Engineering CIP Coordinator supports the Real Estate Services Section for title / closing / condemnation activities. The support for title / closing / condemnation activities should continue to be provided by the Engineering CIP Coordinator in the short-term; in the long-term, this responsibility should be transferred to the staff of the Real Estate Services Section when the two additional positions have been filled and the staff trained.

Recommendation #107: An additional two positions should be authorized for the Real Estate Services Section. One of these two positions should be a journey-level position. After training of the two positions, the contract with Stanley Consultants should be terminated.

Recommendation #108: These additional positions should be authorized within the context of a newly established Right-of-Way Officer classification series. The Real Estate Disposition Coordinator, the Real Estate Officer, and the two new

positions should be included in this classification series. The series should run the gamut from entry level to journey level (e.g., Right-of-Way Agent I, Right-of-Way Agent II, Right-of-Way Agent III).

Recommendation #109: The Real Estate Disposition Coordinator should be converted to permanent. There is sufficient right-of-way acquisition workload to assign to the position, should disposition workload decrease, and consultants are presently being utilized to assist in this acquisition. The use of the Real Estate Disposition Coordinator for right-of-way acquisition would displace consultants.

Recommendation #110: The support for title / closing / condemnation activities should continue to be provided by the Engineering CIP Coordinator in the short-term; in the long-term, this responsibility should be transferred to the staff of the Real Estate Services Section when the two additional positions have been filled and the staff trained.

9. THE POSITIONS ALLOCATED TO THE SURVEY CREW SHOULD BE RE-PURPOSED.

The Engineering Division already outsources almost all of the design of its capital projects. Consulting engineers are being utilized to design 95% of the total of 19 capital projects that the Streets and Bridges Section is currently working on. Consulting engineers are being utilized to design 70% of the capital projects that the Stormwater and Wastewater Section is currently working on. Almost all of the projects being designed with in-house staff by the Stormwater and Wastewater Section are small projects (<$67,000).

In each and every instance in which the design is outsourced, the collection of data for the design is the responsibility of the consulting engineer. In each and every instance involving construction contractors, the construction contractor is responsible for construction staking.

There is simply insufficient workload to warrant a two-person full-time Survey crew within the Public Works Department. Even if the crew was utilized to collect survey

data for those capital projects being designed by in-house staff, the crew would only achieve a 10% utilization on an annual basis given the current split between in-house and consulting design (with construction staking still being performed by the construction contractor).

The Department is spending $182,000 annually on its in-house survey crew in wages and benefits. The Department should outsource this responsibility. The two positions should be re-purposed. The two positions would include a Civil Engineering Survey Party Chief and a Civil Engineering Senior Aide.

Recommendation #111: The Public Works Department should outsource land survey data collection.

Recommendation #112: The two positions allocated to the Survey crew - a Civil Engineering Survey Party Chief and a Civil Engineering Senior Aide - should be re-purposed within the City.

10. OVER THE NEXT TWELVE TO EIGHTEEN MONTHS, THE ENGINEERING DIVISION SHOULD ENHANCE ITS CAPACITY FOR THE DESIGN OF CAPITAL PROJECTS.

The Engineering Division will always need to utilize consulting engineers for the design of capital projects. That is appropriate. As noted previously, in fiscal year 2013-14, the City Council awarded consulting contracts in a total amount of almost $3 million at the behest of the Engineering Division.

However, guidelines for the use of consulting engineers for the design of capital projects should be established as a formal written policy and procedure. The Division's use of consultants is typically driven by feasibility. In general, it is more feasible to use consultants if:

- The Division has an insufficient number of qualified people available to perform a certain function when it is needed; or
- The Division lacks the specific technical expertise required and is unable to gain that

knowledge within the required timeframe; or

- The work is of limited scope or intermittent nature and it is unlikely that the Division would be able to continue the employment of persons hired for the project.

There are numerous simple, capital projects, whose design has been outsourced, that are within the expertise of the staff of the Engineering Division; the Division simply lacks sufficient number of professional-level engineers. These are not large capital projects; their estimated construction cost ranges from $250,000 to as much as $4,500,000; these are small projects.

In-house staff should not design all of the projects. However, it is important to the maintenance of the design skills of the professional-level engineers in the Division that these staff be afforded the frequent opportunity to design capital projects, not just to be project managers. It is important in the City's retention of these professional-level that these staff be afforded the frequent opportunity to design capital projects, not just to be project managers.. The key is finding the right balance between the use of consulting engineers and the in-house professional-level engineers.

In addition, it is not possible to efficiently utilize the Division's Engineering Designer – really a CAD Technician – given the extent of outsourcing. That position can only be utilized efficiently if there is sufficient in-house design workload.

The City Engineer and the Supervising Civil Engineers should review the capital projects that will require design in FY 2015-16, and develop a plan for the consideration of the Public Works Director and the Office of the City Manager that would effectively balance the use consulting firms and the in-house professional-level engineers for the design of capital projects.

This will require additional professional-level engineers. It will **not** require a net increase in the number of authorized positions of the Public Works Department. Rather, it will require a re-allocation of vacant positions internally within the Department to the Engineering Division and their reclassification as professional-level engineers.

Recommendation #113: The City Engineer and the Supervising Civil Engineers should review the capital projects that will require design in FY 2015-16, and develop a plan for the consideration of the Public Works Director and the Office of the City Manager that would effectively balance the use consulting firms and the in-house professional-level engineers for the design of capital projects.

Recommendation #114: Additional professional-level engineers will be required to enhance the capacity of the Engineering Division to design capital projects with its own professional-level engineers. . It will not require a net increase in the number of authorized positions of the Public Works Department. Rather, it will require a re-allocation of vacant positions internally within the Department to the Engineering Division and their reclassification as professional-level engineers.

11. THE ENGINEERING DIVISION AND THE STREET OPERATIONS DIVISION SHOULD WORK COOPERATIVELY TO COMPLY WITH REQUIREMENTS FOR ADA CURB RAMPS.

The City of Cedar Rapids received a letter from the United States Department of Justice in July 2014 regarding an Americans with Disabilities Act compliance review. The compliance review addressed a number of topics including sidewalks. Some of the sections pertaining to sidewalks are noted below.

- Within three (3) months of the effective date of this Agreement, Cedar Rapids will identify and report to the ILA and the United States: (1) a plan for identifying all streets, roads, and highways that have been constructed or altered since January 26, 1992; and (2) a timetable for providing curb ramps or other sloped areas complying with the applicable architectural standards at all intersections of those streets, roads, and highways that have been constructed or altered since January 26, 1992, that have curbs or other barriers from a street level pedestrian walkway. The plan and timetable must be approved by the United States and will specify completion of all required curb ramps or other sloped areas complying with the applicable architectural standards within three (3) years of the effective date of this Agreement.

- Within three (3) years of the effective date of this Agreement, Cedar Rapids will provide curb ramps or other sloped areas complying with the applicable architectural standards as permitted by 28 C.F.R. § 35.151(c) and its Appendix, copied below, at all intersections of the streets, roads, and highways constructed or altered since January 26, 1992, that have curbs or other barriers from a street level pedestrian walkway.

- Within three (3) years of the effective date of this Agreement, Cedar Rapids will provide curb ramps or other sloped areas complying with the applicable architectural standards as permitted by 28 C.F.R. § 35.151(c) and its Appendix, copied below, at all places where a street level pedestrian walkway constructed or altered since January 26, 1992, intersects with a street, road, or highway.

The response to this compliance review by the City of Cedar Rapids will require a lot of work by the Engineering Division. The responsibility for this response should be a coordinated effort by the City Engineer and the Supervising Civil Engineer, Streets and Bridges Section.

Fortunately, the Division had already been working on addressing these issues prior to the receipt of the previously mentioned letter from the United States Department of Justice. Much of the information regarding the City's streets, roads, and highways that have or do not have curb ramps or other sloped areas has already been collected.

However, the Division does need to develop:

- A plan for identifying all streets, roads, and highways that have been constructed or altered since January 26, 1992; and

- A timetable for providing curb ramps or other sloped areas complying with the applicable architectural standards at all intersections of those streets, roads, and highways that have been constructed or altered since January 26, 1992, that have curbs or other barriers from a street level pedestrian walkway.

The City has a significant challenge in responding to the compliance review as it pertains to curb ramps since so many of its intersections either lack curb ramps or include curb ramps that are not compliant. The extent of non-compliance is evident in the table below.

	1-2 Rating	3 Rating	4 Rating	5 Rating	Ramps In Place	Missing Ramps	Total
No. of Ramps	2,171	2,692	2,278	1,959	9,098	1,176	10,274
% of Total	24%	30%	25%	22%	89%	11%	--

Important points to note regarding the table are presented below.

- Curb ramps with a 1 to 2 rating are ramps that have been recently constructed under a City project and verified to be compliant or ramps recently constructed by others or the City and needs to be verified to be compliant;
- Curb ramps with a 3 rating consist of ramps that are non-compliant, but are in good to fair condition;
- Curb ramps with a 4 rating consist of ramps that are non-compliant, and are in fair to poor condition; and
- Curb ramps with a 5 rating consist of ramps in which no curb drop exists at curb ramp.

While 89% of the City's total required locations have curb ramps, 11% of the required locations lack curb ramps and, at best, only 24% of the City's curb ramps are compliant.

Addressing this problem will be complex. Historically, the City has only provided $300,000 annually for installation of ADA-compliant curb ramps using construction contractors. The total estimated cost to address those curb ramps that are non-compliant or are missing approximates $8.1 million, at a cost of approximately $1,000 per curb ramp. There are several existing and potential sources of funding, other than the general fund. The City has already adopted a policy that adjacent property owners would pay for one-half of the cost of installation of ADA-compliant curb ramps. There are other sources of funding including:

- Community-Development Block Grant (CDBG) funds – the City receives over $1 million in CDBG funding annually);
- Federal MAP-21 funding / regional Transportation Improvement Program (TIP) and the Statewide Transportation Improvement Program (STIP); and

- LOST funding for curb ramps on streets being reconstructed as part of the City's Paving for Progress program.

These sources of funding should enable the City to address the requirements of the compliance review, if the City is allowed the same amount of years to meet the requirements as the City of Des Moines.

The design of the installation of ADA-compliant curb ramps should be based upon a design developed by the Engineering Technician. It should be based upon a customization of a standard drawing and specifications for ADA-compliant curb ramps so that a new design does not have to be developed for each intersection.

In addition, the Street Operations Division should dedicate its own staff resources to removal and replacement of concrete for ADA-compliant curb ramps. The Division has fourteen (14) positions allocated to concrete removal and replacement. These positions should be allocated, in past, to removal and replacement of concrete for ADA-compliant curb ramps as a top priority of the Division. Numerical objectives, in terms of removal and replacement of ADA-compliant curb ramps, should be set for the Division for replacement of curb ramps on an annual basis. The Division and its concrete removal and replacement staff should be an essential feature to meeting the requirements.

Lastly, the Engineering Division has assigned a Civil Engineer I to the supervision of the condition assessment inspection of sidewalks by interns and the development of the sidewalk repair program. This responsibility should be reassigned to the Engineering Technician.

Recommendation #115: The design of the installation of ADA-compliant curb ramps should be based upon a design developed by the Engineering Technician.

It should be based upon a customization of a standard drawing and specifications for ADA-compliant curb ramps so that a new design does not have to be developed for each intersection.

Recommendation #116: The Street Operations Division should dedicate its own staff resources to removal and replacement of concrete for ADA-compliant curb ramps as a top priority of the Division.

12. THE ENGINEERING DIVISION SHOULD DEVELOP A NUMBER OF APPROACHES TO PRESERVE CITY STREETS.

The City has a significant investment in its streets, bridges, and sidewalks. The Comprehensive Annual Financial report for FY 2012-13 places the value of the City's streets, bridges, and sidewalks at $356.2 million. The City will be investing additional funds over the next decade. The Finance Department has estimated that LOST / Paving for Progress revenues will approximate $18 million per year.

The Engineering Division should take a number of steps to protect the City's investment in its streets, as noted below.

(1) The City Should Utilize Seal Coats and Thin Overlays to Preserve Asphalt Streets That Are in Good Condition.

Seal coats, and Thin Overlays (0.75 to 1.50 inches thick) with a bonded wearing course are an essential preventive maintenance for improved asphalt streets (e.g., streets with a compacted subgrade and base). Preventive maintenance applies lower-cost treatments to retard a street's deterioration, maintain or improve the functional condition, and extend the pavement's service life. With various short-term treatments, such as seal coats and micro-surfacing, preventive maintenance can extend pavement life an average of five to seven years on an ongoing basis. Applied to the right street at the right time - when the pavements are mostly in good condition - preventive maintenance can improve the street condition significantly at a much lower unit cost.

While a consulting engineering firm is developing the pavement management system, the Engineering Division should ensure that seal coats and Thin Overlays (0.75 to 1.50 inches thick) with a bonded wearing course are part of the mix of preventive maintenance strategies that are used by the City. These treatments will need to be applied in an ongoing basis (e.g., every 5 to 7 years) to ensure the preservation of streets that are in good condition, and subsequently delay the need for reconstruction of the streets.

Recommendation #117: The Engineering Division should ensure that seal coats and Thin Overlays (0.75 to 1.50 inches thick) with a bonded wearing course are part of the mix of preventive maintenance strategies that are used by the City. These treatments will need to be applied in an ongoing basis (e.g., every 5 to 7 years) to ensure the preservation of streets that are in good condition, and subsequently delay the need for reconstruction of the streets.

(2) The Engineering Division Should Take Steps to Reduce the Impact of Utility Cuts on City Streets including Establishing a Pavement Degradation Fee.

Problems associated with the performance of utility cuts have been a concern to cities for many years. Cities have sponsored engineering analysis and these studies indicate that the life expectancy of a street are reduced by utility cuts. The conclusions of these studies conclude the following

- The presence of utility cuts in a street results in lower measured pavement condition scores compared to pavements of the same age with no utility cuts;
- There is a link between the presence of utility cuts and accelerated pavement deterioration, and accelerated pavement deterioration is linked to reduced pavement life;
- A study by the City and County of San Francisco study conceded that high quality workmanship in the repair of utility trenches may reduce the structural damage to pavements, but contended that lower ride quality and increased cracking still result, and, therefore, service lives were diminished;

- Deflection testing in areas adjacent to the trench show that trenching operations reduce pavement strengths in a zone from 3 to 6 feet either side of the centerline of the trench;

- The economic impact of utility cuts is often calculated based on the increased thickness of overlay required to compensate for the presence of the utility cut; and

- Many cities have adopted a pavement degradation fee with a graduated scale that reduces the fee based on the age (time since last overlay) of the pavement.

As noted previously, the City has a significant investment in its streets. The Engineering Division should take a number of steps to ensure that the investment is protected as noted in the paragraphs below.

- **The City Engineer should serve as the chairperson of the City's underground utilities coordinating committee.** The duties of this committee should be to work out scheduling of utility work that is connected with Department of Public Works projects for street reconstruction, overlay, and preventive maintenance and to plan / coordinate the utilities undergrounding construction program including detailed planning of a long-term construction program of all utilities (e.g., five years). The committee should include representatives from the City's utilities and all of the utilities that underground their infrastructure in the City's right-of-way. Meetings should be held quarterly. Attendance should be mandatory as a condition to access to the City's right-of-way.

- **All public and private utilities should be required to coordinate their long-term undergrounding plans with the City.** Each of the utilities should be required to develop and present their long-term plans for undergrounding utilities – in essence, the replacement of existing undergrounding utilities or undergrounding of new utilities. The long-term plan should not be less than 5-years.

- **The Engineering Division should enforce the 5-year moratorium on utility cuts on all new pavement surfaces**. The City should enforce its 5-year moratorium on all new pavement surfaces. This should include overlays, inlays, reconstruction, and new construction of at least a half street or greater. The moratorium should provide that, after any street has been constructed, reconstructed, or paved by City construction contractors or its own staff, the pavement surface shall not thereafter be cut or opened for a period of 5 years. The Engineering Division should grant exemptions to this prohibition in order to facilitate development on adjacent properties, provide for emergency repairs to subsurface facilities, provide for underground service connections to adjacent

properties or allow the upgrading of underground utility facilities. When granting exceptions, the Engineering Division should impose conditions to ensure the complete restoration of the street paving. Repaving may include surface grinding, base and sub-base repairs, or other related work as needed, and may include up to full-width surface paving of the roadway.

- **Utility cuts should be required to be a "T" cut**. The actual trench cut for five-year moratorium streets should follow the standard t-cut as noted below.

  – Lateral utility cuts. On arterials – where the lateral utility cut impacts a travel lane – the utility should be required to replace a minimum of five feet (5') on each side of the trench. For arterials where the lateral utility cut impacts only the parking lane, the utility should be required to replace a minimum of (three feet) 3' on each side of the trench. For local streets, the utility should be required to replace a minimum of three feet (3') on each side of the trench for a lateral cut. In each instance, the utility should be required to extend the patch to the nearest lane line or street centerline.

  – Longitudinal cuts. Generally, if a single lane is impacted, the utility should be required to provide full pavement restoration for the width of the lane. If multiple lanes are impacted, the utility should be required to provide restoration of the full width of those lanes. Impacted bike lanes should be be restored in their entirety.

  For those streets that are not included in the 5-year moratorium, the "T" utility cut should provide a minimum 12" overlap on each side of the trench for base replacement.

- **The Engineering Division should establish a utility cut pavement degradation fee for utility cuts.** This is a fee to pay for the long-term cost of repairing pavement damage associated with utility cuts. The City's franchise fees are <u>not</u> collected to cover damage to the streets due to excavations.

  The fee should be charged to the public and the private utility that caused the utility cut to be made. The fee should be based upon the length and width of the utility cut (per square foot), the existing condition of the street (age of last resurfacing), the street classification (e.g., arterial, major, collector, residential); and the type of utility (wet or dry). For example, wet utilities would pay a higher fee than dry utilities because the related excavations are larger, deeper, and result in more damage.

  There are a multiple number of cities that charge pavement degradation fees including Austin, Texas; San Antonio, Texas; Charlotte, North Carolina; Atlanta, Georgia; Chicago, Illinois; Kansas City, Missouri; etc. The fees range from $1 per square foot to $28.26 per square foot. The fee that would be charged by the City of Cedar Rapids would have to be based upon a study conducted by the

Engineering Division and reflect local conditions. All public and private utilities should be required to pay a pavement degradation fee, unless the pavement has exceeded its useful life and is rated by a pavement condition inspection as needing reconstruction or overlay.

- **The Engineering Division should ensure that utility cuts receive proper construction inspection**. A Civil Engineering Construction Inspector should be notified prior to any trench backfilling or pavement repair within a City right-of-way so that a proper inspection can be made. A pre-construction meeting should be held on-site. The Civil Engineering Construction Inspectors' concern should focus on work zone safety and restoration of the right-of-way, traffic control, backfilling, compaction, hazard protection, concrete bridging and repaving, etc. Some inspections should be ongoing throughout the course of a utility cut job whereas other inspections may be made only after completion of the work. The considerations that would determine the need for ongoing inspection include the location of work, duration of work and size of the area being disturbed. Not all utilities are requesting inspection of the utility cut; the Engineering Division should address this deficiency.

In summary, there is a significant difference in the performance between pavements with cuts and pavements with no cuts. This is evidenced by the fact that the pavements with cuts require a thicker asphalt concrete overlay.

Recommendation #118: The City Engineer should serve as the chairperson of the City's underground utilities coordinating committee.

Recommendation #119: The Engineering Division should enforce the 5-year moratorium on utility cuts on all new pavement surfaces.

Recommendation #120: All public and private utilities should be required to coordinate their long-term undergrounding plans with the City.

Recommendation #121: The Engineering Division should establish a utility cut pavement degradation fee for utility cuts. All public and private utilities should be required to pay a pavement degradation fee, unless the pavement has exceeded its useful life and is rated by a pavement condition inspection as needing reconstruction or overlay.

Recommendation #122: The Engineering Division should ensure that utility cuts receive proper construction inspection, and that all utilities – public and private – request inspection of utility cuts.

13. THE ENGINEERING DIVISION SHOULD DEVELOP MASTER PLANS FOR THE WASTEWATER COLLECTION SYSTEM AND THE STORMWATER COLLECTION SYSTEM.

The *American Public Works Association* has developed a *Public Works Management Practices Manual* that presents recommended practices identified by "nationally recognized experts in the field of public works." Practice 29.15 pertains to long-range system planning for wastewater collection and conveyance and states "*a plan is developed that can forecast system alternatives to meet future needs and community growth. The plan should be developed in conjunction with long-range planning to ensure that effective long-range capital improvements are made. The plan may have a 20-year planning period and should be periodically updated*."

Cedar Rapids lacks a master plan for its wastewater collection system.

Similarly, the *Public Works Management Practices Manual* that presents recommended practices identified by "nationally recognized experts in the field of public works." Practice 26.7 pertains to long-range system planning for watershed stormwater drainage master plan and states "*a stormwater and flood management master plan is developed. A Master Plan is a living document that details facility needs and provides comprehensive guidance for their implementation within a watershed as it develops and / or redevelops. The size and nature of stormwater management facilities and flood management facilities can be determined from the selected design storm for the area and the land use for which the basin is planned. The planning of such facilities should include risk versus cost assessment and balance stormwater management and flood management needs against other community goals. Master plans assist developers in addressing storm drainage system needs, storm water quality requirements, and flood*

protection objectives. The master planning process must consider the existing and planned land uses in the watershed, the existing and projected drainage and flooding problems (risks(, open space needs, water quality goals, wildlife habitat enhancement or protection, wetland protection, community priorities and economics."

Cedar Rapids lacks a watershed stormwater drainage master plan.

Recommendation #123: The Engineering Division should develop a master plan for the wastewater collection system.

Recommendation #124: The Engineering Division should develop a watershed stormwater drainage master plan.

6. ANALYSIS OF THE TRAFFIC ENGINEERING DIVISION

This chapter presents an analysis of the Traffic Engineering Division including staffing, the adequacy of preventive maintenance of the traffic signal system, and the effectiveness of the traffic engineering program.

1. THE TRAFFIC ENGINEERING DIVISION HAS SUFFICIENT AUTHORIZED POSITIONS TO PREVENTIVELY MAINTAIN AND REPAIR THE CITY'S TRAFFIC SIGNALS.

The Traffic Signal and Streetlight Maintenance Section is responsible for the maintenance and repair of the City's traffic signals and streetlights, The Section is authorized two Traffic Signal Electrical Specialist positions and four Traffic Signal Technician I / II positions.

The City has a total of 225 signalized intersections, and approximately 927 streetlights. The traffic signals have not, in recent memory, been preventively maintained.

However, the authorized level of staffing is adequate to preventively maintain and repair the City's traffic signal system and its streetlight system. This conclusion is based upon a significant amount of research conducted by traffic engineers regarding the staffing required to provide appropriate levels of preventive maintenance and repair for signalized intersections. This research is cited below.

- The *Traffic Signal Operations and Maintenance Staffing Guidelines*, prepared by the United States Department of Transportation Federal Highway Administration, stated "a staffing level of 30-40 signals per technician for agencies that operate a minimum of 150 signals will be appropriate. Smaller agencies will likely require fewer signals per technician because economies of scale may be difficult to realize."[13]

[13] United States Department of Transportation Federal Highway Administration, Traffic Signal Operations and Maintenance Staffing Guidelines, 2009

- The *2012 National Traffic Signal Report Card* indicated that the average number of signal technicians allocated to local governments with 150 to 450 traffic signals was 5.5, with another 1.1 "other technicians."[14]

In addition, the Matrix Consulting Group uses a metric of 6,500 streetlights per technician for streetlight maintenance. There are approximately 551 streetlights. This would indicate a need for the equivalent of a 0.1 technician to maintain and repair streetlights.

Altogether, the Matrix Consulting Section concludes that the extent of authorized positions for traffic signal and streetlight maintenance is adequate.

Recommendation #125: The number of authorized positions for traffic signal and streetlight maintenance and repair is sufficient to preventively maintain and repair the City's traffic signal system and its streetlight system. The number of authorized positions should not be increased.

2. THE TRAFFIC ENGINEERING DIVISION SHOULD DEVELOP AND INSTALL A PREVENTIVE MAINTENANCE SYSTEM FOR THE CITY'S TRAFFIC SIGNALS AND STREETLIGHTS.

The Traffic Engineering Division has sufficient authorized positions to preventively maintain its traffic signals. Preventative maintenance activities have not been performed at regularly scheduled intervals. Activities such as cabinet inspections, cabinet cleaning, and hardware maintenance are not performed.

The City Traffic Engineer should develop and install a preventive maintenance system for the City's traffic signals and streetlights. The system should include the following features and work activities as noted below.

[14] National Transportation Operations Coalition, 2012 National Traffic Signal Report Card, 2012

Work Activity	Crew Size	Annual Frequency	Staff Hours Per Unit	Unit
Cabinet preventive maintenance includes the inspection, testing, cleaning and adjustments made to the traffic signal electronic equipment cabinet.	1	Twice	1.0	Cabinet
Inspection of traffic signal intersections to check for proper operation of luminaires, vehicle and pedestrian detection systems, and vehicle and pedestrian signal faces. Signal faces are inspected for proper alignment and adjusted if necessary.	1	Once every two years	2.5	Intersection
Painting of traffic signal poles, mast arms, signal heads, control cabinet, and electrical service cabinet. Clean faces of LED indicators. Check height, visibility and alignment of signal heads; adjust if necessary. Inspect traffic signal wiring and loop wires. Reseal loops if needed. Visual inspection of pull boxes	3	Once every five years	12	Intersection
Streetlight (1) inspection testing, cleaning, lubricating and performing minor repairs of all streetlight system components including luminaires, lighting brackets, wiring, poles, frangible and safety bases, pads and footings; and (2) visual inspection and repair of all grounding and bonding connections and terminations, checking that all connections and terminations are tight, wires are not corroded, frayed, or broken, and test ground resistance.	1	Once every five years	1.0	Streetlight pole

The City-owned streetlights and traffic signal poles have not been inspected with any regularity. The weather extremes in Cedar Rapids require inspection of streetlights and traffic signal poles not less than once every five years. An example of the type of problems that can be found are presented in the picture below. This is an obvious safety risk.

These responsibilities should be assigned to each of the two Traffic Signal Electrical Specialist positions and four Traffic Signal Technician I / II positions. Simply, each of these six staff should be assigned one-sixth of the signalized intersections and one-sixth of the streetlights.

Recommendation #126: The City Traffic Engineer should develop and install a preventive maintenance system for the City's traffic signals and streetlights.

Recommendation #127: The Traffic Engineering Division should perform preventive maintenance on traffic signal controllers / cabinets twice annually.

Recommendation #128: The Traffic Engineering Division should perform inspections of signalized intersections once every two years.

Recommendation #129: The Traffic Engineering Division should paint traffic signal poles, mast arms, signal heads, control cabinet, and electrical service cabinets / controllers once every five years.

Recommendation #130: The Traffic Engineering Division, every five years, should conduct City-owned streetlight (1) inspecting, testing, cleaning, lubricating and performing minor repairs on all streetlight system components including luminaires, lighting brackets, wiring, poles, frangible and safety bases, pads and

footings; and (2) visually inspecting and repairing all grounding and bonding connections and terminations, checking that all connections and terminations are tight, wires are not corroded, frayed, or broken, and testing ground resistance.

3. A FORMAL PLANNING AND SCHEDULING SYSTEM SHOULD BE DEVELOPED FOR THE STAFF ALLOCATED TO TRAFFIC SIGNAL AND STREETLIGHT MAINTENANCE AND REPAIR.

Good maintenance is one of the keys to effective signal operation. Effective planning and scheduling of work must accompany a well-timed traffic signal system if it is to provide continued high quality service to the traveling public. This planning and scheduling includes a number of components according to *Elements of a Comprehensive Signal Asset Management System,* a report published in 2004 by the Federal Highway Administration. These elements are presented below.

- Work Orders – Scheduled work activities including location / component identification, resource assignments, and status.
- Work History – Historical information about signal work completed - description of actions taken, components repaired and replaced, and resources utilized.
- Trouble Reports – Historical information on trouble tickets including location / equipment involved, nature of problem, resolution, and response time.
- Planned Work – List of planned and approved work activities to be scheduled.

The Traffic Engineering Division should develop a formal work planning and scheduling system for the staff allocated to traffic signal and streetlight maintenance and repair using EnerGov. The planning and scheduling system would take information about available resources (personnel, vehicles, and equipment), and schedule work activities on a bi-weekly basis. The elements of this planning and scheduling system should include the following:

- Bi-weekly work schedule prepared for preventive maintenance services to be performed during that month. Work order(s) generated by signalized intersection and streetlight covering the equipment components to be serviced at that

intersection. Work order(s) provided to assigned staff with attached document listing equipment, services required, and parts needed for routine preventive maintenance.

- Project and repair work generated by work order using EnerGov. This should be an electronic work planning and scheduling system with the installation of EnerGov. The supervisor should monitor work orders to determine status/completion – follow up with assigned staff when not completed within time frame scheduled.

- Supervisor meets with staff not less than once per week to monitor status of completion for assigned preventive maintenance and other, non-scheduled repair work orders.

- When work is completed, assigned traffic signal and streetlight maintenance staff should note completion on the work order, services provided, parts used, and labor time expended. The work order should be reviewed by the supervisor of the traffic signal and streetlight maintenance staff and approved..

Recommendation #131: The Traffic Engineering Division should develop a formal work planning and scheduling system using EnerGov for the staff assigned to traffic signal and streetlight maintenance and repair.

3. THE TRAFFIC ENGINEERING DIVISION SHOULD DEVELOP A MASTER PLAN FOR THE CITY'S SIGNALIZED INTERSECTIONS.

The traffic signal system is one of the key components of the City's transportation system. A traffic signal assigns the right-of-way to vehicles and pedestrians at busy intersection, enhancing the safe operation of the City's street network and reducing the potential for crashes. Traffic signals are also flexible traffic management tools. They can be programmed to move large volumes of traffic along a major arterial, to handle large volumes of turning vehicles, or to favor pedestrian movements. Traffic signals can provide priority to emergency vehicles responding to service calls.

A signal controller is a computerized device that controls the traffic signals. Traffic signal controllers should be replaced at approximately fifteen (15)-year intervals due to obsolescence or changes in functionality. These computer-based controllers

deteriorate with time and replacement parts become difficult to find as the equipment is phased out of manufacture. In addition, controllers that are older than fifteen (15)-years are not able to integrate any Intelligent Transportation Systems (ITS) traffic management features such as video monitoring and traffic adaptive technology, that are available in the newer traffic signal systems and can improve overall traffic flow by adjusting signal timing in response to real-time traffic conditions.

Much of the City's existing inventory of traffic signal controllers exceed the recommended interval for replacement as indicated in the table below.[15]

Type and General Age of Controller	Number of Controller	% of Total
M52 controllers (2006-present) -	85	41%
M40 controllers(1995-2006)	71	35%
M10 controllers (1985-1995)	25	12%
M02/03 controllers(1980-1985)	6	3%
820/820A (1985-1990)	18	9%
TOTAL	**205**	**100%**

As the table indicates, 21 controllers or 12% were installed at least 24 years ago. An additional 25 controllers or 12% were installed at least 19 years ago.

The installation of the Intelligent Transportation System will enable replacement of approximately 73% of these controllers (estimated replacement of 150 cabinets). However, another 55 controllers will need to be evaluated for replacement given their age.

The Traffic Engineering Division should identify the signal controllers being replaced as part of the Intelligent Transportation System, and then identify the age of the remaining signal controllers. Any whose age exceeds 15 years should be requested

[15] This information was provided by the Traffic Engineering Division.

for replacement as part of the City's capital improvement program. Thereafter, the Division should continue to request replacement of signal controllers as the controllers reach the interval of fifteen year.

Beyond signal controllers, the Traffic Engineering Division should evaluate the City's signalized intersections, and develop a 5-year capital improvement plan for replacement of outdated and worn out components (recognizing the replacements that will occur as part of the Intelligent Transportation System). The Division should evaluate all of the signalized intersections to evaluate needs for replacement using a rating system such as that presented in the table below.

Rating	Conditions Generally Observed
Poor	Lack of mast arms
	30+ year old wiring and conduits
	Geometric deficiencies related to delay or safety issues
Fair	Mast arms present
	Signal hardware about 20 years old
	Operational deficiencies related to signal equipment (detection or cabinet limitations)
Good	Mast arms present
	Newer installation (>15 years old)
	May need minor upgrades (e.g., video detection or cabinet), but remainder has been upgraded recently

In addition to evaluating the extent of outdated and worn out components at the City's signalized intersections, the Division should develop prioritized recommendations for:

- Uninterruptible Power Supply for each of its signalized intersections to provide 3 hours of regular operation and another hour or so of flash or 6-8 hours of flashing operations in the event of a power outage; and
- Interconnect for each signalized intersection to the Traffic Operations Center.

Recommendation #132: The City should replace traffic signal controllers on a fifteen (15)-year schedule.

Recommendation #133: The Traffic Engineering Division should identify the signal controllers being replaced as part of the Intelligent Transportation System, and then identify the age of the remaining signal controllers. Any whose age exceeds 15 years should be requested for replacement as part of the City's capital improvement program. Thereafter, the Division should continue to request replacement of signal controllers as the controllers reach the interval of fifteen years.

Recommendation #134: The Traffic Engineering Division should evaluate the City's signalized intersections and develop a 5-year capital improvement plan for replacement of outdated and worn out components, Uninterruptible Power Supply for each of the City's signalized intersections, and Interconnect for each signalized intersection to the Traffic Operations Center.

4. THE TRAFFIC ENGINEERING DIVISION SHOULD PREPARE A MASTER PLAN FOR THE CITY'S TRAFFIC SIGNS AND IMPROVE THE NIGHTTIME VISUAL ASSESSMENTS OF THE RETROREFLECTIVITY OF TRAFFIC SIGNS.

The City lacks an asset preservation plan for its traffic signs: regulatory, warning, guide, street name, etc.

Signs are message boards along the street used to convey important information about using the transportation system. Signs are essential for regulating vehicle and pedestrians that share the street system. Without signs, vehicular travel would be dangerous and confusing. Signs are generally one of the least expensive items in a street network but they require continued maintenance to ensure the safety of users.

The City's signs can be grouped into four different categories. These categories are presented below.

- Regulatory signs are used to inform users of selected traffic laws or regulations. The most common examples are Stop signs, speed limit and no turn on red signs. They follow a very strict guideline called the *Manual on Uniform Traffic Control Devices* (MUTCD) for their message, design and application. It is important to be consistent with traffic control signs so they are universally understood. Strictly following the MUTCD helps assure consistency.

- Warning signs call attention to unexpected conditions and alert users to reduce speed or take an action in the interest of safety. Curve ahead, chevrons, divided street, dead ends, height clearance, stop ahead and signal ahead are warning signs. Traffic calming devices often have warning signs associated with them. School zone signs can also be a warning sign, although some have legal enforcement. The application of warning signs should strictly follow the MUTCD.

- Guide signs are essential to direct vehicles along streets and highways. They inform drivers of intersections, direction to highways, or other important destinations. Common guide signs are street name, directions to parking, sporting complexes, libraries, train and airport locations, or cultural interest sites. Street name signs should follow the MUTCD standard.

- Custom signs are a category of signs that have developed over the past 10 years. This group of signs has no regulating structure like the previous types. These signs are built using custom sign making techniques and use artistic principles rather than MUTCD standards. Examples of custom signs are the Neighborhood Watch signs.

As signs age they lose their reflectivity. Without reflectivity, signs are difficult to read at night. If a stop sign cannot be seen, a motorist could miss the stop sign causing an accident. If a warning sign is poor, a hazard could be missed and an accident could occur.

The standards for the reflectivity of signs have been modified by the MUTCD (Section 2.A.0.9); this is a measurable standard. This standard is presented below.

- Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3.

- Compliance with the above standard is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3. Provided that an assessment or management method is being used, an agency or official having jurisdiction would be in compliance with the above standard even if there are some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time.

- Except for those signs specifically identified in the Option in this Section [applicable to highway agencies], one or more of the following assessment or management methods should be used to maintain sign retroreflectivity:

- Visual Nighttime Inspection – The retroreflectivity of an existing sign is assessed by a trained sign inspector conducting a visual inspection from a moving vehicle during nighttime conditions. Signs that are visually identified by the inspector to have retroreflectivity below the minimum levels should be replaced.

- Measured Sign Retroreflectivity – Sign retroreflectivity is measured using a retroreflectometer. Signs with retroreflectivity below the minimum levels should be replaced.

- Expected Sign Life – When signs are installed, the installation date is labeled or recorded so that the age of a sign is known. The age of the sign is compared to the expected sign life. The expected sign life is based on the experience of sign retroreflectivity degradation in a geographic area compared to the minimum levels. Signs older than the expected life should be replaced.

- Blanket Replacement – All signs in an area/corridor, or of a given type, should be replaced at specified intervals. This eliminates the need to assess retroreflectivity or track the life of individual signs. The replacement interval is based on the expected sign life, compared to the minimum levels, for the shortest-life material used on the affected signs.

- Control Signs – Replacement of signs in the field is based on the performance of a sample of control signs. The control signs might be a small sample located in a maintenance yard or a sample of signs in the field. The control signs are monitored to determine the end of retroreflective life for the associated signs. All field signs represented by the control sample should be replaced before the retroreflectivity levels of the control sample reach the minimum levels.

- Other Methods – Other methods developed based on engineering studies can be used.

The Public Works Department does conduct reflectivity inspections. These are performed in the winter using the nighttime vision test method. The Department has completed these inspections for the past three years. This has resulted in approximately 150 to 300 signs being replaced annually of an estimated 30,000 signs in inventory or 1% of the total signs. This is the equivalent of a 100-year replacement schedule. This far exceeds warranty and normal useful life of traffic signs. Typically, regulatory signs

(e.g., stop signs) should be replaced on a 10 to 12 year schedule.

The Public Works Department should use staff that has been trained to conduct of nighttime visual retroreflectivity assessments. The recommended methodology used to conduct these assessments is presented below.

- The assessment should be done by a team of two trained inspectors, one driver and one inspector.

- The team should view a set of calibration signs of each color each night before beginning the inspections, which are known to be slightly above the established minimum retroreflectivity levels. Viewing the calibration signs should be done with the headlights on low beam at or near the speed limit of the street, or at a typical viewing distance that would be adequate to react to the traffic control device. If the Department has not already done so, the Matrix Consulting Group recommends the purchase of an Avery Dennison® Minimum Retroreflectivity Compliance Kit. This kit includes a set of tools intended to assist cities in meeting their maintenance obligations for maintaining minimum sign retroreflectivity levels in the Manual on Uniform Traffic Control Devices. The kit includes all required signs, panels, light sources and accessories enabling City staff to conduct visual day and nighttime sign assessments in accordance the Calibration Signs and Comparison Panel Procedures described by the Federal Highway Administration

- The inspector shall evaluate the existing retroreflectivity of all signs while traveling at or near the posted speed limit with the headlights on low beam. Signs shall be rated according to the following:

  – Fail: Signs with retroreflectivity below that of the calibration test panels.

  – Marginal: Signs with retroreflectivity at or slightly above that of the calibration test panels.

  – Adequate: Signs with retroreflectivity clearly above that of the calibration test panels.

- Consistency of testing conditions. Inspections will be conducted during consistent nighttime conditions whenever possible. More specifically, inspections will be conducted on clear nights when there is no inclement weather. The interior light of the inspection vehicle will be off. A pen light will be used for recording the results of the inspection.

- Signs with a rating of "fail" should be scheduled for replacement as soon as possible. Regulatory sign replacement will take precedence with regards to funding.

- Signs with retroreflectivity ratings of "marginal" should be scheduled for replacement within the next one to five years. Although the signs may be at, or slightly above, the minimum retroreflectivity levels at the time of the inspection, the retroreflectivity levels will degrade over time and will eventually fall below the minimum levels. Therefore, signs with a rating of "marginal" should be scheduled for replacement.

- The first priority should be on regulatory signs to be inspected and changed out, followed by warning signs, guide signs, street signs and others.

- Probably the most important element of nighttime inspection is documenting the process and results. Whichever method is selected, it is important that inspections are properly documented and preserved to provide tort protection. The Matrix Consulting Group recommends that the information should include sign identification or inventory number, Address, Inspection Date, GPS Coordinates, MUTCD Sign Designation Code, Visibility, and Sign Condition. This inspection process could be automated using an iPad and Tap Forms software that would be linked to EnerGov.

A timely replacement program helps assure that regulatory signs will be replaced before they violate reflectivity standards. The Traffic Engineering Division should prepare a long-term renewal and rehabilitation plan for the City's regulatory signs based upon the results of these nighttime visual inspections.

In addition, the Public Works Department has partially completed a traffic sign inventory; it is approximately 25% complete. The Department should complete the inventory.

Recommendation #135: The Traffic Engineering Division should prepare a master plan for the City's regulatory signs. This should be based upon the completion of a sign inventory.

Recommendation #136: The Traffic Engineering Division should use staff that have been <u>trained</u> how to conduct nighttime visual retroreflectivity assessments. If the Department has not already done so, the Matrix Consulting Group recommends the purchase of an Avery Dennison Minimum Retroreflectivity Compliance Kit.

Recommendation #137: The Traffic Engineering Division should document the results of the nighttime visual sign inspections. The Matrix Consulting Group recommends that the information should include sign identification or inventory

number, Address, Inspection Date, GPS Coordinates, MUTCD Sign Designation Code, Visibility, and Sign Condition. This inspection process could be automated using an iPad and Tap Forms software that would be linked to EnerGov.

5. THE TRAFFIC ENGINEERING DIVISION SHOULD PREPARE A MASTER PLAN FOR THE CITY'S STREETLIGHTS.

The streetlight master plan should have two purposes.

The first purpose should be to designate street lighting standards throughout the City for all of the City's streetlights regardless of whether the City owns the streetlights or Alliant Energy. The intent is to ensure the installation of streetlights that are both attractive and consistent with specific uses in the downtown, arterial, principal collector, secondary collector and residential areas. The intent should be to provide a strategy for placement and the type of streetlight that will reflect the functional classification of the street in conjunction with the land use. A type of streetlight could include, as an example, for the residential area, a single-head streetlight with a Granville luminaire, with the poles being 12' high above ground, with a direct-bury Salem fluted pole with a 1.5' diameter base.

The second purpose should be to develop a schedule for the replacement of streetlight equipment and associated components that the City owns, and develop proposed ongoing budget requests for the five-year capital improvement program budget. This should include provides for the replacement of deteriorated components of the City's street light system, such as street light poles, wiring, underground conduits and circuits, controllers, etc.

Recommendation #138: The Traffic Engineering Division should develop a streetlight master plan. The first purpose of the streetlight master plan should be to designate street lighting standards throughout the City for all of the City's streetlights regardless of whether the City owns the streetlights or Alliant Energy. The second purpose should be to develop a schedule for the replacement of

streetlight equipment and associated components that the City owns, and develop proposed ongoing budget requests for the five-year capital improvement program budget.

6. THE TRAFFIC ENGINEERING DIVISION SHOULD PREPARE A BUDGET REQUEST TO REPLACE THE CITY-OWNED STREETLIGHTS WITH LED LIGHTING OVER THE NEXT FIVE TO SEVEN YEARS.

Alliant Energy is in the process of replacing its high-pressure sodium streetlights with LED lights in Iowa. Alliant Energy crews in Iowa started the switch on January 6, 2013. Because many of the high-pressure sodium lights still have useful life, they won't be replaced until they need service, which averages every 5 to 7 years. Alliant Energy crews in Iowa started the switch on January 6, 2013. When using energy prices in 2012, it is estimated that each 80-watt LED streetlight will save a community approximately $0.68 a month in energy costs. The tariff costs for these lights will remain the same as the current high-pressure sodium lights. While the LED fixture is more expensive than high-pressure sodium lights, the monthly energy costs and lifetime maintenance costs are lower, which results in the overall savings.

The Traffic Engineering Division should develop a plan to replace the high-pressure sodium streetlights that the City owns with LED fixtures over the next five to seven years by developing a proposed budget request for the five-year capital improvement program budget.

Recommendation #139: The Traffic Engineering Division should develop a plan to replace the high-pressure sodium streetlights that the City owns with LED fixtures over the next five to seven years by developing a proposed budget request for the five-year capital improvement program budget.

7. AS NEW DEVELOPMENT OCCURS, THE CITY SHOULD REQUIRE THE DEDICATION OF STREETLIGHTS TO THE CITY, AND NOT ALLIANT ENERGY.

City-owned streetlights cost less than Alliant Energy-owned streetlights. The following table presents the equivalent annual cost for a 135-watt LED street light on a 35' concrete pole.[16]

Who Owns The Streetlight?	What Is the Annual Cost?
City	$213.92
Alliant Energy	$230.88

These costs include annual electric and maintenance costs, the annualized capital cost for the pole and the fixture including a 1% inflation rate. Overall, the annual costs for the Alliant Energy – owned streetlights are approximately 8% higher (or almost $17) than City-owned streetlights.

The City has 927 light fixtures. The City is saving almost $16,000 annually by owning these streetlights. Alliant Energy owns approximately 13,000 streetlights in the City. The City is paying approximately $220,000 more annually to Alliant Energy than if the City owned these streetlights.

The City should not allow this situation to worsen. As development occurs, the City should require the dedication of streetlight poles and fixtures to the City as City-owned streetlights.

Recommendation #140: As development occurs, the City should require the dedication of streetlight poles and fixtures to the City as City-owned streetlights.

[16] For a 135 watt LED street light on a 35 foot concrete pole (as is the most common pole recently approved in the City's Complete Streets Policy), assuming a 1% inflation rate, a life cycle for a concrete pole of 50 years, and a life cycle of the 135 watt LED fixture of 10 years (for the City as Alliant's fixture cost is built into the monthly tariff rate)

8. THE TRAFFIC ENGINEERING DIVISION SHOULD REPLACE ALL OF THE TRAFFIC SIGNAL LAMPS THAT HAVE NOT BEEN CONVERTED TO LED.

Converting incandescent traffic signal lamps to LED's is an easy, immediate and cost-effective way to lower municipal energy bills. LED traffic signal lamps use 80% to 90% less energy than incandescent lamps. Cities can expect to save approximately $60 to $130 in annual energy costs per signal head (red, yellow, green lamps) by switching to LED's. Additionally, LED traffic signal lamps can reduce maintenance costs over incandescent technology by approximately 75%. The estimated simple payback on LED traffic signal conversions based on energy cost savings alone is as little as one year.

Not all of the City's signalized intersections have been converted to LED's. The Traffic Engineering Division should identify those intersections that have not been converted to LED's, and develop a proposed capital improvement project for fiscal year 2015-16 to replace those intersections that have not been converted to LED's.

Recommendation #141: The Traffic Engineering Division should identify those signalized intersections that have not been converted to LED's, and develop a proposed capital improvement project for fiscal year 2015-16 to replace the traffic signal lamps at intersections that have not been converted to LED's.

9. THE TRAFFIC ENGINEERING DIVISION SHOULD EVALUATE AND UTILIZE ALTERNATIVE PAVEMENT MARKINGS FOR STREET STRIPING AND PAVEMENT LEGENDS.

Waterborne traffic paints are the most widely used and least expensive pavement marking material available. Waterborne traffic paints generally provide equal performance on asphalt and concrete pavements, but have the shortest service life of all pavement marking materials. Compared to other pavement marking materials, waterborne paints wear off rapidly and lose retroreflectivity quickly after being exposed to factors such as high traffic volumes and winter maintenance activities. In the

experience of Cedar Rapids, the life span of waterborne paints for street striping and pavement legends is, at best, one year.

Waterborne paints can provide a long life on low-volume streets, but less than one year on high-volume streets. In high traffic volume streets, durable materials such as epoxies and in-laid pre-formed thermoplastics should be considered. These durable materials have a much higher cost than waterborne paint, but last longer than one year. The additional cost is not worth the use on low volume streets, but should be considered for high volume streets.

Recommendation #142: The Traffic Engineering Division should experiment with alternative pavement markings for street striping and pavement legends, particularly for high traffic volume streets.

10. THE TRAFFIC ENGINEERING DIVISION SHOULD DEVELOP AND INSTALL A TRAFFIC SAFETY PROGRAM.

There are a number of good trends in the City's rate of accidents. Over the past five years (2008 to 2012), the number of accidents in Cedar Rapids has decreased by almost 20% (although there was a 3% increase from 2011 to 2012). The reduction mirrors a trend in the State overall. The number of injury accidents in Cedar Rapids over the past five years (2008 through 2012) has decreased by 22% although there was a 5% increase from 2011 to 2012). The reduction mirrors a trend in the State overall.

However, 5 of the top 200 accident intersections in the State of Iowa are located in Cedar Rapids. In addition, the City of Cedar Rapids participates in a benchmark survey with 22 Police Departments located in states all across the United States including Lincoln, Nebraska; Overland park, Kansas; Olathe, Kansa; Columbia, Missouri; Springfield, Missouri; Naperville, Illinois; etc. The results of the 2013 benchmark survey indicate that:

- Cedar Rapids is fifth highest in terms of traffic crashes per 1,000 citizens;
- Cedar Rapids is fifth highest in non-injury crashes per 1,000 citizens (but much lower than average for fatalities and injury crashes); and
- The top three causes of traffic crashes in Cedar Rapids were inattention, disobeying a traffic signal or sign, and speed.

The Traffic Engineering Division has initiated efforts, recently, to enhance the City's traffic safety; the Division began the maintenance in 2014 of a traffic collision database, tied to GIS, that can be used to identify high accident intersections. However, the Traffic Engineering Division last generated an *Intersection Accident Summary* presenting the number of accidents, traffic volume, accident rate per million miles, and accident rank for intersections in 2005. A traffic safety program is not in place to proactively identify high accident intersections and develop mitigation measures.

As a first step, the Division should develop traffic safety performance measures and report annually the results of these measures to the Public Works Director and the Office of the City Manager. These should include such measures as traffic fatalities, serious traffic injuries, pedestrian fatalities, number of vehicular accidents, etc.

As a second step, on an annual basis, the Traffic Engineering Division should review its accident records and identify the ten intersections or locations with the highest number of accidents. The Division should assign its traffic engineering staff to observe conditions in the field at these ten locations and develop site-specific recommendations to reduce accidents at these ten intersections or locations including capital improvement projects. There are a host of possible countermeasures available including the following:

- Signalization (e.g., changing the yellow signal timing, converting protected / permissive left-turn phase to permissive / protected, installing a pedestrian signal, improving the visibility of signal heads, installing a left-turn lane, etc.);

- Geometric (e.g., convert an intersection to a roundabout, improve intersection alignment, improve sight distance, etc.);

- Signs / markings (e.g., install larger stop signs, install flashing beacons as an advance warning, prohibit turns etc.); and

- Barriers (e.g., guardrails).

The Traffic Engineering Division should analyze accidents that have occurred at the ten intersections or locations with the highest number of accidents on an annual basis with collision diagramming software, and develop mitigation measures.

Recommendation #143: The Traffic Engineering Division should develop traffic safety performance measures and report annually the results of these measures to the Public Works Director and the Office of the City Manager. These should include such measures as traffic fatalities, serious traffic injuries, pedestrian fatalities, number of vehicular accidents, etc.

Recommendation #144: The Traffic Engineering Division should review its accident records on an annual basis and identify the ten intersections or locations with the highest number of accidents. The Division should conduct a traffic study of each of these ten intersections on an annual basis including the use of collision diagramming software. The Division should assign its traffic engineering staff to observe conditions in the field at these ten locations and develop site-specific recommendations to reduce accidents at these ten intersections or locations including capital improvement projects and work orders to its signal maintenance and sign / striping maintenance staff.

11. THE TRAFFIC ENGINEERING DIVISION SHOULD REPORT ITS TRAFFIC COUNTS ON AN ANNUAL BASIS.

The Traffic Engineering Division has not collected and reported traffic count data since approximately 2008. There are a variety of methodologies to collect traffic count data including traffic signal detector loops. This information is already available; it is simply not collected and reported by the Division.

The traffic count data should be collected and used by the Division to evaluate the need for road improvements, traffic signal installations, traffic signal modifications, guard rail installations, flashing beacon installations for bicycle and pedestrian projects, and transportation planning.

The Division should collect and report the traffic count information on an annual basis for each of the signalized intersections where such information is available. Apparently, 60 of the City's 225 intersections have automated traffic counters using the detection equipment at these signalized intersections.

To collect traffic count information at other locations throughout the City, the Division should establish a traffic counting program using pneumatic hose counters. The City will need to acquire some 30 traffic counting devices to initiate this program The cost of these devices approximates $1,000 to $1,500 each. The signs and striping maintenance staff should be responsible for deploying and collecting the counters.

Recommendation #145: The Traffic Engineering Division should initiate an annual traffic counting program to evaluate the need for road improvements, traffic signal installations, traffic signal modifications, guard rail installations, flashing beacon installations for bicycle and pedestrian projects, and transportation planning.

Recommendation #146: The Traffic Engineering Division should collect and report the traffic count information generated by its traffic signals on an annual basis for each of the signalized intersections where such information is available.

Recommendation #147: The Traffic Engineering Division should establish an annual traffic counting program using pneumatic hose counters. The City will need to acquire some 30 traffic counting devices to initiate this program The cost of these devices approximates $1,000 to $1,500 each.

12. THE TRAFFIC ENGINEERING DIVISION SHOULD DEVELOP A WRITTEN SIGNAL TIMING AND PHASING POLICY.

The Traffic Engineering Division has not developed written policies and procedures regarding the calculation of (1) vehicle clearance intervals that reflect the differences in traffic characteristics at intersection approaches; and (2) pedestrian clearance intervals that reflect the intersections at which pedestrians have special needs (e.g., children, elderly, handicapped, etc.).

The purpose of these policies are to establish standard practices and operational procedures for traffic signal and pedestrian timing parameters to be used by Division staff and consulting engineers performing signal timing services for the Division. The policies should be implemented at new traffic signal installations, traffic signal upgrades, and along signalized corridors as they are re-timed. The policy should provide guidance on various timing parameters. However, timing should be independently evaluated for all situations based upon standard traffic engineering principles and local intersection characteristics. Necessary adjustments should be made to meet the conditions at each individual signalized intersection.

Recommendation #148: The Traffic Engineering Division should written policies and procedures regarding the calculation of (1) vehicle clearance intervals that reflect the differences in traffic characteristics at intersection approaches; and (2) pedestrian clearance intervals that reflect the intersections at which pedestrians have special needs (e.g., children, elderly, handicapped, etc.).

13. THE TRAFFIC ENGINEERING DIVISION SHOULD CONDUCT TRAFFIC IMPROVEMENT STUDIES.

The Traffic Engineering Division does not conduct traffic improvement studies to maximize the capacity of the existing street system and improve traffic flow for the City's arterial and collector streets.

These traffic improvement studies should be low cost measures such as signal coordination, installation of new signals, re-phasing signals to enhance intersection capacity, re-striping streets to provide additional lanes, re-timing streets to more effectively utilize green signal times depending on peak traffic demands, and parking removal to provide additional or longer left-turn lanes. Examples of these traffic improvement studies and the results generated include the following:

- Mast arm modernization to include left turn arrows, illuminated street name signs, and improved pedestrian actuation;
- Reducing side street delay by reducing traffic signal cycle lengths and putting signalized intersections in “free” during daytime, non-peak hours;
- Additional left and right hand turn lanes;
- Modifying existing lane geometry to provide exclusive left turn lanes;
- Lengthening turn lane pockets; and
- Modifying striping to provide a center turn lane.

The Traffic Engineering Division should conduct, on an ongoing basis, traffic improvement studies to proactively design and implement low cost traffic system management measures on an annual basis to reduce traffic congestion and travel time delay.

Recommendation #149: The Traffic Engineering Division should conduct, on an ongoing basis, traffic improvement studies to proactively design and implement low cost traffic system management measures on an annual basis to reduce traffic congestion and travel time delay.

14. THE TRAFFIC ENGINEERING DIVISION SHOULD CALIBRATE THE TIMING OF THE CITY'S SIGNALIZED INTERSECTIONS.

The Traffic Engineering Division last conducted a citywide comprehensive recalibration of traffic signals in 1987. The Institute of Transportation Engineers recommends that signal timing should be considered at least every three years.

The maintenance of traffic signal timing, especially those associated with coordinating a series of traffic signals to optimize the safe and efficient movement of traffic, is an important aspect of traffic engineering. Proper traffic signal retiming results in reductions in overall travel time, delay, and fuel consumption, at the same time improving air quality.

In addition to operational improvements, signal retiming is also gaining recognition for improving safety. According to the Federal Highway Administration and the Institute of Transportation Engineers, five studies of signal coordination indicate reductions in total crashes of about 15% and reductions in right-angle crashes of 25% to 38% as a result of coordination. In a separate effort, the National Cooperative Highway Research Program recently published a report on Low Cost Safety Improvements, identifying employing signal coordination as an objective.

Using Institute of Transportation Engineers estimates, it takes about 20 to 25 staff hours per intersection to conduct a retiming project. The steps in signal timing are outlined below:

- Traffic Data Collection;
- Intersection Data Collection;
- Input information into traffic signal coordination software (e.g. Synchro);
- Run analysis and adjust based on experience;

- Review;
- Implement;
- Field monitoring (driving) and field adjustments; and
- Documentation.

Again using Institute of Transportation Engineers estimates, traffic signal retiming costs are relatively small – ranging from $500 to $3,000 per intersection. Traffic signal retiming is also very cost effective, producing benefit to cost ratios as high as 40 to 1.

While approximately 150 of the City's 225 signalized intersections will be upgraded with the Intelligent Transportation System including associated signal timing calibration at that time, the remainder of the signalized intersections will not be upgraded and will not have their timing recalibrated. The Traffic Engineering Division should begin the task of retiming the signals at these 75 signalized intersections immediately utilizing the signal optimization software (Synchro) for calculating signal timing and evaluating alternative phasing.

Recommendation #150: The Traffic Engineering Division should begin the task of retiming the signals at the 75 signalized intersections that will not be part of the *Intelligent Transportation System* immediately utilizing the signal optimization software (Synchro) for calculating signal timing and evaluating alternative phasing.

15. THE PROFESSIONAL-LEVEL POSITIONS IN THE TRAFFIC ENGINEERING DIVISION SHOULD BE ALLOCATED TO THE CIVIL ENGINEERING SERIES.

At the present time, some of the positions in the Traffic Engineering Division are allocated to traffic engineering classifications and some to civil engineering classifications. The traffic engineering classifications include the Associate Traffic Engineer, the Traffic Engineering Project Coordinator, and the Project Engineer II –

Traffic. The civil engineering classifications include Project Engineer I and Engineering Technician.

All of the professional-level positions allocated to the Traffic Engineering Division, other than the City Traffic Engineer, should be allocated to the civil engineering classification series. As recommended previously, the vacant Associate Traffic Engineer should be classified as a Supervising Civil Engineer. The remaining professional-level engineering positions in the Traffic Engineering Division should be allocated to the Civil Engineer I or Civil Engineer II classification.

Recommendation #151: All of the professional-level positions allocated to the Traffic Engineering Division, other than the City Traffic Engineer, should be allocated to the civil engineering classification series.

16. THE TRAFFIC ENGINEERING DIVISION SHOULD DEVELOP AND MAINTAIN A DATABASE OF APPROVED SIGNAL PHASING AND TIMING SETTINGS FOR EACH INTERSECTION OUTSIDE OF THE ACTRA SOFTWARE.

Traffic Engineering has developed a comprehensive database of approved signal phasing and timing settings for each intersection. The database is maintained in the City's Actra traffic signal software. The City's Actra traffic signal software is obsolete.

Signal retiming projects generate a lot of information, such as traffic data, intersection geometry, signal phasing, signal timing, controller type, and posted speeds. This information should be managed in a database, outside of the Acrtra software, to provide a sustainable record and for future retiming updates. The following is a list of items that are typically collected in a signal re-timing project:

- Type of signal control at each intersection;
- Intersection signal phasing;
- Signal timing plans;

- Traffic volumes and speeds for the network;
- Geometric description of the network; and
- Input data files utilized for simulation and Synchro timing software.

The signal timing process is greatly simplified, and its cost reduced, when this data is stored in a database that can be easily accessed each time area-wide signal timing is developed. However, as with any database, its value will be reduced if it is not kept up to date. It is essential that the database be updated each time controller operation is modified, including all changes in phasing, type of control, timing, or intersection geometrics. In this way the value of the database can be preserved for access during the area-wide signal timing process.

Recommendation #152: The Traffic Engineering Division should develop a comprehensive database of approved signal phasing and timing settings for each intersection. This database should be developed outside of the Actra traffic signal software. The database should be updated each time controller operation is modified, including all changes in phasing, type of control, timing, or intersection geometrics.

17. THE TRAFFIC ENGINEERING DIVISION SHOULD BE RESPONSIBLE FOR THE DESIGN OF TRAFFIC SIGNAL, STREETLIGHT, AND PAVEMENT LEGEND AND STREET STRIPING IMPROVEMENTS FOR CAPITAL PROJECTS WHEN THESE PROJECTS ARE DESIGNED IN-HOUSE.

The design of traffic signal, streetlight, and pavement legend and street striping improvements is accomplished by consulting engineers when the design is outsourced. When that occurs, the Traffic Engineering Division should be provided the opportunity by the Engineering Division to plan check the design at 30%, 60% and 90% complete.

The Engineering Division designs the traffic signal, streetlight, and pavement legend and street striping improvements by in-house staff when design is insourced. That responsibility should be assigned to the Traffic Engineering Division.

Recommendation #153: The Traffic Engineering Division should be provided the opportunity by the Engineering Division to plan check the design of traffic signal, streetlight, and pavement legend and street striping improvements at 30%, 60% and 90% complete when the design of capital projects is accomplished by consulting engineers.

Recommendation #154: The Traffic Engineering Division should design the traffic signal, streetlight, and pavement legend and street striping improvements when design of capital projects is insourced.

18. THE NUMBER OF AUTHORIZED POSITIONS IN THE TRAFFIC ENGINEERING DIVISION IS SUFFICIENT.

The Traffic Engineering Division is authorized six professional and paraprofessional engineering positions. With the present classification structure, this incudes:

- An Associate Traffic Engineer, which is vacant at the present time;
- A Traffic Engineering Project Administrator;
- A Traffic Engineering Project Coordinator;
- A Project Engineer II – Traffic;
- A Project Engineer I; and
- An Engineering Technician.

The City is moving towards the centralization of development services within the Development Services Department. It has not yet completed that centralization; there are a number of positions within the Public Works Department whose role and responsibility is the processing of development-related permits. The remaining responsibilities for receiving, processing and issuing permits within the Public Works Department should be reallocated to the Development Services Department. This would include the Traffic Engineering Project Administrator, who is responsible for issuance of permits for special events, plan checking encroachment permits on City right-of-way

(e.g., parking lots, signs, etc.), sidewalk café renewals (e.g., seating and tables on City sidewalks), etc.

This reallocation would result in five (5) professional and paraprofessional engineering positions. As recommended previously regarding the plan of organization, the vacant Associate Traffic Engineer position should be upgraded to Supervising Civil Engineer; this position should supervise the other professional and paraprofessional positions in the Traffic Engineering Division.

The two professional-level positions that are filled and allocated to the Traffic Engineering Division are underutilized from the perspective of the Matrix Consulting Group as noted below.

- **Project Engineer II.** The Project Engineer II is largely functioning as a bicycle coordinator on almost a full-time basis. The position is not allocated traffic signal re-timing, traffic improvement studies, or traffic safety studies.

- **Traffic Engineering Project Coordinator**. This position plan checks building permits, represents the Division for the school crossing program (develops school crossing agreements with the schools, reviews invoices from the schools for the costs of the crossing guards, etc.), analyzes warrants to determine if a left-turn lane is justified, analyzes requests for regulatory signs, analyzes sight clearance complaints, analyzes requests fro ADA parking, etc. Many of these duties duplicate those cited by the Engineering Technician assigned to the Traffic Engineering Division.

A Project Engineer I position is also vacant, in addition to the Associate Traffic Engineer.

The Traffic Engineering Division should immediately begin to address the needs for traffic signal re-timing, traffic improvement studies, and traffic safety studies. The Division should immediately:

- **Fill the vacant Associate Traffic Engineer position** as a Supervising Civil Engineer;

- **Fill the Project Engineer I position as a Civil Engineer I**. The position should be assigned responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies.

- **Assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Project Engineer II**. The responsibility for bicycle coordination, while important, should not require more than 25% of available work hours;

- **Assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Traffic Engineering Coordinator** The responsibility for the duties currently performed by the Traffic Engineering Coordinator should be re-assigned to the Engineering Technician since many duplicate those already cited by the Engineering Technician.

The allocation of these four professional-level positions to traffic signal re-timing, traffic improvement studies, and traffic safety studies should enable the Traffic Engineering Division to assume a proactive role in the safe and efficient movement of people and goods on City streets.

Recommendation #155: The Traffic Engineering Division should enhance the effective utilization of its professional-level engineering positions.

Recommendation #156: The Traffic Engineering Division should immediately fill the vacant Associate Traffic Engineer position as a Supervising Civil Engineer.

Recommendation #157: The Traffic Engineering Division should immediately fill the Project Engineer I position as a Civil Engineer I. The position should be assigned responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies.

Recommendation #158: The Traffic Engineering Division should immediately assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Project Engineer II. The position should continue to function as a bicycle coordinator for the City, but that responsibility should not require more than 25% of available work hours.

Recommendation #159: The Traffic Engineering Division should immediately assign responsibility for traffic signal re-timing, traffic improvement studies, and traffic safety studies to the Traffic Engineering Coordinator. The responsibility for the duties currently performed by the Traffic Engineering Coordinator should be re-assigned to the Engineering Technician since many duplicate those cited by the Engineering Technician.

7. ANALYSIS OF THE CONSTRUCTION MANAGEMENT AND INSPECTION DIVISION

This chapter presents an analysis of the Construction Management and Inspection Division including its staffing, the adequacy of construction inspection for privately-funded public improvements, the adequacy of its work practices, the effective use of its staff for Construction Management and Inspection, etc.

1. THE CONSTRUCTION MANAGEMENT AND INSPECTION DIVISION SHOULD ENHANCE ITS INSPECTION OF DEVELOPMENT-RELATED PUBLIC IMPROVEMENTS.

The Construction Management and Inspection Division, by its own admission, is ineffective at construction inspection of development-related public improvements associated. And it shows as noted in the pictures in the exhibit following this page.

This is not good practice. It shifts the problem from the developer – building the public improvements correctly - to the City: fixing the failures after the City has accepted the public improvements.

This should not be tolerated. The Civil Engineering Construction Inspectors should be assigned responsibility for the ongoing construction inspection of development-related public improvements associated with development. This should include the specific inspections and inspection meetings as noted below.

- **Pre-construction Conference** Three working days prior notice required before commencement of construction. Pre-construction conference must precede the beginning of construction and include the applicant, contractor, design engineer for the developer, utilities, and other applicable participants. Plan approvals and permits must be in hand prior to the conference.

Exhibit 13 (1)

Examples of Poorly Constructed Development-Related Public Improvements

Landscaping "burg" that the Sewer Operations Division is still trying to remove from an improperly constructed storm pipe. (Pipe full of dumped yard waste, landscaping timbers, railroad ties, mortared by mud and leaves; in a pipe with a 6 foot offset and only 2 feet of horizontal clearance for the debris to make the drop.

This concrete street is already cracking and settling, even though the subdivision has yet to to be completed.

Exhibit 13 (2)

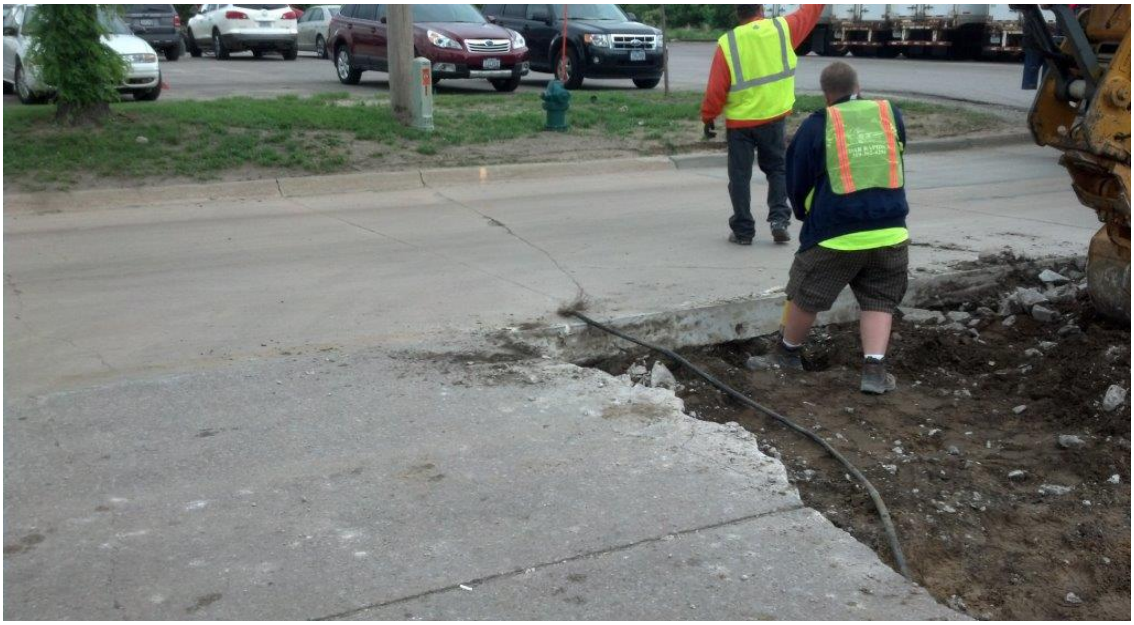
Poor compaction of sanitary sewer caused major settlement and pavement failures. Outside of bond.

This is on a section of pavement less than 2 years old. When you step on this box, the entire slab rocks approximately 2". The expansion material around the box out has fallen into the sewer line below.

Exhibit 13 (3)

This was built in 2000 on a 5-lane road in Cedar Rapids, Council Street North of Blairs Ferry Road. As can be seen from the picture, the sanitary sewer collection crew is cleaning out the box that was poured into the concrete panel without a lid. The two boards shown in the picture were laid across the concrete box; a piece of expansion foam was then used (shown in the picture) as the support for the riser, in which was placed the manhole lid. This lasted for 14 years but when it did fail, it required a major concrete repair and lane closures. From the look of the concrete adjacent to this location, there are other problems that the City will need to deal with over the coming years. It is hard to believe this held in place as long as it did given the amount of traffic and load on this street segment.

City concrete crew removing a failed panel; no base rock was installed by the contractor



- **Clearing and Temporary Erosion/Sedimentation Control**. One working day notice from contractor prior to initial site work involving drainage and installation of temporary erosion/sediment control.

- **Utility and Storm Drainage Installation**. One working day notice from contractor prior to trenching and placing of storm sewers and underground utilities such as sanitary sewer, water, gas, power, telephone, and TV lines.

- **Utility and Storm Drainage Backfill and Compaction**. One working day notice from contractor before backfill and compaction of storm sewers and underground utilities.

- **Sub-grade Completion**. One working day notice from contractor at the stage that underground utilities and roadway grading are complete; to include placement of gravel base if required.

- **Curb, Gutter and Sidewalk Forming**. One working day notice from contractor to verify proper forming and preparation prior to pouring concrete.

- **Curb, Gutter and Sidewalk Placement**. One working day notice from contractor to check placement of concrete.

- **Crushed Surfacing Placement**. One working day notice from contractor to check placement and compaction of crushed surfacing base course and top course.

- **Paving.** Three working days notice from contractor in advance of paving with asphalt or Portland Cement Concrete.

- **Signing, Striping, and Pavement Markings**. Three working days notice from contractor in advance of final application, and after layout work has been completed.

- **Structural.** Three working days notice from contractor prior to each critical stage such as placement of foundation piling or footings, placement and assembly of major components, and completion of structure and approaches. Structural tests and certification requirements will be as directed by the City Engineer.

- **Punch-list Inspection**. 15 working days prior to overall check of street or drainage project site, to include completion of paving and associated appurtenances and improvements, cleaning of drainage system, and all necessary cleanup.

- **Final Inspection**. Prior to final approval of construction work, acceptance, the applicant / contractor shall pay any required City fees, submit any required maintenance and defect financial guarantees, provide a certificate of

monumentation and submit required record drawings reflecting all minor and design plan changes of the street and drainage systems.

- **Final Maintenance Inspection**. The final maintenance inspection is performed by the City 45 days prior to the end of the maintenance bond period. Prior to release of the maintenance financial guarantee, there shall be successful completion of the maintenance period, replacement / repair of any failed facilities, and the payment of any outstanding fees.

The City should require, by written Council-adopted policy, notification by the applicant or the applicant's contractor of the City so that the City can verify, through inspections, that the work by the contractor meets the City's standard specifications. Failure by the contractor to notify Construction Management and Inspection and obtain approval should result in Construction Management and Inspection requiring sampling and testing with certification by a private laboratory. The costs of such testing and certification should be borne by the developer. If the test results conclude that the unauthorized work doesn't meet the standard specifications, the applicant should be required to remove the unauthorized material and replace it with materials that meet the City's standard specifications at his / her own expense.

The City does not require performance bonds; it does require maintenance bonds. Over the past three and one-half years, the maintenance bonds have had a construction bond value as noted in the table below (by calendar year).

2011	2012	2013	2014
$3,111,051	$4,060,328	$1,469,596	$1,175,131

Using cost of construction guidelines, two Civil Engineering Construction Inspectors would be necessary given the workload in 2014. Staffing requirements would have been greater in 2011 and 2012. The two Erosion Control Specialist positions in the Sewer Operations Division, transferred to Construction Management and Inspection,

should be reclassified as Civil Engineering Construction Inspectors, trained in Construction Management and Inspection, and assigned responsibility for privately funded public improvements associated with development.

Recommendation #160: The Civil Engineering Construction Inspectors should be assigned responsibility for the ongoing construction inspection of development-related public improvements.

Recommendation #161: The Public Works Department should develop a written policy and procedure for the consideration of the City Council regarding the construction inspection of development-related public improvements. This policy and procedure should require a pre-construction conference; and inspections for clearing and temporary erosion / sedimentation control; utility and storm drainage installation; utility and storm drainage backfill and compaction; sub-grade completion; curb, gutter and sidewalk forming; curb, gutter and sidewalk placement; crushed surfacing placement; crushed surfacing placement; paving; signing, striping, and pavement markings; structural; punch-list inspection; final inspection; and final warranty inspection.

Recommendation #162: The two Erosion Control Specialist positions in the Sewer Operations Division, transferred to Construction Management and Inspection, should be reclassified as Civil Engineering Construction Inspectors, trained in Construction Management and Inspection, and assigned responsibility for construction inspection of development-related public improvements associated with development.

2. THE EXTENT OF AUTHORIZED STAFFING FOR CONSTRUCTION MANAGEMENT AND INSPECTION IS INSUFFICIENT GIVEN CURRENT WORKLOAD.

The Matrix Consulting Group worked with Construction Management and Inspection to assess the existing inspection workload including the following:

- The project administrator;
- The project number;
- The project name;
- The assigned Civil Engineering Construction Inspector;
- The actual start date;

- The estimated completion date; and
- The current contract amount (award plus change orders)

This is a "snapshot of existing workload for the currently assigned capital projects.

The conclusions that the Matrix Consulting Group reached regarding the construction inspection workload are presented below.

- There are a total of 42 "active" capital improvement program projects with a construction value of $29.1 million. One of these projects is assigned to a Traffic Signal Technician II.
- One-half of these projects are estimated to be completed this fiscal year.
- The allocation of these projects by Civil Engineering Construction Inspector are presented in the table below. It is clear that there is a lack of balance in this workload allocation.

Civil Engineering Construction Inspector	Number of Assigned Capital Improvement Projects	Value of Construction Contract
Civil Engineering Construction Inspector #1	2	$205,652
Civil Engineering Construction Inspector #2	4	$2,698,143
Civil Engineering Construction Inspector #3	5	$607,284
Civil Engineering Construction Inspector #4	5	$5,018,564
Civil Engineering Construction Inspector #5	6	$2,944,723
Civil Engineering Construction Inspector #6	6	$9,514,537
Civil Engineering Construction Inspector #7	6	$4,146,695
Civil Engineering Construction Inspector #8	7	$4,037,167
Civil Engineering Construction Inspector #9	0	$-
TOTAL	**41**	**$29,172,765**

One Civil Engineering Construction Inspector - Civil Engineering Construction Inspector #9 - was retiring – and not assigned workload. In addition, the workload assigned to Civil Engineering Construction Inspector #1 and Civil Engineering Construction Inspector #3 appear to be significantly less than the other Civil Engineering Construction Inspectors; these two positions are underutilized.

- The Construction Contract Specialist is not assigned responsibility for construction management and inspection of specific projects. The Construction Contract Specialist functions more like a supervisor and troubleshooter.

- The average construction contract value for these 41 projects was $764,000. On average, these are not large construction projects. The largest project - 76th Ave Southwest Improvements from Edgewood Road to east of Crandic railroad – had a construction contract value of $3.7 million.

- One half of these projects were estimated to be completed in 2014 and the other half to carry over to 2015. An estimated seven of the projects will not begin construction until 2015.

- Based upon cost of construction guidelines used by the Matrix Consulting Group and an eight-month construction season, the workload for 2014 would indicate a need for sixteen (16) Civil Engineering Construction Inspectors.

The Matrix Consulting Group does not recommend the addition of Civil Engineering Construction Inspector positions. The Civil Engineering Construction Inspector has an eight-month construction season. The positions are not currently effectively utilized during the off-season, generally November through March. Instead, the City should outsource the excess inspection workload.

However, Construction Management and Inspection should balance the workload among its Civil Engineering Construction Inspector positions. Two positions are clearly underutilized. A third position, in which the incumbent is retiring, should be filled several months before the construction season begins to allow for training.

Recommendation #163: Based upon cost of construction guidelines used by the Matrix Consulting Group and an eight-month construction season, the workload for 2014 would indicate a need for additional Civil Engineering Construction Inspectors.

Recommendation #164: The Matrix Consulting Group does not recommend the addition of Civil Engineering Construction Inspector positions. The Civil Engineering Construction Inspector has a seven-month construction season. The positions cannot be effectively utilized during the off-season, generally November through March. Instead, the City should outsource the excess inspection workload.

Recommendation #165: Construction Management and Inspection should balance the workload among its Civil Engineering Construction Inspector positions. Two positions are clearly underutilized. A third position, in which the incumbent is retiring, should be filled several months before the construction season begins to allow for training.

3. THE CONSTRUCTION MANAGEMENT AND INSPECTION STAFF SHOULD BE MOVED TO THE 2ND FLOOR OF THE CITY SERVICES CENTER.

Construction inspection is one of the most important stages in the life cycle of City-owned infrastructure. Even if the Engineering Division has done a perfect job in planning and designing of City-owned infrastructure, unless the actual execution of the design in the construction stage is carried out effectively, the City is bound to run into problems. There are several parameters from the design and pre-construction stages that have to be followed through in the actual construction process to ensure that the construction contractor is building what the Engineering Division has planned and designed. It is the duty of the Civil Engineering Construction Inspectors at the site to ensure that the actual construction matches as closely as possible with the stipulated design parameters. For instance, if the as-built strength of the pavement is lower than that used in the design, premature failures would likely occur.

This requires a partnership between the engineers that design the capital projects and the construction inspectors that make sure the City-owned infrastructure is built as designed and specified. This partnership requires that construction inspectors:

- Be members of the design of the capital projects beginning at the inception of the project (scoping) and ending at the project termination (closeout);
- Participate in the development of the schedule of the design and construction of the capital project early in the process during the initial scoping process throughout the project development phases;

- Agree with the Engineering Division project manager regarding the construction schedule during the internal 90% design review meeting;

- Plan check the design of capital project plans, specifications, and estimates at 30%, 60% and 90% design complete;

- After award of the contract, initiate discussions with the construction contractor, including scheduling of the pre-construction conference, construction start date, etc., and coordinate the scheduling of the pre-construction conference with the Engineering Division project manager, who will also attend these pre-construction conference meetings;

- Distribute the notice to proceed for the construction contractor to the Engineering Division project manager;

- Determine, on purely day-to-day operational issues throughout the construction project, whether the Engineering Division project manager should be copied in on any discussions (the Engineering Division project manager should be copied in correspondence and be directly involved on all items directly affecting the project scope, schedule and budget);

- Communicate with the Engineering Division project manager throughout the construction process via e-mails with these communications occurring, at a minimum, twice monthly on all projects and possibly more depending on the issues involved;

- Involving the Engineering Division project manager in the decision making process for items such as contract modifications, supplemental agreements, proposed design changes, reimbursable agreements, project overruns / underuns, etc.;

- For correspondence received from the construction contractor, determine on an individual basis whether to copy the Engineering Division project manager or not (Items directly affecting Scope, Schedule and Budget should be sent to the Engineering Division project manager);

- Involve the Engineering Division project manager in the decision making process on all project political issues and for all design changes affecting safety (i.e. geometrics, guardrail, etc.);

- Copy the Engineering Division project manager regarding the monthly status report containing information on ongoing construction work;

- Be the point of contact for the construction contractor on issues relating to the normal, routine, day-to-day operational issues of the construction project, such as additional flagging needed on the project, improper placement by the contractor of traffic control signs, etc., while the Engineering Division project

manager should be the point of contact by the construction contractor for items relating to the Scope, Schedule and Budget;

- Coordinate scheduling of the final punchlist and maintenance inspections with the Engineering Division project manager; and

- Review, initially, the claim / termination requests and immediately send to the Engineering Division project manager for review and discussion until final resolution of the claim, including any offers prepared.

This partnership requires daily, in some instances, and weekly interaction between the Engineering Division project manager and the Civil Engineering Construction Inspectors. This can best be accomplished if the staff are located in close proximity, on the 2nd floor of the City services center. The Construction Management and Inspection staff should be re-located to the 2nd floor in close proximity to the Engineering Division project managers that are managing the design of capital projects.

Recommendation #166: The Construction Management and Inspection staff should be re-located to the 2nd floor in close proximity to the Engineering Division engineers managing the capital projects.

Recommendation #167: The specific interaction between the Civil Engineering Construction Inspectors and the Engineering Division project managers should be formally defined in a departmental policy and procedure developed by the City Engineer.

3. IN THE OFF-SEASON, THE CIVIL ENGINEERING CONSTRUCTION INSPECTORS SHOULD BE UTILIZED TO ASSIST IN THE DESIGN OF CAPITAL PROJECTS, ASSISTING THE ENGINEERING DIVISION.

This is a practice that can be found in Iowa and outside Iowa. It is a practice utilized by the Linn County Public Works Department. It is also a practice used by the Engineering Division of the City of Salt Lake City. In both instances, the organizations utilize “construction inspectors” to assist in the design of capital projects during the off-season.

The City of Salt Lake City utilizes a planning and management system oriented around interdisciplinary Project Teams within the Engineering Division. These project teams are assigned a project and are responsible for it from the inception of design to acceptance of the final constructed facility. Each project team is supervised by a senior engineer. Each team contains a mix of professional engineers and paraprofessional engineers with the flexibility to assign team members of the project team to construction management work during the construction season from spring through fall and to assign team members to design activities and preparation for bidding during the off-season in late fall and winter. The project team approach allows a team member to always maintain a presence on the construction project in order to identify and resolve issues in a timely manner. The City of Salt Lake City does not utilize Civil Engineering Construction Inspectors for construction inspection, but instead uses Engineering Technicians (in a series that runs from Engineering Technician I through Engineering Technician V).

The Matrix Consulting Group recommends that the Public Works Department utilize this project team approach to the design and construction inspection of capital projects. This will require time to migrate to this approach, but some of the Civil Engineering Construction Inspectors have CAD experience and training, and with additional training, could migrate to this model quickly. However, a number of the existing Civil Engineering Construction Inspectors already appear to possess this CAD experience and training from previous employment.

The City, in turn, should develop multiple classification levels of Engineering Technician to reflect the knowledge and skills required to multi-task, and reclassify the

Civil Engineering Construction Inspectors within this series when the incumbents demonstrate the requisite knowledge and skills.

Recommendation #168: The Public Works Department should utilize a project team approach to the design and construction inspection of capital projects with the team containing a mix of professional engineers and paraprofessional engineers with the flexibility to assign team members of the project team to construction management work during the construction season from spring through fall and to assign team members to design activities and preparation for bidding during the off-season in late fall and winter.

Recommendation #169: The City should develop multiple classification levels of Engineering Technician to reflect the knowledge and skills required to multi-task (design and construction inspection), and reclassify the Civil Engineering Construction Inspectors within this series when the incumbents demonstrate the requisite knowledge and skills.

5. THE LENGTH OF MAINTENANCE BONDS SHOULD UNIFORMLY BE FOUR YEARS.

At the present time, the length of maintenance bonds for public improvements constructed by developers differs. The length of a maintenance bond for underground utilities is four years. The length of the maintenance bond for pavement is two years.

The length of the maintenance bond should be four years, in both cases. The length of the maintenance bond for pavement should be lengthened from two years to four years. This longer period of time is necessary to assure that adequate compaction has been provided and that premature failure of the street does not occur due to inadequate compaction.

Des Moines, Iowa, for example utilizes four years for street or sidewalk surfaces, traffic control devices or cabling, telecommunications devices or cabling, sewers, water lines, or street trees or plantings.

Recommendation #170: The length of the maintenance bond for pavement should be lengthened from two years to four years. This longer period of time is

necessary to assure that adequate compaction has been provided and that premature failure does not occur.

5. MAINTENANCE BONDS SHOULD NOT BE ACCEPTED AND APPROVED UNTIL THE CITY COUNCIL ACCEPTS THE PUBLIC IMPROVEMENTS.

The staff of the Construction Management and Inspection indicated that, at times, maintenance bonds are accepted before the punch list has been generated for public improvements constructed by developers, and before the improvements have been accepted by the City Council.

Construction Management and Inspection should develop a policy and procedure for the consideration of the Office of the City Manager and the City Council, that maintenance bonds should not be accepted until the public improvements have been accepted by the City Council. In other words, the four-year length of maintenance bonds should not begin until public improvements have been accepted by the City Council.

Recommendation #171: Construction Management and Inspection should develop a policy and procedure, for the consideration of the Office of the City Manager and City Council, that maintenance bonds should not be accepted until the public improvements have been accepted by the City Council. In other words, the four-year length of maintenance bonds should not begin until public improvements have been accepted by the City Council.

6. THE PUBLIC WORKS DEPARTMENT SHOULD IMPROVE ITS MANAGEMENT OF UTILITY CUTS.

Utility cuts are a fact of life for cities. It often seems that as soon as the City overlays or reconstructs a street, the utilities follow along almost immediately with utility cuts.

The volume of utility cuts in Cedar Rapids is not insignificant as shown in the table below.

Type of Excavation Permit	2013	2014 (As of 8-31-14)
Sanitary Sewer	272	186
Storm Sewer	4	8
Water	230	243
Other utilities	701	419
Driveways, streets, sidewalks	236	231
TOTAL	**1,443**	**1,087**

Installing, replacing, or repairing underground utilities is one of the most common reasons for patching in pavements, especially in urban areas, and the leading cause for premature failure of streets. Often the utility cut patch doesn't perform as well as the rest of the pavement.

One of the big challenges for utility cut patches is compaction. This involves not just compaction of the patched surface, but also the underlying base material used to fill the trench. Because of limited space to work in, and the fact that the backfill material may be different from the existing base, it can be difficult to achieve compaction to the appropriate density. Without proper compaction, the life of the patch will be significantly reduced. A T-section patch, as recommended earlier in this report, will not compensate for inadequate compaction of the replacement base.

Soil and subgrade compaction can be verified using a device such as a dynamic cone penotrometer. The Construction Management and Inspection staff should inspect each utility cut prior to its patching to assure proper compaction and use a dynamic cone penotrometer to assess compaction.

The public and private utilities should only be allowed to make temporary patches of utility cuts. The staff of the Street Operations Division should be utilized to replace the temporary patch with a permanent patch to allow time for the fill in the utility cut to settle, and, upon removal of the temporary patch, to insert additional fill and compact, if necessary. The costs of providing the permanent patch should be integrated into the excavation permit.

Utility patches also create a joint where they meet the existing pavement. This opening makes the pavement more permeable and vulnerable to moisture penetration. The staff of the Street Operations Division should also seal the joints of the utility patch at the time a permanent patch is made using a tack coat to keep water and other materials from infiltrating.

The Public Works Department should provide an incentive for the use of trenchless technology in lieu of utility cuts. One incentive is a permit or inspection fee waiver in return for the use of trenchless technology. Since in many cases trenchless technology is still more expensive than traditional trenching, especially in urban and suburban areas, financial incentives can encourage utility contractors to try the technology. Other methods of providing incentives for utility contractors to use trenchless technology is to reduce some of the administrative and regulatory processes necessary under traditional trenching operations. Obviously, any pavement degradation fee that applies to traditional trenches will not be applicable in most trenchless applications. Where limited excavation in the pavement area is necessary to a trenchless operation, the pavement degradation fee can be waived to provide an additional incentive.

There is the problem of utilities not requesting inspections of utility cuts.. Apparently, Alliant Energy and Mid-America Gas don't typically contact Construction Management and Inspection and request utility cut inspections. Construction Management and Inspection and the Development Services Department should meet with Alliant Energy and Mid-America Gas to inform them of the requirements for requesting inspections for utility cuts.

In addition, Construction Management and Inspection should assess a penalty for unpermitted work within the public right of way or utility work performed without requesting an inspection by Construction Management and Inspection. This will require an enabling ordinance. One of the suggestions made by City staff is to cross check *Iowa One Call* locate requests to excavation permits and any *Iowa One Call* locate requests lacking permits should be inspected anyways. The Information Technology Department indicated that this could be readily accomplished.

The utility cuts made by City-owned utilities are not charged any fees whatsoever. A utility cut, whether made by a privately owned utility or by a publicly-owned utility, have the same long-term degradation on the City's streets, and need to the same inspection to ensure a quality restoration. City-owned utilities should pay a fee sufficient to reimburse the City for the costs of construction inspection by Construction Management and Inspection. The Utilities Department makes its own utility cuts and patches its own utility cuts, without an excavation permit and without inspection by Construction Management and Inspection. This should not be allowed. The Utilities Department should be required to obtain an excavation permit for utility cuts. The

Utilities Department should be required to obtain inspection of its utility cuts by Construction Management and Inspection.

And lastly, the Public Works Department should develop a standard detail for utility cuts that includes the pavement patching.

Recommendation #172: The Construction Management and Inspection staff should inspect each utility cut (public and private) prior to patching to assure proper compaction and use a dynamic cone penotrometer to assess compaction.

Recommendation #173: The public and private utilities should only be allowed to make temporary patches of utility cuts. The staff of the Street Operations Division should be utilized to replace the temporary patch with a permanent patch to allow time for the fill in the utility cut to settle, and, upon removal of the temporary patch, to insert additional fill and compact, if necessary. The costs of providing the permanent patch should be integrated into the excavation permit.

Recommendation #174: The joint of the utility patch should also be sealed by the Street Operations Division at the time a permanent patch is made using a tack coat to keep water and other materials from infiltrating.

Recommendation #175: Construction Management and Inspection and the Development Services Department should meet with Alliant Energy and Mid-America Gas to inform them of the requirements for requesting inspections for utility cuts.

Recommendation #176: The City should cross check *Iowa One Call* locate requests to excavation permits in EnerGov and any One Call locate requests lacking permits should be inspected by the Construction Management and Inspection staff. The Information Technology Department should automate this process of cross-checking *Iowa One Call* against EnerGov.

Recommendation #177: Construction Management and Inspection should assess a penalty for unpermitted work within the public right of way or work performed without a request for inspection as required by adopted City policy and procedure. This will require an enabling ordinance.

Recommendation #178: Public and private utilities should pay a fee sufficient to reimburse the City for the costs of construction inspection by Construction Management and Inspection.

Recommendation #179: The Public Works Department should develop a standard detail for utility cuts that includes the pavement patching.

8. ANALYSIS OF THE STREET OPERATIONS DIVISION

The Street Operations Division is responsible for maintaining concrete and asphalt streets in the City. The Division is comprised of 83 personnel engaged in such activities as pothole repair; seal coating; repairing utility cuts; milling and overlay projects for streets and sidewalks; mowing rights of way, detention areas and properties purchased after the 2008 flood; street sweeping; as well as other related functions.

1. THE GROUNDS MAINTENANCE SECTION SHOULD DEVELOP ROUTE SHEETS FOR EACH MAINTENANCE CREW.

The Grounds Maintenance Section is responsible for the mowing of approximately 870 acres of right of way in the City. Three Area Drivers, three Light / Heavy Drivers and two Drivers provide these mowing services. The Section has a targeted service level of mowing each of the 870 acres once every six to eight weeks.

The Department has promulgated broad, general procedures for the mowing of City rights of way, which cover acceptable vegetation heights, safety and the schedule with which specific areas of the City are to be mowed. For example, the procedures state that high service areas such as Edgewood Road from O Avenue to Blairs Ferry and other sections be mowed once every three weeks. Rural sections of road may be mowed, "as the ground conditions permit. This includes Otis Road SE, 6th Street SW south of Wright Brothers Road SW and F and E Avenues in past the residential areas."

Although there are certain general procedures and schedules in the Department's "General Operations" section of its standard operating procedures, the Grounds Maintenance Section lacks formal, written task schedules for its mowing crews to assure a consistent level of service delivery in the maintenance of rights of way, and

to assure a consistent work output by these staff. Further, the lack of specificity as to a routing plan prohibits the analysis of the productivity of crews, and subsequently inhibits the supervisor's ability to address any possible imbalances in the workload of the mowing crews.

Grounds maintenance route sheets should be developed to clearly define the work schedule and daily assignments of each position within the Grounds Maintenance Section.

These route sheets should define the routine ongoing maintenance work that is done periodically according to a pre-determined schedule (i.e., daily, weekly, monthly, etc.). The routine nature of this work allows the Section to program the normal mowing schedule in the most efficient sequence and to provide the specific level of service desired for that facility.

Development of these route sheets starts with the determination of what is to be accomplished and the location of where it must be done. Based upon the lengths of road segments, the obstructions, traffic, and other factors which may facilitate or impeded work in a predictable manner, task lists should be developed for each mowing crew member.

After these initial determinations have been made, with the task list and task times developed, the route sheet can be developed for each section of the City. This route sheet lists in tabular form the following information:

- The type of mowing equipment required for each area of a specific segment of right of way;
- The number of acres to be mowed in each segment (available through the GIS);
- The time required to mow each identified segment;

- The frequency for performance of mowing each segment; and
- The total time for performance of all of the mowing for each cycle for all sections of the City.

The route sheets should cover routine maintenance work for a specific employee on a specific route for a two-week period. Each route sheet should list all of the areas to be mowed in the order in which these mowing tasks should be performed, and the day or days on which they should be mowed.

Each employee performing mowing tasks in the Grounds Maintenance Section should be provided a copy of the route sheet on a regular cycle, typically every two weeks.

Recommendation #180: The Grounds Maintenance Section should prepare route sheets for each maintenance route defining the mowing work performed by the staff assigned to each route.

2. THE STREET OPERATIONS DIVISION SHOULD STANDARDIZE WORK METHODS.

The Street Operations Division divides the City into three geographical areas for purposes of assigning work to the various crews, within which three supervisors have responsibility for providing such maintenance activities as street sweeping, asphalt and concrete surface repair and maintenance, alley maintenance and others. In general, the segmentation of the City into geographical areas of responsibility can be very beneficial in terms of maximizing productive time of crews by minimizing travel times, and can even be beneficial in serving as “laboratories” for experimentation with new processes for performing work to analyze which processes are most efficient and effective.

There will typically be variations in crew productivity that relate to various factors such as weather conditions, surface conditions, crew experience, the condition of equipment utilized, etc. However, as the project team analyzed the cost and productivity of the various street maintenance crews in the three areas in the repair of utility cuts, a relatively common work activity, there appear to be substantial differences that may be attributable to factors that are under the control of Division management.

To illustrate the differences in approaches in each of the three areas of the City, the following table provides pertinent details of several projects relating specifically to the repair of utility cuts for the Utilities Department.

Comparison of Sample Utility Cut Repairs by Area

No. Employees	Equipment Used	Labor Hours	Tons of Asphalt	Total Cost	Cost per Ton
Southeast					
7	1 Roller 3 Dumps	3.5	1.71	$147.43	$86.21
4	1 Roller 1 Hot Box 2 Dumps	4.0	3.84	$453.55	$118.11
6	1 Roller 1 Hot Box 2 Dumps 1 Pickup	6.0	3.74	$252.58	$67.54
Southwest					
5	1 Roller 2 Dumps	10.0	2.00	$553.60	$276.90
4	1 Roller 2 Dumps 1 Hot Box	18.0	6.61	$916.51	$138.65
5	1 Roller 2 Dumps 1 Hot Box	10.0	3.64	$444.26	$122.05
5	1 Roller 2 Dumps 1 Hot Box	10.0	2.41	$461.40	$191.45
4	1 Roller 2 Dumps 1 Hot Box	16.0	3.50	$802.36	$229.14
4	1 Roller 2 Dumps 1 Hot Box	12.0	5.25	$601.77	$114.62

No. Employees	Equipment Used	Labor Hours	Tons of Asphalt	Total Cost	Cost per Ton
Northwest					
6	1 Roller 3 Dumps 1 Pickup	12.0	3.00	$582.52	$194.17
5	1 Load all 1 Roller 2 Dumps	7.5	2.50	$573.81	$229.52
6	1 Roller 3 Dumps	12.0	4.00	$556.82	$139.21
5	1 Roller 2 Dumps 1 Pickup	10.0	2.17	$462.88	$213.31
6	1 Roller 3 Dumps 1 Hot Box	9.0	1.80	$561.83	$312.13

The following table provides a summary of the data relating to the sample utility cut repairs performed in each of the three areas.

Area	Total Jobs in Sample	Average No. of Employees per Job	Average Labor Hours per Job	Average Tons of Asphalt Used	Average Job Cost per Ton of Asphalt
Southeast	3	5.7	4.5	3.1	$91.88
Southwest	6	4.5	12.7	3.9	$161.47
Northwest	5	5.6	10.1	2.7	$203.26

As the table above shows, there are marked differences in key aspects of the performance of similar jobs in the three areas. While no two jobs are precisely the same and the numbers of jobs in the sample are not scientifically significant, the outcomes of the jobs in the three areas were performed differently. For example, the area showing the lowest cost per job (Southeast) utilized the greatest number of employees per crew, but displayed the lowest number of hours on each job by a substantial margin. Further, it is clear that the number of hours expended by staff on the job is the only true predictor of total job cost, as the area with the smallest quantities of asphalt per job (Northwest) displayed the highest average cost per job.

The substantial differences between the area in the numbers of hours expended on each job indicates that there are differences in both the methods utilized in completing the jobs and, perhaps, the way they are supervised and managed. The repair of a utility cut is a routine work activity for which staff should be trained in a standard manner to assure a consistent degree of job performance, and one that requires only a few repetitions to master. These wide variations in performance certainly indicate the need to standardize the methods used in repairing utility cuts. One of the steps should be to reduce crew size; the average crew size exceeds metrics.

However, given the routine work activity of utility cut repairs, it is not unreasonable to infer this challenge into other work activities performed by street maintenance crews. Therefore, the Matrix Consulting Group recommends that the Division analyze other work activities such as sidewalk grinding and repair, pothole patching, skin patching, street sweeping, etc., to standardize the crew size, work methods, equipment utilized, work output, etc..

Recommendation #181: The Street Operations Division should identify and analyze the differences in job performance between the three areas.

Recommendation #182: The Street Operations Division should conduct training sessions of the staff of the Street Operations Division in the most efficient and effective methods to perform its primary work activities.

3. THE STREET OPERATIONS DIVISION IS STAFFED AT A LEVEL THAT SHOULD PROVIDE A VERY HIGH LEVEL OF SERVICE FOR THE CITY'S ASPHALT AND CONCRETE STREETS AND SIDEWALKS

The Street Operations Division is staffed with 83 employees who maintain the City's streets in three sections or areas. The employee count is as follows:

Position Title	Number
Street Operations Superintendent	1
Street Supervisor	3
Grounds Maintenance Supervisor	1
Street Pavement Supervisor	1
Heavy Equipment Operator	18
Area Driver	9
Light/Heavy Operator	12
Driver	8
Extra Driver	11
Laborer	10
Traffic Control Maintenance Worker II	5
Cement Finisher	2
Temporary/Seasonal Laborer	2
TOTAL	**83**

Of the total of 83 in the Section, six (6) of these are supervisory and managerial positions, with the remaining 69 employees serving in various roles in field maintenance (excluding the eight non-supervisory staff assigned to grounds maintenance or mowing). The project team utilizes a range of between 15 and 20 centerline miles per field maintenance employee as a benchmark of reasonable staffing. Given that the City has 670 center line miles of paved and concrete surfaces, this equates to 9.7 center line miles per employee, which is a staffing level that is sufficient to provide a very high level of service.

The efficient use and deployment of these staff needs to be enhanced to address the work order backlogs that exist. There are backlogs of work orders in each District. As of June 25, 2014, the West District, for example, had 57 backlogged work requests dating from March 4 to June 25.

The following sections analyze the staffing levels in the Street Operations Division and opportunities to increase the efficiency of some of its work methods.

(1) The Street Operations Division Should Alter the Methods by Which Street Sweeping Is Accomplished.

The Street Operations Division accomplishes street sweeping in each of the three areas of the City, and attempts to sweep each street between two and three times annually. The Division utilizes three pieces of equipment to sweep its streets. These include a street sweeper, a flusher truck to dampen the roadway in front of the sweeper, and a Load-All truck to carry away the debris collected by the sweeper.

The use of a three-person crew for street sweeping is unnecessary, and not typical of other municipalities. This is particularly true given that the street sweepers used by the Street Operations Division are equipped with sprayers to mitigate dust problems, and can therefore eliminate the need for the flusher trucks except in cases of severe dust. Further, dedicating a Load-All truck to each sweeper is unnecessary as these pieces of equipment are idle much of the time awaiting debris loads from the sweeper, particularly since the typical sweeper has a large 6 cubic yard hopper.

The Matrix Consulting Group recommends that the crew size for street sweeping be reduced from three pieces of equipment, with three Equipment Operators, to one street sweeper and one street sweeper operator with designated locations in each area where the street sweeper operators could dump their debris for later collection by a Load-All truck and operator. The sweeper should utilize the spray attachment to dampen the roads and the effects of rising dust. A street flusher should not be utilized. Only one, possibly two, Load-All trucks should be utilized (two Load-All trucks will likely

be required in the fall during the leaf season and in the spring during the initial sweeping).

Recommendation #183: The Street Operations Division should reduce the crew size for street sweeping from a three-person crew to a single street sweeper with designated locations in each area where the street sweeper operators could dump their debris for later collection by a Load-All truck and operator.

(2) Analysis of Other Activities Performed by the Street Operations Division Indicates That There Are Other Opportunities to Reduce Crew Sizes.

As was noted above, the Street Operations Division is staffed at a level that should be producing a very high level of service for the City's streets. However, visual observations, as well as interviews, indicate that this is not the case. There are large segments of concrete and asphalt roadways that are in poor shape, and perhaps in need of reconstruction. To some extent, the allocation of additional funds through the Paving for Progress program will contribute to a road network that is in better condition, but without a focused and ongoing effort to maximize the efficient use of staff resources in the Division, the City may find that its streets are in similar shape to today's condition in the near future.

The Matrix Consulting Group noted, above, a major area in which an alternative approach to staffing could lead to an allocation of fewer resources in the street sweeping function. However, there are other functions for which the Street Operations Division is utilizing larger crew sizes than is generally necessary. For example, the following table displays the optimum crew sizes for specific activities, and the crew sizes utilized by the Street Operations Division.

Activity	Cedar Rapids Crew Size	Optimum Crew Size
Sidewalk Grinding	2	1
Crack Seal	5	4
Utility Cuts	4 to 7	4

Activity	Cedar Rapids Crew Size	Optimum Crew Size
Pothole Patch	2	2
Sign Installation and Replacement	2	1
Pavement Legend Painting	2	2
Street Striping	2	2

As the table shows, the crew sizes utilized in the Street Operations Division are somewhat greater than optimum, based on the Matrix Consulting Group's experience. There are instances in which crew sizes need to vary from "optimum", particularly as they relate to the need for traffic safety. However the Division should analyze the number of instances in which this is the case, and allocate only the minimum crew size necessary for the conditions as the use of, for example, a 3 or 4-person crew in filling potholes results in between 8 and 16 additional hours each day that could be allocated to another, more productive use.

Recommendation #184: The Street Operations Division should reduce crew sizes to the levels recommended by the Matrix Consulting Group.

Recommendation #185: Given the relatively high levels of staffing in the Street Operations Division versus the metric used by the Matrix Consulting Group, the Matrix Consulting Group recommends that the City immediately re-purpose the two vacant positions of Public Works Laborer Extra Driver.

(3) The Street Operations Division Should Improve The Work Output of the Street Sweeper Operators.

As noted earlier in the chapter, the Street Operations Division has historically utilized a three-person crew for street sweeping. The Matrix Consulting Group made a recommendation to reduce this crew size in order to attain a higher level of efficiency in the function. However, in addition to the operational issues related to crew size, the Street Operations Division is not achieving a high level of productivity on a daily basis, and this would be true even if the crew sizes were reduced to recommended levels.

The Department does not report the number of curb miles swept by street sweeping crews on a daily basis, so it is, therefore, not possible to definitively derive the number of hours that crews expend in sweeping these areas. However, the Matrix Consulting Group calculated the rate at which curbs are swept based on a sample in one of the areas from April though late June. In this area, there are 13 routes that sweeper operators sweep before beginning the cycle over again. From early April through June 25, a period of 60 working days, the crews had completed 8 of the 13 routes. The following table provides an estimate of the number of curb miles swept per day.

Element	Number
A. Number of center line miles in District	270
B. Number of miles of curb and/or shoulder (A*2)	540
C. Number of routes per cycle	13
D. Number of routes completed as of June 25	8
E. Percentage of routes completed as of June 25 (C/D)	61.5%
F. Number of curb / shoulder miles completed as of June 25 (E*B)	332.1
G. Number of work days from April to June 25	60
H. Average number of curb/shoulder miles swept per day (F/G)	**5.5**

As the table shows, this District is accomplishing the sweeping of an estimated 5.5 curb / shoulder miles per day, which is a very low figure compared to the 22 to 28 curb / shoulder miles per workday that the Matrix Consulting Group would expect and has observed. It is understandable that the extent of curb miles swept per street sweeper operator would be lower during the first sweeping in the spring, but any subsequent sweepings should be held to this metric.

Recommendation #186: A metric should be established for street sweeper operators of 22 to 28 curb miles per 8-hour workday, and the street sweeper operators should be expected to meet this metric. The extent of curb miles swept

per street sweeper operator would be lower during the first sweeping in the spring, but any subsequent sweepings should be held to this metric.

(4) The Street Operations Division Should Utilize a Mix of Broom and Regenerative Air Street Sweepers.

The Street Operations Division relies solely on broom sweepers. Mechanical broom sweeping technology may be likened to cleaning with a broom and a dustpan. For years, mechanical broom sweepers were the only machines that were used for road sweeping by municipalities and departments of transportation.

In recent times, it has been recognized that modern regenerative air sweepers (not vacuum) have many advantages over mechanical broom sweepers for general road sweeping usage. One reason is that most mechanical sweepers only give the illusion of leaving a clean pavement surface. Although large debris is removed by mechanical broom sweepers, they are virtually ineffective at removing particles 60 microns and smaller. Studies have even shown that, from an environmental standpoint, mechanical broom sweepers may actually have a negative effect on the amount of storm water runoff pollution.

Regenerative air sweepers employ a closed loop, 'cyclonic effect', to clean. They are similar to vacuum sweepers, in that there is a similar vacuum inlet located on one side of the sweeping head. Unlike vacuum machines, however, regenerative air sweepers constantly re-circulate (regenerate) their air supply internally. To accomplish this, the re-circulating air is blasted into the sweeping head on the side opposite the pickup, or inlet tube. Like any other sweeper type, regenerative air machines can be equipped with gutter brooms to brush material accumulated against the curb into the path of the sweeper. Regenerative air models, like any other type of sweeper designed

to clean the entire lane, can be equipped with gutter brooms on both sides of the machine. This affords the operator the opportunity to effectively sweep both sides of a one-way street without creating a traffic hazard. The disadvantage is that regenerative air models can't handle millings, spring cleanup and other extremely heavy-duty applications as well as can mechanical sweepers.

Over time, the Street Operations Division should convert its street sweeper fleet to a mix of mechanical broom sweepers and regenerative air sweepers.

Recommendation #187: Over time, the Street Operations Division should convert its street sweeper fleet to a mix of mechanical broom sweepers and regenerative air sweepers.

4. THE STREET OPERATIONS DIVISION SHOULD ENHANCE ITS POTHOLE PATCHING PROGRAM.

The Division uses an approach to pothole patching known as “throw and roll.”

Generally, that is acceptable on asphalt streets that are in poor condition. It may also be acceptable in the winter as a temporary patch.

It should not be considered acceptable on asphalt streets that are in fair to good condition. Those streets should be patched using an approach that provides a more effective long-term patching technique. That approach is presented below.

- Area to be patched is removed with the most efficient cutting tool for the job: cutting wheel, jack hammer, or cutting saw.
- Remove temporary or defective asphalt from area to be patched. Main arterial streets are dug to a seven inch depth. Five and a half inch depth is used on collector streets. If base under roadway is inadequate, remove to depth where material becomes firm. Refill hole with proper road base and compact.
- Spray asphalt bonding agent around edge of patch.
- Lay three inches of asphalt in hole to be patched, rake level, then compact. Add another layer of asphalt to be raked level and compacted so that finished product

is level with existing asphalt. When patch is complete, it must be smooth and meet defined compaction standards.

- Compaction standards are met with the use of a 4 Ton vibratory steel wheel roller or vibratory plate. Edges of patches are trimmed to prevent damage and future potholing. A tack coat is applied to the edges of the patch to prevent water intrusion.

This is a more traditional approach to patching potholes. It should generally be used on asphalt streets in fair to good condition.

In addition, the pothole patching crews should not merely relay on service requests to determine where potholes should be patched. The pothole patching crews should be assigned to repair potholes in specific areas in the City (e.g., snow plow routes). The areas or routes should be assigned on a rotating basis, and all streets within the City covered within a two-week period. The crews should cover these routes looking for potholes that need to be patched, regardless of receipt of a service request. This will probably not be necessary year-round; this may only be necessary at the beginning of the spring when potholes are most prevalent.

Recommendation #188: The Street Operations Division should enhance its pothole patching methodology for asphalt streets in fair to good condition by square cutting and tack coating the pothole, applying the asphalt in lifts as necessary, and compacting the pothole with a vibratory plate or roller as necessary.

Recommendation #189: The pothole patching crews should be assigned to repair potholes in specific areas in the City (e.g., snow plow routes). The areas or routes should be assigned on a rotating basis, and all streets within the City covered within a two-week period. The crews should cover these routes looking for potholes that need to be patched, regardless of receipt of a service request. This will probably not be necessary year-round; this may only be necessary at the beginning of the construction season when potholes are most prevalent.

5. THE STREET OPERATIONS DIVISION SHOULD ENHANCE ITS CRACK SEALING PROGRAM.

Crack repair with sealing is a preventive maintenance method used to prevent water and debris from entering a crack in the asphalt or concrete street, which might include routing to clean the entire crack and to create a reservoir to hold the sealant. It is only effective for a few years and must be repeated. However, this preventive maintenance treatment is very effective at prolonging the life of the asphalt or concrete street.

The crack repair with sealing work activity includes the following three methods:

- Clean and seal: Used on all types of cracks, it involves using a hot air lance or compressed air to blow out the debris in the crack, then filling with a sealant;
- Saw and sealing of cracks Involves using a pavement saw to create transverse joints at regular intervals along a newly placed pavement, then filling with a sealant; and
- Route and seal is used on transverse and longitudinal cracks, and involves using a pavement saw or router to create a reservoir centered over existing cracks, then filling with a sealant.

Crack sealing is effective for streets in good condition, not for streets that have alligator cracking. Crack sealing is best used for minor or moderate surface cracking. It is not meant to seal severely affected areas like alligator cracking because excessive use may cause the surface of the pavement to become slippery.

Cracks that are sealed are typically less than 3/4-inch wide. Sealing cracks in asphalt or concrete streets helps prevent moisture from infiltrating the structure. This moisture weakens the structural subsurface layers and is a primary cause of pavement deterioration. Although the benefits of crack sealing may not be obvious immediately,

they will be evident several years later when a sealed pavement shows fewer signs of deterioration than an unsealed pavement.

The crack sealing work activity should include cleaning cracks of all dirt, sand and debris using no less than an air compressor; applying rubberized sealants; and using a squeegee to force the sealant into the cracks. Crack seals should be applied when the street surface is not less than 35°F and rising. In most cases, between March 1 and December 1, temperature should not be a major problem.

Streets that are planned for microsurfacing or seal coating should typically be crack sealed one year prior to the microsurfacing or seal coating; this will require coordination with the Engineering Division. Streets constructed, seal coated, or overlaid 3 to 5 years previously should also be crack sealed. In addition, the Street Maintenance Supervisors should conduct condition assessments of the streets in their area that are in generally good condition and identify streets that need crack sealing. Generally, streets should be crack sealed on a 5 to 7 year cycle, the same cycle as used for seal coats.

The Street Operations Division does utilize crack sealing. In FY 2011, FY 2012, and FY 2013 the Division used an average of 90,200 pounds per fiscal year. The estimate by the Street Operations Division is that approximately 85 to 128 centerline miles of streets are crack sealed each year. Overall, the amount of centerline miles crack sealed each year seems appropriate.

Recommendation #190: Streets that are planned for microsurfacing or seal coating should be crack sealed one year prior to the microsurfacing or seal coating; this will require coordination with the Engineering Division. Streets constructed, seal coated, or overlaid 3 to 5 years previously should also be crack sealed. In addition, the Street Maintenance Supervisors should conduct condition assessments of the streets in their assigned geographical areas and identify

streets that need crack sealing. Generally, streets should be crack sealed on a 5 to 7 year cycle, the same cycle as used for seal coats.

6. THE STREET OPERATIONS DIVISION SHOULD ENHANCE ITS SIDEWALK GRINDING PROGRAM.

The Engineering Division conducts a physical inspection of the City's sidewalks on a 4-year cycle. One of the outcomes of the inspection should be the identification of sidewalks that need grinding. This list should be provided to the Street Operations Division. The Street Operations Division should utilize that list to assign work orders to its crews.

Concrete grinding is a method typically used to remove "stub toes" that are 1 inch high or less, perpendicular to the flow of pedestrian traffic. Stub toes are areas in the sidewalk where part or all of one square is higher than the one next to it, causing a tripping hazard for pedestrians. It may be possible to eliminate the stub toe hazard by grinding down the high edge.

At the present time, the Division does not allocate much in the way of its staff resources to concrete grinding. There were only 384 labor hours expended in sidewalk milling and grinding operations in 2013, which equates to about 128 hours per area. Given that the crew size for a grinding crew is two laborers, this equates to about 8 days per District dedicated to sidewalk grinding.

Accomplishing the reduction of crew size will require that a pickup truck be modified with a tommy lift to enable the lowering and raising of the sidewalk grinder into the bed of the pickup truck.

Recommendation #191: The Engineering Division, as part of its physical inspection of the City's sidewalks on a 4-year cycle, should be to identify sidewalks that need grinding. This list of sidewalks that need grinding should be

provided to the Street Operations Division. The Street Operations Division should utilize that list to assign work orders to its crews to grind these sidewalks.

Recommendation #192: The Street Operations Division should use a 1-person crew for sidewalk grinding. Accomplishing the reduction of crew size will require that a pickup truck be modified with a tommy lift to enable the lowering and raising of the sidewalk grinder into the bed of the pickup truck.

7. THE PLANNING AND SCHEDULING OF THE WORK OF THE CONCRETE CREWS SHOULD BE ENHANCED.

The Street Operations Division has a significant number of staff resources for the maintenance of its concrete streets. These resources are depicted in the table below.

Function	Staffing By Classification		Roles and Responsibilities
Concrete Sawing	Area Driver Laborer	1 1	• These two staff work as a single crew, and are responsible for pre-sawing the holes for removal of concrete, usually two to three weeks ahead of the removal crew.
Concrete Removal	Heavy Equipment Operator Area Driver	2 2	• These four staff work as a single crew, and are responsible for the excavation and removal of concrete including the excavation of the holes, cutting rebar, hand digging around utilities, etc.
Concrete Grading	Area Driver	2	• These two staff work as a single crew and are responsible for the hauling of rock, setting the grade for the pouring of concrete using a bobcat, hand raking areas that the bobcat cannot grade, vibra-tamping the base, etc.
Concrete Pouring	Concrete Finisher Area Driver Laborer	2 1 3	• These six staff operate as a single crew setting the forms for the pouring of concrete, adjusting the grade if needed, setting the drilling holes for rebar, pinning and pasting holes, pouring and finishing the concrete, screeding the concrete to match the existing street, spraying a cure on the finished work, barricading the work, removing forms when the concrete is cured, cleaning up the site, etc.

This is appropriate. An estimated one-half of the City's streets are concrete. Concrete streets have a long life span, if constructed correctly, with little maintenance required compared to asphalt streets.

However, the planning and scheduling of the work of these staff resources needs to be improved dramatically. The staff of this section has a list of streets that need concrete replacement in 2014, but that is all. For example, the list for the west district is presented below.

Arterial Streets
Shaver Rd N.E. From Bridge To J Ave. (Phase 2)
J Ave Ne From Wenig To Shaver Road
O Ave NW From Hillside Drive To #3200
Residential Streets
332 Floral Drive N.W.
Burch Ave N.W. From 19th St To 22nd
19th St N.W. From 1st Ave To Johnson Ave
Franbrook Terrace N.W.
Ravenwood Terrace N.W. From 29th Street To #3117
11th St N.W. North of O Ave
3801 Jackson Drive N.W.
211 Coblestone Drive N.W.
142 Harbet Ave N.W.
3225 & 3231 Elain Drive N.W.
3732 Old Orchard Drive Ne
Adirondack Drive N.E. From Whitney To Blue Ridge
Morelle Road N.E. = 4900 Block

The supervisor for concrete maintenance and repair should be held accountable for generating a plan and schedule in more detail regarding the work to be done. This should be expected since the supervisor is marking the area to be repaired or replaced anyways. This plan and schedule should include:

- Whether the work needed involves repairing concrete spalls (partial depth repair) or replacing slabs / panels;
- The number of slabs or panels to be replaced;
- The square yards of concrete spalls to be repaired;

- Estimates of the labor, equipment and materials required;
- The work processes to be utilized and the sequencing of those processes (concrete sawing, concrete removal, etc.) by week and month; and
- The timing (what week and month) and priority of the work at any location relative to the other locations.

The City is allocating a significant amount of staff to the maintenance and repair of its concrete streets. These staff cannot be more productive than the work planning and scheduling system allows them to be. Work planning decides what, how and a time estimate for a job. Work scheduling decides when and who will do the job. The work planning of a job should be done before work scheduling of a job. The Street Pavement Supervisor should do both.

Recommendation #193: The supervisor for concrete maintenance and repair should be held accountable for generating a formal written plan and schedule in more detail regarding the concrete work to be done. The supervisor should plan the work of the concrete crews three to six months at a time at a time, planning what, how and a time estimate for a job. The supervisor should schedule the work, scheduling when and who will do the job a week at a time, using EnerGov.

8. THE STREET OPERATIONS DIVISION SHOULD UTILIZE MORE TYPES OF WORK ACTIVITIES TO REPAIR CONCRETE STREETS.

The Concrete Section of the Street Operations Division relies largely on one or two work activities to repair concrete streets: full panel repair or replacement of the concrete street from curb to curb. Another crew will crack seal concrete streets.

There are a much fuller range of maintenance and repair strategies for concrete streets. These range of work activities are presented below.

- Partial depth repair;
- Full-depth repair;
- Dowel bar retrofit;

- Cross stitching;
- Slab stabilization;
- Panel replacement; and
- Street replacement (curb-to-curb).

These are not radical, left field strategies. These are strategies promulgated by the *American Concrete Pavement Association*.

The Concrete Section of the Street Operations Division appears to have a tendency and preference for two repair strategies: panel replacement and street replacement (although other strategies will be used infrequently).

The Engineering Division should work with the Street Operations Division to develop work activity guides for concrete maintenance and repairs that will identify when each strategy will be employed.

In particular, the Section does not utilize partial depth repair for concrete spalling. This is not a radical, left field strategy. It is a strategy promulgated by the American Concrete Pavement Association. Partial-depth repairs correct surface distress and joint / crack deterioration in the upper third of a concrete slab. The Association also recommends full-depth repairs, versus full panel replacement, to repair shattered slabs, corner breaks, punchouts, and some low-severity durability problems.

Recommendation #194: The Engineering Division should work with the Street Operations Division to develop work activity guides for concrete maintenance and repairs that will identify when each maintenance and repair strategy will be employed. The Engineering Division should arrange for the provision of training in the application of maintenance and repair techniques other than joint sealing, panel replacement, and replacement of the street (curb-to-curb).

9. THE CLASSIFICATION STRUCTURE OF THE STREET OPERATIONS DIVISION SHOULD BE SIMPLIFIED.

The Street Operations Division uses a complex series of classifications for its staff. The classifications include Public Works Laborer Extra Driver, Streets Driver, Streets Area Driver, Streets Heavy Equipment Operator, Streets Light / Heavy Equipment Operator, West Streets Supervisor, Streets Supervisor - District, Streets Pavement Supervisor, and Streets Ground Control Supervisor.

This is a much more complex series of classifications than the Matrix Consulting Group has observed elsewhere in comparable cities. The complexity of the classification structure impedes managerial and supervisory flexibility and career development / promotional opportunities.

The classification series should be simplified and the number of classifications reduced. The revised series should also include a crew leader classification.

Recommendation #195: The classification series utilized for the Street Operations Division should be simplified and the number of classifications reduced. The revised series should also include a crew leader classification.

10. THE SUPERVISORS IN THE STREET OPERATIONS DIVISION SHOULD BE ROTATED.

With the reclassification of the supervisors in the Street Operations Division into a single classification, the Street Operations Division should initiate a program of rotation of these supervisors among the different sections. The rotation has a number of benefits as noted below.

- Job rotation provides benefits to both employees and the Division, job rotation increases employee interest level and motivation.
- Job rotation provides the Division greater depth at supervisory positions across the Division. By moving supervisors around, the Division develops more supervisors with skills in each area. If a supervisor requires a leave of absence,

goes on vacation or needs a day off, it's good to have several capable replacements to step in and take on the work.

- With job rotation in place, supervisors can move around and avoid falling into a rut in one position. Over time, supervisors develop more skills in a wider array of disciplines. This provides job stability and equips them for better opportunities to earn promotions. All of these advantages, and better overall development, makes supervisors more valuable to the Division.

A job rotation strategy comes with costs. When the Division moves supervisors into multiple positions, the Division must invest time and money into training the supervisors in all those positions.

Recommendation #196: With the reclassification of the supervisors in the Street Operations Division into a single classification, the Street Operations Division should initiate a program of rotation of these supervisors among the different sections.

11. THE STREET OPERATIONS DIVISION SHOULD DEVELOP AND INSTALL A FORMAL WORK PLANNING AND SCHEDULING SYSTEM.

Street Operations is responsible for the maintenance and repair of aging infrastructure. This requires that the talents and skills of staff be planned and scheduled so that these resources can be effectively utilized to maintain and repair this aging infrastructure.

In addition to identifying potential failures in the street and addressing those failures, Street Operations must also focus its resources given the extensive backlog of repairs. With increasing responsibilities, the efficiency of Street Operations staff resources easily becomes a first priority. Unless work is effectively planned and scheduled, Street Operations will experience a slippery slope as less work is completed, more street failures occur, and the time of Street Operations staff is spent repairing failures, not on preventing the failure from happening. The only way to break this cycle is a systematic approach maintenance planning and scheduling.

Planning and scheduling for Street Operations must be a disciplined approach for utilizing its staff resources. This is accomplished through:

- Prioritizing work;
- Developing the physical steps to complete the job;
- Procuring necessary tools and materials;
- Scheduling the work to be done;
- Completing the work; and
- Identifying any additional work to be completed on the asset.

Street Operations should take a number of steps to install a planning and scheduling system. These steps are presented below.

- **Create and utilize work orders, using EnerGov, for all of the work performed by Street Operations staff**. The work order should serve as the basis for identification of requests for services, or work. A work order does basic things for Street Operations. First, it alerts the responsible unit (Streets, Concrete) of a requirement for services. Second, the work order describes the work or services to be performed. Third, the work order authorizes expenditures for the described work (asphalt, concrete, signs). Finally, an effective work order system will enable tracking of performance in the accomplishment of such work. The Division is able to know when the work was required, when it was completed, who performed the work, and the cost of performing that work. Thus the work order system is the backbone of a planning and scheduling system. The work order should include date, name of the requestor, location of the work, nature of the work, priority of the work, etc.

- **A three to six month schedule should be prepared using EnerGov**. A three to six month schedule is a process of balancing workload, both current and anticipated workload demand. This is especially important for the Division given the large backlog of street and concrete repairs. By defining the current workload and anticipating future workloads, the Division's supervisors will be able to make an informed decision on the amount of work that can be accomplished given the staff resources available. The Division's staff resources must be balanced with the workload so that there are enough people and materials to accomplish the work, but not more people and materials than needed or more workload than can be realistically accomplished. This can be accomplished by documenting the available work hours and then documenting work hours required for concrete maintenance repair, street maintenance and repair, and signs and marking

maintenance and repair given the backlog, given service requests received via EnerGov, etc.

- **Develop a weekly schedule using EnerGov.** The weekly schedule for the Division is the plan for assigning staff resources to specific jobs in the coming week. The weekly schedule is normally developed on a Wednesday or Thursday of the preceding week. The assignment of staff resources is based on several factors:

  – Available work hours. This can be affected by planned leave, holidays, attrition, and other factors;

  – Available materials and equipment. To accurately schedule, the supervisors must communicate realistic delivery dates for necessary materials;

  – Rate of success in the current week's schedule; and

  – Priorities. The overall plan of the master schedule becomes a guide in developing priorities for the weekly schedule.

  A weekly schedule does not necessarily define the work of individual staff, but rather the number of hours by a crew to be spent each day on specific work orders.

- **The work should be tracked and reported using EnerGov**. Tracking work progress and reporting on work progress is another important part of the planning and scheduling system. Reporting on work is the process of communicating with management and customers the current progress and the current plans for a concrete repair work, street maintenance repair work, signs and markings repair work. Weekly schedule compliance is an effective method of tracking progress. For instance, how close was the actual weekly execution of the work in relationship to the plan developed in the weekly schedule? How effectively is the backlog of concrete repair work and street maintenance repair work dissipating?

The planning and scheduling system allows the Division's supervisors to manage what, when, how, how much, and how well Street Operations performs its work. The system can be complex and computerized, with full scheduling and tracking controls, or more informal, with a minimum of control. Street Operations must find the right balance of control to enable it to meet its goals and objectives in supporting the Department's

mission.

Recommendation #197: The Street Operations Division should develop and install a formal work planning and scheduling system using EnerGov.

12. THE EQUIPMENT OPERATORS OBTAINING HOT MIX ASPHALT FOR THE STREET OPERATIONS DIVISION SHOULD BEGIN THEIR SHIFT EARLIER.

The Marion asphalt plant is located at 3765 3rd Avenue. That is approximately 10 miles distance from the City Service Yard, or approximately 23 minutes one-way, without traffic, for a dump truck. Once at the plant, the dump truck must get in line with other dump trucks for a load-out. In the morning, there may be a significant number of trucks waiting for load-out. Getting the load, the load ticket, tarping the load, and getting the materials sample could take 5 to 10 minutes. And then the dump truck must haul the asphalt to the job site, at least another 23 minutes away. Altogether, obtaining a load of asphalt could require an hour. Meanwhile, the asphalt crew would largely be idle, waiting for the asphalt to be delivered to the job site.

This work method should be altered. The equipment operator responsible for picking up the asphalt hot mix from the asphalt plants should begin their work day one hour earlier than the Street Operations Division staff assigned to asphalt repair of streets. This would result either in the equipment operator finishing their shift one hour earlier than the other staff assigned to asphalt repair of streets or the conversion of the position to a 4 / 10 hour shift for those months the Division is repairing streets.

Recommendation #198: The work method for pick and delivery of asphalt hot mix should be altered. The equipment operator responsible for picking up the asphalt hot mix from the asphalt plants should begin their work day one hour earlier than the Street Operations Division staff assigned to asphalt repair of streets. This would result either in the equipment operator finishing their shift one hour earlier than the other staff assigned to asphalt repair of streets or the conversion of the position to a 4 / 10 hour shift for those months the Division is repairing streets.

13. THE STREET OPERATIONS DIVISION SHOULD PROVIDE ITS OWN SIGNAGE FOR TRAFFIC CONTROL FOR THE WORK THAT THE DIVISION PERFORMS.

At the present time, the Street Operations Division relies on the Traffic Maintenance Workers to provide traffic control signage setup and take down for the jobs that the Division performs.

This practice should be changed immediately. The Public Works Operations Superintendent should develop a policy and procedure for the traffic control for street maintenance jobs performed by the Street Operations Division, in consultation with the Traffic Engineering Division. Upon development of the policy and procedure, the Public Works Operations Superintendent should coordinate the training of all of the staff in the Street Operations Division in the application of this policy and procedure.

Once the policy and procedure has been developed and training provided, the staff of the Street Operations Division should provide traffic control signage setup and take down for their jobs, and not rely on the Traffic Maintenance Workers.

Recommendation #199: The Public Works Operations Superintendent should develop a policy and procedure for the traffic control for street maintenance jobs performed by the Street Operations Division, in consultation with the Traffic Engineering Division. Upon development of the policy and procedure, the Public Works Operations Superintendent should coordinate the training of all of the staff in the Street Operations Division in the application of this policy and procedure.

Recommendation #200: Once the policy and procedure has been developed and training provided, the staff of the Street Operations Division should provide traffic control signage setup and take down for their jobs, and not rely on the Traffic Maintenance Workers.

9. ANALYSIS OF THE SEWER OPERATIONS DIVISION

The Sewer Operations Division is responsible for the maintenance of the sanitary sewer, storm sewer, and drainage ways of the City, and is comprised of 31.35 full time equivalent personnel engaged in such activities as televising and inspecting sewer lines, operating and maintaining force mains and manholes, and complying with the National Pollutant Discharge Elimination System (NPDES) MS-4 storm water permit requirements.

1. THE SEWER OPERATIONS SECTION SHOULD BEGIN TELEVISING ITS STORMWATER COLLECTION SYSTEM.

Historically, the Sewer Operations Division has televised a very large percentage of the City's sanitary sewer system. Typically, municipalities televise 7% to 8% of their systems annually in order to identify specific areas of the system that exhibit problems related to grease blockage, inflow and infiltration, structural weakness, and other issues. The Sewer Operations Division, however, televised 18% of the system in 2011, 25% in 2012, and 18% in 2013. This is an unusually high percentage of the system, and would normally be performed at this level only if structural failures were at abnormally high levels. However, data indicate that sanitary sewer overflows have been within normal levels, and the numbers of main breaks, at about six per 1,000 miles of line, are well below typical levels.

The Sewer Operations Division, however, does not televise its stormwater collection system. Nor does the Division clean stormwater mains except in response to complaints or flooding problems. Discharges to the City's storm system are not composed entirely of stormwater runoff, and the chemicals and solids that are conveyed

into the storm system contribute to increased levels of nonpoint source pollution and to the degradation of surface waters. The City's MS4 permit requires that checks be performed on illicit discharges and to reduce these to allowable levels. In addition, structural failures in the stormwater conveyance system can lead to groundwater contamination, and televising these lines can be a valuable tool in reducing, and even eliminating, non-stormwater discharges into the storm sewers.

Furthermore, televising these lines can help the Sewer Operations Division obtain a more accurate understanding of the total system, identify illicit discharge points, inadvertent cross connections, and other problems that would not have been known without televising the lines. As the lines are televised, the crews should document the specific failure types and prioritize their repairs. The failure types may reflect the specific operating condition found in the City's storm system, however the following is suggested as a starting point:

- Failed coatings or lining
- Residential connection leak
- Illegal connection
- Pipe Corrosion
- Fats, Oils and Grease (FOG)
- Broken Pipes
- Debris
- Line Deflection
- Joint Separation
- Crushed/Collapsed Pipe

- Offset Joints
- Root Intrusion
- Minor Cracks
- Other

The televising of the stormwater collection system will identify pipe reaches in need of repair, pipe reaches that need cleaning due to the accumulation of debris, identify illicit discharges, etc. For a City that has recently experienced flooding due to significant weather events, the televising of the stormwater collection system is an essential preventive maintenance measure.

The Sewer Operations Division should televise the stormwater collection mains on a twelve-year schedule. The City has 511 miles of stormwater collection mains. This would require that the Division televise approximately 43 miles of stormwater collection mains annually. . The annual staffing requirements to clean catch basins on an annual basis are presented in the table below.

Work Activity	Inventory	Unit	Level of Service	AWQ[17]	ADP[18]	Annual Crew Days	Crew Size	Annual Labor Days
Televise stormwater mains	511	Miles	Twelve year cycle	43	3,000 l.f.	76	2	152

As the table indicates, the workload implications of this level of service are not significant.

Recommendation #201: The Sewer Operations Division should begin a program of televising approximately 7% to 8% of its stormwater collections system on a 12-year cycle until it has completed an inspection of the entire system.

[17] AWQ = annual work quantity
[18] ADP = average daily productivity

2. THE SEWER OPERATIONS DIVISION SHOULD INSPECT, AND CLEAN IF NECESSARY, THE DRAIN INLETS ON AN ANNUAL BASIS.

The City's catch basins / drain inlets are not inspected annually, and cleaned when the depth of deposits reaches 40% of the sump depth as measured from the bottom of the basin to the invert of the lowest pipe into or out of the basin (in no case should there be less than 6 inches clearance from the debris surface to the invert of the lowest pipe). Instead, the Division inspects and cleans approximately 10% of the catch basins / drain inlets on an annual basis.

During the leafy season in the fall, catch basins can become plugged.

The Division should use a simpler process to inspect and clean these catch basins. It should not use a jet vactor to clean all basins. Rather, the Division should use a 1-person crew and a manual cleaning process, with the jet vactor only scheduled if there is a presence of 5 cubic yards of debris or heavy debris. Typically, the Matrix Consulting Group would expect 90% of the catch basins to be inspected and cleaned manually, versus 10% with a jet vactor.

The Matrix Consulting Group would expect the Division to be able to inspect, and clean if necessary, 40 catch basins a day, using the 1-person crew. The Matrix Consulting Group would expect the Division to be able to clean 15 catch basins a day using the 2-person jet vactor crew. The annual staffing requirements to clean catch basins on an annual basis are presented in the table below.

Work Activity	Inventory	Unit	Level of Service	AWQ[19]	ADP[20]	Annual Crew Days	Crew Size	Annual Labor Days
Inspect catch basins (90% of inventory)	615	Catch Basin	Annual	553	60	9.22	1	9.22
Jet Vactor clean catch basins (10% of the inventory)	615	Catch Basin	Annual	62	25	2.48	2	4.96

As the table indicates, the workload implications of this level of service are minimal.

Recommendation #202: The Sewer Operations Division should clean catch basins using a 1-person crew and a manual cleaning process, with a jet vactor only scheduled if there is a presence of 5 cubic yards of debris or heavy debris in a catch basin.

Recommendation #203: The Sewer Operations Division should inspect and clean catch basins on an annual basis.

3. THE SEWER OPERATIONS DIVISION SHOULD ESTABLISH A FATS, OILS AND GREASE PROGRAM.

The Sewer Operations Division should prepare and implement a grease, fat, and oil source control program to reduce the amount of these substances discharged to the sewer collection system. This program should include the legal authority to prohibit discharges to the system and identify measures to prevent overflows or backups caused by fats, oils, and grease blockages of sewers.

The elements of an effective grease control program should include requirements to install grease removal devices (such as traps or, preferably, interceptors), design standards for the removal devices, maintenance requirements, best management practice requirements, record keeping and reporting requirements.

[19] AWQ = annual work quantity
[20] ADP = average daily productivity

An effective grease control program must also include authority of the staff of the Sewer Operations Division to inspect grease producing facilities, enforce the requirements, and inspection of the facilities to enforce the grease ordinance. The program should include annual routine inspections of food service establishments, inspection at any time in response to complaints or reports of sewer blockages, and verification during the inspection that all required fixtures are connected to a grease treatment device, that the grease treatment device is adequately sized, installed, and maintained, and that grease is collected on an ongoing basis.

Recommendation #204: The Sewer Operations Division should prepare and implement a grease, fat, and oil source control program to reduce the amount of these substances discharged to the sewer collection system.

4. THE CCTV CREW SHOULD UTILIZE THE NASSCO PIPELINE ASSESSMENT AND CERTIFICATION PROGRAM RATING SYSTEM.

The Sewer Operations Division utilizes a digital video pipeline inspection system. Under this system, a CCTV crew gathers video and data for each pipe segment to identify any deficiencies and review the tapes and video logs to determine if the sewer facilities should be repaired or replaced.

The Sewer Operations Division should use the *Pipeline Assessment and Certification Program* rating system, which was developed by the *National Association of Sewer Service Companies*. The *Pipeline Assessment and Certification Program* rating system requires CCTV operators to code defects either by infrastructure or maintenance defect. Each defect code is assigned a grade of 1 to 5, with 1 being the least severe and 5 being the most severe defect. These grades only consider the internal pipe conditions obtained from the televised inspection. After a sewer segment

has been inspected, several grading systems can be applied to determine the most severe pipe segments.

Recommendation #205: The Sewer Operations Division should use the *Pipeline Assessment and Certification Program* rating system, which was developed by the *National Association of Sewer Service Companies,* to code defects either by infrastructure or maintenance defect.

5. THE EMPLOYEE ASSIGNED TO THE COLLECTION SYSTEM MAINTENANCE WORKER III – TELEVISOR SHOULD BE REASSIGNED TO COLLECTION SYSTEM MAINTENANCE WORKER IV.

There is one employee in the Sewer Operations Division assigned to the Collection System Maintenance Worker III – Televisor classification. This employee functions as a leadworker, much like that described by the classification description for Collection System Worker IV. In fact, the distinguishing features for the classification description of Collection System Worker IV state "*the personnel will be the lead operator for the use of a Jetter Vacuum combination truck that employs a jet propelled camera for investigation of sanitary sewer lines and Construction crew. The Collection System Maintenance Worker IV operates mainline camera systems*."

The classification of Collection System Maintenance Worker III – Televisor is unnecessary. The classification should be eliminated. The incumbent of the Collection System Maintenance Worker III – Televisor classification should be reassigned to the Collection System Maintenance Worker IV classification.

Recommendation #206: The classification of Collection System Maintenance Worker III – Televisor is unnecessary. The classification should be eliminated.

Recommendation #207: The incumbent of the Collection System Maintenance Worker III – Televisor classification should be reassigned to the Collection System Maintenance Worker IV classification.

6. THE SEWER OPERATIONS DIVISION SHOULD ORDER AND PLACE THE CONCRETE FOR THE MANHOLE RINGS WHEN THE JOBS DO NOT INVOLVE REPLACEMENT OF CONCRETE PANELS OR THE CONCRETE STREET (CURB TO CURB).

At the present time, the Street Operations Division will request Sewer Operations Division to order, place, and finish the concrete for manhole rings when the Street Operations Division is replacing a concrete panel or the entire street (curb to curb). In these instances, the Street Operations Division should order, place, and finish the concrete for manhole rings itself.

The Sewer Operations Division, itself, should order, place, and finish the concrete for manhole rings when the Division is repairing or reconstructing manholes as a single and separate job.

Recommendation #208: When the Street Operations Division is replacing a concrete panel or the entire street (curb to curb), the Street Operations Division should order, place, and finish the concrete for manhole rings.

Recommendation #209: The Sewer Operations Division, itself, should order, place, and finish the concrete for manhole rings when the Division is repairing or reconstructing manholes when the Division is repairing or reconstructing manholes as a single and separate job.

7. THE SEWER OPERATIONS DIVISION SHOULD DEVELOP AND INSTALL A FORMAL WORK PLANNING AND SCHEDULING SYSTEM USING ENERGOV.

The Water Environment Federation published in 2004 "*The O & M in CMOM" [Capacity, Management, Operations and Maintenance] Operation and Maintenance – A Reference Guide for Utility Operators*." This publication noted that cleaning, root removal, and pump station service are the most important routine maintenance activities, although a total of twelve (12) key maintenance activities are still necessary for a balanced routine maintenance program.

The guide states that a good preventive maintenance program is one of the best ways to keep a system in good working order and prevent service interruptions and system failures that can result in overflows and / or backups. In addition to preventing service interruptions and system failures, a preventive maintenance program can protect the capital investment in the collection system. The publication states that preventive maintenance activities should ensure that the agency:

- Routinely inspects the collection system, including pump stations, and addresses defects or other problems.
- Investigates complaints and promptly corrects faulty conditions.
- Provides maintenance records, an adequate workforce and appropriate equipment in working order.
- Maintains and updates a schedule of planned activities.

The Sewer Operations Division should develop a formal planning and scheduling system. This system should include the elements presented below.

- **Create and utilize work orders in EnerGov for all of the work performed by Sewer Operations staff using EnerGov**. The work order describes the work or services to be performed. The work order should include the date, name of the requestor, location of the work, nature of the work, priority of the work, etc.
- **A three to six month schedule should be prepared in EnerGov**. A three to six month schedule is a process of balancing workload, both current and anticipated workload demand. This can be accomplished by documenting the available work hours and then documenting work hours required for sewer maintenance, catch basin maintenance and inspection, service requests received via EnerGov, etc.
- **Weekly schedules should be prepared in EnerGov** providing the number of staff required, work hours, and the Sewer Operations supervisor should prepare the job duration information.
- **Weekly and daily schedules should be adhered to as closely as possible**. Proper priorities must be placed on new work orders to prevent undue interruption of these schedules.
- **The Sewer Operations supervisor should develop a one-week schedule in**

EnerGov for each crew based on work hours available, the forecast that shows job priorities, and information from the three to six month plans.

- **The one-week schedule should assign work for every available work hour**. The schedule allows for emergencies and high priority, reactive jobs by scheduling a significant amount of work on easily interrupted tasks.

- **The Sewer Operations supervisor should develop a daily schedule one day in advance in EnerGov** using current job progress, the one-week schedule and new high priority, reactive jobs as a guide. The Sewer Operations supervisor should match personnel skills and tasks. The Sewer Operations supervisor should handle the current day's work and problems even to rescheduling the entire crew for emergencies.

- **The Sewer Operations supervisor should track and report the work in EnerGov.** Tracking work progress and reporting on work progress is another important part of the planning and scheduling system. Weekly schedule compliance is an effective method of tracking progress. For instance, how close was the actual weekly execution of the work in relationship to the plan developed in the weekly schedule?

Schedule compliance is a measure of the effectiveness of managers and supervisors.

Recommendation #210: The Sewer Operations Division should develop and install a formal work planning and scheduling system using EnerGov.

8. A GIS ANALYST POSITION SHOULD BE AUTHORIZED FOR THE PUBLIC WORKS DEPARTMENT.

The Public Works Department must quickly respond to crises, manage high volumes of data, and manage workflow. To meet the growing needs of the City and to effectively work with other departments, the Department needs to be able to rely on updated enterprise geographic information system (GIS) technology.

GIS organizes geographic data so a person can select data necessary for a job such as road repairs, tree trimming, or solid waste collection. An enterprise-wide GIS allows all sections within a department, even those with little or no GIS experience, to share and easily access data, which facilitates better communication, improves data

integrity, and enhances productivity within a department and with other departments. Employees can tap into the Department's database to create maps, design new projects, build and maintain the infrastructure, and make decisions based on current and accurate information. GIS applications such as asset management, street sweeper routing, traffic analysis, mobile computing, pavement management, and work order management make it easier to understand a problem, participate in a project, and communicate ideas.

The Public Works Department is authorized two GIS positions within the Sewer Operations Division. Those staff can only work on GIS for the Sewer Operations Division.

There is a need for a third GIS position to work on the development and updating of GIS layers for streets, bridges, snow control routes, street sweeping routes, traffic signals, street striping and pavement legends, regulatory signs, capital project location mapping, survey control points, easement locations, City-owned right of way, etc.

The City should authorize a third GIS position for the Public Works Department to fulfill this role. The role of the GIS position should be to develop and maintain the geographic information systems (GIS) databases, coverages, and linkages to various databases including reading and interpreting source documents, such as civil engineering plans, plot maps, and legal descriptions; and entering required data into the GIS. The essential functions fulfilled by this position should include the following:

- Perform complex GIS analysis and mapping; analyze cartographic and statistical data and prepare reports, charts, and tables, and coordinate with managers and supervisors to address and respond to mapping, tabular, analytical, and report needs;
- Confer with divisions to coordinate system integration and define required output,

and work with divisions to ensure specific requirements are met;

- Provide quality assurance and control for map layers, seeking out appropriate information for mapping purposes, and perform field checks to verify locations of infrastructure;

- Perform data entry and data conversion through tablet digitization, on-screen digitization, keyboard data entry, scanning, GPS, remote sensing analysis, portable data entry units, and field data collection, preparing, designing and printing maps and related information, and communicating GIS related information to Department staff and the public;

- Research, collect, compile, evaluate, reconcile, integrate, and analyze complex spatial data and attributes for mapping; edit geographic and tabular data; maintain metadata and documentation, online and hard copy;

- Analyze and manipulate databases to support a variety of infrastructure planning, engineering, administrative, and other applications; design and produce high quality cartographic output suitable for publication and public display;

- Present maps and data to Department staff; analyze and present demographic and census data; respond to a variety of inquiries and requests for information and resolve issues or complaints; and

- Train and assist Department staff with GIS applications and software.

The Department lacks a general fund GIS position resource necessary to update and maintain the mapping systems and GIS layers databases, coverages, and linkages.

This position should be funded by the general fund, but report to the Utility Infrastructure Management / Specialist III in the Sewer Operations Division.

However, a centralized GIS data repository should be maintained by the Information Technology Department. The centralized GIS data repository will generate cost savings resulting from reduced effort to retrieve, verify currency, and distribute GIS data to other divisions, departments, and external users. Additionally, a centralized GIS data repository will minimize duplicative copies of typically very large files and reduce hardware components such as server space. Finally, the greatest benefits of the Hub

would be for casual users who could begin accessing GIS data from their desktop computers. To minimize duplicative or outdated data sets stored at other locations, all GIS data should be provided at the Hub in the Information Technology Department.

Recommendation #211: The City should authorize a third GIS position for the Public Works Department. The position should be funded by the general fund, but be placed under the supervision of the GIS staff in the Sewer Operations Division.

9. THE GIS POSITIONS IN THE PUBLIC WORKS DEPARTMENT SHOULD BE CLASSIFIED USING THE SAME CLASSIFICATION STRUCTURE AS THE INFORMATION TECHNOLOGY DEPARTMENT.

The GIS positions in the Information Technology Department and the GIS positions in the Public Works Department are assigned to different classification series. The GIS positions are assigned to GIS classifications such as GIS Data Analyst, GIS Project Specialist, etc. The GIS positions assigned to the Public Works Department are assigned a classification series entitled Utilities Infrastructure Management Specialist.

The Utilities Infrastructure Management Specialist is responsible for the maintenance of GIS layers for the Sewer Operations Division; developing and maintaining sewer infrastructure databases such as sewer laterals, sewer piping segments, etc.; conducting complex analysis using ArcInfo or ArcGIS; filtering, formatting, processing and uploading geospatial data such as data from the CCTV crew; etc. This is the work expected of a GIS Analyst.

The two Utilities Infrastructure Management Specialist positions within the Public Works Department should be reallocated to the GIS Analyst classification series.

The Utilities Infrastructure Management Specialist classification series should be eliminated.

Recommendation #212: The two Utilities Infrastructure Management Specialist positions within the Public Works Department should be reallocated to the GIS Analyst classification series.

Recommendation #213: The Utilities Infrastructure Management Specialist classification series should be eliminated.

8. THE SEWER OPERATIONS DIVISION SHOULD DEVELOP A FORMAL TRAINING PROGRAM FOR ITS GIS STAFF.

Training for the use and application of GIS should be based upon the the depth and extent of use of GIS by the user. Not everyone will need the same depth of understanding. More specifically:

- Tier 1 users typically use GIS on a daily basis. They are responsible for using high-end GIS software to create, edit, and maintain spatial datasets being used enterprise wide. They are knowledgeable with respect to spatial constrains, topology rules and data structure. Examples of Tier 1 datasets are street centerlines, parcel polygons and utility infrastructure.

- Tier 2 users leverage GIS to conduct analysis, improve decision making, or display related data in a map environment. Tier 2 users leverage the availability of enterprise data to perform their jobs more efficiently. Although the analysis process may result in additional datasets, they are typically project or department specific. In addition, Tier 2 users may be tasked with creating high quality cartographic products that also tend to be project or department specific. Examples of Tier 2 datasets are crime analysis, emergency evacuation planning, and work order tracking.

- Tier 3 users typically leverage GIS as an intuitive mechanism to retrieve information from a map interface. Often this is done through an enterprise level browser solution. Data and maps are retrieved using pre defined search routines. Cartographic products are typically limited and no data is being created or edited. Examples include locating points of interest and retrieving property ownership information.

The GIS staff in the Sewer Operations Division are Tier 1 and Tier 2 users. Tier 1 users (i.e., staff members responsible for the creation / maintenance of GIS databases in the ArcGIS environment) should take the weeklong ArcGIS class (*ArcGIS I and ArcGIS II).* The *ArcGIS* classes teach functionality for ArcInfo, ArcEditor, and ArcView.

Upon completion of those courses, the GIS staff should proceed with training in ESRI Analysis and Geoprocessing (e.g., ArcGIS 3: Performing Analysis), Geodata (e.g., building databases), etc. There are ESRI-certified trainers that could provide this training on-site.

The Sewer Superintendent should develop a multi-year training plan for the GIS staff in the Public Works Department in consultation with the GIS Manager with the Information Technology Department.

Recommendation #214: The Sewer Superintendent should develop a multi-year training plan for the GIS staff in the Public Works Department in consultation with the GIS Manager with the Information Technology Department.

9. THE CITY SHOULD AUTHORIZE SUMMER GIS INTERNS FOR THE SEWER OPERATIONS DIVISION.

There is a lot of work to be done in developing GIS layers for the general fund side of the Public Works Department. This includes such examples of layers as the following:

- Sidewalks, curbs, and gutters, and ADA ramps;
- Streetlights;
- Street sweeping routes;
- Traffic signals;
- Drainage ditches;
- Pavement markings and street striping;
- Street improvements (e.g., overlays, seal coats, reconstruction) including previous and budgeted over the next 5-years;
- School crossings;
- Bicycle paths;

- Survey benchmarks;
- Encroachments;
- Snow plow routes; and
- Sanitary sewer taps.

There will undoubtedly be additional layers developed beyond those previously cited.

While the third GIS position will definitely assist in compiling this data, labor is also required to collect the data. This can best be accomplished with seasonal GIS interns. A total of approximately 800 hours of summer interns should be authorized to assist in the collection of data so that these layers can be developed. The cost of the interns would approximate $8,000 to $10,000 annually.

Recommendation #215: A total of approximately 800 hours of summer interns should be authorized to assist in the collection of data so that these layers can be developed for the Public Works Department. The cost of the interns would approximate $8,000 to $10,000 annually.

10. ANALYSIS OF THE FORESTRY SECTION

The Forestry Operations Section is responsible for maintaining trees and woody vegetation along City rights of way, parks and golf courses. The Section is comprised of 12 staff, engaged in such activities as trimming and removing trees, limbs and stumps and debris from roadways.

1. THE FORESTRY SECTION SHOULD INCREASE THE NUMBER OF TREES TRIMMED USING A BLOCK-BY-BLOCK TRIMMING APPROACH.

The Forestry Section should assign one tree trimming crew to a quadrant in the City. Each crew should consist of 2-persons. That crew should be responsible for the maintenance of the urban forest within that quadrant, including responding to service requests within that quadrant. Each crew should be allocated an aerial tower or boom truck. This would require four 2-person crews and four aerial towers and four brush chippers.

The crew assigned to a quadrant should respond to the service requests in each quadrant on a specific day of the week (e.g., Friday) unless it is an emergency. The Section should avoid the disruption of responding to service requests on an every workday basis unless it is an emergency.

These crews should be utilized to increase the number of trees trimmed – boom tree trimming and ground tree trimming. In fiscal year 2013, the Section trimmed 4,154 trees using the aerial towers and ground crews in an urban forest of an estimated 40,000 to 50,000 trees. This represents a 10 to 12-year cycle for trimming the City's street trees. That cycle is too long. The cycle should proximate 5 to 7 years.

The pruning cycle is the frequency that a tree is pruned under planned and scheduled care. The longer the pruning cycle (time between pruning), the greater the

reduction in tree health, structure and ultimately tree value and benefits. Extending the pruning cycle saves money by reducing annual pruning costs, but also lowers tree value. By comparing the loss in tree value to savings in pruning costs over time, the optimum pruning cycle can be determined. When pruning cycles go beyond 5 to 7 years the loss in tree value exceeds savings.

The longer pruning cycle used by the Forestry Section results in many trees developing structural defects and weaknesses, undesirably dense crowns, and unaddressed aesthetic and health challenges due to neglect. When trees are finally maintained, work required to correct advanced poor conditions requires an excessive amount of time and cost, and may result in larger physical and aesthetic impacts to the tree.

Tree growth characteristics and responses to pruning in the urban environment often result in the growth of new limbs and branches that can result in poor structure (e.g. crossing/rubbing limbs, poor limb connections at the stem, etc.), which can be detrimental to the health and safety of the tree and public if not regularly addressed.

Regular, appropriately scheduled pruning has been demonstrated to better identify and minimize obstructions and the resultant safety hazards and public complaints. Dieback of limbs and branches in response to normal tree growth processes (e.g. shading, age decline) and environmental and human interactions (e.g. insect/disease, construction, soil compaction) in the urban environment can result in hazards to people and property from falling limbs and branches.

A regularly scheduled pruning cycle must be implemented to reasonably identify, remove, and minimize the risk of limb and branch failure, so as to reduce the possibility

of injury, and property damage. Currently, the Forestry Section does not conduct significant, long-range, cost-effective planning for routine block-by-block mature tree pruning. Mature tree pruning is primarily conducted according to a reactive, by-request system.

Pruning all trees within a designated area, as opposed to pruning individual trees on a request or as-needed basis, has been demonstrated to significantly reduce costs. Non-productive travel time is significantly higher when using an individual tree approach, which is currently practiced by the Section. Crew productivity during an individual tree pruning approach (hot spot maintenance) can be less than half of what it is during scheduled pruning within a designated area.

The most efficient pruning practice is to prune every tree in a specified geographic area on a block-by-block basis, on a regular cycle based on tree growth. Each tree should be pruned according to its specific needs and growth rate. This system is efficient because it minimizes significant non-productive travel time between trees. It also provides for good public relations because all trees are pruned at once eliminating the concern by residents that the street tree in front of their house was missed, as well as the noise and inconvenience of multiple visits to the same small geographical area.

To enable the Forestry Section crews to spend more time pruning street trees, the Section should outsource stump removal. In fiscal year 2013, the Section allocated 1,100 labor hours to stump removal for 645 work orders. This work activity is a lower priority than block-by-block tree trimming. The cost of outsourcing this work should approximate $100,000 annually.

Recommendation #216: The Forestry Section should trim mature street trees in Cedar rapids on a five to seven year cycle using a block-by-block trimming approach.

Recommendation #217: The Public Works Department should acquire a fourth aerial tower and brush chipper for the Forestry Section. The one-time capital outlay cost will approximate $200,000.

Recommendation #218: The Public Works Department should outsource stump removal.

2. THE FORESTRY SECTION SHOULD ALLOCATE A GREATER PROPORTION OF ITS CREW HOURS TO BOOM TREE TRIM AND GROUND TREE TRIM.

The table below presents the allocation of labor hours by the Forestry Section for fiscal year 2013 by work activity.

Task	Work Orders	Labor Hours	% of Total
117 Post No-Parking Signs	1	1	0.01%
2105 In Field Investigation	5	5	0.03%
345 Storm Damage	422	1,704	10.19%
470 Dirt Work	28	64	0.38%
540 Mailbox Repair	2	2	0.01%
697 Work for Other Dept.	3	15	0.09%
700 Tree Removal	706	5,750	34.37%
701 Ground Tree Trim	359	1,320	7.89%
702 Boom Tree Trim	841	4,494	26.87%
703 Plant Tree	9	65	0.39%
704 Stump Removal	645	1,100	6.58%
706 Tree Staking	26	63	0.37%
707 Equipment Maintenance/Shop Forestry	1	992	5.93%
708 Flag Placement	1	83	0.49%
710 Mulch Tree	1	2	0.01%
711 Tree Wrapping	1	5	0.03%
714 Pickup limb debris	171	593	3.55%
716 Dump Chips	2	164	0.98%
970 Meetings / Training	4	237	1.41%
9999 Miscellaneous	9	72	0.43%
TOTAL	**3,237**	**16,729**	**100.00%**

Important points to note regarding the labor hour allocation are presented below.

- These labor hours exclude snow removal.
- A little more than one-third (35%) of the total labor hours were allocated to boom tree trimming and ground tree trimming. In fiscal year 2013, the Section trimmed 4,154 trees in an urban forest of an estimated 40,000 to 50,000 trees. This represents a 10 to 12-year cycle for trimming the City's street trees.
- The removal of trees were allocated almost the same proportion (34%) of hours as boom tree trimming and ground tree trimming. There is a 2 to 3 month backlog of requests for tree removals that have already been identified by the Forestry Section as being legitimate
- Storm damage was the activity with the third greatest proportion of labor hours (10%).

Boom tree trimming and ground tree trimming is the primary mission or purpose of the Forestry Section, but it is receiving little more than one-third of their labor hours. This picture is not likely to change given the Emerald Ash Borer.

However, with the assignment of crews to quadrants and the reduction of unproductive travel time, the Forestry Section should focus more attention on allocation of its crews to block-by-block tree trimming. Even with the Emerald Ash Borer and the impact of tree removals and stump grinding, the Section should continue to dedicate crews to block-by-block tree trimming.

Recommendation #219: Boom tree trimming and ground tree trimming should be assigned greater emphasis and the Forestry Section should assign one crew to each quadrant, with each crew allocated an aerial tower and chipper truck.

3. THE FORESTRY SECTION SHOULD BE AUTHORIZED SEASONAL LABOR FOR THE WATERING OF STREET TREES.

The Forestry Section outsources the planting of its trees. It does not routinely water the trees planted. The crews of the Forestry Section have had to remove some of the young trees that were planted in 2013 that died due to a lack of water.

The Forestry Operations Supervisor should prepare a budget request for fiscal year 2015-16 to request funding for the seasonal labor necessary to water these young trees.

Newly planted trees should be watered immediately after planting. During the first two growing seasons, newly planted trees are expending a lot of energy trying to get their roots established in the soil. Especially during the first few summers of the new trees life, it will have a difficult time dealing with heat and drought. The Forestry Section can make this easier by watering these young trees once a week and covering the soil with wood-chip mulch.

Recommendation #220: The Forestry Operations Supervisor should prepare a budget request for fiscal year 2015-16 to request funding for the seasonal labor necessary to water young trees once a week during the growing season.

Recommendation #221: The Forestry Section should water newly planted trees immediately after planting. During the first two growing seasons, the newly planted trees should be watered once a week during the growing season.

4. THE FORESTRY SECTION SHOULD INSTALL A FORMAL WORK PLANNING AND SCHEDULING SYSTEM USING ENERGOV.

The Forestry Section should install a formal work planning and scheduling system in the Section. At the present time, the crews are not concentrated in one geographical area of the City, are wasting too much of their time travelling from one section of the City to another, and need a formal planning and scheduling system so that the crews can focus on block-by-block tree trimming for entire work days deferring service requests to an entire work day (e.g., every Friday). Clearly, the existing work practices are resulting in wasted labor hours travelling by the in-house tree crews.

Planning and scheduling for the Forestry Section must be a disciplined approach

for utilizing its staff resources. This is accomplished through:

- Prioritizing work;
- Developing the physical steps to complete the job;
- Procuring necessary tools and materials;
- Scheduling the work to be done;
- Completing the work; and
- Identifying any additional work to be completed on the asset.

The Forestry Section should take a number of steps to install a formal planning and scheduling system. These steps are presented below.

- **The Forestry Operations Supervisor should inspect all of the service requests before the development of a work order for the service requests**. The Forestry Section Supervisor should first respond to the address of the service request to determine the type of work required and to develop the work order. The work order should be assigned to the crews using the FIFO (First in - First out) system within established priorities and crew assignments.

- **The Forestry Section should develop a priority system for the assignment of service requests**. The priorities should be emergency, urgent, and routine. Emergency work orders should be safety items that demand immediate response to protect and save property and lives, and should be completed the same day. Urgent work orders should be responses that require a response as soon as possible to protect property or to prevent disruption; these work orders should be completed in one week of receipt of the request. Routine work orders are other work that can be handled on a routine planned and scheduled basis. These should be completed within <u>one month</u> of receipt of the request.

- **The Forestry Operations Supervisor should prepare a three to six month long-term schedule using EnerGov**. A three to six month schedule is a process of balancing workload, both current and anticipated workload demand. This is especially important for the Forestry Section given the backlog of block-by-block tree trimming. By defining the current workload and anticipating future workloads, the Forestry Operations Supervisor will be able to make an informed decision on the amount of work that can be accomplished given the staff resources available. The Forestry Section staff resources must be balanced with the workload so that there are enough people and materials to accomplish the work, but not more people and materials than needed or more workload than can be realistically accomplished. This can be accomplished by documenting the

available work hours and then the work hours required for tree maintenance,

- **The Forestry Operations Supervisor should prepare a weekly schedule using EnerGov.** The Forestry Operations Supervisor should develop a written weekly schedule using EnerGov. The weekly schedule for the Forestry Section is the plan for assigning staff resources to specific jobs in the coming week. The weekly schedule is normally developed on a Wednesday or Thursday of the preceding week. The assignment of staff resources is based on several factors:

  – Available work hours. This can be affected by planned leave, holidays, attrition, and other factors.

  – Available materials and equipment. To accurately schedule, materials planners must communicate realistic delivery dates for necessary materials.

  – Rate of success in the current week's schedule.

  – Priorities. The overall plan of the master schedule becomes a guide in developing priorities for the weekly schedule.

  A weekly schedule does not necessarily define the work of individual staff, but rather the number of hours by a crew to be spent each day on specific work orders.

The planning and scheduling system allows the Forestry Operations Supervisor to manage what, when, how, how much, and how well the Forestry Section performs its work. The Forestry Operations Supervisor should utilize EnerGov for this purpose.

Recommendation #222: The Forestry Section Supervisor should inspect all of the service requests before the development of a work order for the service requests.

Recommendation #223: The Forestry Section Supervisor should develop a formal written priority system for the assignment of service requests in a written policy and procedure for the consideration of the Office of the City Manager.

Recommendation #224: The Forestry Section Supervisor should prepare a three to six month long-term schedule using EnerGov.

Recommendation #225: The Forestry Operations Supervisor should prepare a weekly schedule using EnerGov.

5. THE FORESTRY SECTION AND THE STREET OPERATIONS DIVISION SHOULD CLARIFY WHERE THE STREET OPERATIONS DIVISION SHOULD DUMP LOGS AND BRUSH AT THE DUMP.

The staff of the Forestry Section indicated that, at times, the staff of the Street Operations Division would dump brush and logs at an inappropriate location at the landfill. The location was approximately 200 yards short of the landfill, and the crews of the Forestry Section would have to pick up the brush and logs and deliver this material to the landfill.

The Forestry Operations Supervisor and the Public Works Operations Superintendent should resolve this issue. The supervisor and the superintendent should identify the proper location for dumping of brush and logs by the staff of the Street Operations Division, develop a written memorandum regarding its resolution, and provide the information to the staff of the Street Operations Division regarding the approved locations for dumping of brush and logs.

Recommendation #226: The Forestry Operations Supervisor and the Public Works Operations Superintendent should identify the proper location for dumping of brush and logs by the staff of the Street Operations Division, develop a written memorandum regarding its resolution, and provide the information to the staff of the Street Operations Division regarding the approved locations for dumping of brush and logs.

6. THE CITY SHOULD CONDUCT AN INVENTORY OF THE CITY'S STREET AND PARK TREES.

The basis for an effective urban forestry management is an accurate, up-to-date, accessible tree inventory. This type of inventory will permit more efficient, effective budgeting, work planning, work direction, and hazard tree reduction. An accurate, accessible, up-to-date inventory:

- Provides a current measurement of the types, age and condition of trees;

- Identifies maintenance needs, including costs, timing and specific work requirements;
- Provides effective identification of hazard trees permitting more timely removal, increasing public safety;
- Identifies and quantifies urban forest stocking to most effectively guide planting programs;
- Permits the establishment of planting and maintenance priorities based on reliable field data;
- Enables more efficient scheduling and direction of Forestry Section crews; and
- Provides a tool to educate the public on the value of the urban forest and the importance of proper planning and species selection.

An accurate, accessible, up-to-date inventory "provides the basis for the development of a comprehensive community forestry management plan.

And for a City faced with the real threat of the Emerald Ash Borer, an inventory is critical. It is estimated that there are an estimated 40,000 to 50,000 city owned trees. Of those, it is estimated that 20% to 25% are ash. The actual numbers and condition ratings of the city's ash trees will allow the City to initiate a more effective proactive treatment, removal and reforestation program. Emerald ash borer mortality rates are nearly 100%. With that many trees dying at once, the Forestry Section crews will be overwhelmed and dead trees will stand for a long time. This information is crucial when planning management strategies for threats to the urban forest, including, but not limited to, the Emerald Ash Borer.

The procedure for the developing the tree inventory is noted below.

- **Urban Street Tree Inventory -** Use Global Positioning System (GPS) technology and Geographic Information System (GIS) base mapping to determine the such information as the following:
  - Location of each tree using GPS;

- Species name;
- Diameter at breast height;
- Distance from center of tree to existing roadway, drives, sidewalks plus storm sewer and sanitary sewer.

- **Initial Condition Assessment –** In conjunction with information gathering, provide initial assessment of condition and general health of each tree.
- **Initial Establishment of Database –** Enter gathered information into an interactive database compatible with the City's existing ArcGIS and with its tree management software.
- **Tree Identification System –** In conjunction with database development, assign a distinct identifier to each tree. Identification system shall be logical and expandable.
- **Tree Management System -** Working with the City's Information Technology Department and GIS staff, load the tree management software into the City network and customize as required to properly integrate with the existing City software. After loading and testing software, repeat testing of software using random entries for a database developed from the tree inventory. After initial establishment of database, work with qualified City staff to develop initial maintenance recommendations for each tree (e.g., thinning, raising, removal, etc.).

Over time, the Department should require its tree maintenance staff to update the inventory information as these staff trim the City's street trees. This recognizes that maintaining an inventory of urban street trees will consistently be a dynamic process. While there will be trees that are part of an inventory due to validation through an inventory conducted by the Department, there will also be trees that have been added to the inventory without notice such as unmonitored neighborhood planting or individual planting.

The estimated cost for conducting the inventory, using interns, amounts to approximately $60,000 to $100,000.

Recommendation #227: The City should conduct an inventory of its street trees.

7. THE CITY'S PLAN FOR RESPONDING TO THE EMERALD ASH BORER SHOULD BE REVISED.

The plan prepared by the Public Works Department is, in essence, to remove the ash trees once the tree is infested. The City would experience almost the total loss of its ash trees within two to three years. The City has an estimated 40,000 to 50,000 street trees. Of those, it is estimated that 20% to 25% are ash. This means that the City could lose a quarter of its urban forest in two to three years.

This should be considered unacceptable.

And the City's approach is unlike many of the plans developed by other cities. Other cities are planning on identifying the ash trees worth saving (e.g., healthy trees with a good canopy), treating those ash trees for a number of years while the remaining ash trees are removed and replaced, allowing time to develop a replacement canopy.

In Des Moines, for example, 5,800 of 47,000 ash trees have been identified as in good health with good structure. The City plans on treating those trees to allow time for replacement trees to develop a canopy. The treatment approach that Des Moines is planning on using is treatment by injection that is 99% effective in killing adult and larval emerald ash borers. The trees would require this injection once every two to three years. The cost of the treatment approximates $90 per tree, excluding labor. This cost is much less than the cost of removal.

The Arborist / Landscape Architect should be directed to immediately revise the proposed emerald ash borer plan for the City to include treatment for ash trees that are in good health with good structure, treating those street trees for a number of years

while other trees are removed on the block, replaced, and allowed time to develop a replacement canopy.

Recommendation #228: The Arborist / Landscape Architect should be directed to immediately revise the proposed emerald ash borer plan for the City to include treatment for ash trees that are in good health with good structure, treating those street trees for a number of years while other trees are removed on the block, replaced, and allowed time to develop a replacement canopy.

11. ANALYSIS OF THE ADMINISTRATION DIVISION

The Administrative Section is responsible for the support of the other divisions in the Public Works Department. The Administrative Services Division provides most, but not all, administrative support for all the other divisions in the Public Works Department. Some of the Administrative Assistants are located on the first floor of the at City Services Center with responsibility for taking calls for service from citizens, generating work order requests using Lucity or EnerGov, and inputting data for the time required to complete the task from work orders provided by employees. There were 5,978 requests for service taken and 10,454 total work orders handled in calendar year 2013.

Other Administrative Assistants are located on the second floor of the City Services Center. In addition, a temporary position serves as receptionist providing the first point of contact for citizens entering the City Services Center. The staff provides clerical and administrative support for the other Divisions including Engineering Services, Construction Services, Traffic Engineering and Street Maintenance Operations.

Overall, the Division is responsible for providing the following services:

- Receptionist services for individuals entering the building and requiring assistance;
- Preparation of all correspondence;
- Clerical support for bids and specifications;
- Tracking of contract data;
- Input of work order data into Lucity / EnerGov;
- Preparation of all Agenda items for Council by the Department;

- Providing 10 Day Notices property owners for overgrown property and sidewalks that have not been shoveled;
- Billing property owners for overgrown property cut and sidewalks shoveled by contractors;
- Filing tax liens against property owners who fail to pay;
- Issuing large load and demolition permits; and
- Coordinating the implementation of EnerGov within the Public Works Department (Administrative Services Supervisor).

Given the day-to-day demands of the other manages in the department, the skills and talents of the Administrative Services Supervisor should be used more effectively.

1. THE ADMINISTRATIVE DIVISION SHOULD ANALYZE THE UTILIZATION OF PUBLIC WORKS DEPARTMENT VEHICLES TO REDUCE THE SIZE OF THE FLEET AND DECREASE OPERATING COSTS.

The functions performed by public works departments are many and diverse, and utilize many resources in their performance. These include direct labor, indirect labor, materials, equipment, contractor costs, health and life insurance, retirement costs, longevity costs, uniform costs, and many more. Every hour that is expended in the performance of the functions for which the Public Works Department is responsible has an associated cost, whether direct or indirect.

However, one cost that is largely overlooked in the performance of the Public Works Department functions is the cost of retaining underutilized equipment. The costs associated with an Equipment Operator are clear. The costs associate with a street sweeper, grader or dump truck that are retained in the fleet, but which are underutilized, or even seldom utilized, are not as clear, however they, too, have associated costs such as licensing, insurance, depreciation and even maintenance and repair. Further, there

are costs associated with the retention of vehicle mechanics to maintain and repair the fleet of under-utilized equipment.

And the Public Works Department has over 350 pieces of equipment in its fleet.

For these reasons, it is imperative that the Public Works Department establish a standard methodology to evaluate each piece of equipment in its fleet to determine whether there are opportunities to eliminate equipment.

For example, the Matrix Consulting Group analyzed the utilization of one category of equipment, motor graders. The following table provides the utilization for each of the 15 graders in the fleet over three years. The utilization data provided is in motor hours, which is a measure of the time for which each grader was in use during the workday.

Equipment No.	Model	FY 12 Hours	FY 13 Hours	FY 14 Hours
1-185	1992	30	106	135
1-186	1996	241	194	216
1-187	1990	13	208	548
1-190	2005	262	394	388
1-191	1994	221	-	75
1-192	1992	333	269	257
1-194	1996	59	131	86
1-195	2008	No Data	No Data	No Data
1-196	2008	No Data	No Data	No Data
1-197	2007	578	187	270
1-198	1996	45	79	123
1-199	2008	49	86	100
1-202	2004	35	116	138
1-203	2001	109	680	204
1-205	1992	No Data	No Data	No Data

In analyzing the data in the table above, a notable point is that only six of the 12 graders for which data area were available in FY 14 displayed utilization over 200

hours. To place this in perspective, assuming an average of three hours of utilization per day of use (a grader, even when fully utilized, is not constantly in operation for the full workday), an annual utilization of 200 hours equates to full utilization on about 67 days of the year. Clearly, though, there are several graders that do not meet even this minimal standard, and should be analyzed for their continued retention in the fleet.

The use of motor hours (or, in the case of vehicles, odometer readings) in determining whether a piece of equipment is fully utilized is a one-dimensional method of determining whether a piece of equipment is "fully utilized". There are reasons other than hours, or mileage, that can factor into the determination as to whether a particular piece of equipment is required for use in the fleet. However, it is also true that motor hour and odometer readings can, and should, be used as a "first cut" in identifying specific units for which a justification should be made for retention in the fleet. The Cedar Rapids fleet of motor graders includes four pieces of equipment that logged 75, 86, 100 and 123 hours, equating to an assumed average of 25, 29, 33 and 41 days, respectively, of utilization in FY 14. Further, there have been four to five graders with similar utilization in the previous two fiscal years, indicating that there are opportunities for eliminating certain motor graders from the fleet. Given that a new motor grader can cost $200,000 or more, there may be significant cost savings available to the City in conducting a comprehensive fleet utilization study.

Recommendation #229: The Administrative Services Supervisor should conduct a study of the utilization of the Public Works Department motorized equipment and develop recommendations for elimination of pieces of equipment.

2. THE PUBLIC WORKS DEPARTMENT AND THE FLEET SERVICES DIVISION SHOULD ESTABLISH A SPECIFICATIONS COMMITTEE FOR THE REPLACEMENT OF EQUIPMENT ASSIGNED TO THE PUBLIC WORKS DEPARTMENT.

The Public Works Department and the Fleet Services Division should establish a Specifications Committee. The Fleet Services Manager should chair the Specifications Committee.

The Specifications Committee should meet on an ad hoc basis to discuss specifications for upcoming acquisitions, discuss concerns with existing equipment and their features and specifications, and explore ways to tighten the specifications to protect City's interests and deliver equipment that effectively and efficiently meets the functional requirements of the end user.

The Specifications Committee should include representatives from all levels of the Public Works Department, but its membership should be limited to five to seven staff.

Recommendation #230: The Public Works Department and the Fleet Services Division should establish a Specifications Committee. The Specifications Committee should meet on an ad hoc basis to discuss specifications for upcoming acquisitions, discuss concerns with existing equipment and their features and specifications, and explore ways to tighten the specifications to protect City's interests and deliver equipment that effectively and efficiently meets the functional requirements of the end user.

Recommendation #231: The Fleet Services Manager should chair the Specifications Committee.

Recommendation #232: The Specifications Committee should include representatives from all levels of the Public Works Department, but its membership should be limited to five to seven staff.

3. THE PUBLIC WORKS DEPARTMENT AND THE FLEET SERVICES DIVISION SHOULD DEVELOP A 5-YEAR REPLACEMENT PLAN FOR THE EQUIPMENT ASSIGNED TO THE PUBLIC WORKS DEPARTMENT.

The Fleet Services Division has made progress in recent years in replacing an aging fleet. However, the fleet assigned to the Public Works Department still exceeds the age that the Matrix Consulting Group would expect to find. Examples are provided in the table below.

Class	No. of Equipment	Average Age (Years)	Median Age (Years)	25th Percentile (Years)	75th Percentile (Years)
Dump Truck	57	8.5	8.0	3.0	13.0
Tractor	27	9.1	6.0	4.0	11.5
Pickup Truck	47	7.2	6.0	3.0	9.5
Motor Grader	15	14.7	18.0	8.0	21.0

Important points to note concerning the table are presented below.

- The dump trucks assigned to the Public Works Department are an average of 8.5 years of age: at the 75th percentile, dump trucks are 13 years old. The Matrix Consulting Group would expect an average age of 6 years for dump trucks.

- Tractors assigned to the Public Works Department are an average of 9.1 years of age: at the 75th percentile, tractors are 11.5 years old. The Matrix Consulting Group would expect an average age of 6 years for tractors.

- Pickup trucks assigned to the Public Works Department are an average of 7.2 years of age: at the 75th percentile, pickup trucks are 9.5 years old. The Matrix Consulting Group would expect an average age of 5 years for pickup trucks.

- Motor graders assigned to the Public Works Department are an average of 14.7 years of age: at the 75th percentile, motor graders are 21 years old. The Matrix Consulting Group would expect an average age of 6 years for motor graders. This is just an additional reason to reduce the number of motor graders assigned to the Public Works Department given the age of the motor graders and the expense of replacing motor graders.

Planning for the replacement of the Public Works Department's fleet is a matter of prudent financial management. In its more basic form, the development of a five-year replacement plan is no more than a schedule listing the specific equipment proposed for

replacement in order of priority, together with cost estimates and the proposed method to finance them (i.e., guaranteed buyback, purchase, etc.).

The five-year replacement plan would not be static. It would be updated each fiscal year to reflect changing priorities, changing maintenance and repair costs, unexpected component failures, etc.

The five-year replacement plan should identify the specific equipment to be replaced, the year in which it would be replaced, the amount proposed to be expended each year, and the proposed method of financing the replacement of the equipment. The City does not have the fiscal ability to raise replacement rates and replace every piece of equipment assigned to the Public Works Department solely based on the age of a vehicle. Rather, the City will have to balance priorities for replacement of equipment assigned to the Public Works Department within the financial resources available. The five-year replacement plan is an important tool to evaluate whether the balancing of these priorities against the limited financial resources will result in an aging, expensive-to-maintain fleet and replacement rates need to be increased.

The Fleet Services Division should prepare this five-year replacement plan for the review of the Public Works Department. The five-year replacement plan should be reviewed with the Public Works Department Specification Committee.

Recommendation #233: The Fleet Services Division should prepare a five-year replacement plan for the review of the Public Works Department for the equipment assigned to the Public Works Department.

Recommendation #234: The five-year replacement plan for the equipment assigned to the Public Works Department should be reviewed with the Public Works Department Specification Committee.

4. THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP AN EQUIPMENT OPERATOR TRAINING PROGRAM.

The Public Works Department lacks a formal equipment operator training program to provide training in the operation of heavy equipment such as backhoes, skip loaders, rollers, three-axle dump trucks, etc.

The Department should develop such a program to establish a standardized process by which equipment operators may advance through the progressive job classifications and so that the Department can be sure that its employees have been certified to operate heavy equipment before their actual use. Employees should be required to successfully complete operator safety instruction, and operator effectiveness instruction consisting of classroom instruction and on-the-job equipment instruction. Training, for example, for operation of a backhoe could include earthmoving fundamentals such as the proper use of a variety of attachments to dig trenches, break rock and / or concrete, back-fill excavations, and scoop and / or dump materials, personal, work site and machine safety, pre-operation inspection and hands-on operation, and machinery maintenance. Training in the proper operation of a backhoe, for example, should not just focus on how to manipulate the controls and choose the right digging attachments. Operators should also learn applicable safety measures such as safe moving and operating procedures, safe excavating procedures and loading procedures.

Recommendation #235: The Public Works Department should develop an equipment operator-training program for the proper and safe use of heavy equipment.

5. THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP A CLEARLY WRITTEN FIVE-YEAR STRATEGIC PLAN.

Public sector managers are often so preoccupied with immediate issues that they lose sight of their ultimate goals. That's why a strategic plan is a virtual necessity. It may not be a recipe for success, but without it the Public Works Department is less likely to achieve its goals.

A sound plan should:

- Serve as a framework for decisions or for securing support / approval;
- Explain the goals and objectives of the Department to others in order to inform, motivate and involve;
- Assist benchmarking and performance measurement; and
- Stimulate change and become the building block for the next plan.

The best practices regarding development of a strategic plan that should be utilized by the Public Works Department are presented in the table below:

The department has a multi-year strategic plan with annual goals and measurable objectives based on identified needs, projected workload, and expenditures and revenues.
The department maintains and publishes a clearly written, multi-year (five years at a minimum) strategic plan to provide vision and direction for the department. The plan links citywide and department goals.
In developing the strategic plan, the department: • Identifies and formally adopts a limited number (5 to 10) of departmental priorities to guide the department's strategies and major financial and program decisions; • Considers the impacts of the city's financial condition, current expenditures by the department, and opportunities to reallocate staff and other resources to enhance performance; and • Instructs departmental management on how these priorities should be considered in making program and budget decisions.
The strategic plan clearly delineates the department goals, and objectives and strategies for achieving them. In developing these strategies, the department considers alternative service delivery systems such as outsourcing.
The plan also delineates the priorities the City Council and City Manager assign to its goals, objectives, and strategies.
The objectives in the strategic plan are measurable, and the department has set annual objectives for each goal for at least five years into the future.
The department's goals, objectives, and performance measures are based on past performance, identified needs, projected workload, and expenditures and revenues.

The plan delineates the managers responsible for implementing the strategies in the plan and the time frames for implementation.
The department head annually assesses the progress the department has made toward achieving the goals and objectives in the plan.

In developing the strategic plan for the department, the Department should (1) identify its strengths, weaknesses, threats (e.g., slowdown in growth of City revenues), and opportunities (e.g., increased use of technology); (2) develop a vision and mission statement for the Department; (3) define the goals, objectives and strategies the Department will utilize to achieve those goals, objectives and strategies; and (4) define the managerial responsibilities for accomplishing those goals, objectives and strategies.

The Administrative Services Supervisor should be responsible for facilitating the development and implementation of the Department's strategic plan.

Recommendation #236: The Public Works Department should develop a clearly written, five-year minimum, Strategic Plan.

Recommendation #237: The Administrative Services Supervisor should be responsible for coordinating the development and implementation of the Department's strategic plan.

6. EACH DIVISION WITHIN THE PUBLIC WORKS DEPARTMENT SHOULD DEVELOP GOALS, OBJECTIVES, AND PERFORMANCE MEASURES, MORE THAN WHAT IS CONTAINED IN THE CITY'S OPERATING BUDGET.

Each division head should be held accountable for developing goals, objectives, and performance measures and presenting them to the Director each year as part of their budget proposal at the program level.

Goals should be developed for each division with objectives developed for each program such as traffic signal maintenance and repair, street striping and legend painting, sign maintenance and repair; and the like. Performance measures should then

be developed to assess the workload, efficiency, and effectiveness with which these objectives are accomplished.

The development of goals, objectives and performance measures at the program level by the Department should consider the guidelines presented below.

- **Goals should be developed for each division and each program within a division**. These goals should give specific direction on how the divisions, and the programs within these divisions, will contribute to the mission and goals of the Department. These goals should be not quantifiable. These goals should span multiple years.

- **Objectives should be developed for each program**. Objectives are outcome-based statements of what specifically will be achieved within the fiscal year. Each program should have 3 to 5 objectives. The objectives should clearly demonstrate progress toward the goal of the program. These objectives should be written to allow measurement of progress, and be quantifiable.

- **Performance measures should be developed for each objective**. Performance measures should convey the extent to which an objective has been met. These measures should include a range of indicators including input, output, efficiency, service quality and outcome. For example, an input measure would be the value of the resources used to produce output such as the dollars spent on contract seal coating of streets or the staff hours used to patch potholes in streets. An output measure is the quantity or number of units produced such as the linear feet of sewer mains that were cleaned. An efficiency measure is the inputs used per unit of output such as the cost per catch basin cleaned. A service quality measure is the degree to which customers are satisfied with a program or how accurately or timely a service is provided such as the frequency that all of the sewer mains are televised. An outcome measure is the qualitative consequences associated with a program or service – the ultimate benefit to a customer. An example would be the amount of sanitary sewer overflows.

- **The Department should develop reliable and accurate data to measure performance, using EnerGov to the maximum extent possible**. Each performance measure needs a consistent reliable data source. The Department should acquire and install the information systems necessary to develop good data sources. Departmental management and staff should work closely together to define the method, frequency, and reliability of data collection.

- **The Department should communicate and use performance measurement data for decision-making and accountability reporting**. Top management of the Department should communicate their commitment to the value and use of goals, objectives, and performance measures to all Departmental managers and

supervisors. Management should involve line managers and staff in the development and reporting of goals, objectives, and performance measures. The Departmental managers should communicate the results of these goals, objectives, and performance measures internally to its staff.

Each division head should report quarterly to the Director regarding their progress in achieving their goals and objectives using the performance measures as a measure of progress.

The Administrative Services Supervisor should be assigned responsibility for providing training and technical assistance to the Department's managers and first-line supervisors in the development of goals, objectives, and performance measures.

Concurrently, the Administrative Services Supervisor should be assigned responsibility for providing training and technical assistance to first-line supervisors and other staff as needed for collecting the data needed to track their activities against established goals, objectives, and performance measures. The Administrative Services Supervisor should compile data gathered by division managers, and generate a report quarterly for the Division and Department Heads.

Recommendation #238: The Public Works Department should develop goals, objectives, and performance measures beyond those contained in the City's operating budget.

Recommendation #239: The Administrative Services Supervisor should be assigned responsibility for coordinating the provision of training and technical assistance to the Department's division managers and first-line supervisors in the development of goals, objectives, and performance measures.

Recommendation #240: The Administrative Services Supervisor should be assigned responsibility for coordinating the necessary training and technical assistance required for collecting performance data.

7. THE PUBLIC WORKS DEPARTMENT SHOULD ESTABLISH A CAREER DEVELOPMENT PROGRAM FOR ITS EMPLOYEES.

The old career model of remaining with one organization for an entire career and in one classification series and one division has become outmoded. Employees now make lateral moves, work for three to ten organizations, and change professions. This new model requires employees, and the organizations that they work for, to be adaptable and flexible, continuously learning, and upgrading the skills of the employees and the organization.

Career development is the ongoing acquisition or refinement of skills and knowledge, including job mastery and professional development, coupled with career planning activities.

Since career development is an ongoing, dynamic process, employees would need encouragement and support in reviewing and re-assessing their goals and activities. Formal training and classes away from the job are effective in providing new information, but employees also need to practice new skills. Therefore, the Public Works Department can contribute significantly to the employee's career development by supporting career development activities within the Department.

The Department's support for career development is important for a number of reasons including the following:

- A focus on skill development contributes to learning opportunities that benefit both the employee and the Department;
- Career development enhances opportunities for employee promotion and/or lateral moves that contribute to an employee's career satisfaction;
- The Department should promote a greater sense of employee responsibility for managing their own career;

- Career planning and development clarifies the match between the Department's and an individual employee's goals;

- It's cost-effective for the Department to use its own staff talent to provide career development opportunities within the Department – recruitment and selection costs are reduced and positions are vacant for a less amount of time;

- Career development increases employee motivation and productivity; and

- Attention to career development helps the Department attract top staff and retain valued employees.

The Department should take a number of steps to develop a career development program within the Department.

- Annually, the employee's supervisor should develop an individual development plan and career discussion with his or her employees;

- Supervisors should be held accountable for supporting employee development efforts;

- The Department should create programs and activities to provide skill development, such as job rotation, cross training, mentoring, internships, coaching, and career strategy groups;

- The Department should recognize that part of the development of the career plan for the employee should include providing support and / or release time for development beyond their current jobs; and

- The Department should support requests for flexible work arrangements from staff members.

Recommendation #241: The Public Works Department should develop a career development program.

Recommendation #242: The Administrative Services Supervisor should be assigned responsibility for coordinating the provision of training and technical assistance to the Department's division managers and first-line supervisors in the development of career development plans.

8. THE ADMINISTRATIVE ASSISTANTS IN THE ADMINISTRATIVE DIVISION SHOULD BE CROSS TRAINED AND DESK MANUALS DEVELOPED TO ASSIST IN THEIR CROSS TRAINING.

The Administrative Division provides support for the Public Works Department on both floors of the City Service Center.

These Administrative Assistants should be periodically rotated and cross-trained. Cross training will leverage the talent of the Administrative Assistants by helping Administrative Assistants acquire new skills. Cross training prepares Administrative Assistants for additional responsibility. Cross training sustains the Administrative Assistant's production levels during absences. Cross training Administrative Assistants will enable a particular job to get done even when an Administrative Assistant is out sick.

In addition, desk manuals should be developed for the different "posts" that the Administrative Assistants are assigned to. Desk manuals assure continuity when Administrative Assistants are on leave or their positions are vacant. A desk manual documents the tasks and processes. It should include screen shots of information systems (e.g., EnerGov), reports, processes or activities.

Recommendation #243: The Administrative Assistants in the Administration Division should be periodically rotated and cross-trained.

Recommendation #244: The Administrative Services Supervisor should develop desk manuals for the different "posts" that the Administrative Assistants are assigned to.

12. ANALYSIS OF CULTURE AND LEADERSHIP

What is corporate culture? Simply put, "culture is the way things are done around here." An organization's culture is the beliefs, values, and behaviors that the organization has adopted over time as a way to survive and succeed.

Kotter and Heskett's landmark study *Corporate Culture and Performance*, documented results for 207 large U.S. companies in 22 different industries over an eleven- year period.[21] Kotter and Heskett reported that companies that managed their cultures well saw revenue increases four-times greater than the companies that did not manage their cultures well,

Bain & Company research found that nearly 70% of business leaders agree: culture provides the greatest source of competitive advantage. In fact, more than 80% believe an organization that lacks a high-performance culture is doomed to mediocrity.[22]

McKinsey and Company research has found that companies with strong performance cultures have 11% higher annual total return to shareholders and 5.2% higher return on investment capital than those with weak performance cultures. [23]

An organization's key to success is in its heart and soul – it's culture.

1. THE EMPLOYEE QUESTIONNAIRE ADMINISTERED BY THE MATRIX CONSULTING GROUP INDICATES THAT THE CULTURE AND LEADERSHIP OF THE PUBLIC WORKS DEPARTMENT NEEDS TO BE ENHANCED.

The survey was distributed to 176 employees with a response rate of 50%. A summary of the responses by topic is provided below.

[21] Corporate Culture and Performance, John P. Kotter, 1992
[22] Building a Winning Culture, Bain and Company, 2006
[23] On Performance Culture, Scott Keller and Carolyn Aiken, 2004

(1) There Were Mixed Responses Regarding The Culture Of The Public Works Department.

Respondents were asked four questions about how they viewed the Public Works Department's culture. An analysis of the response to these four questions is provided below.

- Question #1 - In response to the statement "My Division is innovative in the way it provides services and products to its customers", 51% of the respondents agreed or strongly agreed with the statement, while 49% disagreed or strongly disagreed with the statement.

- Question #3 - In response to the statement "I feel encouraged to come up with new and better ways of doing things in my Division", 48% of the respondents agreed or strongly agreed with the statement, while 52% disagreed or strongly disagreed with the statement.

- Question #10 - In response to the statement "My Division promotes a culture that continuously improves the quality of services and products delivered", 42% of the respondents agreed or strongly agreed with the statement, while 58% disagreed or strongly disagreed with the statement.

- Question #30 - In response to the statement "My Division is open to new ideas suggested by others or myself", 58% of the respondents agreed or strongly agreed with the statement, while 42% disagreed or strongly disagreed with the statement.

As the above points indicate, the statements relating to the culture of the Public Works Department and the extent that it promoted new ideas and innovation were definitely mixed, with respondents almost evenly divided in terms of agreeing with the statement and disagreeing with the statement.

(2) There Were Mixed Responses Regarding The Management And Supervision Of The Public Works Department.

There were six questions pertaining to the management and supervision of the Public Works Department. An analysis of the response to these six questions is provided below.

- Question #12 - In response to the statement "I have a good working relationship with my immediate supervisor", 80% of the respondents agreed or strongly agreed with the statement, while 20% disagreed or strongly disagreed with the statement.

- Question #14 - In response to the statement "My immediate supervisor holds employees accountable for their job performance", 60% of the respondents agreed or strongly agreed with the statement, while 40% disagreed or strongly disagreed with the statement.

- Question #16 - In response to the statement "My immediate supervisor takes steps to deal with poor performers", 35% of the respondents agreed or strongly agreed with the statement, while 65% disagreed or strongly disagreed with the statement.

- Question #24 - In response to the statement "My supervisor empowers me to make decisions concerning my work", 76% of the respondents agreed or strongly agreed with the statement, while 24% disagreed or strongly disagreed with the statement.

- Question #25 - In response to the statement "I feel that I am valued as a member of my Division", 70% of the respondents agreed or strongly agreed with the statement, while 30% disagreed or strongly disagreed with the statement.

- Question #28 - In response to the statement "Managers and supervisors in my Division are held accountable for their job performance", 29% of the respondents agreed or strongly agreed with the statement, while 71% disagreed or strongly disagreed with the statement.

There were positive responses regarding the working relation with their immediate supervisor, empowerment to make decisions concerning their work, and feeling valued as a member of their division. However, respondents clearly expressed concern regarding the effectiveness with which their supervisor was dealing with poor performers and the extent to which managers and supervisors were held accountable for their job performance.

(3) There Were Mixed Responses Regarding Communication.

Respondents were asked seven questions regarding their views on ability of management to adequately communicate information to employees. An analysis of the response to these seven questions is provided below.

- Question #2 - In response to the statement "My Division has clear, well-documented policies and procedures to guide my day-to-day work", 50% of the respondents agreed or strongly agreed with the statement, while 50% disagreed or strongly disagreed with the statement.

- Question #4 - In response to the statement "My immediate supervisor clearly communicates performance expectations to me", 70% of the respondents agreed or strongly agreed with the statement, while 30% disagreed or strongly disagreed with the statement.

- Question #5 - In response to the statement "Managers and supervisors in my Division do a good job of communicating important information to me in a timely manner", 47% of the respondents agreed or strongly agreed with the statement, while 53% disagreed or strongly disagreed with the statement.

- Question #6 - In response to the statement "My immediate supervisor gives me timely feedback about my job performance", 64% of the respondents agreed or strongly agreed with the statement, while 36% disagreed or strongly disagreed with the statement.

- Question #7 - In response to the statement "I understand clearly what is expected of me at work", 79% of the respondents agreed or strongly agreed with the statement, while 21% disagreed or strongly disagreed with the statement.

- Question #22 - In response to the statement "I have input into decisions that affect my work", 62% of the respondents agreed or strongly agreed with the statement, while 38% disagreed or strongly disagreed with the statement.

- Question #23 - In response to the statement "Overall, I understand how the work I do relates to the overall goals and priorities of my Division", 86% of the respondents agreed or strongly agreed with the statement, while 14% disagreed or strongly disagreed with the statement.

There were a number of positive responses to questions regarding communications (e.g., making sure that employees understood expectations regarding work, feedback regarding performance, etc.) Concerns expressed by respondents

pertained to documented policies and procedures and communicating information in a timely manner.

(4) There Were Mixed Responses Regarding Career Development and Training in the Public Works Department.

Respondents were asked three questions about how opportunities for career development and training in the Public Works Department's culture. An analysis of the response to these three questions is provided below.

- Question #18 - In response to the statement "I am given real opportunities in my Division to improve my skills", 50% of the respondents agreed or strongly agreed with the statement, while 50% disagreed or strongly disagreed with the statement.

- Question #19 - In response to the statement "Opportunities exist in the Department for career advancement", 24% of the respondents agreed or strongly agreed with the statement, while 76% disagreed or strongly disagreed with the statement.

- Question #26 - In response to the statement "My current work assignments enable me to apply and practice my knowledge and skills", 83% of the respondents agreed or strongly agreed with the statement, while 17% disagreed or strongly disagreed with the statement.

While respondents indicated that their current assignment enabled them to apply and practice their knowledge and skills, responses regarding opportunities to improve their skills were mixed, and most respondents indicated that opportunities for career advancement were problematic.

* * * * * *

So what does all this mean? The respondents expressed concern regarding the department's ability to promote new ideas and innovation. The respondents expressed concern regarding the performance of the department as it pertains to supervisors dealing with poor performers and holding managers and supervisors accountable for

their job performance. The respondents expressed concern regarding managers and supervisors communicating information in a timely manner. The respondents expressed concern regarding opportunities for career advancement.

In meetings with the Matrix Consulting Group, employees frequently described the culture and the ways managers and supervisors worked together in the department in less than flattering terms.

These challenges all stem from the culture and the leadership of the Public Works Department. While many factors influence culture, the single most important is leadership - what leaders do and say, in that order, consistently over time.

2. THE PUBLIC WORKS DIRECTOR SHOULD SET EXPECTATIONS FOR THE NECESSITY OF CHANGE IN THE CULTURE OF THE PUBLIC WORKS DEPARTMENT.

The Public Works Director should set the expectations about the necessity for change within the Public Works Department, the type of new culture required in the the Public Works Department and how it will result in a more successful Public Works Department.

To transform the culture of the Public Works Department, the executive and middle-level managers must also transform. This will, of necessity, require a tightly knit team of executive and middle-level managers that develop and adopt the cultural values for the Public Works Department and “live” them in their day-today actions, so that the cultural values of the Public Works Department can take root.

The team of executive and middle-level managers team should jointly define the cultural values they want to see in the Public Works Department. The Public Works Director should then set the executive and middle-level managers loose to drive that

message into the department with a single voice. These values for the department should be "grounded" in the values already developed by the City.

In defining the cultural values, the executive and middle-level managers should define the "from – to" shifts in culture that the Public Works Department is making. This will provide clarity to the cultural values, provide a vision for the desired end state and a vehicle for drawing links between different initiatives that make up the overall program. For example, some of the from – to shifts in culture could be:

- From blame / finger pointing to accountability;
- From an organization that is hierarchical in nature to an organization that is collegial, collaborative, and team-based in nature;
- From an organization that is opaque in chain-of-command communication to one that is transparent;
- From an organization that takes its employees for granted to one that celebrates their accomplishments; and
- From an organization that consists of silos and turf to "One Public Works Department'.

The culture of the Public Works Department has not been the result of intention, but rather the unintentional result of the Department's management practices and behaviors. The culture of the Department needs to change; that will require the executive and middle management of the department to be intentional about shaping and changing the culture. The executive and middle management of the department must begin by understanding what the departmental culture they are trying to create, committing to each another to demonstrate the traits of that culture, and then calling out behavior that runs counter to those traits when they see it.

Recommendation #245: The Public Works Director should set the expectations about the necessity for the change of the culture within the Public Works

Department, the type of new culture required in the Public Works Department, and how it will result in a more successful Public Works Department.

Recommendation #246: The executive and middle-level managers of the Public Works Department should develop and adopt the cultural values for the Public Works Department (based upon values already developed by the City) and "live" them in their day-to-day actions, so that the cultural values of the Public Works Department can take root.

3. THE PUBLIC WORKS DIRECTOR SHOULD BUILD A CULTURE OF EMPLOYEE INVOLVEMENT IN THE PUBLIC WORKS DEPARTMENT.

The table below presents the three aspects of employee involvement that the Public Works Director should foster in the Public Works Department.[24]

Involvement. Building employee capability and creating a shared sense of ownership and responsibility throughout the Public Works Department		
Empowerment	Do employees feel informed and involved in the work that they do? Do they feel they can have a positive impact on the department?	Executives and middle managers create an environment where employees have the authority, initiative, and ability to develop and manage their own work. Employees have a sense of ownership and responsibility toward the department.
Team Orientation	Is teamwork encouraged AND practiced in the department? Do employees value collaboration and feel mutually accountable for common goals?	Executives and middle managers place value on working cooperatively toward common goals and know how to use team effort to get work done. Executives and middle managers establish a sense of mutual accountability for the accomplishment of goals.
Capability Development	Do employees believe that they are being invested in and that their skills are improving? Is the department's bench strength improving? Does the department have the skills it needs to be competitive today and into the future?	Executives and middle managers continually focus on the development of employees' skills and knowledge to meet ongoing departmental needs. Executives and middle managers effectively use the diverse capabilities of the workforce.

The Public Works Director should foster a culture of empowerment, team-orientation, and capability or skill development in the Public Works Department.

[24] The Matrix Consulting Group, in developing recommendations for the culture of the Public Works Department, utilized the features of the Denison Organizational Culture Model. This model was validated based upon a large and diverse sample of 35,474 individuals from 160 different public and private sector organizations.

The Public Works Director, in fostering empowerment in the Public Works Department, should:

- See that decisions are made at the lowest level;
- Involve all of the employees in shaping the plans and decisions that affect the employees;
- Ensure that authority and responsibility is delegated to middle managers and first line supervisors – the lowest level possible – so that the middle managers and first line supervisors can do their work more efficiently and effectively;
- Create an environment where each employee feels that his / her effort makes a difference; and
- Share information at all levels of the department so that employees get the information that they need.

The Public Works Director, in fostering a team-orientation in the Public Works Department, should:

- Use a team approach to solve problems and improve service delivery by the Department with the teams consisting of employees from all levels of the department;
- Foster teamwork within each division of the department;
- Build effective teams at all levels of the department to get the job done; and
- Acknowledge and celebrate team accomplishments.

The Public Works Director, in fostering the development of employee skills in the Public Works Department, should:

- Work with the executive and middle managers of the department to develop a career development program for the employees of the department;
- Develop systems within the department to use rewards and recognition to motivate good performance;
- Develop executive and middle managers of the department so that they are ready for promotion; and

- Build employee skills so that the department always has good "bench depth" (succession planning).

Overall, the Public Works Director should be held accountable for encouraging and supporting employee Involvement, creating a sense of teamwork and collaboration so that creative ideas are captured and employees support one another in accomplishing the work that needs to get done, and develops the skills of the employees in a variety of ways including training, coaching, mentoring, the opportunity to participate in external professional groups, and giving employees exposure to new roles and responsibilities.

Recommendation #247: The Public Works Director should build a culture of employee involvement in the Public Works Department that includes empowering employees, building a team-orientation, and continually developing employee skills and knowledge.

4. THE PUBLIC WORKS DIRECTOR SHOULD BUILD A CULTURE OF ADAPTABILITY IN THE PUBLIC WORKS DEPARTMENT.

The table below presents the three aspects of adaptability that the Public Works Director should foster in the Public Works Department.[25]

Adaptability. Translating the demands of the external environment into action.		
Creating Change.	Can employees read the external environment and react to trends and changes? Do employees constantly look for new and improved ways to do their work?	Executives and middle managers know the departmental environment and quickly react to current trends, and anticipate future changes. Executives and middle managers continually create adaptive and innovative ways to meet changing needs.

[25] The Matrix Consulting Group, in developing recommendations for the culture of the Public Works Department, utilized the features of the Denison Organizational Culture Model. This model was validated based upon a large and diverse sample of 35,474 individuals from 160 different public and private sector organizations.

Adaptability. Translating the demands of the external environment into action (Cont'd)		
Customer Focus	Do we understand the needs of our customers? Are employees committed to responding to their ever-changing needs? Is customer focus a primary concern throughout the department?	Executives and middle managers are driven to clearly understand the present and future needs of the customer, seek ongoing input from the customer, continuously strive to improve the customer service, and ensure that all employees are driven by a concern to satisfy the customer.
Departmental Learning	Is importance placed on learning in the workplace? Do we create an environment where reasonable risk taking and innovation can occur? Do we share knowledge across the department?	Executives and middle managers encourage innovation, risk taking and continuous improvement. Executives and middle managers see mistakes as opportunities for gaining knowledge and developing capabilities.

The Public Works Director should foster a culture of change, customer-focus, and learning in the Public Works Department.

The Public Works Director, in fostering a culture of change in the Public Works Department, should:

- Establish teams to work on implementation of the recommendations contained within this report and to continuously look for new and better ways for the department to deliver services;
- Champion change at all levels of the department to seek improvement in methods and practices used by the Public Works Department to deliver its services;
- Encourage the executive and middle management team to foresee problems and develop recommended solutions to those problems.

The Public Works Director, in fostering a customer focus in the Public Works Department, should:

- Encourage direct contact of customers by the executive and middle management team (e.g., telephone follow-up to service requests) to ascertain satisfaction with services delivered by the department (for example, after the completion of service requests);
- Use systematic and ongoing customer surveys to assess satisfaction with services delivered by the department and use those surveys to improve those services; and

- Develop customer service strategies (e.g., improve e-business opportunities) and action plans (e.g., residents and business are provided the opportunity for the submittal of service requests using an on-line application: CitySourced) delivery of services by the department.

The Public Works Director, in fostering departmental learning in the Public Works Department, should:

- Encourage "lessons learned" at all levels of the department to deal constructively with failures and mistakes;
- Create an environment in which learning is an important objective; and
- Encourage employees at all levels of the department to learn about best practices in the public works profession.

The Public Works Director should be held accountable for fostering a culture in the department that continuously looks for new and improved ways to do its work, continuously looks for new and improved ways to meet and exceed customer expectations, and promotes learning from the knowledge gained from the department's successes and failures, not 'Who is to blame?', but rather 'What can we learn?'

Recommendation #248: The Public Works Director should develop a culture in the department of adaptability that includes a culture of embracing change, a customer focus, and departmental learning from failure, mistakes, and from best practices.

5. THE PUBLIC WORKS DIRECTOR SHOULD BUILD A CULTURE OF COOPERATIVE VALUES IN THE PUBLIC WORKS DEPARTMENT.

The table below presents the three aspects of cooperative values that the Public Works Director should foster in the Public Works Department.[26]

[26] The Matrix Consulting Group, in developing recommendations for the culture of the Public Works Department, utilized the features of the Denison Organizational Culture Model. This model was validated based upon a large and diverse sample of 35,474 individuals from 160 different public and private sector organizations.

Consistency. Defining the values and systems that are the basis of the culture.		
Core Values.	Do employees share a set of values that create a strong sense of identity and a clear set of expectations? Do executives and middle managers model and reinforce those values?	Executives and middle managers communicate and live by a set of core values. Help to define the department's culture, values, and ethics; and help employees learn to apply the values when dealing with themselves and their customers and stakeholders.
Reconcile Differences	Is the department able to reach agreement on critical issues? Can employees reconcile differences in a constructive way when problems arise?	Executives and middle managers help to reconcile differences when they occur by actively promoting constructive discussion of conflicting ideas, incorporating diverse points of view into decisions, and working toward win-win solutions.
Coordination and Integration	Do employees from different parts of the department share a common perspective that allows them to work effectively across departmental boundaries? Do they work to eliminate 'silos' and promote actions that are in the best interest of the department as a whole?	Executives and middle managers ensure that different work groups are able to work together well to achieve common goals. Executives and middle managers establish necessary contacts and coordinates resources in sections and divisions to prevent departmental boundaries from interfering with getting the work done.

The Public Works Director should foster a culture of core values, systems to constructively reconcile differences, and common perspectives to enable different work groups in the department to work together cooperatively.

The Public Works Director, in fostering a culture of core values in the Public Works Department, should:

- Work with a team of employees at all levels of the department to define the core values of the department;
- Provide training to employees to learn to apply the core values in dealing with fellow employees, customers, and stakeholders; and
- Ensure that the executive and middle management team practice the core values.

The Public Works Director, in fostering a culture of constructive reconciliation of differences in the Public Works Department, should:

- Help employees in the department to reach consensus on the causes of problems (e.g., change orders in capital projects);
- Help employees in the department reconcile differences by helping the employees clarify and understand other's points of view; and
- Help employees in the department identify critical issues (e.g., the root causes of problems) and reach agreement on resolution of those key issues.

The Public Works Director, in fostering a culture of common perspectives in the Public Works Department, should:

- Foster alignment of goals and objectives across departmental boundaries;
- Build coordination (e.g., capital projects) across departmental boundaries; and
- Establish mechanisms that facilitate effective cross-functional communication.

The Public Works Director should be held accountable for fostering a clear set of core values for the department that help employees and leaders make consistent decisions and behave in a consistent manner, reach constructive agreement when difficult issues and problems arise, and do not 'throw things over the fence' (e.g., this problem does not belong to my section), but coordinate their work with other sections, divisions, and departments to promote efficiency and serve the City as a whole.

Recommendation #249: The Public Works Director should build a culture of core values, the systems to constructively reconcile differences among the different divisions of the department, and common perspectives to enable different work groups in the department to work together cooperatively.

6. THE PUBLIC WORKS DIRECTOR SHOULD BUILD A CULTURE OF MEANINGFUL LONG-TERM DIRECTION FOR THE PUBLIC WORKS DEPARTMENT.

The table below presents the three aspects of meaningful long-term direction that the Public Works Director should foster in the Public Works Department.[27]

Mission. Defining a meaningful long-term direction for the department.		
Strategic Direction and Intent	Do employees understand the strategies identified by the department and do they think the strategies will work?	Executives and middle managers communicate the department's overall strategies so that all of the departmental employees can see the relationship between their work and the accomplishment of their section, division, or department's goals. Executives and middle managers effectively implement short and long-term strategies to meet departmental needs.
Goals and Objectives / Accountability	Are there short-term goals that help link what employees do on a day-to-day basis to the strategy and vision of the department? Do employees understand how their job fits in?	Executives and middle managers encourage high employee accountability in setting and accomplishing departmental goals. Executives and middle managers communicate a clear set of goals and objectives that can be linked to the mission, vision and strategy of the department.
Vision	Do employees share a common desired future state for the department? Do they understand the vision? Does it motivate them?	Executives and middle managers help create a shared view of a desired future state for the department. Executives and middle managers inspire employees with this vision, translate it into everyday activities and engage others to ensure buy-in and commitment.

The Public Works Director should foster a culture of strategic direction, accountability, and vision to provide a meaningful long-term direction for the department.

The Public Works Director, in fostering a culture of strategic direction and intent in the Public Works Department, should:

- Work cooperatively with employees form all levels of the department, develop a mission that gives direction for the department;

[27] The Matrix Consulting Group, in developing recommendations for the culture of the Public Works Department, utilized the features of the Denison Organizational Culture Model. This model was validated based upon a large and diverse sample of 35,474 individuals from 160 different public and private sector organizations.

- Help executive and middle managers focus on long-term strategies rather than quick-fix solutions; and

- Help executive and middle managers allocate the department's resources in line with the long-term strategies.

The Public Works Director, in fostering a culture of accountability in the Public Works Department, should:

- Work cooperatively with employees from all levels of the department, develop goals, objectives, and performance measures for the department;

- Communicate the goals, objectives, and performance measures to all employees in the department; and

- Hold executive and middle managers accountable for the achievement of the goals, objectives, and performance measures, reporting progress in accomplishing the goals, objectives, and performance measures to all employees in the department.

The Public Works Director, in fostering a culture of vision in the Public Works Department, should:

- Work cooperatively with employees from all levels of the Department to create a vision of what the department will be like in the future;

- Communicate the vision to all employees in the department; and

- Organize the work of the department so that everyone sees the connection between the vision and their day-to-day work.

The Public Works Director should be held accountable for providing a purpose and mission for the department, providing a clear direction for the department.

Recommendation #250: The Public Works Director should work cooperatively with employees at all levels of the organization in the development of a purpose and mission for the department, and providing a clear long-term direction for the department.

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The Public Works Director cannot achieve the recommendations contained within this chapter by staying on the second flood of the City Service Center and directing that all communication be channeled through his or her immediate reports. The Public Works Director must be willing to practice "management by walking around" - spending some part of his time every day listening to problems and ideas of the staff of the Public Works Department, while wandering around both floors of the City Service Center. The Public Works Director should communicate at all levels of the organization in informal ways, like just hanging around in the office and chatting with them.

This will require the Public Works Director to:

* Make management by walking around part of his or her routine every day to discuss departmental issues with all levels of the departmental organization;
- Not bring the executive and middle management team with him;
- Visit employees working in all sections and divisions – 1st floor and 2nd floor;
- Ask questions, ask for suggestions, watch and listen, and recognize good ideas;
- Share the long-term direction with the employees and clarify how their work contributes to that long-term direction;
- Catch employees in the act of doing something right, looking for things done well, and not failures; and
- Don't criticize, but focus on building rapport.

The Public Works Director, in "managing by walking around", will need to listen, respond to ideas or problems voiced at all levels of the department, and take effective action about the ideas or problems. "Managing by walking around" is an important opportunity to make sure that when the executive and middle manages of the department lead the department in a new direction, the employees won't trip over themselves trying to follow. The Public Works Director should tell them about the

department's vision for the future, and where their section and division fits in with the "big picture." The Public Works Director should reveal the goals and objectives that the Public Works Director wants them to help fulfill together as a departmental team.

Recommendation #251: The Public Works Director should practice "management by walking around" spending some part of his time every day listening to problems and ideas of the staff of the Public Works Department, while wandering around both floors of the City Service Center. The Public Works Director should communicate at all levels of the Public Works Department organization in informal ways, like just hanging around in the office and chatting with them.