Final Report for:

TOWN OF WESTLOCK

STORMWATER MASTER PLAN UPDATE

2017

Date: January 18, 2018
Project No.: 5454-004-00

Proud of Our Past... Building the Future

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Westlock, Alberta
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January 18, 2018
File: N:\5454\004\00\R01

Attention: Don Hamilton, C.E.T.
Director of Operations

Dear Mr. Hamilton:

Re: Town of Westlock
Stormwater Master Plan Update – 2017
Final Report

MPE Engineering Ltd. is pleased to submit the *Stormwater Master Plan Update – 2017* – Final Report.

If you have any inquiries regarding this report or if clarification is required, please contact the undersigned at 780-509-4311 or mdowhun@mpe.ca.

Yours truly,

MPE ENGINEERING LTD.

Mike Dowhun, C.Tech.
Project Manager

MA:sb

Enclosure

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the Town of Westlock. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information. Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

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MPE ENGINEERING LTD.
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta

Kevin Fitzpatrick, P.Eng.

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1.0 INTRODUCTION

1.1 Background

The Town of Westlock (Town) is located on Highways 44 and 18, approximately 80 km northwest of Edmonton. The Town is located within the Wabash Creek Watershed, a tributary to the Pembina River. The Town's Stormwater Master Plan (SMP) is outdated and must be updated to reflect current conditions within the Town to ensure the Town can operate a safe and effective stormwater system. MPE Engineering Ltd. (MPE) was retained to confirm and update the Town's current SMP.

The following three documents have been reviewed and analyzed as a part of this report:

- *Town of Westlock Stormwater Master Plan*, November 2004 – A **master plan** by ISL Engineering and Land Services Ltd. that identifies generic information regarding overall drainage patterns and specific information regarding the existing stormwater facilities. The report identifies the deficiencies in the existing system and makes recommendations to improve it. Class D cost estimates are also provided for budgeting purposes.
- *Stormwater Master Plan – 2009 Update*, November 2009 – A **master plan update** by ISL Engineering and Land Services Ltd. Similar to the 2004 report, this update outlines the changes in development since the previous master plan as well as upgrades and maintenance to the stormwater system that have been implemented as a result of the previous report. This report also recommends completion of deferred work as well as new work required as a result of development.
- *Stormwater Assessment and Master Plan Review*, September 2017 – A **preliminary design report** by MPE Engineering Ltd. that focuses on the upgrades required for a single portion of the major storm system. The focus of this report is on the West Ditch, which will be discussed in this report, and seeking funding assistance with the proposed upgrades.

MPE also completed a thorough review of the Town's Procedures and Design Standards for Development, dated October 2009.

1.2 Scope of Assessment

In general, the following tasks are included in this study:

- Collect and review all relevant data and available information provided by the Town.
- Review previous recommended work as well as what work has been completed.
- Inventory all new stormwater infrastructure as well as note any infrastructure with known issues.
- Assess the capacity and condition of the minor and major stormwater systems with consideration of current and future projected flows.
- Present prioritized upgrade options as well as budgetary cost estimates.
- Identify and provide recommendations for upgrades that will reflect current, innovative and practical ideas.
- Prepare a report summarizing the following:
  - Findings, conclusions and recommendations
  - Description of proposed upgrades
  - Preliminary cost estimates for each option

2.0 EXISTING AND FUTURE DEVELOPMENT

2.1 Existing Development

The Town of Westlock is approximately 1,371 hectares in total size (according to Municipal Affairs); of this, approximately 597 hectares are developed, or about 44%. This means there is a total of 774 hectares left to be developed. Based on the topography, it is believed that most of this land is developable and therefore must be considered when looking at stormwater infrastructure.

Currently, commercial development in the Town is centred around the two highway corridors as well as in the downtown area. There is some industrial development that is focused on the west side of the Town. Several post-disaster structures, such as the schools, are located in the northeast, while the hospital and long-term care facility are located on the south side of the Town along Highway 44. The residential development is typically within the northeast side of Town, with some subdivisions growing in the southwest side of Town. Also in the southwest portion of Town, there is a large recreational area consisting of a recreation centre, rodeo grounds and agricultural museum.

2.2 Future Development

Future development of the Town is a very important aspect of stormwater management. As currently pervious areas are made impervious through building roads and houses, a well-established stormwater plan can result in less grief when these areas are developed.

There are currently plans for four new developments. The Skyrider (partially completed) and Greenfield Estates developments are planned residential subdivisions in the southwest portion of Town. The Aspendale development is a planned residential subdivision in the northeast portion of Town. The Westgate development is a planned commercial subdivision on the south side of Town.

2.3 Growth Projection

A typical projection for future development is between 1 and 2%; however, the Town has seen growth rates in excess of 5% in recent history. According to Statistics Canada, the growth rate between the last three census periods (2001–2006, 2006–2011 and 2011–2016) have been 3.9%, -3.7% and 5.8%, respectively. Therefore, an expected growth rate of 3% is reasonable. This will result in the projected populations shown in ***Table 2.1***.

Table 2.1: Population Projections

	Federal Census	Current Population	Population Projections				Design Population
Year	**2016**	**2017**	**2020**	**2040**	**2050**	**2060**	**2070**
Town of Westlock	5,101	5,147	5,624	10,158	13,652	18,347	24,656

By comparing population to developed land, 5,147 persons with 597 hectares developed, a rough population density of 8.6 persons per hectare can be determined. Based on the Town's current land, the maximum population, while maintaining this density, is 11,791 persons. This population will occur around 2045, rather than 2070 as expressed in the previous report. This is a result of the increased growth rate seen in recent years since publication of the previous report. If the Town continues to experience this high of a growth rate, the future ponds should be reviewed as the Town annexes new land.

2.4 Future Stormwater Requirements

The previous Master Plan Update provides stormwater pond requirements for currently undeveloped land owned by the Town. For the most part, these lands are still undeveloped and will require ponds when the land is developed. Several areas where ponds will be required in the near future are discussed in detail in later sections.

3.0 EXISTING STORMWATER SYSTEM

3.1 Existing Drainage

The existing drainage in the Town is split into two, roughly in line with Highway 44. The east half of the Town drains north and northeast. The west half of the Town drains north and northwest, toward Wabash Creek.

Overland flow from the south is intercepted by the ditch on the south side of Highway 18 and is conveyed to the West Ditch. The West Ditch begins near Highway 18 and 96 Avenue and travels north and west toward Wabash Creek.

3.2 Existing Stormwater Infrastructure

The existing stormwater management system consists of a combination of open ditches, storm sewers and stormwater management ponds. Water generally flows toward the north with the flows split by 104 Avenue (Highway 44). The drainage west of 104 Avenue flows to the northwest and into a stormwater management pond located in NW 5-60-26-4. From this pond, the water flows to the northwest and enters Wabash Creek through a series of surface drainage ditches.

Areas south of 100 Street (Highway 18) drainage flows to the northwest through storm sewer and drainage ditches and crosses the railroad tracks at 108 Street and moves north along 96 Avenue through surface drainage channels and drains into Wabash Creek.

Areas east of 100 Avenue drain to the north and northeast. Between 104 Avenue and 108 Avenue, the drainage moves to the north through the storm sewer system and empties into the highway ditches on 104 Avenue. The areas east of 108 Avenue drain through the storm sewer system and surface drainage ditches to the northeast. The areas south of 100 Street and east of 104 Avenue drain to the north and west.

Figures 2 and ***3*** showing the existing stormwater management system can be found in ***Appendix A***.

4.0 PREVIOUS MASTER PLANS

4.1 Previous Recommendations

The *Stormwater Master Plan – 2009 Update*, completed by ISL in November 2009, lists several of the recommendations previously made in the SMP completed by ISL in November 2004 that are summarized below:

1. Maintenance items including removal of vegetation in select ditches and flushing of select sewers. These items are intended to increase capacity of these facilities.
2. Upgrade the existing northeast pond to a stormwater management pond including an outlet control structure and license according to Alberta Environment requirements, to reduce flow into the Highway 44 ditch system. The existing pond is an old borrow pit from road or subdivision construction.
3. Two upgrades near Westlock Ford that include the following:
   a. Replacing the two 450 mm culverts with two 600 mm culverts to accommodate 1:5 year flows
   b. Re-grading the east ditch to prevent flooding onto private property
4. Construction of stormwater management ponds G and H. These are intended to provide a buffer between the Town and incoming overland flows from the south including relief for the 99 Street sewer.
5. Construction of a ditch around the Southview neighbourhood to reduce inflow into the neighbourhood.
6. Upgrades to the existing West Ditch (96 Avenue) including twinning of the 1200 mm culverts under approaches, widening the ditch bottom and building up its banks.
7. Upgrades to the existing West Ditch including twinning the 600 mm culvert under 96 Avenue near 113A Street as well as replacing the adjacent 600 mm outfall to ensure capacity is maintained.
8. Requirements for future developments to provide stormwater management ponds capable of retaining the 1:100 year storm event while maintaining pre-development flows.

4.2 Implemented Recommendations

Further to the 2009 Update and discussions with the Town, it is understood that the following recommendations have been implemented:

1. Vegetation has been removed from some ditches but still remains an issue for most, especially the West Ditch and the ditch along 96 Avenue south of Highway 18.
2. The ditch east of Westlock Ford has been deepened with the banks built up.
3. Some berms were constructed to deflect runoff into the Southview area.

5.0 DESIGN CRITERIA

5.1 Stormwater Model

MPE completed a review of the existing stormwater model and updated it based on recent development. The XP-SWMM software is a versatile model capable of running dynamic, unsteady flow simulations that deliver very accurate results. The model includes alternatives for the minor system, or the 1:5 year event, and the major system, or the 1:100 year event.

The 2004 Stormwater Master Plan and 2009 Stormwater Master Plan Update use a predevelopment flow rate of 4 L/s/ha to determine the volume of runoff storage required. The rate appears to be reasonable.

The design input was discussed in the previous reports and has been collected from various sources. The input data and parameters were reviewed by MPE and no issues were noted.

5.2 Design Rainfall Events

The minor system is comprised of curbs and gutters, catch basins and piped systems. Minor systems are designed to accommodate the 1:5 year storm event. This storm event was modeled with a 1:5 year, 4-hour Chicago Distribution. The Chicago Method is a simple rainfall distribution method based on a fixed storm intensity and duration for a given frequency.

The major system is comprised of all other conveyance mechanisms including roads, ditches, sports fields and storm ponds. Major systems are designed to accommodate the 1:100 year storm event. This storm event was modeled with a 1:100, 24-hour Huff Distribution. The Huff Method is more flexible than Chicago in that duration is not restricted as it is based on statistical distribution of the peak of a storm event.

Alberta Environment Stormwater Management Guidelines indicate “the minor system should be designed to carry the peak flow resulting from a one in 5-year rainfall event.” It also goes on to say that smaller communities may consider a one in 2-year event if there are substantial financial hurdles that make the implementation of a one in 5-year system not feasible.

Based on the previous reports, MPE selected the one in 5-year Chicago Distribution for the minor system and the one in 100-year Huff Distribution for the major system. These considerations will, however, be discussed further in later sections.

5.3 Results from Stormwater Models

1:5 Year Storm Event:

For the 1:5 year storm event, the model indicates the current system generally performs well. There are some portions of the piped storm system estimated to be in a surcharge condition. In a surcharge condition, the pipe ceases to act as a gravity sewer pipe and behaves like a pressure pipe. This reduces the flow capacity of the pipe. The flow backs up into the manholes but does not create an issue until the water surcharges manholes or adjacent catch basins.

There is a critical section of storm sewer where the flows from the south cross the railroad tracks and enter the surface drainage channels in the industrial park. Upgrades to the crossing have been identified as Priority 2 – 108 Street Outlet Replacement.

For the 1:5 year storm event, several of the conduits are near or at capacity. These conduits will restrict the development of areas to the south and should be upsized or twinned to add additional capacity. The following are other areas where the 1:5 year storm event is expected to cause flooding issues:

1. 96 Avenue – The drainage ditch and culverts are undersized.
2. 113A Street – The drainage channel along the north side of the road allowance is undersized.

The remainder of the storm sewer system where the flows exceed capacity are in the upper ends of the system and consist of smaller-diameter mains. Upgrading these portions of the system should be considered only if flooding becomes an ongoing issue.

Figure 5.1 presents the **1:5 Year Storm Event – Conduits in Surcharge** and is presented on the following page.

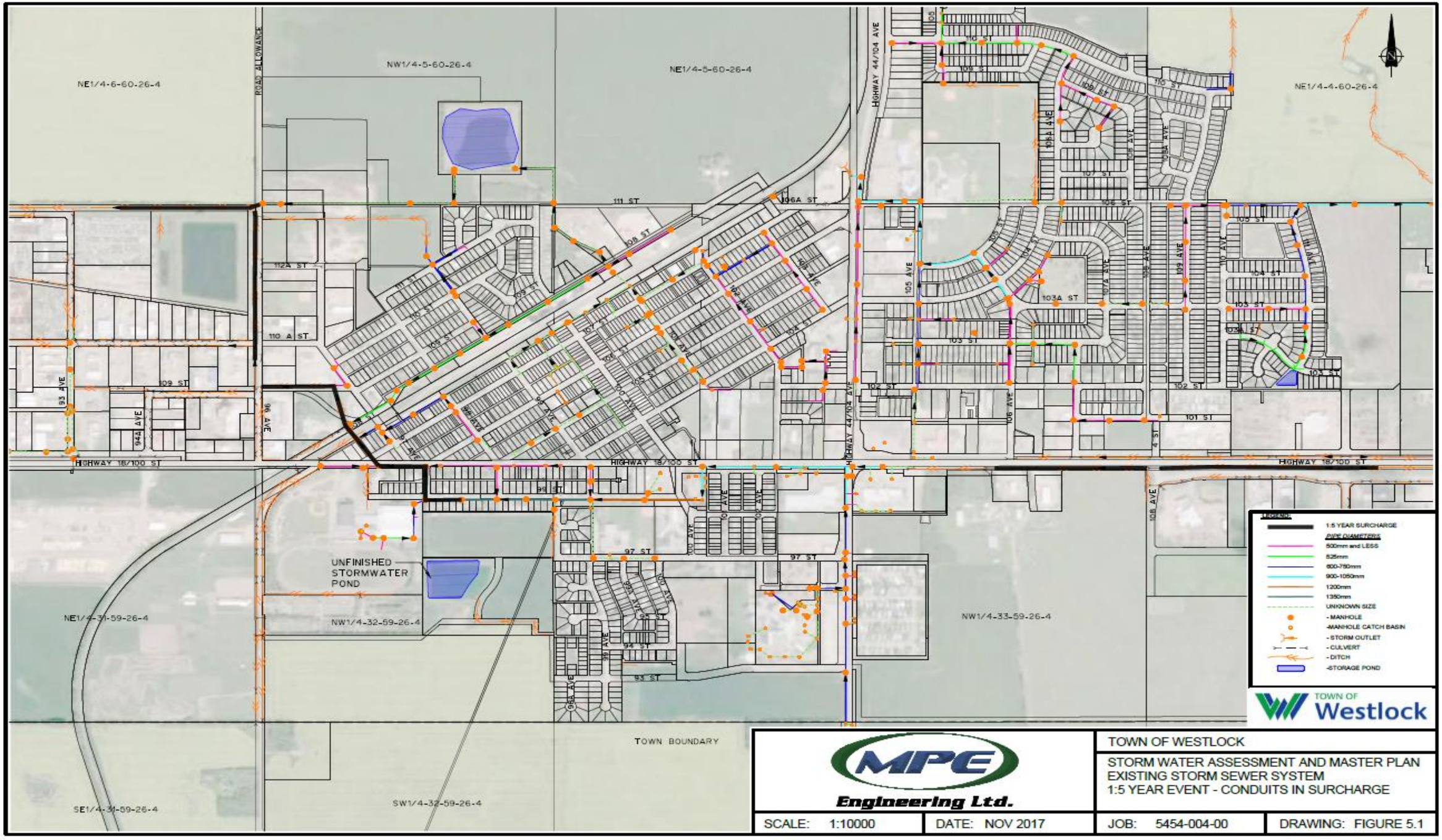
1:100 Year Storm Event:

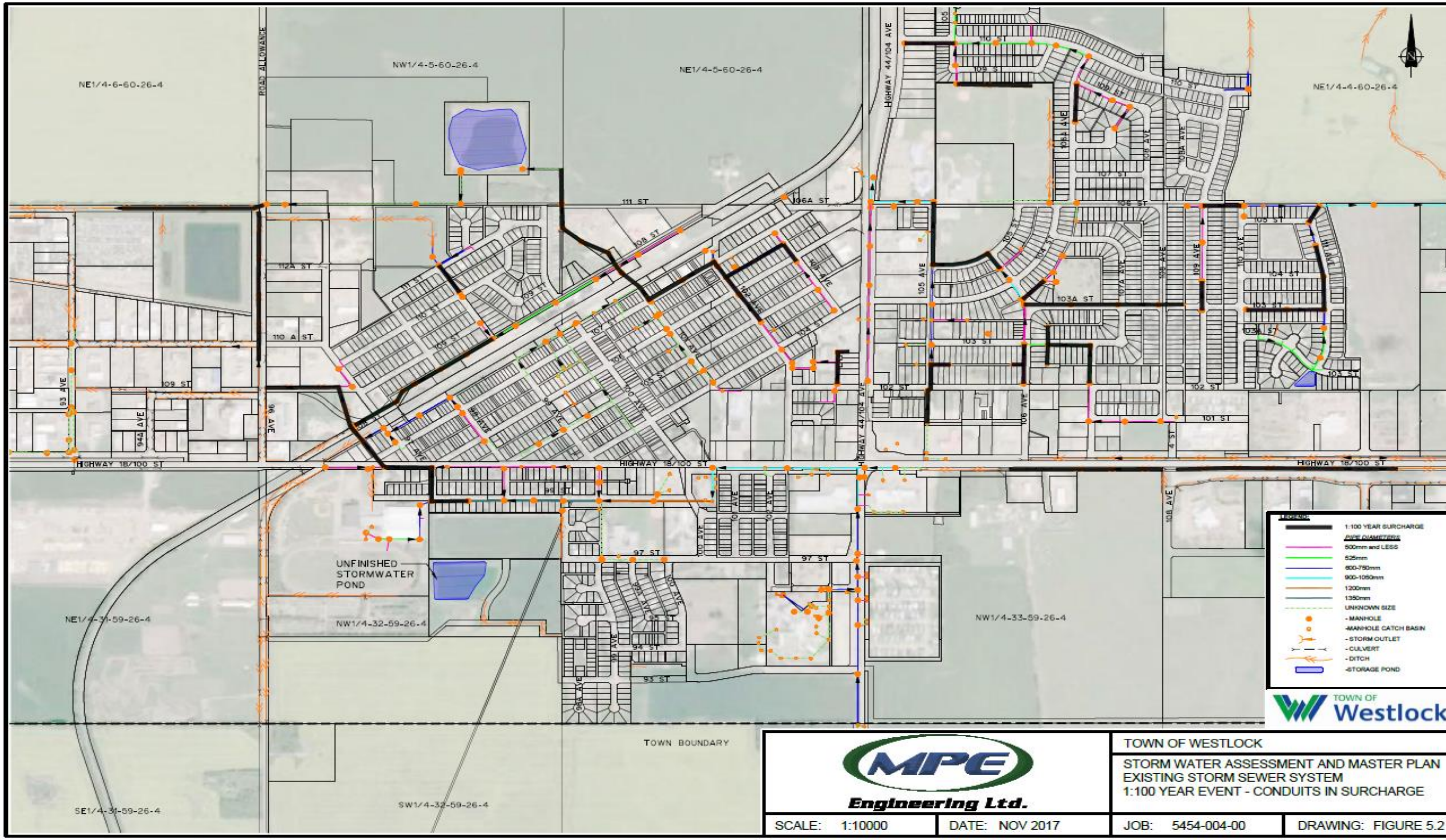
For the 1:100 year storm event, the system also behaves reasonably well. The same components that affect the performance of the system for the 1:5 year storm event also have a limiting effect of the system's performance for the 1:100 year storm event.

The higher flows generated by the 1:100 year storm event exacerbate the flooding and overland flows through public and private properties. These overland flows can be reduced by making improvements to the portions of the system recommended for upgrading for the 1:5 year storm event.

It is not feasibly possible to eliminate all flooding due to the 1:100 year storm event, as the minor storm sewer piping systems are designed within Alberta Environment's requirements to handle the 1:5 year event.

Figure 5.2 presents the **1:100 Year Storm Event – Conduits in Surcharge** and is presented following ***Figure 5.1***.


NE1/4-6-60-26-4
NW1/4-5-60-26-4
NE1/4-5-60-26-4
NE1/4-4-60-26-4
ROAD ALLOWANCE
HIGHWAY 44/104 AVE
HIGHWAY 18/100 ST
111 ST
106A ST
108 ST
112A ST
110 ST
110 A ST
109 ST
107 ST
106 ST
105 ST
104 ST
103A ST
103 ST
102 ST
101 ST
100 ST
99 ST
98 ST
97 ST
96 ST
95 ST
94 ST
93 ST
93 AVE
94A AVE
96 AVE
97 AVE
98 AVE
99 AVE
100 AVE
101 AVE
102 AVE
103 AVE
104 AVE
105 AVE
106 AVE
106A AVE
107 AVE
108 AVE
108A AVE
109 AVE
4 ST
UNFINISHED STORMWATER POND
NE1/4-31-59-26-4
NW1/4-32-59-26-4
NW1/4-33-59-26-4
TOWN BOUNDARY
SE1/4-31-59-26-4
SW1/4-32-59-26-4
1:5 YEAR SURCHARGE
PIPE DIAMETERS
500mm and LESS
525mm
600-750mm
900-1050mm
1200mm
1350mm
UNKNOWN SIZE
- MANHOLE
-MANHOLE CATCH BASIN
- STORM OUTLET
- CULVERT
- DITCH
-STORAGE POND
TOWN OF Westlock
MPE Engineering Ltd.
TOWN OF WESTLOCK
STORM WATER ASSESSMENT AND MASTER PLAN
EXISTING STORM SEWER SYSTEM
1:5 YEAR EVENT - CONDUITS IN SURCHARGE
SCALE: 1:10000
DATE: NOV 2017
JOB: 5454-004-00
DRAWING: FIGURE 5.1


TOWN OF WESTLOCK
STORM WATER ASSESSMENT AND MASTER PLAN
EXISTING STORM SEWER SYSTEM
1:100 YEAR EVENT - CONDUITS IN SURCHARGE
MPE Engineering Ltd.
SCALE: 1:10000
DATE: NOV 2017
JOB: 5454-004-00
DRAWING: FIGURE 5.2
1:100 YEAR SURCHARGE
PIPE DIAMETERS
500mm and LESS
525mm
600-750mm
900-1050mm
1200mm
1350mm
UNKNOWN SIZE
- MANHOLE
-MANHOLE CATCH BASIN
- STORM OUTLET
- CULVERT
- DITCH
-STORAGE POND
UNFINISHED STORMWATER POND
TOWN BOUNDARY
HIGHWAY 18/100 ST
HIGHWAY 44/104 AVE
ROAD ALLOWANCE
NE1/4-6-60-26-4
NW1/4-5-60-26-4
NE1/4-5-60-26-4
NE1/4-4-60-26-4
NE1/4-31-59-26-4
NW1/4-32-59-26-4
NW1/4-33-59-26-4
SE1/4-31-59-26-4
SW1/4-32-59-26-4
TOWN OF Westlock

6.0 RECOMMENDED WORK

6.1 Results from Stormwater Models

On the basis of the previous reports, the results of the model and discussions with the Town, MPE has identified the following eight stormwater projects that should be given priority:

1. <u>Priority 1 – West Ditch Upgrades</u>

A primary drainage feature in the Town is the West Ditch that runs north along 96 Avenue and west along the 113A Street road allowance and follows a northwest direction within NW 6-60-26-4 out of the Town limits for 4.5 km to Wabash Creek. The West Ditch not only collects the runoff from most of the Town but also from the upstream rural catchments south and northwest of the Town. As a part of the Town's major storm system, this West Ditch system should have a capacity of a 1:100 year flood in accordance with the standards set by Alberta Environment and Parks and the Town. However, the West Ditch is currently undersized to meet both the 1:100 year and 1:10 year flood capacities. In addition, the ditch has accumulated silt, debris and vegetation growth over the years resulting in frequent standing water. The Town has also identified the 600 mm culvert crossing 96 Avenue at 110A Street as being undersized, as stormwater overtops the roadway during substantial rainfall events. The 108 Street crossing is also of concern as the outlet is damaged and is inundated by siltation (see Priority 2).

The Town has indicated there are concerns with the ditch on the north side of the 113A Street road allowance flooding during storm events. This flooding has begun to impact local businesses in the area. As part of the West Ditch Upgrades, MPE is proposing to widen and deepen the existing channel along 113A Street, west of 96 Avenue and north to the proposed stormwater pond. The proposed channel will have a 3-metre bottom with 3 to 1 side slopes. The channel will be deep enough to accommodate the 1:100 year storm event and this will prevent overland spillage into adjacent commercial properties and rural farmland.

A second 600 mm culvert will be added at the 96 Avenue crossing at 110A Street to provide additional capacity, preventing standing water and backup into the Town's minor system. The ditch along 96 Avenue will also be upsized complete with raised banks, twinned 1200 mm culverts at all approach crossings, and a new crossing under 109 Street. The outlet of the existing 108 Street crossing will have to be replaced and a second crossing added to provide satisfactory capacity.

In addition to these upgrades to the existing stormwater infrastructure, a new stormwater pond shall be constructed within a portion of SW 7-60-26 W4M. This pond will be essential to providing storage for the 1:100 year storm event as well as providing adequate treatment prior to discharge into Wabash Creek. The release rate for the proposed pond would be based on the 4 L/s/ha release rate established in the Town's Development Standards. Refer to Sketch SK1.1 in the pre-design report for the location and scope of the proposed project.

A pre-design report for this priority is included in ***Appendix B***.

2. Priority 2 – 108 Street Outlet Replacement

Located beside the 108 Street crossing discussed previously is an outlet from the minor system that runs parallel to 108 Street. This outlet is damaged and has inundated the beginning of the West Ditch with sediment buildup that has nearly blocked off the 108 Street crossing.

MPE is proposing to install a new outlet structure complete with a Stormceptor manhole and impact baffle. A Stormceptor is a proprietary product that uses centrifugal force to collect sediment, oils and pollutants from the stormwater. This results in less sediment in the storm system to cause damage and reduce capacity. An impact baffle is a precast concrete structure that acts as an energy dissipator and slows the stormwater prior to entering the West Ditch resulting in reduced erosion, sediment buildup and increased capacity. Once installed, the ditch will be regraded and seeded, and recycled concrete rip-rap will be utilized for additional erosion control.

3. Priority 3 – Future Development in Westgate and Greenfield Estates

The existing minor system along 97 Avenue and 99 Street south of Highway 18 is comprised of three sections of 1350 mm pipe that are surcharging in the stormwater model during the 1:5 year storm event. While this does not necessarily mean they are flooding, it is an indication they are at capacity and any further development may result in flooding. Existing drainage patterns indicate that most of the stormwater in this area is overland drainage from the undeveloped land to the south. It is, however, understood there are two developments planned to the south of this area. The Greenfield Estates subdivision requires the construction of Pond H as identified in the previous *Stormwater Master Plan – 2009 Update*, prepared by ISL Engineering, to accommodate the runoff from the remainder of the catchment area. The existing unfinished pond within the Greenfield Estates subdivision will require upgrading to meet current regulations. The Westgate subdivision to the south and east, adjacent to Highway 44, includes a large interceptor ditch that would capture any overland flow from the south and convey it to the Greenfield Estates pond.

MPE is proposing to upsize the existing three sections of the minor system to 1650 mm pipe to provide capacity for the future discharge of the Greenfield Estates pond. It is also expected that the Greenfield Estates pond and the Westgate ditch will have to be constructed in the near future.

4. Priority 4 – Stormwater System Preventative Maintenance

The existing minor system within the Town, comprised of curb and gutters, catch basins, manholes and the piped system, is intended to effectively and safely convey the 1:2 to 1:5 year storm events. As with any infrastructure, preventative maintenance is key in ensuring it is operating at peak performance and does not unnecessarily degrade prematurely, resulting in high replacement costs and even higher emergency repair costs.

MPE is proposing to work with the Town to develop a Stormwater System Preventative Maintenance Plan. These generally include annual maintenance tasks such as street-sweeping to remove grit from roadways before it enters the system, hydro-vaccing catch basin sumps to remove sediment buildup, adding storm manholes at strategic locations to allow for effective access, and high-pressure flushing of the stormwater pipes to remove deposits within the pipes. These tasks are usually implemented in a cyclic manner to

allow for every part of the system to be maintained within a certain period, such as four years, meaning that approximately one quarter of the system would have to be maintained every year.

5. Priority 5 – Pond G

Pond G is identified in the previous *Stormwater Master Plan – 2009 Update* by ISL Engineering. This pond is located east of Highway 44 and south of Highway 18 and will support a massive catchment area of approximately 110 hectares. As there is currently no stormwater infrastructure in this area, Pond G will provide much-needed storage to collect overland drainage and will result in significantly reduced discharge into the ditch on the south side of Highway 18. It is important to note that this ditch ultimately conveys stormwater to the West Ditch, so Pond G will alleviate some of the stress already placed on the West Ditch.

MPE is proposing to construct Pond G with a total storage volume of 43,400 m^3 and controlled outlet flow rate of 0.44 m^3/s, as per the previous master plan update. The pond would be located to the east of the Westlock Inn.

6. Priority 6 – Overland Drainage in Southview

The neighbourhood of Southview, located south of Highway 18, has been noted as being frequently subjected to overland flooding. This is primarily due to there being a limited piped minor system in Southview, so there are primarily overland drainage mechanisms to convey stormwater. While not uncommon, this drainage technique is not desirable and usually gains public attention very quickly. Ways to alleviate these issues include expanding the piped system where feasible, remediating curbs where grade deficiencies exist by grinding or mud-jacking, upgrading curb and gutters to a larger size allowing for more storage, installing swales to convey flows more effectively, and natural means such as bioswales, grassy swales underlain with sand or washed rock and a perforated pipe.

MPE is proposing a survey of Southview be completed to determine any grade deficiencies and the feasibility of swales. It is important to note, however, that the primary inflow of stormwater into Southview is through overland flow from the undeveloped land to the south. As a result, once the Westgate ditch is implemented, it could be reasonably assumed that these issues may cease naturally due to decreased inflow into the neighbourhood. The approximate cost of the proposed study is $18,500.00.

7. Priority 7 – General Surcharging During 1:5 Year Storm Events

An important finding of the stormwater modeling was that various portions of the piped system are surcharging during the 1:5 year storm event. While this does not necessarily mean they are flooding, it is an indication they are at capacity, and any further development or inflow may result in flooding. Generally speaking, these pipes are at the most upstream end of these piped systems meaning they are the smallest diameter and are relatively easy to upsize.

MPE is proposing the Town approach these upgrades on a case-by-case basis as issues arise or as budget permits. These small upgrades could be implemented with the annual preventative maintenance plan as scheduled upgrades.

Preliminary Cost Estimates for the priorities can be found in ***Appendix C***.

6.2 Future Stormwater Management Ponds

The previous stormwater master plan update, prepared by ISL Engineering in 2009, presented a plan for future stormwater management ponds. These future ponds were distributed geographically at one pond per quarter section and at other areas where drainage constraints exist. Upon review, MPE generally agrees with the size and spacing of these proposed ponds. The Town should ensure these ponds are included under any development agreements as the Town is developed.

Figure 5 showing the future stormwater management ponds can be found in ***Appendix A***.

7.0 COST ESTIMATES

MPE has analyzed each of the priorities listed in the previous section.

1. Priority 1 – West Ditch Upgrades

   The estimated capital cost for these upgrades is $2,957,564; however; it could be staged by completing the upgrades to the existing system with an estimated cost of $1,575,514 and then completing the construction of the new stormwater pond at a later date for approximately $1,382,050.

2. Priority 2 – 108 Street Outlet Replacement

   The estimated cost for this upgrade is $301,500; however, these costs could be reduced if the Town would prefer a traditional flared concrete outlet with recycled concrete rip-rap rather than the impact baffle. The cost of the impact baffle is in the order of $100,000.

3. Priority 3 – Future Development in Westgate and Greenfield Estates

   The estimated cost for the upsized minor system is $757,770. The estimated cost for the Greenfield Estates pond and Westgate ditch is approximately $2,261,900. It is important to note that the upgrades would be subject to cost-sharing with the respective developers.

4. Priority 4 – Stormwater System Preventative Maintenance

   The estimated cost for these works is primarily budget driven and could be as low as $25,000 to $100,000 per year depending on the Town's desired level of service and the overall cleanliness of the system. It is expected that the first cycle would cost substantially more than normal as it would require more effort to bring the system back to a "like-new" state.

5. Priority 5 – Pond G

   The estimated cost for Pond G is $1,334,256. It is important to note that a portion of the cost could be recovered in the form of an off-site levy from future developers in the area.

6. Priority 6 – Overland Drainage in Southview

   A detailed drainage study would be required to identify specific issues and constraints of the drainage within Southview. MPE estimates the cost of this study would be approximately $18,500.

7. Priority 7 – General Surcharging During 1:5 Year Storm Events

   MPE is proposing the Town approach these upgrades on a case-by-case basis as issues arise or as budget permits. These small upgrades could be implemented with the annual preventative maintenance plan as scheduled upgrades.

The capital costs for each priority are summarized in ***Table 6.1***. The estimated cost includes 20% contingency allowance and 15% for engineering and testing. GST is not included. The estimate is based on previously completed projects of similar scope.

Table 6.1: Capital Cost Estimates

Description	Capital Cost
Priority 1 – West Ditch Upgrades	$2,957,564
Priority 2 – 108 Street Outlet Replacement	$301,500
Priority 3 – Future Development in Westgate and Greenfield Estates	$2,261,900
Priority 4 – Stormwater System Preventative Maintenance	n/a
Priority 5 – Pond G	$1,334,256
Priority 6 – Overland Drainage in Southview	n/a
Priority 7 – General Surcharging During 1:5 Year Storm Events	n/a

MPE has also updated the estimated costs for each of the future stormwater management ponds outlined in the previous master plan update. Ponds G and H have been estimated above in Priorities 5 and 3, respectively. Compared to these detailed cost estimates, it was determined that the costs have increased approximately 17%, or 2% growth per year. This results in the new estimated costs shown in ***Table 6.2***. It is assumed that these costs will be borne by the Developers, or if the initial costs are borne by the Town, they will be recovered as the areas develop.

Table 6.2: Future Stormwater Pond Cost Estimates

Description	Capital Cost
Pond A	$1,210,000
Pond B	$970,000
Pond C	$970,000
Pond D	$820,000
Pond E	$495,000
Pond F	$1,110,000
Pond I	$550,000
Pond J	$340,000
Pond K	$1,290,000
Pond L	$970,000
Pond M	$1,110,000
Pond N	$1,195,000
Pond O	$1,450,000

The approximate locations of the proposed ponds can be found in ***Figure 5*** in ***Appendix A***.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The following are the major conclusions of this assessment:

1. Three previous documents were reviewed and analyzed:
   a. *Town of Westlock Stormwater Master Plan*, November 2004 – ISL Engineering Ltd.
   b. *Stormwater Master Plan – 2009 Update*, November 2009 – ISL Engineering Ltd.
   c. *Stormwater Assessment and Master Plan Review*, September 2017 – MPE Engineering Ltd.
2. The Town's Procedures and Design Standards for Development, dated October 2009, was thoroughly reviewed.
3. The Town's Stormwater Model was reviewed and confirmed. The model was updated based on upgrades to the system.
4. MPE determined areas where the existing system is currently under capacity, as well as where it may be under capacity in the future.
5. These areas were separated into manageable projects and were prioritized based on Town input, public safety and safety of the infrastructure.
6. The upgrades to the existing stormwater system include the following:
   a. Priority 1 – West Ditch Upgrades
   b. Priority 2 – 108 Street Outlet Replacement
   c. Priority 3 – Future Development in Westgate and Greenfield Estates
   d. Priority 4 – Stormwater System Preventative Maintenance
   e. Priority 5 – Pond G
   f. Priority 6 – Overland Drainage in Southview
   g. Priority 7 – General Surcharging During 1:5 Year Storm Events
7. The need for stormwater management ponds with future development was also reviewed.
8. The predevelopment flow rate of 4 L/s/ha for stormwater runoff appears to be reasonable.
9. Class 'D' cost estimates were developed for each of the priorities as well as all the proposed ponds.

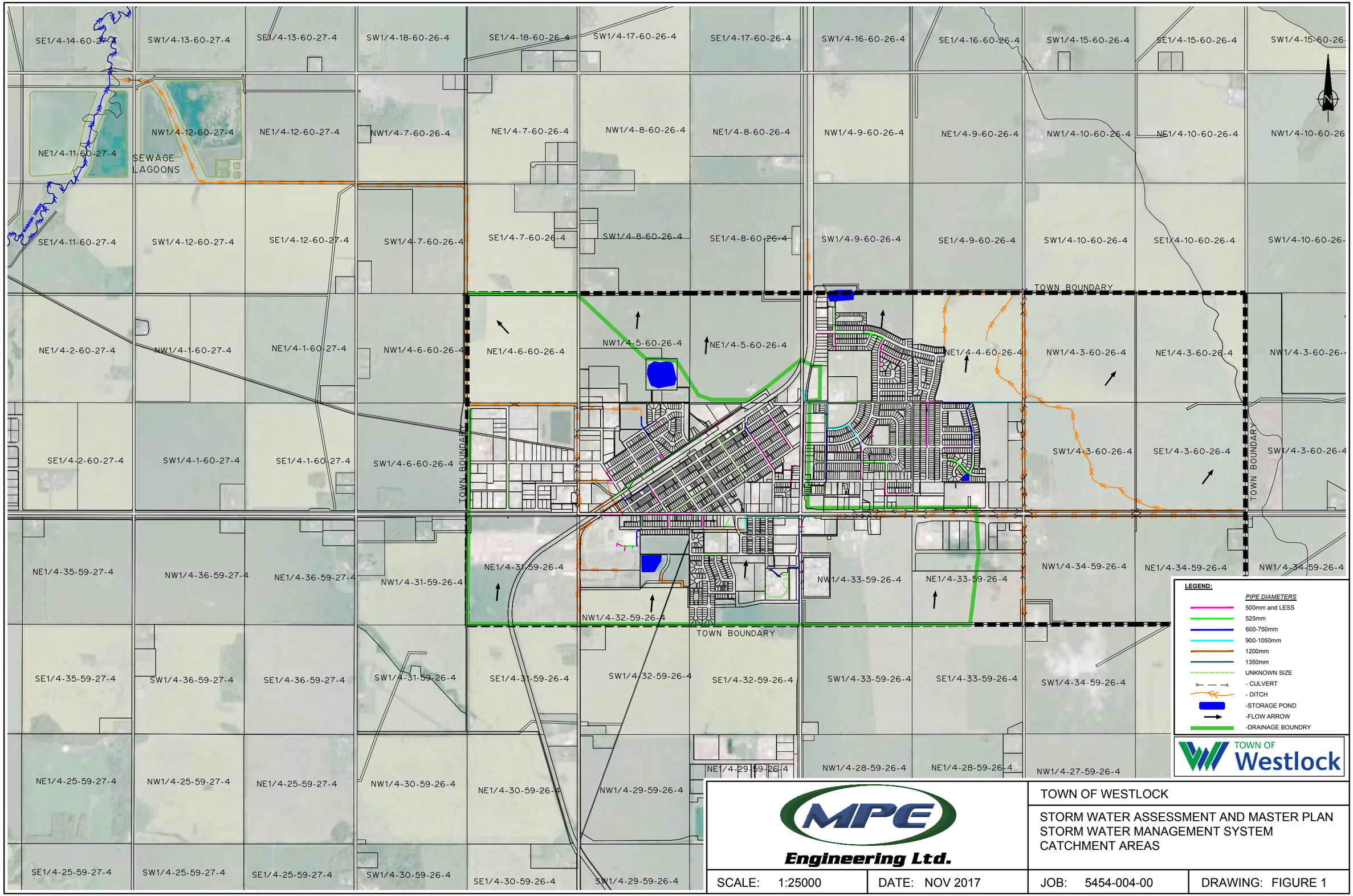
8.2 Recommendations

MPE's recommendation for this assessment is as follows:

MPE recommends the Town of Westlock begin budgeting, and continue pursuing funding for these identified upgrades and projects. They are all very important and several of them have implications regarding public safety if they are ignored. A reasonable timeframe should be determined that allows for realistic budgets to be formed and upgrades be completed over this period. MPE is capable of providing full engineering services for the work described and outlined in this master plan update.

APPENDIX A

Figures



Engineering Ltd.

TOWN OF WESTLOCK

STORM WATER ASSESSMENT AND MASTER PLAN
STORM WATER MANAGEMENT SYSTEM
CATCHMENT AREAS

SCALE: 1:25000	DATE: NOV 2017	JOB: 5454-004-00	DRAWING: FIGURE 1

NW1/4-6-60-26-4

NE1/4-6-60-26-4

NW1/4-5-60-26-4

NE1/4-5-60-26-4

SW1/4-6-60-26-4

TOWN BOUNDARY

ROAD ALLOWANCE

HIGHWAY 44/104 AVE

HIGHWAY 18/100 ST

111 ST

112A ST

110 A ST

109 ST

108 ST

107 ST

106 ST

106A ST

105 ST

104 ST

103A ST

103 ST

102 ST

101 ST

100 ST

99 ST

98 ST

97 ST

96 ST

95 ST

94 ST

93 ST

90 AVE

93 AVE

94A AVE

96 AVE

98 AVE

98A AVE

99 AVE

99A AVE

100 AVE

101 AVE

102 AVE

103 AVE

104 AVE

105 AVE

106 AVE

107A AVE

108 AVE

108A AVE

109 AVE

110 AVE

UNFINISHED STORMWATER POND

NW1/4-31-59-26-4

NE1/4-31-59-26-4

NW1/4-32-59-26-4

NW1/4-33-59-26-4

SW1/4-31-59-26-4

SE1/4-31-59-26-4

SW1/4-32-59-26-4

LEGEND:

PIPE DIAMETERS

- 500mm and LESS
- 525mm
- 600-750mm
- 900-1050mm
- 1200mm
- 1350mm
- UNKNOWN SIZE
- MANHOLE
- MANHOLE CATCH BASIN
- STORM OUTLET
- CULVERT
- DITCH
- STORAGE POND

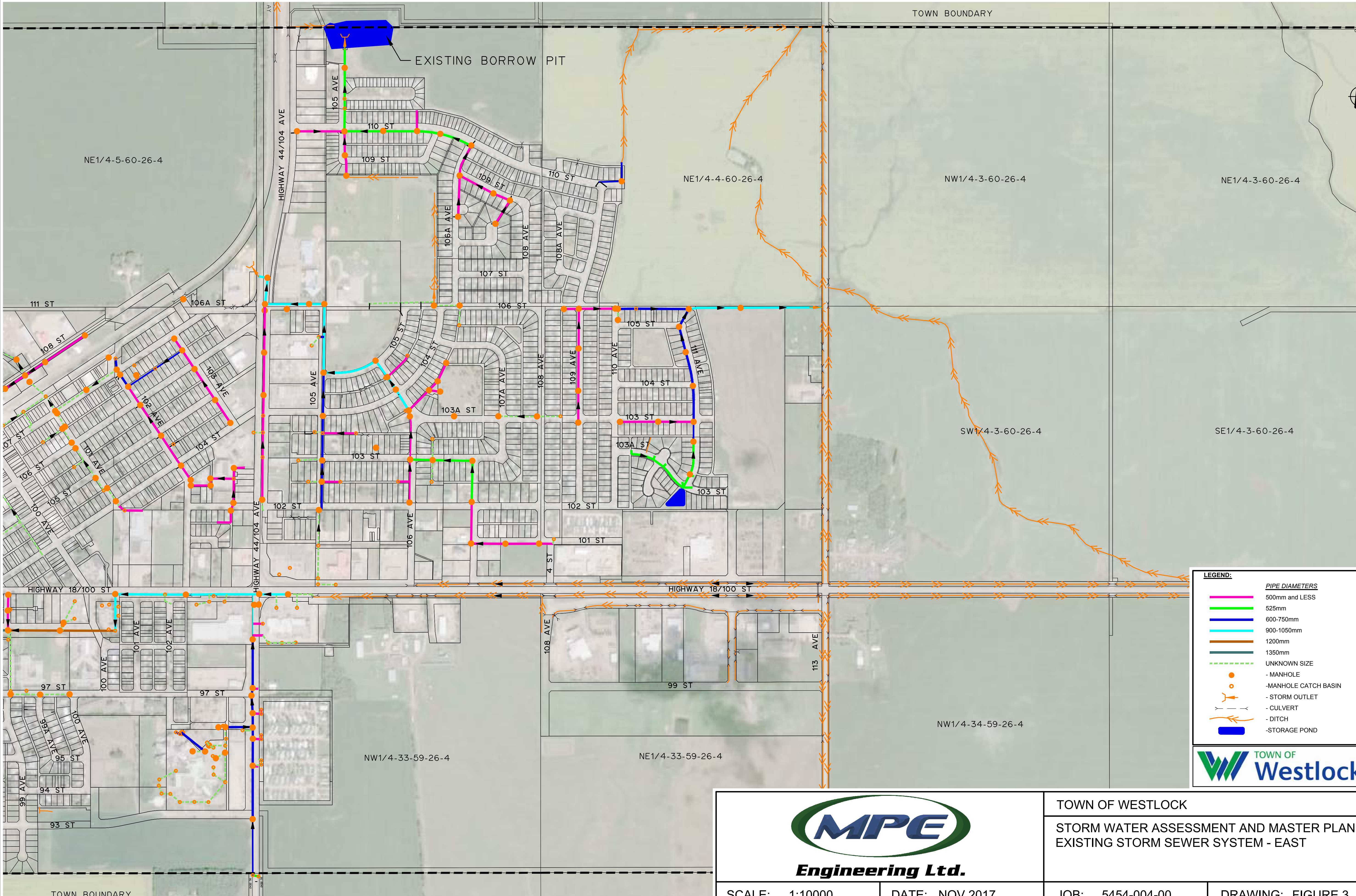
TOWN OF Westlock

MPE Engineering Ltd.

TOWN OF WESTLOCK

STORM WATER ASSESSMENT AND MASTER PLAN
EXISTING STORM SEWER SYSTEM - WEST

SCALE: 1:10000	DATE: NOV 2017	JOB: 5454-004-00	DRAWING: FIGURE 2



TOWN BOUNDARY
EXISTING BORROW PIT
NE1/4-5-60-26-4
NE1/4-4-60-26-4
NW1/4-3-60-26-4
NE1/4-3-60-26-4
SW1/4-3-60-26-4
SE1/4-3-60-26-4
NW1/4-34-59-26-4
NW1/4-33-59-26-4
NE1/4-33-59-26-4
HIGHWAY 44/104 AVE
HIGHWAY 18/100 ST
105 AVE
110 ST
109 ST
110 ST
109 ST
106A AVE
108 AVE
108A AVE
107 ST
111 ST
106A ST
106 ST
108 ST
105 ST
104 ST
103 AVE
102 AVE
101 AVE
104 ST
107 ST
106 ST
105 ST
100 AVE
105 AVE
103A ST
107A AVE
108 AVE
109 AVE
110 AVE
105 ST
111 AVE
104 ST
103 ST
103A ST
103 ST
103 ST
102 ST
102 ST
106 AVE
101 ST
4 ST
101 AVE
102 AVE
100 AVE
97 ST
97 ST
99A AVE
100 AVE
95 ST
94 ST
99 AVE
93 ST
108 AVE
99 ST
113 AVE
TOWN BOUNDARY
LEGEND:
PIPE DIAMETERS
500mm and LESS
525mm
600-750mm
900-1050mm
1200mm
1350mm
UNKNOWN SIZE
- MANHOLE
-MANHOLE CATCH BASIN
- STORM OUTLET
- CULVERT
- DITCH
-STORAGE POND
TOWN OF Westlock

MPE Engineering Ltd.

TOWN OF WESTLOCK

STORM WATER ASSESSMENT AND MASTER PLAN
EXISTING STORM SEWER SYSTEM - EAST

SCALE: 1:10000	DATE: NOV 2017	JOB: 5454-004-00	DRAWING: FIGURE 3

TO FUTURE
STORM POND

PRIORITY UPGRADES
1. WEST DITCH UPGRADES.
2. 108 STREET OUTLET REPLACEMENT.
3. PROPOSED GREENFIELD ESTATES AND WESTGATE BUSINESS PARK.
4. STORMWATER SYSTEM PREVENTATIVE MAINTENANCE.
5. STORMWATER POND G.
6. OVERLAND DRAINAGE INTO SOUTHVIEW SUBDIVISION.
7. GENERAL SURCHARGING DURING 1:5 STORM EVENT.

TOWN OF Westlock

Engineering Ltd.

TOWN OF WESTLOCK			
STORM WATER ASSESSMENT AND MASTER PLAN STORM WATER MANAGEMENT SYSTEM CATCHMENT AREAS			
SCALE: 1:10000	DATE: NOV 2017	JOB: 5454-004-00	DRAWING: FIGURE 4

PROPOSED STORMWATER POND
1:100 YEAR STORAGE
VOLUME=65,000m

SE1/4-12-60-27-4 | SW1/4-7-60-26-4 | SE1/4-7-60-26-4 | SW1/4-8-60-26-4 | SE1/4-8-60-26-4 | SW1/4-9-60-26-4 | SE1/4-9-60-26-4 | SW1/4-10-60-26-4 | SE1/4-10-60-26-4 | SW1/4-10-60-26-4

NE1/4-1-60-27-4 | NW1/4-6-60-26-4 | NE1/4-6-60-26-4 | NW1/4-5-60-26-4 | NE1/4-5-60-26-4 | NW1/4-4-60-26-4 | NE1/4-4-60-26-4 | NW1/4-3-60-26-4 | NE1/4-3-60-26-4 | NW1/4-3-60-26-4

SE1/4-1-60-27-4 | SW1/4-6-60-26-4 | SW1/4-3-60-26-4 | SE1/4-3-60-26-4 | SW1/4-3-60-26-4

NE1/4-36-59-27-4 | NW1/4-31-59-26-4 | NE1/4-31-59-26-4 | NW1/4-32-59-26-4 | NE1/4-32-59-26-4 | NW1/4-33-59-26-4 | NE1/4-33-59-26-4 | NW1/4-34-59-26-4 | NE1/4-34-59-26-4 | NW1/4-34-59-26-4

SE1/4-36-59-27-4 | SW1/4-31-59-26-4 | SE1/4-31-59-26-4 | SW1/4-32-59-26-4 | SE1/4-32-59-26-4 | SW1/4-33-59-26-4 | SE1/4-33-59-26-4 | SW1/4-34-59-26-4 | SE1/4-34-59-26-4 | SW1/4-34-59-26-4

NE1/4-25-59-27-4 | NW1/4-30-59-26-4 | NE1/4-30-59-26-4 | NW1/4-29-59-26-4 | NE1/4-29-59-26-4 | NW1/4-28-59-26-4 | NE1/4-28-59-26-4 | NW1/4-27-59-26-4

CANADIAN NATIONAL RAILWAY

GRANDVIEW TRAIL

HIGHWAY 18 (100 ST)

SOUTH AVE

LEGEND

- TOWN BOUNDARY
- 450mm DIA AND LESS
- 525mm DIA
- 600mm - 800mm DIA
- 900mm - 1100mm DIA
- 1200mm - 1300mm DIA
- 1400mm - 1500mm DIA
- 1600mm - 1700mm DIA
- DITCH
- PROP STORM POND

MPE Engineering Ltd.

TOWN OF Westlock

TOWN OF WESTLOCK

STORM WATER ASSESSMENT AND MASTER PLAN
STORMWATER
FUTURE STORMWATER SYSTEM

SCALE: 1:15000	DATE: NOV 2017	JOB: 5454-004-00	DRAWING: FIGURE 5

APPENDIX B

Priority 1 Predesign Report

Draft Report for:

TOWN OF WESTLOCK

STORMWATER ASSESSMENT AND MASTER PLAN REVIEW

Stormwater Management Facilities Upgrading
Pre-Design Report

Date: September 19, 2017
Project #: 5454-004-00

Proud of Our Past... Building the Future

www.mpe.ca

#101, 10630-172 Street
Edmonton, AB T5S 1H8
Phone: 780-486-2000
Fax: 780-486-9090

Engineering Ltd.

Town of Westlock
10003–106 Street
Westlock, Alberta
T7P 2K3

September 19, 2017
File: N:\5454\004\00\R01

Attention: Dean Krause, CLGM
Chief Administrative Officer

Dear Mr. Krause:

Re: Stormwater Assessment and Master Plan Review
ACRP Grant Application Pre-Design Report

We are pleased to submit the pre-design report for the Town of Westlock Stormwater Management Facilities Upgrading. The final version of the report will be modified and finalized to incorporate the Town's comments. The predesign report is written to support the Town's funding application to Alberta Community Resilience Program.

Thank you for the opportunity to be of service and to have prepare this assessment on your behalf. If you have any inquiries regarding our report or if clarification is required, please contact the undersigned at 780-632-8720 or mdowhun@mpe.ca.

Yours truly,

MPE ENGINEERING LTD.

Mike Dowhun, C.Tech.
Project Manager

MD:ik

Enclosure

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the Town of Westlock. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information. Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

PERMIT TO PRACTICE
MPE ENGINEERING LTD.
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta

Professional Seal

Corporate Permit

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

The Town of Westlock (Town) is upgrading portions of the stormwater management system to alleviate flooding and protect the Town's infrastructure. As part of this process, MPE Engineering Ltd. (MPE) has been commissioned to update the stormwater management plan (SWMP). Preliminary information from this SWMP update and observations reported from Town personnel have indicated that upgrading the outlet ditches and constructing a new stormwater management facility (pond) would greatly alleviate potential infrastructure and property damage.

2.0 EXISTING CONDITIONS

The Town's stormwater management facilities consist of a combination of open drainage channels, piped storm sewers and stormwater ponds. The main drainage feature in the Town is the West Ditch that runs north along 96 Avenue and west on 113A Street and follows a north and westerly direction out of the Town limits for 4.5 km to Wabash Creek. The West Ditch not only collects the runoff from most of the Town, but also from the upstream rural catchments south and northwest of the Town. As the Town's major storm system, this West Ditch system should have a capacity of a 1:100 year flood in accordance with the Town's standards. However, the West Ditch is currently undersized to meet both the 1:100 year and 1:10 year flood capacities. In addition, the ditch has accumulated silt, debris and vegetation growth over the years, resulting in frequent standing water. The following photos show the deficiencies along the main West Ditch channel system.

Ditch along 113A Street full of water due to limited capacity in downstream systems and heavy vegetation growth.

Damaged CNR/108 Street crossing

There are several areas where stormwater ponding and flooding has occurred over the past several years. The most affected areas are the West Industrial Park and the Southview Community where the Town hospital and St. Mary's School are located. In order to alleviate flooding in these areas and safeguard the infrastructure and private property from damage, the Town is proposing to upgrade the capacity of the downstream facilities and provide better management of the stormwater system.

3.0 PROPOSED PROJECT

3.1 Proposed Upgrades

The proposed upgrades will improve the Town's ability to protect public and private property and critical infrastructure due to flooding resulting from severe storm events.

In accordance with the Town's goal to promote sustainable practices where practical, the Town will be using recycled concrete as part of the erosion protection and lining of the proposed channel upgrades, new culvert crossings and areas susceptible to erosion. The construction of the proposed stormwater management pond will improve the water quality being discharged downstream. The new pond will also be designed to include a wetland, which will create additional wildlife habitat in the area.

The proposed project consists of the following components:

1. Upgrade the existing drainage channels located in the NE6-60-26-W4.
2. Upgrade the culvert crossing of 96 Avenue at 113A Street.
3. Upgrade the drainage channel along 96 Avenue. Culverts along 96 Avenue will be twinned.
4. Auger a new culvert crossing at 108 Street to remove a flow restriction.
5. Construct a new stormwater management facility in SW7-60-26-W4. This facility will be designed to accommodate the 1:100 storm event. This facility may be constructed in stages depending on the available budget.

The scope of the project is shown in ***Figure 1, Appendix A***.

Upgrading Existing Drainage Channels in NE6-60-26-W4

The existing drainage channels in NE6-60-26-W4 is undefined and undersized for the 1:10 year flood which is causing localized flooding. Flooding has been seen to spill over into adjacent farmlands during high flow events. It is proposed to widen and deepen the existing channel. The proposed channel will have a 3-metre bottom with 3 to 1 side slopes. The channel will be deep enough to accommodate the 1:10 year storm event, and this will prevent overland spillage into adjacent farms.

Upgrading Culverts Crossing 96 Avenue at 113A Street

The single 600 mm culvert that connects the east ditch is undersized and Town personnel have observed flooding and road overtopping during the high rainfall events. A second 600 mm diameter crossing is proposed to provide additional capacity and prevent flooding. These upgrades will prevent the standing water and backup into the Town's storm system.

96 Avenue Ditch Upgrading

The drainage channel along 96 Avenue is a main channel for moving stormwater from part of Downtown and areas south of Highway 18. Stormwater modeling has identified this channel for upgrading. The upgrading would involve increasing the width and depth of the existing channel. Increasing the depth of the channel shall include raising the banks to prevent runoff from overtopping the banks to the West Industrial Park. In addition, all the existing 1200 mm diameter culvert approach/road crossing along 96 Avenue shall be twined with the same-sized culverts. The upgrading will also include a new road crossing on 96 Avenue north of 109 Street. These upgrades will ensure the West Industrial Park is free from flooding during the high-intensity rain seasons.

108 Street Crossing Upgrading

This location has also been identified by the stormwater modeling and Town personnel as a critical restriction in the system. The existing storm outlet infrastructure is damaged and needs to be replaced. The proposed upgrade involves augering a second culvert across 108 Street west of 97 Avenue and improving the channel.

Construction of a New Stormwater Management Pond in SW7-60-26-W4

The Town has purchased a portion of SW7-60-26-W4 for the construction of a new stormwater management facility (stormwater pond). The proposed facility is required to accommodate the 1:100 year storm event and prevent damage and flooding to infrastructure and private property north of the Town. This improvement will be critical is preventing any further damage to crops and farmlands adjacent to the ditch.

3.2 Cost Estimate

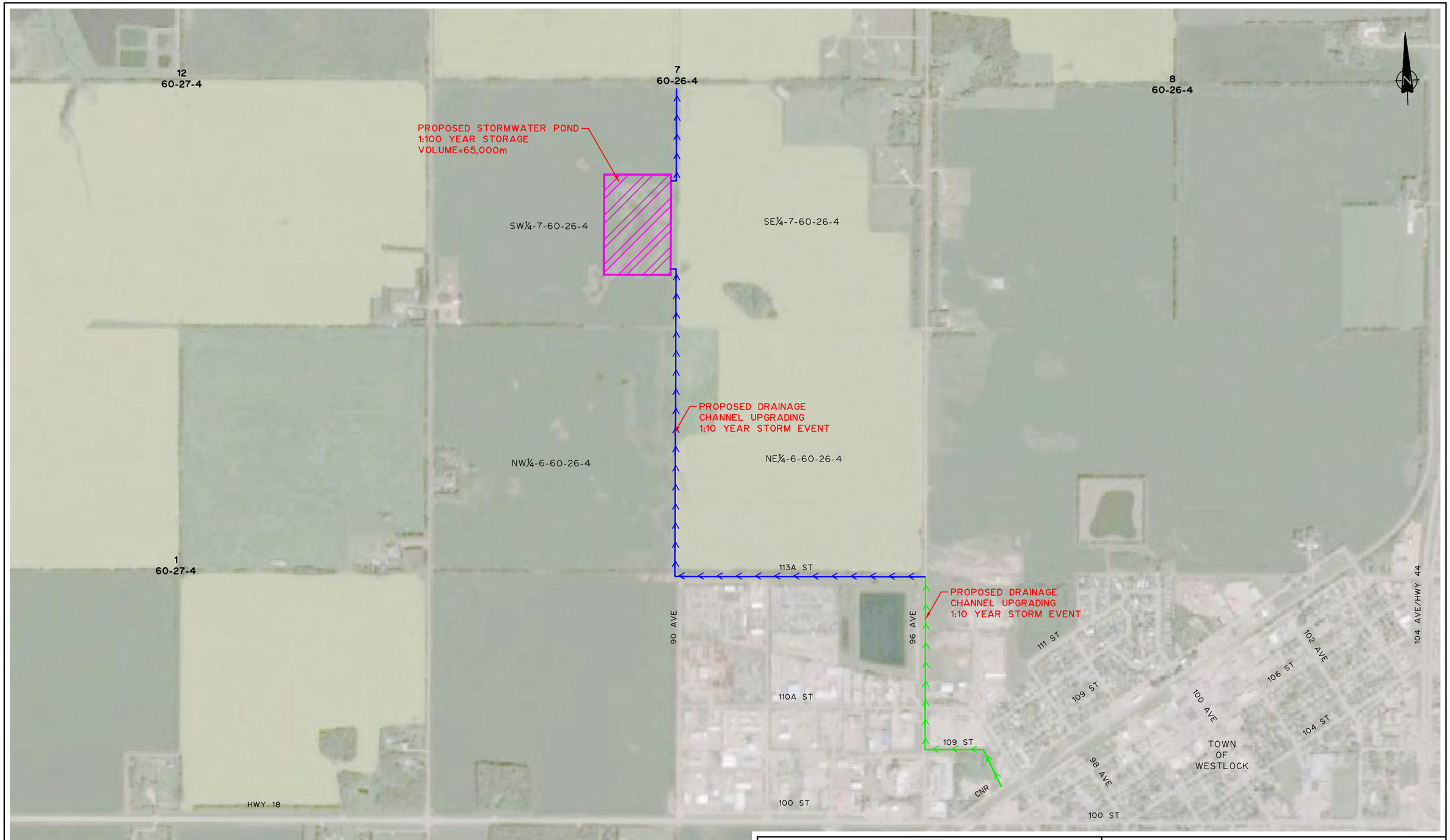
The Capital costs have been prepared and are summarized below. They are inclusive of a contingency of 20% and engineering fees; GST has not been included. Estimates are based on budget prices from previous completed projects of similar scope.

Item	Description	Capital Cost
1	Channel Upgrading in NE6-60-24-W4	$540,660.00
2	Channel Upgrading Along 96 Avenue	$220,510.00
3	Stormwater Management Pond	$1,382,050.00
Contingency and Engineering Fees		$814,423.00
	TOTAL	**$2,957,643.00**

Refer to ***Appendix B*** for complete details of the capital cost estimate.

APPENDIX A

Figure 1: Proposed Project



MPE Engineering Ltd.		TOWN OF WESTLOCK	
		STORM WATER ASSESSMENT AND MASTER PLAN PROPOSED DRAINAGE PLAN	
SCALE: NTS	DATE: SEPT 2017	JOB: 5454-004-00	DRAWING: SK1.1

APPENDIX B

Detailed Cost Estimate

Town of Westlock
Proposed Stormwater Facilities Upgrading

COST ESTIMATE

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	**Channel Upgrading in NE 6-60-26-W4**				
1.1	Topsoil Stripping and Stockpiling	19,700	m^2	1.40	27,580.00
1.2	Channel Excavation	20,000	m^3	10.00	200,000.00
1.3	Topsoil Respreading and Seeding	19,700	m^2	1.40	27,580.00
1.4	Armouring Channel Bottom (Recycled Conrete)	4,800	m^2	50.00	240,000.00
1.5	Erosion Protection	350	m^2	100.00	35,000.00
1.6	Culvert Installation (96 Avenue and 113A Street)	15	m	700.00	10,500.00
	Subtotal				**540,660.00**
2	**Channel Upgrading Along 96 Avenue**				
2.1	Topsoil Stripping and Stockpiling	5,450	m^2	1.40	7,630.00
2.2	Channel Excavation	2,000	m^3	10.00	20,000.00
2.3	Topsoil Respreading and Seeding	5,450	m^2	1.40	7,630.00
2.4	Culvert Installation	75	m	70.00	5,250.00
2.5	Erosion Protection	300	m^2	100.00	30,000.00
2.6	Augered Crossing at 108 Street	60	m	2,500.00	150,000.00
	Subtotal				**220,510.00**
3	**Stormwater Management Pond**				
3.1	Topsoil Stripping and Stockpiling	41,250	m^2	1.40	57,750.00
3.2	Excavation	71,500	m^3	11.00	786,500.00
3.3	Clay Liner Construction	23,000	m^3	11.00	253,000.00
3.4	Inlet Structure	1	L.S.	90,000.00	90,000.00
3.5	Outlet Structure	1	L.S.	90,000.00	90,000.00
3.6	Topsoil Respreading and Seeding	2,000	m^2	1.40	2,800.00
3.7	Drainage Channel Excavation	7,500	m^3	10.00	75,000.00
3.8	Erosion Protection	3,000	m^2	9.00	27,000.00
	Subtotal				**1,382,050.00**

Subtotal	$	2,143,220.00
CONTINGENCY (20%)	$	428,644.00
ENGINEERING (15%)	$	385,779.60
TOTAL	**$**	**2,957,643.60**

APPENDIX C

Preliminary Cost Estimates

TOWN OF WESTLOCK - STORMWATER MASTER PLAN UPDATE - PRIORITY 1
WEST DITCH UPGRADES

COST ESTIMATE - Class 'D'

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	**Channel Upgrading Along 113A Street and NE 6-60-26-W4**				
1.1	Topsoil Stripping and Stockpiling	19,700	m^2	$ 1.40	$ 27,580.00
1.2	Channel Excavation	20,000	m^3	$ 10.00	$ 200,000.00
1.3	Topsoil Respreading and Seeding	19,700	m^2	$ 1.40	$ 27,580.00
1.4	Armouring Channel Bottom (Recycled Concrete)	4,800	m^2	$ 50.00	$ 240,000.00
1.5	Erosion Protection	350	m^2	$ 100.00	$ 35,000.00
1.6	Culvert Installation (96 Avenue and 113A Street)	15	m	$ 700.00	$ 10,500.00
	Subtotal				**$ 540,660.00**
2	**Channel Upgrading Along 96 Avenue**				
2.1	Topsoil Stripping and Stockpiling	5,450	m^2	$ 1.40	$ 7,630.00
2.2	Channel Excavation	2,000	m^3	$ 10.00	$ 20,000.00
2.3	Topsoil Respreading and Seeding	5,450	m^2	$ 1.40	$ 7,630.00
2.4	Culvert Installation	75	m	$ 70.00	$ 5,250.00
2.5	Erosion Protection	300	m^2	$ 100.00	$ 30,000.00
2.6	Augered Crossing at 108 Street	60	m	$ 2,500.00	$ 150,000.00
	Subtotal				**$ 220,510.00**
3	**Stormwater Management Pond**				
3.1	Topsoil Stripping and Stockpiling	41,250	m^2	$ 1.40	$ 57,750.00
3.2	Excavation	71,500	m^3	$ 11.00	$ 786,500.00
3.3	Clay Liner Construction	23,000	m^3	$ 11.00	$ 253,000.00
3.4	Inlet Structure	1	L.S.	$ 90,000.00	$ 90,000.00
3.5	Outlet Structure	1	L.S.	$ 90,000.00	$ 90,000.00
3.6	Topsoil Respreading and Seeding	2,000	m^2	$ 1.40	$ 2,800.00
3.7	Drainage Channel Excavation	7,500	m^3	$ 10.00	$ 75,000.00
3.8	Erosion Protection	3,000	m^2	$ 9.00	$ 27,000.00
	Subtotal				**$ 1,382,050.00**
Subtotal					$ 2,143,220.00
CONTINGENCY (20%)					$ 428,644.00
ENGINEERING (15%)					$ 385,700.00
TOTAL					**$ 2,957,564.00**

TOWN OF WESTLOCK - STORMWATER MASTER PLAN UPDATE - PRIORITY 2
108 STREET OUTLET REPLACEMENT

COST ESTIMATE - Class 'D'

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	**Outfall Rehabilitation**				
1.1	Topsoil Stripping and Stockpiling	1	L.S.	$ 10,000.00	$ 10,000.00
1.2	Impact Baffle	1	unit	$ 100,000.00	$ 100,000.00
1.3	Stormceptor Manhole	1	unit	$ 80,000.00	$ 80,000.00
1.4	Import Material	250	m^3	$ 40.00	$ 10,000.00
1.5	Site Grading	1	L.S.	$ 8,500.00	$ 8,500.00
1.6	Topsoil Respreading and Seeding	1	L.S.	$ 4,000.00	$ 4,000.00
1.7	Armouring Channel Bottom (Recycled Concrete)	50	m^2	$ 100.00	$ 5,000.00
1.8	Seeding	200	m^2	$ 5.00	$ 1,000.00
	Subtotal				**$ 218,500.00**
Subtotal					$ 218,500.00
CONTINGENCY (20%)					$ 43,700.00
ENGINEERING (15%)					$ 39,300.00
TOTAL					**$ 301,500.00**

TOWN OF WESTLOCK - STORMWATER MASTER PLAN UPDATE - PRIORITY 3
FUTURE DEVELOPMENT IN WESTGATE AND GREENFIELD ESTATES

COST ESTIMATE

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
General Items				
Method #1A Construct Pond South of Greenfield Estates				
Mobilization/Demobilization	1	L.S.	45,000.00	45,000.00
Locate/Protect Existing Utilities	1	L.S.	5,500.00	5,500.00
Topsoil Stripping and Stockpiling/Finish Grading	12100	m^3	5.00	60,500.00
Excavation	128900	m^3	7.50	966,750.00
Erosion and Sediment control	1	L.S.	15,000.00	15,000.00
Edge Treatment	600	m	4.50	2,700.00
Rip Rap Armouring	45	m^2	150.00	6,750.00
Wetland Preparation	0.5	ha	2,000.00	1,000.00
Connection to Storm Sewer System	100	m	1,035.00	103,500.00
Topsoil Re-spreading and seeding -ponds	3600	m^3	3.00	10,800.00
Overhaul Topsoil allowance	1	L.S.	50,000.00	50,000.00
Overhaul Allowance	1	L.S.	100,000.00	100,000.00
Topsoil Stripping and stockpiling - ditch	7300	m^2	1.25	9,125.00
Excavation - Ditch	5700	m^3	9.00	51,300.00
Topsoil Re-spreading and Seeding - Ditch	7300	m^2	1.25	9,125.00
Inlet Structure	1	L.S.	32,000.00	32,000.00
Interconnecting piping	150	m	900.00	135,000.00
Outlet structure	1	L.S.	35,000.00	35,000.00
Subtotal				$ 1,639,050.00
CONTINGENCY (20%)				$ 327,810.00
ENGINEERING (15%)				$ 295,040.00
TOTAL				**$ 2,261,900.00**

Note: Land Acquisition Costs not Included.

TOWN OF WESTLOCK - STORMWATER MASTER PLAN UPDATE - PRIORITY 5
POND G

COST ESTIMATE - Class 'D'

	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	**Stormwater Management Pond 'G'**				
1.1	Topsoil Stripping and Stockpiling	36,200	m^2	$ 1.40	$ 50,680.00
1.2	Excavation	43,400	m^3	$ 11.00	$ 477,400.00
1.3	Clay Liner Construction	14,000	m^3	$ 11.00	$ 154,000.00
1.4	Inlet Structure	1	L.S.	$ 90,000.00	$ 90,000.00
1.5	Outlet Structure	1	L.S.	$ 90,000.00	$ 90,000.00
1.6	Topsoil Respreading and Seeding	2,000	m^2	$ 1.40	$ 2,800.00
1.7	Drainage Channel Excavation	7,500	m^3	$ 10.00	$ 75,000.00
1.8	Erosion Protection	3,000	m^2	$ 9.00	$ 27,000.00
	Subtotal				**$ 966,880.00**
Subtotal					$ 966,880.00
CONTINGENCY (20%)					$ 193,376.00
ENGINEERING (15%)					$ 174,000.00
TOTAL					**$ 1,334,256.00**