June 20, 2022, Rain Event Response – Report Back

ISSUE

On June 20, 2022, Saskatoon experienced heavy rain with accumulations concentrated in the south, southeast, and north sides of the city. Upwards of 75 millimeters were received in some areas over the course of one hour. Questions have been raised around how the City of Saskatoon (City) could consider signalling to vehicles when roadways become dangerously flooded as a result of major rain events. In addition, inspections were completed on the storm sewer infrastructure system in areas with significant flooding.

This report provides an overview of rainfall event signalling options and the results of storm water infrastructure investigations.

BACKGROUND

At its January 28, 2019, Regular Business Meeting, City Council received the Intelligent Transportation Systems (ITS) Strategic Plan and resolved:

> That the vision, goals, and key directions of the Intelligent Transportation Systems Strategic Plan be approved.

The ITS plan identified ten specific projects, of which one is “Traffic Management”. The purpose of this project is to implement traffic management system technologies that support traffic flow monitoring, incident management, and traffic control. Another relevant project included in the plan is ‘Traveller Information’. The purpose of this project is to provide more information to motorists to allow for better decision making about their travel during their trip and as part of pre-trip planning.

At the June 27, 2022, regular business meeting of City Council, a report from the Administration was received regarding the June 20, 2022, Rain Event Response. City Council resolved:

> Would the Administration investigate a device that could signal to vehicle operators not to proceed under overpasses when water/snow gets to a certain dangerous depth; and

City Council further resolved:

> That the Administration report to Council or the appropriate committee regarding the results of the investigations into storm water infrastructure following the June 20, 2022, storm event.

CURRENT STATUS

Driver Information System Review

Closures of underpasses during a flood event are based on real-time information received through various methods (phone calls and emails to the Customer Care Centre, Fire Department, and Saskatoon Police Service). Crews are dispatched to close approaches to an underpass using a similar process as any other emergency road closure request (accident, chemical spill, train derailment, etc.).

Storm Water Infrastructure Investigation

The City's storm sewer infrastructure includes lift stations, storm ponds, and linear systems including pipes and drainage ditches/swales. Storm water is collected via storm drains, usually located at the curbs of streets, and then moved via local collection pipes to large mainline trunk sewer pipes. Eventually the storm water flows into the South Saskatchewan River.

While the sanitary and storm sewer systems are designed to operate independently, storm water does enter the sanitary system through weeping tile, sump pump connections, and infiltration and inflow into pipes and manholes. The typical average daily flow into the Wastewater Treatment Plant (WWTP) is estimated at 79 Million Litres (MLD). During the peak of the June 20, 2022 storm, flows of up to 270 MLD were observed into the WWTP. For reference, the previous highest flow rate at the WWTP in recent history was 170 MLD in 2017.

While high flows into the sanitary system during a storm help to flush out debris and solids in the pipes, these materials and increased flows travel through lift stations, the sanitary collection system and end up at the WWTP.

It is routine to conduct annual targeted inspections of the storm water collection infrastructure. Following a storm of this magnitude, the focus of inspections is at locations of concern identified through modelling and observations.

The rain event that occurred on June 20, 2022, ranged from a 5 to 25-year design storm for many of the neighbourhoods south of 8th Street East between Circle Drive East and Idylwyld Drive. Many of the known high-risk flood locations are within these boundaries and reported flooding during the June 20, 2022 rain event. The neighbourhoods within these boundaries primarily drain through the Preston Avenue South and Taylor Street storm sewer trunks. The storm sewers in these neighbourhoods were constructed to the design standards in-place at the time of development which was prior to the standards update in 1989.

In response to the rain event and flood inquiries, the City launched a priority Closed-Circuit Television Video (CCTV) and visual inspection program to determine the current state of the infrastructure.

DISCUSSION/ANALYSIS

Driver Information System Review

A device that warns drivers not to proceed through an underpass due to flooding aligns with the ITS Strategy for the City. A number of different approaches to flooding detection and messaging are used in other jurisdictions.

Standalone detection and warning system – This type of system is available in the traffic control devices industry. These systems place a water level indicator at the critical elevation of the flood-prone location and warning signs ahead of exits so drivers can divert from the flooded roadway. Communications between the detection system and the warning signs is automated and independent of any other city systems. The warning signs are static and illuminated only after detection. The detection and warning signs can be solar powered reducing installation and operating costs.

Integrated detection and warning system - A detection and warning system integrated with the existing Automated Traffic Management System (ATMS) can be provided. A detection system can be located at the flood-prone location, and signals relayed from the detection system to the ATMS, forwarded to the appropriate emergency services and detour crews for response. Warning signs could be illuminated after detection or City crews would be responsible for the necessary detours.

Traffic camera and warning system - Alternately, real-time traffic cameras could be deployed at flood prone locations and monitored during severe rainfall events. Resources would be required to monitor and direct response in the event of flooding.

Storm Water Infrastructure Investigation

The Administration and an external contractor completed CCTV inspections in response to the June 2022 rain event. Approximately 10.5 km of storm sewer was inspected.

The results of the CCTV inspections for the Preston Avenue storm trunk and connecting local storm mains is summarized below:

Storm Sewer	Intersection (from)	Intersection (to)	Length (m)	Operational Condition
Preston Ave S	Louise St	South Saskatchewan River	4,075	Debris level: 5-10% of pipe diameter
Sturby Pl	Sturby Pl	Arlington Ave	200	Debris level: 30-50% of pipe diameter
Arlington Ave	Sturby Pl	Porter St	50	Debris level: 25% of pipe diameter
Porter St	Arlington Ave	Nutana Kiwanis (Park)	125	Debris level: 5-10% of pipe diameter
Nutana Kiwanis (Park)	Porter St	Louise St	175	Debris level: 40-50% of pipe diameter
Louise St	East Centre	Preston Ave S	600	Debris level: 15% of pipe diameter
Taylor St	Grosvenor Cres	Preston Ave S	230	Debris level: 5-10% of pipe diameter

The results of the CCTV inspections for the Taylor Street storm trunk and local connecting storm mains are summarized below:

Storm Sewer	Intersection (from)	Intersection (to)	Length (m)	Operational Condition
Taylor St	Eastlake Ave	South Saskatchewan River	1,470	Debris level: 5-10% of pipe diameter
Cascade St	Dufferin Ave	Royal Ave	290	Debris level: 40% of pipe diameter
Royal Ave	Cascade St	Ruth St E	330	Debris level: 20-40% of pipe diameter
Eastlake Ave	Ruth St E	Taylor St E	790	Debris level: 30% of pipe diameter

Bute St	Albert Ave	Royal Ave	700	Cleaned prior to inspection
St. George Ave	Hilliard St W	Taylor St	420	Debris level: 5-10% of pipe diameter

Pipe cleaning is recommended for locations with debris impacting 20% of the pipe diameter or greater. Funding is available to begin this work in 2023 and will continue into 2024 pending approval of additional funding during the 2024-2025 Business Plan and Budget Deliberations.

The debris observed within the Taylor Street storm trunk was crumpled steel liner which will be removed as part of a lining project to repair the deficiency in 2023.

CCTV inspections at other locations with reports of flooding during the June 2022 event are summarized below:

- The storm sewer at the intersection of Main Street and Dufferin Avenue connects to the South Saskatchewan River via Main Street and then Broadway Avenue (775 m) and was inspected with a debris level of approximately 5-10%.
- The storm sewer along Ferguson Avenue and at the intersection of Ferguson Avenue and Wilson Crescent was inspected. The storm sewer connecting Ferguson Avenue to this intersection was clear of debris. The storm sewers at the intersection and connecting to the small dry pond in Churchill Park were filled with debris (>50%) preventing thorough inspections. A cleaning and secondary inspection is scheduled in early 2023.
- Material build-up preventing a thorough inspection for the storm sewer at 615 Highlands Crescent (backyard catch basin connecting to the street) was observed. A cleaning and secondary inspection is scheduled in early 2023.

Visual surface inspections of the storm sewer infrastructure were also completed in addition to the CCTV inspections. Key deficiencies or observations are summarized below:

- Small surface repairs and cleaning were completed at Arlington Avenue and Fraser Crescent. These deficiencies did not impact performance.
- No deficiencies were observed at Early Drive and Tucker Crescent, 615 Highlands Crescent, 1st Street East and Lansdowne Avenue, 1st Street East and Dufferin Avenue, and Ferguson Avenue and Wilson Crescent.

Projects related to the Flood Control Strategy (FCS) such as W.W. Ashley Park dry pond, Churchill Park dry pond, and related storm sewer infrastructure are in service to reduce flooding for nearby intersections. The third project of the FCS, which includes relief at the intersections of Bute Street and Dufferin Avenue and Cascade Street and Dufferin Avenue, will start construction of the dry storm pond in Weaver Park in February 2023. Planning has started for the fourth project that includes the intersection of Early Drive and Tucker Crescent. An update on future projects including modelling and calibration from the June 2022 rain event is planned to be provided in the next FCS City Council report.

FINANCIAL IMPLICATIONS

Driver Information System Review

A high-level estimate for the deployment of each system at the lowest elevation of Circle Drive under Taylor Street East is provided in the following table:

System	Cost Estimate for Installation at Circle Drive and Taylor Street East
1. Standalone detection and warning system	$43,000.00
2. Integrated detection and warning system	$52,000.00
3. Traffic camera alone	$9,000.00

The standalone detection and warning system offers the easiest solution and deployment; however, without a messaging or communications system, flooding may be detected without any messages to emergency services or staff. Drivers may also not pay attention to the illuminated warning signs during the flooding. This system is likely to have the lowest operating cost.

A system integrated with the ATMS does provide notice to emergency services and staff allowing for the deployment of barricades and additional signage directing drivers to more appropriate exits and routes. This system leverages much of the existing communications and notification infrastructure and is expected to have relatively low operating costs primarily related to communications equipment.

Use of traffic cameras alone requires resources dedicated to monitoring the video feed, but this model of monitoring system does have the advantage of direct observation and prioritization of resources; however, considerably higher operating costs, largely through staffing costs. Real-time, monitored traffic cameras would provide the highest level of confidence in both high-water levels and snow-covered roads detection.

The above installation costs are per location. The Administration has identified ten underpass locations throughout the City that would benefit from a system. Accordingly, the installations costs for an integrated detection and warning system at 10 locations is approximately $550,000.

Storm Water Infrastructure Investigation

The CCTV work for inspecting the storm sewers through the external contractor costs $108,000 (4.4 km), funded through existing capital budgets. The CCTV and visual inspections, completed by Operations staff, utilized existing operational and capital budgets.

The Taylor Street storm sewer lining project will be funded through existing preservation capital budgets.

Cleaning or flushing of the storm sewer system is an ongoing program and is executed based on known issues, complaints, or in advance of other preservation work utilizing existing operational budget. An expanded comprehensive cleaning program will be reviewed and if proven necessary, may result in an increase to the storm water utility rate or require a current program to be decreased in scope.

OTHER IMPLICATIONS

Due to the prioritized inspections of the storm sewer resulting from the June 2022 rain event, the regular CCTV inspection program was deferred until 2023.

NEXT STEPS

Transportation Signalling Review

No further action is planned at this time. An optional budget request could be provided for consideration during the 2024-2025 Multi-Year Budget process for the installation of integrated warning and detection systems at 10 locations.

Storm Water Infrastructure Investigation

- An update on the FCS and request to proceed with construction for project four of the strategy will be presented to City Council in 2023.
- The Taylor Street storm sewer lining construction project is planned for 2023.
- The secondary inspections in response to the June 2022 rain event will be completed in 2023. The regular CCTV storm sewer inspection program will also continue in 2023.
- The cleaning of pipes with 20% or greater debris levels is planned the begin in 2023 and will continue into 2024.
- Investigation of the requirements and resources of an expanded comprehensive cleaning program.

APPENDICES

1. CCTV Inspection Map

Report Approval

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