Executive Summary

The City of Rocklin retained Michael Baker International (Michael Baker) to complete an assessment of the City's existing storm drain conveyance system. The scope included site visits to capture and record visual assessment data from all accessible public storm drain discharge outlets. Michael Baker pulled and organized thousands of data points and documents, and with the assistance of the City staff created a reliable document control system for tracking and recording project-related communication. Michael Baker consistently worked with City staff to ensure shared point access, to locate the difficult or missing outlets in the field, and to successfully convert the City's existing storm drain GIS database to LGIM standards. This assessment report serves two common goals:

1. Provide a comprehensive assessment of the City's public discharge outlets, capturing the existing conditions and delivering a reliable engineering determination for the benefit of MS4 permit compliance.

2. Analyze the diverse data captured through the updated GIS database and localize the physical data obtained from site visits and CCTV investigation in order to determine the state of the storm drain conveyance system and submit the assessment and recommendations.

With the above goals in mind, guidelines and recommendations include the following:

1. A clear road map with associated costs to address the discharge outlet facilities determined to have significant structural deterioration conditions and maintenance concerns.

2. Recommendation to initiate a citywide operation and maintenance program, with the associated cost, with the anchor of the program being the implementation of a comprehensive CCTV investigation and pipe cleaning operation on a regular basis.

3. Recommend an O&M program for the existing O/S separator

4. Recommend implementing a City wide filter inserts for inlets and catch basin, and an O&M program

5. Recommendation to initiate a corrugated metal pipe (CMP) replacement program, with the associated costs, with the CMP completely replaced or retrofitted within 5 years.

6. A similar recommendation for corrugated metal pipe arch (CMPA), with a goal that it can be replaced within 20 years.

7. Guidelines on the costs associated with a storm drain pipe replacement/rehabilitation program, based on parameters such as material size and year of installation.

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The following report includes a detailed description of the site investigation assessment, the GIS update process, the associated results, and recommendations for the City to implement in order to provide a reliable storm drain conveyance system that operates as designed and maximizes the useful life of the facilities. A summary of the findings and recommendations is provided in this Executive Summary.

Outlet Facility Condition Assessments

A visual condition assessment of the visible and accessible open sections of the existing storm drain system, including the discharge outlets and v-ditches, was conducted in 2015 during the months of June, July, and August. A custom iPad application utilizing the GIS database as the basis was used during the assessment to locate the facilities, take and upload photos, document collected data and observations, and rank each individual structure for maintenance and structural condition. A scale of 1 to 5, from worst to best, was used to rank the structural and maintenance conditions of each observed facility. Aspects such as concrete condition, screen functionality, connections, and overall life expectancy were assessed for the structures. Aspects such as debris accumulation and vegetation overgrowth which would impede water flow were assessed and ranked for maintenance.

A ranking of 5 is the best, used to indicate the structure is in top condition and does not require repair and/or replacement. A ranking of 1 is the worst, used to indicate that structural repairs and/or replacement are required for facilities to function appropriately.

There are a total of 747 discharge outlets within the Rocklin city limits; 102 of these outlets are privately owned. Private discharge outlets were not included in this condition assessment. In total, there are 645 City-owned and City-maintained discharge outlets. Of those, 467 discharge outlets were located, accessible, and could be visually inspected during the condition assessment. The remaining 177 discharge outlets were not visually inspected due to various interferences such as unable to traverse private property to access the facility, locked fences, overgrown brush, new construction, the facility could not be found, or the facility no longer exists.

Table ES-1 summarizes the number of outlet structures inspected, their ranks, and the percentage of structures with each ranking.

Table ES-1 – *Structural Condition Assessment*

Ranking	Number of City Outlet Structures	Ranking Percentage of System
5	140	30%
4	189	40%
3	49	10%
2	14	3%
1	29	6%
N/A	46	10%
Total	467	100%

Based on the discharge outlet condition assessment, 43 structures assessed were dilapidated and in poor condition, and thus ranked as a 1 or 2. These structures constitute 9% of the City's total outlet structures. The 43 structures identified in poor condition were further evaluated and stratified into three priority categories: 39% or 17 structures appear to be severely damaged, 26% or 11 structures are moderately damaged, and 35% or 15 of the structures are damaged to a certain degree.

Based on the field condition assessment, it was observed that 39% or 180 structures visited required immediate maintenance and were assigned a maintenance ranking of 1 or 2. Reference Table ES-2 for the complete summary of findings of the maintenance assessment. It is recommended that the structures ranked 1 and 2 during the maintenance assessment be cleared of debris to allow proper functioning of the system.

The maintenance assessment concluded that 180 outlet structures, or approximately 39% of the current system, that are ranked 1 or 2 should be immediately cleared and cleaned. The remaining 61% of the outlets require a maintenance plan that should be coordinated with the maintenance plan for the upstream pipes for flushing, cleaning, and CCTV investigation or pipe repair, rehabilitation, or replacement. .

A regular maintenance program will increase the capacity of the system, extend the life of the system, and allow additional collection of data for the structural assessment. This will allow the City to prevent structural damage, repair damage before it gets too severe, and ultimately significantly reduce capital costs.

Table ES-2 – *Maintenance Condition Assessment*

Ranking	Number of City Outlet Structures	Ranking Percentage of System
5	70	15%
4	134	28%
3	83	18%
2	50	11%
1	130	28%
Total	467	100%

CCTV Investigation

A limited closed circuit television video (CCTV) pipe inspection was conducted to visually inspect sections of storm drain pipes in the area known as Old Town in Rocklin. The methodology developed to identify potential CCTV locations included the selection of pipe segments that represent a cross section of the City's current infrastructure, considering pipe diameter, material, year of installation, and location. The materials selected for the inspections included reinforced concrete pipe (RCP), non-reinforced concrete pipe (CP), corrugated metal pipe (CMP), and asbestos cement (AC). Collectively these four materials constitute 90% of the pipes installed in Rocklin, with the vast majority, 56%, being RCP and CP.

Five locations were identified in or near Old Town Rocklin in which to perform the CCTV investigation. All five locations selected have pipes that were installed prior to 1990 and are of varying length and diameter. Because approximately 24% of the City's total storm drain system comprises RCP pipes, for redundancy, two locations containing RCP were chosen (Area 1 and Area 5) for investigation. The CCTV investigation was conducted for a total of approximately 4,740 linear feet of pipe. Table ES-3 describes each area investigated with pipe information based on the GIS and as-builts.

Table ES-3 – *Selected CCTV Areas*

Description	Length (LF)	Material	Size	Year of Installation
Area 1	928	RCP	36"–42"	1981
Area 2	660	CMP/CP	10"–18"	1978
Area 3	1,334	CMP	15"–48"	1978/1987
Area 4	1,028	AC	15"–24"	1987
Area 5	721	RCP	24"–27"	1975
Total	4,671			

The notable outcomes of the CCTV pipe assessment are summarized below by area. For the areas investigated as a part of this project, it was generally noted that significant pipe blockages were encountered. Approximately 4,671 linear feet were identified for the initial CCTV investigation. Approximately 374 linear feet of pipe, or 8%, could not be inspected due to debris and blockage in the pipes. Of the remaining pipe inspected, significant portions require repair or replacement, as identified in Tables ES-4 and ES-5.

Table ES-4 – *Summary of CCTV Findings*

Summary of Pipe CCTV Results			
Material	**Installation Year**	**% CIPP Repair**	**% Replacement**
Non-Reinforced Concrete Pipe	1981	0%	16%
Corrugated Metal Pipe	*1978*	*42%*	*44%*
Asbestos Cement Pipe	1975	2%	0%
Reinforced Concrete Pipe	1975/1981	18%	0%

Table ES-5 – *Summary of Cost Due to CCTV Findings*

Summary of CCTV Repair and Rehabilitation Costs		
Material	**Length (ft)**	**Replacement/Repair Cost**
Non-Reinforced Concrete Pipe	107	$25,583
Corrugated Metal Pipe	*1,888*	*$313,705*
Asbestos Cement Pipe	1,028	$7,511
Reinforced Concrete Pipe	1648	$68,391
Total with CMP	**4,671**	**$415,190**
Total without CMP	**Total Cost without CMP***	**$101,485**

Cost Analysis of Pipe Replacement Due to Age and Material

Based on the as-built research compiled, reviewed, verified, and updated in the City of Rocklin's GIS database, the data for pipe material, diameter, and year of installation was extracted. Each pipe segment in the system was assigned an expected replacement year based on the pipe installation year and the pipe material's expected useful life. The general assessment is that the City's storm drain conveyance system can be classified as relatively new, as most of the system was constructed within the last 55 years.

However, documentation does not exist for portions of the system in Old Town, which were likely installed more than 55 years ago. In addition, portions of the system in Old Town are described as "Chinese drains." These parts of the system are undocumented and are typically found when uncovered during other construction projects. It is likely that the age of the Chinese drains extends well beyond 80 years.

An analysis was prepared to determine the replacement cost for each pipe segment in the City's system based on the installation year and its expected useful life. The analysis assumed replacement with the same pipe diameter with a material of HDPE or equivalent.

The cost estimates summarized in Tables ES-6 through ES-14 should be considered the theoretical pipe replacement value for the system over the next 20 years. **In 20 years is estimated 16,774 LF of pipe could be replaced. The replacement value of the existing storm drain pipes is estimated at $12,986,350, with consideration for mobilization (5%), traffic control (3%), CCTV for replacement lines (80$/lf), soft cost (6%) the replacement value for storm drain system is estimated at $16,289,209.**

The replacement value for the Storm drain system **for year 2020 including for mobilization (5%), traffic control (3%), CCTV for replacement lines (80$/lf), soft cost (6%) is estimated at $5,583,609.**

The $5,583,609 value proposition includes 2,117 LF of CMP. However, we are conducting a separate analysis for the CMP, as such, when the CMP from the 2020 replacement, the total replacement value for the storm drain system is estimated at $3,971,241 inclusive of mobilization, traffic control, and soft costs. Note, **$3,971,241 includes removal of 695 LF of CIPP, 95 LF of AC, 171 LF of CSP, and 5,010 LF of unknown pipe.**

Table ES-6 – – *Theoretical CIPP Replacement Cost*

Replacement Year	Pipe Length (ft)	Cost
2013	669	$674,846
2015-2035 (9% CIPP unknown)	**105**	**$105,939**
Total	**774**	**$780,785**

Table ES-7– *Theoretical AC Replacement Cost*

AC		
Replacement Year	Pipe Length (ft)	Cost
2016	95	$22,871
Total	**95**	**$22,871**

Table ES-8 – *Theoretical CMPA Replacement Cost*

CMPA		
Replacement Year	Pipe Length (ft)	Cost
2022	69	$82,607
2024	248	$256,363
2030	157	$63,276
2034	1732	$867,149.00
2035	67	$19,339
Total	**2,273**	**$1,288,734**

Table ES-9 - *Theoretical Replacement CMP Cost*

CMP		
Replacement Year	Pipe Length (ft)	Cost
2008	529	$ 219,692
2009	1025	$ 784,722
2013	104	$ 30,015
2020	152	$ 58,095
2021	42	$ 18,255
2022	1092	$ 262,140
2023	929	$ 464,681
2024	1102	$ 453,694
2025	211	$ 52,479
2028	105	$ 30,361
2032	410	$ 656,282
2034	2068	$ 1,229,881
2035	30	$ 12,927
2015-2035 (7% CMP unknown)	1,226	$ 672,001
Total	**9,026**	**$4,945,225**

Table ES-10– *Theoretical HDPE Replacement Cost*

HDPE		
Replacement Year	Pipe Length (ft)	Cost
2016	0	0
Total	**0**	**0**

It's assumed that the 7,592 LF of unknown HDPE Installation date are installed 1980, matching the oldest record for City of Rocklin. As such, 2087 will be the first replacement, based on lifecycle.

Table ES-11– *Theoretical CP Replacement Cost*

CP		
Replacement Year	Pipe Length (ft)	Cost
2035	837	$208,440
Total	**837**	**$208,440**

Table ES-12– *Theoretical RCP Replacement Cost*

RCP		
Replacement Year	Pipe Length (ft)	Cost
2016	0	0
Total	**0**	**0**

It's assumed that the 24,722 LF of unknown RCP Installation date are installed 1962, matching the oldest record for City of Rocklin. As such, 2052 will be the first replacement, based on lifecycle.

Table ES-13– *Theoretical CSP Replacement Cost*

CSP		
Replacement Year	Pipe Length (ft)	Cost
2020	171	$123,147
2024	147	$37,894
2034	2431	$1,170,630
Total	**2,749**	**$1,331,671**

Table ES-14– *Theoretical Unknown Pipe Material Replacement Cost*

Unknown		
Replacement Year	Pipe Length (ft)	Cost
2015	5,010	$2,204,312
2025	5,010	$2,204,312
Total	**10,020**	**$4,408,624**

Corrugated Metal Pipe (CMP)

Based on the CCTV investigation of the corrugated metal pipe (CMP) systems installed in 1978 and/or 1987, 45% of the pipe was found to require replacement or retrofit to continue functioning as designed. The findings indicate that 55% of the CMP is meeting its life-cycle expectancy after approximately 30 years, while the remaining 45% suffers moderate signs of corrosion, oxidation, and loss of galvanization, including moderate pitting that has resulted in significant clogging starting 28–37 years after installation. It should be expected, in the event the CMP is untreated, that the steel pipe will continue to oxidize, weakening the structural integrity of the pipe and causing a full loss of functionality.

The City may consider rehabilitating only the damaged portions of the CMP. This approach is feasible in the short term in localized areas that are at a lower or limited risk of flooding and road failure and other risks in case of pipe failure. However, it is important to note that rehabilitating only portions of the CMP will not extend the life cycle of the pipe, as the remainder of the CMP that was not treated may still fail sooner.

Therefore, the recommended approach for the CMP is to completely rehabilitate or replace it, rather than patch-fix the failing segments.

The GIS data indicates that 52% of the CMP will reach the end of its expected 45-year life cycle by the year 2035. It's relevant to note that by the year 2027, 13,000 linear feet of CMP in the city will be older than 30 years, by year 2035 all the CMP in the City will be older than 30 years old. Based on the CCTV data, it is highly probable that 45% of the CMP in the city will be dilapidated by 2020. For CMPA, this milestone will be achieved by the year 2035.

While other metallic pipes, steel pipe (SP) and ductile iron pipe (DI or DIP), are also at risk for corrosion damage, it's noted that the expected life for those materials is longer than CMP, with the SP replacement year starting in 2046 and the DI replacement year starting in 2039. Since this analysis is considering a 20-year planning horizon (concluding in 2035), it would be consistent to delay the retrofitting or replacement of the other steel pipes.

An analysis of all CMP and CMPA was conducted based on the length and diameter, and the values were correlated with the replacement cost/diameter and rehabilitation cost/diameter. The costs are summarized in Table ES-15. It is assumed, based on the CCTV findings for CMP, that 45% of the pipe needs to be replaced, while 55% can be rehabilitated. As such, the total costs shown in Table ES-15 can be annualized over 5 years, with a priority for CMP/CMPA to be completely replaced by 2020.

Table ES-15 – *CMP/CMPA Pipe Replacement and Repair Cost – exclude design and construction fee*

Material	Length of Pipe to Replace (feet)	Cost to Replace	Length of Pipe to CIPP (feet)	Cost to CIPP	Total Cost for Pipe Repair
CMP	7,878	$3,471,831	9,629	$2,121,675	**$5,593,506**
CMPA	3,938	$2,090,861	4,813	$1,277,748	**$3,368,609**
Total	*11,816*	*$5,562,692*	*14,442*	*$3,399,423*	***$8,962,115***

The estimate fee to design and construct the CMP/CMPA replacement and repair cost is noted in the below Tables ES-15 A and ES-15 B as follows:

The Grand total to complete the CMP works is estimated to be $7,887,929, whereas, the CMPA work is estimated at $4,598,297, the Sum Total of CMP and CMPA $12,486,226. NOTE: The fees presented herein are an estimate, which can vary greatly depending on the conditions of the soil, depth of pipe, number of project, contractor experience and multiple of externalities. This value provided herein is for estimation purpose. It should be noted that for CMP replacement and/or CIPP analysis the following was assumed:

- Assumed 14 Total Project, spread among 4 quadrants.

- 8 Projects are located in the SE quadrant.

- The Number of projects are geographically based, with consideration to the number of streets, diameter sizes, length of pipes, and estimated value of bid.

- The value provided herein for separation of CIPP and R&R of pipes are empirical, it's envisioned that a SD system will either be replaced or treated, however, there may be occasions that warrant both treatments that can be evaluated on a case by case.

- It's recommended the SD system to be flushed and CCTV prior to engagement

-The existing conditions, depth, geology, location, and a host of unknown external factors can impact the estimate.

Similar assumptions were complete for the CMPA, however, consideration was for 8 projects in total, 5 to be located in the SE quadrant.

Table ES-15 A – *Estimated **CMP** Pipe Replacement and Repair Cost Project per Quadrant*

Description		CMP Geographic location per Quadrant			
	unit	NW	NE	SW	SE
CIPP		$ 34,433	$ 78,400	$ 660,214	$ 1,348,570
R&R		$ 56,345	$ 128,290	$ 1,080,350	$ 2,206,751
CIPP/R&R Total		**$ 90,777**	**$ 206,690**	**$ 1,740,564**	**$ 3,555,322**
No. Project		**1**	**1**	**4**	**8**
CIPP/R&R Per Project		$ 90,777	$ 206,690	$ 435,141	$ 444,415
Mobilization/Project	5%	$ 4,539	$ 10,335	$ 21,757	$ 22,221
Traffic Control/Project	3%	$ 2,723	$ 6,201	$ 13,054	$ 13,332
CCTV/project	(80$/lf)	$ 34,781	$ 42,216	$ 74,006	$ 128,450
Sub Total Fee Per Project		**$ 132,820**	**$ 265,441**	**$ 543,958**	**$ 608,419**
Sub Total Fee Per Quadrant		**$ 132,820**	**$ 265,441**	**$ 2,175,832**	**$ 4,867,348**
Total Cost		**$ 7,441,442**			
Eng. Soft Cost	6%	**$ 446,487**			
Grand Total (CMP)		**$ 7,887,929**			

Basis of Estimate

est. no. street		*5*	*4*	*12*	*33*
avg. lf/st		*87*	*132*	*308*	*389*
No. Project		*1*	*1*	*4*	*8*
est. lf/project		*435*	*528*	*1233*	*1606*

Table ES-15 B – *Estimated **CMPA**- Pipe Replacement and Repair Cost Project per Quadrant*

Description		CMPA Geographic location per Quadrant			
	unit	NW	NE	SW	SE
CIPP		$ 67,177	$ 28,035	$ 68,860	$ 1,113,646
R&R		$ 109,926	$ 45,876	$ 112,681	$ 1,822,330
CIPP/R&R Total		**$ 177,102**	**$ 73,911**	**$ 181,541**	**$ 2,935,976**
No. Project		$ 1	$ 1	$ 1	$ 5
CIPP/R&R Per Project		**$ 177,102**	**$ 73,911**	**$ 181,541**	**$ 587,195**
Mobilization/Project	5%	$ 8,855	$ 3,696	$ 9,077	$ 29,360
Traffic Control/Project	3%	$ 5,313	$ 2,217	$ 5,446	$ 17,616
CCTV/project	(80$/lf)	$ 19,583	$ 10,879	$ 19,873	$ 129,934
Sub Total Fee Per Project		**$ 210,853**	**$ 90,703**	**$ 215,937**	**$ 764,104**
Sub Total Fee Per Quadrant		**$ 210,853**	**$ 90,703**	**$ 215,937**	**$ 3,820,522**
Total Cost		**$ 4,338,016**			
Eng. Soft Cost	6%	**$ 260,281**			
Grand Total (CMPA)		**$ 4,598,297**			

Basis of Estimate

est. no. street		*1*	*1*	*1*	*14*
avg. lf/st		*245*	*136*	*248*	*580*
No. Project		*1*	*1*	*1*	*5*
est. lf/project		*245*	*136*	*248*	*1624*

Cost Analysis for Prioritized Outlets with Structural Concerns

There are 43 outlets with significant structural damage observed. To assist with the priority of repair or replacement, these outlets were further prioritized into three classifications of damage:

Severe is a high priority. Refers to the damaged outlets which are recommended to be replaced first. There are a total of 17 outlets in this category.

Critical is a medium-high priority, below severe. Refers to the outlets structurally impacted; however, the extent of the damage cannot be fully assessed due to obstructions. Further clearing and removal of debris is required to determine the full extent of the damage and replacement costs. There are a total of 11 outlets in this category.

Marginal is a lower priority than critical. The extent of the damage cannot be fully assessed due to obstructions. Clearing and removal of debris is required to determine the full extent of the damage and replacement costs. There are a total of 15 outlets in this category.

It's important to acknowledge that these assessments and recommendations for repair/replacement are initially provided as a guideline. It is critical that further operational details, such as a hydraulic analysis, be performed to determine the outlets' capacity and whether the existing diameters are adequate.

To quantify the associated costs to repair the damaged outlets, a matrix was devised to correlate the photos taken in the field with a narrative and to as-built drawings where available. The matrix includes required improvements, such as screen, headwall, riprap, pipe replacement, pipe repair, and incidentals that may be required such as additional pipes, aprons, etc. An appraisal was made with regard to determining the conceptual quantities that may be required to repair or replace a given outlet. Furthermore, a unit cost was assigned to each outlet, based on historical references. The following unit costs and assumptions were used to determine the basis of the cost estimate:

Headwall concrete = 1,500 CY
Screen = $3,000–$9,000 EA
Riprap = $60/CF
Pipe replacement = $300/LF
Concrete/repairs/misc. = varies $50/LF–$245/LF

The cost for structural replacement should be considered a rough order of magnitude, pending further information. The cumulative costs to repair/replace the structurally deficient outlets are summarized in Table ES-16, while the cost for each category is identified as a lump sum effort.

Table ES-16 – *Cost Summary of Replacement Priority for Structural Ranking 1 and 2*

Replacement Priority for 1 & 2 Structural Rankings	%	No.	Cost
Severe	39%	17	$546,119
Critical	26%	11	$249,028
Marginal	36%	15	$414,830
Total	**100%**	**43**	**$1,209,977**

Cost Analysis for Prioritized Maintenance Outlets

There are 180 outlets that are ranked as 1 or 2 for maintenance. The scope of services that will be considered to address the observed concerns would typically involve the following:

- Heavy clearing: thick shrubs, tall and medium growth
- Medium to heavy grubbing: adjusting loose riprap, exposing outlets
- Medium scattering, collecting, bundling, hauling, and disposal of removed material
- Topographical terrain – distributed between ground slopes: gentle (under 20%), moderate (20%–45%), and steep (over 45%)

The maintenance services can be comfortably completed by a two-man crew with chain saws, hand tools, and pickup trucks. The area of work per outlet is typically 20 feet by 20 feet, or 400 square feet.

It's estimated that a two-man crew will be able to complete six site visits per day. Considering a unit cost of $500 per day per crew, the cost for maintenance is estimated at $15,000 to complete maintenance of the 180 outfalls in 30 working days.

If the City chooses to implement a routine program to clean the existing storm drain system, many of the clogged outlets will be unclogged by the pipe cleaning. Therefore, the cleaning program should be closely coordinated with the outlet maintenance program.

Comprehensive CCTV and Pipe Flushing Program

It's recommended that a program be included for regular CCTV inspections and pipe flushing. As noted in the site assessment, a significant number of outlets were inundated with sediment, gravel, and debris, and there were a number of incidents where the outlets couldn't be located or were barely visible due to complete immersion with sediment. Furthermore, the CCTV investigation revealed that 8% of the pipes were too clogged to pass a camera, and the survey was abandoned.

As such, a matrix was developed that correlated all 697,761 LF of pipe in Rocklin's current system with the CCTV results. Per the pipe diameters, an estimate was generated using a dynamic unit cost for pipe flushing and CCTV. The CCTV investigation's revelation of clogged pipes was extrapolated over the total storm drain system to generate the cost estimate. Reference Table ES-17 for the results.

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Table ES-17 – *CCTV and Pressure Cleaning Program*

Diameter (inches)	Length Total (ft)	0–5% Clogged	6%–25% Clogged	26%–60% Clogged	61%–100% Clogged	Sum Cost for Pipe Cleaning	Sum CCTV Inspection
2–6	1,319	$379.87	$527.60	$76.50	$242.70	$1,226.67	$923.30
8–15	281,623	$94,625.33	$132,560.04	$21,150.21	$99,599.44	$347,935.02	$197,136.10
18	89,249	$32,129.64	$49,979.44	$9,281.90	$37,841.58	$129,232.56	$62,474.30
20–21	28,740	$28,740.00	$28,740.00	$28,740.00	$28,740.00	$114,960.00	$28,740.00
24	68,937	$28,126.30	$45,498.42	$9,237.56	$37,501.73	$120,364.01	$55,149.60
27–30	48,979	$21,158.93	$37,224.04	$7,726.26	$31,296.86	$97,406.09	$39,183.20
33–36	31,590	$14,405.04	$24,008.40	$5,180.76	$20,975.76	$64,569.96	$25,272.00
41–54	28,848	$13,847.04	$29,172.88	$5,803.39	$23,444.35	$72,267.66	$24,002.65
55–Unknown	104,972	$55,425.22	$142,761.92	$7,712.61	$111,690.21	$317,589.96	$125,966.40
	684,257	**$288,837.37**	**$490,472.74**	**$94,909.19**	**$391,332.63**	**$1,265,551.93**	**$558,847.55**
Sub Total						**$1,265,551.93**	**$558,847.55**
Contingency (20%) mobilization/Traffic control/multiple projects						**$1,518,662.32**	**$670,617.06**
Common Total							**$2,189,280**
Credit (CCTV completed)							**$(12,570.00)**
TOTAL							**$2,176,710**

Water Quality

The work completed and documented in this report addresses Section E.11.f of the City's Municipal Separate Storm Sewer System (MS4) Phase II National Pollutant Discharge Elimination System (NPDES) permit conditions and requirements specifically in several ways:

- Assessed and ranked in order of priority the replacement and maintenance for all accessible and public outlets in the city.

- Assessed a representative sample of the conveyance system that is historically problematic, located in the Old Town area.

- Developed and proposed a procedure to assess and prioritize storm drain system maintenance, including for the structures that were inspected and/or reviewed.

A total of 467 outlets were visually assessed, and 57% of these outlets were prone to sedimentation settlement, debris, litter, and root infiltration and classified as high priority areas. It should be noted that approximately 10% of the assessed outlets were observed to be impacted, requiring repair or other structural modification in order for the conveyance system to function as designed.

Analysis from Old Town Rocklin

A separate assessment was conducted in the Old Town area of Rocklin. A CCTV investigation was completed for approximately 4,300 LF of varying pipe diameter and material. An analysis of the CCTV results indicates that 8% of the assessed pipes are severely clogged, meaning the internal cross-sectional area of the pipe is blocked in a range from 61% to 100%.

If the CCTV data is considered representative of the system as whole, with approximately 697,762 LF of total storm drain pipe in the city, approximately 54,740 LF of pipe (approximately 8%) are assumed to be severely clogged. These existing conditions further exacerbate the functionality of the conveyance system, and in time of heavy rain may lead to flooding and property damage, and further impact the streams and channels.

Preventive Maintenance

It is recommended that the City apply preventive maintenance efforts to reduce the quantity of trash, litter, and large sediments from building up and blocking the underground conveyance system. This can be accomplished through a combination of public education and outreach, installation and regular maintenance of filters in catch basins and inlets, and regular street sweeping.

Furthermore, considering the pervasiveness of the sediment and debris accumulation in the pipes and at the outlets, it is recommended that the City actively flush/clean and CCTV the entire storm drain network. In addition, it is suggested that the City further refine the budgetary costs provided in this report and improve the planning and execution of the operation and maintenance strategies for the system. System cleaning will contribute greatly to the quality of the discharge in the neighboring creeks and channels and will provide a valuable tool for inspection and assessment.

The accumulation of trash impacts aquatic life in streams, rivers, and the ocean as well as terrestrial species in adjacent riparian and shore areas. It's understood that trash, particularly plastics, persists for years. It concentrates organic toxins, entangles and ensnares wildlife, and disrupts feeding when animals mistake plastic for food and ingest it. Additionally, trash creates aesthetic impacts, impairing enjoyment of waterways.

One method to reduce trash impact would be to capture it at the source with the addition of filter inserts, which are removable curb inlet inserts that capture trash before it enters the drainage system. Various types of filters are available and vary by the facility in which they are used. Skimmer boxes are designed for grated inlets and can be used for retrofit applications. They can provide multistage filtration and are

effective at removing trash, as well as other pollutants, including total suspended solids (TSS), phosphorus, and metals. Catch basin inserts can capture sediment and trash while allowing high flows to bypass, and they are available in various sizes. Filters can be perforated meshes similar to pipe screens or they can be made of fibrous material that replicates a biofiltration process.

Typically, prior to the implementation of citywide best management practice (BMP) improvements, the City embarks on a comprehensive study evaluating the effectiveness of structural and nonstructural BMPs as part of an integrated system of water quality management. Notwithstanding the above, there is a strong correlation between the inlets that drain to the outlets that were ranked 1 or 2 for maintenance and the upstream catch basins.

The City currently operates a series of water quality treatment structures such as oil/sand separators. The Oil/Sand separators are typically located prior to the outfall and on an average the structures assist with maintaining the water quality in the area of influence. The Oil/Sand separators may operate by receiving volume or flow based. While the research did not include hydraulic analysis of the Oil/Sand separators, the location near the outfalls and their connection to inlets in series, is a positive indication of the logical functionality of the structures. With proper maintenance the Oil/Sand Separators can greatly contribute to meeting the water quality requirements.

The Oil/Sand Separator include a maintenance program that is recommended by the manufacturer, however, typically these type of structures are checked every six months, and based on the consistency of the structures' performance the maintenance adjusts.

There are approximately 146 structures in the City. Noting that a structure was not located in the NE quadrant.

Table ES-18 – *Summary of the O/S Maintenance Program*

Quadrant	OS Structure	MH with OS	Yearly Inspections	Maintenance Fee	Total O&M Fee
NW	53	10	$ 37,800.00	$ 37,800.00	$ 75,600.00
NE	0	0	$ -	$ -	$ -
SW	34	1	$ 21,000.00	$ 21,000.00	$ 42,000.00
SE	40	8	$ 28,800.00	$ 28,800.00	$ 57,600.00
Sub-Total	127	19	$ 87,600.00	$ 87,600.00	$ 175,200.00
Total	146		$ 175,200.00	$ 175,200.00	$ 350,400.00

The maintenance is typically performed by the manufacture, and would include inspection for damage, removal of parts, filters, and vacuuming. These fees, vary based on contract and assorted external conditions. However, it's reasonable to assume that City can inspect each structure and determine the next step, if any. The inspection would be a $600 inspection year, considering 2 hours of staff to visit every six months, billed at $150/hr. However, it is recommended to establish a maintenance program to assist with up-keeping these facilities. It would be reasonable to assume $50 a month for each structure set aside in the event an inspection yields the need for repair.

The O/S structures located near the outlets and connected to inlets in series may not be as vulnerable to other inlets in the City that lack sediment protection. Considering that on average the 146 O/s separator are connected to 4 inlets, we can assume that 580 inlets are in better condition than the remaining 4,416 inlets.

A typical filter insertion would cost $800. With approximately 5,000 inlets in Rocklin, a trash capture program would cost $4,000,000 to execute as a whole. In addition, it's recommended to implement a citywide filter insert maintenance. These inserts should be removed and cleaned monthly or bimonthly. Typical labor to commit to such program would be .5 hour per inlet, bimonthly that will amount to $2,250,000 when the program is mature.

The Program can be phased, in such a manner, where approximately 400 inlets located in the NE Quadrant are provided with inserts. The total cost is approximately $320,000. In addition a maintenance of $180,000 a year should be allocated.

Recommendations

Based on the results of the outlet site assessment, limited CCTV investigation, and desktop analysis of pipe age and material, it is recommended that the City implement the following actions:

1. Replace and/or repair the 43 damaged outlets, prioritizing the structures with severe damage to be completed in the first year, critical structures to be completed in the second year, and marginal structures to be completed in years 3–5.
2. Replace and/or rehabilitate all CMP in the city over 5 years.
3. Establish a replacement program for CMPA starting in 2016 and complete in 2035 years.
4. Establish a systematic rehabilitation and replacement program for all storm drain pipes expected to reach the end of their useful life over the next 20 years.
5. Establish a systematic method to clear, clean, and maintain the 180 existing storm drain outlets with an observed maintenance concern.
6. Implement a citywide storm drain CCTV program with a goal to inspect all storm drain pipes in the system within 5 years.
7. Implement an annual citywide flushing and cleaning program to be coordinated with CCTV efforts.
8. Explore options to stop trash and debris from entering the system at the source, such as the installation of inlet filters in all of the City's inlets.

Table ES-19 – *Capital Improvement Costs with O&M Recommendations*

Capital Improvement Projects		
Years		**5**
Description of Projects		**Projects**
Item 1 - R&R Structural Outlets - Reference Table 29, Section 7.4.1	**$**	**1,209,977.17**
* R&R - 17 Structural Outlets - Severe right away	*$*	*546,119.17*
* R&R - 11 Structural Outlets - Critical may wait to be completed by next yearar)	*$*	*249,028.00*
* R&R - 15 Structural Outlets - Marginal no later than a full year	*$*	*414,830.00*
Item 2 - R&R SD Pipes for Areas (1-5) - Reference Section 5.1, Table 11	**$**	**101,485.00**
*Area (1)		*$29,583*
(Area 2) CP replacement		*$25,583*
* (Area 4)		*$7,511*
* (Area 5)		*$38,808*
Item 3 - R&R SD Pipes due to install date - Reference Section 7.1, Table 16-24 (Exclude CMP/CMPA)	**$**	**3,971,241.00**
CIPP		
AC		
HDPE		
CP		
RCP		
CSP		
UNK		
Item 4 - CMP and CMPA Full replacement program - Refernce Section 7.3, Table 27	**$**	**9,037,503.25**
CMP(spread over 5 years equal)= (7,887,929/5) =1,577,585.80		**$7,887,929**
CMPA (spread over 20) ($4,598,297/20) = 229,914.85$/year	**$**	**1,149,574.25**
Sub-Total CIP Projects (for five years)	**$**	**14,320,206.42**
O&M Costs (for 5 years)	**$**	**8,746,747.86**
Total Budgetary cost (for five years)	**$**	**23,066,954.28**

Sum of Operation & Maintenance (to be annualized 5 years)	**$**	**8,746,747.86**
Item A- C&G Maintenance Outlets - reference Section 4.2 & 7.5		$33,500.00
* C&G - 180 Main Structural Outlets - (30*500) (1st year)	$	15,000.00
C&G - 217 Structural Outlets) (37*500) (2nd year)	$	18,500.00
Item B - Comprehensive Pipe Cleaning program & CCTV - reference Section 7.3		$2,114,997.86
Flushing and Cleaning (assume to go in parallel with CMP 5 year replacement)	$	1,463,882.84
CCTV (assume to go in parallel with CMP 5 years replacment)	$	651,115.02
Item C - Comprehensive Filter Insert Program - reference Section 8	$	6,598,250.00
Filter Inserts replace 2,500 inserts in 5 years	$	2,000,000.00
400 filter insert first year		
525 filter insert following year until 2020		
Maintenace of Filter Inserts per 2500/5year	$	1,125,000.00
Maintenance of O/S seperator	$	1,752,000.00