STORMWATER SYSTEMS
ASSET MANAGEMENT PROGRAM

WASHTENAW COUNTY ROAD COMMISSION
(WCRC)

EGLE SAW GRANT #1256-01

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VERSION NOTES:

Asset management programs are intended to be "living processes" that will be revisited and updated from time to time to reflect any changes in the regulatory, social, economic, organizational, and institutional environments in which the infrastructure exists and operates. As such this document will undergo minor or wholesale updates over time. The Michigan Department of Environment, Great Lakes & Energy - State of Michigan (EGLE) Stormwater, Wastewater and Asset Management (SAW) grant program provided significant grant funding to create this Program but had a timeline of only approximately three years. This "Round 5" SAW grant was between 2017 and 2020 during which time the work would be funded, and this report deliverable was required. Subsequent versions can be tracked below:

- **DATE.** REASON FOR UPDATE

August 2020, first draft: All numbers are approximate and subject to change as the data continues to be reviewed. Highlighted sections are to be revisited or require review from WCRC.

September 2020, second draft: Updates from the first draft were made. All numbers are approximate and subject to change as the data continues to be reviewed. Highlighted sections are to be revisited or require review from WCRC. Incorporated CIP and criticality numbers.

October 2020, third draft: Updates from the second draft were made. Asset numbers and data have been updated to reflect most current GIS database. Appendices have also been included

November 2020, fourth draft: Updates from the third draft were made. Removed projects from 2020 from the CIP

December 2020, Final Draft

CHAPTER 1: EXECUTIVE SUMMARY

1.0 INTRODUCTION

Washtenaw County Road Commission (WCRC) is undertaking the development of an Asset Management Program ("Program") for its stormwater system, which it owns and operates. WCRC applied for and received a grant to develop a Program through the Michigan Department of Environment, Great Lakes & Energy (EGLE) Stormwater, Wastewater and Asset Management (SAW) program. This grant provides between 90% and 75% grant funding for costs related to developing an asset management program. The SAW program was established by EGLE in order to help communities move toward financial sustainability. Outside funding sources for stormwater systems are typically no longer available, and therefore EGLE is encouraging utilities to move toward becoming self-sustaining enterprises. This report includes Program elements related to WCRC stormwater systems

1.0.1 What is an Asset Management Program?

The *International Infrastructure Management Manual* defines the goal of asset management as meeting a required level of service in the most cost-effective way through the creation, acquisition, operation, maintenance, rehabilitation, and disposal of assets to provide for present and future customers.

An Asset Management Program includes a set of procedures to manage assets based on principles of life cycle costing implemented in a programmatic way. The intent of asset management is to ensure the long-term sustainability of the system. By helping a system manager make better decisions on when it is most appropriate to repair, replace, or rehabilitate particular assets and by developing a long-term funding strategy, WCRC can ensure its ability to deliver the required level of service perpetually.

Effective asset management implementation is comprehensive. It may involve integrating a number of tools along with other existing systems (accounting, financial reporting, purchasing and stores, payroll, etc.) to create an overarching information system that will support an integrated Asset Management Program. Properly practiced, it involves all parts of the organization and entails a living set of performance goals.

A good Program is not "done" and put on a shelf, but rather provides a framework of tools that may be continuously used for decision making. It is an active, on-going process that provides information to managers in order to make sound decisions about their capital assets and allows decision makers to better identify and manage needed investments in their system's infrastructure. The Program tools may be used for tasks such as reviewing and establishing annual budgets, planning improvements, allocating resources, and communicating performance with the public and regulatory agencies.

1.0.2 What is an Asset Management Plan?

An Asset Management Plan ("Plan") is a tool to help the Road Commission implement its Asset Management Program. The purpose of this report is to provide a long-term Plan that will assist

WCRC in planning for the short and long-term needs of the stormwater system, with a focus on the next 20 years. The goal of the Plan is to provide WCRC with the information required that will allow the organization to be able to continue to provide the desired level of service to the community at the lowest life cycle costs. This will be achieved by developing a strategic process to perform proactive maintenance and investment in the system, rather than reacting to failures.

The Plan consists of the five core components as described in the EGLE document, "Asset Management Guidance for Wastewater and Stormwater Systems." These include:

- Development of an Asset Inventory and Estimating Condition of Assets
- Identifying Critical Assets
- Identifying the Proposed Level of Service
- Capital Improvement Planning
- Establishing a Revenue Structure

1.1 SCOPE OF WORK

The scope of work for development of this Asset Management Plan included review of the stormwater system, and related structures and facilities. Because of the size of the system, all assets were not able to be mapped and inspected as part of this program. The program focused on the assets on Primary roads owned by WCRC in the five most urbanized Townships, Scio, Ann Arbor, Superior, Pittsfield, and Ypsilanti. As this first portion of the scope was completed, we expanded the scope to include all of the 2010 Urbanized Area, which included portions of Augusta, York, Saline, Lodi, Lima, Dexter, Webster, North, and Salem Townships which were also included for field inspection. Since not every storm asset could be inspected, this plan recommends programmatic changes to address the remaining County-owned assets.

Approximately 3,474 individual assets (4 Stormceptors, 3,119 structures, 255 end sections, and 96 outfalls) were inspected in the storm collection system, which represents approximately 93% of the storm structures located in primary roads in the County. WCRC also owns and maintains storm systems on local subdivision streets that were not included in the scope of this project. Storm sewers in primary roads account for approximate 47% of the total storm sewers owned and operated by WCRC as currently mapped. As WCRC continues to update the GIS, this number will be updated.

Each asset examined was categorized, given a rehabilitation and replacement value, and assessed for condition and criticality. These determinations were made by review of record documents on file for the asset and, in most cases, included detailed field inspections.

A Geographic Information System (GIS) was utilized for the asset inventories of the system. System Level of Service goals were developed with staff input. Structures were cleaned, inspected, and located using GPS technology. A capital improvement plan was developed for the rehabilitation and/or replacement of assets based on condition assessment data and upcoming road projects. Operation and maintenance recommendations were made as well.

1.1.1 Inventory of Assets and Condition Assessment

WCRC utilized its existing GIS geodatabase as the primary means to record and map the assets. The software package used was ESRI ArcGIS. The geodatabase records the attributes associated with each asset, such as installation date (age), size, and material. Again, this mapping was focused on the areas listed above, but the database was updated so that information can be collected on all assets in the future.

WCRC also used Roadsoft to inventory and evaluate the condition of culverts. Culvert information for culverts 5 feet or larger in diameter has also been added to the GIS.

Storm structures and assets at the five WCRC Service Centers were inventoried, inspected, and added to GIS database including the stormwater basins.

WCRC's Municipal Separated Storm Sewer System (MS4) outfalls, which discharge to Waters of the State, were identified in the GIS. The points of discharge along Primary roads from WCRC's system to other storm systems were recognized as well. Outfalls were located using GPS technology with pictures taken, and size and material recorded.

1.1.2 Level of Service Determination

WCRC maintains a Vision and Guiding Principles published on the website. Measurable goals were developed to further define the level of service. Considerations into the level of service included compliance to regulations, impact to the public, cost, personnel safety, etc. The level of service is used in conjunction with the Business Risk Evaluation (BRE) to determine the acceptable level of risk.

1.1.3 Capital Improvement / Operations and Management Planning

Capital Improvement Plans identify system rehabilitation and replacement needs for the future. The capital improvements related to the storm system are completed in conjunction road improvements. The information collected through this Grant will be used in the decision-making process to determine the scope of storm repairs in upcoming road projects. It should be noted that because of the funding mechanisms based on being a County road agency, much of the CIP is based on the roadways. The CIP for the stormwater system will be developed based on road planning.

Operation and Management tasks for the storm system, such as cleaning catch basins and rehabilitation, have been recommended on an ongoing basis based on observations made during catch basin cleaning and condition assessments.

1.1.4 Criticality and Risk Evaluation

WCRC developed formulas to estimate the probability of failure (POF) and consequence of failure (COF) of individual assets, which are then multiplied to determine the Business Risk Evaluation score (BRE) (POF x COF = BRE). Below is a summary of BRE scores for each horizontal asset type investigated during the SAW Grant program.

Table 1. Manhole BRE Summary

BRE Rating	Manhole Count
<= 5	6%
> 5 and <= 10	83%
> 10 and <= 15	10%
> 15 and <= 20	1%
> 20 and <= 25	0%

Table 2. Catch Basin BRE Summary

BRE Rating	Catch Basin Count
<= 5	52%
> 5 and <= 10	34%
> 10 and <= 15	13%
> 15 and <= 20	1%
> 20 and <= 25	0%

Table 3. Pipe BRE Summary

BRE Rating	Pipe Count
<= 5	31%
> 5 and <= 10	42%
> 10 and <= 15	25%
> 15 and <= 20	2%
> 20 and <= 25	0%

Table 4. Outfall BRE Summary

BRE Rating	Outfall Count
<= 5	42%
> 5 and <= 10	48%
> 10 and <= 15	10%
> 15 and <= 20	0%
> 20 and <= 25	0%

Table 5. End Section BRE Summary

BRE Rating	End Section Count
<= 5	14%
> 5 and <= 10	67%
> 10 and <= 15	18%
> 15 and <= 20	1%
> 20 and <= 25	0%

1.1.5 Budget Structure

WCRC maintains an annual budget available on its website. No further work was necessary to update the budget process.

1.2 FOR SAW, REQUIRED REPORTING

The deliverables required to complete the SAW grant project for the development of WCRC's AMP for the stormwater systems are provided in Appendix A, and include the following:

- A signed Certification of Project Completion for the stormwater AMP.
- A summary as required by the grant, that includes a brief discussion of the five major AMP components, a list of the plan's major identified assets, and contact information for the grant.

In addition, this report (which will likely be updated periodically) will be available for review by EGLE and/or the public for a period of at least 15 years. In addition, we understand an electronic copy of the summary will be posted on EGLE's website.

CHAPTER 2: SYSTEM OVERVIEW

2.0 DESCRIPTION OF WASHTENAW COUNTY ROAD COMMISSION (WCRC)

The Washtenaw County Road Commission (WCRC) is the county-level road agency in Washtenaw County, Michigan. WCRC is responsible for maintaining a road system that is reasonably safe and convenient to the traveling public.

At the time of this report in the year 2020, the agency was governed by a five-member Board of County Road Commissioners: Douglas E. Fuller (Chair), Barbara Ryan Fuller (Vice-Chair), Rodrick K. Green (Member), Gloria Llamas (Member), and Jo Ann McCollum (Member). The day-to-day operations are overseen by Managing Director, Sheryl Soderholm Siddall, and carried out by its 130 employees. WCRC is divided into three departments: Operations, Engineering, and Administration.

WCRC maintains 1,652 miles of certified public roads, which includes 770 miles of unpaved roads. All Primary and Local public roads in Washtenaw County located outside of city and village limits are maintained by WCRC crews. Many of these roads contain stormwater management infrastructure, which is the focus of this report. Outside of maintaining the storm sewers, crews also provide services such as dust control, gravel road grading, snow removal, pavement resurfacing, tree removal and a variety of other services, including but not limited to road and bridge construction, sign and signal maintenance, pavement markings, and guardrail repairs. In addition, WCRC is contracted by the Michigan Department of Transportation (MDOT) to maintain 598 lane-miles of state highways. The stormwater assets associated with the MDOT roadways are not included in this analysis because they are not County-owned assets.

2.0.1 WCRC Vision

WCRC aspires to be a premier road maintenance and planning agency, providing a high-quality system of roads and bridges through efficient maintenance, fiscal responsibility, and innovative planning and improvement strategies.

We aspire to provide the highest quality service through an open and fair decision-making process to meet the needs of the traveling public in Washtenaw County.

We strive to enhance the quality of life in urban and rural communities by drawing on the expertise, creativity, and commitment of our staff and partners.

We recognize that our success is dependent upon the collective talents of our staff and community resources to meet the challenges.

We commit to attracting the best and brightest workforce, strengthening their skills, and promoting and rewarding excellence, while nurturing diversity and encouraging innovation.

2.0.2 WCRC Guiding Principals

In our work together at WCRC, with our communities and other stakeholders, we will:

- Promote openness and transparency in decision-making.
- Provide ample opportunities for participation by the public and local government.
- Be conscientious stewards of the public's money.
- Value diversity.
- Be sensitive to the environment.
- Value all employees.
- Provide leadership in transportation planning and road system improvement.

2.1 WCRC ASSET MANAGEMENT TEAM

WCRC Asset Management Program was developed with input from WCRC staff (officials, accountants, engineers, managers, and operators) and other stakeholders. The main group of staff designated includes the Managing Director, Director of Engineering, Director of Operations, two Superintendents of Maintenance, and GIS Developer. Contact information is below and WCRC's organization chart as of July 13, 2020 can be found in Appendix B:

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2.2 SUPPORTING SERVICES

WCRC operates as a separate entity to the Washtenaw County municipal government. Support services, such as human resources, communication, finance, information technology (IT), etc. are provided in-house by WCRC staff.

2.3 SYSTEMS DESCRIPTION

Washtenaw County is located in Southeast Michigan surrounded by Wayne County to the east, Oakland and Livingston Counties to the north, Monroe and Lenawee Counties to the south, and Jackson County to the west. The entire County covers an area of approximately 722 square miles. The City of Ann Arbor is located in the eastern portion of the County and covers approximately 29 square miles. The eastern portion of the County is more developed, and the western portion more rural with the Pinckney and Waterloo Recreation Areas in the northwestern portion.

Roads and storm infrastructure within Cities and Villages are generally owned, operated, and maintained by the City or Village. The County includes the following Cities and Villages.

- City of Chelsea
- City of Dexter
- Barton Hills Village
- City of Ann Arbor
- City of Ypsilanti
- Village of Manchester
- City of Saline

- City of Milan (northern portion)

The roads and associated storm systems located in the Townships are generally owned, operated, and maintained by WCRC. The County includes the following Townships:

- Ann Arbor Township
- Augusta Township
- Bridgewater Township
- Dexter Township
- Freedom Township
- Lima Township
- Lodi Township
- Lyndon Township
- Manchester Township
- Northfield Township
- Pittsfield Township
- Salem Township
- Saline Township
- Scio Township
- Sharon Township
- Superior Township
- Sylvan Township
- Webster Township
- York Township
- Ypsilanti Township

The Washtenaw County Water Resource Commissioner (WCWRC) also owns drains located in easements or neighborhood streets, which were outside the scope of this project as only WCRC's assets in Primary roads were reviewed.

Locations where stormwater flows in or out of WCRC's system located in Primary roads to Cities, Villages, WCWRC, or Adjoining Counties were noted as Discharge Points in the GIS for the purpose of the EGLE Municipal Separated Storm Sewer System (MS4) permit. Locations where stormwater flows from WCRC's system to Waters of the State were noted as MS4 Outfalls.

Through Grant efforts, WCRC has identified 135 miles of storm sewer with 260 end sections, 2,437 culverts, 7,181 structures, 5 Stormceptors. 193 outfalls were also recorded in the GIS of which 113 have been identified as MS4 outfalls. Lastly, there are 6 basins across the 5 service center locations and 1 at the northwest corner of Carpenter Road and Textile Road. All of these assets are owned and operated by WCRC and were identified through record drawings, field inspections, and discussions with WCRC staff. Maps of County storm system are provided in Appendix C.

CHAPTER 3: ASSET INVENTORY

3.0 INTRODUCTION

The first EGLE core component of asset management is the asset inventory. The goal of developing an inventory is to answer the following questions:

- What do I own?
- Where is it?
- What condition is it in?
- What is its remaining useful life?
- What is its value?

It is critical for WCRC to understand what it owns in order to manage it effectively. In many systems, unfortunately, records regarding what assets have been installed may be old, incomplete, inaccurate, and/or missing; and staff turnover in operations and management may limit the historical knowledge of system assets.

The key to any asset inventory is that the data is comprehensive, accessible, and secure. The inventory can start as a very basic list and the data quality can be increased over time as the system gathers more information. The basic inventory data will typically include an asset name or ID, type of asset, location, material or make/model number, nameplate data for equipment, original cost, etc. More robust inventories can be expanded with additional data or linked to work orders.

Some assets will be too small or inexpensive to include in the database. In these cases, the value of the time it takes to input and track the asset is greater than its actual value to the system. Therefore, it is important to generate a definition of what will be considered an asset. For the purposes of developing the inventory, an "asset" may be individual items, a group of related items, an entire system or unit processes The inventory is typically organized into logical groupings of assets that fit into a hierarchy of larger and larger groups that can be "rolled" up or down in terms of detail. Items grouped into larger categories or systems can share a single replacement value and a common replacement schedule.

The inventory must also include an estimate of the condition of the assets, the remaining useful life and value. Historical data and staff knowledge can be used at first to make a reasonable estimate to answer these questions, and then the data can be expanded and refined as actual field inspection of the assets is made.

It is important to recognize that asset inventory is an ongoing process. After the initial inventory is established, there must be a system in place in order to ensure the inventory remains up-to-date. New assets must be added, and when existing assets are repaired, replaced, or decommissioned, the data for those existing assets must also be updated.

WCRC's stormwater system is required to maintain a MS4 Permit for its urbanized areas under the NPDES through EGLE because the system discharges to Waters of the State. The goal of the MS4 program is to reduce the discharge of pollutants to surface waters of the State. A MS4 is a system of drainage (including

roads, storm drains, pipes, culverts, and ditches, etc.) that is not a combined sewer or part of a sewage treatment plant. During wet weather, pollutants are transported through MS4s to local water bodies.

While this AMP is not directly related to WCRC's MS4 permit, many of the inventory and condition deliverables will assist with compliance. Progress Reports are due biennially for the MS4 permit and cover the previous two-year span. Employee training, illicit discharge identification, catch basin cleaning, new outfall discovery, Best Management Practices (BMP) implementation, and public education materials are just a few of the aspects that need to be documented. The SAW effort will be relevant to the next Progress Report.

The initial focus areas for asset inventory and condition assessments were the Primary roads in the five most developed Townships: Scio, Ann Arbor, Superior, Pittsfield, and Ypsilanti, referred to as the Five Townships throughout this report. Once the Five Townships were complete, Urbanized Area (UA) outside the Five Townships was added. The Census Bureau draws the UA every 10 years as part of the Decennial Census. The 2010 boundary was used, as the 2020 boundary has not been published. This expanded scope added urbanized area located in Augusta, York, Saline, Lodi, Lima, Dexter, Webster, Salem, and Northfield Townships.

3.1 SYSTEM INVENTORY

The general process followed to inventory these areas was to review existing plans, where available, and Google Street View to add approximate locations of storm system structures and sewers to the GIS. Then, a crew field located the structures using a GPS unit. Structures were cleaned and inspected (discussed more below) to verify or locate the associated pipes. The results of the field inspections were updated in the GIS system.

3.1.1 Inventory Scope of Work and Method

The "horizontal assets" generally include the assets that form a collection system and are disbursed over a large area. The storm sewers, manholes, and other related structures are inventoried using the databases generated by WCRC's GIS. Each structure or pipe is given a unique asset ID in the database, and related information such as size, depth, slope, material of construction, installation date, etc. are provided where available.

The locations of 3,461 storm sewer system structures and 96 outfalls were recorded. Many of these assets were located with a GPS unit that WCRC purchased through the SAW Grant. This unit will enable WCRC to continue to reliably record existing and new assets' locations through the coming years.

All 90 originally existing outfalls in WCRC's geodatabase were reviewed to identify potential State-regulated MS4 outfalls within the area of the Primary roads based on mapped storm sewers. Upon our review, approximately half of these were determined not to be outfalls. In addition, many other locations were determined to be MS4 eligible outfalls, which resulted in a total of 113 suspected MS4 outfalls within the 2010 Urbanized Area boundary along WCRC owned Primary roads. This information was crosschecked with WCWRC database of outfalls. HRC also utilized

contour data, numerous aerials, Google Street View and the WCWRC's County Drain maps which showed WCRC's drains, WCWRC's drains, as well as "waters of the State" to determine locations and the status of outfalls.

WCRC also owns 2,437 culverts identified in their GIS. The mapped culverts are generally those with diameters ranging from 12 inches (1 foot) up to 240 inches (20 feet). A culvert inventory and assessment program was undertaken by WCRC staff with the assistance of Great Lakes Engineering.

"Vertical assets" generally include buildings and facilities that have multiple assets at one location such as the basins at retention facilities. The individual assets that make up a particular location may be further broken down into process and sub-process areas, or "tiers." These tiers form a hierarchy that allows an individual asset to be "rolled up" into higher process areas so that planning can occur at an individual asset level, at a system level, or at the entire facility level. WCRC owns and operates stormwater retention/detention basins located at five (5) service centers which were inspected with the results included on maps of each service center in Appendix D. WCRC also owns and operates a stormwater detention basin along northwest corner of Carpenter Road and Textile Road.

3.1.2 Asset Management Software

WCRC utilizes software systems as a support structure for functions such as asset registry, condition assessment tracking, customer service tracking, maintenance planning, work order management, cost and rate analysis, and financial planning.

3.1.2.1 GIS Geodatabase

A geodatabase is an object relational database approach for storing spatial data. It acts as a repository for inventory data and links spatial features (location) with attributes (properties such as size, material, age, etc.) A geodatabase typically contains three primary dataset types: tables, feature classes, and raster datasets. The tables are a collection of rows each containing the same columns or attributes. Feature classes are tables with a shape field containing point, line, or polygon geometries for geographic features with each row being a feature. Each feature class shares a common set of attribute columns. A raster dataset contains rasters which represent continuous geographic phenomena. Raster datasets represent geographic features by dividing the world into discrete cells laid out in a grid. Each cell has a value that is used to represent some characteristic of that location. These are commonly used for representing and managing imagery, digital elevation models, and other phenomena.

The GIS geodatabase is a mechanism to improve "location-based" data management, facilitate strategic decision-making, and share data across various organization functions. This allows, for example, data collected by WCRC to be shared with the office of the WCWRC. As part of that example, it provides a means for road project planning to be coordinated with buried infrastructure needs. The current software WCRC uses is ESRI's ArcGIS.

Maintaining and updating geodatabases is an important task. Having the most up to date data is very important when making decisions about upcoming construction projects, maintenance

projects, or responding to customer's questions. WCRC's GIS is constantly maintained and is updated often. As newly constructed or rehabilitated assets are completed, a WCRC staff member will record the new assets location via GPS. Once the location of the asset has been recorded, information about the asset can be inputted into the GIS in the field through mobile apps, or from construction drawings at a desktop computer in the office. For example, the fields that were filled out during inspections for storm structures during the SAW Grant will be populated with updated inspection data as structures are revisited, rehabilitated, or replaced.

WCRC and WCWRC are two separate entities within the County. This means they are working around each other's utilities all the time. WCRC and WCWRC work together by sharing geodatabase updates with each other on an annual basis, or as requested. Since the two entities share data, they are able to use one another's inspection forms, which helps create continuity between separate parties that work together often.

3.1.2.2 Roadsoft

WCRC uses Roadsoft as a roadway asset management system for collecting, storing, and analyzing data associated with transportation infrastructure. It has a component that contains information about culvert locations, condition, types, and work order information. Throughout the SAW grant, WCRC staff, assisted by Great Lakes Engineering, located and inspected the condition of WCRC's culverts. Conditions were collected and stored in Roadsoft. The culvert information was incorporated into the geodatabase as well.

3.1.2.3 Precision

WCRC uses Precision as its financial software. It creates job numbers for large projects, such as culvert replacement. All project costs such as labor, equipment, materials, overhead, fringe, and payables are billed and tracked using the project job number. The construction work completed is tracked in Roadsoft. The two software programs do not communicate to each other but are used in tandem.

Operation and maintenance costs are also tracked through Precision, but with less detail. The software helps to divide costs for Primary or Local roads as they have different funding sources.

3.1.2.4 GPS Technology

A Trimble R2 GPS unit was purchased and used to record locations of the storm structures inspected. WCRC will continue to use the unit to accurately locate assets as they review the remaining structures. This unit was selected because of its accuracy, recommendations, and past experience. The Trimble R2 has a maximum accuracy of 1 centimeter horizontally, and 2 centimeters vertically. Field staff were consistently, and quickly, able to record points between 3 and 7 centimeters accuracy. The Trimble R2 was also recommended by HRC as a device that would suit the described needs of WCRC. Lastly, WCWRC uses Trimble products and has an R2 device. WCRC has used WCWRC's Trimble R2 in the past and found it easy to use with acceptable accuracy.

3.2 CONDITION ASSESSMENT, USEFUL LIFE AND VALUE

3.2.1 Condition Assessment, General

Condition assessment can be completed in many different ways, depending on the budget and resources available. Some of the simplest ways are to assign a numerical ranking to each asset using the best record information available, or by using age and expected remaining useful life. If additional resources are available, higher level of assessments using physical inspection and analysis can be prioritized for more critical assets. Sometimes physical inspection is not feasible, such as when equipment must be taken out of service for an extended period or when equipment is not readily accessible. As long as the consequence of failure is manageable, it may be more cost-effective to plan for rehabilitation or replacement based on reasonable assumptions of the asset's condition.

The overall condition of an asset may be summarized by rating it on a scale of 1 to 5, generally as described in the following:

Table 6. Asset Ratings Based on Condition

Asset Condition	Rating
Unserviceable - Over 50% of asset requires replacement	5
Significant deterioration - significant renewal/upgrade required (20 -40%)	4
Moderate deterioration -Significant maintenance required (10 -20%)	3
Minor Deterioration - Minor maintenance required (5%)	2
New or Excellent Condition - Only normal maintenance required	1

All assets will eventually reach the end of their remaining useful lives. Some assets will reach this point sooner than others. There are many factors that will affect the useful life of an asset such as maintenance practices, type of materials, usage, and surrounding environment. Useful life will also vary over time; for example, a structure may originally have been assigned a useful life of 75 years, but with proper maintenance and basic rehabilitation that useful life may extend to 100 years. Useful life should be reevaluated on a regular basis. Past experience, system knowledge, existing and future conditions, and maintenance practices will dictate ongoing updates to the useful life.

The value of the asset is the cost to replace the asset after it has exhausted its useful life. Obtaining costs for the asset replacement is not easy. In most cases, WCRC will use an estimate based on best practices. More reliable data can be added when available.

3.2.2 Condition Assessment, Horizontal Assets

As described previously, the horizontal assets that are the focus of this Program include the storm sewer and drain systems as well as the associated structures and other connected appurtenances

within WCRC's infrastructure. The primary means of condition assessment criteria for enclosed sewers, structures, manholes, and leads were developed by the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) and Manhole Assessment Certification Program (MACP.) These programs were first developed in 2001 and are updated regularly. NASSCO's programs provide standards for defect identification and condition assessment using a consistent and repeatable methods to identify, evaluate, and manage pipelines and manholes.

3.2.2.1 NASSCO Assessment and Scoring of Manholes

The NASSCO MACP program includes "Level 1" and "Level 2" inspections. Level 1 inspections are made by opening the manhole or structure and collecting some limited data that is visible from the surface without entering the manhole. For Level 2 inspections the defects and features are systematically cataloged along the length of the structure. This is usually done by entering the manhole or structure, typically under a confined space program, or by scanning the manhole with digital equipment.

As part of WCRC's SAW grant inspections, a "Level 1 plus" level of inspection form was developed. This inspection is performed from the surface but includes additional data beyond MACP's typical Level 1 assessment that will be used for condition assessment and overall evaluation of the structure. A minimum of three pictures were taken of each structure inspected showing the general area, the cover, and the inside of the structure. All structures with sumps were cleaned using vactor equipment prior to inspection. 3,280 structures and 4 Stormceptors were attempted to be inspected as part of the SAW grant effort. About 1,053 tons of waste was removed from the storm system by United Resources, Inc, averaging approximately 0.6 tons per structure. Table 7 breaks down the number of structures inspected in each municipality.

Table 7. Structures Inspected by Municipality

Municipality	Structures cleaned and inspected	Structures Inspected without cleaning	Total Structures inspected
Scio	590	188	778
Ann Arbor	127	24	151
Superior	109	37	146
Ypsilanti	630	254	884
Pittsfield	626	280	906
Additional Urbanized Area	165	93	258
Total	**2,247**	**876**	**3,123**

One of the fields collected was the general structural condition based on the following criteria:

Good Condition

- No visual signs of structural defects
- No major root intrusion
- No observed chimney problems
- No frame casting fractures

Fair Condition

- No visual signs of structural defects
- Defects that should be addressed in the next year (pointing)
- Some minor root intrusion, (fine roots)
- Some chimney problems (cracked or poor grouting, etc.)
- Some frame issue (frame offset from chimney, minor corrosion, etc.)

Poor Condition

- Visual signs of structural defects (deteriorated, fractured, collapsed, etc.)
- Defects that would suggest immediate repair (buried structure, collapsing structure, undermined, etc.)
- Root intrusion (causing obstruction, prohibited flow, etc.)
- Observed chimney damage (grout or block damage, heaving, voids, etc.) Visual frame damage (fractured/cracked, major corrosion, missing, etc.)

The conditions are entered into the GIS and then analyzed according to Chapter 5, Criticality and Risk Evaluation, in order to develop operation and maintenance and capital improvement strategies. Overall, the condition of the structures inspected are as follows:

Table 8. Asset Ratings Based on Condition

Asset Condition	Number of Structures
Good	2,936
Fair	280
Poor	68
Unknown*	94

*Unknown structures include, ones that are not found, inaccessible, or contained too much debris to properly inspect the structure.

As is typical with catch basins and manholes, the most common defect for these structures was found to be within the top 2 feet of the structure. This usually includes the chimney section where adjusting material, such as brick or block, begins to crack and break over time.

United Resources, Inc. also cleaned out four (4) Stormceptor structures, which were inspected using the same form as other structures. There is a fifth Stormceptor in a residential neighborhood that was not included as part of the scope of work for the grant. The maps in Appendix C include the locations of these Stormceptors.

Inspections of storm pipe interiors were not regularly completed as part of the condition assessment work done through SAW. One location storm pipes were cleaned and televised was near the Carpenter and Ellsworth intersection to address ponding and understand system connectivity. In the future, WCRC may be interested in inspecting additional storm pipes with Closed-Circuit Televising (CCTV) with NASSCO's PACP ratings. Defects that are found are weighted with scores on a severity scale of 1 to 5, with a "1" meaning the defect is minor, and a "5" indicating the defect is significant. Defects are classified into two primary categories, Structural, and Operation and Maintenance. Overall pipe grades are provided in several ways, including a "Quick Structural Rating" (QSR,) a Quick Maintenance Rating (QMR,) and an Overall Quick Rating (QPR.). These ratings are scored as a four-digit code from 5Z5Z to 0000, the higher the rating the worse the condition.

96 of the 113 suspected MS4 outfalls were located using GPS, photographed, and the material, diameter, and percentage open of the pipe/end section was recorded.

3.2.2.2 Culvert Assessments

WCRC has 2,437 culverts recorded in the system. 328 Culverts that are at least 5 feet in diameter have been inspected. The culverts were rated based on the Michigan Transportation Asset Management Council Rating Cards located in Appendix E. The culverts are rated on a of scale 1 to 10, 1 being failed and 10 being excellent. There are different observations made to assess the numerical condition rating depending on the material of the culvert. In general, the inspection takes into account structural deterioration, invert deterioration, section deformation, joints/seams, blockages, and scour. The condition data is presented in Table 9.

Table 9. Summary of Culvert Condition Assessment

Asset Condition	Number of Structures
10 – Excellent	35
9 – Very Good	0
8 – Good	21
7 – Satisfactory	58
6 – Fair	78
5 – Poor	72
4 – Serious	60
3 – Critical	27
2 – Imminent Failure	7
1 – Failed	0
0 – Unknown	2,054

3.2.3 Condition Assessment, Vertical Assets

WCRC's vertical assets include basins. Six basins located at five (5) WCRC Service Centers were inspected using ArcCollector, an ESRI mobile application. Maps of each Service Center are included in Appendix D. Overall, the six basins at the Service Centers were structurally sound. Several of the basins did exhibit excessive vegetation and algae. Lastly, a few of the pipes flowing into the basins were underwater due to high water levels at the time of inspection. Below are the inspection notes from each service center:

Main Yard Service Center – A retention pond is on the south side of the service center. Excessive vegetation and stagnant water were observed in the pond. Two outlets were actively discharging from WCRC's property to the north. A third pipe was discharging into the pond from the northeast corner of the pond. It was reported that this pipe was property of Ann Arbor. A fourth pipe outlets into the pond from the Holiday Inn's parking lot east of the pond. No immediate action is needed. WCRC should continue to monitor the vegetation and consider removing invasive species such as Phragmites. As vegetation increases, the areas around pipe end sections should be cleared.

Chelsea Service Center – A retention pond is located in the northeast corner of the property. The inlet from the retention pond flows west into the detention area. The retention pond's inlet is submerged underwater. Severe algae and cattail vegetation were noted on the eastern portion of the pond. The overflow structure is located on the west side

of the detention area. Structures need to be cleaned regularly as water backs up into the pipes when the basin water levels are high.

Northeast Service Center – There are two retention ponds at this service center. One is in the southwest corner and the other is towards the northern portion of the site. In the southwest corner a retention pond with excessive algae and minor vegetation was observed. An outfall from the parking lot was underwater, causing the structures to hold water. An open drain flows into the pond from the southeast corner of the service center parking lot. Water appears to overflow to the southwest towards the County Drain. The excessive algae should be addressed. The northern pond is located between the service center fence and Territorial Road. The pond is separated by weirs with two concrete outfalls and one corrugated metal pipe. One of the concrete outfalls was completely underwater, while the second was half submerged. Excessive algae was observed with excessive vegetation in some areas. The algae should be addressed in this area also.

Southeast Service Center – Excessive vegetation was observed throughout the basin. Phragmites were found on the north side of the basin near one of the two basin inlets emptying into the basin. It is estimated that one-third of the basin consisted of phragmites, while the remaining two-thirds of the basin were covered in cattails. The vegetation was matted down near the inlets from water flow. One overflow outlet was found towards the south side of the basin. Vegetation should be cleared near inflow structures to allow for more effective flow. Phragmites could also be removed.

Manchester Service Center – Two inlets were observed, one on the west side of the basin and the other on the north side. The basin overflows to the northeast through a channel. Sediment observed blocking outfalls should be cleared regularly.

Copies of the Inspection data and photos are in WCRC's GIS. Below are recommendations, including estimated costs, to address algae and phragmites. Algae was present in 3 of the 6 basins while excessive or invasive vegetation was found in 4 of the 6 basins.

Algae – Algae growth is a result of nutrification of the water being discharged into the basin. The process to control algae is to construct a forebay or level spreader that will act as a nutrient sink before the run-off enters the basin. Because these structures are more elaborate, and require site specific design requirements, a cost estimate was not provided.

Phragmites – Phragmites are an invasive plant species. The use of herbicide treatments is recommended as the primary control method. After an initial herbicide treatment, one or more follow-up methods at each site are recommended such as prescribed fire, mechanical treatment, or water level management. Once areas of invasive species have been controlled (e.g., greater than 85% reduction), it is recommended that an annual maintenance control program be implemented. In general, herbicide treatment costs about $400 per acre.

Table 10. Basin Acreage for Remediation

Basin	Acreage	Algae	Excessive / Invasive Vegetation	Cost to Remediate Vegetation
Main Yard Service Center	1.4	No	Yes	$560
Chelsea Service Center	0.25	Yes	Yes	$100
Northeast Service Center - Southwest	0.66	Yes	No	N/A
Northeast Service Center - North	0.50	Yes	Yes	$200
Southeast Service Center	0.70	No	Yes	$280
Manchester Service Center	0.25	No	No	N/A

*Cost for initial herbicide treatment excessive or invasive vegetation: $400 / acre

3.3 USEFUL LIFE

All assets will eventually reach the end of their remaining useful lives. Some assets will reach this point sooner than other assets. There are many factors that will affect the useful life of an asset such as maintenance practices, type of materials, usage, and surrounding environment. Useful life will also vary over time; for example, a sewer may originally have been assigned a useful life of 100 years, but with proper maintenance and/or lining, the actual life may extend well beyond the original useful life estimate. Useful life should be reevaluated on a regular basis. Past experience, system knowledge, existing and future conditions, and maintenance practices will dictate ongoing updates to the useful life.

Any data collected during a physical inspection only represents the condition of that asset at the time the assessment is made. As time passes after the inspection, the asset will continue to age, experience wear due to operational conditions, and be subject to damage or failure through other modes. The frequency required for inspection and condition assessment of various assets and types of systems was reviewed and standards developed.

CHAPTER 4: LEVEL OF SERVICE

4.0 INTRODUCTION

Level of Service (LOS) defines the way in which the stakeholders want the system to perform over the long term. The LOS can include any technical, managerial, or financial components desired. The LOS will become a fundamental part of how the system is operated. An example of this includes questions such as what design storm should be used for drainage, or in other words, how often is it acceptable for the streets to flood? While this question may seem theoretical and the answer intuitively obvious, trying to construct and maintain a system that would have "unlimited capacity" and "never fail" is unrealistic as well as unaffordable to operate and maintain.

All systems must operate within the state and federal regulations and requirements. In Michigan, these regulations are generally specified in facility's National Pollutant Discharge Elimination System (NPDES) permit, but there are additional rules and regulations that will apply, such as compliance with MIOSHA. Although the local, state, and federal regulations may set bare minimum standards of operation in the LOS, these standards may not adequately address all areas of operation and should not be the sole factor of the LOS. Utilities should include many other factors to delineate important areas of the system's operation.

Within the range of the minimum (regulations) and maximum (absolute capabilities of assets), there are numerous components a system could include within its LOS to communicate its intentions with its customers, measure its performance, and determine critical assets. Communicating the capabilities of the system with customers will avoid confusion and a negative public image if an event occurs for which the system wasn't designed or intended to service and will build community support for financing the system. Communication should be used to manage expectations between the system and the users.

Defining the LOS also sets the goals for WCRC system. These goals allow the operations staff to have a better understanding of what is desired from them, and the management has a better understanding of how to use staff and other resources more efficiently and effectively. Periodic review of how the system is meeting the LOS allows management to shift resources, if needed, from one task to another to meet all the goals most effectively. Understanding the desired LOS will help to prioritize and characterize WCRC's system, as well as how to manage finances to reach the LOS goals.

There is a direct link between the LOS provided and the cost to WCRC customer. A higher LOS usually costs more to provide than a lower service level. This direct link demands that the system have an open dialogue with its customers regarding the LOS desired and the amount WCRC has the ability to pay.

Similar to asset management plans that will change and adjust over time, the LOS may need to be adjusted from time to time. This adjustment may be required because WCRC may discover that it is too costly to operate the system at the levels previously defined. Or the adjustment may be necessary due to new rules or regulations that require a change in operation. As with all components of asset management, LOS is an ongoing process and determining and detailing the level of service that the system is going to provide is a key step in asset management.

4.1 LEVEL OF SERVICE GOALS

Meetings were held with strategic staff to determine what goals and measurable indicators to establish for WCRC.

The LOS identifies the long-term goals and strategies of the organization. The strategic LOS has a strong external focus and covers the major portions of the organization. It identifies major targets, actions, and resource allocations relating to the long-term survival, value, and adoption to ongoing changes of an organization. An overall LOS guiding matrix was developed to document the goals and strategies for WCRC's stormwater management system.

Table 11. Level of Service Goals

	WCRC Base Level of Service Goals	Measurables
Financial Viability and Impact	Emergency repairs can be repaired within Reserve Budgets of the system	Exceedances of reserve budgets
Public Confidence / System Service Impact	Minimal to some standing water for less than twenty-four hours.	Number and length of unscheduled road closures due to flooding and complaints
Regulatory Compliance	No state permit violations. Comply with all EGLE policies.	Number of violations
Safety of Public and Employees	No reportable injuries, no lost-time injuries, or medical attention required. No impact to public health	Number of injuries and any public health advisories
Staffing	Staffing levels and training maintained to meet level of service	Number of open positions, training hours

WCRC's full Vision and Guiding Principles are included above in Chapter 2. These statements provide an overarching purpose for maintaining the Asset Management Program by considering the impacts to public health, the system's ability to comply with regulations, and financial stability if resources are not properly managed. The Vision and Guiding Principles are not specifically relevant to the stormwater management system, so the above goals were developed.

CHAPTER 5: CRITICALITY AND RISK EVALUATION

5.0 INTRODUCTION

Not all assets are equally important to the system's operation. Some assets are highly critical to maintaining operations, and others could be out of service for a period of time without negative consequences. Certain types of assets may be critical in one location, but not critical in another. For example, a storm sewer serving a long stretch of a main road with high traffic counts would be deemed more critical than a storm sewer serving two catch basins on a less travelled road. WCRC must examine its assets very carefully to determine which assets are critical and why.

In determining criticality, two questions are important. The first is how likely it is that the asset will fail; and second, what is the consequence of failure. By developing a scoring scale for these two measures, and then combining the two results, the overall risk of an individual asset can be quantified. Determining an asset's overall risk will allow WCRC to manage its risk, aid in the allocation of operation and maintenance dollars, and prioritize capital expenditures.

5.0.1 Probability of Failure (POF)

To estimate the Probability of Failure (POF) of a given asset, consider a number of factors such as asset age, condition of asset, failure history, historical knowledge, experiences with that type of asset in general, maintenance records, and other knowledge regarding how that type of asset is likely to fail. POF ratings are weighted using significant factors of that asset type with scoring values from 1 to 5, with 1 being the least likely to fail and 5 being the most likely to fail.

Probability of failure typically increases as an asset ages or continues to operate. Risk associated with assets with high probabilities of failure may be reduced, if warranted, by increasing the level of maintenance, frequency of replacement, or by changing the asset type or providing redundancy.

5.0.2 Consequence of Failure (COF)

To estimate the potential Consequence of Failure (COF) of a given asset, it is important to consider all potential costs associated with failure of that asset. These can include not only costs to repair and/or replace the asset but also social costs associated with the loss of the asset, repair or replacement costs, and legal costs related to collateral damage caused by the failure, environmental costs, loss of emergency services access, impacts to the public, and other types of losses. The consequence of failure can be high if any one of these costs is significant or the accumulation of several costs occurs with a failure. COF ratings are weighted using significant factors of that asset type with scoring values from 1 to 5, with 1 having the lowest potential cost impacts due to failure and 5 having the highest potential cost impacts.

The consequence of failure typically is established when the asset is placed into operation and generally remains the same over the asset's lifecycle. Risk associated with assets with high consequences of failure is primarily managed by reducing the probability of sudden failure through increased maintenance and replacement, or by providing redundancy.

5.0.3 Business Risk Evaluation (BRE, or Risk)

The assets that have the greatest probability of failure and the greatest consequences associated with the failure will be the assets that are the most critical. The Business Risk Evaluation (BRE or Risk) score takes into account the POF, the COF, shown below. Adjustments can be made to take into account any redundancy available that would mitigate the consequence of failure.

$$Risk = POF \times COF$$

Assets with the highest risk scores are likely candidates for immediate rehabilitation or replacement. Assets with lower scores should to be analyzed to develop the best life cycle strategy. If an asset's potential modes of failure and risks of failure are understood, it is possible to leverage use of the asset for a longer period and ensure the useful life is maximized before investing in replacement.

For some assets with a low consequence of failure, it may be most cost effective to operate in a "run to failure" mode, where the asset is operated until it can no longer function. An example of this might be a catch basin on a smaller road that drains directly to a ditch. The structures and pipes would not be cleaned or replaced unless there was a blockage causing a flood. It is more cost effective to run the asset to failure than to perform routine monitoring. Preventive and predictive maintenance programs are most cost effective for assets with higher consequences of failure. In these cases, the cost of the routine monitoring is much less than the cost associated with consequences due to a failure.

Risk should be managed in any decision-making process by analyzing and documenting acceptable risk tolerance for all critical assets. It will be necessary to periodically review the criticality analysis, and to make adjustments to account for changes in the probability and consequence of any asset failures. As with all the components of the Asset Management Program, the criticality analysis is an on-going process.

5.1 PROBABILITY OF FAILURE

Each of the assets were given a ranking from 1 to 5 for probability of failure. This ranking was based on 50% condition score and 50% Pavement Surface Evaluation and Rating (PASER) system score, for areas where inspections occurred, and condition scores are available. Where condition scores are not available PASER ratings are used. PASER is a system for visually rating the surface condition of a pavement from a scale of 1 to 10, with 1 being a pavement in a failed condition and 10 being a pavement in excellent condition. By using the PASER score, it is assumed that roads in poor condition will also have storm structures in poor condition. A complete list of the probability of failures for the system's assets is given in Appendix F.

5.2 CONSEQUENCE OF FAILURE

Each asset was given a ranking from 1 to 5 for consequence of failure. This ranking was based on traffic counts (20%), number of lanes (20%), pipe size (40%), depth (10%), and location within the Floodplain (10%). A complete listing of the consequence of failures for the system's assets is given in Appendix F.

5.3 BUSINESS RISK EVALUATION

The product of the probability of failure and the consequence of failure resulted in the final business risk evaluation (BRE) score. The calculations were completed in ArcMap using GIS modeling software. A complete listing of the BRE scores for the system's assets is given in Appendix F. Table 11 summarizes the BRE scores for structures:

Table 12. Summary of BRE Scores

BRE Score	Number of structures
1 - 5	2,654
5 - 10	3,546
10 - 15	884
15 - 20	95
20 - 25	2

The BRE scores will allow WCRC to prioritize repairs and maintenance to the storm sewer system. By comparing the BRE scores of areas that have not been inspected yet, WCRC will be able develop an inspection program that will prioritize the areas with a higher risk. From there, WCRC can inspect the less critical infrastructure at the end of the inspection program, or on a less frequent basis.

The areas with the most concentrated BRE scores greater than 15 are:

- Ellsworth Rd between Carpenter Rd and Golfside Rd
- Baker Rd in Northwest Scio Township
- Jackson Rd in Scio Township
- Dixboro Rd between E Huron River Dr. and Erin Ct, Ann Arbor Township
- Textile Rd between Tuttle Hill Rd and Bunton Rd, Ypsilanti Township

CHAPTER 6: O&M AND REVENUE STRUCTURE

6.0 INTRODUCTION

Typically, stormwater utilities do not have a customer base billed for services, or other dedicated funding source. O&M and capital improvements are often funded through a Michigan Transportation Fund or as part of a larger road or bridge project.

The budget should consist of the actual budget line items as required by the State of Michigan Chart of Accounts and other accounting statutes, rules, regulations, and requirements applicable to municipal entities. Accurate budgeting will help track and control spending, ensure accountability, and improve the ability to anticipate expenses.

Once total expenses have been identified, charges can be reviewed to determine how to provide sufficient revenues to cover expenses. Because WCRC does not charge rates for stormwater service, revenue is based on non-user sources, such as Act 51, federal, and local funding.

WCRC's annual budget for the current and previous year is available online. WCRC's budget does not specifically call out O&M Costs. Sources of income include Michigan Transportation Fund, Federal/State Funds, State Trunkline Maintenance, Township contributions, and other miscellaneous contributions. Expenditures are grouped into categories for operations, administration, engineering, non-departmental, debt services, and reimbursable road project, capital improvements, and state trunkline.

6.1 OPERATION AND MAINTENANCE (O&M) RECOMMENDATIONS

WCRC classifies its roads as Primary or Local which have different funding sources. Due to the different road classifications WCRC provides different levels of maintenance depending on the condition of the road, surrounding area, type of traffic, and several other factors. Data was collected during the inspections regarding the structural integrity and O&M needs of each structure inspected. The total tons of material removed from the structures cleaned each day was also tracked. Based on this data and observations, O&M recommendation are included below.

Currently, WCRC's O&M practices are reactive based. As problems arise, staff and resources are allocated to amend the issue. Through this SAW Grant, WCRC has cleaning data for most of its structures in Primary roads. This gives WCRC the ability to be more proactive by regularly maintaining areas that exhibited higher levels of sediment and debris, reducing the likelihood of maintenance related issues such as road flooding.

6.1.1 Structures

Any structure with a sump will collect material in the sump over time and should be cleaned a minimum of every 10 years. There are some structures observed that should be cleaned more frequently based on the amount of material removed during this inspection. Using the data collected during inspections, recommendations have been made for areas to clean every year, 3 years, and 6 years. Those structure recommended to be cleaned every year may show significant improvement next year allowing the frequency to be reduced. At this time however, an excess

amount of material was removed through the recent SAW grant efforts resulting in a recommendation to review these structures next year. The remaining structures with sumps should be cleaned on a 10-year rotation. The four Stormceptors have also been categorized with these structures. The following list summarizes the recommendations:

- 1-year rotation: 210 structures
    - The Stormceptors and structure upstream.
    - Ford Blvd between Holmes Rd and M-17.
    - Rawsonville Rd at the intersection of Willis Rd and to the south (See bullet in "Other Issues" below).
    - Zeeb Rd and Park Rd Intersection.
    - Wagner Rd between Jackson Rd and Liberty Rd.
    - Structures located at the Chelsea Service Center, emphasis on the structure inside the northwest garage.
    - Pit at the Northeast Service Center garage where vactor waste is dumped should be cleaned regularly to avoid catch basins filling with sediment.
    - Pit at the Manchester Service Center garage.
    - Jackson Rd and Parker Rd Intersection.
    - Jackson Rd between Metty Dr and Stabler Rd.
    - Jackson Rd and April Dr Intersection.
    - Jackson Rd between Wagner Rd and Parklake Ave.
    - Ellsworth Rd between Carpenter Rd and Golfside Rd
    - Dixboro Rd between E Huron River Dr. and Erin Ct.
    - Textile Rd between Tuttle Hill Rd and Bunton Rd
    - Baker Rd between Jackson Rd and Dan Hoey Rd.
    - Hewitt Rd and Valley Dr Intersection.
- 3-year rotation: 91 structures
    - Ann Arbor-Saline Rd between Maple Rd and I-94.

  - Boulder Ridge Blvd and Oak Valley Dr Intersection.
  - Oak Valley Dr between Scio Church Rd and Ellsworth Rd.
  - Ellsworth Rd between Maple Rd and State St.
  - Ranchero Dr between Ellsworth Rd and Oak Valley Dr.
  - Lohr Rd between Ann Arbor-Saline Rd and Ellsworth Rd.
  - Waters Rd between Oak Valley Dr and Ann Arbor-Saline Rd.
  - Rawsonville Rd between Bemis Rd and Willis Rd.
  - Willis Rd between Rawsonville Rd and McKean Rd.

- 6-year rotation: 156 structures
  - Textile Rd and Maple Rd.
  - Lohr Rd between Textile Rd and Ellsworth Rd.
  - Lohr Circle off Lohr Rd.
  - Hitchingham Rd between Textile Rd and Hampton Ct.
  - Merritt Rd between Whittaker Rd and Stoney Creek Rd.
  - Zeeb Rd between Park Rd and Dexter Ann Arbor Rd.
  - Ann Arbor-Saline Rd between Wagner Rd and Surrey Dr.
  - Dean Dr between Stoney Creek Rd and Morgan Rd.
  - Willis Rd between Warner Rd and Crane Rd.
  - Ann Arbor-Saline Rd between Textile Rd and Ellsworth Rd.
  - Carpenter Rd between Willis Rd and Judd Rd.
  - Hewitt Dr between Congress St and Packard St.
  - Merritt Rd between Poplar Dr and Whittaker Rd.
  - Tuttle Hill Rd between Martz Rd and Textile Rd.
  - Dixboro Rd between Woodridge Ave and Geddes Rd.

- Earhart Rd between Plymouth Rd and I-94.
- Plymouth Rd between Earhart Rd and US-23.
- Platt Rd between Textile Rd and Morgan Rd.

- Other Issues
  - Rawsonville Rd at the intersection of Willis Rd and further south were full of sediment. Just south of Country Farms Supermarket, southwest of the intersection, the pipe opens to a ditch that is blocked. If this blockage could be removed, the area may improve. Otherwise this area should be cleaned annually.
  - Oak Valley Dr catch basin between two retention basins was observed to be surcharged as the basin levels are high.

During the 2020 SAW Grant, extensive structure cleaning was conducted. WCRC performed some of the work in-house, as well as contracted a portion out to United Resource, LLC. The average cost to clean structures through United Resources was $160 per structure. The road sections with the most material removed from structures were organized above into a 1 year, 3 year, and 6 year recommended cleaning schedule. Structures with BRE scores of 15 or higher were also included in the 1 year cleaning rotation. Table 13 provides the estimate costs for the recommended cleaning schedule discussed above.

Table 13. Recommended Cleaning Schedule Cost

Rotation	Number of Structures	Total Cost*	Cost per year*
1 Year	210	$33,600	$33,600
3 Year	91	$14,560	$4,850
6 Year	156	$24,960	$4,160

*Average cost for contractor to clean structure: $160

6.1.2 Sewers

A minimum amount of sewer televising around Carpenter Rd and Ellsworth Rd intersection was completed as part of the SAW grant effort to investigate areas with frequent flooding and verify the system mapping. Therefore, the condition of the sewers outside of this intersection is mostly unknown. However, it can be assumed that areas with increased material removed from the sumps would benefit from cleaning the sewers. It is beneficial for preventative maintenance to clean and televise storm sewers every 15 years, beginning with areas with high BRE scores and a history of above average amounts of sediment.

6.2 O&M BUDGET

The annual operation and maintenance budget includes the typical costs spent each year to perform normal maintenance activities on both roads and the associated storm sewer infrastructure. It does not include major capital improvements that are required to increase capacity or meet new regulatory requirements, or replacement of items with a useful life of more than 20 years, such as major structures. The O&M budget includes costs related to personnel, supplies, disposal costs, etc. The typical annual O&M budget accounts for expected annual cost increases, such as increases in wages and benefits, etc. This baseline O&M budget does not include major capital improvements that are required to increase capacity, meet new regulatory requirements, or replace items that have failed or reached the end of their useful service life.

Almost all of the categories in the website published budget would be considered operation and maintenance items except reimbursable road projects, capital improvements, and state trunkline expenditures. Most operation and maintenance funding for the stormwater system come from WCRC's Michigan Transportation Fund (MTF).

6.3 REPLACEMENT COSTS

The replacement cost is the cost to replace the item at failure or replacement time, and can help justify the cost of maintenance and rehabilitation that would delay or even eliminate the need for replacement. The replacement cost can be divided by the remaining useful life to calculate an annual contribution to the Replacement Fund for each item. The annual total amount for replacement could then be included in the budget as a line item. These items would have to be funded out of system revenues, so they must be accounted for in the annual budget and in the rates and charges.

It is noted that this process of determining valuation did not involve a determination of depreciation value for accounting purposes. The only purpose in this valuation determination was to determine the recommended amount of funds to set aside for yearly basic replacement and rehabilitation.

A valuation of the existing storm sewer system assets that estimates replacement of the entire system is not feasible or necessary. It would be more feasible for the entire system to be lined using cured-in-place pipe (CIPP). The cost to rehabilitate the entire storm sewer system using cured-in-place pipe (CIPP) lining is a more accurate way to value the existing system and was estimate for each line with a total cost of approximately $63 million.

As discussed in Chapter 6.1.2, a minimum amount of storm sewer pipe televising and cleaning was completed as a part of the SAW Grant. It is estimated to cost $1.9 million to clean and televise all of WCRC's pipes, as recorded in the GIS.

About 93% percent of the storm sewer structures were located and inspected sufficiently within Primary roads to determine a rehabilitation cost of $302,000 which is included with the Storm Manhole CIP further discussed in Chapter 7. A replacement cost for storm structures was calculated based on structure diameter, depth, proximity to utilities, water, and roads to be $300 million.

The following plan for culverts 5 ft or larger has been developed over the past 5 years as inventory has been identified. WCRC inspects them every 5 years on a rotating basis. Once a culvert reaches a critical point, WCRC begins inspecting the culvert every year. No preventative maintenance occurs during the inspection process. After the culvert is given a poor condition classification, WCRC works to replace the culvert if it is along a Primary road. If the culvert is located along a Local classified road, WCRC collaborates with the local Township to replace the culvert.

CHAPTER 7: CAPITAL IMPROVEMENT PLAN

7.0 INTRODUCTION

A long-term Capital Improvement Plan (CIP) should look at WCRC's system needs for the future, typically over a period of at least 20 years, with greater emphasis on the first five years of the plan. It is understood that the specific expenditures and needs of the system in the latter years are more speculative than the needs for the first 5 years; however, the inclusion of needs over this longer timespan will provide a better opportunity for WCRC to ensure the system is evaluated in a comprehensive manner. Capital improvement projects are those that WCRC has an extended period of time to plan for, and are projects that usually cover high cost, non-recurring work items.

In order to fund any short or long-term project, WCRC must first identify the desired project, its anticipated cost, and the appropriate funding source. Because WCRC does not have a dedicated funding source for stormwater improvements, the majority of the Road Commission's stormwater projects and preventative maintenance are conducted during pavement resurfacing or more intense road rehabilitation projects. The method to prioritize future projects is mainly driven by their process to select road projects.

Once road projects have been identified, WCRC would like to include necessary stormwater projects and proactive measures in conjunction with the road project. By making it a priority to investigate the stormwater system before beginning the road project the Road Commission can allocate the necessary funding reducing the surprise of additional costs. The stormwater system can be investigated by cleaning and televising pipes, and inspecting manholes prior to finalizing road construction plans.

A separate stormwater Capital Improvement Fund could be funded on an annual basis and the accumulated Capital Improvement Fund monies can be used to supplement bonding for the particular project, act as a down payment, or cover the entire cost of the project as determined by WCRC. Using a stormwater CIP in conjunction with the Road Commission's TIP, Millage Schedule, and Long Range Plan, WCRC can estimate the cost of each identified stormwater project and the intended date for project initiation. The clear identification of the project, its cost, and the intended timeframe provides WCRC with a defensible presentation for setting aside and safeguarding funds for projects.

The following information is helpful when prioritizing and gaining support for a capital improvement project:

- Description of the project
- Brief statement regarding the need for the project
- Year project needed
- Is the year needed flexible or absolute
- Estimate of project cost
- How costs were estimated
- Funding source(s) considered/available for this type of project
- Business case cost-effectiveness study for new technology/efficiency projects

7.1 RECOMMENDED CIP PROJECTS

The method to prioritize future stormwater projects is mainly driven by WCRC's process to select road projects, with as-needed rehabilitation or replacement of the associated storm assets included in the project. The Road Commission, in general, selects road projects based on PASER data, and their future Pavement AMP and Bridge AMP. The Pavement and Bridge AMPs are scheduled to be completed in the Fall of 2021 and will incorporate WCRC's TIP, Local Millage Schedule, and LRP.

Stormwater CIP projects will be constructed along with road projects, and therefore their priority will be based on the funding for each year. As these road projects are planned, the storm sewer system needs will be reviewed and addressed accordingly. This may include televising pipes to determine condition, completing structure inspections, pointing, and tucking structures, raising structures, or completing pipe rehabilitation or replacement. Based on the current project lists, the areas in Appendix G are slated for a potential project in the next 0-5 and 6-20 years. These projects are based upon available funding and may change as priorities change.

The data collected through the SAW grant on storm structures in the Primary roads will assist WCRC with developing the scope of storm system upgrades needed for future road projects with less field investigation needed.

While most storm sewer projects will be completed along with road projects, the inspections that have been completed as part of the SAW grant have identified multiple structures that should be slated for repair outside of pavement projects in the next 0-5 years due to damaged covers, soil being visible, undermining, and other significant structural issues. Manholes with significant infiltration issues such as runners and gushers were included in this repair list as well. These structures are listed in Appendix G. Maps are also included in Appendix G.

7.2 ANTICIPATED SCHEDULE AND FUNDING

WCRC provides a Transportation Improvement Program (TIP) which is a 4-year financial program that describes the schedule for obligating federally funded projects. The Road Commission also has the 2021-2024 Millage project schedule for local road projects. This Millage is voted on by citizens and provides an increase in local funding to allow WCRC to perform additional preventive maintenance, rehabilitation, and road reconstruction projects. Lastly, WCRC uses a Long Range Plan (LRP) to identify and begin to plan for projects up to 25 years ahead. Currently WCRC's LRP extends to the year 2045.

WCRC's operations and maintenance and investment in infrastructure are generally funded through the Michigan Transportation Fund (MTF). This work normally includes Primary roads. Subdivisions and Local roads are funded differently based on the Township. Routine maintenance of Local roads such as pothole patching, replacing small culverts, grading, mowing, and other similar work is funded using MTF solely. If Local roads require capital improvements that are above normal maintenance activities such as crack sealing, chip seal, road resurfacing, and more intense work, Townships can go directly to WCRC for assistance, but normally use available methods through the Michigan's Public Act 188 (PA 188). In general, PA 188 allows Townships to pay for improvements, such as road and stormwater projects, through

special assessment districts (SAD). Townships may also fund road and stormwater projects through a road millage or simply through the general fund collected from property taxes.

When a culvert is identified as needing rehabilitation or replacement along Primary roads, WCRC is responsible for funding 100% of the work. When a Local road culvert is identified as needing replacement and requires an EGLE or County Drain Permit, WCRC and the respective Township split the cost of the project 50% each.

Typical funding sources for WCRC are:

- Federal & State Funds
- Michigan Transportation Fund (MTF)
- Special Assessment Districts
- Township Contributions
- Four-Year County Road Millage
- Other Contributions

7.3 IDENTIFICATION OF FUTURE PROJECTS

Since WCRC has short- and long-term road projects and dates detailed in advance, storm sewer improvements can be proactively identified with proper funding allocated. Using condition data gathered through SAW Grant efforts and condition data that will be collected in the same manner at future dates, the Road Commission has the ability to judge if significant storm system work needs to be done during the future road projects along Primary roads. For near-term Local road or subdivision projects, it is recommended WCRC follow a similar condition assessment procedure regarding storm structures and televise storm sewer pipes. Although the stormwater assessment will cost additional funding now, the proactive approach can prevent a costly repair in the future. For projects in the distant future, WCRC can factor in the cost to perform condition assessments for the storm utility in the original scope of the project to relieve the need for additional funding later on.

CHAPTER 8: PROGRAM CONCLUSIONS AND HIGHLIGHTS

8.0 INTRODUCTION AND PROJECT HIGHLIGHTS

The SAW program provided funding for a thorough review of WCRC's storm sewer and culvert system. Below is a summary of how the funding was used:

- Asset Inventory
    - Significant updates to the GIS database to improve location accuracy and add condition data, particularly in the Urbanized area.
    - 1,579 sets of plans were scanned and linked to GIS for easier reference
    - Located 3,195 structures and 96 outfalls with the purchased GPS unit
    - 2,437 culverts were located and rated using Roadsoft
- Condition Assessment/ Preventative Maintenance
    - Cleaned and inspected 93% eligible structures on the Primary roads in the Five Townships and Urbanized Area. Inspection data was collected on 3,474 points and 3,902 pipes; 1,053 tons of debris were removed from structure sumps.
    - Condition data for 328 culverts was recorded using Roadsoft.
    - Cleaned and inspected four Stormceptors.
    - Inspected five service centers including inspections of all structures and basins.
- Criticality, LOS, CIP, and Planning
    - Developed LOS goals.
    - Calculated criticality scores for horizontal assets
    - Provided O&M and CIP recommendations with cost estimates
- Hardware, Software, Training
    - 26 Laptops and associated hardware
    - Trimble R2 GPS Device and iPad controller
    - GoPro Camera
    - Leica Imaging Scanner and iPad controller

8.1 FOR SAW, REQUIRED REPORTING

This Plan includes a Certification of Completion for the EGLE SAW Grant Program. In addition, we understand a summary of this report will be posted on EGLE's website and materials made available to the public upon request. We also understand the AMP shall be available for public review for 15 years from submission.

8.2 FUTURE ASSET MANAGEMENT GOALS

WCRC will continue to maintain and add to the GIS database. The Primary roads were the focus of the SAW efforts; future efforts will expand to the Local roads, particularly to complete tasks related to the MS4 program.

WCRC should revise this plan as needed to manage assets effectively and efficiently. Updates can be tracked in the Version Notes Section at the beginning of this report.

Along with this Stormwater Asset Management Plan, WCRC is required to submit Asset Management Plans for its bridges and its pavement in the Fall of 2021. Because WCRC does not have a rate that it charges customers for its services, asset management planning is more challenging. When accounting for the Stormwater AMP, Pavement AMP, and Bridge AMP, the Road Commission will have a more holistic view of their assets and asset's conditions to better allocate resources for repairs, capital improvements, equipment, facilities, pensions, other post-employment benefits, and other responsibilities.

Appendix A

Executive Summary and Certificate of Completion

HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

MEMORANDUM

To: Michigan Department of Environmental, Great Lakes, and Energy (EGLE)
Revolving Loan Section
Attn: Kathy Roeder

From: Hubbell, Roth and Clark, Inc.

CC: Washtenaw County Road Commission

Date: December 2, 2020

Re: Washtenaw County Road Commission
EGLE Stormwater, Asset Management and Wastewater (SAW) Grant #1256-01
Summary of Stormwater Asset Management Plan

The following is a summary of the work completed under the EGLE SAW Grant work performed by Washtenaw County Road Commission (WCRC). It includes a summary of the project scope, results and findings of activities covered by the grant, grant amount spent and match amount, and contact information. It has been prepared as required under Section 603 of Public Act 84 of 2015 and follows recent EGLE guidance.

GRANTEE INFORMATION

Washtenaw County Road Commission
555 North Zeeb Road,
Ann Arbor, MI 48103

SAW Grant Project #1256-01

Project Grant Amount: $1,291,667

Applicant Match Amount $208,333

Authorized Representative:	Engineering Contact:	Consultant Contact:
Sheryl Soderholm Siddall, PE Managing Director	Matthew F. MacDonell, PE Director of Engineering and County Highway Engineer	Karyn Stickel, PE Hubbell, Roth & Clark
Phone: (734) 761-1500 siddalls@wcroads.org	Phone: (734) 327-6688 macdonellm@wcroads.org	Phone: (248)-454-6300 KStickel@hrcengr.com

EXECUTIVE SUMMARY

Washtenaw County Road Commission (WCRC) applied for and received a grant to further develop an Asset Management Plan (AMP) for its stormwater system through the Michigan Department of Environmental, Great Lakes, and Energy's (EGLE) Stormwater, Wastewater and Asset Management (SAW) program. Because the SAW program was funded through monies appropriated for water quality, other related infrastructure systems, such as roads and bridges, were not eligible for funding through the grant, but are considered in analysis and recommendations where appropriate.

WCRC owns, operates and maintains the storm sewer system and has various tools used to manage the assets, including an Esri Geographic Information System (GIS) geodatabase, condition assessment methods, risk and prioritization models, and an operating and capital improvement project plan. These tools are used to guide the short and long-term strategies to operate the various systems in a sustainable manner that meets the required level of service, with a focus on prioritizing assets that are most critical and being cost-effective. In general, stormwater improvements are made to the WCRC system as part of road projects, or as failures occur.

The following is a summary of the AMP, as required by the grant, which includes a brief discussion of the five major AMP components, a list of the plan's major identified assets, and contact information for the grant. WCRC's AMPs will be available to EGLE upon request, and a copy of the plan will be available to the public review on the WCRC's website for at least 15 years.

STORMWATER INVENTORY

WCRC uses its existing Geographic Information System (GIS) geodatabase as the primary means to inventory and map the assets in the system. The geodatabase includes key attributes associated with each asset, such as installation date (age), size, material, along with other information as needed for a given asset type. Through grant efforts, WCRC populated the information necessary to use the GIS more effectively for the federal aid road located in the five most populous Townships (Ann Arbor, Ypsilanti, Scio, Pittsfield and Superior).

GIS has been used by WCRC for the past number of years through a subscription with Esri ArcGIS software. Although some of the stormwater assets were included in GIS, it was not a comprehensive inventory. The inventory did not include all of the local or residential streets. As part of this grant, the stormwater assets in the primary roads of the five urban Township's were updated. Using record drawings, GPS, and field observations made during condition assessment, the data in the GIS was expanded and accuracy greatly improved using grant funds. Laptops were purchased for key staff for easier access to the GIS data. A Trimble R2 GPS device was also purchased to assist in recording the locations of assets.

Below is a summary table of the inventory in GIS.

Asset Type	Amount
Manholes	2,326 assets
Catch Basins	4,855 assets
Special Chambers (oil separators, stormceptors, others)	19 assets
Pipe Segments	7,791 assets (135 miles)
Potential MS4 Outfalls	113 assets
Outfalls	80 assets
End Sections	260 assets

Condition assessment tools and protocols were developed by WCRC to allow for efficient and consistent recording of asset condition. Storm sewers were televised only for a special investigation. NASSCO-compliant inspection information was collected during the sewer televising investigation at Carpenter Rd and Ellsworth Rd. For manholes, NASSCO inspection protocols were used to collect data. The data is stored in the GIS system. This data will also be used to maintain assets, further develop inspection schedules, and capital improvements.

As part of the grant, the GIS geodatabase inventory was reviewed for completeness and to ensure critical attributes were populated. Approximately 3,461 structures and other related assets were evaluated using the NASSCO inspection protocol. The Contractor, United Resources, cleaned the structures with sumps in order for inspectors to properly assess the conditions of the assets. The inspection data is linked to the assets in the GIS system.

CRITICALITY OF ASSETS

WCRC developed baseline Probability of Failure (POF) and Consequence of Failure (COF) factors that were added to the GIS attributes, and were used to estimate the overall risk of the horizontal assets (sewers and associated structures).

Both the POF and COF were scored on a scale of 1 to 5, with 1 being the lowest probability or consequence of failure, and 5 corresponding to the highest probability or consequence of failure. The Business Risk Evaluation (BRE or Risk) score is the product of the POF score and the COF score (POF times COF equals Risk,) and has a scale of 1 to 25. Higher BRE scores identify the assets with the greatest overall risk.

The POF and COF for horizontal assets are determined using scoring values developed uniquely for each asset type, such as gravity main, manhole, etc. The POF and COF scores for each asset type are calculated using attribute data from the GIS geodatabase, inspection data, a modified version of NASSCO MACP ratings and PASER ratings. Where inspection data were not available, the POF score was based only on PASER ratings of the asset. The COF for horizontal assets was determined based on asset depth, size, surface type, proximity to wetlands, proximity to railroads, and proximity to roads and intersections.

Below is a list of BRE scores for the horizontal assets in the WCRC's storm water system

Storm Pipes	
BRE Score	Percent of Manholes
<= 5	31%
5 <= 10	42%
10 <= 15	25%
15 <= 20	2%
20 <= 25	0%

Storm Manholes	
BRE Score	Percent of Manholes
<= 5	6%
5 <= 10	83%
10 <= 15	10%
15 <= 20	1%
20 <= 25	0%

LEVEL OF SERVICE DETERMINATION

WCRC has developed a vision to provide quality service to its residents. This vision statement is as follows:

WCRC aspires to be a premier road maintenance and planning agency, providing a high-quality system of roads and bridges through efficient maintenance, fiscal responsibility, and innovative planning and improvement strategies.

We aspire to provide the highest quality service through an open and fair decision-making process to meet the needs of the traveling public in Washtenaw County.

We strive to enhance the quality of life in urban and rural communities by drawing on the expertise, creativity, and commitment of our staff and partners.

We recognize that our success is dependent upon the collective talents of our staff and community resources to meet the challenges.

We commit to attracting the best and brightest workforce, strengthening their skills, and promoting and rewarding excellence, while nurturing diversity and encouraging innovation.

The current procedures and ongoing operations of WCRC have successfully fulfilled this mission and will continue to be implemented. WCRC has chosen to continue their ongoing process rather than adopting specific goals. They will continue to consider the impact of to the public health and the system's ability to comply with any applicable regulations and operational needs.

REVENUE STRUCTURE

The annual operation and maintenance budget includes the typical costs spent each year to operate the system and to perform normal maintenance activities. This baseline O&M budget does not include major capital improvements that are required to increase capacity, meet new regulatory requirements, or replace items that have failed or reached the end of their useful service life.

WCRC does not charge a stormwater utility rate; therefore, the revenue structure was not reviewed for the AMP. Improvements to the storm system, when needed, are primarily funded through road funds.

CAPITAL IMPROVEMENT PLAN

The method to prioritize future stormwater projects is mainly driven by WCRC's process to select road projects, with as-needed rehabilitation or replacement of the associated storm assets included in the project. WCRC, in general, selects road projects based on PASER data, and their future Pavement AMP and Bridge AMP. The Pavement and Bridge AMPs are scheduled to be completed in the Fall of 2021 and will incorporate WCRC's TIP, Local Millage Schedule, and LRP.

Stormwater CIP projects will be constructed along with road projects, and therefore their priority will be based on the funding for each year. As these road projects are planned, the storm sewer system needs will be reviewed and addressed accordingly. This may include televising pipes to determine condition, completing structure inspections, pointing, and tucking structures, raising structures, or completing pipe rehabilitation or replacement. These projects are based upon available funding and may change as priorities change.

The data collected through the SAW grant on storm structures in the Primary roads will assist WCRC with developing the scope of storm system upgrades needed for future road projects with less field investigation needed.

While most storm sewer projects will be completed along with road projects, the inspections that have been completed as part of the SAW grant have identified multiple structures that should be slated for repair outside of pavement projects in the next 0-5 years due to damaged covers, soil being visible, undermining, and other significant structural issues. Manholes with significant infiltration issues such as runners and gushers were included in this repair list as well.

RECOMMENDATIONS

In order to keep this AMP sustainable into the future, a review process will be undertaken annually to review existing recommendations, status of current projects, and forecasted needs against available reserves and anticipated funding. The asset information will be regularly updated to incorporate any new GIS and operational and condition data. The information can be reviewed to update recommended treatment and replacement strategies, and capital projects. The updated recommendations will be reviewed on a regular basis as part of the annual process to ensure the availability of required funds for the projects.

LIST OF MAJOR ASSETS

WCRC's major assets include:

- 712,800 feet (135 miles) of 2-72-inch storm sewer pipe
- 4,855 storm catch basins
- 2,326 storm manholes
- 2,437 Culverts
- 193 Outfalls (Includes MS4)
- 260 End Sections
- 5 Stormceptors (4 inspected)

EGLE

Department of Environment, Great Lakes, and Energy (EGLE)
SAW Grant
Stormwater Asset Management Plan
Certification of Project Completeness

Completion Due Date December 31, 2020
(no later than 3 years from executed grant date)

The **Washtenaw County Road Commission** *(legal name of grantee)* certifies that all stormwater asset management plan (SWAMP) activities specified in SAW Grant No. **1256-01** have been completed and the SWAMP, prepared with the assistance of SAW Grant funding, is being maintained. Part 52 of the Natural Resources and Environmental Protection Act, 1994, PA 451, as amended, requires implementation of the SWAMP within 3 years of the executed grant (Section 5204e(3)).

Attached to this certification is a summary of the SWAMP that identifies major assets. Copies of the SWAMP and/or other materials prepared through SAW Grant funding will be made available to EGLE or the public upon request by contacting:

Sheryl Soderholm Siddall, at	(734) 327-6687	siddalls@wcroads.org
Name	Phone Number	Email

Sheryl Soderholm Siddall — Sheryl Soderholm Siddall, Dec 16 2020 8:30 AM

Signature of Authorized Representative (Original Signature Required) — Date

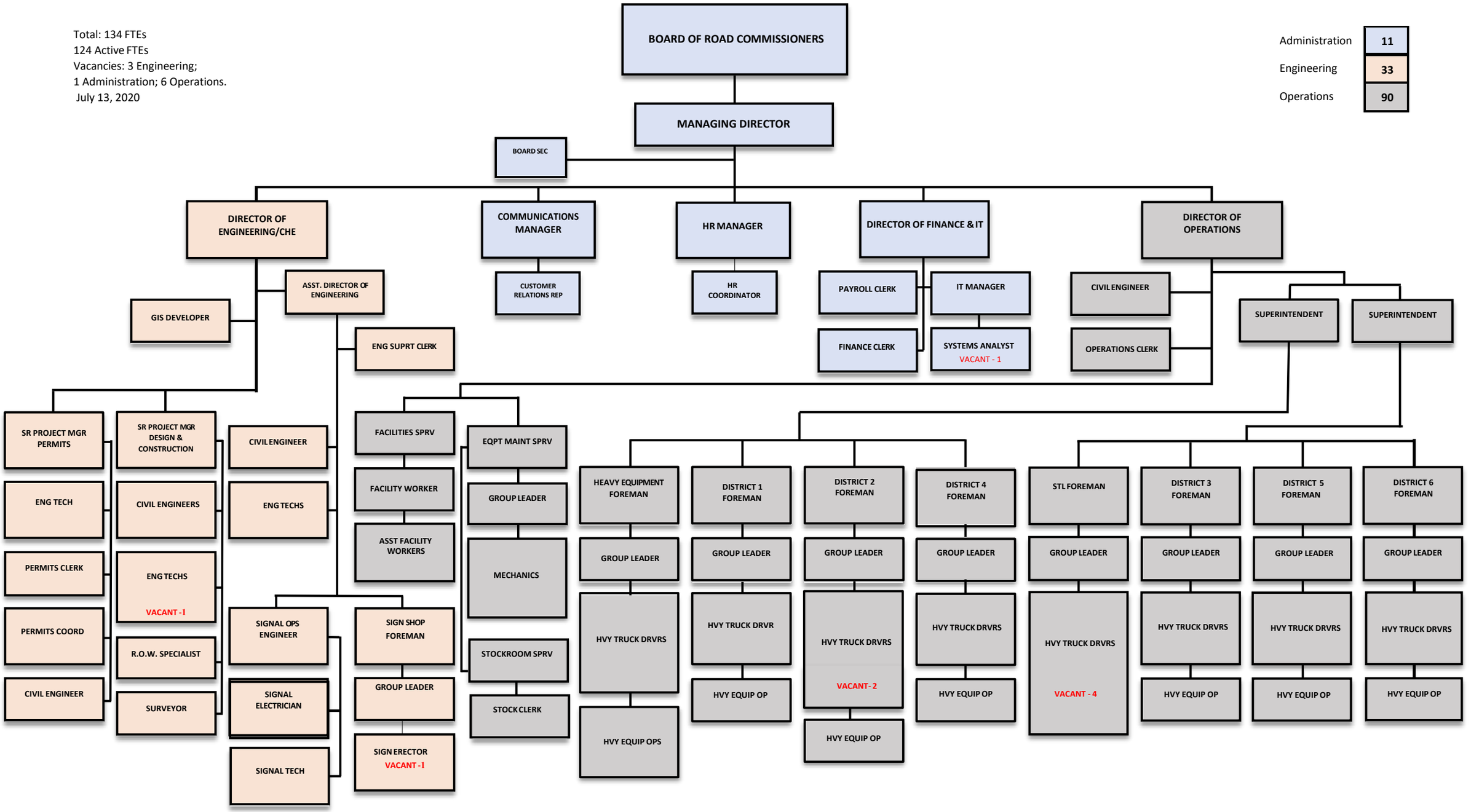
Sheryl Soderholm Siddall, Managing Director
Print Name and Title of Authorized Representative

Appendix B

WCRC Organization Chart

Total: 134 FTEs
124 Active FTEs
Vacancies: 3 Engineering;
1 Administration; 6 Operations.
July 13, 2020

Administration	11
Engineering	33
Operations	90



Appendix C

County Storm System Maps

Overall Storm System: North West Quadrant

Structures
- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Culverts

Pipes
- Pipes

N

0 0.5 1 2 3
Miles

Date: 11/11/2020

WASHTENAW COUNTY ROAD COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
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Lyndon
Dexter
Webster
Chelsea
Sylvan
Lima
Scio
Sharon
Freedom
Lodi
Waterloo
Cavanaugh Lake
Grass Lake
Roepke
Hadley
Glenbrook
Hankerd
McGregor
Strawberry Lake
North Territorial
Dexter Town Hall
Dexter Pinckney
Stofer
Mast
Huron River
Island Lake
Lima Center
Werkner
Joy
Huron
Central
Forest
4th
2nd
Hudson
Main
Dan Hoey
Shield
Dexter Chelsea
Dexter Ann Arbor
Miller
Baker
Pratt
Zeeb
Liberty
Jackson
Parker
Dancer
Fletcher
Scio Church
Sylvan
Old US 12
Kalmbach
Industrial
Sibley
Dewey
Railroad
North
Hayes
Middle
Summit
Lincoln
Washington
Wilkinson
Freer
Commerce Park
Manchester

Overall Storm System: North East Quadrant

Structures
- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Culverts

Pipes
- Pipes

N

0 0.5 1 2 3
Miles

Date: 11/11/2020

COUNTY ROAD WASHTENAW COMMISSION

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CONSULTING ENGINEERS SINCE 1915

Webster
Northfield
Salem
Scio
Ann Arbor
Superior
Lodi
Pittsfield
Ypsilanti

Eight Mile
8 Mile
7 Mile
6 Mile
Barker
Shore
Main
Merrill
Valentine
Coyle
Rushton
Tower
Angle
Curtis
Napier
Webster Church
North Territorial
Sutton
Pontiac
Curtis
Whitmore Lake
Gotfredson
Joy
Huron River
Warren
Nixon
Plymouth
Ford
Dixboro
Whitehall
Eastfield
Miller
Dexter Ann Arbor
Pratt
Zeeb
Jackson
Barton
Dhu Varren
Traver
Travierwood
Green
Huron
Goss
Arrowhead
Woodridge
Prospect
Newport
Brooks
Sunset
Wildt
Swift
Maiden
Depot
Fuller
Glazier
Dexter
Kingsley
1st
Ann
Catherine
Glen
Washington
Liberty
Ashley
William
Fletcher
Observatory
Madison
4th
5th
Division
Church
University
Hill
Oxford
Federal
Pauline
Greene
Hoover
State
Maple
7th
Stadium
Granger
Park
Packard
Ferdon
Brockman
Arlington
Wagner
Scio Ridge
Greenview
Scio Church
Oak Valley
Ann Arbor Saline
Industrial
Boardwalk
King George
Platt
Pittsfield
Carpenter
Hogback
Golfside
Hewitt
Cornell
Lorvell
Forest
Geddes
Harris
Macarthur
Clark
Ward
Ridge
Leforge
Superior
Holmes

Overall Storm System: South West Quadrant

Structures
- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Culverts

Pipes
- Pipes

N

0 0.5 1 2 3
Miles

Date: 11/11/2020

COUNTY ROAD WASHTENAW COMMISSION

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CONSULTING ENGINEERS SINCE 1915

Sylvan
Lima
Scio
Sharon
Freedom
Lodi
Manchester
Bridgewater
Saline
Scio Church
Grass Lake
Struthers
Fletcher
Parker
Zeeb
Prospect Hill
Below
Jacob
Pleasant Lake
Reno
Hieber
Easudes
Weber
Ernest
Schneider
Sharon Valley
Dutch
Madison
Duncan
Vernon
Division
Hubbard
Main
Macomb
Adrian
Austin
Kaiser
Sharon Hollow
Logan
Burmeister
Herman
Watkins
Braun
Clinton
McCollum
Case
Willow
Arkona
Lindsley
Wellwood
Hack

Overall Storm System: South East Quadrant

Structures
- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Culverts

Pipes
- Pipes

N

0 0.5 1 2 3
Miles

Date: 11/11/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Washtenaw County Road Commission Stormceptors

Stormceptor

N

0 0.1 0.2 0.4 0.6 Miles

Date: 12/03/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Appendix D

Service Center Maps

Zeeb Road Service Center

Legend

Structures

- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Pipes

N

0 50 100 200 300 400

Feet

Date: 10/19/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Chelsea Service Center

Legend

Structures

- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Pipes

N

0 25 50 100 150

Feet

Date: 10/19/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Cleveland
Chelsea
Middle
Wilkinson
Middle

Manchester Service Center

Legend

Structures

- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Pipes

N

0 25 50 100 150 200

Feet

Date: 10/19/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

North Territorial Service Center

Legend

Structures

- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Pipes

N

0 50 100 200 300 400

Feet

Date: 10/19/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Michigan Ave. Service Center

Legend

Structures

- Catch Basin
- Manhole
- Inlet
- Inlet End Section
- Other Special Chamber
- Pipes

N

0 50 100 200 300

Feet

Date: 10/19/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Appendix E

Michigan Transportation Asset Management Council Culvert Rating Cards

CMP

CMP	Structural Deterioration (Corrosion)	Closed Bottom Invert Deterioration	Open Bottom Invert Deterioration	Section Deformation	Joints/ Seams	Condition
10	New condition. Galvanizing intact. No corrosion.	New condition; galvanizing intact; no corrosion.	New condition	Reference CMP Shape Deformation Table	Reference CMP Joints / Seams Table	Excellent
9	Discoloration of surface. Galvanizing partially gone. No layers of rust.	Discoloration of surface. Galvanizing partially gone along invert. No layers of rust.	Good with no invert erosion			Very Good
8	Discoloration of surface. Galvanizing gone along invert but no layers of rust. Minor section loss at ends of pipe not located beneath roadway.	Discoloration of surface. Galvanizing gone along invert but no layers of rust. Minor section loss at ends of pipe not located beneath roadway.	Good with only minor invert erosion			Good
7	Galvanizing gone with layers of rust. Moderate section loss at ends of pipe not located beneath roadway. Moderate section loss: Less than 6 in^2/ft^2.	Galvanizing gone along invert with layers of rust. Moderate section loss at ends of pipe not located beneath roadway. Moderate section loss: Less than 4% of invert area.	Minor erosion near footings			Satisfactory
6	Heavy rust and scale throughout. Heavy section loss with perforations not located under the roadway. Heavy section loss: Up to 15 in^2/ft^2.	Heavy rust and scale throughout. Heavy section loss with perforations in invert not located under the roadway. Heavy section loss: Up to 10% of invert area.	Moderate erosion along footing; protective measures may be required			Fair
5	Extensive heavy rust and scaling throughout. Perforations throughout with an area less than 30 in^2/ft^2. Overall thin metal, which allows for an easy puncture with chipping hammer.	Extensive heavy rust and scaling throughout. Perforations throughout invert with an area less than 20% of invert area. Overall thin metal, which allows for an easy puncture with chipping hammer.	Erosion along footing with slight undermining, protection required			Poor
4	Extensive heavy rust and scaling throughout. Perforations throughout with an area less than 36 in^2/ft^2.	Extensive heavy rust and scaling throughout. Perforations throughout invert with an area less than 25% of invert area.	Severe undermining with slight differential settlement causing minor cracking or spalling in footing and minor distress in walls			Serious
3	Perforations throughout with an area greater than 36 in^2/ft^2 .	Perforations throughout invert with an area greater than 25% of invert area.	Severe undermining with significant differential settlement causing severe cracks in footing and distress in walls			Critical
2	Pipe partially collapsed.	Pipe partially collapsed.	Structure partially collapsed or collapse is imminent.			Imminent Failure
1	Total failure of pipe.	Total failure of pipe.	Total failure of structure.			Failed

CMP	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

CONCRETE PIPE

Concrete Pipe	Structural Deterioration/Closed Bottom Invert Deterioration	Open Bottom Invert Deterioration	Section Deformation	Joints/Seams	Condition
10	New Condition. Superficial and isolated damage from construction.	New condition	Not Applicable: Rigid material pipes are not rated for deformation	Straight line between sections.	Excellent
9	Hairline cracking without rust staining or delamination(s). Surface in good condition.	Good with no invert erosion		No settlement or misalignment. Tight with no defects apparent.	Very Good
8	Hairline cracking: Less than 1/16th inch wide parallel to traffic without rust staining. Light scaling: Less than 1/8th inch deep with less than 10% of exposed area. Delaminated or Spalled area: Less than 1% of surface area. Note: cast-in-place box culverts may have a single large crack less than 3/16th inch on each surface parallel traffic direction.	Good with only minor invert erosion		Minor misalignment at joints. Minor settlement. Distress to pipe material adjacent to joint.	Good
7	Hairline and map cracking: Cracks less than 1/8th inch parallel to traffic with minor efflorescence or minor amounts of leakage. Scaling: Less than 1/4th inch deep or 20% of exposed area. Spalled areas with exposed reinforcing: Less than 5%. Total delaminated and spalled areas less than 5% of surface area.	Minor erosion near footings		Misalignment of joints but no infiltration. Settlement. Dislocated end section. Extensive areas of shallow deterioration. Minor cracking.	Satisfactory
6	Map cracking with hairline cracks less than 1/8th inch parallel to traffic or less than 1/16th inch transverse to traffic with efflorescence, or rust stains, or leakage or all. Scaling 3/16th inch deep on less than 30% of surface area. Spalled areas with exposed reinforcing on less than 10% of surface area. Total delaminated and spalled areas less than 15% of surface area.	Moderate erosion along footing; protective measures may be required		Joint open and allowing backfill to infiltrate. Significant cracking, spalling, or buckling of pipe material. Joint offset less than 3 inches. End sections dislocated and about to drop off from main portion of the structure. Infiltration staining apparent.	Fair
5	Transverse cracks open greater than 1/8th inch with efflorescence and rust staining. Spalling at numerous locations. Extensive surface scaling on invert greater than 1/2 inch. Extensive cracking with cracks open more than 1/8th inch with efflorescence. Spalling has caused exposure of heavily corroded reinforcing steel on bottom or top of slab. Extensive surface scaling on invert greater than 3/4th inch or approximately 50% of culvert invert.	Erosion along footing with slight undermining, protection required		Differential movement and separation of joints. Significant infiltration or exfiltration at joints. Joint offset less than 4 inches. Voids seen in fill through offset joints. End sections dropped off at inlet.	Poor
4	Extensive cracking with spalling, delaminations, and slight differential movement. Scaling has exposed all surfaces of the reinforcing steel in bottom and top slab or invert with approximately 50% loss of wall thickness at invert. Concrete very soft.	Severe undermining with slight differential settlement causing minor cracking or spalling in footing and minor distress in walls		Significant openings. Dislocated joints at several locations exposing fill material with joint offsets greater than 4 inches. Infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway. Large voids seen in fill through offset joints.	Serious
3	Full depth holes. Extensive cracking greater than 1/2 inch. Spalled areas with exposed reinforcing greater than 25%. Over 50% of the surface area is delaminated, spalled, or punky. Reinforcing steel bars have extensive section loss and bar perimeter is completely exposed.	Severe undermining with significant differential settlement causing severe cracks in footing and distress in walls		Culvert not functioning due to alignment problems throughout. Large voids seen in fill through offset joints.	Critical
2	Culvert partially collapsed or collapse is imminent.	Structure partially collapsed or collapse is imminent.		Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	The culvert is collapsed.	Total failure of structure.		Total failure of pipe.	Failed

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CONCRETE PIPE

Concrete Pipe	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

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PLASTIC PIPE

Plastic Pipe	Structural Deterioration	Invert Deterioration*	Section Deformation	Joints/Seams	Condition
10	New Condition.	New Condition.	Smooth wall. Span dimension up to 2% greater than design.	Straight line between sections.	Excellent
9	Isolated rip or tear less than or equal to 6 inches caused by floating debris or construction. Minor discoloration at isolated locations.	Minor discoloration at isolated locations.	Smooth wall. Span dimension up to 5% greater than design.	No settlement or misalignment. Tight with no defects apparent.	Very Good
8	Split less than or equal to 6 inches but not open more than 1/4th inch at two or three locations. Damage due to cuts, gouges, or distortion at end sections from construction or maintenance.	Perforations caused by abrasion located within 5 feet of outlet and not located under roadway.	Relatively smooth wall. Span dimension up to 7.5% greater than design.	Minor misalignment at joints. Minor settlement. Distress to pipe material adjacent to joint.	Good
7	Split less than 6 inches with width not to exceed ½ inch at two or three locations. Damage due to cuts, gouges, burnt edges, or distortion at end sections from construction or maintenance.	Perforations caused by abrasion located within 5 feet of inlet and outlet and not located under roadway.	Minor dimpling appearing at an isolated small area: Less than 1/16th of circumference area and 1 foot in length. Dimpling less than 1/4 inch deep. Span dimension up to 10% greater than design.	Misalignment of joints but no infiltration. Settlement. Dislocated end section. Extensive areas of shallow deterioration. Minor cracking.	Satisfactory
6	Split less than 6 inches with width exceeding ½ inch at two or three locations. Damage due to cuts, gouges, or distortion to end sections from construction or maintenance.	Substantial perforations caused by abrasion located within 5 feet of inlet and outlet and not located under roadway.	Minor dimpling appearing over 1/16 to ⅛ of circumference area and 2 feet in length. Dimples between ¼ and ½ inch deep. Pipe deflection less than 12.5% from original shape.	Joint open and allowing backfill to infiltrate. Significant cracking or buckling of pipe material. Joint offset less than 3 inches. End sections dislocated and about to drop off from main portion of the structure. Infiltration staining apparent.	Fair
5	Split less than 6 inches with width exceeding ½ inch at several locations. Splits causing loses of backfill material.	Perforations caused by abrasion located throughout pipe.	Wall Crushing or hinging occurring with lengths less than 3 feet. Pipe deflection less than 15% from original shape.	Differential movement and separation of joints. Significant infiltration or exfiltration at joints. Joint offset less than 4 inches. Voids seen in fill through offset joints. End sections dropped off at inlet.	Poor
4	Split less than 6 inches with width exceeding 1 inch at several locations. Splits causing loss of backfill material.	Section loses caused by abrasion located throughout pipe.	Wall Crushing or hinging occurring with lengths greater than 3 feet. Moderate degree of dimpling appearing. Dimples more than ½ inch deep. Wall tearing or cracking in the buckled region. Pipe deflection less than 20% from original shape.	Significant openings. Dislocated joints at several locations exposing fill material with joint offsets greater than 4 inches. Infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway. Large voids seen in fill through offset joints.	Serious
3	Split larger than 6 inches with width exceeding 1 inch at several locations. Splits causing loss of backfill material.	Section loss caused by abrasion located throughout pipe with at least a 2 foot in length by ½ foot in width invert section eroded away.	Wall Crushing or hinging occurring over the majority of the length of pipe under the roadway. Moderate degree of dimpling appearing. Dimples more than ½ inch deep. Wall tearing or cracking in the buckled region. Pipe deflection greater than 20% from original shape. Severe dimpling accompanied with wall splits.	Culvert not functioning due to alignment problems throughout. Large voids seen in fill through offset joints.	Critical
2	Pipe partially collapsed or collapse is imminent.	Pipe partially collapsed or collapse is imminent.	Pipe partially collapsed or collapse is imminent.	Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	Total failure of pipe.	Total failure of pipe.	Total failure of pipe.	Total failure of pipe.	Failed

* For open bottom structures, rate footing condition. If concrete invert present, rate invert based upon Concrete Structural Deterioration.

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PLASTIC PIPE

Plastic Pipe	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

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MASONRY

Masonry	Structural Deterioration	Invert Deterioration*	Section Deformation	Joints/Seams	Condition
10	New Condition	New condition	Not Applicable: Rigid material pipes are not rated for deformation	Straight line between sections.	Excellent
9	No cracking. No missing or dislocated masonry. Surface in great condition.	Good with no invert erosion		No settlement or misalignment. Tight with no defects apparent.	Very Good
8	Surface deterioration at isolated locations.	Good with only minor invert erosion		Minor misalignment at joints. Minor settlement. Distress to pipe material adjacent to joint. Shallow mortar deterioration at isolated locations.	Good
7	Minor cracking in masonry units	Minor erosion near footings		Misalignment of joints but no infiltration. Settlement. Dislocated end section. Extensive areas of shallow deterioration. Missing mortar at isolated locations. Minor cracking.	Satisfactory
6	Minor cracking. Slight dislocation of masonry units. Large areas of surface scaling. Split or cracked stones.	Moderate erosion along footing; protective measures may be required		Joint open and allowing backfill to infiltrate. Significant cracking, spalling, or buckling of pipe material. Joint offset less than 3 inches. End sections dislocated and about to drop off from main portion of the structure. Mortar generally deteriorated. Loose or missing mortar at isolated locations. Infiltration staining apparent.	Fair
5	Extensive cracking. Significant dislocation of masonry units. Large areas of surface scaling. Split or cracked stones.	Erosion along footing with slight undermining, protection required		Differential movement and separation of joints. Significant infiltration or exfiltration at joints. Joint offset less than 4 inches. Voids seen in fill through offset joints. End sections dropped off at inlet. Mortar severely deteriorated. Significant loss of mortar. Significant infiltration or exfiltration between masonry units.	Poor
4	Severe cracking with spalling. Delamination(s). Slight differential movement. Individual lower masonry units of structure missing or crushed.	Severe undermining with slight differential settlement causing minor cracking or spalling in footing and minor distress in walls		Significant openings. Dislocated joints at several locations exposing fill material with joint offsets greater than 4 inches. Infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway. Large voids seen in fill through offset joints. Extensive areas of missing mortar for masonry structures.	Serious
3	Cracking very severe with significant spalling, delamination, and differential movement. Individual masonry units in lower part of structure missing or crushed. Individual masonry units in top of culvert missing or crushed.	Severe undermining with significant differential settlement causing severe cracks in footing and distress in walls		Culvert not functioning due to alignment problems throughout. Large voids seen in fill through offset joints.	Critical
2	Structure partially collapsed or collapse is imminent.	Structure partially collapsed or collapse is imminent.		Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	Total failure of structure.	Total failure of structure.		Total failure of pipe.	Failed

* For open bottom structures, rate footing condition. If concrete invert present, rate invert based upon Concrete Structural Deterioration.

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MASONRY

Masonry	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

SLAB & ABUTMENT

Slab/ Superstructure & Abutment	Structural Deterioration	Invert Deterioration*	Concrete Abutment	Masonry Abutment	Condition
10	No signs of distress. No discoloration.	New condition	No signs of distress. No discoloration.	No signs of distress. Minor spalling of stone surface.	Excellent
9	Minor scaling less than ⅛ inch deep over 5% of deck surface. Hairline cracking without rust staining or delamination. No dampness. No leakage. No spalling. Isolated damage from construction.	Good with no invert erosion	Minor scaling less than ⅛ inch deep over 5% of concrete surface. Hairline cracking. No rust staining, delamination(s), dampness, leakage, or spalling. Minor construction damage.	Minor spalling of stone surface. Scaling of stone surface less than ½ inch.	Very Good
8	Hairline cracking with no single crack greater then 1/16 inch parallel to the direction of traffic. Light scaling less than ⅛ inch deep on less than 10% of exposed area. Delaminated or spalled area less than 1% of surface area but not including the first 12 inches of the outside slab edges. Isolated damage from construction or vehicle impact. Slab may have a single large crack less than 3/16 inch on bottom surface parallel to the direction of traffic.	Good with only minor invert erosion	Hairline cracking. No single crack greater than 1/16 inch. No rust staining. Light scaling less than ⅛ inch deep on less than 10% of exposed area. Delaminated and spalled area less than 1% of surface area.	Diagonal or vertical shear crack in isolated stones. Fracture of stone surface less than 2 inches.	Good
7	Transverse cracks evident on bottom side: Spaced 10'-20' with or without water leaking through cracks. Some spalling may be present on 1% - 10% of total deck area. Spalled areas with exposed reinforcing on less than 5% of slab area. Hairline map cracking combined with molted areas. Cracks less than ⅛ inch parallel to traffic with minor efflorescence or minor amounts of leakage. Scaling, less than ¼ inch deep, on less than 20% of slab area. Additional delaminated and spalled areas on less than 10% of surface area: Exclude the first 12 inches of the outside slab edges.	Minor erosion near footings	Hairline map cracking combined with molted areas. Horizontal and diagonal cracks less than ⅛ inch with minor efflorescence or minor amounts of leakage. Scaling less than ¼ inch deep on less than 20% of slab area. Spalled areas with exposed reinforcing on less than 5% of slab area. Delaminated and spalled area less than 10% of surface area. Minor differential settlement.	Diagonal or vertical shear cracks through several courses of stone with some minor displacement. Spalls along edge of seat area.	Satisfactory
6	Map cracking. Cracks less than ⅛ inch parallel to traffic and cracks less than 1/16 inch transverse to traffic with efflorescence or rust stain, leakage and molted areas. Scaling, less than 3/16th inch deep, on less than 30% of exposed area. Spalled areas with exposed reinforcing less than 10%. Total delaminated and spalled areas less than 20% of surface area excluding the first 12 inches of the outside slab edges.	Moderate erosion along footing; protective measures may be required	Map cracking. Horizontal cracks less than ⅛ inch. Diagonal cracks less than 1/16 inch with efflorescence or rust stain or leakage, or molted areas or all. Scaling less than 3/16 inch deep on less than 30% of exposed area. Spalled areas with less than 10% showing exposed reinforcing. Total delaminated and spalled areas on less than 20% of surface area. Moderate differential or rotational settlement.	Diagonal or vertical shear cracks through several courses of stone with displacement. Displacement may be bulge or leaning stones. Total displacement is less than ¼ of stone depth.	Fair
5	Steel plates covering full depth holes. Map cracking with dark damp areas and effloresces over at least 30% of deck bottom. Several transverse cracks open more than ⅛ inch with efflorescence and rust staining. Spalling at numerous locations. Extensive surface scaling greater than ½ inch deep. Reinforcing steel bars have extensive section loss: 4 or more adjacent bars with more than 10% of original diameter lost. Total delaminated and spalled areas greater than 25% of surface area excluding the first 12 inches of the outside slab edges.	Erosion along footing with slight undermining, protection required	Map cracking with dark or damp areas, efflorescence, and unsound concrete over 30% of abutment face. Several horizontal and diagonal cracks open more than ⅛ inch with efflorescence and rust staining. Spalling at numerous locations. Extensive surface scaling greater than ½ inch deep. Total delaminated and spalled areas on less than 25% of surface area. Reinforcing steel bars have extensive section losses greater than 10% of original diameter for more than 4 adjacent bars. Severe differential or rotational settlement.	Settlement causing diagonal or vertical shear cracks through several courses of stone with displacement. Total displacement is less than ⅓ of stone depth. Large fractures or erosion of stone surfaces less than 5 inches on adjacent stones. Spalls on beam seats cause reduced bearing area.	Poor
4	Refer to the above rating except reinforcing steel bars have extensive section loss: Greater than 20% of original diameter for more than 5 adjacent bars.	Severe undermining with slight differential settlement causing minor cracking or spalling in footing and minor distress in walls	Map cracking with dark or damp areas and effloresces over at least 40% of abutment face. Several transverse cracks open more than ¼ inch with efflorescence and rust staining. Spalling at numerous locations. Extensive surface scaling greater than ½ inch. Total delaminated and spalled areas over more than 25% of surface area. Reinforcing steel bars have extensive section losses greater than 20% of original diameter for more than 5 adjacent bars. Severe differential or rotational settlement.	Large unsound areas. Several stones are displaced or missing. Misalignment of mortar joints. Large fractures or erosion of stone surfaces greater than 5 inches. Spalls on beam seats causing reduced bearing area.	Serious
3	Full depth holes. Total delaminated, spalled, map cracking, and punky concrete areas are greater than 50% of surface area. Reinforcing steel bars have extensive section loss: Greater than 30% of original diameter for more than 10 adjacent bars. Additional dark and damp areas over at least 50% of deck.	Severe undermining with significant differential settlement causing severe cracks in footing and distress in walls	Cracking and white efflorescence. Total delaminated, spalled, map cracking, and unsound concrete areas on over 50% of surface area. Reinforcing steel bars have extensive section losses greater than 30% of original diameter for more than 10 adjacent bars. Extreme differential or rotational settlement.	Numerous missing or displaced stones. Displacements greater than 1/3 of stone depth. Partially collapsed wingwall.	Critical
2	Structure partially collapsed or collapse is imminent.		Structure partially collapsed or collapse is imminent.	Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	Total failure of structure.		Total failure of structure.	Total failure of pipe.	Failed

* For open bottom structures, rate footing condition. If concrete invert present, rate invert based upon Concrete Structural Deterioration.

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SLAB & ABUTMENT

Slab/ Superstructure & Abutment	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

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CMP SECTION DEFORMATION

CMP Section Deformation	Round/Vertical/ Elongated Pipes	Pipe Arch	Plate Arch	Box	Low Profile Long Span*	High Profile Long Span*	Pear*	Horizontal Ellipse*	Condition
10	New Condition	New Condition	New Condition	New Condition	New Condition	New Condition	New Condition	New Condition	Excellent
9	Good, smooth curvature in barrel. Horizontal diameter (span) dimension within 10% of original design.	Good with smooth curvature in barrel. Horizontal span dimension less than 3% greater than original design.	Good, smooth symmetrical curvature. Rise: within +/- 3 percent of original design.	Good appearance, smooth symmetrical curvature. Top arc mid-ordinate: within 11 percent of original design. Horizontal span: within 5 percent of original design. Sides: straight leg very slightly deflected inward or outward and curvature smooth	Good appearance, smooth symmetrical curvature. Top arc mid-ordinate: within 11 percent of original design. Horizontal span: within 5 percent of original design.	Good appearance, smooth symmetrical curvature. Top arc mid-ordinate: within 11 percent of original design. Horizontal span: within 5 percent of original design.	Good appearance, smooth symmetrical curvature. Top arc mid-ordinate: within 11 percent of original design. Horizontal span: within 5 percent of original design. Side plates: smooth curvature	Good appearance, smooth symmetrical curvature. Top arc mid-ordinate: within 11 percent of original design. Horizontal span: within 5 percent of original design. Bottom arc: smooth curvature, mid-ordinate within 50 percent of original design.	Very Good
8	Generally good, top half of pipe smooth but minor flattening of bottom. Horizontal diameter (span) dimension within 10% of original design.	Generally good, smooth curvature in top half, flattened but still curved. Horizontal span within 3 to 5 percent greater than design.	Generally good with smooth curvature, symmetrical; slight flattening of top or sides in one section. Rise within 3 to 4 percent of original design.	Generally good; curvature is smooth and symmetrical. Top arc mid-ordinate: within 11 percent to 15 percent of original design. Sides: straight leg slightly deflected inward or moderately deflected outward, curvature smooth.	Generally good; curvature is smooth and symmetrical. Top arc mid-ordinate: within 11 percent to 15 percent of original design. Horizontal span: within 5 percent of original design.	Generally good; curvature is smooth and symmetrical. Top arc mid-ordinate: within 11 percent to 15 percent of original design. Horizontal span: within 5 percent of original design.	Generally good; curvature is smooth and symmetrical. Top arc mid-ordinate: within 11 percent to 15 percent of original design. Horizontal span: within 5 percent of original design. Side plates: side flattened, mid-ordinate less than 50 percent of original design.	Generally good; curvature is smooth and symmetrical. Top arc mid-ordinate: within 11 percent to 15 percent of original design. Horizontal span: within 5 percent of original design. Bottom arc: bottom flattened, mid-ordinate less than 50 percent of original design.	Good
7	Fair, top half has smooth curvature but bottom half has flattened significantly. Horizontal diameter (span) dimension within 10% of original design.	Fair, smooth curvature in top half, bottom flat. Horizontal span 5 percent greater than original design.	Fair, smooth curvature but non-symmetrical; slight flattening of top and sides throughout. Rise: within 4 to 5 percent of original design.	Smooth curvature, shape is non-symmetrical. Top arc mid-ordinate: within 15 percent of original design. Horizontal span: more than +/- 5 percent of design. Sides: straight leg moderately deflected inward or extremely deflected outward, curvature smooth.	Smooth curvature, shape is non-symmetrical. Top arc mid-ordinate: within 15 percent of original design. Horizontal span: more than +/- 5 percent of design.	Smooth curvature, shape is non-symmetrical. Top arc mid-ordinate: within 15 percent of original design. Horizontal span: more than +/- 5 percent of design.	Smooth curvature, shape is non-symmetrical. Top arc mid-ordinate: within 15 percent of original design. Horizontal span: more than +/- 5 percent of design. Side plates: side flattened, mid-ordinate less than 35 percent of original design.	Smooth curvature, shape is non-symmetrical. Top arc mid-ordinate: within 15 percent of original design. Horizontal span: more than +/- 5 percent of design. Bottom arc: bottom flattened and irregular, mid-ordinate less than 50 percent of original design.	Satisfactory
6	Generally fair, significant distortion at isolated locations in top half and extreme flattening of the invert. Horizontal diameter (span) dimension 10% to 15% greater than original design.	Generally fair, significant distortion in top in one location; bottom has slight reverse curvature in one location. Horizontal span: within 5 to 7 percent greater than original design.	Generally fair, significant distortion and deflection in one section; sides beginning to flatten; non-symmetrical. Rise: within 5 to 7 percent of original design.	Generally fair; significant distortion and deflection in one section; half top of arcs beginning to flatten; mid-ordinate of half top arc 30 percent less than original design. Top arc mid-ordinate: within 15 to 20 percent of original design. Horizontal span: more than +/- 5 percent of original design. Sides: straight leg bowed inward significantly or extremely bowed outward for distance of less than 1/4 span length	Generally fair; significant distortion and deflection is one section; half top of arcs beginning to flatten; mid-ordinate of half top arc 30 percent less than original design. Top arc mid-ordinate: within 15 to 20 percent of original design. Horizontal span: more than +/- 5 percent of original design.	Generally fair; significant distortion and deflection is one section; half top of arcs beginning to flatten; mid-ordinate of half top arc 30 percent less than original design. Top arc mid-ordinate: within 15 to 20 percent of original design. Horizontal span: more than +/- 5 percent of original design.	Generally fair; significant distortion and deflection is one section; half top of arcs beginning to flatten; mid-ordinate of half top arc 30 percent less than original design. Top arc mid-ordinate: within 15 to 20 percent of original design. Horizontal span: more than +/- 5 percent of original design. Side plates: side flattened, mid-ordinate less than 25 percent of original design.	Generally fair; significant distortion and deflection is one section; half top of arcs beginning to flatten; mid-ordinate of half top arc 30 percent less than original design. Top arc mid-ordinate: within 15 to 20 percent of original design. Horizontal span: more than +/- 5 percent of original design. Bottom arc: bottom virtually flat over center half of arc	Fair
5	Marginal significant distortion throughout length of pipe, lower third may be kinked. Horizontal diameter (span) dimension 10% to 15% greater than original design.	Marginal, significant distortion all along top of arch, bottom has reverse curve. Horizontal span: more than 7 percent greater than original design	Marginal, significant distortion and deflection throughout; sides flattened with radius 100 percent greater than design. Rise: within 7 to 8 percent of original design	Marginal, significant distortion and deflection throughout; mid-ordinate of half top arc less than 50 percent of original design. Top arc mid-ordinate: within 20 to 30 percent of design. Horizontal span: more than +/- 5 percent of design. Sides: straight leg bowed inward significantly or extremely bowed outward for distance between 1/4 and 1/2 span length, curvature irregular	Marginal, significant distortion and deflection throughout; mid-ordinate of half top arc less than 50 percent of original design. Top arc mid-ordinate: within 15 to 20 percent of design. Horizontal span: more than +/- 5 percent of design.	Marginal, significant distortion and deflection throughout; mid-ordinate of half top arc less than 50 percent of original design. Top arc mid-ordinate: within 15 to 20 percent of design. Horizontal span: more than +/- 5 percent of design.	Marginal, significant distortion and deflection throughout; mid-ordinate of half top arc less than 50 percent of original design. Top arc mid-ordinate: within 15 to 20 percent of design. Horizontal span: more than +/- 5 percent of design. Side plates: side flattened, mid-ordinate less than 20 percent of original design.	Marginal, significant distortion and deflection throughout; mid-ordinate of half top arc less than 50 percent of original design. Top arc mid-ordinate: within 15 to 20 percent of design. Horizontal span: more than +/- 5 percent of design. Bottom arc: bottom virtually flat over center half of arc and deflected down at corners.	Poor
4	Poor with extreme deflection at isolated locations, flattening of the crown, crown radius 20 to 30 feet. Horizontal diameter (span) dimension in excess of 15% greater than original design.	Poor, extreme deflection in top arch in one section; bottom has reverse curvature throughout. Horizontal span: more than 7 percent greater than original design.	Poor, extreme distortion and deflection in one section; sides virtually flattened; extremely non-symmetrical. Rise: within 8 to 10 percent of original design.	Poor, extreme distortion and deflection in one section and ordinate of half top arc 50 to 70 percent less than design. Top arc mid-ordinate: 30 to 40 percent less than original design. Horizontal span: more than +/- 6 percent of original design. Sides: straight leg extremely bowed inward for distance less than 1/2 span length of leg bowed outward severely causing bulges in metal.	Poor, extreme distortion and deflection in one section and ordinate of half top arc 50 to 70 percent less than design. Top arc mid-ordinate: 20 to 30 percent less than original design. Horizontal span: more than +/- 6 percent of original design.	Poor, extreme distortion and deflection in one section and ordinate of half top arc 50 to 70 percent less than design. Top arc mid-ordinate: 20 to 30 percent less than original design. Horizontal span: more than +/- 6 percent of original design.	Poor, extreme distortion and deflection in one section and ordinate of half top arc 50 to 70 percent less than design. Top arc mid-ordinate: 20 to 30 percent less than original design. Horizontal span: more than +/- 6 percent of original design. Side plates: side flattened, mid-ordinate less than 12 percent of design.	Poor, extreme distortion and deflection in one section and ordinate of half top arc 50 to 70 percent less than design. Top arc mid-ordinate: 20 to 30 percent less than original design. Horizontal span: more than +/- 6 percent of original design. Bottom arc: bottom reverse curved in center.	Serious
3	Critical, extreme distortion and deflection throughout pipe, flattening of the crown, crown radius over 30 feet. Horizontal diameter (span) dimension more than 20% greater than original design.	Critical, extreme deflection along top of pipe. Horizontal span: more than 7 percent greater than original design.	Critical, extreme deflection, throughout; sides flattened; extremely non-symmetrical. Rise: greater than 10 percent of original design	Critical, extreme distortion and end deflection throughout; mid-ordinate of half top arc more than 70 percent less than design. Top arc mid-ordinate: more than 40 percent of original design. Horizontal span: more than +/- 8 percent of design. Sides: straight leg extremely bowed inward for a distance of 1/2 to 1 span length, or leg bowed outward severely causing bulges or kinking in metal.	Critical, extreme distortion and end deflection throughout; mid-ordinate of half top arc more than 70 percent less than design. Top arc mid-ordinate: more than 30 percent of original design. Horizontal span: more than +/- 8 percent of design.	Critical, extreme distortion and end deflection throughout; mid-ordinate of half top arc more than 70 percent less than design. Top arc mid-ordinate: more than 30 percent of original design. Horizontal span: more than +/- 8 percent of design.	Critical, extreme distortion and end deflection throughout; mid-ordinate of half top arc more than 70 percent less than design. Top arc mid-ordinate: more than 30 percent of original design. Horizontal span: more than +/- 8 percent of design. Side plates: side flattened, mid-ordinate less than 10 percent of design.	Critical, extreme distortion and deflection throughout; mid-ordinate of half top arc more than 70 percent less than design. Top arc mid-ordinate: more than 30 percent of original design. Horizontal span: more than +/- 8 percent of design. Bottom arc: bottom reversed curved in center and bulged out at sides.	Critical
2	Partially collapsed with crown in reverse curvature	Structure partially collapsed	Severe due to partial collapse; local reverse curve of crown and sides	Severe due to partial collapse; top arc curvature flat or reverse curved.	Severe due to partial collapse; top arc curvature flat or reverse curved.	Severe due to partial collapse; top arc curvature flat or reverse curved.	Severe due to partial collapse; top arc curvature flat or reverse curved. Side plates: side flat or reversed curved	Severe due to partial collapse; top arc curvature flat or reverse curved.	Imminent Failure
1	Structure collapsed	Structure collapsed	Completely collapsed	Completely collapsed	Completely collapsed	Completely collapsed	Completely collapsed	Completely collapsed	Failed

* These geometries are uncommon for spans under 20 feet..

Michigan Transportation Asset Management Council
in conjunction with Center for Technology & Training

CMP JOINTS & SEAMS

CMP Joints & Seams	Pipe Joints or Seams	Multi-plate Joints or Seams	Condition
10	Straight line between sections.	Minor amounts of efflorescence or staining	Excellent
9	No settlement or misalignment. Tight with no defects apparent.	Light surface rust on bolts due to loss of galvanizing. Efflorescence staining.	Very Good
8	Minor misalignment at joints. Minor settlement. Distress to pipe material adjacent to joint.	Metal has cracking on each side of a bolt hole: Less than 3 in a seam section. Minor seam openings that are less than ⅛ inch. Potential for backfill infiltration. More than 2 missing bolts in a row. Rust scale around bolts.	Good
7	Misalignment of joints but no infiltration. Settlement. Dislocated end section. Extensive areas of shallow deterioration.	Evidence of backfill infiltration through seams.	Satisfactory
6	Joint open and allowing backfill to infiltrate. Significant cracking or buckling of pipe material. Joint offset less than 3 inches. End sections dislocated and about to drop off from main portion of the structure. Infiltration staining apparent.	Moderate cracking at bolt holes along a seam in one section. Backfill being lost through seam causing slight deflection. Less than 6 missing bolts in a row or 20% along the total seam.	Fair
5	Differential movement and separation of joints. Significant infiltration or exfiltration at joints. Joint offset less than 4 inches. Voids seen in fill through offset joints. End sections dropped off at inlet.	Major cracking of seam near crown. Infiltration of backfill causing major deflection. Partial cocked and cusped seams. 10% section loss to bolt heads along seams.	Poor
4	Significant openings. Dislocated joints at several locations exposing fill material with joint offsets greater than 4 inches. Infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway. Large voids seen in fill through offset joints.	Longitudinal cocked and cusped seams. Metal has 3 inch crack on each side of the bolt hole run for the entire length of the culvert. Missing or tipping bolts.	Serious
3	Culvert not functioning due to alignment problems throughout. Large voids seen in fill through offset joints.	Seam cracked from bolt to bolt. Significant amounts of backfill infiltration.	Critical
2	Pipe partially collapsed or collapse is imminent.	Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	Total failure of pipe.	Total failure of pipe.	Failed

* For open bottom structures, rate footing condition. If concrete invert present, rate invert based upon Concrete Structural Deterioration.

TAMC Michigan Transportation Asset Management Council
in conjunction with Center for Technology & Training

TIMBER

Timber	Structural Deterioration	Invert Deterioration*	Section Deformation	Joints/Seams	Condition
10	New condition	New condition	Not Applicable: Not rated for deformation	Straight line between sections.	Excellent
9	No evidence decay or abrasion/wear. Connections are in place and functioning as intended.	Good with no invert erosion		No settlement or misalignment. Tight with no defects apparent.	Very Good
8	Little to no evidence of decay. Minor abrasion/wearing. Connections are in place and functioning as intended. No issues with structural members. Checks/cracks penetrate <5% of the member thickness. Member does not have splits or shakes.	Good with only minor invert erosion		Minor misalignment at joints. Minor settlement. Distress to pipe material adjacent to joint.	Good
7	Some evidence of decay, moderate abrasion/wearing, negligible section loss in structural members. Affects less than 10% of member section. Loose fasteners but the connection is in place and functioning as intended. Checks/Cracks penetrate 5-50% of the member thickness and not in tension zone.	Minor erosion near footings		Misalignment of joints but no infiltration. Settlement. Dislocated end section. Extensive areas of shallow deterioration.	Satisfactory
6	Some evidence of decay, moderate abrasion/wearing, negligible section loss in structural members. Affects less than 10% of member section. Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended. Checks/Cracks penetrate 5-50% of the member thickness and not in tension zone. Member has splits/shakes with length less than member depth.	Moderate erosion along footing; protective measures may be required		Joint open and allowing backfill to infiltrate. Significant deterioration or buckling of pipe material. Joint offset less than 3 inches. End sections dislocated and about to drop off from main portion of the structure. Infiltration staining apparent.	Fair
5	Decay and section loss affects 10% or more of the member but does not warrant structural review. Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended. Checks/cracks penetrate >50% of member thickness or >5% in tension zone. Member has splits/shakes with length greater than member depth.	Erosion along footing with slight undermining, protection required		Differential movement and separation of joints. Significant infiltration or exfiltration at joints. Joint offset less than 4 inches. Voids seen in fill through offset joints. End sections dropped off at inlet.	Poor
4	Decay and section loss affects 10% or more of the member but does not warrant structural review. Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant structural review. Checks/cracks penetrate >50% of member thickness or >5% in tension zone. Member has splits/shakes with length greater than member depth and have not been arrested.	Severe undermining with slight differential settlement causing minor cracking or spalling in footing and minor distress in walls		Significant openings. Dislocated joints at several locations exposing fill material with joint offsets greater than 4 inches. Infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway. Large voids seen in fill through offset joints.	Serious
3	The condition warrants a structural review to determine the effect on strength, or serviceability of the element OR a structural review has been completed and the defects impact strength or serviceability.	Severe undermining with significant differential settlement causing severe cracks in footing and distress in walls		Culvert not functioning due to alignment problems throughout. Large voids seen in fill through offset joints.	Critical
2	Structure partially collapsed or collapse is imminent.	Structure partially collapsed or collapse is imminent.		Pipe partially collapsed or collapse is imminent.	Imminent Failure
1	Total failure of structure.	Total failure of structure.		Total failure of pipe.	Failed

* For open bottom structures, rate footing condition. If concrete invert present, rate invert based upon Concrete Structural Deterioration.

TAMC Michigan Transportation Asset Management Council
in conjunction with Center for Technology & Training

Timber	Blockage	Scour	Condition
10	No blockage. Designed condition.	No evidence of scour at either inlet or outlet of culvert.	Excellent
9	Minor amounts of sediment build-up with no appreciable loss of opening.	Minor scour holes developing at inlet or outlet. Scour protection placed.	Very Good
8	Culvert waterway blockage is less than 5% of the cross sectional area of the opening. Bank and channel have minor amounts of drift.	Minor scour holes developing at inlet or outlet. Top of footings is exposed. Probing indicates soft material in scour hole.	Good
7	Culvert waterway blockage is less than 10% of the cross sectional area of the opening. Sediment buildup causing flow through 1 of 2 pipes. Silt and Gravel buildup restricts half of the channel. Tree or bush growing in the channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 1 foot or less deep, developing at inlet or outlet. Footings along the side are exposed less than 6 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Satisfactory
6	Culvert waterway blockage is less than 30% of the cross sectional area of the opening. Tree or bush growing in channel. Fence placed at inlet or outlet. Rock dams in culvert.	Minor scour holes, 2 feet or less deep, developing at inlet or outlet. Footings along the side are exposed less than 12 inches. Damage to scour counter measures. Probing indicates soft material in scour hole.	Fair
5	Culvert waterway blockage is less than 40% of the cross sectional area of the opening. Occasional overtopping of roadway. Large deposits of debris are in the waterway.	Significant scour holes, 3 feet or less deep, developing at inlet or outlet. Does not appear to be undermining cutoff walls or headwalls. Bottom of footing is exposed. Major stream erosion behind headwall that threatens to undermine culvert.	Poor
4	Culvert waterway blockage is less than 80% of the cross sectional area of the opening. Overtopping of roadway with significant traffic delays.	Major scour holes, 3 feet or deeper, at inlet or outlet undermining cutoff walls or headwalls. Footing is undermined.	Serious
3	Culvert waterway blockage is 80% or greater of the cross sectional area of the opening. Frequent overtopping of roadway with significant traffic delays.	Streambed degradation causing severe settlement.	Critical
2	Culvert waterway completely blocked and causing water to pool. Road closed because of channel failure.	Culvert closed because of channel failure.	Imminent Failure
1	Total failure of pipe.	Total failure of culvert because of channel failure.	Failed

TIMBER

Appendix F

Criticality Ratings and Maps

WCRC Manhole Criticality Rating Criteria

October 23, 2020

Outgoing Pipe Diameter	Size Rating	MH Count	Percent of MH
8"	1	325	14.0%
12"	2	1635	70.3%
15"	3	226	9.7%
30"	4	15	0.6%
> 30"	5	125	5.4%
No Value	2	0	0.0%

COF Variable	Weight
Pipe Diameter	40.0%
Depth	10.0%
Traffic Volume	20.0%
Wetlands	10.0%
Lane Counts	20.0%

Depth	Depth Rating	MH Count	Percent of MHs
<= 3'	1	17	0.7%
> 3' and <= 5'	2	464	19.9%
> 5' and <= 7'	3	395	17.0%
> 7' and <= 9'	4	10	0.4%
> 9'	5	0	0.0%
No Value	3	1440	61.9%

COF Rating	MH Count
1	15
2	1715
3	548
4	48
5	0

Traffic Volume (AADT)	Road Type Rating	MH Count	Percent of MHs
<5,000	1	794	34.1%
>5,000 - <=10,000	2	654	28.1%
>10,000 - <=20,000	3	753	32.4%
>20,000 - <=40,000	4	125	5.4%
>40,000	5	0	0.0%

Wetlands	Water Rating	MH Count	Percent of MHs
> 200'	1	1899	81.6%
<= 200	5	427	18.4%

Lanes	Lane Ratings	MH Count	Percent of MHs
1	1	0	0.0%
2,3	2	2156	92.7%
4,5	3	170	7.3%
6	4	0	0.0%
7	5	0	0.0%

Condition	Condition_Rating	MH Count	Percent of MHs
Good	1	747	32.1%
Fair	3	127	5.5%
Poor	5	12	0.5%
Null, 0	0	1440	61.9%

POF Variable	Weight
Condition	50%
Paser Rating	50%
No Condition, 100% PASER	

Paser Score	PASER_Rating	MH Count	Percent of MHs
10,9	1	129	5.5%
8,7	2	1521	65.4%
6,5	3	654	28.1%
4,3	4	22	0.9%
2,1	5	0	0.0%
Null, 0	2	0	0.0%

POF Rating	MH Count
1	33
2	110
3	1750
4	384
5	49

BRE Rating	MH Count
<= 5	132
> 5 and <= 10	1919
> 10 and <= 15	240
> 15 and <= 20	34
> 20 and <= 25	1

WCRC Pipe Criticality Rating Criteria

October 23, 2020

Outgoing Pipe Diameter	Size Rating	Pipe Count	Percent of Pipes
8"	1	1296	16.6%
12"	2	2682	34.5%
15"	3	3055	39.2%
30"	4	509	6.5%
> 30"	5	243	3.1%
No Value	2	0	0.0%

COF Variable	Weight
Pipe Diameter	40.0%
Depth	10.0%
Traffic Volume	20.0%
Wetlands	10.0%
Lane Counts	20.0%

Depth	Depth Rating	Pipe Count	Percent of Pipes
<= 3'	1	856	11.0%
> 3' and <= 5'	2	2569	33.0%
> 5' and <= 7'	3	2349	30.2%
> 7' and <= 9'	4	352	4.5%
> 9'	5	2	0.0%
No Value	3	1657	21.3%

COF Rating	Pipe Count
1	1765
2	3461
3	2523
4	36
5	0

Traffic Volume (AADT)	Road Type Rating	Pipe Count	Percent of Pipes
<5,000	1	1701	21.8%
>5,000 - <=10,000	2	2441	31.4%
>10,000 - <=20,000	3	3367	43.2%
>20,000 - <=40,000	4	276	3.5%
>40,000	5	0	0.0%

Wetlands	Water Rating	Pipe Count	Percent of Pipes
> 200'	1	5638	72.4%
<= 200	5	2147	27.6%

Lanes	Lane Ratings	Pipe Count	Percent of Pipes
1	1	54	0.7%
2,3	2	6210	79.8%
4,5	3	1488	19.1%
6	4	11	0.1%
7	5	22	0.3%

Condition	Condition_Rating	Pipe Count	Percent of Pipes
Good	1	5450	70.0%
Fair	3	594	7.6%
Poor	5	84	1.1%
Null, 0	2	1657	21.3%

POF Variable	Weight
Condition	50%
Paser Rating	50%
No Condition, 100% PASER	

Paser Score	PASER_Rating	Pipe Count	Percent of Pipes
10,9	1	1880	24.1%
8,7	2	2332	30.0%
6,5	3	1535	19.7%
4,3	4	1803	23.2%
2,1	5	235	3.0%
Null, 0	2	0	0.0%

POF Rating	Pipe Count
1	846
2	2752
3	1798
4	2130
5	259

BRE Rating	Pipe Count
<= 5	2421
> 5 and <= 10	3262
> 10 and <= 15	1952
> 15 and <= 20	156
> 20 and <= 25	0

WCRC CB Criticality Rating Criteria

October 23, 2020

Outgoing Pipe Diameter	Size Rating	CB Count	Percent of CBs
8"	1	225	4.6%
12"	2	194	4.0%
15"	3	1856	38.2%
30"	4	84	1.7%
> 30"	5	39	0.8%
No Value	Null	2457	50.6%

COF Variable	Weight
Pipe Diameter	40.0%
Depth	10.0%
Traffic Volume	20.0%
Wetlands	10.0%
Lane Counts	20.0%

Depth	Depth Rating	CB Count	Percent of CBs
<= 3'	1	413	8.5%
> 3' and <= 5'	2	968	19.9%
> 5' and <= 7'	3	828	17.1%
> 7' and <= 9'	4	140	2.9%
> 9'	5	49	1.0%
No Value	Null	2457	50.6%

COF Rating	CB Count
1	231
2	3241
3	1350
4	33
5	0

Traffic Volume (AADT)	Road Type Rating	CB Count	Percent of CBs
<5,000	1	426	8.8%
>5,000 - <=10,000	2	2643	54.4%
>10,000 - <=20,000	3	1678	34.6%
>20,000 - <=40,000	4	108	2.2%
>40,000	5	0	0.0%

Wetlands	Water Rating	CB Count	Percent of CBs
> 200'	1	3777	77.8%
<= 200	5	1078	22.2%

Lanes	Lane Ratings	CB Count	Percent of CBs
1	1	36	0.7%
2,3	2	4109	84.6%
4,5	3	696	14.3%
6	4	4	0.1%
7	5	10	0.2%

Condition	Condition_Rating	CB Count	Percent of CBs
Good	1	2189	45.1%
Fair	3	153	3.2%
Poor	5	56	1.2%
Null, 0	2	2457	50.6%

POF Variable	Weight
Condition	50%
Paser Rating	50%
No Condition, 100% PASER	

Paser Score	PASER_Rating	CB Count	Percent of CBs
10,9	1	143	2.9%
8,7	2	2152	44.3%
6,5	3	1407	29.0%
4,3	4	1057	21.8%
2,1	5	96	2.0%
Null, 0	2	0	0.0%

POF Rating	CB Count
1	161
2	2599
3	999
4	1096
5	0

BRE Rating	CB Count
<= 5	2522
> 5 and <= 10	1627
> 10 and <= 15	644
> 15 and <= 20	61
> 20 and <= 25	1

WCRC MS4 Outfalls Criticality Rating Criteria

October 23, 2020

Traffic Volume (AADT)	Road Type Rating	OF Count	Percent of OFs
<5,000	1	23	20.4%
>5,000 - <=10,000	2	66	58.4%
>10,000 - <=20,000	3	24	21.2%
>20,000 - <=40,000	4	0	0.0%
>40,000	5	0	0.0%

COF Variable	Weight
Traffic Volume	40.0%
Wetlands	20.0%
Lane Counts	40.0%

Wetlands	Water Rating	OF Count	Percent of OFs
> 200'	1	85	75.2%
<= 200	5	28	24.8%

COF Rating	OF Count
1	0
2	80
3	7
4	26
5	0

Lanes	Lane Ratings	OF Count	Percent of OFs
1	1	0	0.0%
2,3	2	88	77.9%
4,5	3	25	22.1%
6	4	0	0.0%
7	5	0	0.0%

Paser Score	PASER_Rating	OF Count	Percent of OFs
10,9	1	0	0.0%
8,7	2	70	61.9%
6,5	3	43	38.1%
4,3	4	0	0.0%
2,1	5	0	0.0%
Null, 0	2	0	0.0%

POF Variable	Weight
PASER	100%

POF Rating	OF Count
1	0
2	70
3	43
4	0
5	0

BRE Rating	OF Count
<= 5	54
> 5 and <= 10	44
> 10 and <= 15	15
> 15 and <= 20	0
> 20 and <= 25	0

WCRC Outfalls Criticality Rating Criteria

October 23, 2020

Traffic Volume (AADT)	Road Type Rating	OF Count	Percent of OFs
<5,000	1	10	12.5%
>5,000 - <=10,000	2	55	68.8%
>10,000 - <=20,000	3	15	18.8%
>20,000 - <=40,000	4	0	0.0%
>40,000	5	0	0.0%

COF Variable	Weight
Traffic Volume	40.0%
Wetlands	20.0%
Lane Counts	40.0%

Wetlands	Water Rating	OF Count	Percent of OFs
> 200'	1	80	100.0%
<= 200	5	0	0.0%

COF Rating	OF Count
1	0
2	75
3	5
4	0
5	0

Lanes	Lane Ratings	OF Count	Percent of OFs
1	1	0	0.0%
2,3	2	75	93.8%
4,5	3	5	6.3%
6	4	0	0.0%
7	5	0	0.0%

Paser Score	PASER_Rating	OF Count	Percent of OFs
10,9	1	8	10.0%
8,7	2	21	26.3%
6,5	3	23	28.8%
4,3	4	25	31.3%
2,1	5	3	3.8%
Null, 0	2	0	0.0%

POF Variable	Weight
PASER	100%

POF Rating	OF Count
1	8
2	21
3	23
4	25
5	3

BRE Rating	OF Count
<= 5	28
> 5 and <= 10	48
> 10 and <= 15	4
> 15 and <= 20	0
> 20 and <= 25	0

WCRC End Sections Criticality Rating Criteria

October 23, 2020

Outgoing Pipe Diameter	Size Rating	ES Count	Percent of ES's
8"	1	63	24.2%
12"	2	39	15.0%
15"	3	130	50.0%
30"	4	16	6.2%
> 30"	5	12	4.6%
No Value	Null	0	0.0%

COF Variable	Weight
Pipe Diameter	40.0%
Depth	10.0%
Traffic Volume	20.0%
Wetlands	10.0%
Lane Counts	20.0%

Depth	Depth Rating	ES Count	Percent of ES's
<= 3'	1	123	47.3%
> 3' and <= 5'	2	72	27.7%
> 5' and <= 7'	3	50	19.2%
> 7' and <= 9'	4	10	3.8%
> 9'	5	5	1.9%
No Value	Null	0	0.0%

COF Rating	ES Count
1	6
2	153
3	95
4	6
5	0

Traffic Volume (AADT)	Road Type Rating	ES Count	Percent of ES's
<5,000	1	53	20.4%
>5,000 - <=10,000	2	46	17.7%
>10,000 - <=20,000	3	151	58.1%
>20,000 - <=40,000	4	10	3.8%
>40,000	5	0	0.0%

Wetlands	Water Rating	ES Count	Percent of ES's
> 200'	1	192	73.8%
<= 200	5	68	26.2%

Lanes	Lane Ratings	ES Count	Percent of ES's
1	1	1	0.4%
2,3	2	233	89.6%
4,5	3	26	10.0%
6	4	0	0.0%
7	5	0	0.0%

Condition	Condition_Rating	ES Count	Percent of ES's
Good	1	231	88.8%
Fair	3	29	11.2%
Poor	5	0	0.0%
Null, 0	2	0	0.0%

POF Variable	Weight
Condition	50%
Paser Rating	50%
No Condition, 100% PASER	

Paser Score	PASER_Rating	ES Count	Percent of ES's
10,9	1	36	13.8%
8,7	2	60	23.1%
6,5	3	78	30.0%
4,3	4	74	28.5%
2,1	5	12	4.6%
Null, 0	2	0	0.0%

POF Rating	ES Count
1	21
2	24
3	133
4	73
5	9

BRE Rating	ES Count
<= 5	36
> 5 and <= 10	173
> 10 and <= 15	48
> 15 and <= 20	3
> 20 and <= 25	0

WCRC Special Chambers Criticality Rating Criteria

October 23, 2020

Outgoing Pipe Diameter	Size Rating	SC Count	Percent of SC's
8"	1	4	21.1%
12"	2	5	26.3%
15"	3	7	36.8%
30"	4	2	10.5%
> 30"	5	1	5.3%
No Value	Null	0	0.0%

COF Variable	Weight
Pipe Diameter	40.0%
Depth	10.0%
Traffic Volume	20.0%
Wetlands	10.0%
Lane Counts	20.0%

Depth	Depth Rating	SC Count	Percent of SC's
<= 3'	1	2	10.5%
> 3' and <= 5'	2	5	26.3%
> 5' and <= 7'	3	7	36.8%
> 7' and <= 9'	4	3	15.8%
> 9'	5	2	10.5%
No Value	Null	0	0.0%

COF Rating	SC Count
1	0
2	7
3	11
4	1
5	0

Traffic Volume (AADT)	Road Type Rating	SC Count	Percent of SC's
<5,000	1	0	0.0%
>5,000 - <=10,000	2	2	10.5%
>10,000 - <=20,000	3	17	89.5%
>20,000 - <=40,000	4	0	0.0%
>40,000	5	0	0.0%

Wetlands	Water Rating	SC Count	Percent of SC's
> 200'	1	8	42.1%
<= 200	5	11	57.9%

Lanes	Lane Ratings	SC Count	Percent of SC's
1	1	0	0.0%
2,3	2	14	73.7%
4,5	3	5	26.3%
6	4	0	0.0%
7	5	0	0.0%

Condition	Condition_Rating	SC Count	Percent of SC's
Good	1	16	84.2%
Fair	3	3	15.8%
Poor	5	0	0.0%
Null, 0	2	0	0.0%

POF Variable	Weight
Condition	50%
Paser Rating	50%
No Condition, 100% PASER	

Paser Score	PASER_Rating	SC Count	Percent of SC's
10,9	1	0	0.0%
8,7	2	11	57.9%
6,5	3	0	0.0%
4,3	4	8	42.1%
2,1	5	0	0.0%
Null, 0	2	0	0.0%

POF Rating	SC Count
1	0
2	11
3	0
4	8
5	0

BRE Rating	SC Count
<= 5	3
> 5 and <= 10	12
> 10 and <= 15	4
> 15 and <= 20	0
> 20 and <= 25	0

BRE Criticality Ratings: North East Quadrant

Structures

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

Pipes

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

N

0 0.5 1 2 3

Miles

Date: 10/15/2020

COUNTY ROAD WASHTENAW COMMISSION

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CONSULTING ENGINEERS SINCE 1915

BRE Criticality Ratings: North West Quadrant

Structures

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

Pipes

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

N

0 0.5 1 2 3

Miles

Date: 10/15/2020

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Lyndon
Webster
Dexter
Chelsea
Lima
Scio
Sylvan
Freedom
Lodi
Sharon
Roepke
Hadley
Glenbrook
Hankerd
McGregor
Strawberry Lake
North Territorial
Dexter Town Hall
Dexter Pinckney
Mast
Stofer
Island Lake
Huron River
Waterloo
Werkner
Lima Center
Joy
Huron
Central
4th
2nd
Forest
Hudson
Main
Dan Hoey
Shield
Dexter Chelsea
Dancer
Dexter Ann Arbor
Miller
Baker
Pratt
Jackson
Parker
Zeeb
Liberty
Fletcher
Scio Church
Sylvan
Kalmbach
Old US 12
Cavanaugh Lake
Sibley
Dewey
Railroad
Industrial
North
Harrison
Middle
Van Buren
Washington
Lincoln
Wilkinson
Commerce Park
Manchester
Freer

BRE Criticality Ratings: South East Quadrant

Structures

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

Pipes

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

N

0 0.5 1 2 3

Miles

Date: 10/15/2020

WASHTENAW COUNTY ROAD COMMISSION

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Scio
Ann Arbor
Superior
Lodi
Pittsfield
Ypsilanti
Saline
York
Augusta
Milan
Scio Church
Pleasant Lake
Austin
Arkona
Waters
Hilton
Packard
Ellsworth
Morgan
Bennett
Bemis
Willis
Judd
Willow
Milan Oakville
Huron River
Textile
Merritt
Martz
Bunton
Holmes
Clark
Ecorse
Russell
Forest
Cross
South
Maus
Spring
Harriet
Ferris
Pearl
Congress
Michigan
Ellsworth
Morgan
Stadium
Granger
Greenview
7th
Main
Park
Ferdon
Brockman
Arlington
Huron
Hogback
Superior
Leforge
Macarthur
Oakbrook
Eisenhower
King George
Boardwalk
Victors
Stone School
Fernwood
Pittsfield
Golfside
Hewitt
Cornell
Oakwood
College
Hamilton
Adams
Wallace
Anna
Prospect
River
Miles
Ford
Dorset
Harris
Emerick
Washington
Catherine
1st
Mansfield
Ann Arbor Saline
Zeeb
Wagner
Oak Valley
Lohr
Maple
Woodland
Tefft
Industrial
Campus
State
Ohio
Barnes
Harper
Beach
Carpenter
Munger
Bridge
Tuttle Hill
Hitchingham
Mills
McKay
Henry
Risdon
Ann Arbor
Monroe
Old Creek
Platt
Moon
Macon
Jordan
Saline Milan
Mooreville
Ridge
Dennison
Goodrich
Hack
Lewis
2nd
North
Church
Marvin
Dexter
County
Sanford
McCrone
Stony Creek
Whittaker
Rawsonville
Oakville Waltz
Research Park
Phoenix
Varsity
Airport
Tyler
McGregor
William
Grove
South Service
E US 12/S Ward
W US 12/S Ward
N Ward
St Ward
N Ward/Tyler

BRE Criticality Ratings: South West Quadrant

Structures

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

Pipes

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

N

0 0.5 1 2 3

Miles

Date: 10/15/2020

WASHTENAW COUNTY ROAD COMMISSION

HRC HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Appendix G

Capital Improvement Plan Recommendations

Washtenaw County Road Commission
0-5 Year Road Projects

Year	Township	Road / Project Name	Project Limits	Type of Work	Source	Number of Structures	Feet of Pipe	Total Cost
2021	Scio	Miller Rd	Zeeb Rd to Honey Creek	Mill & Overlay	2021 - 2024 Millage	No Data		
2021	Scio/Ann Arbor	Maple Rd	Blueberry Ln to Newport Rd	Pulverize & Pave	2021 - 2024 Millage	No Data		
2021	Ann Arbor	Geddes Rd	Dixboro Rd to Twp Line	Pulverize & Pave	2021 - 2024 Millage	26	4,702	$ 39,142
2021	Superior	Geddes Rd	Twp Line to Superior Rd	Pulverize & Pave	2021 - 2024 Millage	21	1,464	$ 23,445
2021	Manchester	Sharon Hollow Rd	Herman Rd to Austin Rd	Mill & Overlay	2021 - 2024 Millage	No Data		
2021	Freedom	Pleasant Lake Rd	Schneider Rd to Steinbach Rd	Mill & Overlay	2021 - 2024 Millage	No Data		
2021	Lodi	Zeeb Road	Pleasant Lake Rd to Ellsworth Rd	Pave Gravel Rd	2021 - 2024 Millage	No Data		
2021	Pittsfield/York	Bemis Rd	at Carpenter Road	Intersection	2021 - 2024 Millage	No Data		
2021	Pittsfield	Maple Rd	Textile Rd to Ann Arbor-Saline Rd	Mill & Overlay	2021 - 2024 Millage	3	314	$ 3,718
2021	Pittsfield	Ellsworth Rd	Oak Valley Dr to State Rd	Mill & Overlay	2021 - 2024 Millage	54	4,347	$ 62,328
2021	Ypsilanti	Packard Rd	Golfside Rd to Ypsilanti City Limits	Mill & Overlay	2021 - 2024 Millage	58	5,059	$ 68,312
2021	-	Bemis	Platt Rd to Carpenter	Rehabilitate Roadway	LRP / TIP	31	2,165	$ 34,624
2021	-	Ford	Ford Rd from Plymouth-Ann Arbor Rd to M-153	Rehabilitate Roadway	LRP / TIP	No Data		
2021	-	Packard	Carpenter to Golfside	Rehabilitate Roadway	LRP	33	5,046	$ 46,453
2021	-	Wiard	I-94 - Airport Dr	Rehabilitate Roadway	LRP / TIP	No Data		
2021	-	Bridge Road / Mast Road	Bridge Rd, Str# 10971 and Mast Rd, Str# 10996 over Huron River, Washtenaw	Bridge CPM	TIP	No Data		
2021	-	Pontiac Trl	North Territorial Rd at Pontiac Trail	Road Rehabilitation	TIP	No Data		
2021	-	W 8 Mile Rd	Currie at Eight Mile Rd	Reconstruction	TIP	No Data		
2021	-	Dennison Rd	Dennison Road over Saline River, Str# 11000, Washtenaw County	Bridge Replacement	LRP / TIP	No Data		
2021	-	Geddes Rd	Geddes Road over Fowler Creek, Str# 10977, Washtenaw County	Bridge Replacement	TIP	No Data		
2021	-	Factory	over Huron River	Bridge Rehabilitation	LRP	No Data		

Washtenaw County Road Commission
0-5 Year Road Projects

Year	Township	Road / Project Name	Project Limits	Type of Work	Source	Number of Structures	Feet of Pipe	Total Cost
2022	Sylvan	Cavanaugh Lake Rd	Pierce Rd to Chelsea City Limits	Pulverize & Pave	2021 - 2024 Millage	No Data		
2022	Scio	Huron River Dr	Mast Rd to Zeeb Rd	Mill & Overlay	2021 - 2024 Millage	No Data		
2022	Scio/Lodi	Scio Church Rd	Strieter Rd to Zeeb Rd	Mill & Overlay	2021 - 2024 Millage	No Data		
2022	Scio/Lodi	Scio Church Rd	Parker Rd to Strieter Rd	Pulverize & Pave	2021 - 2024 Millage	No Data		
2022	York	Platt Rd	Milan City Limits to Willow Rd	Pulverize & Pave	2021 - 2024 Millage	No Data		
2022	Pittsfield	Lohr Rd	Regents Park Ct to Ann Arbor-Saline Rd	Mill & Overlay	2021 - 2024 Millage	80	5,268	$ 88,239
2022	Pittsfield	Ellsworth Rd	at Oak Valley Dr	Intersection	2021 - 2024 Millage	3	294	$ 3,645
2022	-	Barker	end of Pavements to US-23	Rehabilitate Roadway	LRP	No Data		
2022	-	Carpenter	N. Cloverlane to Ellsworth	Rehabilitate Roadway	LRP / TIP	32	2,537	$ 36,798
2022	-	Grove	Harris to Bridge Rd	Rehabilitate Roadway	LRP / TIP	53	4,095	$ 60,574
2022	-	LeForge	Clark to Geddes	Rehabilitate Roadway	LRP / TIP	No Data		
2022	-	Tuttle Hill	Martz to Huron River Dr	Rehabilitate Roadway	LRP	123	13,207	$ 153,541
2022	-	Plymouth Rd	Dixboro at Plymouth	Minor Widening	TIP	No Data		
2023	Scio	Jackson Rd	Baker Rd to Wagner Rd	Conc Pavt & Joint Repairs	2021 - 2024 Millage	492	34,294	$ 549,301
2023	Webster/Dexter	Huron River Dr	Gregory Rd to North Territorial Rd	Pulverize & Pave	2021 - 2024 Millage	No Data		
2023	Webster	Huron River Dr	North of Brass Creek Dr to Gregory Rd	Pulverize & Pave	2021 - 2024 Millage	No Data		
2023	Northfield	Barker Rd	US-23 to Main St	Pulverize & Pave	2021 - 2024 Millage	No Data		
2023	Superior	Prospect Rd	Cherry Hill Rd to M-153	Mill & Overlay	2021 - 2024 Millage	No Data		
2023	Pittsfield	Lohr Rd	Textile Rd to Regents Park Ct	Pulverize & Pave	2021 - 2024 Millage	No Data		
2023	Pittsfield	Bemis Rd	Moon Rd to Warner Rd	Mill & Overlay	2021 - 2024 Millage	No Data		
2023	Pittsfield	Textile Rd	Carpenter Rd to Munger Rd	Mill & Overlay	2021 - 2024 Millage	No Data		

Washtenaw County Road Commission
0-5 Year Road Projects

Year	Township	Road / Project Name	Project Limits	Type of Work	Source	Number of Structures	Feet of Pipe	Total Cost
2023	Ypsilanti/Augusta	Whittaker Rd	at Bemis Rd	Intersection	2021 - 2024 Millage		No Data	
2023	Ypsilanti	Textile Rd	Munger Rd to Rawsonville Rd	Mill & Overlay	2021 - 2024 Millage	532	38,806	$ 599,992
2023	Ypsilanti	Holmes Rd	Prospect Rd to Ford Blvd	Mill & Overlay	2021 - 2024 Millage	71	5,773	$ 82,152
2023	-	Huron River Dr	Hospital Entrance to Hogback	Rehabilitate Roadway	LRP / TIP		No Data	
2024	Lima	Fletcher Rd	Scio Church Rd to I-94	6" of limestone	2021 - 2024 Millage		No Data	
2024	Lyndon	Waterloo Rd	M-52 to Werkner Rd	Limestone & Drainage	2021 - 2024 Millage		No Data	
2024	Scio/Lima	Parker Rd	Scio Church Rd to Jerusalem Rd	Pulverize/Mill & Pave	2021 - 2024 Millage		No Data	
2024	Lodi/Scio	Scio Church Rd	Zeeb Rd to Wagner Rd	Mill & Overlay	2021 - 2024 Millage		No Data	
2024	Ann Arbor/Northfield	Joy Rd	Whitmore Lake Rd to Earhart Rd	Limestone & Drainage	2021 - 2024 Millage		No Data	
2024	Ann Arbor/Superior	Dixboro Rd	Plymouth Rd to M-14	Pulverize & Pave	2021 - 2024 Millage		No Data	
2024	Salem	7 Mile Rd	Pontiac Tr to Angle Rd	Pulverize & Pave	2021 - 2024 Millage		No Data	
2024	Manchester	Sharon Hollow Rd	Austin Rd to Twp Line	Mill & Overlay	2021 - 2024 Millage		No Data	
2024	Sharon	Sharon Hollow Rd	Twp Line to Sharon Valley Rd	Mill & Overlay	2021 - 2024 Millage		No Data	
2024	Pittsfield	Platt Rd	US-12 to Ellsworth Rd	Pulverize & Pave	2021 - 2024 Millage	15	679	$ 15,464
2024	Pittsfield	Hogback Rd	Washtenaw Av to Clark Rd	Pulverize/Mill & Pave	2021 - 2024 Millage	9	1,204	$ 12,068
2024	Ypsilanti/Augusta	Bemis Rd	Stony Creek Rd to Hitchingham Rd	Pave Gravel Rd	2021 - 2024 Millage		No Data	
					Totals	**1,636**	**129,253**	**1,879,794**

- LRP projects are limited to WCRC agency projects
- LRP projects are limited to pavement projects and bridge replacement / rehabilitation projects
- TIP projects are limited to pavement projects and bridge replacement / rehabilitation projects
- Millage projects exclude chip and seal repairs
- Projects that are "County-wide" or lack defined project limits are not included
- Projects that have "No Data" may not have assets mapped in the GIS at this time or are unpaved roads. Unpaved roads generally have few to any stormwater assets along the road.
- Total Cost is based on the following unit costs:
  structure cleaning: $160, structure inspection: $100, structure chimney pointing: $250, structure reconstruct (5% of structures): $7,500, and pipe cleaning and televising: $3.50/ft.

Date: October 2020

HRC Job # 20180081

Washtenaw County Road Commission
6 - 20 Year Road Projects

Year	Township	Road / Project Name	Project Limits	Type of Work	Source	Number of Structures	Feet of Pipe	Total Cost
2026–2029	-	Bemis	Stony Creek to Hitchingham	Pave Gravel Road	LRP		No Data	
2026–2029	-	Jackson Phase 4	Dino to Parker	Reconstruct Roadway - Center Left Turn Lane	LRP		No Data	
2026-2030	-	Geddes	Over Fowler Creek	Replace Bridge	LRP		No Data	
2026-2030	-	LeForege	over Huron River	Bridge Rehabilitation	LRP	7	506	$ 7,878.50
2030–2034	-	Bemis	Whittaker to Rawsonville	Pave gravel road	LRP		No Data	
2030–2034	-	Whittaker	at Willis	Improve Intersection - Traffic Operations	LRP		No Data	
2030–2034	-	Willis	over Paint Creek	Replace Bridge	LRP		No Data	
2035–2039	-	Bemis Road	Carpenter to Stony Creek	Pave gravel road	LRP		No Data	
2035–2039	-	Ellsworth Road	from Wagner to Maple	Pave gravel road	LRP		No Data	
2035–2039	-	Fletcher Road	from Scio Church to I-94	Pave gravel road	LRP		No Data	
2035–2039	-	Merritt Road	Stony Creek to Hitchingham	Pave gravel road	LRP		No Data	
2035–2039	-	State Street	from Textile to Morgan	Widen from 2 to 4-lane boulevard	LRP	7	619	$ 8,274.00
2040–2045	-	Seven Mile Road	Main St to Seven Mile Rd	Construct new 2 lane road	LRP		No Data	
2040–2045	-	Willow Road	Stony Creek to Platt	Pave gravel road	LRP		No Data	
					Totals	**14**	**1125**	**$ 16,152.50**

- LRP projects are limited to WCRC agency projects
- LRP projects are limited to pavement projects and bridge replacement / rehabilitation projects
- Projects that are "County-wide" or lack defined project limits are not included
- Projects that have "No Data" may not have assets mapped in the GIS at this time or are unpaved roads. Unpaved roads generally have few to any stormwater assets along the road.
- Total Cost is based on the following unit costs:
  structure cleaning: $160, structure inspection: $100, structure chimney pointing: $250, structure reconstruct (5% of structures): $7,500, and pipe cleaning and televising: $3.50/ft.

Washtenaw County Road Commission
0-5 Year Structure CIP Recommendations,
Not Included in Pavement Rehabilitation Schedule

Asset ID	Township	Cover	Chimney Depth (FT)	MH Depth (FT)	MH Diameter (FT)	Inspector's Rating	BRE Score	Defects	Defect Notes	Proposed Repair(s)	Rehab. Cost
CB8088		Flat Inlet Grate	1.50	5.0	4.0	Fair	15	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,300
CB9622	Ann Arbor	Vented	1.23	8.0	4.0	Fair	15	Chimney structurally defective.	Frame seal soil visible. Gap between frame and cone. Construction debris.	Chimney replacement (pav.).	$ 1,246
CB9228	Ann Arbor	Curb Inlet Grate		5.0	4.0	Poor	15	Cone structurally defective. Wall structurally defective.	Frame seal missing. Frame broken. Surrounding pavement broken.	Replace frame and cover (pav.). Cone replacement (pav.). Cementitious grout wall joint.	$ 3,500
CB9292	Ypsilanti	Curb Inlet Grate		2.4	2.0	Fair	12	Wall cracks/fractures.	Soil visible wall.	Cementitious grout wall joint.	$ 500
CB9298	Ypsilanti	Curb Inlet Grate		3.6	2.0	Poor	12	Wall structurally defective.	Mortar missing wall.	Cementitious grout wall joint.	$ 500
MH6323		Vented		5.7	2.0	Good	12	Wall structurally defective.		Cementitious grout wall joint.	$ 500
CB9349	Ypsilanti	Flat Inlet Grate	1.10	5.9	4.0	Fair	12	Chimney structurally defective.	Gap between frame and chimney.	Chimney repair, point grout.	$ 250
CB8507	Pittsfield	Curb Inlet Grate	1.17	5.1	4.0	Fair	12	Chimney surface damage (spalling, pitting, rough aggregate). Cone surface damage (spoiling, pitting, rough aggregate).	Construction debris.	Chimney repair, point grout.	$ 250
MH6104	Pittsfield	Vented	1.83	6.1	4.0	Fair	12	Chimney cracks/fractures. Cone surface damage (spoiling, pitting, rough aggregate).		Chimney repair, point grout. Cone repair, point grout.	$ 500
CB8616	Pittsfield	Flat Inlet Grate		9.2	4.0	Good	12		Undermined surrounding pavement. Soil visible.	Chimney replacement (pav.).	$ 1,000
CB9043	Ypsilanti	Curb Inlet Grate	1.10	5.8	4.0	Fair	12	Chimney structurally defective.	Chimney broken	Chimney replacement (pav.).	$ 1,220
CB8313	Scio	Curb Inlet Grate	1.93	7.0	2.0	Fair	12	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,386
CB9307	Ypsilanti	Flat Inlet Grate	1.80	7.6	4.0	Fair	12	Chimney structurally defective.	Void visible chimney.	Chimney replacement (pav.).	$ 1,360
CB9026	Ypsilanti	Curb Inlet Grate	2.20	8.7	4.0	Fair	12	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,440
CB9027	Ypsilanti	Curb Inlet Grate	2.30	9.6	4.0	Poor	12	Chimney structurally defective. Cone cracks/fractures.	Undermined surrounding pavement. Soil visible.	Chimney replacement (pav.).	$ 1,460
CB8260		Flat Inlet Grate	1.02	6.5	2.0	Poor	12	Chimney structurally defective. Wall structurally defective.	Undermined surrounding pavement. Soil visible.	Chimney replacement (pav.).	$ 1,204
CB8258		Flat Inlet Grate	1.25	7.0	2.0	Fair	12	Chimney cracks/fractures. Wall structurally defective.	Gap between frame and chimney	Chimney replacement (pav.). Cementitious grout wall joint.	$ 1,750
CB9215	Ann Arbor	Curb Inlet Grate	1.04	5.3	4.0	Good	12	Cone surface damage (spoiling, pitting, rough aggregate).		Cone repair, point grout.	$ 250
CB9299	Ann Arbor	Curb Inlet Grate		7.5	4.0	Fair	12	Cone surface damage (spoiling, pitting, rough aggregate).		Cone repair, point grout.	$ 250
CB9301	Ann Arbor	Curb Inlet Grate		7.6	4.0	Fair	12	Cone surface damage (spoiling, pitting, rough aggregate).	Cone cracks / fractures.	Cone repair, point grout.	$ 250
CB9304	Ann Arbor	Curb Inlet Grate		9.2	4.0	Fair	12		Soil visible cone.	Cone replacement (pav.).	$ 1,000
MH6285	Pittsfield	Vented		4.2	4.0	Fair	12	Cone surface damage (spoiling, pitting, rough aggregate).	Surrounding pavement broken	Cone replacement (pav.).	$ 1,500
MH6100	Pittsfield	Vented	1.50	5.7	4.0	Good	12	Cover broken.		Replace cover.	$ 500
MH6189	Pittsfield	Vented					12	Cover broken.	Broken cover.	Replace cover.	$ 500
MH6108	Pittsfield	Vented	2.37	8.3	4.0	Good	12	Cover cracked.		Replace cover.	$ 500
MH6109	Ypsilanti	Vented					12	Cover cracked.	Filled to rim with dirt. Broken cover.	Replace cover.	$ 500
CB2355	Ypsilanti	Beehive Dome		1.4	2.0	Poor	12	Wall structurally defective. Bench defective.	No wall observed in manhole.	Replacement (grass).	$ 5,000
CB8397	Pittsfield	Curb Inlet Grate		4.6		Poor	12		Collapsing. Surrounding surface is compromised.	Replacement (pav.).	$ 11,250
CB9049	Ypsilanti	Flat Inlet Grate		3.3	2.0	Fair	12	Wall structurally defective.	Wall undermined soil visible.	Replacement (pav.).	$ 7,500
CB9303	Ypsilanti	Curb Inlet Grate		4.2	2.0	Poor	12	Wall structurally defective.	Wall undermined soil visible.	Replacement (pav.).	$ 7,500
CB8617	Pittsfield	Curb Inlet Grate		5.2	2.0	Fair	12	Wall structurally defective.		Replacement (pav.).	$ 7,500
CB8620	Pittsfield	Flat Inlet Grate		5.8	2.0	Poor	12	Wall structurally defective.	Gap between frame and wall. Undermined surrounding pavement. Soil visible.	Replacement (pav.).	$ 7,500
CB9025	Ypsilanti	Curb Inlet Grate		6.3	2.0	Poor	12	Wall structurally defective.	Hole soil visible wall.	Replacement (pav.).	$ 7,500
CB8622	Pittsfield	Flat Inlet Grate		6.8	2.0	Fair	12	Wall structurally defective.	Gap between frame and wall	Replacement (pav.).	$ 7,500
CB8615	Pittsfield	Curb Inlet Grate		7.9	2.0	Fair	12	Wall structurally defective.		Replacement (pav.).	$ 7,500
CB8084	Scio	Curb Inlet Grate		5.2	2.0	Fair	10	Wall surface damage (spoiling, pitting, rough aggregate).	Block wall missing. Block cracked top of wall.	Cementitious grout wall joint.	$ 500
CB8762	Pittsfield	Curb Inlet Grate	1.30	6.5	4.0	Good	10	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
CB9623	Ann Arbor	Vented	1.30	6.2	4.0	Fair	10		Soil visible cone.	Chimney repair, point grout. Cone repair, point grout.	$ 500
CB9222	Ann Arbor	Curb Inlet Grate	1.10	8.6	4.0	Fair	10	Chimney surface damage (spalling, pitting, rough aggregate). Cone cracks/fractures.		Chimney repair, point grout. Cone repair, point grout.	$ 500
CB8763	Pittsfield	Curb Inlet Grate	1.20	6.5	4.0	Poor	10	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,240
MH6070	Ann Arbor	Solid	1.39	8.2	4.0	Good	10	Cover broken.	Broken cover inside manhole.	Replace cover.	$ 500

Washtenaw County Road Commission
0-5 Year Structure CIP Recommendations,
Not Included in Pavement Rehabilitation Schedule

Asset ID	Township	Cover	Chimney Depth (FT)	MH Depth (FT)	MH Diameter (FT)	Inspector's Rating	BRE Score	Defects	Defect Notes	Proposed Repair(s)	Rehab. Cost
CB9218	Ann Arbor	Curb Inlet Grate	1.20	10.7	4.0	Poor	10	Cover broken. Chimney cracks/fractures.		Replace cover. Chimney repair, point grout.	$ 1,000
CB9277	Ypsilanti	Curb Inlet Grate		4.2	2.0	Fair	9	Wall cracks/ fractures.	Soil visible wall.	Cementitious grout wall joint.	$ 500
CB9452	Ann Arbor	Curb Inlet Grate		4.1	2.0	Good	9	Wall surface damage (reinforcement exposed).		Cementitious grout wall joint.	$ 500
CB9566	Superior	Flat Inlet Grate		5.9	2.0	Fair	9	Wall surface damage (reinforcement exposed).		Cementitious grout wall joint.	$ 500
CB9563	Superior	Flat Inlet Grate		7.9	2.0	Good	9	Wall surface damage (spoiling, pitting, rough aggregate).		Cementitious grout wall joint.	$ 500
MH6197	Pittsfield	Vented	2.00	5.7	4.0	Fair	9	Chimney surface damage (spalling, pitting, rough aggregate).	Soil visible chimney.	Chimney repair, point grout.	$ 250
MH6061	Ypsilanti	Vented	1.31	5.7	4.0	Fair	9	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
NEW20190822_032	Ypsilanti	Curb Inlet Grate	1.70	6.7	4.0	Good	9	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
CB9192	Ypsilanti	Curb Inlet Grate	1.32	6.9	4.0	Good	9	Chimney surface damage (spalling, pitting, rough aggregate).	Construction debris.	Chimney repair, point grout.	$ 250
MH6096	Pittsfield	Vented	1.85	7.0	4.0	Fair	9	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
MH6098	Pittsfield	Vented	1.65	7.0	4.0	Fair	9	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
CB9286	Ypsilanti	Curb Inlet Grate	1.60	7.2	4.0	Fair	9	Cone surface damage (spoiling, pitting, rough aggregate). Wall surface damage (spoiling, pitting, rough aggregate).		Chimney repair, point grout. Cementitious grout wall joint.	$ 750
CB9547	Superior	Flat Inlet Grate	1.20	6.6	2.0	Poor	9	Chimney cracks/fractures. Wall cracks/fractures.	Chimney undermined. Pipe full of sediment.	Chimney replacement (pav.).	$ 1,240
CB9550	Superior	Flat Inlet Grate	1.30	7.1	2.0	Fair	9	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,260
CB9195	Ypsilanti	Curb Inlet Grate		8.2	4.0	Fair	9	Cone surface damage (spoiling, pitting, rough aggregate).		Cone repair, point grout.	$ 250
20191107_006	Superior_(green)	Flat Inlet Grate	1.85	7.2	4.0	Fair	9	Chimney cracks/fractures. Cone structurally defective. Wall not known.	Water level did not change with vactor truck. At level with local water source.	Cone replacement (pav.).	$ 1,500
MH6220	Ann Arbor	Beehive Dome		6.1	4.0	Fair	9	Cover broken.	Could not open cover.	Replace cover.	$ 500
CB9558	Superior	Flat Inlet Grate		5.0			9	Cover cracked.	Cracked cover. Can't open without cover falling in.	Replace cover.	$ 500
CB9194	Ypsilanti	Curb Inlet Grate		5.5			9	Cover cracked.	Cracked cover.	Replace cover.	$ 500
MH6301		Flat Inlet Grate					9	Cover cracked.	Unable to open.	Replace cover.	$ 500
CB9036	Ypsilanti	Flat Inlet Grate		7.2	2.0	Fair	9	Cover cracked.	Mortar cracked frame seal.	Replace cover. Cementitious grout wall joint.	$ 1,000
MH6062	Ypsilanti	Vented	1.21	6.1	4.0	Fair	9	Chimney surface damage (spalling, pitting, rough aggregate).	Chimney fractured. Frame corroded. Steps corroded.	Replace frame and cover (pav.). Chimney repair, point grout.	$ 1,750
CB9548	Superior	Flat Inlet Grate	1.80	7.6	2.0	Poor	9	Chimney cracks/fractures. Wall structurally defective.	Wall material block and concrete. Hole soil visible wall.	Replacement (pav.).	$ 7,500
CB9542	Superior	Flat Inlet Grate	1.86	5.7	2.0	Fair	9	Chimney structurally defective. Wall surface damage (spoiling, pitting, rough aggregate).	Hole soil visible wall.	Replacement (pav.).	$ 7,500
CB8742	Pittsfield	Curb Inlet Grate		1.8	2.0	Fair	9	Wall cracks/fractures.	Soil visible pipe seal.	Replacement (pav.).	$ 7,500
CB8389	Pittsfield	Curb Inlet Grate		4.8	2.0	Fair	9	Wall cracks/fractures.	Wall undermined soil visible.	Replacement (pav.).	$ 7,500
CB9555	Superior	Flat Inlet Grate		6.6	2.0	Fair	9	Wall cracks/fractures.	Hole soil visible wall. Construction debris.	Replacement (pav.).	$ 7,500
20191107_003		Flat Inlet Grate		3.7	2.0	Poor	9	Wall structurally defective.	Wall material block and concrete. Portion of block wall missing under frame.	Replacement (pav.).	$ 7,500
CB9038	Ypsilanti	Flat Inlet Grate		4.5	2.0	Fair	9	Wall structurally defective.	Void visible wall.	Replacement (pav.).	$ 7,500
20190828_001	Ypsilanti	Flat Inlet Grate		4.5	2.0	Poor	9	Wall structurally defective.	Wall missing on the side under the road.	Replacement (pav.).	$ 7,500
CB9546	Superior	Flat Inlet Grate		4.8	2.0	Fair	9	Wall structurally defective.	Hole soil visible wall.	Replacement (pav.).	$ 7,500
CB9035	Ypsilanti	Flat Inlet Grate		5.2	2.0	Fair	9	Wall structurally defective.	Mortar broken frame seal.	Replacement (pav.).	$ 7,500
CB9146	Ypsilanti	Curb Inlet Grate	1.10	5.8	2.0	Poor	9	Wall structurally defective.		Replacement (pav.).	$ 7,500
CB9568	Superior	Flat Inlet Grate		5.9	2.0	Poor	9	Wall structurally defective.	Reconstruct Manhole. Construction debris	Replacement (pav.).	$ 7,500
CB9033	Ypsilanti	Flat Inlet Grate		7.2	2.0	Fair	9	Wall structurally defective.	Hole wall.	Replacement (pav.).	$ 7,500
CB9032	Ypsilanti	Flat Inlet Grate		7.9	2.0	Fair	9	Wall structurally defective.	Block missing.	Replacement (pav.).	$ 7,500
CB9031	Ypsilanti	Flat Inlet Grate		8.5	2.0	Fair	9	Wall structurally defective.	Bricks loose, mortar missing under frame.	Replacement (pav.).	$ 7,500
CB9338	Ypsilanti	Curb Inlet Grate		4.8	4.0	Fair	8	Wall structurally defective.	6 ft x 2 ft combined box.	Cementitious grout wall joint.	$ 500
CB9341	Ypsilanti	Curb Inlet Grate		4.7	4.0	Fair	8	Wall structurally defective. Bench construction debris.	Mortar missing frame seal. Connected to CB9342. 6' x 2' combined box.	Cementitious grout wall joint.	$ 500
20190724_002	Scio	Flat Inlet Grate		6.7	2.0	Poor	8	Wall cracks/fractures.	Infiltration gusher wall.	Chemical grout (run./gush.) joint.	$ 1,500
20191120-015	Pittsfield	Curb Inlet Grate	1.34	3.9	4.0	Fair	8	Chimney structurally defective.		Chimney repair, point grout.	$ 250

Washtenaw County Road Commission
0-5 Year Structure CIP Recommendations,
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Asset ID	Township	Cover	Chimney Depth (FT)	MH Depth (FT)	MH Diameter (FT)	Inspector's Rating	BRE Score	Defects	Defect Notes	Proposed Repair(s)	Rehab. Cost
20191120-012	Pittsfield	Curb Inlet Grate	1.21	4.9	4.0	Fair	8	Chimney structurally defective.		Chimney repair, point grout.	$ 250
CB9472	Ann Arbor	Curb Inlet Grate	1.00	7.7	4.0	Fair	8	Chimney structurally defective.		Chimney repair, point grout.	$ 250
CB8215	Scio	Curb Inlet Grate	0.90	9.7	4.0	Poor	8	Chimney structurally defective. Cone cracks/fractures.		Chimney repair, point grout.	$ 250
CB8124	Pittsfield	Beehive Ditch Grate (Large)	1.88	6.5	4.0	Fair	8	Chimney cracks/fractures. Wall structurally defective.		Chimney repair, point grout. Cementitious grout wall joint.	$ 750
CB9288	Ypsilanti	Curb Inlet Grate	1.34	3.7	4.0	Fair	8	Chimney cracks/fractures. Cone surface damage (spoiling, pitting, rough aggregate). Wall surface damage (spoiling, pitting, rough aggregate). Bench construction debris.		Chimney repair, point grout. Cone repair, point grout. Cementitious grout wall joint.	$ 1,000
CB9045	Ypsilanti	Curb Inlet Grate	1.10	7.0	4.0	Fair	8	Chimney structurally defective. Wall encrustation/deposits.	Brick missing wall.	Chimney replacement (pav.).	$ 1,220
MH6018	Ypsilanti	Vented	1.08	8.7	4.0	Fair	8	Cone surface damage (spoiling, pitting, rough aggregate).		Cone repair, point grout.	$ 250
CB8118	Pittsfield	Curb Inlet Grate	2.30	5.9	4.0	Good	8	Cover cracked.		Replace cover. Cementitious grout wall joint.	$ 1,000
CB8919	Ypsilanti	Curb Inlet Grate		6.3	4.0	Poor	8		Surrounding grass undermined. Soil visible.	Replacement (pav.).	$ 11,250
CB9044	Ypsilanti	Curb Inlet Grate		6.6	2.0	Fair	8	Wall structurally defective.	Block missing wall.	Replacement (pav.).	$ 7,500
MH5912	Pittsfield	Flat Inlet Grate		3.9	2.0	Poor	8	Wall structurally defective. Sump defective.	Block missing.	Replacement (pav.).	$ 7,500
CB8625	Pittsfield	Curb Inlet Grate		4.4	2.0	Fair	6	Wall structurally defective.		Cementitious grout wall joint.	$ 500
CB8442	Pittsfield	Curb Inlet Grate	1.05	4.4	2.0	Fair	6	Wall surface damage (spoiling, pitting, rough aggregate).		Cementitious grout wall joint.	$ 500
CB8355	Pittsfield	Curb Inlet Grate		5.0	2.0	Fair	6	Wall surface damage (spoiling, pitting, rough aggregate).		Cementitious grout wall joint.	$ 500
CB8455	Pittsfield	Curb Inlet Grate		5.9	2.0	Fair	6	Wall surface damage (spoiling, pitting, rough aggregate).	Mortar missing wall.	Cementitious grout wall joint.	$ 500
CB8360	Pittsfield	Curb Inlet Grate		6.7	2.0	Poor	6	Wall surface damage (spoiling, pitting, rough aggregate).		Cementitious grout wall joint.	$ 500
CB8357	Pittsfield	Curb Inlet Grate		7.5	2.0	Fair	6	Wall surface damage (spoiling, pitting, rough aggregate).		Cementitious grout wall joint.	$ 500
NEW20190822_06	Ypsilanti	Solid	1.10	5.0	4.0	Fair	6	Chimney structurally defective.	Gap between frame and chimney.	Chimney repair, point grout.	$ 250
CB9232	Ypsilanti	Curb Inlet Grate	1.22	5.5	4.0	Fair	6	Chimney structurally defective.		Chimney repair, point grout.	$ 250
CB9094	Ypsilanti	Curb Inlet Grate	1.70	5.7	4.0	Good	6	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
20191024_003	Ypsilanti	Vented	2.20	14.0	4.0	Fair	6	Chimney surface damage (spalling, pitting, rough aggregate). Bench construction debris.	Mortar missing wall. Mortar missing frame.	Chimney repair, point grout. Cone repair, point grout. Cementitious grout wall joint.	$ 1,000
CB9183	Ypsilanti	Curb Inlet Grate		5.2	4.0	Fair	6	Cone surface damage (spoiling, pitting, rough aggregate).		Chimney repair, point grout. Cone repair, point grout. Cementitious grout wall joint.	$ 1,000
CB9147	Ypsilanti	Curb Inlet Grate	1.30	6.2	2.0	Poor	6	Chimney structurally defective.		Chimney replacement (pav.).	$ 1,260
CB8225	Scio	Flat Inlet Grate	1.56	6.6	4.0	Good	6	Cover cracked. Chimney cracks/fractures.		Replace cover. Chimney repair, point grout.	$ 1,000
MH6145	Ypsilanti	Solid		7.6	4.0	Fair	4	Wall surface damage (spoiling, pitting, rough aggregate). Bench erosion (pitting).		Cementitious grout wall joint.	$ 500
MH6153	Ypsilanti	Flat Inlet Grate	1.60	5.6	4.0	Fair	4	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
MH6183	Ypsilanti	Vented	1.60	4.4	4.0	Poor	4	Wall surface damage (reinforcement exposed).	Pipes reinforcement exposed.	Chimney repair, point grout.	$ 250
MH6146	Ypsilanti	Vented		6.8	4.0	Fair	4	Wall surface damage (spoiling, pitting, rough aggregate). Bench erosion (pitting).		Chimney repair, point grout.	$ 250
CB9240	Ypsilanti	Flat Inlet Grate	1.20	4.2	2.0	Poor	4	Chimney structurally defective. Wall cracks/fractures.		Chimney replacement (pav.).	$ 1,240
CB9370	Ypsilanti	Curb Inlet Grate		3.5	2.0	Fair	4	Cover broken.		Replace cover.	$ 500
CB9356	Ypsilanti	Curb Inlet Grate		4.6	2.0	Good	4	Cover broken.	Cross bore.	Replace cover.	$ 500
CB9369	Ypsilanti	Curb Inlet Grate					4	Cover cracked.	Unable to open.	Replace cover.	$ 500
CB9368	Ypsilanti	Curb Inlet Grate		3.5	3.0	Fair	4	Cover cracked.	Cracked mortar frame seal. Cracked frame.	Replace frame and cover (pav.).	$ 1,500
CB8183		Flat Inlet Grate		6.3	2.0	Good	4	Wall structurally defective.	Broken frame. Offset 5 inch. Block missing wall.	Replace frame and cover (pav.).	$ 1,500
CB9366	Ypsilanti	Curb Inlet Grate		5.0	2.0	Poor	4	Wall structurally defective.	Void visible wall.	Replacement (pav.).	$ 7,500
CB8352	Pittsfield	Flat Inlet Grate		6.7	2.0	Poor	4	Wall structurally defective.		Replacement (pav.).	$ 7,500
CB8680	Pittsfield	Curb Inlet Grate	1.55	5.5	4.0	Fair	3	Chimney structurally defective.		Chimney repair, point grout.	$ 250
CB9354	Ypsilanti	Flat Inlet Grate	1.80	6.8	4.0	Good	3	Chimney structurally defective.		Chimney repair, point grout.	$ 250
CB8733	Pittsfield	Curb Inlet Grate	1.50	7.3	4.0	Fair	3	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
CB8731	Pittsfield	Curb Inlet Grate	1.25	7.4	4.0	Fair	3	Chimney surface damage (spalling, pitting, rough aggregate).		Chimney repair, point grout.	$ 250
MH6232	Pittsfield	Vented	1.21	8.4	4.0	Good	3	Cone surface damage (spoiling, pitting, rough aggregate).	Mortar cracked chimney.	Chimney repair, point grout. Cone repair, point grout.	$ 500

Washtenaw County Road Commission
0-5 Year Structure CIP Recommendations,
Not Included in Pavement Rehabilitation Schedule

Asset ID	Township	Cover	Chimney Depth (FT)	MH Depth (FT)	MH Diameter (FT)	Inspector's Rating	BRE Score	Defects	Defect Notes	Proposed Repair(s)	Rehab. Cost
CB8853	Pittsfield	Flat Inlet Grate		5.4	2.0	Fair	3	Wall structurally defective.	Block missing wall. Gap under frame,	Reset frame and cover (pav.). Cementitious grout wall joint.	$ 7,500
MH5750	Scio	Vented	1.20	5.6	4.0	Poor	2	Wall structurally defective.		Cementitious grout wall joint.	$ 500
CB8459	Pittsfield	Curb Inlet Grate	1.55	8.0	4.0	Poor	2	Chimney structurally defective.	Vactor could not remove water as fast as it entered.	Chimney repair, point grout.	$ 250
CB9454	Ann Arbor	Curb Inlet Grate	1.30	4.6	2.0	Fair	2	Chimney structurally defective. Wall cracks/fractures. Bench construction debris.		Chimney repair, point grout.	$ 250
CB8387	Pittsfield	Curb Inlet Grate	1.56	6.4	4.0	Fair	2	Chimney surface damage (reinforcement exposed).		Chimney repair, point grout.	$ 250
CB8860	Pittsfield	Flat Inlet Grate	0.88	6.1	4.0	Good	2	Chimney structurally defective.	Brick missing chimney. Mortar missing walls.	Chimney repair, point grout. Cementitious grout wall joint.	$ 750
CB8723	Pittsfield	Curb Inlet Grate	2.10	6.6	4.0	Fair	2	Chimney cracks/fractures. Wall structurally defective.	Infiltration gusher wall.	Chimney repair, point grout. Chemical grout (run./gush.) joint.	$ 1,750
CB8266	Scio	Flat Inlet Grate	2.25	6.5	4.0	Fair	2	Chimney cracks/fractures. Cone surface damage (reinforcement exposed).		Chimney repair, point grout. Cone repair, point grout.	$ 500
CB1933	Pittsfield	Flat Inlet Grate	1.20	6.2	4.0	Fair	2	Chimney cracks/fractures. Cone surface damage (spoiling, pitting, rough aggregate).	Mortar cracked chimney. Cone broken and surface damage. Frame seal cracked.	Chimney repair, point grout. Cone repair, point grout.	$ 500
CB8392	Pittsfield	Curb Inlet Grate		6.9	4.0	Fair	2	Cone surface damage (spoiling, pitting, rough aggregate).		Cone repair, point grout.	$ 250
This list includes structures with the following defects:										**0 - 5 Year Total**	**$ 301,576**
• Broken or cracked covers										**Yearly Average Cost**	**$ 60,315**
• Components that are structurally defective or exhibit surface damage											
• Soil visible, undermining or collapsed											
• Infiltration runners and gushers											
• Manhole depth is calculated by: Lowest invert + Sump depth (if applicable)											

0-5 year CIP Recommendations Not Included in Pavement Rehabilitation Schedule

Structures

BRE Scores

- 1-<=5
- >5-<=10
- >10-<=15
- >15-<=20
- >20-<=25

– **Pipes**

N

0 0.5 1 2 3

Miles

Date: 10/15/2020

COUNTY ROAD WASHTENAW COMMISSION

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915