



TOWN OF WESTLOCK

WESTGATE AREA STRUCTURE PLAN

BYLAW NO. 2017-07

EFFECTIVE DATE – July 17, 2017

CONSOLIDATED FOR CONVENIENCE ONLY

This is a consolidation of the bylaws below. The amendment bylaws have been combined with the original bylaw for convenience only. This consolidation is not a legal document. Certified copies of the original bylaws should be consulted for all interpretations and applications of the bylaws on this subject.

AMENDMENT BYLAW

DATE OF ADOPTION

EFFECTIVE DATE

(If different from Date of Adoption)

Bylaw No. 2018-11

August 2, 2018

Town of WESTLOCK

By-Law 2017-07

Province of Alberta

BEING A BY-LAW OF THE TOWN OF WESTLOCK IN THE PROVINCE OF ALBERTA FOR THE PURPOSE OF ADOPTING AN AREA STRUCTURE PLAN

WHEREAS, an Area Structure Plan has been prepared for part of NW 32-59-26-4 and NE 32-59-26-4 within the Town of Westlock;

WHEREAS, the Area Structure Plan provides the planning framework for future subdivision and development at the neighbourhood level;

NOW THEREFORE, the Town of Westlock Council enacts as follows:

1. This Bylaw may be sited as the NW 32-59-26-4 and NE 32-59-26-4 Area Structure Plan.
2. That the document entitled "Westgate Developments Combined Area Structure Plan for Greenfield Estates and Westgate Business Park" attached as part of this Bylaw is hereby adopted.
3. This Bylaw comes into force and effect upon the third and final reading.

Read a first time this 12th day of June, 2017.


Read a second time this 4th day of July, 2017.

Read a third and final time and passed this 17th day of July, 2017.

Signed by Mayor and CAO this 17th day of July, 2017.



Mayor, Ralph Leriger



CAO, Dean Krause



Westgate Developments Ltd.

**COMBINED AREA STRUCTURE PLAN
GREENFIELD ESTATES AND WESTGATE BUSINESS PARK**

310, 400 Palisades Way, Sherwood Park, Alberta T8H 2T9

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PUBLISHING INFORMATION

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AUTHOR: Joel West Consulting Ltd.
Planning and Land Development Management

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ACKNOWLEDGEMENTS

The consulting team would like to acknowledge the contributions of others in the preparation of this area structure plan. The acknowledgements will be completed prior to the formal submission to the Town of Westlock.

Consultant Team

Project Lead, Planning, Project Development and Construction Manager

- Joel West Consulting Ltd.

Concept Planning and Design

- Joel West Consulting and ARKK Engineering Corporation

Prime Engineering

- ARKK Engineering Corporation

Geotechnical Assessments

- ARKK Engineering Corporation

Stormwater Management

- ARKK Engineering Corporation

Traffic Impact Assessment

- ARKK Engineering Corporation

ESA Phase 1

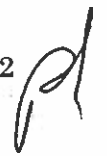
- ARKK Engineering Corporation

Surveyors

- Hamilton and Olsen Surveys Ltd.

Biophysical Assessments

- EcoVenture Inc.

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OVERVIEW

Westgate Developments Ltd. is presenting this Combined Area Structure Plan to provide a Vision for the future development of land located within the Town of Westlock Alberta; Greenfield Estates is bound by the north south extension of 98 Ave to the north – collector road and accessed by Highway 18 and an east-west extension of 97 street. The Westgate Business Park is bound by the east-west extension of 93 Street and north-south by the 104 Ave extension.

The Combined Area Structure Plan will be home to approximately 58 R1 – Single Family oversized lots all averaging over Fifty (50') foot frontage or more and 54 R2 - large Duplex and town home lots. The R2 lots all average sixty (60') foot frontage. The two (2) townhome lots contain six (6) residential units each.

In the Mixed-use Commercial Westgate Business Park, there are two R3 – high density lots to facilitate one condo and one Senior assisted living residential buildings with a maximum of eighty (80) units each. With a mixed-use work-live model, Highway commercial, Professional buildings, and light industrial lots. This combined area structure plan could potentially increase Westlock's population by approximately 550 - 600 residents.

Westgate Business Parks' mixed use commercial and residential lots and Greenfield Estates' low to medium density residential are the two proposed development area concepts.

Greenfield Estates and Westgate Business Park have distinct identities that function together as an integral part of the town. It will be an area where public amenities are located within comfortable walking distance, with excellent pedestrian connections, public walking providing access to wider employment, work-live, light commercial, retail, leisure and cultural destinations in the Town of Westlock, Alberta. Conservation of the unique natural environment within the Westgate developments combined ASP, including the Greenfield Pond, Green spaces, Pathways ensures and enables residents, workers, and visitors to enjoy their natural surroundings.

The Area Structure Plan refines and implements the strategic objectives and policies identified within the Westlock Master Development Plan and has been influenced by The Town's broader planning and sustainability objectives. It has been informed by specific engineering, transportation, and land use studies and transportation and servicing constraints in the area. The Plan has evolved through a consultation and open house exercise involving landowners, the public, Town Administration, school boards, and other key stakeholders.

The purpose of this area structure plan (ASP) is to provide further direction regarding future development in the area than that provided in the Municipal Development Plan. This ASP provides guidance for the plan area to ensure smart growth development.

An ASP is a long-term document with a horizon around 20 – 25 years. It is anticipated that as variables change this plan will have amendments. The plan may be amended in the future, but the broad intent of the plan should remain consistent.

Through this process, detailed policies and guidelines have been developed. These will be used to direct land use, subdivision, and development permit applications that will collectively shape the future development of the combined area structure plan to achieve the plan vision.

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1.0 Introduction

1.1 Vision & Objectives

The Vision and Objectives for Westgate Developments Combined Area Structure Plan hopes to present today the aspirations of The Town of Westlock, its partners and stakeholders. They have been influenced by a review of relevant Town of Westlock Policy and Bylaws, community and stakeholder consultation and a thorough understanding of the Plan Area. The Policies contained within this Area Structure Plan (ASP) aim to guide development to achieve the Plan Objectives and realize the Westgate Developments Ltd. Combined ASP Vision.

1.1.1 Vision

Westgate Developments' vision is to create communities that stand the test of time, leaving a legacy for future generations to come. As developers, we have an opportunity to create sustainable and innovative communities by paying attention to the finer details of planning and design – while continually caring and thinking about individuals and keeping their lifestyles in mind. Westgate Developments' mission and goal is to develop communities where we want to live, work, and call the community home.

1.1.2 Objectives

1. Complete Community
Foster the development of vibrant, diverse and attractive communities that have access to ample opportunities for recreation, cultural development, education and employment. Complete communities provide a physical and social environment where residents and visitors can live, work and play.
2. Safe and Healthy Neighborhoods
Promote safe and healthy neighborhoods through the delivery of good design, safe public realm and recreational facilities that complement the quality of the built environment.
3. Built Design
Improve the quality of new buildings, homes and public realm in terms of design, diversity, character, performance specification, health, sustainability and management to create attractive, vibrant, livable complete communities.
4. Towns' Image
Enhance Westlock's image through the Town's entranceway of Hwy 44 - Westgate Business Park development design features, to provide visitors with a positive impression when entering Westlock.
5. Community Diversity
Enhance community diversity and sustainability by encouraging affordable home ownership and rental opportunities by providing access to a range of housing opportunities and community facilities to enable social



- integration.
6. **Walkable Communities**
Develop integrated and well connected, compact communities based on a network of streets that encourage walking and cycling and are complemented by efficient public transport to increase accessibility to schools, retail, services and places to work and play.
 7. **Natural Area Conservation**
Conserve and enhance the existing wetlands, habitats and gradients to ensure a visually appealing and biologically diverse development, where the built form is designed to respect the functions and values of the natural environment.
 8. **Environmentally Sustainable Design**
Encourage sustainable design solutions by creating communities where energy and resource use are minimized and building designs incorporate green building methods and alternative energy solutions.
 9. **Economic Viability**
Provide a wide and diverse range of opportunities for capital investment in the future development of the Westlock area.
 10. **Employment**
Provide for a range of employment opportunities in a mixed-use context focused around the trade and industry area surrounding Westlock Alberta and the Westlock Healthcare Centre. Additionally, encourage mixed uses, home occupation, accessory dwelling units and live-work units around within the Plan area to maximize the opportunities for a positive jobs-to-housing balance.

1.2 Growth Rationale

The strategic decision to proceed with land use development concept for the Westlock Area was based on the following growth management rationale:

- The Town of Westlock approved policy plans in place and bylaws, will help ensure that there is a sufficient supply of pre-planned land to respond to variations in growth rates and to support a healthy, competitive land market.
- The financial capital costs for infrastructure adopted Offsite Levy prepared and addressed as part of the consideration to proceed with the Westgate Developments Combined Area Structure Plan in hopes to make Land Use Development application.
- Residential development within the Plan area supports The Town's job/housing balance policies and provides an opportunity to house a significant population base adjacent to the employment opportunities offered within the Plan area and surrounding region.
- A greater mixture of land uses is required to meet commercial and employment needs for the community and region.

1.3 Strategic Policies

In developing the Westgate Developments Combined ASP, a wide range of existing plans, policies and guidelines that have been adopted by Council to provide direction for development within Westlock have been reviewed and considered. The Vision and Policies for the Westgate Developments Combined ASP Plan have been influenced by these documents and the Plan both complies with these policies and aims to deliver the identified aspirations and principles. A summary of the interrelationship between these adopted plans and policies and the Westgate Developments Combined ASP objectives is provided in the Land Use Concept Plans.

1.4 Municipal Government Act

Westgate Developments' Combined ASP framework follows the requirements set out by the Municipal Government Act. An ASP as defined by the Municipal Government Act Section 633 must address the below:

- The sequence of development for the plan area;
- Land uses;
- Population density;
- Transportation network and location of public utilities;
- Provide guidance for future subdivision and development;
- Other matters established by the Municipal Council.

1.5 Municipal Development Plan

Our Combined Area Structure Plan is designed with the Town of Westlock's' Municipal Development Plan (MDP) for the subject lands listed as a residential and commercial mixed-use growth, within the MDP. This area structure plan strives to achieve the community's vision as established in the MDP.

1.6 Land Use Bylaw Amendment

With the proposed Westgate Developments Combined ASP, an amendment to the Land Use Bylaw will be required to establish the appropriate districts to allow for the development of the plan areas.

1.7 Community Consultation

Westgate Developments Ltd. held a community Open House May 26th, 2017. With prior advertising and signage to encourage community member's thoughts and welcoming input. The Town of Westlock community members were introduced to the developers' owner, team of professional consultants and the ASP display stations. Community members engaged in constructive conversations with the ability to leave written comments and suggestions. The Open House Community Consultation was received well. Comments and suggestions resulting from the community members was



considered and is reflected in increasing the R2 – Duplex Lots and a few large estates sized lots to accommodate oversized three car garages.

2.0 Influencing Factors

2.1 Plan Boundary

The Greenfield Estates is bordered by:

- Single family homes 98th Ave North, 98a Ave, 98th St., 97th St. East, and 95th St.
- Spirit Center
- Westlock Cemetery

The Westgate Business Park is Bordered by:

- Westlock Healthcare Centre
- F & D Holdings. under construction
- 93rd St. East and West and Highway 44 (104th Ave.) North and South
- Westlock County lands bordering the south

2.3 Access

The Combined ASP access to the plan Westgate Business Park is accommodated by Highway 44 (104) Ave and 93 St. Access to the Greenfield Estates ASP area is accommodated by Highway 18, 98th Ave and 97th Street.

2.4 Ownership

The Westgate Developments Ltd. has an agreement in place with the landowner for the purchase of the ASP Plan areas.

Table 1 Land Owners

Land Area	Owner	Short Legal	Area (ha).
Greenfield Estates	Westgate Developments Ltd.	4; 26; 59; 32; NW	14.1 (34 Aces)
Westgate Business Park	Westgate Developments Ltd.	4; 26; 59; 32; NE	9.3 (24 Aces)

2.5 Figure 1 Location Plan



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2.6 Figure 2 Ownership Plan (amended)



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3.0 Timeframe of the Plan

The Plan is future-oriented and depicts how the Plan Area is to be developed over a five-year time frame through a series of phases. Proposed ASP with Detailed Construction engineering submitted, and approved Westgate Developments Ltd. hope is to start land development construction late summer 2017.

3.1. Map Interpretation

Unless otherwise specified within the Plan, the boundaries or locations of any symbols or areas shown on a map are approximate only, not absolute and shall be interpreted as such. They are not intended to define exact locations except where they coincide with clearly recognizable physical features or fixed boundaries such as property lines or road and utility rights-of-way.

3.1.1 ASP Interpretation

Where the ASP purpose, it is provided for information only to enhance the understanding of the ASP. Should an inconsistency arise between the purpose of the ASP and the Town of Westlock's' policy and bylaws the policy will take precedence.

Where actual quantities or numerical standards are contained within a mandatory policy (e.g., density policies), the quantities or standards may be deviated from if the deviation is necessary to address unique circumstances that will otherwise render compliance impractical or impossible, and the intent of the policy is still achieved.

Where the ASP may be deviated from in a specific situation where the deviation is necessary to address unique circumstances that will otherwise render compliance.

Where a policy requires compliance at the ASP stage, that requirement may be deferred to the Subdivision Approval or Development Permit Approval stage. We ask the Town of Westlock to consider the deviation requested with a formal letter, without requiring an amendment to the Plan.

This ASP Land Use Concept Plan Interpretation is requested for the deviation required for the Greenfield Estate Lots located along the south boundary.

3.1.2 Guideline Interpretation

Where the guidelines identify information or analysis to be submitted as part of the ASP Land Use Concept Plan. Amendment application, requirements will be applied as needed and may be varied or expanded upon as determined appropriate given the specific circumstances that exist.

Where the guidelines identify standards to be addressed within an Land Use Concept Plan we ask the Town of Westlock to consider the guidelines may be varied without an amendment to the Plan.

Where the policies of this plan refer to compliance with the guidelines it is understood that the guidelines are provided for direction only.

3.2 Monitoring and Review

The Plan shall be monitored over time in relation to development to ensure they remain current and relevant. Where determined necessary, the monitoring by: Westgate Developments and the Town of Westlock shall be updated through plan amendments and formal letters of approval from the Town of Westlock, in process either generally or in response to a specific issue.

3.3 ASP Amendments

Any change to the text or figure within the Plan requires an amendment to the Plan, in accordance with the MGA. Where an amendment to the Plan is requested, the applicant shall submit the supporting information necessary to evaluate the potential amendment.

3.4 ASP Limitations

Area Structure Plans are long-term planning documents by nature. As such, they promote a vision for a community and put in place policies and guidelines that work towards achieving that vision over time.

4.0 Environmental Conditions

The topography of the site is gently undulating with slopes of 0.5 to 2% to the west; generally, higher lands in the east and south of the ASP area result in the drainage within the ASP area trending towards the northwest. The ASP area is a flat landscape, predominantly cleared and utilized for agricultural purposes; at the time of the ASP preparation, the area was cultivated, with wheat stubble present in the area. No wetlands or water courses were found within the site.

The site was divided in two areas: Westgate Business Park and Greenfield Estates. To the south of the Westgate

Business Park a forested area is present; this area is dominated by aspen poplar and balsam poplar. To the north there is a row of trees planted by the Town of Westlock; this row extends to the west approximately 160m, starting close to the intersection of 93 Street and Highway 44. To the west, existing infrastructure is present which includes underground services (sewer line and storm sewer line). This area is not included within the ASP area, and it drains towards the existing interim stormwater pond on the Greenfield Estates area (NW-32-059-26 W4). There is an interim drainage ditch / channel that collects runoff from the Westgate Business Park and the area west of it and conveys runoff to the existing interim stormwater pond.

The Greenfield Estates area is generally flat with slopes varying from 0.5% to 2%. The current land use is agricultural, and area was cultivated at the ASP development time, with wheat stubble present in the area. An interim stormwater pond was built in 2010/2011, has approximately 2 hectares of area, and currently holds runoff water; runoff is conveyed to the retention pond through an interim channel / ditch system that starts in the southeast corner of the property and ends in the southeast corner of the retention pond. Within this area no wetlands or watercourses were present and wildlife activity is limited. On the southern side of the pond there are two large stockpiles of topsoil and subsoil from pond excavation. Along the western boundary of the ASP area (Greenfield Estates) there is a shelter belt tree line of spruce trees and shrubs which backs onto a park area.

4.1 Land Use

Currently the lands are being utilized for agricultural operations.

4.2 Right of Ways

Within the ASP area there are several right of ways, including potable water lines, and natural gas pipelines. Many the corridors will remain in their current alignment. The existing AltaGas pipeline right of way provides a substantial constraint to development (Greenfield Estates) and will be relocated.

4.3 Environmental Site Assessments ESA

Environmental site assessments will be completed and submitted in the two weeks for review and use.

With presenting the Combined ASP we don't foresee any environmental constraints that would affect the Land Development approval process.

4.4 Geotechnical Assessment

The Combined ASP Geotechnical Assessment was completed by ARKK Engineering Corporation in April 2017. Nine boreholes were drilled using a track-mounted drill rig, and standpipes / monitoring wells were installed in all boreholes. A locked steel protector was installed at each standpipe location to house the stick-up portion of the standpipes for security and liability reasons.

Topsoil and subsoil were encountered in all borehole locations. The topsoil was clayey, contained organics and trace rootlets and was dark brown to black. The topsoil ranged in thickness from about 150mm to 300mm. The subsoil was clayey, contained some silt and sand and was brown. The subsoil ranged in thickness from about 100mm to 300mm. The combined thickness of topsoil over subsoil approximately ranged from 250mm to 600mm.

A clay layer extending to depths ranging from about 0.75m to 2.45m was encountered underlying the subsoil in all borehole locations. A glacial clay till deposit was encountered underlying the shallow clay layer in all borehole locations. Clay till was the predominant soil encountered in the boreholes, and extended to the termination of the boreholes, except for BH-01, 03 and 04 locations, which terminated in sand. The clay till deposit was interbedded with lenses and layers of glacial sand.

Water bearing glacial sand lenses and layers ranging in thickness from 10mm to more than 3m were encountered interbedded in the clay till layer deposit at variable depths. A sand layer encountered at BH-01 and 03 location extended from about 2.9m depth to the termination of the boreholes generally at 5.9m depth.

A deep clay layer was encountered embedded in the clay till deposit at about 7.5m and 4.5m depth in BH-08 and BH-09 locations, respectively, interbedded in the clay till. The clay layer thickness was about 1.5m in BH-08 and more than 1.3m in BH-09, where it extended to the termination of the borehole.

Ground water levels were taken from the monitoring wells. It should be noted that the groundwater level fluctuates seasonally. The highest elevation of the groundwater level typically occurs sometime after spring thaw. Water levels varied from 0.4m to 3.1m in April 2017.

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5.0 Land Use Concept

5.1 Residential Areas Greenfield Estates / Westgate Business Park

5.1.1 Purpose

The purpose of these policies is to provide the framework for the establishment of residential neighborhoods within the Plan area that are pedestrian oriented, allow for diverse housing options and create a sense of community. The Residential Area comprises most lands within the central and eastern portions of the Plan area.

The character of each community will be established through Architectural Guidelines and Design Principles, the placement of homes and buildings and their relationship to the street they front, street widths and landscaping of the public and private realms. The detailed residential design framework will be determined through the Town of Weslock's Municipal Development Plan.

5.1.2 Residential Area

1. Composition of Residential Area

Subject to policies of the Plan:

- a range of residential housing forms shall be allowed within the Residential Area;
- Multi-Residential Development within the Residential Area shall be designed to be compatible with the built form of the surrounding lower density residential area;
- alternative housing forms (e.g., three or more-bedroom dwelling units within multi residential development, community-oriented institutional uses, recreational uses, public uses, neighborhood commercial uses, 'live-work' and other similar and accessory uses to the above may be allowed within the residential area where determined to be compatible and appropriate; and
- open space and other public focal points such as the Rotary Trail areas and shall be provided throughout the Residential Area and Commercial.

2. 'Live-Work' Units within the Westgate Business Park Area

'Live-Work' units compatible with the surrounding area are encouraged throughout the commercial mixed use residential Area. 'Live-Work' units are encouraged to be located, but not limited to:

- Within the Westgate Business Park Neighborhood;



- Is adjacent to or near commercial uses; and
- Adjacent to or near walking routes, collector and major roads.
- 3. Neighborhood parks and recreation facilities in the Residential Area
 - Detailed design and development plans for each of the Greenfield green space and municipal reserve MR areas will be prepared by Westgate Developments Ltd., with the Town of Westlock Procedures and Design Standards, for Development October 2009.
 - Neighborhood parks and recreation facilities within the Residential Area is:
 - connected to each community by suitable pedestrian routes; and
 - visibly located and designed to be easily and safely accessible by all residents.
 - Neighborhood parks and recreation facilities are:
 - designed to be durable, particularly about the size of plant materials, types of landscapes and building materials;
 - sized and configured to create spaces that are functional, safe and flexible and provide for residential and work-live recreational opportunities;
 - designed to be environmentally sensitive MR and green spaces and apply sustainable technologies where appropriate, for example, permeable materials on pathways, energy efficient lighting;
 - provided with low water vegetation to encourage low demands in irrigation;
 - provide enhanced visibility to natural open space systems; and
 - inclusive of residential frontage to ensure “eyes on the street” for Man-Made Constraints.

6.0 Design Approach

6.1 Neighbourhood and Community Design

This Combined ASP uses traditional and modern elements of neighborhood and community design. There is a lot of supporting and proven literature available on how to design and build better communities that are utilized and in focus within the ASP Land Use Concept Plans.

The plan is to create a much-needed addition to the Town of Westlock. Our aim is to create a community where all walks of life flourish in their neighborhoods. This plan has an attractive streetscape for both the residential and mixed use commercial areas, which contributes to the goals and vision set out in the Town of Westlock Development Plan.

6.2 Smart Growth

The Town of Westlock has local smart growth principles to create diverse communities and foster unique neighborhoods and mixed land use commercial areas. The Town encourages growth in its existing communities' areas and the Combined ASP is a continuous addition to the Town's economic and growth plan. This plan is not outside of the Municipal Development Plan Bylaw and adopts the smart growth of mixed land uses for both residential and commercial areas, create diverse housing opportunities, preserve open space and parks, create new open spaces and parks areas, and utilize smart growth sustainable principles within the Municipal Development Plan.

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7.0 Man Made Constraints

7.1 Development Under Construction

To the west of the Westgate Business Park, there is a land development project under construction, comprised of approximately 4.4ha. The project is currently on hold and presents itself with incomplete underground servicing and incomplete road infrastructure.

7.2 AltaGAS High Pressure Pipeline

AltaGAS owns and operates a high-pressure gas line that crosses the Greenfield Estates ASP area from the south to the northeast corner of the property. The line was built in 1954 using a steel pipe, Ø114.3mm (4 inch), approximately 1.6m below existing land elevation.

The communication with AltaGAS is the proposed relocation of the high-pressure gas-line to the south and east borders of Greenfield Estates within the town of Weslock's Laneway adjacent to the area.

7.3 Existing Stormwater Management Features

The east portion of the Westgate Business Park drains north and into a small depression west of the hospital's helipad. During extreme storm events, runoff collected in this depression would overflow to the northwest and into the Town's drainage system. Surface water runoff from the remaining portion of the Westgate Business Park is collected by an existing storm water line (Ø1050mm) installed in the abandoned development west of the Westgate Business Park area. The system discharges the runoff into an existing interim ditch / channel system south of the Greenfield Estates area and conveys the runoff to the existing interim stormwater pond. The interim storm water pond was built in 2010/2011 and covers an area of about 2 hectares. The pond currently has no outlet. When the pond is full, the water backs up into the ditch along the east side of the proposed Greenfield Estates development (98A Ave). This overflow condition was observed during a site visit on April 26, 2017. The elevation where the ditch overflows is similar to the low point along the west edge of the pond; therefore, it is likely that the pond would also overflow to the north west and into the parking lot of the Rotary Spirit Centre. During the April 26, 2017 site visit, the water level in the pond was at the point of spilling in this direction. It is likely that the existing lots between the two proposed developments would also flood when the pond overflows. The ditch along 98A Ave drains into the storm sewer along 99 Street. The northeast corner of the proposed Greenfield Estates development also drains to this point.

The northwest corner of the proposed Greenfield Estates development drains north west and into the parking lot of the Rotary Spirit Centre. As noted above, during an extreme rainfall event is likely that the pond would also overflow in this

direction. Along the west, north, and east boundaries of the developments, runoff generally flows north and is collected in the Town's storm drainage system. The Westlock Health Centre owns and operates a storm water drainage system and a lift station that directs runoff from the area into the Town's storm water system along Highway 44.

A previous assessment determined that the stormwater system within the abandoned sub-division was not constructed as per the design. The road is not finished, and the catch basins and other components appear to be blocked with sediment. The current condition of the system is not considered functional. The system should be remediated prior to being relied upon for the proposed developments.

Based on the assessment provided in the "Schedule of Accompanying Documents", the existing storm drainage system downstream of the proposed developments does not meet the Town's current design standards in terms of flood risk. Additionally, the runoff rate from the undeveloped lands and south of the developments was estimated to be 19 L/s/ha during the 100-year, 24-hour storm. This is about four times higher than the allowable release rate for SWMF's in the Town's standards (4 L/s/ha). This means that, even without the proposed development, substantial storage would be required to reduce flows from 19 to 4 L/s/ha, given the large watershed upstream of the development.

7.4 Existing Sanitary Sewer Lines

The existing sanitary sewage collection system in the Town of Westlock contains a Ø375mm sewer line running east to west along 93 Street, in the northern portion of the proposed Westgate Business Park. The line extends along 93 Street and connects to the Ø450mm diameter Southwest Wastewater Trunk Sewer.

The trunk sewer is routed from the proposed Westgate Business Park both north and east, and travels directly through the proposed Greenfields Estates development, and then continues to the northeast and then north along 96 Avenue. Directly north of the Greenfield Estates Development there are also existing Ø 200mm diameter minor collector mains along 98A Avenue and 99 Street.

7.5 Existing Water Lines

The existing water distribution system in the Town of Westlock contains a Ø300mm diameter water main which connects to a dedicated pipeline to Pickardsville which supplies the regional water distribution system. The Ø300mm main is located along 93 Street, north of the Westgate Business Park area. The line extends along 93 Street, through the development under construction (west of Westgate Business Park).

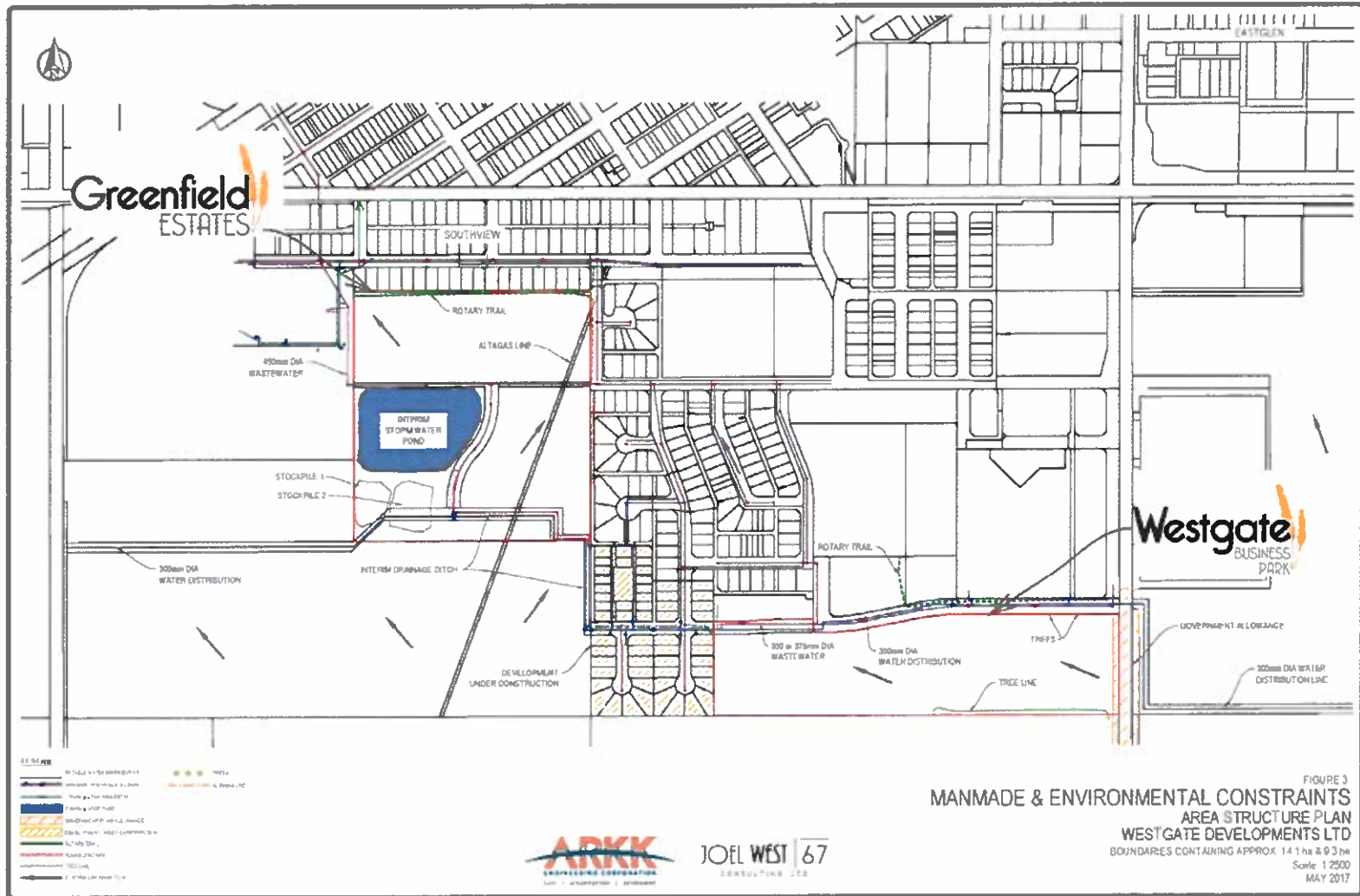
The Ø300mm water line reaches the Greenfield Estates area by the south border heading north, along the alignment of 98 Avenue and connects to an existing underground Ø150mm water line along the alignment of 97 Street.

7.6 Rotary Trail

The Rotary Trail has 9.6km and it is used by the community for walking, jogging, roller blading or cycling. A part of the existing trail system is located north of the Westgate Business Park area, along 93 Street, and north of Greenfield Estates, from 98 Avenue to the west boundary of the ASP area.



7.7 Figure 3 Man Made & Environmental Constraints



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8.0 Development Concepts

8.1 Theme

Westgate Business Park and Greenfield Estates will have a traditional theme with modern influence with today's construction materials. This theme will reflect and blend with the Town of Westlock community areas. The entrance to both locations will have similar community entrance signage, architectural guidelines and landscape vegetation. The joint theme will carry through in form and function to seamlessly come together in similar styles.

8.2 Commercial Mixed-Use Theme

The Concepts for Westgate Business Park will blend well with Greenfield Estates' look and feel, however because of the mixed-use highway commercial (CH), commercial multi -purpose (CMP), industrial light (IL) through to the transition west neighborhood high density residential (R3). The focal point of the ASP is the Storm water pond where the landscape will be an addition to the community in athletics and walkable component function around the pond with walking paths to pay attention to the neighborhood recreational use.

8.3 Density

8.3.1 Purpose

The purpose of the Combined ASP is to establish the minimum density requirements for each Community within the Plan area. Compliance with this minimum density has been evaluated during the concept planning stage and ASP stage.

Greenfield Estates density is low to medium density in a balanced concept and number of R1 to R2 lots ratio.

Westgate Business Park density is medium to high density residential in balance from commercial mixed use to high density residential lots. It is intended that the neighborhood commercial use will provide services required by the residents of Greenfield Estate, Westgate Business Park and the community. We anticipate the commercial areas will exhibit a small neighborhood shop format rather than large box format. This will enhance the community environment.

To provide a walkable community the ASP addresses the functionality of the Town of Westlock's existing walking paths and sidewalks with creating new routes given in the ASP as part of the developer's commitment to pedestrian accessibility.



8.3.2 Density Policies

1. Community Development Areas

The Town of Westlock Municipal Development Plan states:

ASP for new communities in future Westlock areas will achieve a minimum 10%.

2. Plan Area Density

The minimum residential density required, when calculated over the entire Westgate Developments Area Structure Plan area has meet the Town of Westlock Municipal Development Plan. And design procedures and standards for construction.

3. Density

The density for this ASP are displayed in Figures 4 through to 6a conceptually identifies areas within the Plan Area where various ranges of residential density should be located, in accordance with the policies of this Municipal Development Plan.

4. Minimum Densities

For meeting the intent of the density policies of the Plan, the minimum residential densities identified within the Plan has met the minimum density requirement.

8.3.3 Special Density Area

8.3.4 Purpose

The purpose of these policies is to provide for Special Density Areas within a community on a voluntary basis. These areas may need to review and will need to contain densities established by Council.

Special Density Areas can exceed typical service standard levels of the transportation network and will be characterized by a high-quality community design that emphasizes an employment and transit supportive development pattern, and other elements that minimize the impact of vehicle traffic.

8.4 Low and Medium Density/Mixed Use Area

8.4.1 Purpose

The Medium Density/Mixed Use Area, as identified on figures 5, 5a,6, and 6a will provide for a medium density residential development area in a mixed-use setting include residential, commercial, retail and office use. The Medium Density/Mixed Use Area will provide for transit supportive development and a transition in density between the High Density/Mixed Use Area and the Residential Area.

8.4.2 Low Density and Medium Density/Mixed Use Area

1. Composition of Low Density Medium Density/ Mixed Use Area
 - The predominant use of land within the Low and Medium Density/Mixed Use Area, as identified on figures 5, 5a, 6 shall be medium density residential development including, but not limited to, multi-residential development buildings with Westgate Business Parks retail and commercial uses located at grade.
 - In addition, offices, recreational, local commercial and retail uses within the Medium to High Density/Mixed Use Areas of the ASP Concepts.
2. ASP Land Use Concepts aim to meet the Approving Authority and their policies. Integrated into the Combined ASP low, medium to high density residential nature of the area in the form of mixed use buildings.
 - Residential and ancillary commercial uses will:
 - provided and meet the needs of the residents;
 - comprehensively designed within a pedestrian oriented environment in mind,
 - consisting predominantly of smaller scale businesses and shops;
 - through the land use concepts, the ASP applies the Medium - High Density/Mixed Use Area; and
 - in the form of mixed use developments, integrated with uses such as residential dwelling units, employment uses, affordable housing, assisted/senior's living units and other compatible uses to the satisfaction of the Approving Authority.
 - Open space, consisting of soft landscaped areas, provided within the Low and Medium Density/Mixed Use Area to meet the active and/or passive recreational needs of residents.
 - Seniors housing facilities and special care uses are located within the Medium Density/Mixed Use Area.
 - Child Care Uses and special needs housing are encouraged to be in the Medium Density/Mixed Use Area.
 - No drive-thru businesses shall be located within the residential Medium Density/Mixed Use Area.

3. Compatibility of Medium Density/ Mixed Use Area Development within the Medium Density/Mixed Use Area is designed to be compatible both with development within the Commercial/ Mixed Use area Westgate Business Park and with the surrounding low density residential area of Greenfield Estates;
4. Design of Medium Density/Mixed Use Area
The Medium Density/Mixed Use is designed with a simple street network (public or private) and accordance with the Development Design Guidelines in Westlock Master Development Plan and Environmental Design Guidelines.

8.5 Natural Area

Natural Area Management Plan

Requirements for a Natural Area Management Plan shall be reviewed prior to the approval of an Outline Plan/ Land Use Amendment, or detailed land use planning for lands protected within EOS. If a Natural Area Management Plan is deemed required, it will be completed under the guidelines and specifications of the Westlock Parks and Recreation Natural Area Management Plan.

8.6 Open Space Municipal Reserve MR

Westgate Developments Ltd. Voluntary Dedication exceeds minimum of 10 % Municipal Reserve. In accordance with the Municipal Government Act 10% of the gross area of the ASP shall be dedicated as municipal reserve, excluding areas identified as environmental reserve. The Combined Greenfield Estates and Westgate developments MR is over 25%.

8.7 Public Open Spaces

8.7.1. Purpose

The purpose of the public open space system is to provide a range of passive and active recreational opportunities contributing to the social, environmental, cultural and economic well-being for residents and visitors. The design of the system should create an environment of connectivity, user safety, comfort and enjoyment. Success will be attained if the Storm water pond watersheds, drainage systems, mature vegetation and biologically diverse areas work together in connections can be achieved through the inclusion of green infrastructure such as bioswales and soft surface landscape green spaces.

The location, size and configuration of the system will be determined through the ARKK Engineering and the Town of Westlock's Storm Water Master Plan.

Amendment process for Municipal Reserve, Municipal School Reserve lands and/or Environment Reserve Easements.



8.7.2 ASP Public Open Space

In the design of the public open space system three functions should be achieved social function, biophysical function, and aesthetic function. Although each parcel may not equally achieve these functions, the overall diversity of the system has a net benefit which meets these requirements.

1. Social Function

The intent of the social function is to create an overall sense of individual well-being and to encourage social gathering for a wide variety of user groups, ages, abilities, etc. The following objectives are encouraged to be demonstrated at the ASP Land Use Concept Plans and Vision.

- a. Integration of the space into the wider community through pedestrian walking routes, green spaces and municipal reserve areas.
- b. Seasonal adaptability to provide year-long usability.
- c. Visibility of the open space to encourage public access.
- d. Opportunities to connect with natural features.
- e. Ability to encourage public access.
- g. Ability to encourage a diversity of user access and activity.
- h. Where possible, encourage the development of perimeter residential frontage to overlook open space.

2. Biophysical Function

The intent of the biophysical function is to promote biodiversity as well as contributing to a positive impact on habitat zones, air quality and the physical environment.

- a. The application of sustainable technologies, where appropriate; for example, permeable materials on pathways, energy efficient lighting, and water efficiency measures for potential future irrigation requirements.
- b. The potential of the open space to maintain and enhance existing mature tree stock and overall biodiversity.
- c. The ability of the open space to provide some shading and sunlight access.
- d. Connection via green infrastructure such as bio swale, soft landscape green spaces and paths.

- e. Linkages to larger ecological areas such as the Storm Pond watersheds, drainage system, plantings of vegetation and biologically diverse areas.

3. Aesthetic Function

The intent of the aesthetic function is to contribute to the overall urban form of the combined ASP area.

- a. The open space will provide view corridors and visual aesthetic impact within the ASP areas.
- b. Sizing and articulation of the open space will create spaces that are functional, safe, flexible and provide for a variety of recreational opportunities for varying user age groups.
- c. Maximize sunlight exposure by avoiding adjacent shadowing from buildings yet provide tree clusters for seasonal shading.

8.8 Implementation

Detailed design and development plans for each of the parks will be prepared by the developer in consultation with The Town of Westlock. Such plans should address the requirements of Open Space, including project design, landscaping, performance standards and maintenance. Issues related to visibility, access, use, lighting, safety and security, seating and solar exposure should also be addressed.

8.9 Environmental Sustainability

8.9.1 Purpose

The purpose of these policies is to promote environmental sustainability through urban design, recycling, water conservation, resource conservation and energy conservation.

8.9.2 Environmental Sustainability Policies

1. Street Trees

- a. Street trees within boulevards should be provided as per The Town of Westlock's Complete Design Standards Guide.

2. Water Conservation

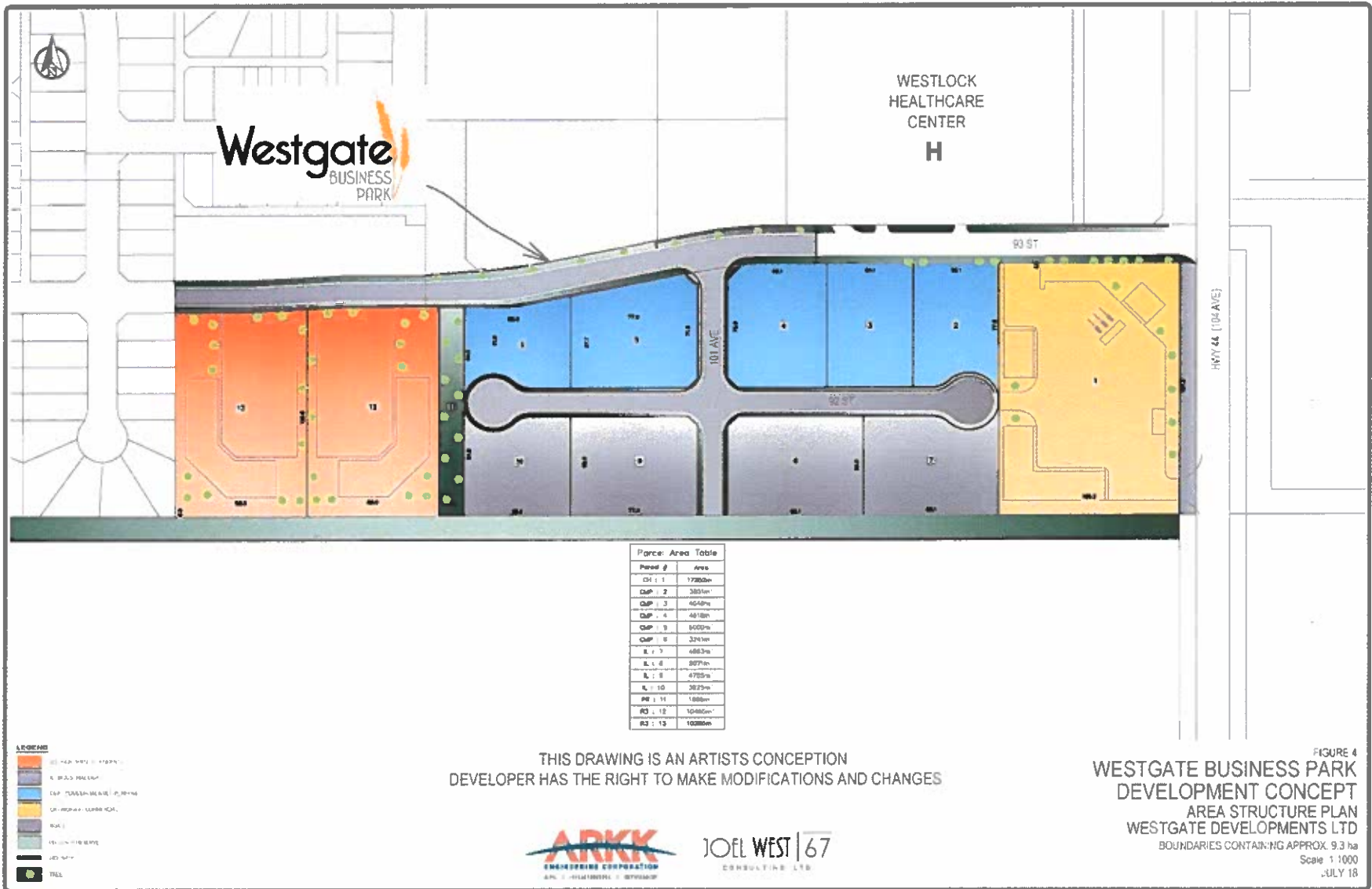
Encourage water conservation measures such as:



- a. the use of rain gardens, open ditches or swales, and pervious driveways and parking areas to maximize infiltration of stormwater and minimize runoff into environmentally critical areas;
- b. water efficient open space, parks, and other landscaped areas, including the use of drought-tolerant vegetation for landscaping and xeriscaping strategies; and
- c. matching water quality to water use by incorporating rainwater collection systems on site and architectural design for the use of rainwater for irrigation and other uses, Review of Urban Growth

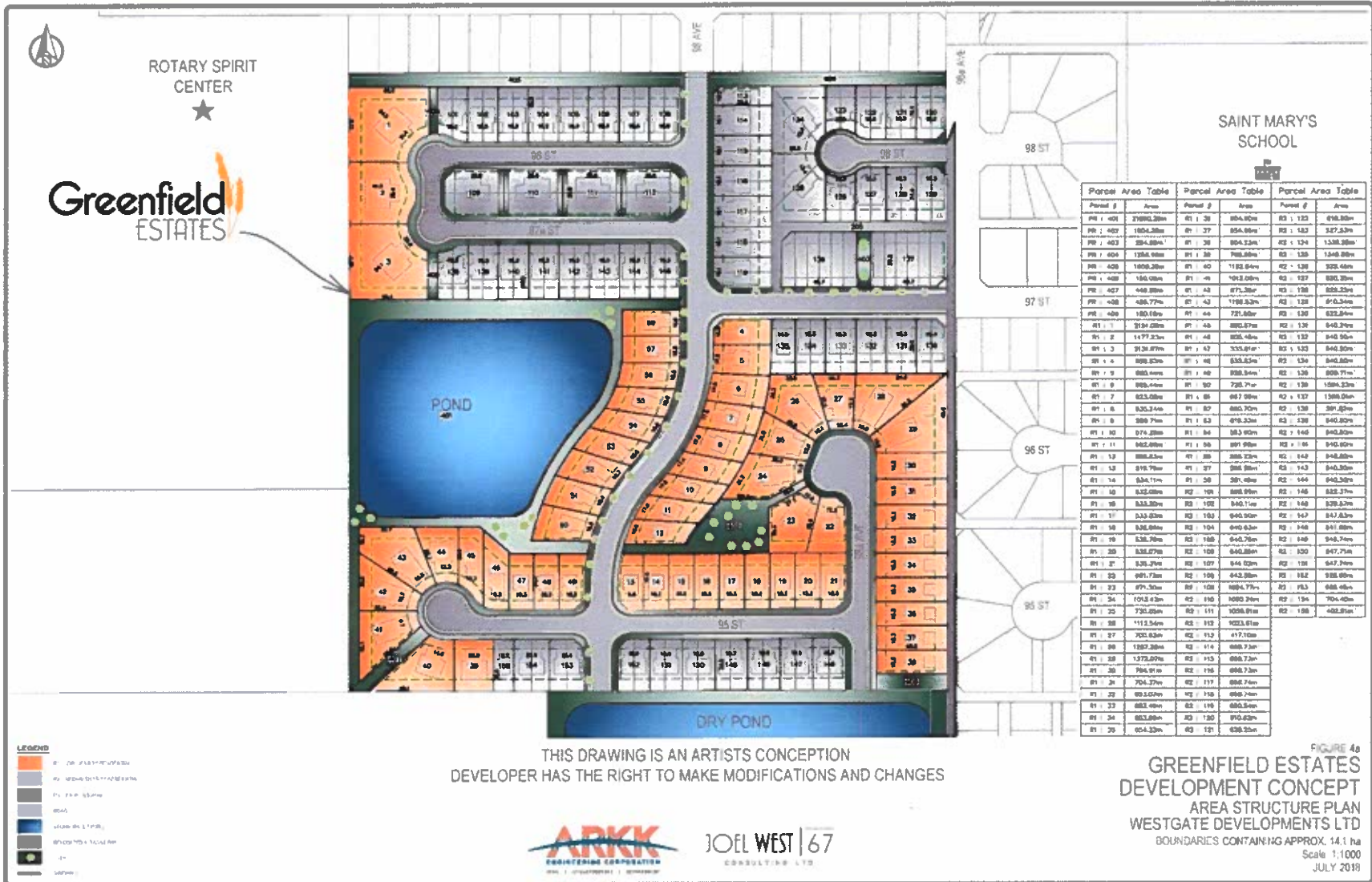
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8.10 Figure 4 Westgate Business Park Development Concept (amended)



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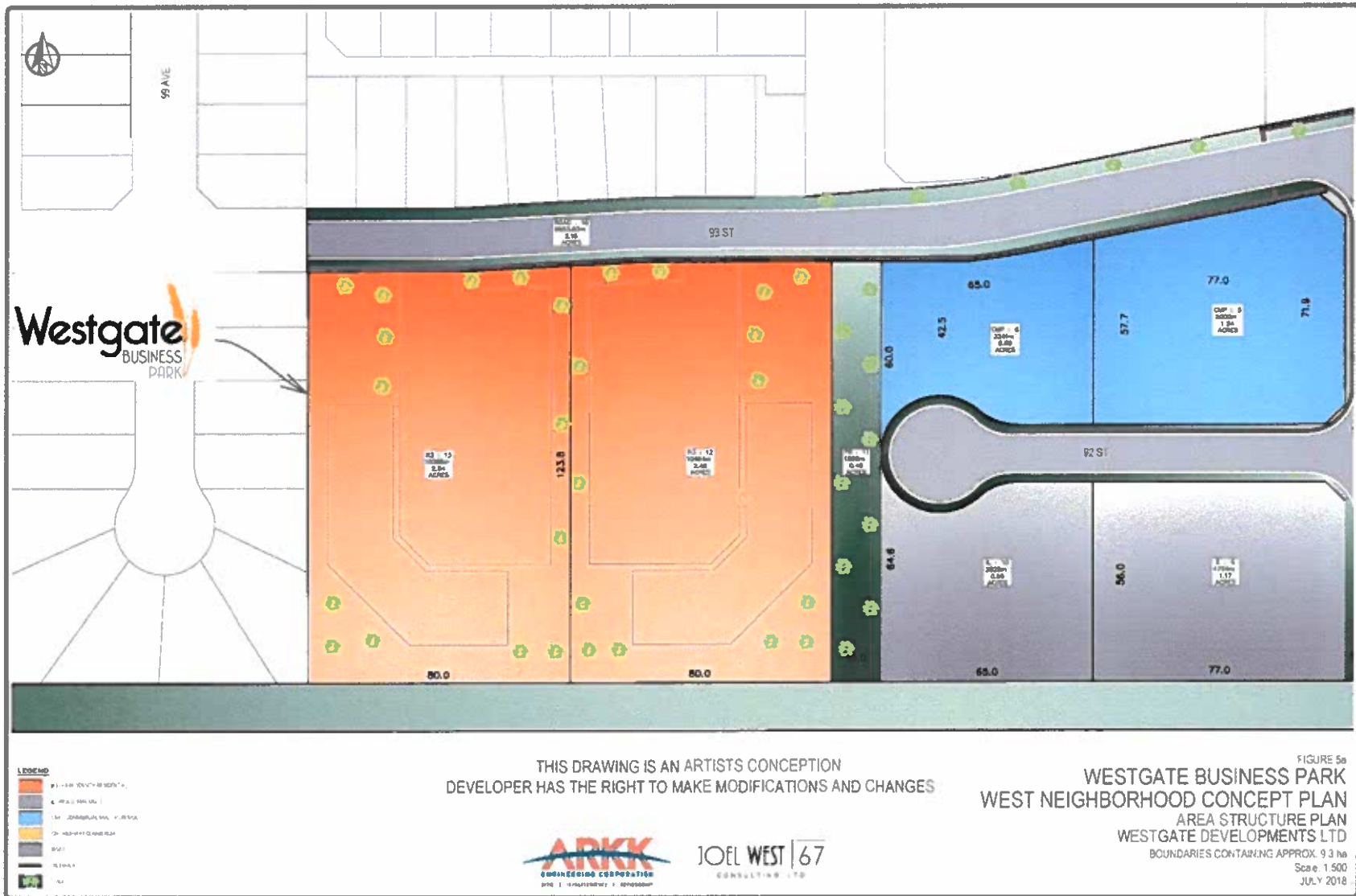
8.10 Figure 4a Greenfield Estates Development Concept (amended)



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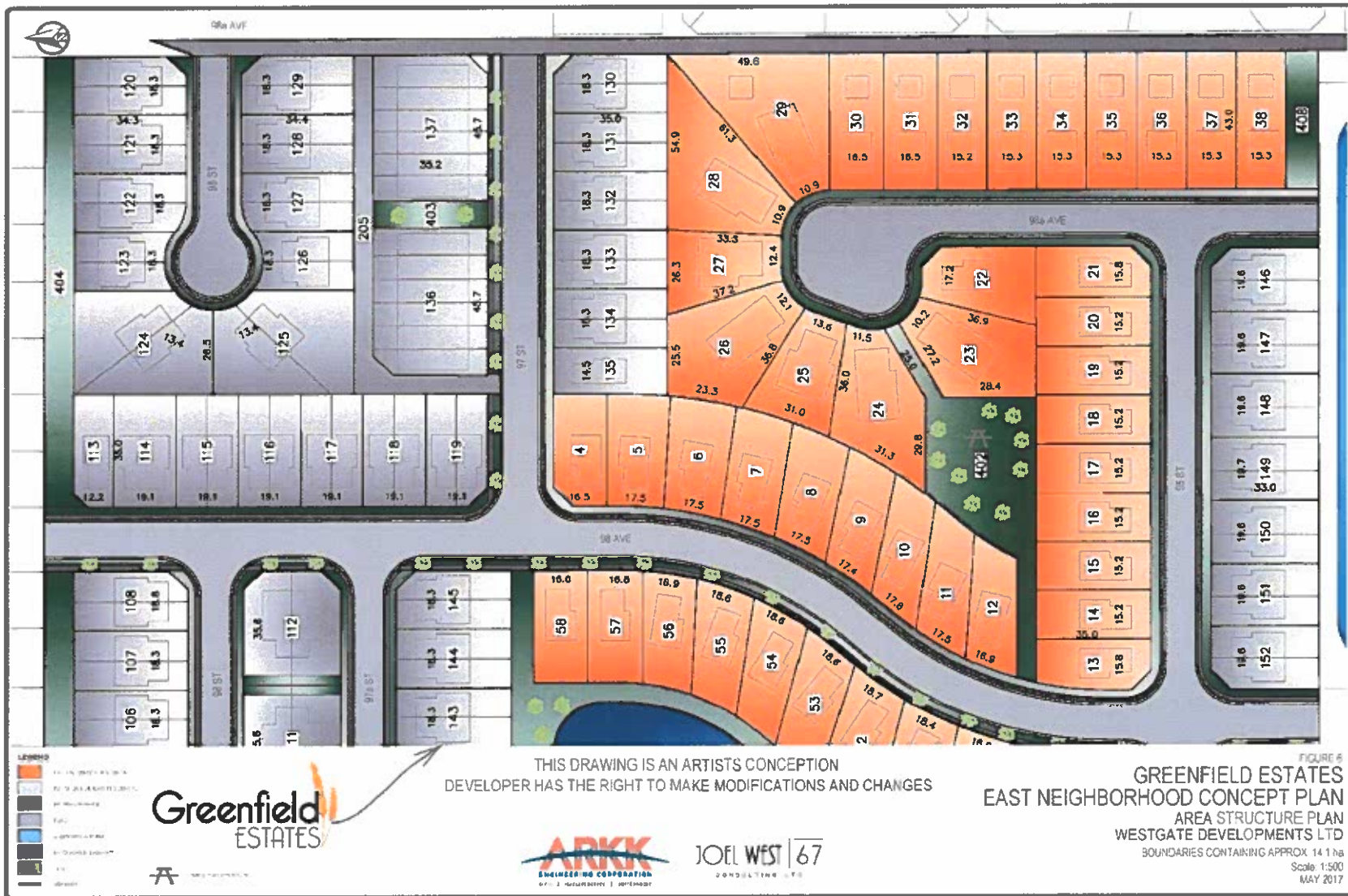
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8.12 Figure 5a Westgate Business Park West Neighborhood Concept (amended)



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8.13 Figure 6 Greenfield Estates East Neighborhood Concept



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8.14 Figure 6a Greenfield West Neighborhood Concept



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9.0 Land Use Stats and Projection Tables

9.1 Land Use Statistics Combined Table

Land Use	Description	Area
Gross Development Area	Combined	58 Acres
Residential R1	Single Family	28 Acres R1 & R2 Combined
Residential R2	Duplex / Townhome	
Residential R3	Condo	2.43 Acre
Residential R3	Senior Assisted Living	2.47 Acre
CH	Commercial Highway	4.04 Acre
CMP	Commercial Multi Purpose	5.2 Acre
LI	Light Industrial	4.2 Acre
PR Westgate Business Park	Public Reserve	1.4 Acre
PR Greenfield Estates	Public Reserve	6.9 Acre
UR	Utility Reserve	3.36 Acre
Total Developed Area	Combined	54.64 Acres

9.2 Unit & Population Projections Table

Density	Units	Population
Low density R1	58 - Single Family Units	162
Medium Density R2	54 – Duplex Units	108
Medium Density R2	2 Town Homes – 6 Units	36
High Density R3	1 Condo – 80 Units	160
High Density	1 Assisted Living – 80 Units	120
Work- Live	Apartment 6 Units	12
Total Population		598

10.0 Transportation and Mobility Traffic Impact

The purpose of the transportation and mobility is defined in the Traffic Impact Assessment to provide for a functional, safe and efficient regional road network. The general alignment of the regional roads is shown on the Land Use Concept plan and Transportation concept plan and the Traffic Impact Assessments.

10.1 Traffic Impact Assessment

10.1.1 Purpose

The purpose of the transportation and mobility is to provide the submission of a Traffic Impact Assessment (TIA) to address the network improvements, if required, to serve a proposed development.

Traffic Impact Assessment (TIA) - The Greenfield Estates and Westgate Business Park TIA Study shall be submitted as separate assessments due to the proximity to different provincial highways (Highway 18 and Highway 44).

The TIA Study also addresses the internal road network, including the design, capacity and timing of the network improvements necessary to serve the subject site; the perimeter road network, including the design, capacity and timing of construction required to serve the subject site; and the coordination of the development of the subject site with timing of construction and capacity of any transportation improvements.

10.2 Greenfield Estates

The proposed transportation network for Greenfield Estates are to be planned, designed and constructed in accordance with the Town of Westlock design standards and typical specifications. Figure 8 identified the proposed road network for the ASP area.

The plan includes the extension of existing collector roads to serve the community. The proposed roadway network includes a north-south extension of 98 Avenue - collector road - accessed via Highway 18 (Highway Arterial), and an east-west extension of 97 Street – collector road – that will connect to 98 Avenue in a “T” intersection. The remainder of the transportation network is comprised of local residential streets and avenues.

10.2.1 Emergency Access

Emergency access to the developing portion of the community will be identified at the Land Use Bylaw Amendment stage. Information received from the Town of Westlock has indicated that there is a need to accommodate an emergency access located at the southeast corner of the Greenfields Estate area. A green lane was planned to provide access to 98A Avenue through the existing gravel lane located east of the ASP area.

10.3 Westgate Business Park

The proposed transportation network for Westgate Business Park are to be planned, designed and constructed in accordance with the Town of Westlock design standards and typical specifications. Figure 8 identified the proposed road network for the ASP area.

The plan includes the extension of existing collector road to serve the community. The proposed roadway network includes an east-west extension of 93 Street up to the existing alignment of 99 Avenue, as it will be extended by Westgate Developments. The new access to the Westgate Business Park was designed to minimize the impact of new traffic to the existing intersection of 93 Street with Highway 44.

It is the resolve of the Transportation Department to decrease the number of direct access to Highway 44 in the future. As a result, the TIA Study for Westgate Business Park proposes an extension of 101 Avenue will be designed and function as a service access road to be used in future connections for lands to be developed south of the Westgate Business Park area.

Local Residential roads will connect to the north of 93 Street (100 Avenue and 99 Avenue) to provide access to the Westgate Business Park. Local Industrial roads will connect to the south of 93 Street (101 Avenue and 92 Street) to provide access to individual commercial and industrial lots at the Westgate Business Park area.

10.4 Roadway Network

10.4.1 Collector Roadways

Collector roadway will provide access from the arterial roadway to the northern and western portions of the ASP area. It will be designed and constructed within a 20m wide right-of-way, as per the Town of Westlock specifications.

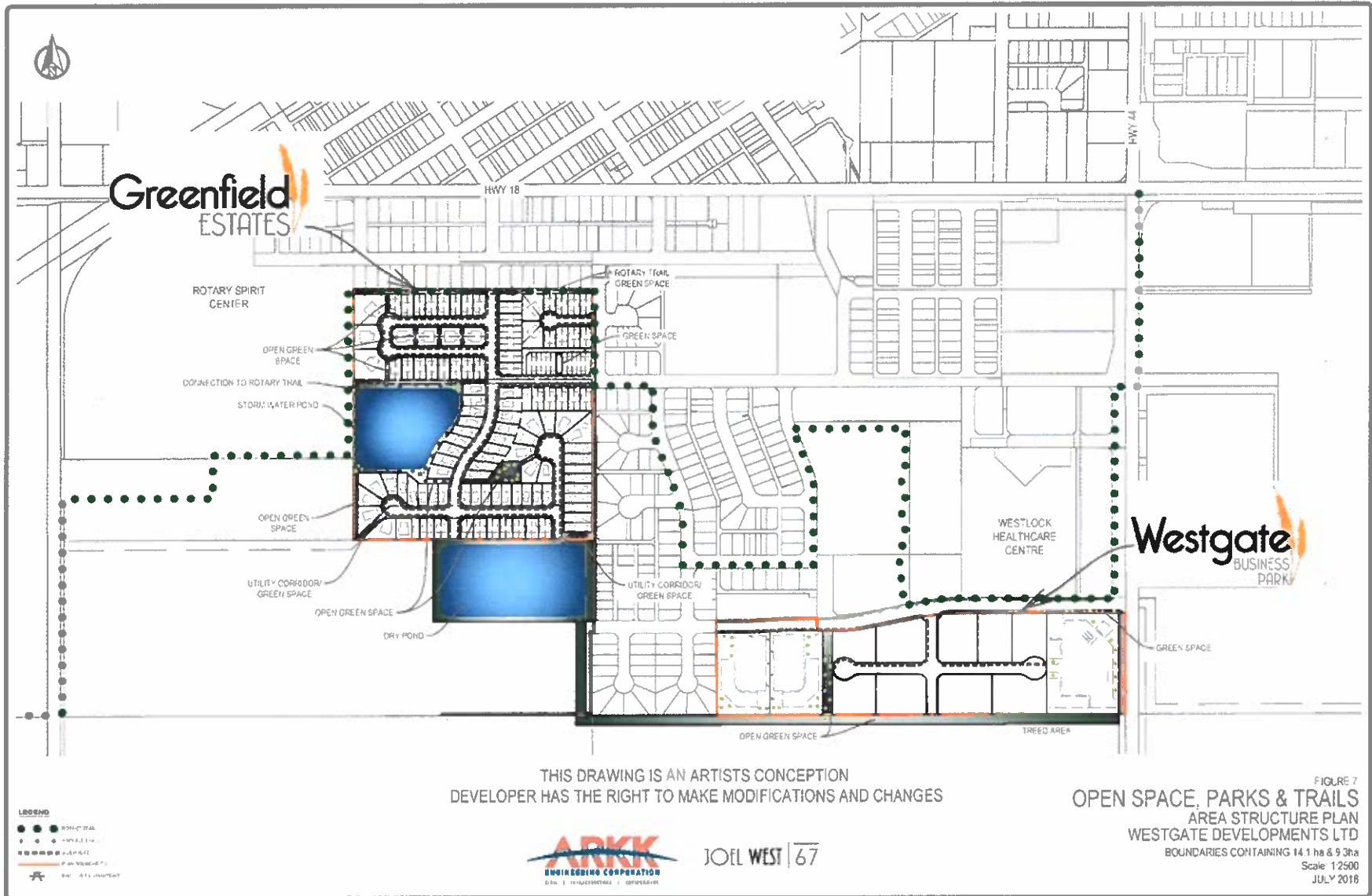
10.4.2 Local Residential Roadways

A system of local roadways to provide access to individual residential lots, based on a modified grid system designed to discourage outside traffic from shortcutting through residential areas. The local roadways will be constructed within a 17m (minimum) wide right-of-way, as per the Town of Westlock specifications.

10.4.3 Local Industrial Roadways

A system of local industrial roadways to provide access to individual light industrial lots is planned. The local industrial roadways will be constructed within a 18m (minimum) wide right-of-way, as per the Town of Westlock specifications.

10.4 Figure 7 Open Space, Parks & Trails (amended)



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11.0 Utility Servicing

An analysis of the sanitary sewer, water and storm servicing requirements for the ASP area was conducted in accordance with the goals and objectives of the Town of Westlock Municipal Development Plan (MDP) and the Area Structure Plan (ASP) criteria set by Town's bylaws.

The design of the Conceptual Storm Servicing Concept was also aligned with directives from the Alberta Water Act, the Alberta Environment Stormwater Management Guidelines, and the 2009 Town of Westlock Storm Water Management Master Plan.

Water and Wastewater servicing concepts were developed based on the current Town of Westlock Water and Wastewater Masterplans and the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, and accepted municipal engineering practices.

Franchise utility servicing (gas, power, data, cable, etc.) information was contributed by the respective utility owner.

11.1 Servicing – Water

The Town Water Masterplan indicates that a Ø300mm water main has been constructed around 2009 along 93 Street immediately north of the Westgate Business Park. To service the Westgate Business Park area, ARKK will connect to the Ø300mm main as shown in Figure 9 and proceed both east and west offset from the proposed sanitary servicing south along the proposed main access roadway to the park. Proposed lots one thru to ten will be serviced from this proposed watermain. Lots 13 and 14 will be serviced from the existing Ø300mm watermain on 93 Street.

During the detailed design phase, modelling of the proposed water system will be completed, and main sizes will be confirmed against the Town's Master Plan requirements. Watermains will be a minimum size as recommended in the Master Plan but will be increased in size if necessary to meet the fire protection requirements of the proposed development.

To provide fire flows to the Westgate Business Park, it may be required to run the proposed waterline using an easement through one of the lots two through five, and to provide a second flow path into the Westgate Business Park.

Referring to Figure 9A, the water servicing in the Greenfield Estates area will be along an alignment within the road right of way. A connection will be completed at the existing watermain at 98A Avenue and 95 Street and will be run north to service homes within this cul-de-sac area. The existing watermain running west along the proposed 95 Street alignment will service the cul-de-sac in the western part of the development.

A watermain will be installed within the proposed 98 Avenue right of way between 95 and 97 Street and will provide service connections to the proposed lots on the east and west side of 98 Avenue, as well as the proposed lots on the north and south side of the proposed 97 Street roadway.

The lots located in the northeast corner of Greenfield Estates area will be serviced from the existing watermain located at 98 Street and 98A Avenue; the lots in the northwest area will be serviced by a looped main running east west along the road rights of way from 98A Avenue. The watermain will be extended along 98 Avenue north to provide a connection at 99 Street and 98 Avenue. This will also provide a second source of water to the proposed development. Refer to Figure 9A — Conceptual Water Servicing Plan.

Existing records and preliminary surveys of the area between the proposed Westgate Business Park and the proposed Greenfield Estates development have not conclusively determined the extent and sizing of the existing water systems. These will be determined during the detailed design phase, and any required portions of the water distribution will be constructed.

11.2 Servicing – Sanitary Sewer

The Town of Westlock MDP has stipulated that the ASP lands should be serviced. Existing records and preliminary surveys of the area between the proposed Westgate Business Park and the proposed Greenfield Estates development have not conclusively determined the extent and sizing of the existing sanitary systems. These will be determined during the detailed design phase, and any required portions of the water distribution will be constructed.

11.2.1 Westgate Business Park

The Westgate business park will be serviced via connection to the existing Southwest Wastewater trunk system. Referring to Figure 9, lots 1 thru to 10 will be serviced by proposed sanitary sewer connected to the existing Ø450mm sanitary sewer at 93 Street. Proposed lots 13 and 14 will be serviced by direct connection to the trunk main on 93 Street.

11.2.2 Greenfield Estates

The Greenfield Estates development will have approximately 70 lots serviced by direct connection to the existing Ø450mm diameter sanitary sewer. The southeast area will be serviced from a sanitary sewer main north from sanitary manhole number 756. The southwest area will be serviced by a sanitary main to the west from manhole number 758. The northeast area of the development will be serviced by connection to the existing Ø200mm sanitary sewer running along 98A Avenue. The northwest portion of the development will be serviced by a connection to existing sanitary manhole number 762. The proposed main will be installed along 98 Avenue north to service the proposed medium residential lot number 113, with a connection that will run east west to service the residential lots 101 through to 112. Preliminary sewer sizing indicated Ø200mm sanitary mains would be of adequate size; this will be confirmed during the detailed design phase.



11.3 Servicing – Storm Sewer and Surface Water Management

Stormwater management systems have been designed to service the proposed developments and to address changes to stormwater due to the proposed development. The stormwater management systems have been developed based on the policies, standards and guidelines defined in the Town of Westlock's Stormwater Master Plan.

Base on a meeting between WGDL and the Town on April 5, 2018 it was jointly agreed that:

- An upstream SWMF would be constructed to manage the runoff from upstream of the development; and
- The Town and WGDL would negotiate a cost-sharing arrangement for construction of the SWMF.

WGDL will provide the following:

- biophysical impact assessment report;
- stormwater management report;
- conceptual design plan;
- preliminary grading plan;
- restoration/landscape plan; and
- other applicable information where determined necessary by Alberta Environment and Parks.

The Combined ASP stormwater management system for the proposed developments will utilize a dual drainage concept with minor and major systems. The minor system consists of storm sewers, catch basins, manholes design to convey the 5-year or 10-year return period storm event, depending on land value, in accordance with current Town of Westlock design guidelines. The major system will convey runoff more than the 5-year storm to a SWMF via overland drainage routes (roads, swales). The SWMF's is to be sized to store runoff up to the 100-year, 24-hour storm event when discharging into the existing downstream system at 4L/s/ha. Furthered detail from ARKK Engineering Corporation is provided in the "Schedule of Accompanying Documents".

11.3.1 Minor System

The minor system has been preliminarily sized to convey the 10-year, 4-hour peak flow at the crown of the pipe for the high value commercial developments within the Westgate Business Park. The minor system for the other portions of the developments have been sized to convey the 5-year, 4-hour peak flow at the crown of the pipe system. Figure 2 show the proposed manhole and pipe layout and pipe sizes. The minimum slopes and depth of cover generally conform to the design standard. During detailed engineering the pipe system layout, depth, and size will be optimized as the grading plans are finalized and optimized for construction.

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11.3.2 Major System

The major storm system will consist of streets, gutters, and swales. The system will direct runoff that exceeds the capacity of the minor system toward the SWMF's. The design of the major system will be performed and optimized during detailed design phase along with the grading plan.

11.3.3 Stormwater Management Facility (SWMF)

The purpose of a SWMF is to off-set the increased runoff volume and peak flow that results from developing land (increased imperviousness). This allows upstream development to occur while maintaining the pre-development risk of flooding for the downstream areas, for the 100-year design event. The purpose of a SWMF is to control the 100-year, 24-hour peak flow to 4 L/s/ha (as per Town's requirements) and store the runoff volume until downstream system capacity is available to drain the SWMF. Following the 100-year design storm, the water level should reduce to the Normal Water Level (NWL) or base of pond (dry pond) within 96 hours so storage is available for subsequent events.

The proposed developments will have two SWMF's:

- Pond 1, which will be a wetlands; and
- Pond 2, which will be a dry pond.

Pond 1 will be constructed in the location of the temporary pond in the future Greenfield Estates. The temporary pond will need to be modified to meet the needs of the development and to conform to the design standards. As wetlands, Pond 1 will have a NWL controlled by the outlet elevation, which is dictated by the downstream system elevations. A 2 to 2.5m deep permanent pool will be required at the inlets and outlet of the facility to promote settlement and collection of sediment. A control structure (manhole with an orifice) will be constructed at the outlet of Pond 1 to limit outflow to the allowable rate. The high-water level (HWL) is to be no more than 2 m above the NWL, during the 100-year design storm.

Pond 2 will be constructed as a dry pond. This will reduce costs through reduced excavation and simplification of inlet and outlet structures. Pond 2 will conform to the Town of Westlock Standards which include:

- maximum water level fluctuation of 2 m for the 100-year storm event;
- flow bypass (ditch) for the 5-year design event;
- maximum horizontal to vertical side slope shall be 7:1;
- pond bottom and side slopes shall be grass covered (seed or sod);
- erosion protection measures shall be used when required by the Town Engineer;
- inlets and outlets shall utilize trash racks and proper security measures to limit human access into the structures;
- Sediment traps, or hard bottom pre-treatment sumps, shall be provided at each inlet; and
- Minimum detention time of the full pond volume shall be 24 hours



Given the configuration and topographic limitations of the site, the following Town Standards are likely not practical or achievable and deviations will be required. WGDL and ARKK will work with the Town during detailed design of Pond 2 to adequately resolve these challenges:

- Minimum effective length to effective width ratio shall be from 2:1 to 5:1.
- Minimum longitudinal slope of pond bottom shall be 2%.
- Minimum lateral slope of pond bottom shall be 1%.
- French drains (pond underdrain system) shall be provided in the pond bottom where longitudinal slopes are less than 2%.

Overflow routes will be provided for both ponds to minimize the risk of flooding should discharge become reduced. The overflow route for Pond 1 consists of an east-west oriented paved pathway at the north-west corner that would connect the Rotary Trail pathway to the proposed pathway around Pond 1. Removal of trees and a portion of the fence would be required. Additionally, the existing Rotary Trail will need to be regraded for a length of approximately 100 m for the overflow route. Pond 2 would overflow into the roadway through Greenfield Estates and connect to Pond 1

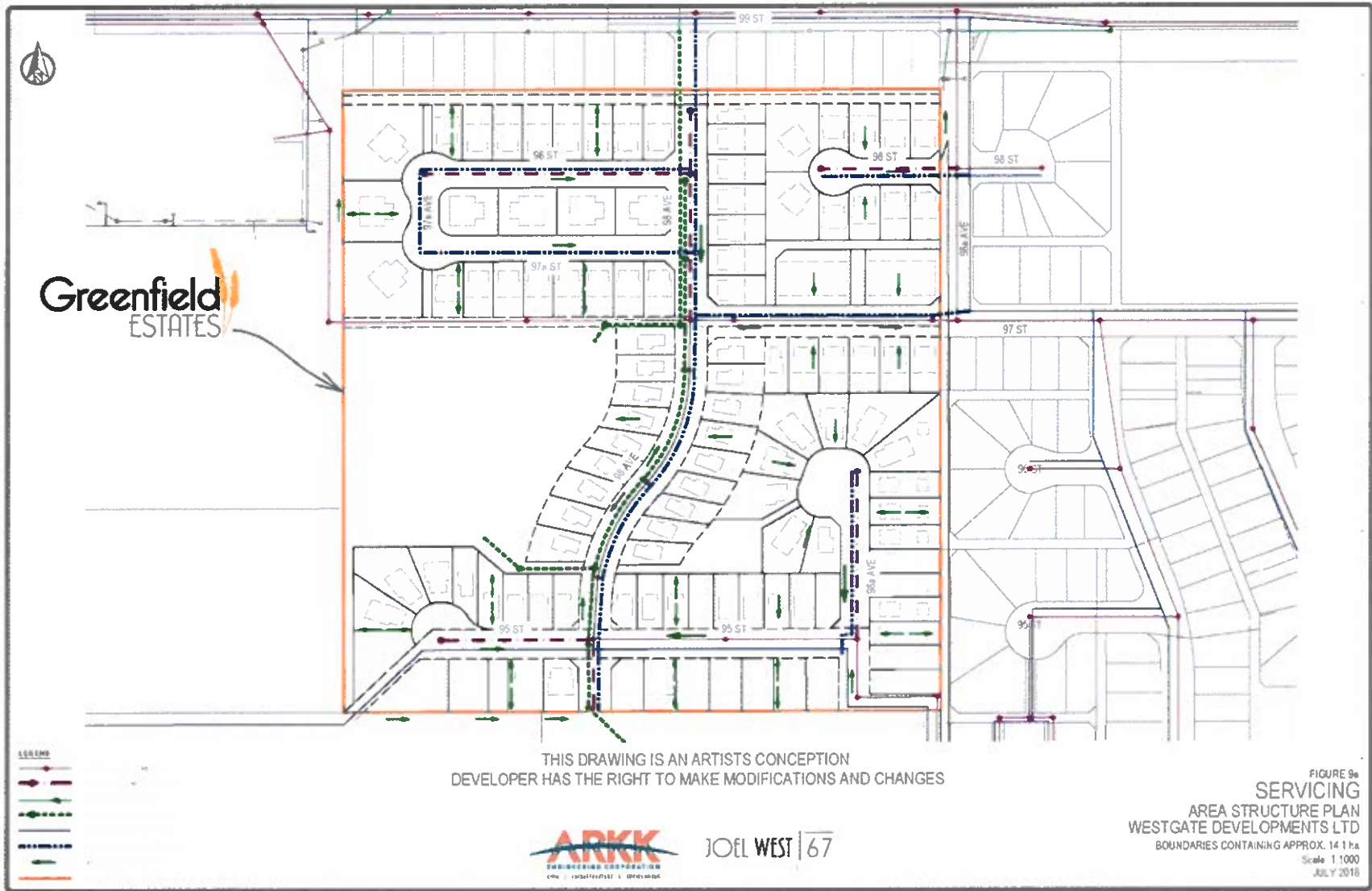
11.4 Servicing – Shallow Utilities

It is anticipated that natural gas, power, cable TV, data and telephone services will be provided through extensions of the existing systems.

The shallow utilities will be extended from the existing adjacent neighborhoods. These utilities will be placed underground, and the developer will grant rights-of-way. Alternative non-typical shallow utility alignments will be required to implement the pedestrian corridor.

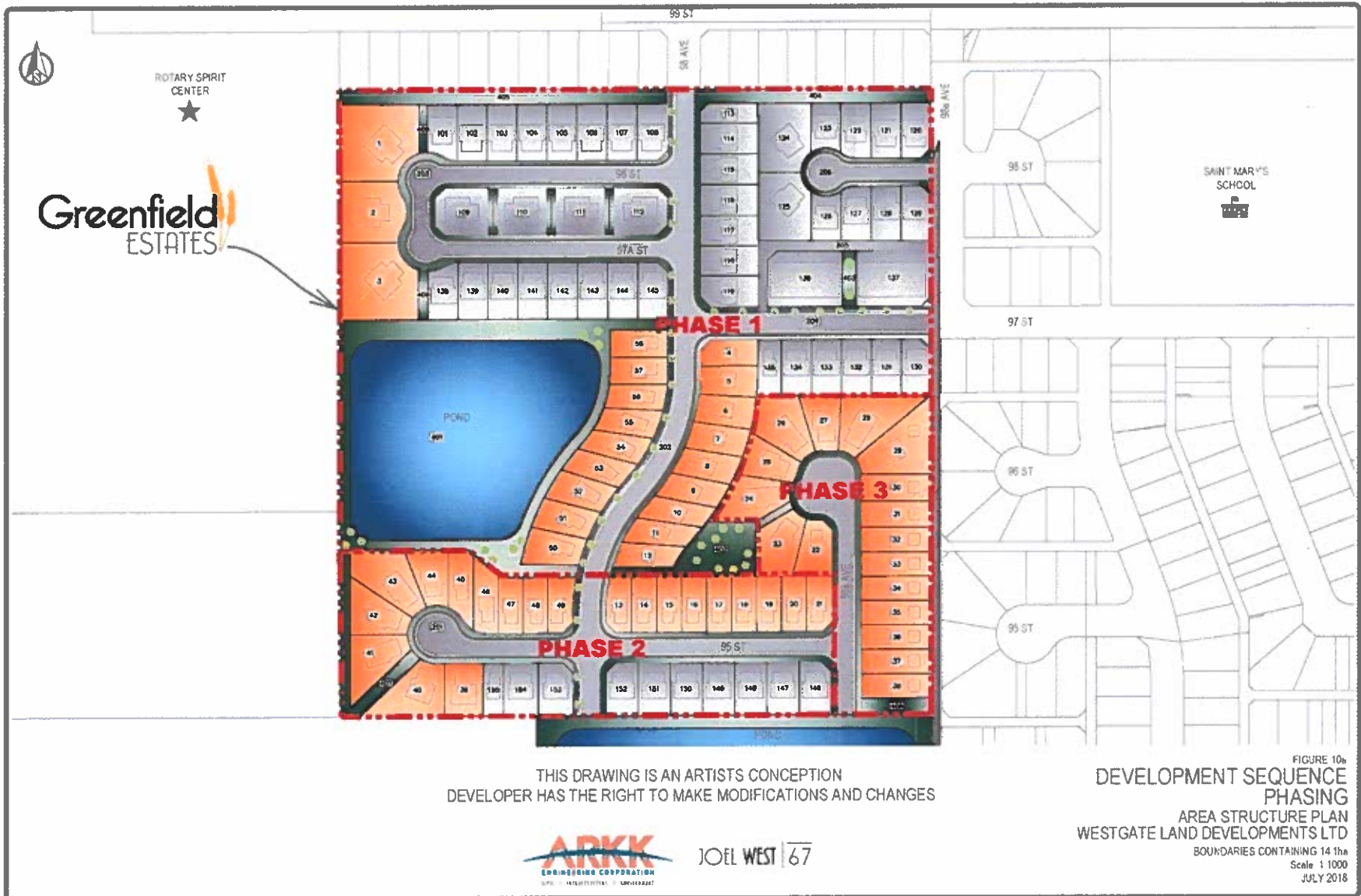


11.6 Figure 9a Servicing Greenfield Estates (amended)



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12.2 Figure 10a Greenfield Estates Development Sequence Phasing (amended)



13.0 Architectural Guidelines

The purpose of design guidelines is to provide direction for development to ensure the vision and objectives of the Plan are met. The guidelines are intended to be applied in a flexible manner and may be varied or revised as determined appropriate. To achieve the optimal design solution, it is anticipated that negotiation and innovation will occur in relation to the guidelines.

Architectural guidelines will be submitted to the Town of Westlock and tied to title upon plan of Survey
General Guidelines

The following general guidelines will apply to all areas and development within the Plan.

1. Built Form
 - a. Development is designed:
 - i. to ensure that active frontages are oriented towards the street.
 - ii. for individuality and identity with architectural character that provides visual interest and avoids monotonous massing (e.g., by using high quality building materials, architectural detailing, varying roof pitches, stepping down development on grades etc.).

The Combined ASP provides a variety of housing and commercial mixed-use lots, which accommodate a variety of residential and commercial building types and styles.

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References

Area Structure Plan Framework and References

A wide range of the Town of Westlock plans, policies and guidance documents have been influential in the preparation of the Westgate Developments Ltd. Combined Area Structure Plan. Some of these documents have been referenced within the main body of the ASP and consideration should be given to these documents at the Outline Plan, Subdivision and Development Permit stage for any development in the Plan area.

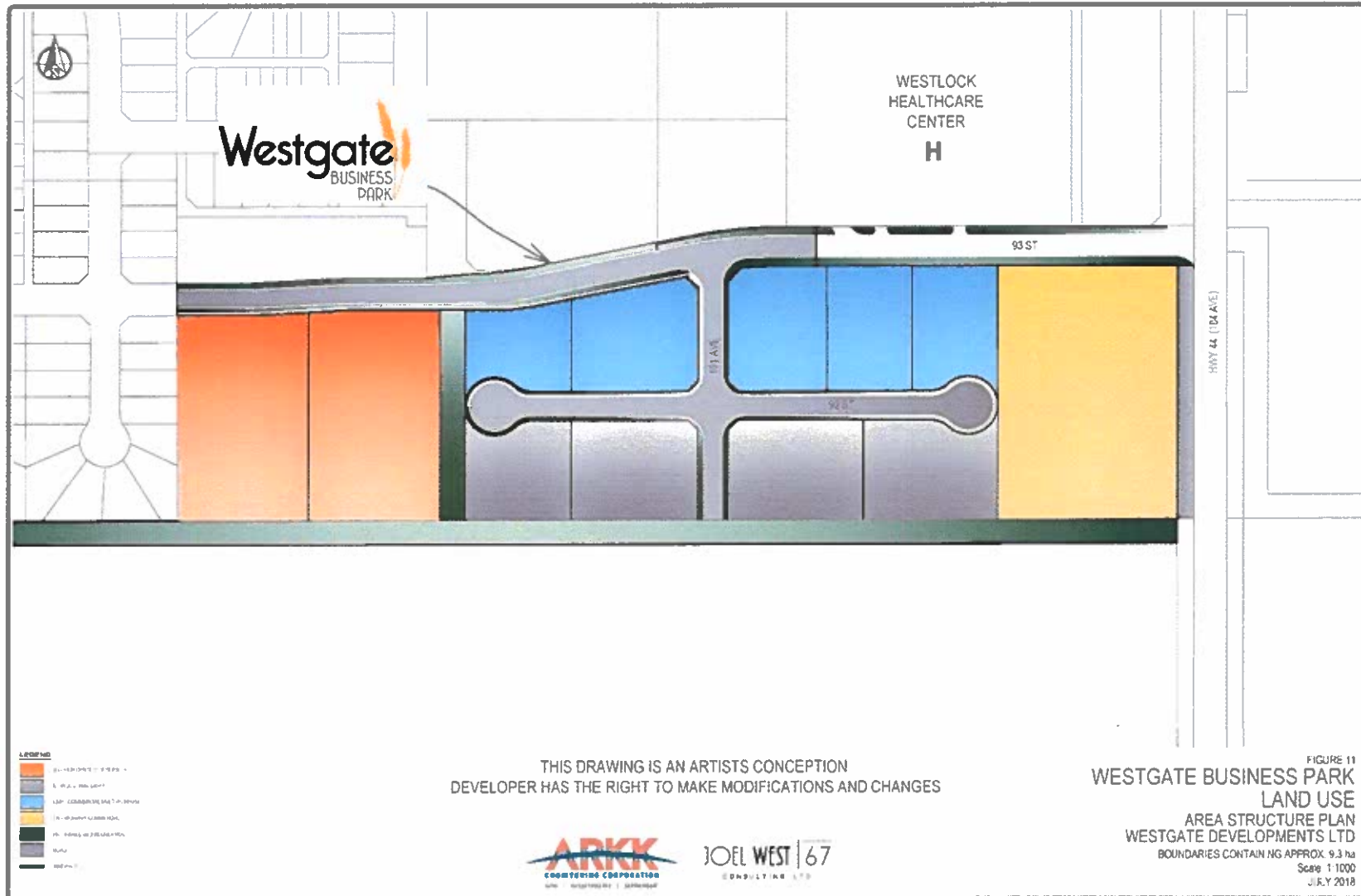
The reference documents are listed below and their consideration within the preparation of the Plan is summarized with:

- Town of Westlock Municipal Development Plan – Bylaw 2015.03, May 2015
- Town of Westlock Procedures and Design Standards for Development - October 2009
- Town of Westlock Land Use Bylaw 2015-02, May 2015
- Province of Alberta Municipal Government Act - January 1, 2017
- Environmental Development Review Policy, 2006.

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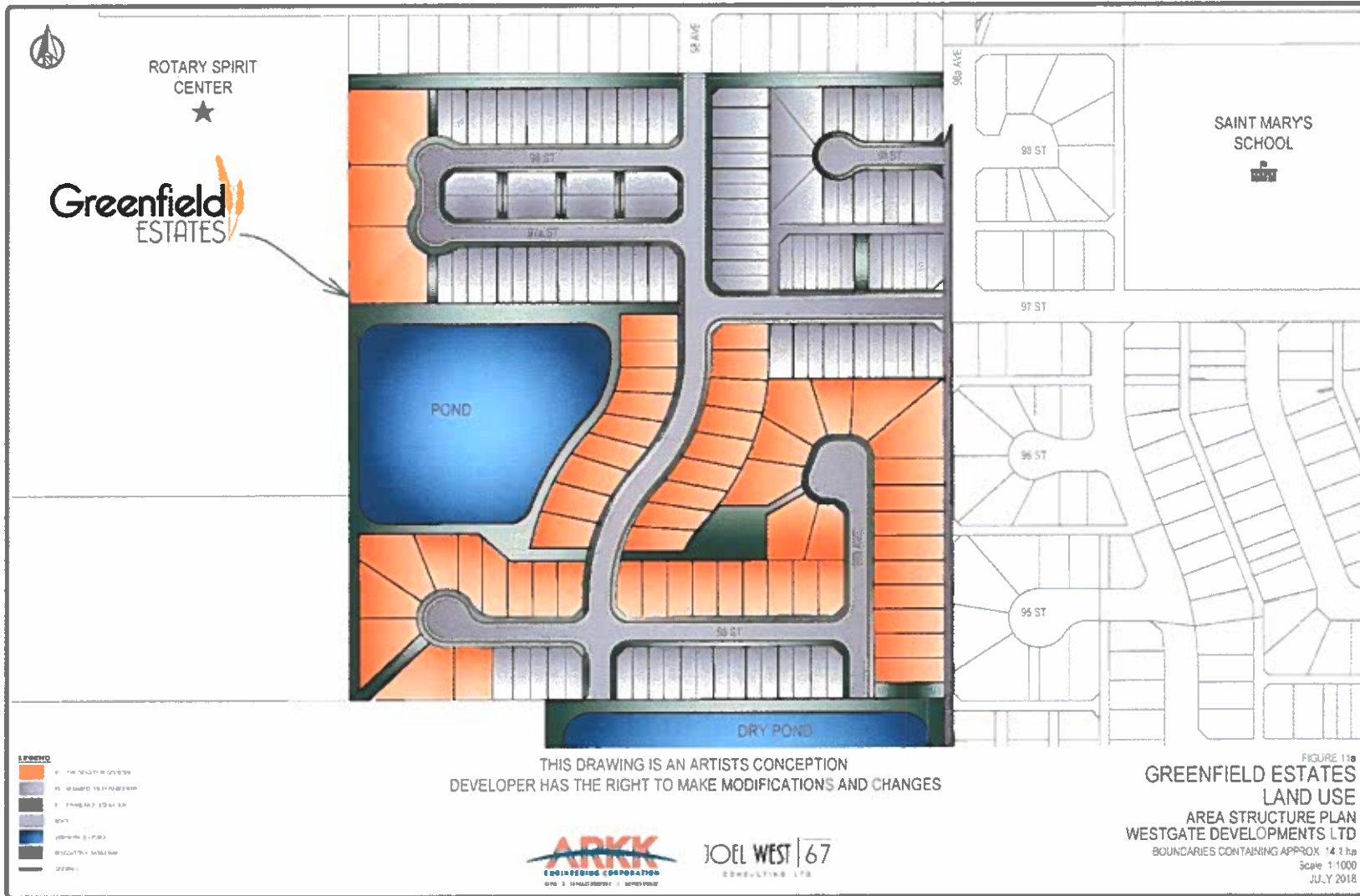
Appendix A – Land Use Bylaw Westgate Business Park Amendment

Figure 11 Westgate Business Park (amended)



Appendix A Land Use Bylaw Greenfield Estates Amendment

Figure 11a Greenfield Estates (amended)



Appendix B Emergency Access

Figure 12 Greenfield Estates



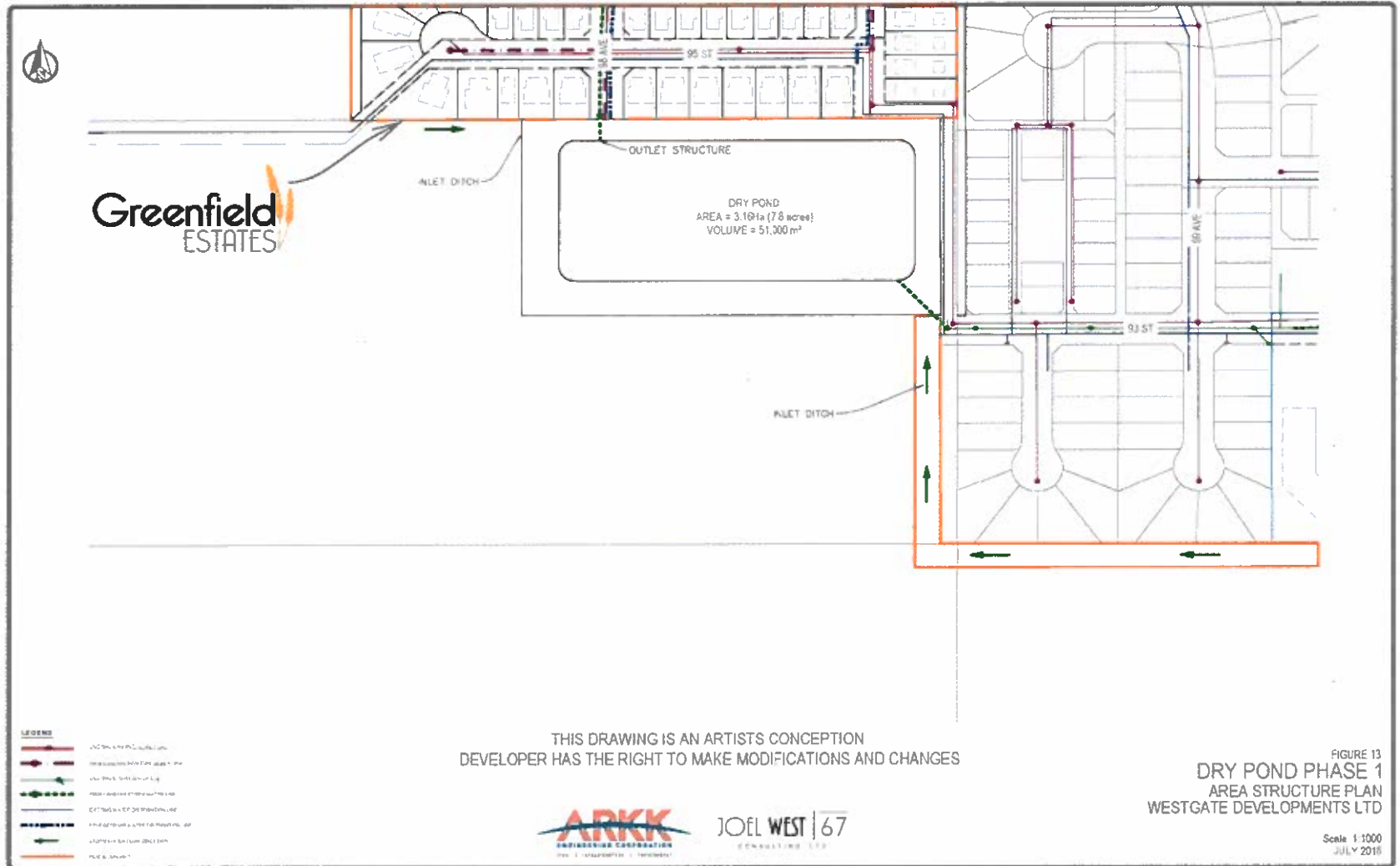
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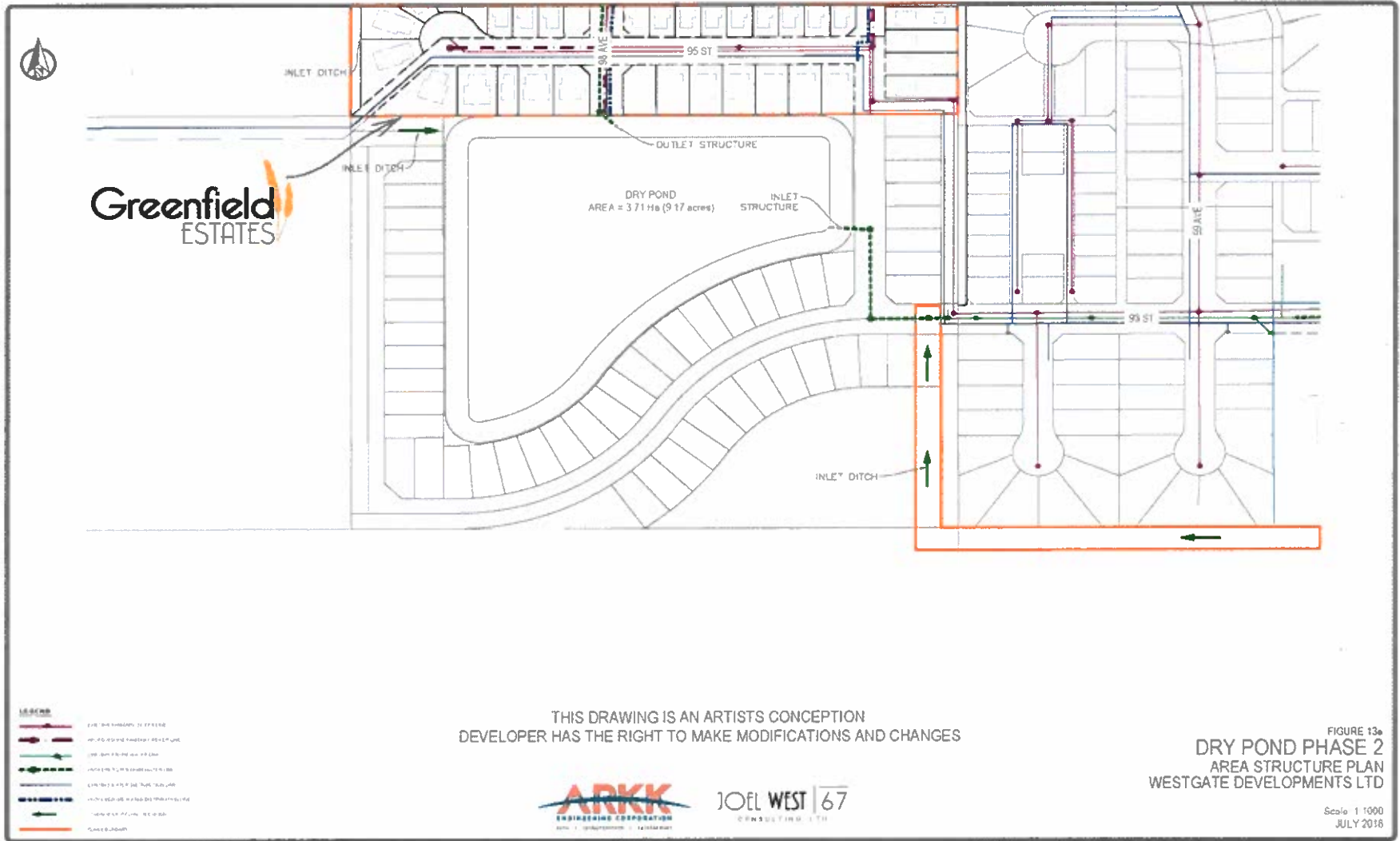
Appendix C – Surface Water Management Sequencing (amended)

Figure 13 Dry Pond – Surface Water Management Facility Phase 1



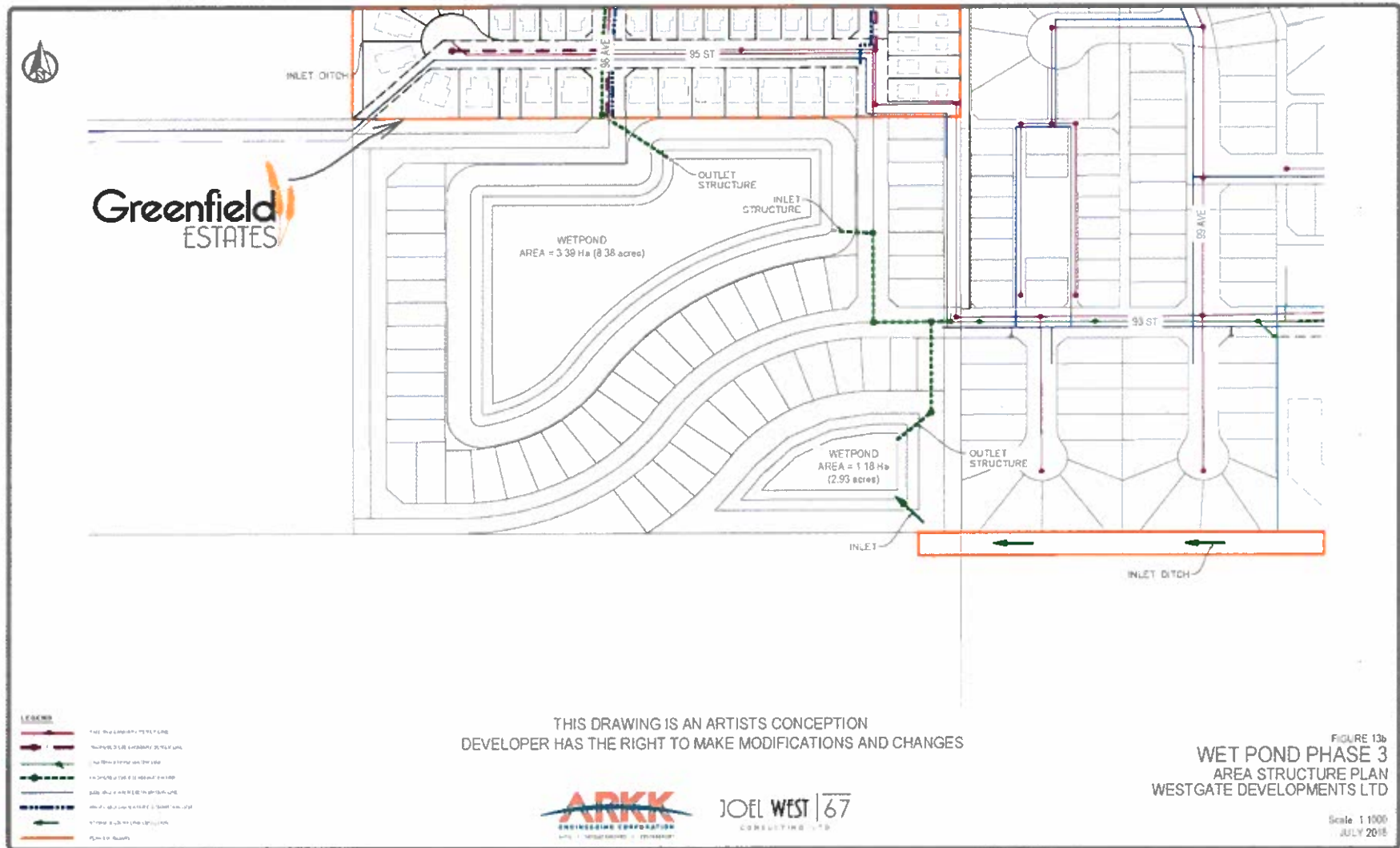
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JD

Figure 13a Dry Pond – Surface Water Management Facility Phase 2



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64 *[Handwritten initials]*

Figure 13b Wet Pond – Surface Water Management Facility Phase 3



65

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Schedule of Accompanying Documents

1. Desktop Biophysical Assessment for Greenfield Estates and Westgate Business Park – May 1, 2017
Author: ECOVENTURE INC.
2. Geotechnical Report for Greenfield Estates and Westgate Business Park
Author: ARKK Engineering Corporation
3. ESA Phase One for Westgate Business Park and Greenfield Estates
Author: ARKK Engineering Corporation
4. Storm Water Management Plan for Westgate Business Park and Greenfield Estates
Author: ARKK Engineering Corporation
5. Traffic Impact Assessment for Greenfield Estates
Author: ARKK Engineering Corporation
6. Traffic Impact Assessment for Westgate Business Park
Author: ARKK Engineering Corporation



GLOSSARY

Abbreviations:

ASP: Area Structure Plan

BIA: Biophysical Impact Assessment

DP: Development Permit

ER: Environmental Reserve

ESA: Environmentally Significant Area

IDP: Intermunicipal Development Plan

LID: Low Impact Development

MDP: Municipal Development Plan MGA:

Municipal Government Act MR: Municipal Reserve

TIA: Traffic Impact Assessment




General Definitions

The following general definitions shall apply:

1. **Approving Authority** means the Subdivision Authority, Development Authority or Subdivision and Development Appeal Board of The Town of Westlock, as the context implies.
2. **The Town** means The Town of Westlock
3. **Concept Plan** means a Plan submitted at the Outline Plan/Land Use Amendment application stage at the discretion of the Approving Authority, showing the relationship of the design of the subject site with adjoining parcels, the possible development of adjoining parcels, and/or the next phases of development. A Shadow Plan may include, but not limited to land use patterns, environmental features, road network and pathway connections.
4. **Core Infrastructure** means water utilities, transportation and facilities regard to accommodate subdivision and development activity in the ASP area.
5. **Council** means the Council of The Town of Westlock.

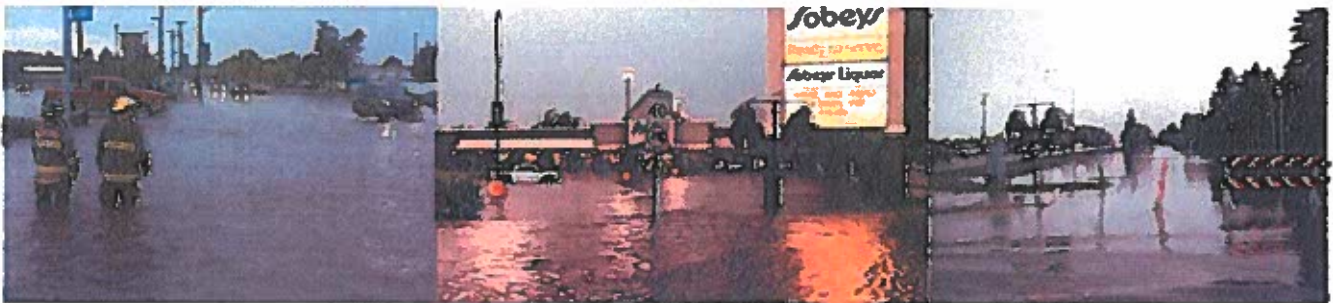
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STORMWATER MANAGEMENT PLAN

GREENFIELD ESTATES AND WESTGATE BUSINESS PARK

Presented to
Westgate Developments Ltd.



July 11, 2018
Re-Issued for Use
17-002-CI-REP-0003

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17-002 – Stormwater Management Plan, Greenfield Estates and Westgate Business Park							
Rev	Description	Originator	Review	Corporate Approval	Date	Client Approval	Date
A	Issued for Review	RF	NR	FQ	08-MAY-17	N/A	N/A
B	Issued for Use	RF	NR	FQ	02-JUN-17	N/A	N/A
1	Re-Issued for Use	RF	NR	FQ	28-JUN-17	N/A	N/A
2	Re-Issued for Use	RF	NR	FQ	11-JUL-18	N/A	N/A

Project: 17-002 - Westgate Land Development, 3.0 Report, 2.0 - Final Report, Stormwater Management Plan Rev: 2017-07-01-05
 03/27/2018

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APPENDIX 1 – DRY POND LETTER FROM TOWN OF WESTLOCK

APPENDIX 2 – PROPOSED SYSTEM DATA TABLES

APPENDIX 3 – SKETCH OF PROPOSED STORM SYSTEM

EXECUTIVE SUMMARY

The purpose of this report is to support an amendment to the Area Structure Plan (ASP) for the Greenfield Estates and Westgate Business Park developments (the developments). Although the ASP has been approved by the Town, the amendment is required due to a change in the proposed stormwater management system. The changes to the system include:

- adjustments to the location of the ditch along the southern edge of the West Gate Business Park, and
- a change from wetlands to a dry pond for southern stormwater management facility (Pond 2, referred to as Pond H in ARKK 2017a).

Since submission of the ASP, additional analysis has been completed. Therefore this document provides:

- an assessment of the existing conditions and existing system capacity;
- information on the proposed stormwater management system (updated);
- an assessment of change in flood risk with the proposed development, and
- definition of the portion of storage volume in Pond 2 that is required to manage upstream runoff and the portion required to manage increased runoff from the developments.

The existing storm system downstream of the developments does not meet the Town's standards in terms of flood risk. These downstream conditions, along with the large watershed upstream of the developments, make it challenging for the development to meet the Town's design standards in terms of flood risk.

The proposed stormwater management system allows the development to meet Town's standards in terms of flood risk. The system also reduces the flood levels in the downstream system, which reduces the existing flood risk for the Town.

1 INTRODUCTION

ARCC Engineering Corporation (ARCC) was retained by Westgate Developments Ltd. (the Client) to design two proposed developments within the Town of Westlock (the Town). The developments are the Greenfield Estates (14.1 ha of residential developments) and the Westgate Business Park (9.3 ha of commercial and light industrial developments) herein referred to as “the developments”. The location of the developments are shown on Figure 1 and will be comprised of residential lots (ranging from small lot one family houses to multi family buildings), commercial lots (including multi purpose and highway commercial areas), park and recreation areas, roads, buried utilities (water, sanitary sewer, natural gas, power and street lighting) and a storm water collection system with stormwater management facilities. The Area Structure Plan (ASP) for the developments (WGDL 2017) and the supporting Stormwater Management Plan (ARCC 2017a) were accepted by Westlock Town Council during the July 17, 2017 Council Meeting (Town of Westlock 2017).



FIGURE 1 – LOCATION OF PROPOSED WGD L DEVELOPMENTS

1.1 PURPOSE

The purpose of this report is to support an amendment to the ASP for the developments. The amendment is required due to a change in the proposed stormwater management system. The changes to the system include:

- adjustments to the location of the ditch along the southern edge of the West Gate Business Park; and
- a change from wetlands to a dry pond for southern stormwater management facility (Pond 2, referred to as Pond H in ARCC 2017a).

To support the amendment to the ASP, this report provides:

- an assessment of the existing conditions and existing system capacity;
- Information on the proposed stormwater management system;
- an assessment of change in flood risk with the proposed development; and
- definition of the portion of storage volume in Pond 2 that is required to manage upstream runoff and the portion required to manage increased runoff from the developments.

2 BACKGROUND

The following points summarize activities that have occurred since the Town accepted the ASP.

- ARKK has completed a 90% engineering design for the developments in accordance with the ASP and the Town requirements;
- The Town's consultant, MPE Engineering Ltd., evaluated alternatives to Pond 2 to manage upstream runoff (MPE 2017a and MPE 2017b).
- ARKK provided a review of the suggested alternatives (ARCC 2017b).
- The Town's consultant issued a letter stating that WGD L should pay for 60% of the construction costs for Pond 2 and downstream upgrades (MPE 2018a)
- The Town's consultant completed an update to the 2009 Stormwater Master Drainage Plan (MPE 2018b).
- ARKK received the computer model for the downstream system and assessed the existing system capacity and the changes to flood risk that would occur with the proposed development.
- WGD L, the Town, and ARKK met on April 5, 2018 to discuss the management plans for the stormwater upstream of the development. During this meeting it was jointly agreed that an upstream stormwater management facility (Pond 2) would be constructed to manage the runoff from upstream of the development, and the Town and WGD L would negotiate a cost-sharing arrangement for construction of Pond 2.
- Since the meeting on April 5, 2018, WGD L has proposed that the upstream stormwater management facility be constructed as a dry pond to minimize construction costs, while providing an equivalent level of flood protection. The Town accepted this proposal in principle and issued a letter to WGD L (Appendix 1).

3 DESIGN CRITERIA AND METHODOLOGY

3.1 INFORMATION SOURCES

The stormwater management plan has been developed based on the following documents:

- Town of Westlock Procedures and Design Standards for Development (Town of Westlock 2009);
- Town of Westlock Stormwater Master Plan 2009 (ISL 2009);
- Town of Westlock Stormwater Master Plan 2018 (MPE 2018b);
- Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5 Stormwater Management Guidelines (AESRD 2013); and
- Stormwater Management Guidelines for the Province of Alberta (AEP 1999).

Additional background information included:

- the XP-SWMM computer model of the existing downstream system provided by the Town;
- design drawings for the Rotary Spirit Centre, which included elevations of the drainage system downstream of the Greenfield development at 99 Street and 97 Avenue (ISL, 2010);
- design drawings for the Sky-Rider sub-division (Altime Engineering, 2012); and
- topographic survey of the proposed development area completed as part of ARKK's design.

Two site visits were performed in April and May 2017, as well as a meeting with Town staff, to review conditions and discuss the existing drainage systems. The Town staff noted that 99 Street was flooded during the extreme rainfall event in the summer of 2016.

3.2 DESIGN CRITERIA

The stormwater management system for the proposed developments will utilize a dual drainage concept with minor and major systems. The minor system consists of storm sewers, catch basins, and manholes designed to convey the 5-year or 10-year return period storm event, depending on land value, in accordance with current Town of Westlock design guidelines.

The major system will convey runoff in excess of the 5-year storm to a Stormwater Management Facility (SWMF) via overland drainage routes (roads, swales). The SWMF is to be sized to store runoff up to the 100-year, 24-hour storm event when discharging into the existing downstream system at 4 L/s/ha. Given that the watershed area of the study area is larger than 30 ha, computer modelling is recommended for design of the stormwater management system.

It is important to note that the proposed stormwater management system has been developed with the focus of mitigating impacts of the proposed development and to meet the design standards for the proposed development.

3.3 COMPUTER MODELLING

The stormwater system was assessed using EPA-SWMM5 modelling software and Autodesk Storm and Sanitary Analysis 2018. As mentioned in Section 2, the Town provided an XP-SWMM computer model of the existing storm system. Based on this model, ARKK assessed the existing system capacity and effects of the proposed development. The existing system model was reviewed and adjusted based on additional information ARKK obtained through design of the developments, as detailed below. The existing model was then modified to include the proposed development (changes to imperviousness, watershed slopes, and expansion of the hydraulic system to include the proposed manholes, pipes, and SWMF's). Comparison of model results before and after the development is critical to understanding changes to flood risk due to the proposed development.

The 10-year, 4-hour storm was used to size the system draining the commercial lots in the Westgate Business Park. The 5-year, 4-hour storm was used to size the minor system in the other areas. Ditches were sized based on the 100-year, 4-hour storm. The 100-year, 24-hour storm was used to assess the size of the SWMFs. Table 1 provides a summary of the design rainfall events.

TABLE 1 – DESIGN RAINFALL EVENTS

RETURN PERIOD, DURATION	DEPTH (mm)	DISTRIBUTION
5-year, 4-hour	37	Chicago
10-year, 4-hour	45	Chicago
100-year, 4-hour	69	Chicago
100-year, 24-hour	126	HUFF

Tables 2 and 3 provide a summary of hydrologic input parameters used in the model, based on the ISL (2009) Master Plan and Town of Westlock (2009) Design Standards.

TABLE 2 – IMPERVIOUSNESS VALUES

LAND USE	PERCENT IMPERVIOUS
Roadways	95
Commercial/Industrial	75
Institutional	65
Residential	50
Cultivated Farmland and Grassed Areas	10

TABLE 3 – MODEL INPUT PARAMETERS

PARAMETER	VALUE	UNIT
Depression Storage Pervious Area	6.4	mm
Depression Storage Impervious Area	3.2	mm
Manning n Pervious Area (within developed areas) ¹	0.25	N/A
Manning n Pervious Area (for upstream areas) ¹	0.17	N/A
Manning n Impervious Area	0.013	N/A
Initial Infiltration Rate	76	mm/h
Ultimate Infiltration Rate	2.5	mm/h
Infiltration Decay Coefficient	4.14	/h
Watershed Slope ²	0.8 to 1.2	%

Note:

1. The Manning n for pervious areas (i.e. undeveloped/unpaved areas) used in ISL 2009 and MPE 2018b was 0.025, which is appropriate for steel pipe or concrete. ARKK adopted values 0.25 for grass and 0.17 for crop land, based on reference values provided by EPA SWMM 5.1 manual. Higher values of Manning n provide lower peak flows.
2. Watershed slopes used in ISL 2009 and MPE 2018b were 0.7%, regardless of the actual ground slope. ARKK estimated the slope of each sub-watershed based on topographic data which allows for a more accurately representation of stormwater runoff volume and peak flow in the model.

The watershed areas in the model provided by the Town were checked and the following modifications were made:

- Addition of Watershed 126 (58.910 ha) near the Rotary Spirit Centre to Manhole 126;
- Increase of area upstream Watershed 140 from 80.47 ha to 96.4 ha to account for adjustment to the watershed boundary based on ARKK's site visits;
- Adjustment to Watershed 139 (total area of 29.578 ha) according to the sewer/catch basin location observed during ARKK's site visit and review of google earth, which indicated storm sewer is present along 97st that ties in to existing downstream at 99 St. This sewer was not present in the Town's model and was not included in ARKK's model, however, runoff from a 27.918 ha was directed to Manhole 141 (renamed sub-catchment 141#1) and watershed 139 was changed to 1.66 ha to more accurately proportion runoff in this area of the storm system.

The pipes and manholes in the model provided by the Town was reviewed the following adjustment were made:

- The rim and invert elevation of Manhole 24 were updated based on the survey data collected as part of ARKK's design.
- It was noted that approximately 40% of the runoff from the 100-year storm was being lost from the existing model due to manhole surcharge. Figure 2 provides a screen capture of model results using the based on the Town's existing system model. The volumes in yellow font represent the sum of losses from the model within the clouded areas. These losses results in underprediction of flood levels in the downstream system. To account for the overflow, ARKK added channels in the model to represent the road surfaces. This allows runoff to overflow manholes and re-enter the downstream system, which more accurately represents flood risks and the existing system capacity.



FIGURE 2 – FLOODING LOSSES (100-YEAR, 24-HOUR STORM) TOWN'S EXISTING SYSTEM MODEL

4 EXISTING CONDITIONS

An understanding of the existing system is important when preparing a stormwater plan to ensure the proposed design integrates with the existing system and functions in a manner that provides the level of flood protection required in the Town's standards. This section provides a summary of existing drainage patterns and features around the developments as well as an evaluation of the existing system capacity.

4.1 EXISTING DRAINAGE PATTERNS

Figure 3 shows the general drainage patterns around the developments. Runoff from south of the developments flows into the existing storm system along 99 Street. Along the west, north, and east boundaries of the developments, runoff generally flows north and is also collected in the existing storm system. The Westlock Health Centre owns and operates a stormwater drainage system and a lift station that directs runoff from the area into the Town's stormwater system along Highway 44. The east portion of the Westgate Business Park drains north and into a small depression west of the hospital's helipad. During extreme storm events, runoff collected in this depression would overflow to the northwest and into the Town's drainage system.

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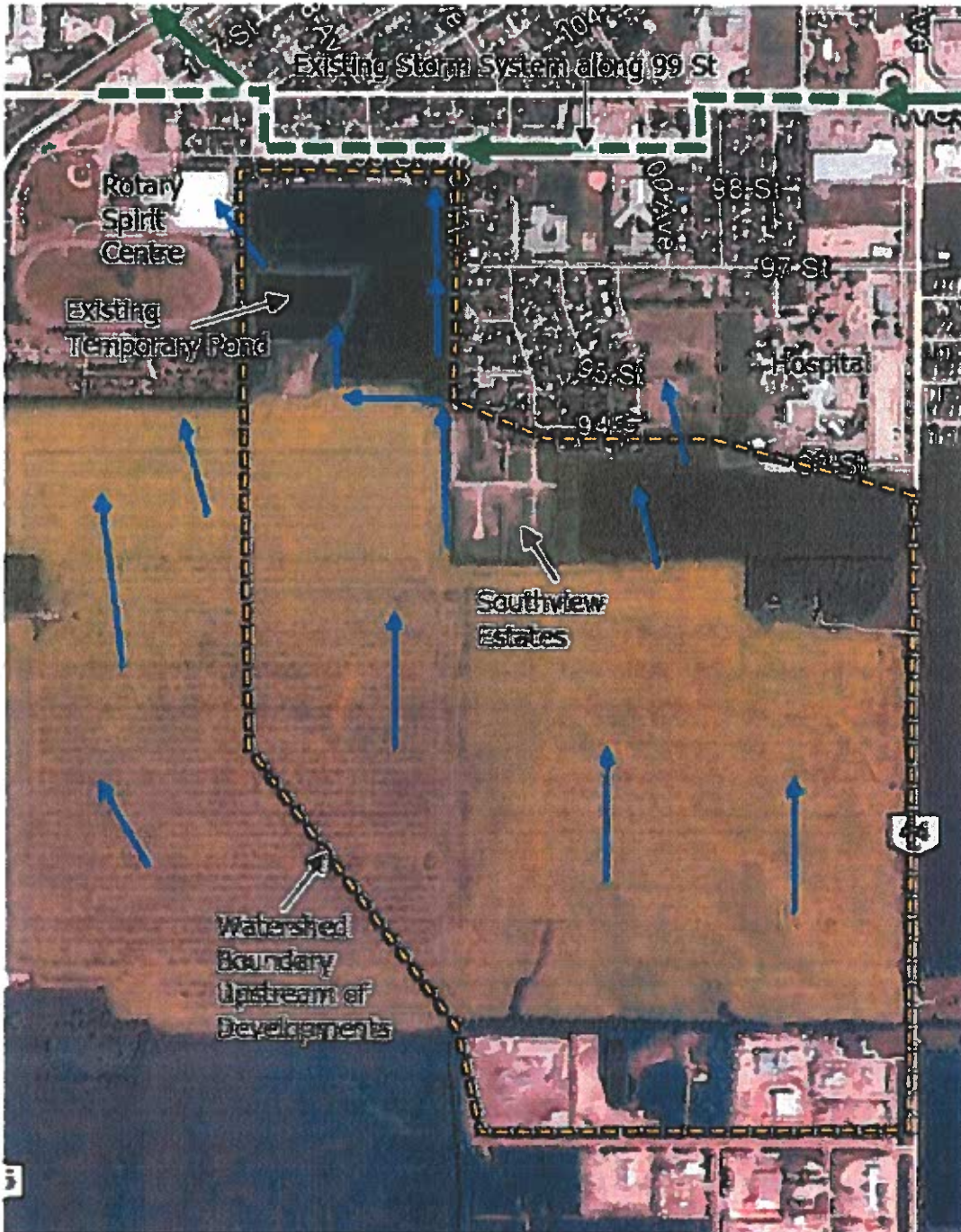


FIGURE 3 – EXISTING DRAINAGE PATTERNS IN THE AREA OF THE DEVELOPMENTS

A partially constructed residential development (Estates of Southview) exists between the proposed developments. It is ARKK's understanding that work on this development has ceased indefinitely. A storm sewer system was constructed within the Estates of Southview to convey runoff through and from the development. A ditch and temporary pond were also constructed as part of the development.

The west portion of the proposed Westgate Business Park drains west and to a 600mm diameter Inlet into the storm drainage system of Southview Estates. The condition of this existing storm drainage system was reviewed by WSP (2015). The assessment found that the catch basin leads were connected directly to the pipe, reinforcement had been exposed and mass concrete was left partially blocking the 600mm diameter inlet diameter pipe. The invert elevations were not surveyed (as-built) and should be confirmed prior to detailed design. The road is not finished, and the catch basins and other components appear to be blocked with sediment. The current condition of the system is not considered functional. The system should be remediated prior to being relied upon for the proposed developments.

The temporary pond is located within the proposed Greenfield Estates area as shown in Figure 3. No Water Act or Environmental Protection and Enhancement Act Approvals were found for the pond on the Alberta Environment and Parks Authorization Viewer (AEP 2017). The temporary pond currently has no outlet. When it is full, the water backs up overflows into the ditch along the east side of the proposed Greenfield Estates development (98a Avenue). This overflow condition was observed during a site visit on April 26, 2017. The elevation where the ditch overflows is similar to the low point along the west edge of the pond; therefore, it is likely that pond would also overflow to the north west and into the parking lot of the Rotary Spirit Centre. During the April 26, 2017 site visit, the water level in the pond was at the point of spilling in this direction. It is likely that the existing lots between the two proposed developments would also flood when the pond overflows. Based on discussion with local residents, this area has a history of frequent flooding. The ditch along 98a Avenue drains into the storm sewer along 99 Street. The northeast corner of the proposed Greenfield Estates development also drains to this point.

The northwest corner of the proposed Greenfield Estates development drains north west and into the parking lot of the Rotary Spirit Centre. As noted above, during an extreme rainfall event, it is likely that the pond would also overflow in this direction.

4.2 EXISTING SYSTEM CAPACITY

The existing capacity of the system downstream of the developments was assessed using the XP-SWMM model provided by the Town, with the modifications described in Section 3. Town's standards state that the 5-year, 4-hour storm should be conveyed within the storm pipe system (at or below the top of pipe). For the 100-year, 24-hour storm it is acceptable for stormwater to flood the pipe system and flow on the ground surface if properties do not flood (runoff 3 m from buildings).

Figure 4 shows the 5-year, 24-hour storm depth along the Town's storm system. It is apparent that the water level is above the top of pipe for much of the system, therefore the system is over capacity.

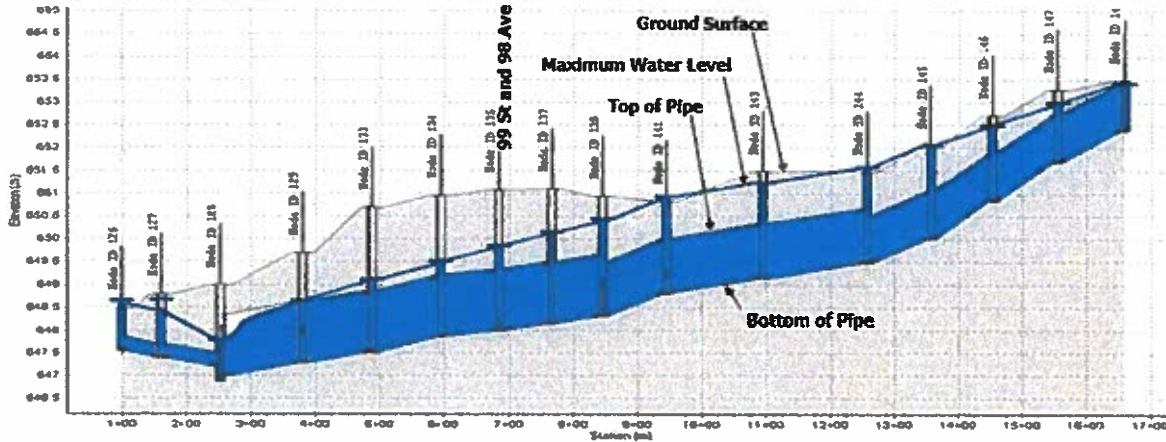


FIGURE 4 – MAXIMUM WATER LEVEL FOR EXISTING STORM SYSTEM ALONG 99 ST - 5-YEAR, 4-HOUR STORM

Figure 5 shows the 100-year, 24-hour storm depth along the Town’s storm system relative to the ground and top of pipe. The modelling result suggests the pipe system is completely flooded and runoff is flowing overland.

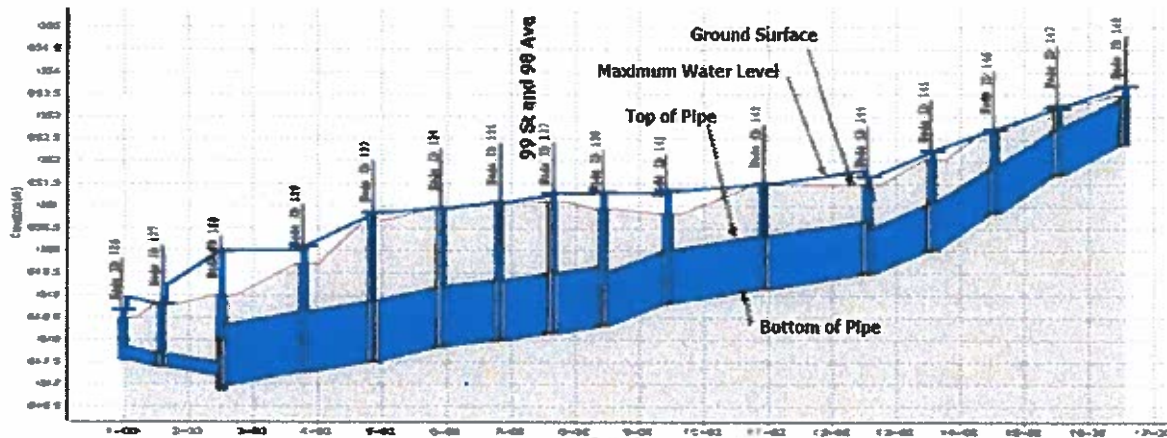


FIGURE 5 – MAXIMUM WATER LEVEL FOR EXISTING STORM SYSTEM ALONG 99 ST - 100-YEAR, 24-HOUR STORM

The results shown in Figure 5 match well with the photos taken during the extreme storm that occurred on 22 August 2016, Figure 6. The rainfall was slightly less than the 100-year, 24-hour design storm; however, it provides useful context for the existing system capacity.

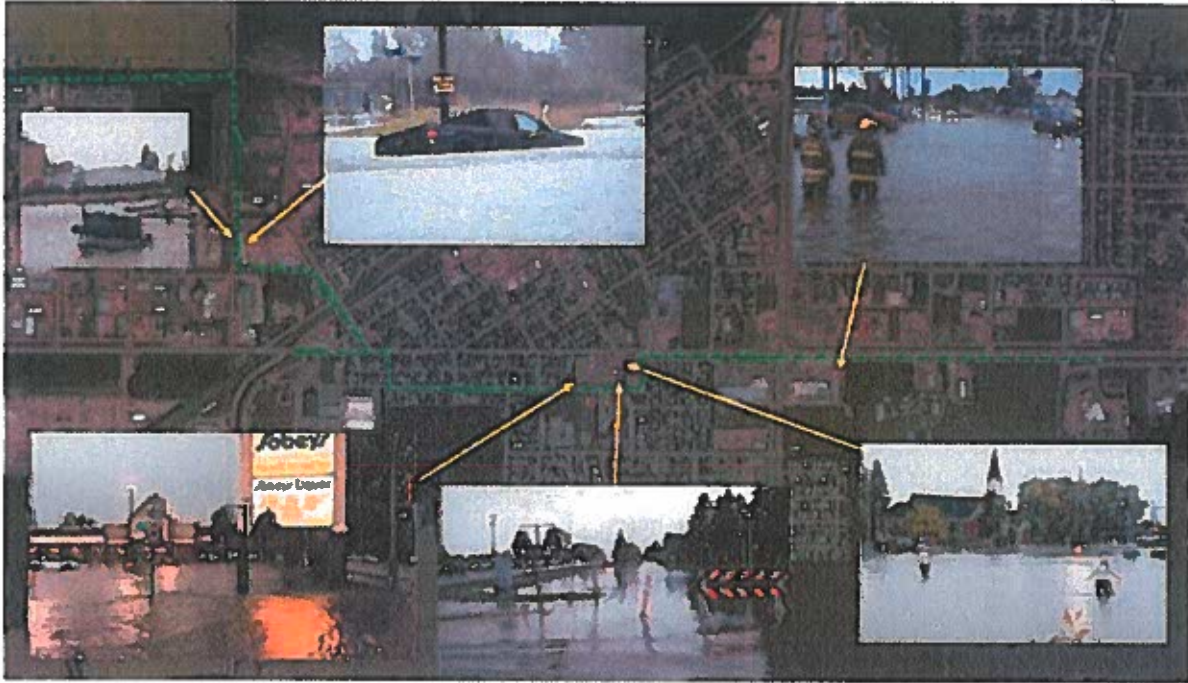


FIGURE 6 – PHOTOS OF FROM WESTLOCK FLOOD ON 22 AUGUST 2016

Additionally, the runoff rate from the undeveloped lands and south of the developments was estimated to be 19 L/s/ha during the 100-year, 24-hour storm, based on the existing system model. This is about four times higher than the allowable release rate for SWMF's in the Town's standards. This means that substantial storage would be required to reduce flows from 19 to 4 L/s/ha, given the large watershed upstream of the development.

5 PROPOSED STORMWATER MANAGEMENT SYSTEM

The proposed stormwater management system consists of a minor system (catch basins, manholes, and pipes) and a major system (overland flow routes and two SWMF's: Pond 1 (wetlands) and Pond 2 (dry pond)). Figure 7 provides a schematic of the proposed stormwater management system. Appendix 3 provides a sketch of the system. Additional details on the system are provided in the sections below.

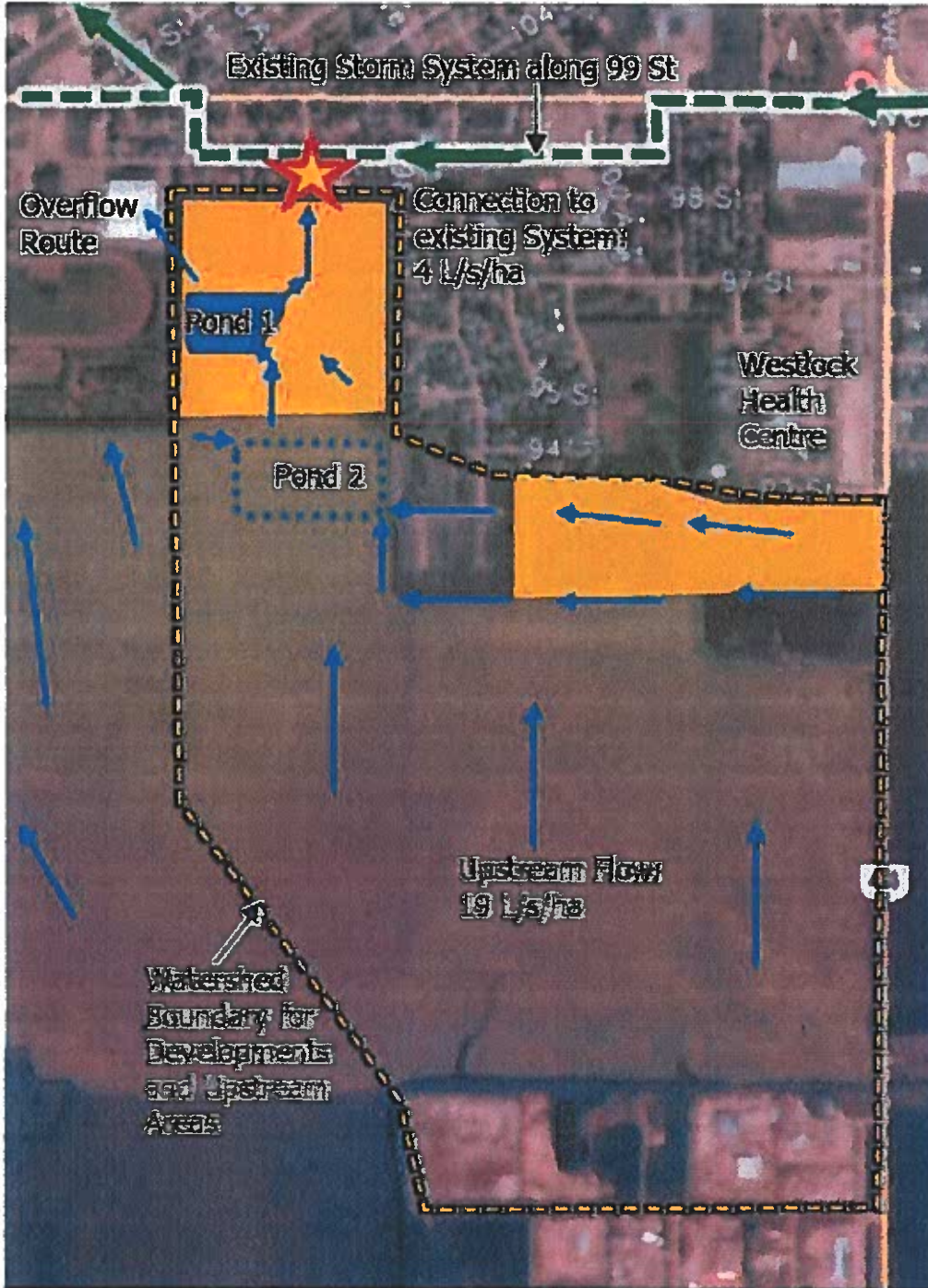


FIGURE 7 – PROPOSED STORMWATER MANAGEMENT SYSTEM

5.1 MINOR SYSTEM

The minor system has been sized to convey the 10-year, 4-hour peak flow at the crown of the pipe for the high value commercial developments within the Westgate Business Park. The minor system for the other portions of the developments have been sized to convey the 5-year, 4-hour peak flow at the crown of the pipe system. Ditches are sized to convey the 100-year, 4 hr storm.

The minimum slopes and depth of cover generally conform to the design standard. During detailed engineering the pipe system layout, depth, and size will be optimized as the grading plans are finalized and optimized for construction. Appendix 2 provides a summary of the watershed characteristics used in the model as well as a summary of the pipe conditions.

Figure 8 provides a comparison in the flood levels for the 5-year, 4-hour storm with and without the proposed development. The proposed development reduces the water level near the connection point of the developments to the existing system (99 St and 98 Ave). This reduction in water level is a result of the stormwater being stored in the ponds.

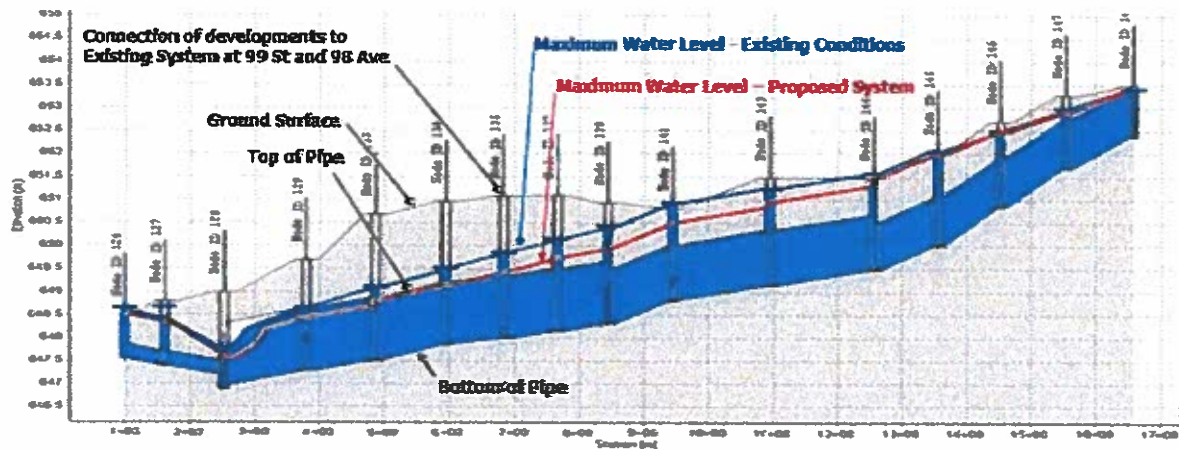


FIGURE 8 – PROPOSED STORMWATER MANAGEMENT SYSTEM

5.2 MAJOR SYSTEM

The major storm system will consist of ditches, streets, gutters, and swales. The system will direct runoff that exceeds the capacity of the minor system toward Pond 1 and Pond 2 in general accordance with the Town's standards. Optimization of the systems will be completed in detailed engineering.

Figure 9 provides a comparison in the flood levels for the 100-year, 24-hour storm with and without the proposed development. The proposed development reduces the water level near the connection point of the developments to the existing system (99 St and 98 Ave). This reduction in water level is a result of the stormwater being stored in the ponds. The sections of sewer downstream and slightly upstream would meet

and exceed the design standard with the proposed system. Therefore the proposed system is reducing the flood risk for the Town's downstream system.

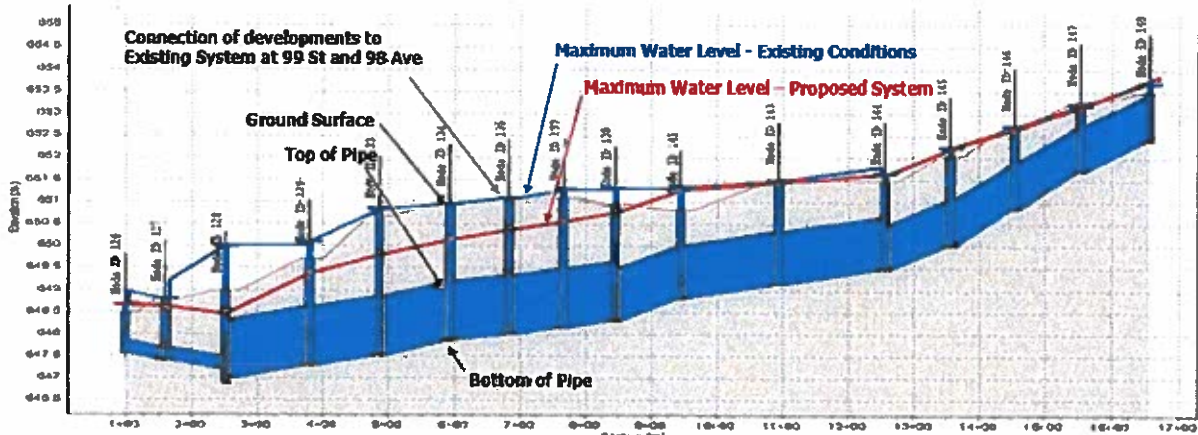


FIGURE 9 – PROPOSED STORMWATER MANAGEMENT SYSTEM

5.3 STORMWATER MANAGEMENT FACILITIES

The purpose of a SWMF is to off-set the increased runoff volume and peak flow that results from developing land (increased imperviousness). This allows upstream development to occur while maintaining the pre-development risk of flooding for the downstream areas, for the 100-year design event. The purpose of a SWMF is to control the 100-year, 24-hour peak flow to 4 L/s/ha (as per Town's requirements) and store the runoff volume until downstream system capacity is available to drain the SWMF. Following the 100-year design storm, the water level should reduce to the Normal Water Level (NWL) or base of pond (dry pond) within 96 hours so storage is available for subsequent events.

The proposed developments will have two SWMF's:

- Pond 1, which will be a wetlands; and
- Pond 2, which will be a dry pond.

Pond 1 will be constructed in the location of the temporary pond in the future Greenfield Estates. The temporary pond will need to be modified to meet the needs of the development and to conform to the design standards. As wetlands, Pond 1 will have a NWL controlled by the outlet elevation, which is dictated by the downstream system elevations. A 2 to 2.5m deep permanent pool will be required at the inlets and outlet of the facility to promote settlement and collection of sediment. A control structure (manhole with an orifice) will be constructed at the outlet of Pond 1 to limit outflow to the allowable rate. The high-water level (HWL) is to be no more than 2 m above the NWL, during the 100-year design storm.

Pond 2 will be constructed as a dry pond. This will reduce costs through reduced excavation and simplification of inlet and outlet structures. Pond 2 will conform to the Town of Westlock Standards which include:

- maximum water level fluctuation of 2 m for the 1:100 year storm event;
- flow bypass (ditch) for the 5 year design event;
- maximum horizontal to vertical side slope shall be 7:1;
- pond bottom and side slopes shall be grass covered (seed or sod);
- erosion protection measures shall be used when required by the Town Engineer;
- Inlets and outlets shall utilize trash racks and proper security measures to limit human access into the structures;
- Sediment traps, or hard bottom pre-treatment sumps, shall be provided at each Inlet; and
- Minimum detention time of the full pond volume shall be 24 hours

Given the configuration and topographic limitations of the site, the following Town Standards are likely not practical or achievable and deviations will be required. WGDL and ARKK will work with the Town during detailed design of Pond 2 to adequately resolve these challenges:

- Minimum effective length to effective width ratio shall be from 2:1 to 5:1.
- Minimum longitudinal slope of pond bottom shall be 2%.
- Minimum lateral slope of pond bottom shall be 1%.
- French drains (pond underdrain system) shall be provided in the pond bottom where longitudinal slopes are less than 2%.

Overflow routes will be provided for both ponds to minimize the risk of flooding should discharge become reduced. The overflow route for Pond 1 consists of an east-west oriented paved pathway at the north-west corner that would connect the Rotary Trail pathway to the proposed pathway around Pond 1. Removal of trees and a portion of the fence would be required. Additionally, the existing Rotary Trail will need to be regraded for a length of approximately 100 m for the overflow route. Pond 2 would overflow into the roadway through Greenfield Estates and connect to Pond 1.

Figure 10 provides the water level, storage and flow rate data for Ponds 1 and 2, based on the 100-year, 24-hour modelling results. provide stage – storage information for Ponds 1 and 2, respectively.

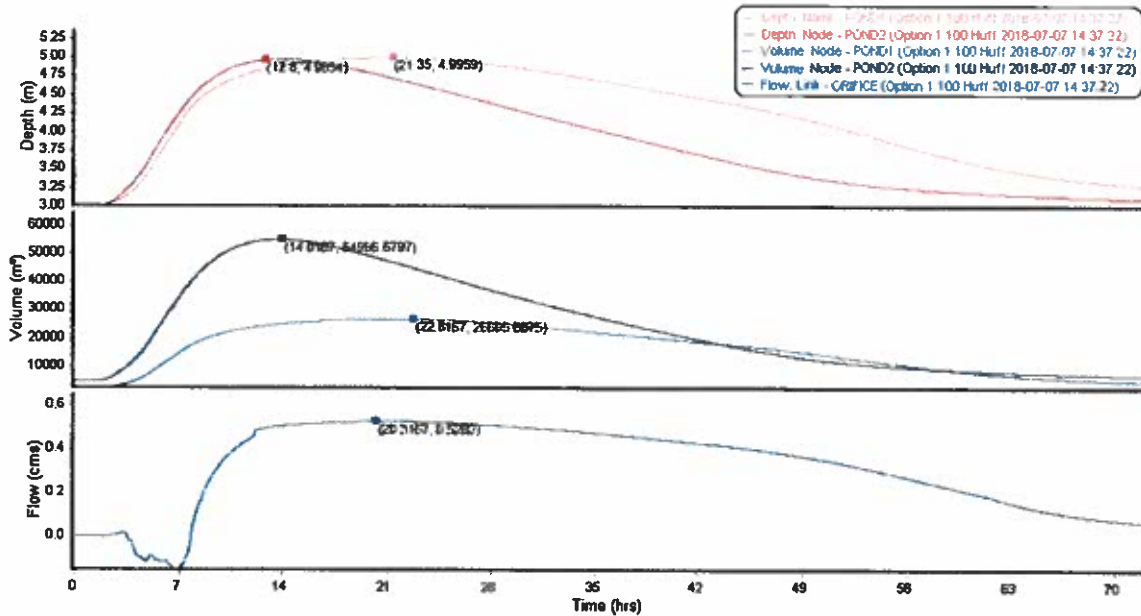


FIGURE 10 – MODELLING RESULTS FOR PONDS 1 AND 2 (100-YEAR, 24-HOUR STORM)

Table 4 provides a summary of design data for Pond 1 and Pond 2. Table 5 and 6

TABLE 4 – POND DESIGN DATA

PARAMETER	POND 1	POND 2
Type of SWMF	Wetlands	Dry Pond
Base of Permanent Pool	647.0m	N/A (Dry Pond)
Normal Water Level (NWL)	649.0 m	650.0 m
High Water Level (HWL)	651.0 m	652.0 m
Top of Freeboard	651.3 m	0 m
Watershed Area (approximate post-development)	131 ha	Connected to Pond 1
Peak Discharge from Pond (based on 4 L/s/ha)	0.52 m ³ /s ¹	Connected to Pond 1
Head (H) at HWL	1.8 m	1.8 m
Discharge Coefficient (C)	0.6	0.6
Orifice Diameter	500 mm	600 mm

Note:

1. The peak flow is based on model simulations which account for downstream head reducing capacity of the Pond 1 outlet.



TABLE 5 – POND 1 STORAGE / ELEVATION RELATIONSHIP

ELEVATION (m)	ACTIVE STORAGE VOLUME (m ³)	COMMENTS
647.0	0	Base of Permanent Pool
649.0	0	NWL (outlet elevation)
649.5	4,900	
650.0	10,700	
650.5	17,200	
651.0	24,600	HWL
651.5	32,800	

TABLE 6 – POND 2 STORAGE / ELEVATION RELATIONSHIP

ELEVATION (m)	ACTIVE STORAGE VOLUME (m ³)	COMMENTS
650.0	0	Base (outlet elevation)
650.5	10,400	
651.0	22,300	
651.5	35,800	
652.0	51,000	HWL
652.5	67,500	

5.4 POND 2 STORAGE VOLUME ALLOCATION

The proposed stormwater management system reduces the flood levels in the downstream system, which reduces the existing flood risk for the Town. As noted in Section 2, the Town has agreed with WGLD to cost-share construction of Pond 2.

In order to provide a basis for a cost-sharing arrangement between the Town and WGLD, an additional modelling simulation was completed to estimate the storage in Pond 2 that would be requirement to maintain existing flood risk.

In this simulation, the storage volume in Pond 2 was reduced until the water levels in the downstream system matched those in the existing system. The reduced Pond 2 volume was 6,200 m³, which is the portion of Pond 2 storage that is required to off-set increases in runoff due to the development. The proposed volume for Pond 2, required to manage upstream runoff and meet the Town's standards in terms of flood risk is 51,000 m³.

5.5 OPERATION AND MAINTENANCE

The operation and maintenance requirements for Ponds 1 and 2 are expected to be minimal. The control structures should be inspected and maintained periodically to ensure the orifices are not blocked with debris. Sediment collected within the permanent pools will also need to be cleaned out periodically to ensure they continue to function. Maintenance of vegetation will depend on the type of vegetation that will be

established along the fringe of the normal water level. Warning signs are recommended to protect the public when the ponds flood. For Pond 2 it is recommended that the Town have personnel to warn people when runoff fills the pond.

6 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control measures must be in place during construction to minimize soil loss from the construction site and to minimize sediment deposition in the downstream infrastructure and watercourses. A detailed erosion and sedimentation control plan will be developed prior to construction that outlines specific requirements and strategies. Potential erosion and sedimentation control measures are listed below. The City of Edmonton Erosion and Sedimentation Control Guidelines and Field Manual (City of Edmonton 2005) provides a wide range of additional measures.

- Construction sequence scheduling
- Preservation of existing vegetation
- Seeding and mulches
- Silt fences
- Check dams/dikes
- Fibre rolls
- Sediment basins, traps, barriers
- Inlet protection measures
- Dewatering

7 APPROVALS, AGREEMENTS, AND ADDITIONAL CONSIDERATIONS

It is anticipated that the stormwater system will require the following approvals and agreements to be in place:

- Town of Westlock approval;
- Servicing Agreement between Developer and Town of Westlock; and
- Environmental Protection and Enhancement Act approvals.

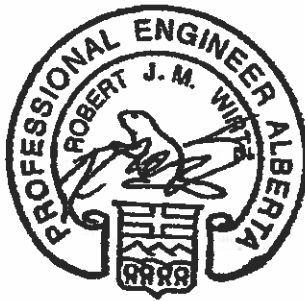
Based on a discussion with Alberta Environment and Parks, Water Act and Public Lands Act approvals would not be required for the system because no water bodies are within the proposed development and the outlet for the proposed stormwater system would discharge into the Town's existing system.

The deficiencies in the drainage system of the abandoned sub-division should be remediated before being relied upon for drainage of the proposed developments. Additionally, the lands need to be acquired for Pond 2 and designated public utility.

8 CLOSURE

This report is based on preliminary analysis of the conceptual drainage system for the developments. Additional refinement and analysis will be required during detailed design.

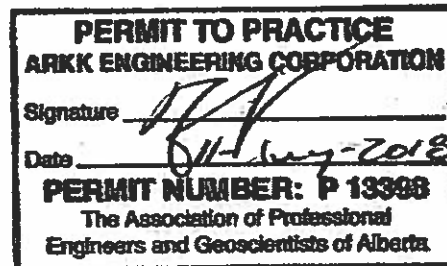
Respectfully,



11-July-2018

Rob Wirtz, P.Eng.
Senior Civil Engineer

Reviewed by:



Kyle Koza, P.Eng.
Principal

9 REFERENCES

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- Alberta Environment and Sustainable Resource Development (AESRD), 2013. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5 Stormwater Management Guidelines, March 2013.
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July/2018



APPENDIX 1 – DRY POND LETTER FROM TOWN OF WESTLOCK

July/2018

ARKK ENGINEERING CORPORATION



July 5, 2018

Westgate Developments Ltd.
310, 400 Palisades Way
Sherwood Park, AB
T8H 2T9

Attn: Tammy Joel Kerma

RE: Storm Water Management Alternative

The Town has reviewed the proposed dry pond concept submitted for review and consideration. Although the concept is not included in the Town's current Procedures and Design Standards for Development, the method is an acceptable alternative to a wet pond as per Alberta Environment standards.

The Town does not have any concern with a dry pond as the choice for the upstream storm water management. The dry pond would serve as a permanent storm water management facility within the Town's storm water management system.

Sincerely,

A handwritten signature in black ink, appearing to read 'Simone Wiley', is written over a horizontal line.

Simone Wiley
Director of Development Services

cc: Dwight Dibben
CAO-Town of Westlock

10003 – 106th Street, WESTLOCK, Alberta T7P 2K3

Telephone (780) 349-4444 Toll Free 1-866-349-4445 Fax: (780) 349-4436 www.westlock.ca

Handwritten initials in black ink, possibly 'P' and 'W', are located in the bottom right corner of the page.

APPENDIX 2 – PROPOSED SYSTEM DATA TABLES

July/2018

ARKK ENGINEERING CORPORATION



TABLE A2-1 – WATERSHED CHARACTERISTICS BY MODEL NODE

Watershed	Area (ha)	Width (m)	Imperviousness (%)	Slope (%)	Outlet / Description
WS02	1.07	54	37	1.4	MH02
WS03	1.41	118	48	1.5	MH03
WS04	0.52	50	56	1.4	MH04
WS08	0.95	63	68	1.5	MH08
WS09	0.59	39	65	0.9	MH09
WS9C	0.29	19	95	0.6	MH9C
WS10	0.47	31	95	0.6	MH10
WS11	0.37	25	95	0.6	MH11
WS12	0.50	33	95	0.6	MH12
WS15	1.10	122	57	1.5	MH15
WS16a	1.23	65	52	1.5	MH16
WS16b	1.11	58	50	1.5	MH16
WS1009	1.43	95	62	1.6	STMH1009
WS1012	1.43	95	62	1.6	STMH1012
WSPOND1	3.64	208	49	4.2	POND1
WSPOND2	1.40	233	58	1.6	POND2
CH1	1.63	128	75	1.0	Westgate Lot 1 Service
CMP2	0.38	62	75	1.0	Westgate Lot 2 Service
CMP3	0.41	64	75	1.0	Westgate Lot 3 Service
CMP4	0.46	68	75	1.0	Westgate Lot 4 Service
CMP5	0.50	70	75	1.0	Westgate Lot 5 Service
CMP6	0.32	57	75	1.0	Westgate Lot 6 Service
IL7	0.44	66	75	1.0	Westgate Lot 7 Service
IL8	0.46	68	75	1.0	Westgate Lot 8 Service
IL9	0.43	65	75	1.0	Westgate Lot 9 Service
IL10	0.34	59	75	1.0	Westgate Lot 10 Service
R3-14	1.00	100	75	1.0	Westgate Lot 14 Service
R3-15	0.98	99	75	1.0	Westgate Lot 15 Service
US1	16.80	300	10	1.5	Upstream Ditch
US2	24.30	300	10	1.5	Upstream Ditch
US3	40.60	300	10	1.5	Upstream Ditch
US4	6.00	150	28	1.2	Upstream Ditch
US5	19.60	300	10	1.5	Upstream Ditch

TABLE A2-2 – PROPOSED STORM SYSTEM DESIGN DATA

From Node	To Node	Diameter (mm)	Length (m)	Slope (%)	Roughness
MH13	MH11	70	0.013	525	0.008
POND2	MH04	750	27	2.22	0.013
MH04	MH04A	750	23	0.13	0.013
MH04A	MH03	750	14	0.07	0.013
MH03	MH02	900	50	0.54	0.013
MH02	MH01	900	45	0.68	0.013
MH01	POND1	900	50	3.04	0.013
POND1	MH18	750	78	-0.53	0.013
MH18	MH19	750	78	0.06	0.013
MH19	MH20	750	101	0.06	0.013
MH20	EXMH25	750	84	0.15	0.013
MH16	MH15	600	54	0.07	0.013
MH15	MH14A	600	31	0.07	0.013
MH14A	MH14	600	73	0.12	0.013
MH14	MH02	600	63	0.13	0.013
MH11	49 (tee)	450	49	0.41	0.013
49 (tee)	MH10B	450	31	0.42	0.013
MH10B	MH10	750	38	0.71	0.013
MH10	MH10A	750	10	0.60	0.013
MH10A	50 (tee)	750	76	0.70	0.013
50 (tee)	MH09A	750	14	0.35	0.013
MH09A	MH09B	750	47	0.68	0.013
MH09B	MH09	750	11	0.55	0.013
MH09	51 (tee)	1050	87	0.49	0.013
51 (tee)	MH08	1050	81	0.50	0.013
MH08	STMH1012	1050	17	0.29	0.013
STMH1012	STMH1011	1050	97	0.28	0.013
STMH1011	STMH1010	1050	71	0.02	0.013
STMH1010	STMH1009	1050	15	0.10	0.013
STMH1009	POND2	1050	65	4.00	0.013
MH13	54 (tee)	525	58	0.80	0.013
54 (tee)	53 (tee)	525	77	0.78	0.013
53 (tee)	MH12	525	18	0.82	0.013
MH12	MH10	750	100	0.80	0.013
MH9D	MH9C	375	75	0.92	0.013
MH9C	MH9E	450	59	0.58	0.013
MH9E	MH09	450	13	0.54	0.013
39	46	Ditch	115	0.91	0.08
46	40	Ditch	160	0.78	0.08
40	7	Culvert	20	1.45	0.024
7	45	Ditch	135	1.02	0.08
45	44	Ditch	170	0.78	0.08
44	43	Ditch	10	0.40	0.08
43	42	Ditch	200	0.49	0.08
42	41	Ditch	120	0.48	0.08
41	POND2	Ditch	55	0.51	0.08
12	55	Ditch	170	0.50	0.08
55	POND2	Ditch	20	0.55	0.08

APPENDIX 3 – SKETCH OF PROPOSED STORM SYSTEM

July/2018

ARKK ENGINEERING CORPORATION



