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December 20, 2013

Our File: 1170

Mr. Robert Briggs
Glen Lynn Engineering Ltd.
rnbriggs@shaw.ca

Attention: Mr. Robert Briggs

Re: Floodplain Delineation Review of Edmonton Springs Golf Resort

Dear Mr. Briggs,

Following your request to conduct a floodplain delineation of the Edmonton Springs Golf Resort as well as the Grandview, Walker Lakes and Walker Estates area, please find below a summary of our assessment.

PROJECT BACKGROUND

According to the Lois Hole Centennial Provincial Park map published by Alberta Environment on November 1, 2010, most of the Edmonton Springs Golf Resort, including the existing clubhouse, is shown as being in the 1:100 year floodplain of Atim Creek / Big Lake. A replacement of the existing clubhouse is currently proposed.

PROJECT SCOPE

The main scope of this project is to conduct an accurate and precise delineation of the 1:100 year floodplain within the study area, using the floodplain elevation presented in the floodplain delineation report and using recent elevation data. The study area is defined by all land located within Sections SE-20-53-26-W4 and NE-17-53-26-W4, that is the Edmonton Springs Golf Resort.

REVIEW OF PREVIOUS REPORTS

Acheson/Big Lake Area Master Drainage Plan

The "Acheson/Big Lake Area Master Drainage Plan - Amendment" (AECOM, August 2011) report was prepared for Parkland County and had for objectives to "quantify the effectiveness of the existing drainage systems in place, propose drainage upgrades, which may be required to address existing drainage and accommodate additional development, and develop an overall drainage plan to allow development to proceed."

According to this report, the southern part of the study area (above the floodplain) would form part of Drainage Basin 4. Runoff from a large area to the south would flow across Township Road 532A via a culvert and into the southeast corner of quarter-section NE-17-53-26-W4. An existing watercourse would carry this flow to the northeast and across Range Road 264 via another culvert, also located near the southeast corner of the quarter-section. The stormwater would then make its way into an existing small lake/pond and into Atim Creek to the north.

A drainage plan was not developed for the land defined to be in the floodplain of Atim Creek/Big Lake. However, the report does show some watercourses at the north end of the study area flowing east. A review of recent contour data indicates that drainage in the study area is typically to the northeast and into Atim Creek.

In terms of floodplain delineation of Atim Creek and Big Lake, the report references Sameng's "Big Lake Basin Task Force: Floodplain Delineation for Atim Creek from Campsite Road to Big Lake" completed in 2007.

Big Lake Basin Task Force: Floodplain Delineation for Atim Creek from Campsite Road to Big Lake

The "Big Lake Basin Task Force: Floodplain Delineation for Atim Creek from Campsite Road to Big Lake" (Sameng, March 2007) report was prepared for Parkland County and had for main objective to identify the flood hazard areas of Atim Creek from Campsite Road to Big Lake by delineating the Atim Creek floodplain.

The report mentions that "flooding in the Sturgeon River Basin tends to occur during snowmelt with the peak spring snowmelt occurring in late March to early May... Rainfall events also cause high flow levels but these events are normally limited to June and July. Backwater flooding from Big Lake is the main cause of flooding from Pioneer Road to the mouth of the lake."

The study assessed the floodplain elevation of Atim Creek from hydrological data, survey data and hydraulic data and used the HEC-RAS computer model software to develop a series of water surface profiles for selected discharge. The data was utilized to perform hydraulic simulations of a 100 year flood for the existing and future condition.

The report indicates that the floodplain elevation at the study area is constant at 653.30 m for both the existing and future development conditions. This indicates that the floodplain elevation at the study area is governed by the high water level in Big Lake which would backflow into the study area. As there are many uncertainties in any estimate of a 1:100 year water level (e.g.

discharge value, channel hydraulic resistance, wind effect on water level, wave effect on lake, etc.), a factor of safety of 0.5 m (653.80 m) was recommended.

The complete 1:100 year floodplain delineations – for the post-development (future) condition – are shown in Figure 1 (from Figure 2 of the "Big Lake Flood Delineation" project (Sameng Inc., March 2007). The floodplain delineation provided in that report, which is almost identical to the Lois Hole Centennial Provincial Park map (Alberta Environment, November 1, 2010) shows that almost all of the study area, except a small portion to the south, is in the floodplain of Atim Creek & Big Lake.

The report mentions that "contour lines, at an interval of 1 m, were used to aid in plotting the flood levels on the topographic map." A review of the contour lines that were used for the study seems to indicate that the floodplain delineation disregarded several area that are above the floodplain elevation but surrounded by lower land areas that are in the flood zone; several of those being in the study area including the clubhouse area.

FLOODPLAIN DELINEATION

The current study focused in providing an accurate floodplain delineation within the study area.

For this study, the following data were collected and used:

- Recent air photo (acquired October 2009),
- Cadastral / Property lines (collected August 14, 2013),
- LiDAR elevation data (October 2009), and
- GPS survey of the clubhouse area (August 13, 2013).

The LiDAR has an horizontal accuracy of 45 cm and a fundamental vertical accuracy (on hard surfaces) of 30 cm – 95% accuracy. The GPS survey elevations were compared to the LiDAR elevations and were found to be typically about 10 cm lower in elevation than the LiDAR elevations. The GPS survey has an accuracy of about 5 cm. Contour elevations were created from the LiDAR data as they were deemed adequate for this project.

The floodplain delineation shown in the attached figures was conducted using AutoCAD Civil 3D; these delineations were computer automatically using the LiDAR elevations such that the outlines are very accurate.

- Figure 2 shows the existing site conditions, including all the main drainage features and contour elevations at 1m intervals.
- Figure 3 shows the same information as presented in Figure 1 plus the floodplain delineations at both 653.30m and 653.80m (including 0.50m freeboard). It also shows the land area above the floodplain at the trailer home site (A), around the clubhouse (B) and at the possible future condo site (C).

- Figures 4 and 5 show the floodplain delineation in the immediate vicinity of the clubhouse, and shows existing buildings and a rough outline of the proposed clubhouse expansion. The proposed area to be removed from Atim Creek / Big Lake Floodplain Bylaw (3.7 ha) is also identified; it follows the 653.30m elevation around the clubhouse building and also includes the existing gravel parking lot and gravel access. The figure also shows some of the survey elevations.
- Figure 6 shows three cross sections in the clubhouse area, with the floodplain elevation and existing/proposed building location.

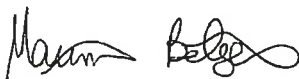
CONCLUSION AND RECOMMENDATIONS

The current study identified some areas within the study area that are located above the 100 year floodplain of Atim Creek and Big Lake and that were previously defined to be within the floodplain. Of note, the existing clubhouse is about 2.5 m above the 100 year floodplain. The proposed clubhouse would be in the same general area, and also about 2.5 m above the floodplain. The removal of Area B (clubhouse area above the 100 year floodplain) or the replacement of the clubhouse would have no impact on the 100 year floodplain.

The existing gravel parking lot and gravel access to Range Road 264 are, however, in the floodplain. Nevertheless, as the area floods due to backwater from Big Lake, raising the elevation of the access road and parking lot (if required) above the floodplain is feasible and would have a negligible impact on the floodplain's water level and storage capacity. The area south of the raised gravel access and parking lot could still flood and provide storage as backwater would flood that area from the southwest. A raised access road would maintain access to the clubhouse during high water levels and would also protect any private properties that may be located in these areas such as vehicles.

Should you have any questions or wish discussion on any aspect of this letter-report, please contact me at (780) 482-2557.

Sincerely,



Maxime Bélanger, M.Sc., P.Eng.
Water Resources Engineer

Attachment: 6 figures



Dec 20, 2013
APEGA Permit to Practice P02863

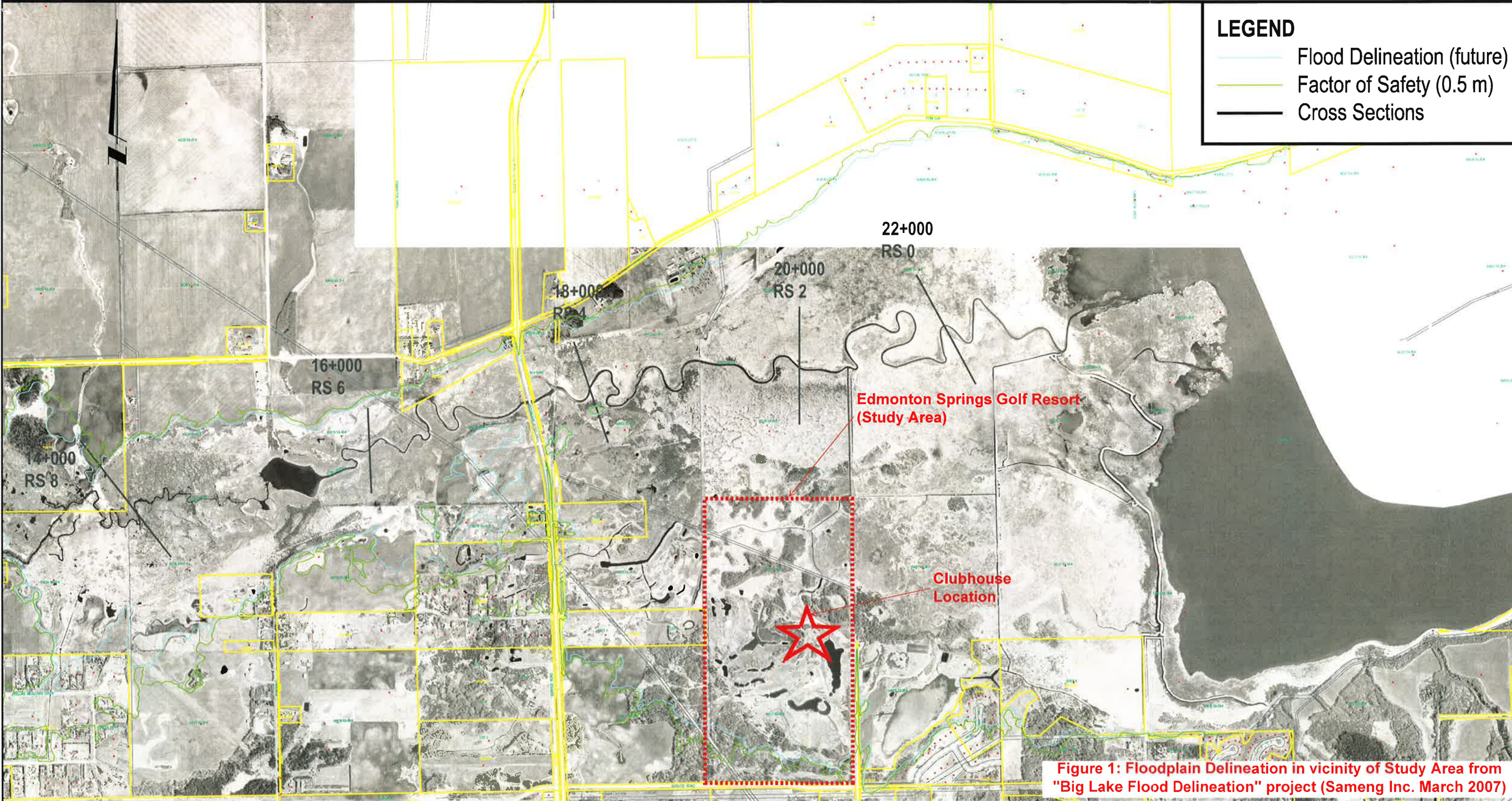


Figure 1: Floodplain Delineation in vicinity of Study Area from "Big Lake Flood Delineation" project (Sameng Inc. March 2007)

PERMIT PERMIT TO PRACTICE SAMENG INC. Signature: <i>[Signature]</i> Date: FEBRUARY 16, 2007 PERMIT NUMBER: P 2863 The Association of Professional Engineers, Geologists and Geophysicists of Alberta		SEAL 		<table><tr><td>(F)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>(E)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>(D)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>(C)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>(B)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>(A)</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>MARK</td><td>DESCRIPTION OF REVISIONS</td><td>DATE</td><td>OWN.</td><td>ENG.</td><td></td></tr></table>		(F)						(E)						(D)						(C)						(B)						(A)						MARK	DESCRIPTION OF REVISIONS	DATE	OWN.	ENG.		<table><tr><td>DESIGNED BY</td><td>APPROVED BY</td></tr><tr><td>DRAWN BY</td><td>CHECKED BY</td></tr><tr><td>C. MOORE</td><td>K. UNTERSCHULTZ</td></tr><tr><td colspan="2">SCALE</td></tr><tr><td colspan="2">1:10,000</td></tr></table>		DESIGNED BY	APPROVED BY	DRAWN BY	CHECKED BY	C. MOORE	K. UNTERSCHULTZ	SCALE		1:10,000		<table><tr><td colspan="2">CONSULTANT</td></tr><tr><td colspan="2"></td></tr></table>		CONSULTANT				<table><tr><td colspan="2"></td></tr></table>				<table><tr><td colspan="4">PROJECT</td></tr><tr><td colspan="4">BIG LAKE FLOOD DELINEATION</td></tr><tr><td colspan="4">TITLE</td></tr><tr><td colspan="4">Figure 2: Atim Creek Flood Delineation showing cross sections 14+000 to 22+000</td></tr><tr><td>DATE</td><td>SHEET</td><td>DRAWING No.</td><td>REV.</td></tr><tr><td>MARCH 2007</td><td>2 OF 3</td><td>ACBLFD - 002</td><td></td></tr></table>				PROJECT				BIG LAKE FLOOD DELINEATION				TITLE				Figure 2: Atim Creek Flood Delineation showing cross sections 14+000 to 22+000				DATE	SHEET	DRAWING No.	REV.	MARCH 2007	2 OF 3	ACBLFD - 002	
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This aerial map displays a golf course area with various topographic features. A yellow star marks the 'CLUBHOUSE LOCATION' near the center of the map. The map includes several labeled sections: 'SE20 53-26-4' in the upper left, 'SW21 53-26-4' in the upper right, and 'NE17 53-26-4' in the lower left. A road labeled 'RANGE ROAD 284' runs vertically through the center. Other roads visible include 'TOWNSHIP ROAD 532A' at the bottom and 'MAIN AVENUE' at the bottom right. The map shows a mix of green grass, brown earth, and blue water features, with red and yellow contour lines indicating elevation changes.



- | Legend: | |
|---|---|
|  | STUDY AREA |
|  | PROPERTY LINES |
|  | CLUBHOUSE LOCATION |
|  | EXISTING BUILDING |
|  | PROPOSED BUILDING |
|  | EDGE OF ROAD |
|  | EXISTING MAJOR CONTOURS (2m) |
|  | EXISTING MINOR CONTOURS (1m) |
|  | EXISTING MAIN DRAINAGE FEATURES |
|  | EXISTING CULVERT |
|  | FLOODPLAIN AREA @ 653.30m |
|  | FLOODPLAIN AREA @653.80m (INCLUDES 0.5m FACTOR OF SAFETY) |
|  | PROPOSED AREA TO BE REMOVED FROM ATIM CREEK / BIG LAKE FLOODPLAIN BYLAW (AREA = 3.7 ha.) |
|  | SURVEYED ELEVATION |
|  | EXISTING CLUBHOUSE |
|  | PROPOSED CLUBHOUSE |

NOTE:

- AIR PHOTO TAKEN IN SEPTEMBER - OCTOBER 2009
- LIDAR TAKEN IN OCTOBER 2009
- SURVEY CONDUCTED ON AUGUST 13, 2013
- CADASTRAL COLLECTED ON AUGUST 14, 2013
- THE CONTOURS WERE CREATED FROM LIDAR DATA ONLY.
- THE SURVEY ELEVATIONS WERE TYPICALLY 0.10m LOWER THAN LIDAR ELEVATIONS.

Prepared By:

 **sameng inc.**
better water | better world

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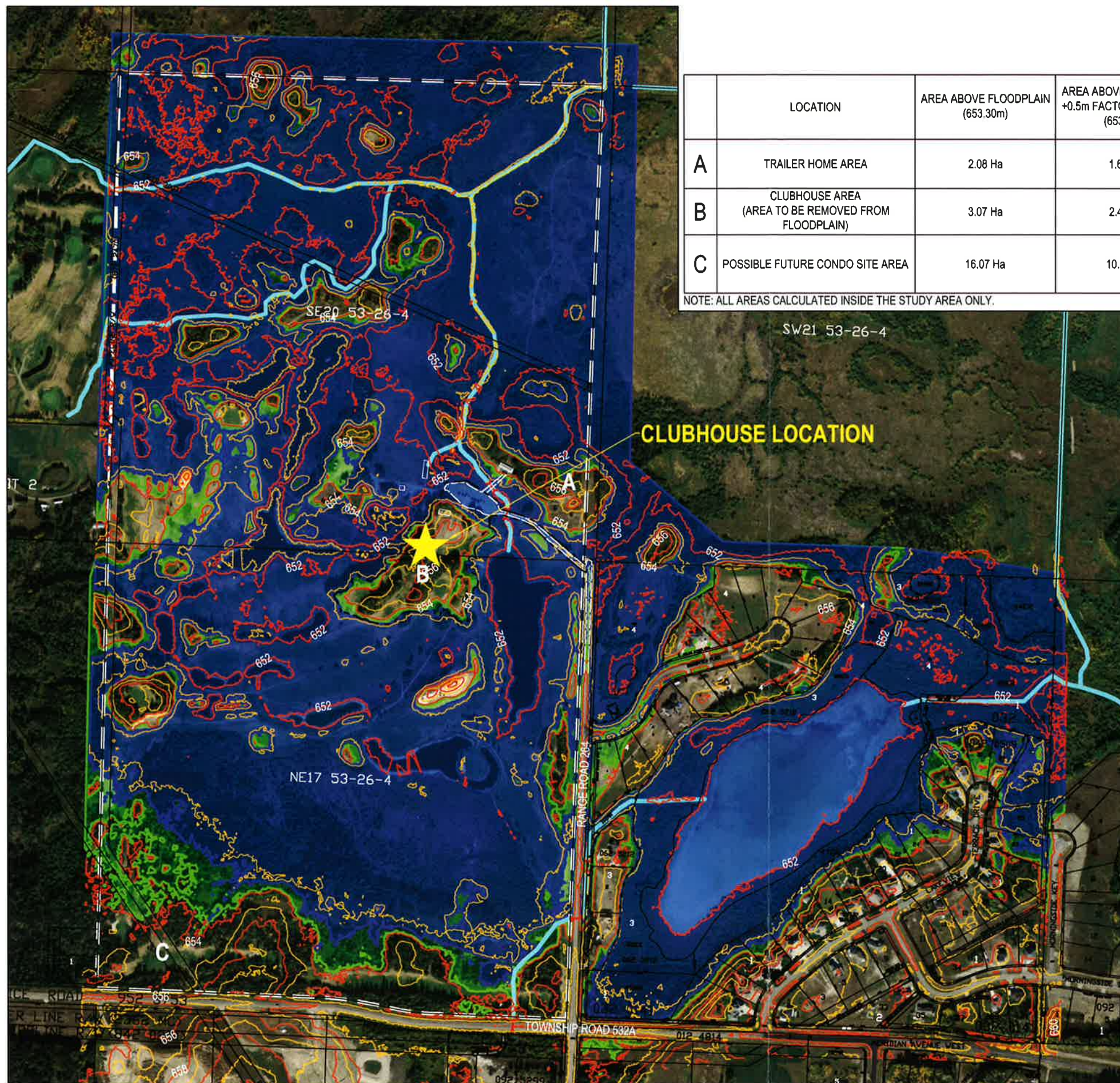
Client:

Glen Lynn Engineering Ltd.

Project:	Floodplain Delineation Review Of Edmonton Spring Golf Resort
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Title: **Existing Site Conditions**

Scale: 1:7500 	Figure: 2
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	LOCATION	AREA ABOVE FLOODPLAIN (653.30m)	AREA ABOVE FLOODPLAIN +0.5m FACTOR OF SAFETY (653.80m)
A	TRAILER HOME AREA	2.08 Ha	1.66 Ha
B	CLUBHOUSE AREA (AREA TO BE REMOVED FROM FLOODPLAIN)	3.07 Ha	2.47 Ha
C	POSSIBLE FUTURE CONDO SITE AREA	16.07 Ha	10.10 Ha

NOTE: ALL AREAS CALCULATED INSIDE THE STUDY AREA ONLY.

Legend:	
	STUDY AREA
	PROPERTY LINES
	CLUBHOUSE LOCATION
	EXISTING BUILDING
	PROPOSED BUILDING
	EDGE OF ROAD
	EXISTING MAJOR CONTOURS (2m)
	EXISTING MINOR CONTOURS (1m)
	EXISTING MAIN DRAINAGE FEATURES
	EXISTING CULVERT
	FLOODPLAIN AREA @ 653.30m
	FLOODPLAIN AREA @653.80m (INCLUDES 0.5m FACTOR OF SAFETY)
	PROPOSED AREA TO BE REMOVED FROM ATIM CREEK / BIG LAKE FLOODPLAIN BYLAW (AREA = 3.7 ha.)
	652.00 SURVEYED ELEVATION
	EXISTING CLUBHOUSE
	PROPOSED CLUBHOUSE

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Project:

**Floodplain Delineation Review Of
Edmonton Spring Golf Resort**

Title:

Floodplain Delineation

Scale:

1:7500

Figure:

3



- Legend:**
- STUDY AREA
 - PROPERTY LINES
 - CLUBHOUSE LOCATION
 - EXISTING BUILDING
 - PROPOSED BUILDING
 - EDGE OF ROAD
 - EXISTING MAJOR CONTOURS (2m)
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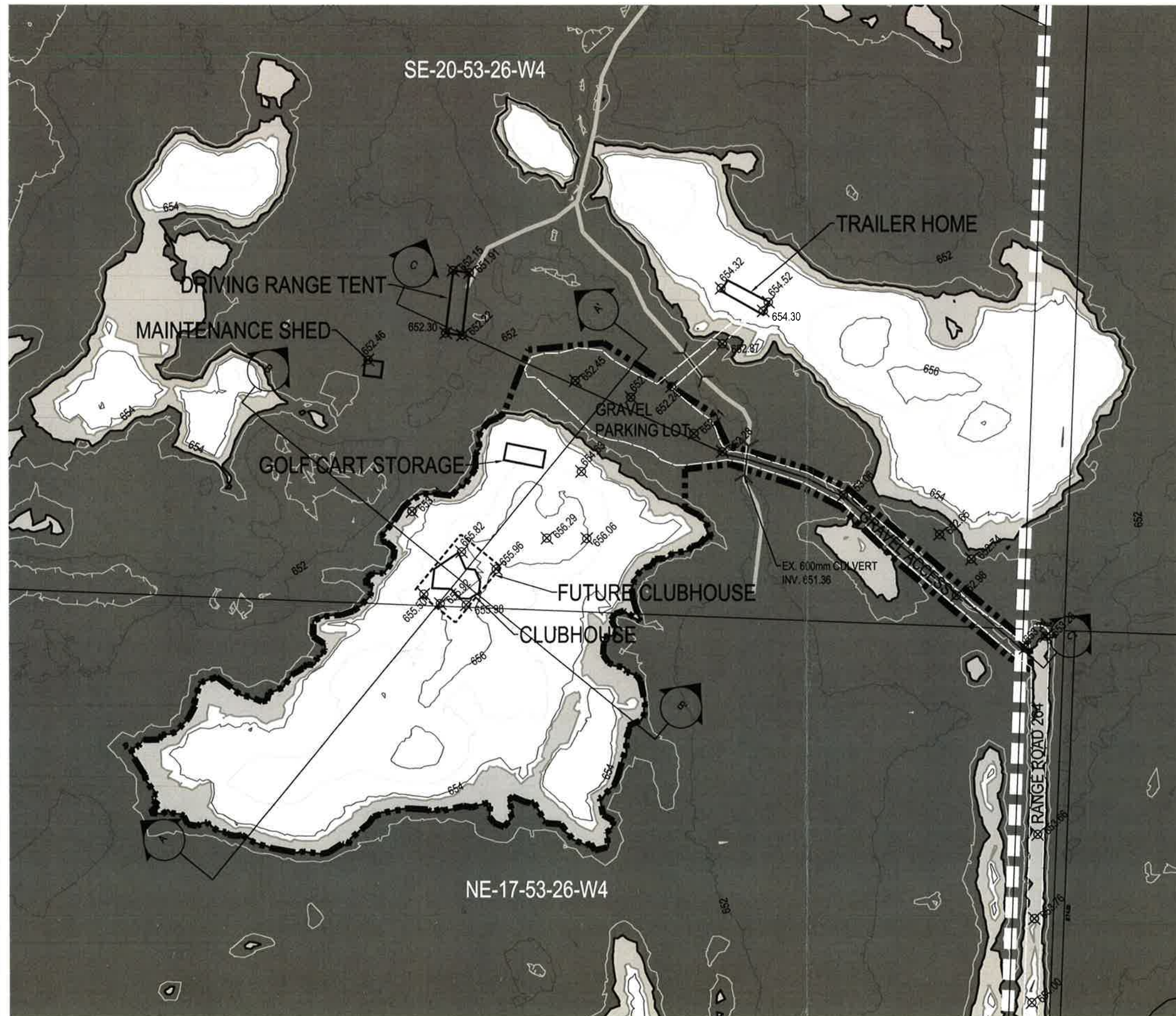
**Floodplain Delineation At
Clubhouse Site (Color)**

Scale:

1:2000

Figure:

4



- Legend:**
- STUDY AREA
 - PROPERTY LINES
 - CLUBHOUSE LOCATION
 - EXISTING BUILDING
 - PROPOSED BUILDING
 - EDGE OF ROAD
 - EXISTING MAJOR CONTOURS (2m)
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 - ⊗ 652.00 SURVEYED ELEVATION
 - EXISTING CLUBHOUSE
 - PROPOSED CLUBHOUSE

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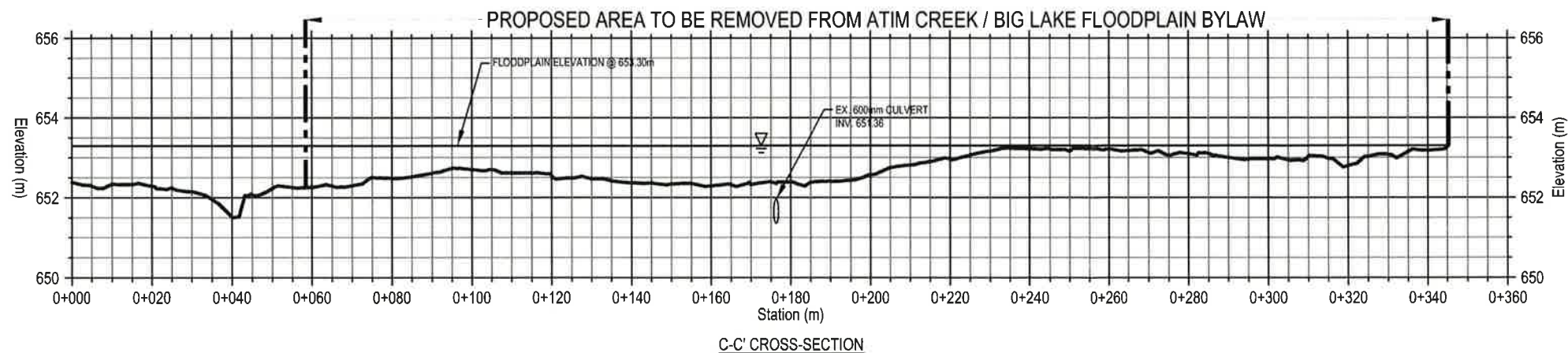
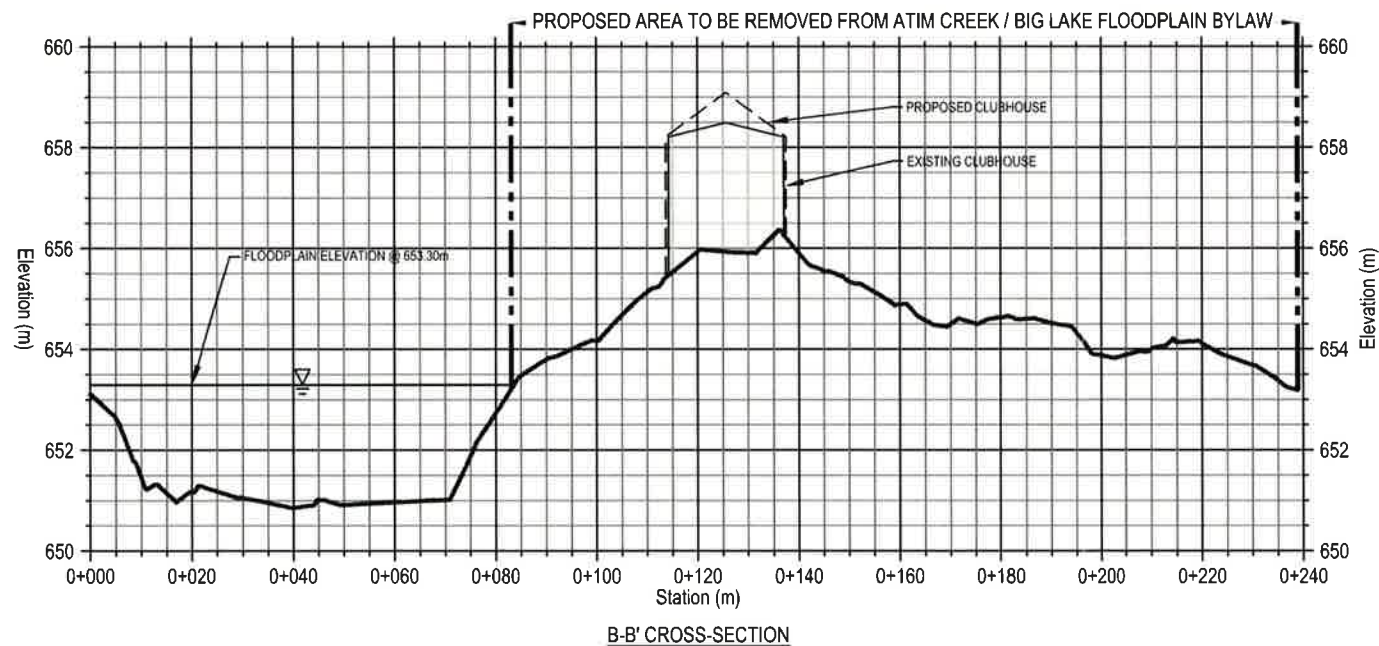
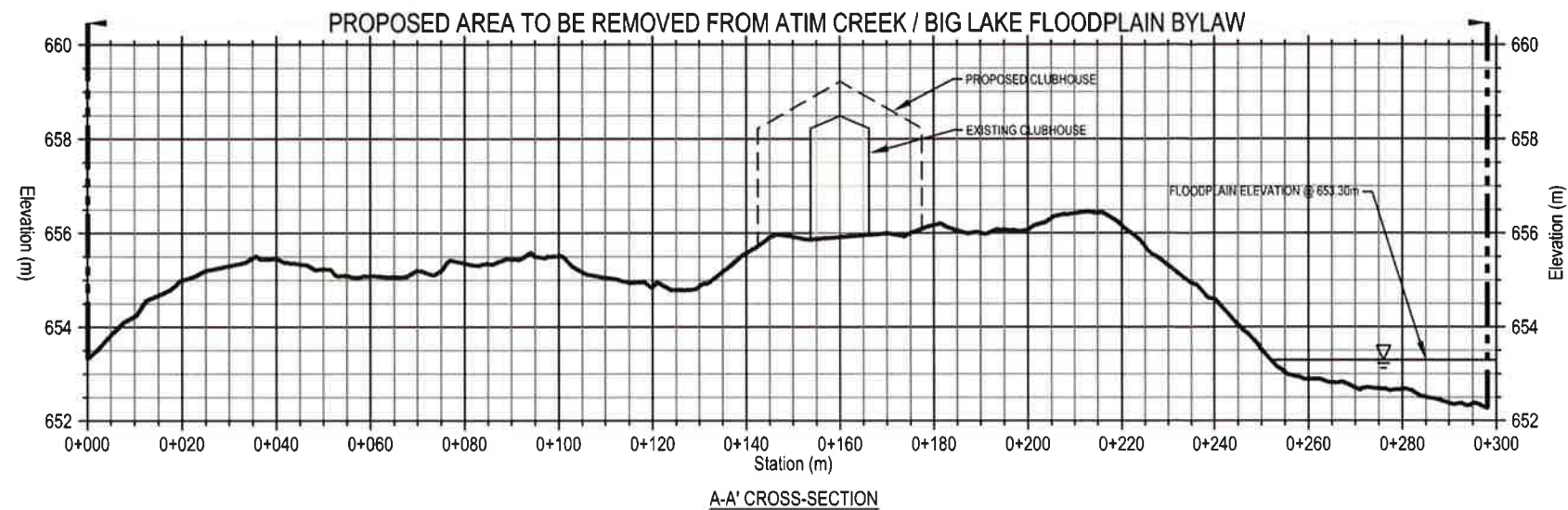
**Floodplain Delineation At
 Clubhouse Site (Black & White)**

Scale:

1:2000 0 20 40

Figure:

5



Legend:	
STUDY AREA	---
PROPERTY LINES	---
CLUBHOUSE LOCATION	★
EXISTING BUILDING	---
PROPOSED BUILDING	---
EDGE OF ROAD	---
EXISTING MAJOR CONTOURS (2m)	---
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Title:

Cross-Section A-A' , B-B' & C-C'

Scale:

H= 1:1500
V= 1:150

Figure:

6