

**STORMWATER MANAGEMENT CONCEPT AND STRATEGIES
FOR WILLOW RANCH IN SE 21-24-3-W5M IN ROCKY VIEW COUNTY**

Prepared by:

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Resources, Inc.**

Land & Water Resources Management Consultants

Stormwater Management Concept and Strategies for Willow Ranch in SE 21-24-3-W5M in Rocky View County

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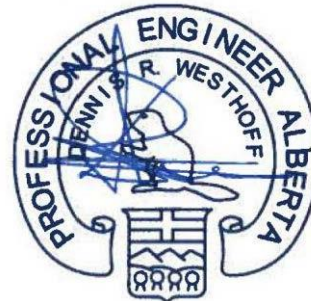
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Corporate Authorization

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March 22, 2021

APEGA Permit P6305

Corporate Permit

Responsible Engineer

Report prepared by Dennis R. Westhoff, M.Eng., P.Eng.

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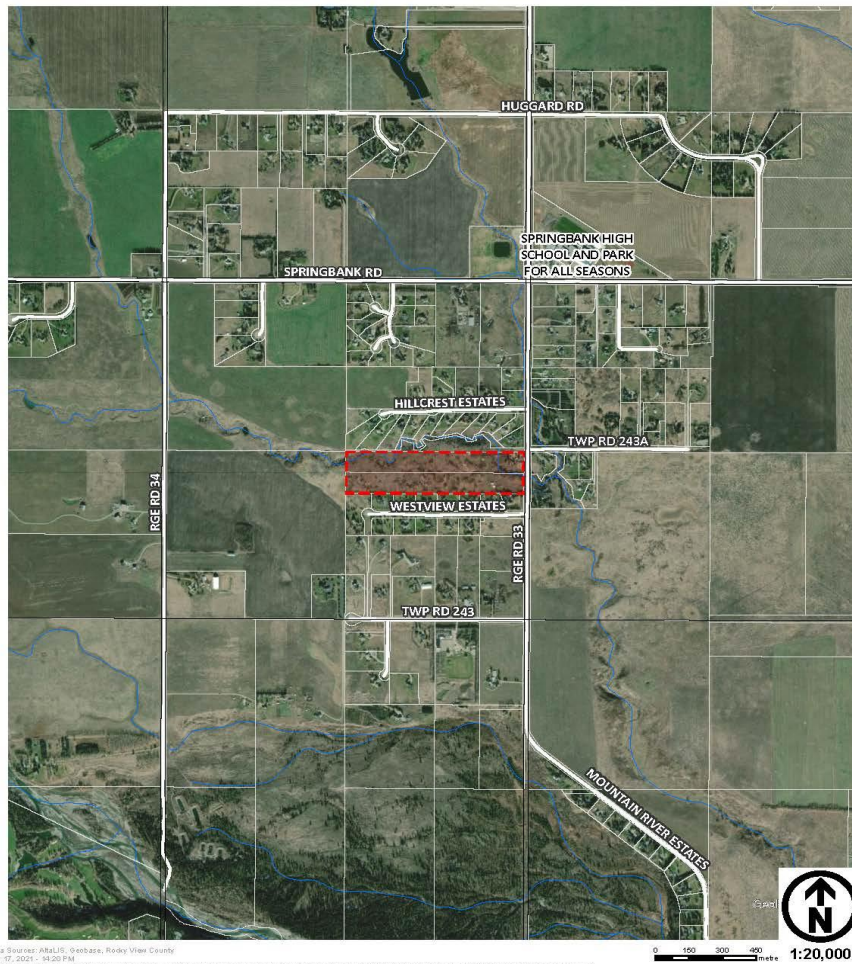
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1 Introduction

Westhoff Engineering Resources, Inc. (Westhoff) has been retained by Allan Markin to prepare a Stormwater Management Concept for the Willow Ranch subdivision. The development area is shown in below and is located in SE ¼ Sec. 21-24-3-W5M in Rocky View County, Alberta. The site is wedged between the existing Hill Crest Estates and Westview Estates subdivisions, west of Range Road 33.



Data Source: ABALIS - 9999999, Rocky View County
Mar 17, 2021 - 4:20 PM
W:\2102-12_Rocky View\Willow Ranch\GIS\Map5.0_Technical\5.1_Technical Production\5.1.2_GIS_Maps\2102-12_WillowRanch_LUA\2102-12_WillowRanch_LUA.aprx



- Legend**
- Subject Site
 - ATIS Gnd
 - Parcel

**Willow Ranch
Conceptual Scheme**
Local Context
Block 1 & 2, Plan 811 1225
March 2021
Map and data for informational planning purposes only.

The Willow Ranch development includes a total of 17 lots, including two (2) ER lots, and one (1) MR lot. The proposed lotting is shown in Exhibit 1 below.

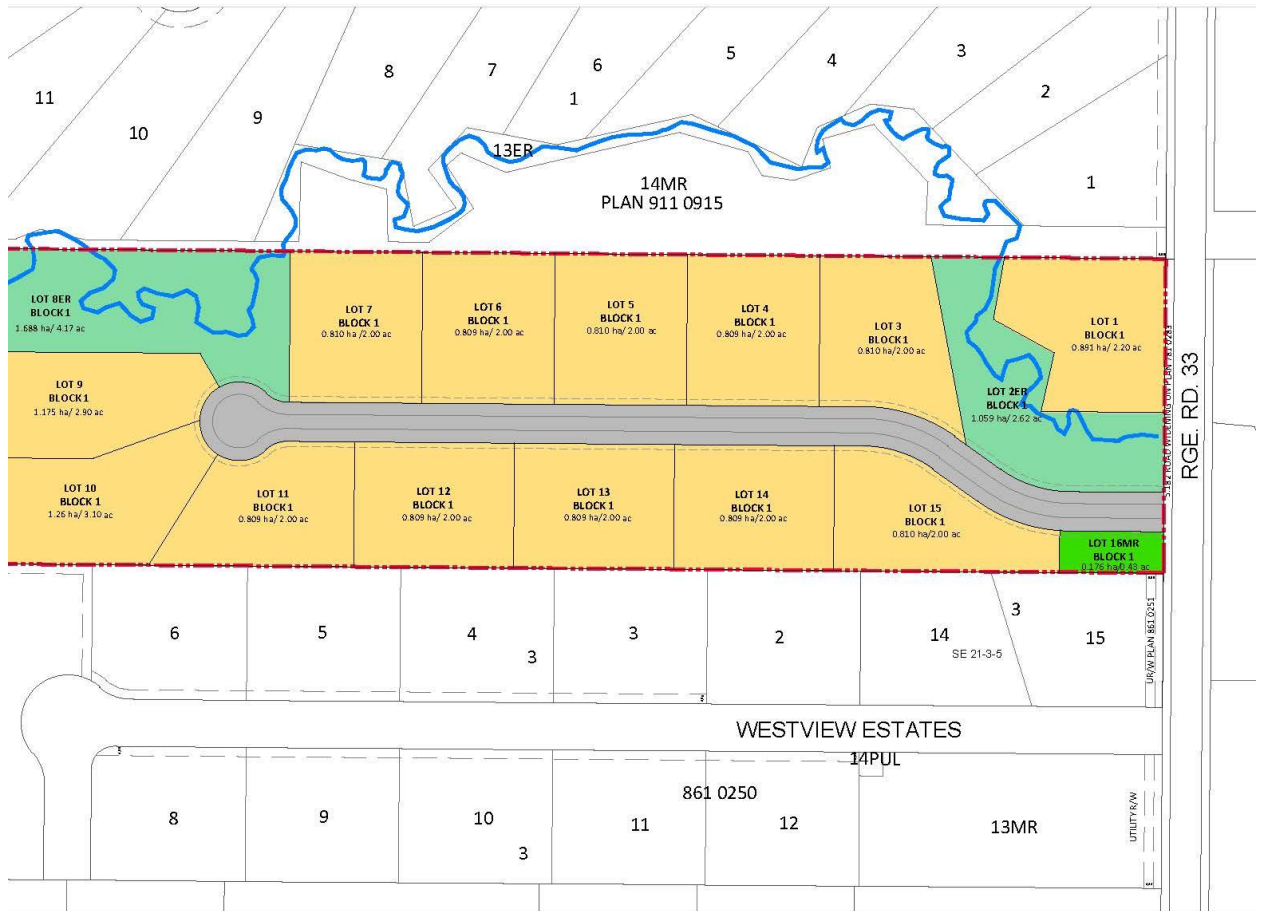


Exhibit 1 – Proposed lotting

2 Stormwater Management Strategies

2.1 Site Description

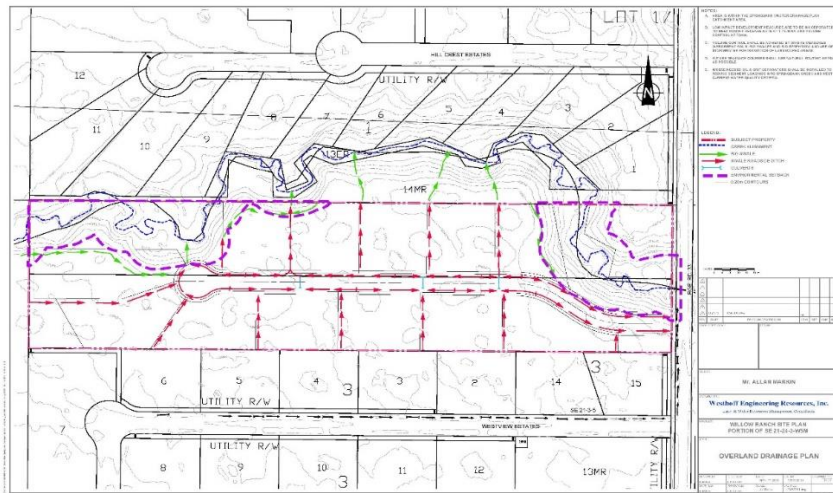
The proposed development is recognizing the unique natural composition of the 40 acres located adjacent to the upper portions of Springbank Creek. As such, the stormwater management concept is based on Low Impact Development (LIDs) and Best Management Practices. In addition, the area is within the Springbank Master Drainage Plan area for which runoff controls exist related to permissible release rates and volume controls.

2.2 Stormwater Management Strategies

Stormwater management for the subdivision is to comply with the Springbank Master Drainage Plan. That is, release rates are limited to 1.71 L/s/Ha and volume control is 45 mm.

Given the unique site characteristics it is recommended that the subdivision is **not** facilitated with a central pond where the above noted stormwater release requirements are carried out. Instead, it is recommended that these criteria be achieved at the time a Site-specific Stormwater Implementation Plan (SSIP) is prepared.

The overall drainage of the Willow Ranch is via overland bio-swales and roadside ditches as depicted in the illustration below¹.



¹ A larger sized drawing is presented at the end of this report.

To mitigate the effects of the development within a specific lot, i.e., constructing a driveway and a home, on-lot Best Management Practices (BMPs) should be implemented. Lot Control BMPs are practices that reduce runoff volumes and/or treat stormwater before it reaches the receiving conveyance system; i.e., Springbank Creek. It includes BMPs such as reduced lot grading, directing downspouts to grassed surfaces, on lot infiltration systems and bio-filters, sump pumping foundation drains to grassed surfaces, vegetated filter or buffer strips, infiltration trenches and rain harvesting for irrigation landscaped areas. It must be recognized that these on-lot BMPs are site specific and are best dealt when the development of the lot is being prepared. Therefore, it is recommended that the requirements to demonstrate the effectiveness of the Lot Control BMPs are presented at the time that a SSIP is required.

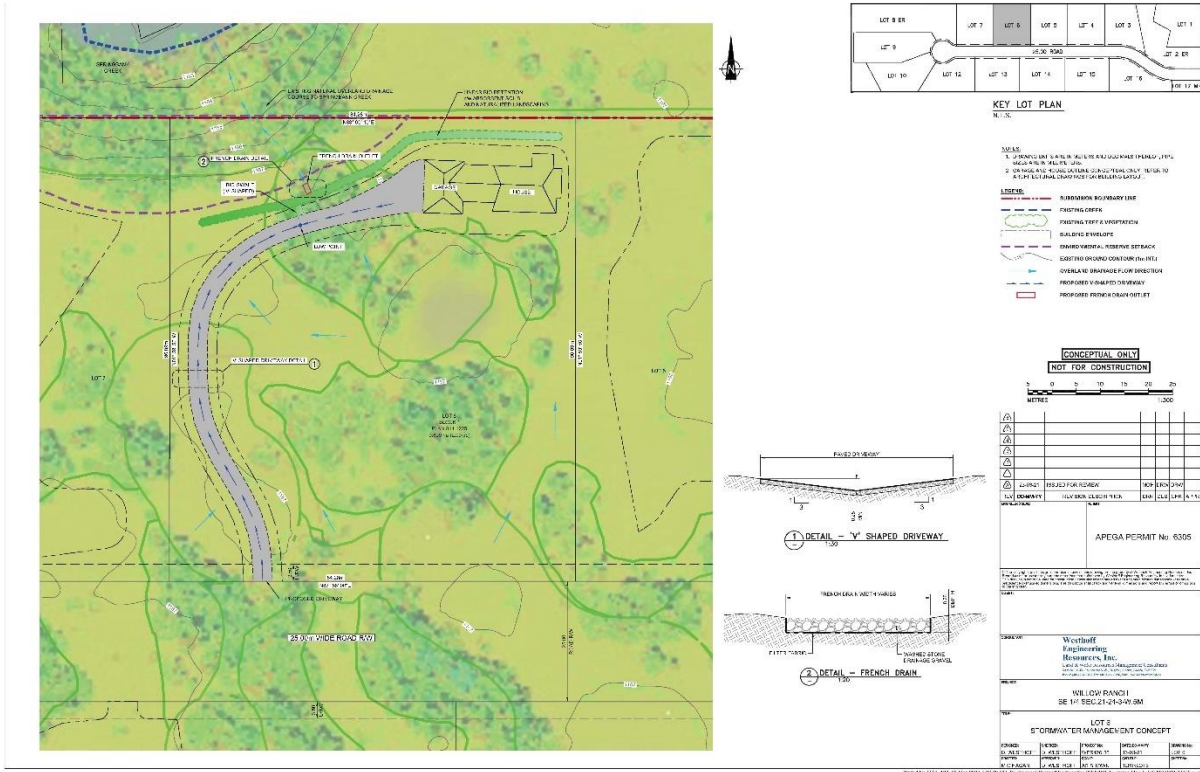
To demonstrate what the SSIP is to include, two examples are presented at a conceptual level.

Lot 6 example shown on the next page² is a typical strategy for lots that are adjacent to Springbank Creek and the following stormwater design criteria is suggested:

- The driveway is to be V-shaped so runoff can be easily directed towards a bio-retention area at the back of the house;
- Roof leaders from the house and garage and any other auxiliary building shall be directed to the bio-retention area;
- Absorbent soils should be used within and at the perimeter of the bio-retention area to meet the runoff volume control requirements;
- The French drain outlet and bio-retention area shall be designed to meet the 1.71 L/s/Ha release rate requirements; and,
- The French drain outlet shall be located where a natural overland draw already exists so that no grading or disturbance is needed within the environmental fringe area of Springbank Creek.

² A larger scale version is presented at the back of this report

Lot 6 example



For lot 14³, the similar guiding principles as for lot 6 are recommended. The only difference is that the releases are to the roadside ditch. The onsite stormwater management elements are the same as noted for Lot 6.

³ A larger scaled version is presented at the back of the report

Within the context of this unique area, it is recommended that efforts be expended towards changing the typical cross-section for the internal roadway and embrace a LID approach for roadside ditches. An example, albeit for a more urban situation, is illustrated in the picture below.



2.3 Stormwater Management – Runoff Water Quality

In addition to quantity control of storm discharges, Alberta Environment requires that quality control measures be incorporated in new developments. Their 1999 Stormwater Guidelines for the Province of Alberta identifies several Best Management Practice (BMP) techniques that can be implemented to improve the quality of stormwater runoff and discharges to receiving water courses. In addition to quality control for ultimate development conditions, it is equally important to practice temporary sediment and erosion controls during construction of new developments.

The lot-level BMPs as proposed are extremely well suited for this type of development. The runoff handled by a bio-retention area with a French drain (filter) outlet can easily meet the objectives of controlling sediments. Also, it must be recognized that + 2 acre developments with a lot of green space will simply not generate the sediment loadings that are typical of a dense urban development.

3 Stormwater Management

3.1 Single Event Analysis

The most common method of analysis used for stormwater management is based on a single storm event; either a real historic storm or a theoretical design storm. Single event analysis and design is an accepted procedure as outlined in the Guidelines for Stormwater Management in the Province of Alberta (1999). This is also an accepted analysis by the Rocky View County. Therefore, this method is used in this study.

The aforementioned guidelines require that the major drainage system, including storage facilities, shall be designed to accommodate the runoff resulting from a 1:100 year return period storm event. Accordingly, a 24 hour duration, 1:100 year design storm event of the Chicago distribution was used for this study. The distribution represents two important characteristics for design purposes:

- The total precipitation of the Chicago storm, for any duration, is the same as the total precipitation defined for the 1:100 year event.
- The peak intensity of the Chicago storm, for any time increment, is the same as the peak intensity defined for the 1:100 year event.

A total storm duration of 24 hours with 5 minute rainfall increments was used, based on the Intensity-Duration-Frequency (IDF) relationship for the City of Calgary and as provided by Atmospheric Environmental Services (AES).

Rainfall intensities for the Chicago distribution are determined from the IDF relationship and described as:

$$i = \frac{a}{(t+b)^c} \quad [1]$$

where i is intensity (mm/h), a , b and c are IDF parameters and t is the time duration (minutes). The time to storm peak is determined by:

$$t_p = r(td) \quad [2]$$

where t_p is the time to peak and r is the ratio of time to peak versus storm duration, t_d . The following parameters were used to derive the rainfall intensities for this design storm, which are based on the IDF data for the City of Calgary.

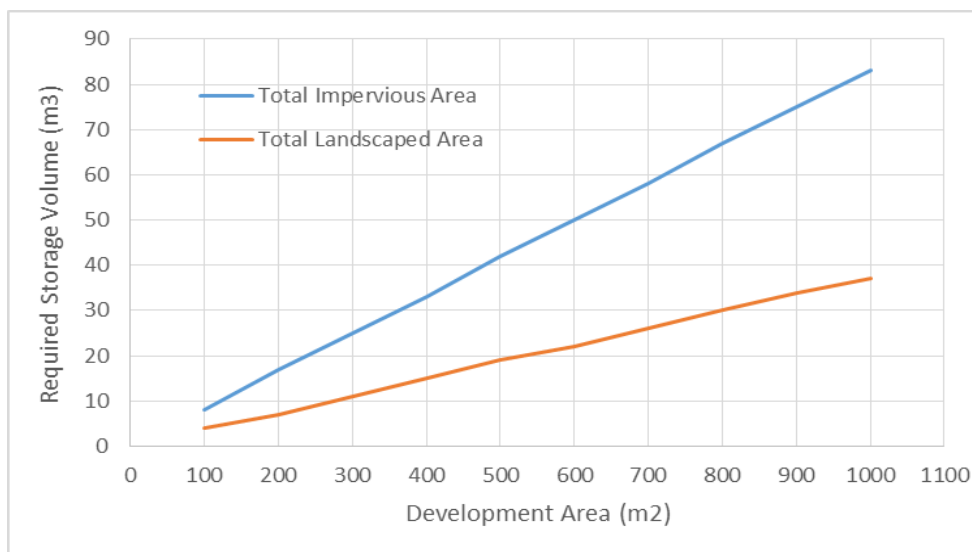
$$a = 663.1 \quad b = 1.87 \quad c = 0.712 \quad r = 0.3$$

The above method is especially important to use and check flows against the criteria for depth and velocity criteria. The results will yield information to check for safety and erosion potential.

A second analysis should be undertaken using continuous simulation techniques. The PCSWMM or the Westhoff Water Balance Model (WWBM) model can be used to analyze the proposed stormwater management features to ensure compliance to the unit area release rate of 1.71 L/s/ha and volume control of 45 mm/year. The analysis should include precipitation and climatic data for the period from 1960 to 2014.

As an **example**, the results of a sensitivity analysis to determine the relationship between the amount of impervious area and the detention capacity requirements is shown in Figure 1. It is emphasized that this will be different for each individual lot once the layout and details on driveway, house and any other hard surfaces are known.

Figure 1: Storage versus Development Area



As mentioned in the Biophysical Impact Assessment report by Westhoff, there are many natural depressional storages within this development. They are to be incorporated in the hydrologic response analysis once the details of the development of a lot become available.

4 Conclusions and Recommendations

4.1 Conclusion

The 2 acre lot subdivision is most suitable for incorporating Low Impact Development (LID) and this should be encouraged when the development of these lands are advanced. Many options to integrate stormwater management measures in the actual lot development are available. The opportunity to make this a showcase of a development should not be missed.

4.2 Recommendations

Where possible, Lot level Stormwater Best Management Practices shall be integrated in the development each lot of the Willow Ranch development.

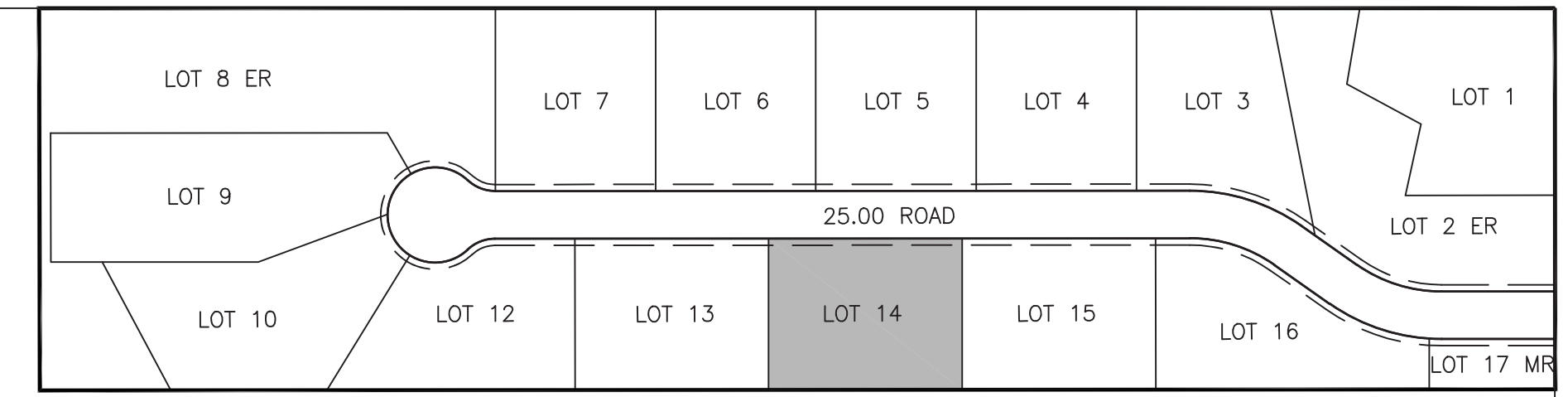
The information provided in this report shall be used as a guide only. Rocky View County is encouraged to share this document to safeguard the intent of developing these lands with stormwater management features that meets the intent of current changes in managing runoff to protect the environment from effects associated with urban development.

The SSIP should include detailed analysis and pertinent information of the drainage system, including at minimum:

- Confirmation of the retention volume of the incremental volumetric increase (post-development minus pre-development volume) as determined by continuous simulation techniques and using the precipitation and climatic data spanning 1960 to 2014, at minimum. The volume to retain shall be for the 1:100 year runoff event or greater.
- Detailed analysis is provided demonstrating compliance with the Springbank Master Drainage Plan. That is, release to Springbank Creek is at 1.71 L/s/ha and runoff volume control to 45 mm.
- Overland conveyance flow shall meet Provincial criteria with respect to depth of flow and velocity.
- An erosion and sediment control plan, which shall be required at the subdivision stage.

5 References

- “Stormwater Guidelines for the Province of Alberta”, Alberta Environmental Protection, 1999.
- “Stormwater Management Guidelines and Design Manual”, The City of Calgary, 2011

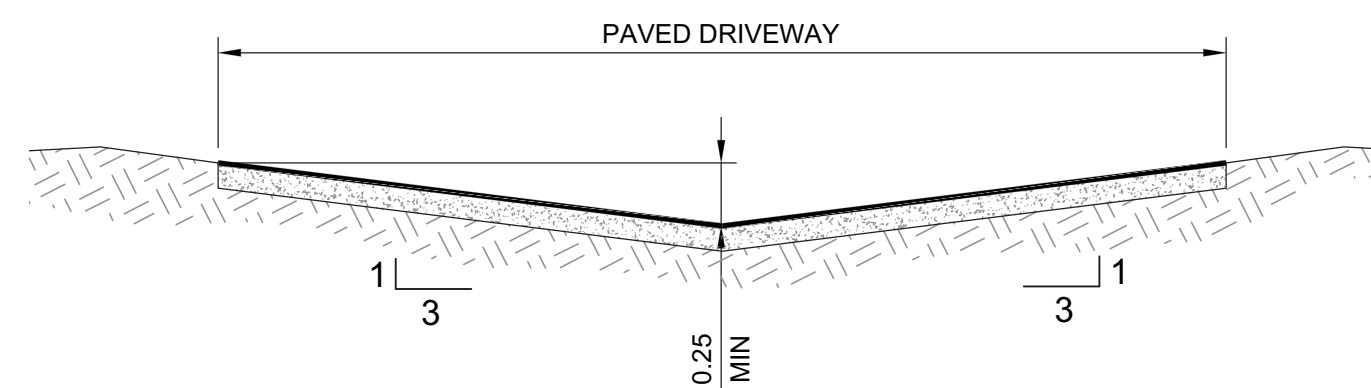
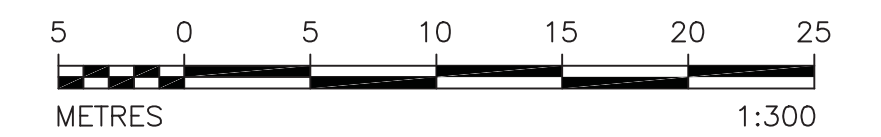


KEY LOT PLAN
N.T.S.

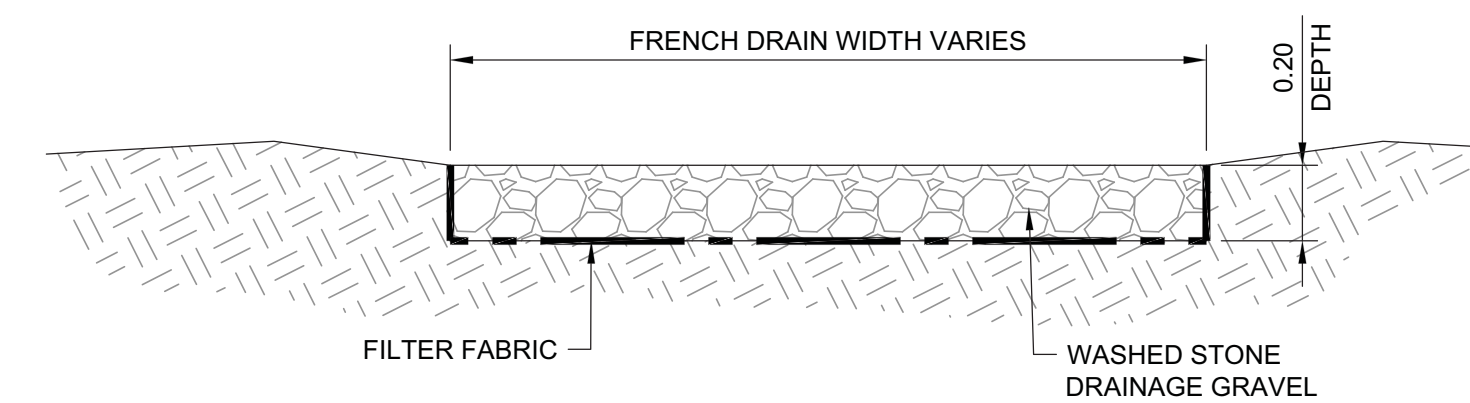
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- DRAWING UNITS ARE IN METERS AND DECIMALS THEREOF, PIPE SIZES ARE IN MILLIMETERS.
 - GARAGE AND HOUSE OUTLINE CONCEPTUAL ONLY, REFER TO ARCHITECTURAL DRAWINGS FOR BUILDING LAYOUT.

- LEGEND:**
- SUBDIVISION BOUNDARY LINE
 - EXISTING TREE & VEGETATION
 - BUILDING ENVELOPE
 - NATURALIZED TRAPLOW
 - EXISTING GROUND CONTOUR (1m INT.)
 - OVERLAND DRAINAGE FLOW DIRECTION
 - PROPOSED DRAINAGE SWALE
 - PROPOSED CULVERT
 - PROPOSED V-SHAPED DRIVEWAY
 - PROPOSED FRENCH DRAIN OUTLET

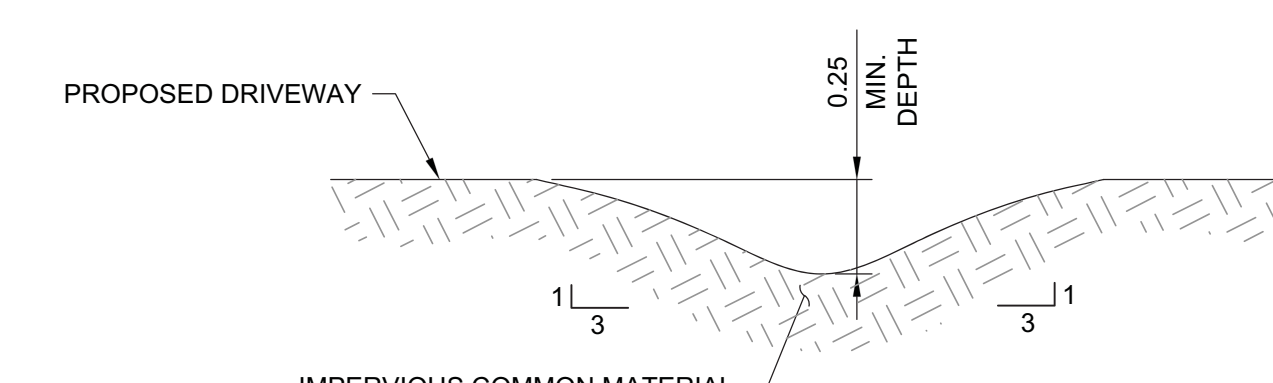
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION



1 DETAIL - 'V' SHAPED DRIVEWAY
1:30



2 DETAIL - FRENCH DRAIN
1:20



3 DETAIL - DRAINAGE SWALE
1:20

6					
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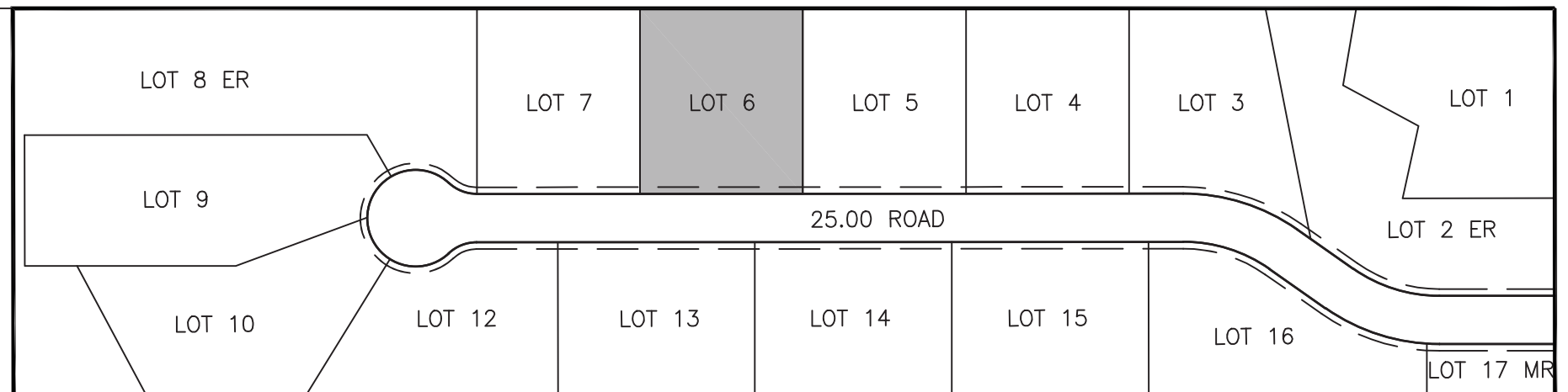
CLIENT: _____

CONSULTANT: **Westhoff Engineering Resources, Inc.**
Land & Water Resources Management Consultants
Suite 601, 1040 - 7th Avenue S.W., Calgary, Alberta, Canada, T2P 3G9
Phone: (403) 244-9566, Fax: (403) 244-8796, Email: werc@westhoff.ca

PROJECT: **WILLOW RANCH**
SE 1/4 SEC.21-24-3-W.5M

TITLE: **LOT 14**
STORMWATER MANAGEMENT CONCEPT

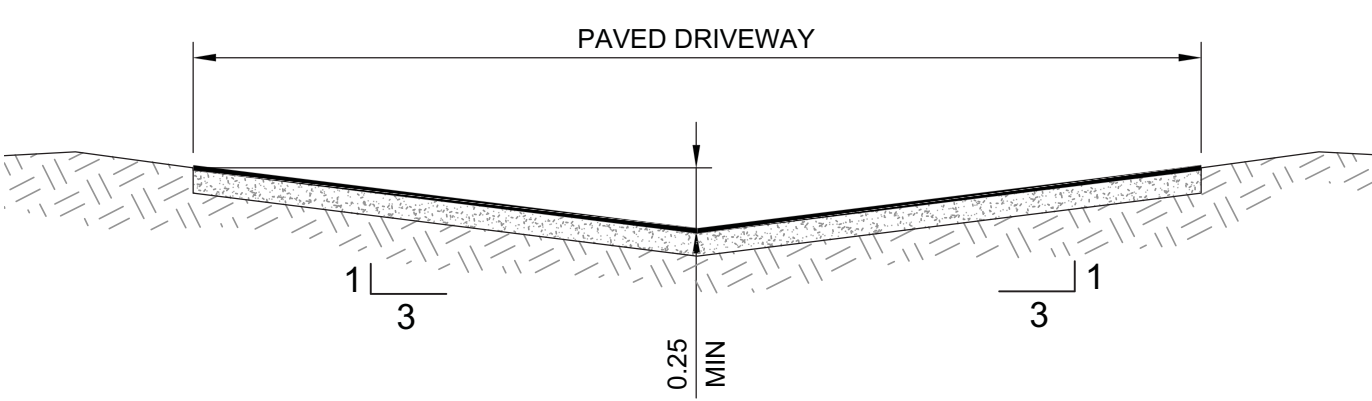
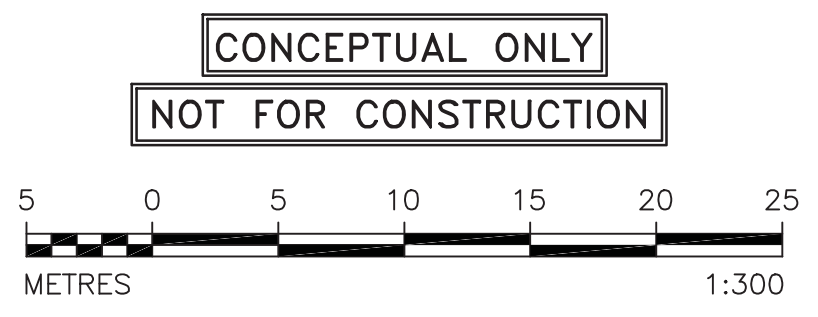
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D. WESTHOFF	D. WESTHOFF	WER120-35	13-03-21	LOT14
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M O'HAGAN	D. WESTHOFF	AS SHOWN	12035LOT14	



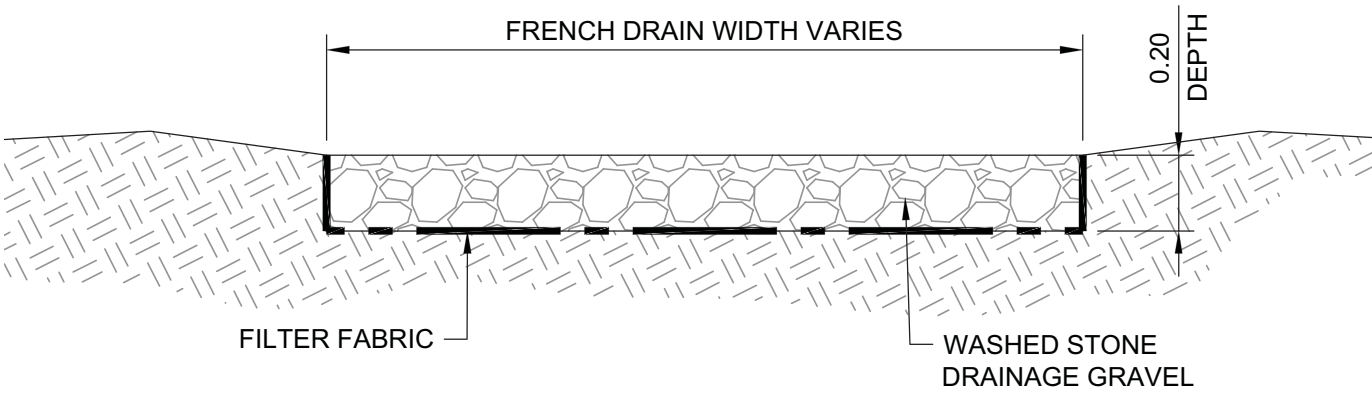
KEY LOT PLAN
N.T.S.

- NOTES:**
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- LEGEND:**
- SUBDIVISION BOUNDARY LINE
 - EXISTING CREEK
 - EXISTING TREE & VEGETATION
 - BUILDING ENVELOPE
 - ENVIRONMENTAL RESERVE SETBACK
 - EXISTING GROUND CONTOUR (1m INT.)
 - OVERLAND DRAINAGE FLOW DIRECTION
 - PROPOSED V-SHAPED DRIVEWAY
 - PROPOSED FRENCH DRAIN OUTLET



1 DETAIL - 'V' SHAPED DRIVEWAY
1:30



2 DETAIL - FRENCH DRAIN
1:20

6						
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Phone: (403) 264-9266, Fax: (403) 264-8796, Email: wro@westhoff.ca

PROJECT: **WILLOW RANCH**
SE 1/4 SEC.21-24-3-W.5M

TITLE: **LOT 6**
STORMWATER MANAGEMENT CONCEPT

DESIGNED: D. WESTHOFF	CHECKED: D. WESTHOFF	PROJECT No: WER120-35	DATE: DD-MM-YY 13-03-21	DRAWING No: LOT 6
DRAFTED: M O'HAGAN	APPROVED: D. WESTHOFF	SCALE: AS SHOWN	CAD FILE: 12035LOT6	SHEET No: