Memorandum

AECOM
ConnectEd Transit Partnership
10235 101 Street, Suite 1200, Edmonton, AB, Canada T5J 3E9

To	Brad Smid, Brad Griffith	Page	1
CC	File, Quinn Nicholson, Art Washuta, Ryan Olbrycht		
Subject	Valley Line LRT – Alternate Route Comparison through River Valley		
From	Josh Jones		
Date	February 7, 2014	Project Number	60297552

This memo summarizes the comparison between the existing approved alignment between the Quarters Stop and the Muttart Stop through the North Saskatchewan River Valley with the proposed alignment provided by Mr. Allan Shute from the Riverdale Community League.

The proposed alignment was received from Brad Smid on February 4th and AECOM tried to address as closely as possible the proposal provided by Mr Shute. Mr Shute's alignment contained very sharp radius turns at 102 St, at the top and bottom Grierson Hill Road and at 98 Ave. The alignment completed by AECOM used 85m radius curves which are comparable to other 'sharp' radius curves currently being used. One thing to note is that these curves are also on steep grades. Mr. Shute's description of the alignment also noted that the alignment would cross under Jasper Avenue but then above Grierson Hill Road. Unfortunately we were not able to make that alignment work so we continued the tunnel under Grierson Hill Road. The alignment that we used for this comparison is shown in Figure 1.

We have assessed the proposed alignment against the existing alignment and have summarized the findings in the attached table. Here is a brief summary of the findings.

- The existing Cloverdale Pedestrian Bridge could remain intact with no requirement to build the underslung pedestrian bridge with the LRT bridge
- Quarters Stop is not feasible thus there will be no stop within the Quarters Redevelopment
- Nearly 300 m of the alignment runs close to the historic Grierson Hill slide scarp. This requires approx. 300m of slope stabilization compared to approx. 40m for the existing alignment
- Due to the grade on Grierson Hill Road a Conference Centre Stop is not feasible
- There would be approximately 2.5 ha more forest restoration required
- The Edmonton Queen Riverboat facility would need to be moved to another location
- The North Saskatchewan River Bridge will increase in length by approx. 45m
- There is approx. 235m of more track required
- There is approx. 400 m more elevated guideway required

- There is approx. 90 m less tunnel required

Recommendation

Due the technical complications of the proposed alignment along with the removal of the Quarters Stop and the geotechnical concerns we have determined that the proposed alignment is technical inferior and cost prohibitive as compared to the currently proposed alignment. These concerns would be similar even if the alignment was tweaked slightly from the current assessed proposal.

Figures

Table 1 : Conceptual level analysis of alternate alignment proposed through river valley

Issues	Existing Option (Base comparison)	Proposed Option	Cost Delta Order of Magnitude
Alignment	Alignment includes an existing 85m radius at 95st/102 Ave 6% grade to get underground. 1.9% grade across river. Total track length is 1300 m from 97 St to Muttart Stop with 250 m of embedded track.	Alignment feasible if 85m radius required at 96st/102 ave. Broken back curve south along 96th Street will decrease ride quality plus ~6% grade is not recommended. Four tight radius curves at approximately 85m radius curve will be required in tunnel and on elevated structure. Entire route would be slow speeds due to the tight radius curves combined with steep slopes. Curved track on elevated structures and bridge could significantly increase trackwork costs (sliding rail joints, restraining rail, etc...) Total track length from 97 st to Muttart Stop is approximately 1535m with 0 m of embedded track.	Costs included in other items
Quarters Stop	At grade stop between 97 St and 96 St	Not feasible in same location due to the proximity of the portal. Maximum recommended grade at stop is 1.5%. Track grade through stop location is 6%. This would mean that the stop within the Quarters redevelopment area is not feasible	-5 M
Conference Centre Stop	Not included	Would be on approx. 3.5% slope. Maximum recommended slope is 1.5% so this stop is currently not feasible.	N/A
Muttart Stop	Located just west of the Muttart Conservatory. Includes storage track.	Siding Track may not be feasible due to location of horizontal curve.	
Edmonton Queen	Edmonton Queen unaffected.	Edmonton Queen facility impacted. Facility would need to be relocated	+5 M
Cloverdale Pedestrian Bridge	Existing bridge to be removed and replaced with new one to be installed under new LRT bridge	Existing bridge can remain. No new pedestrian bridge required.	-5 M
Grierson Hill track structure	Not required	Would be similar to Connors Road Structure but on difficult soil conditions.(See Geotechnical)	+ 10 M

Table 1 : Conceptual level analysis of alternate alignment proposed through river valley

Issues	Existing Option (Base comparison)	Proposed Option	Cost Delta Order of Magnitude
River Bridge/Elevated Structure	Existing extradosed bridge is 280 m long with approx. 320 m of elevated guideway/bridge across 98 Avenue. The river bridge includes an underslung pedestrian bridge	Proposed extradosed bridge is approximately 325m long with approximately 725 m of elevated guideway from the portal on the north bank to Muttart Stop. Will not include underslung ped bridge. Extradosed bridge may not be feasible due to tight radius curved track. No existing geotechnical holes in area so additional holes would need to be drilled in river to confirm feasibility of design. Unknown risk.	+20 M
Tunnel	Existing tunnel is 350 m long	Proposed tunnel would be 260 m long.	-10 M
Louise McKinney Park	No impact on park vehicular access or parking Limited long term impact to park programming Alignment crosses 3 SUPs	Affects vehicular access into park Parking lot would need to be reconfigured/ moved Limited long term impact to park programming Requires relocation of temporary summer dock, which is the only small watercraft access to the park Park space at top of park would be reduced. Alignment crosses 3 SUPs	+ 10 M

Table 1 : Conceptual level analysis of alternate alignment proposed through river valley

Issues	Existing Option (Base comparison)	Proposed Option	Cost Delta Order of Magnitude
Environmental* (blue alignment is assessed; assumes similar structures would be built in both scenarios; EISA vegetation study area did not extend to western extent of blue alignment)	Crosses through disturbed areas N of river and forest S of river - affects 1 Natural Area	Crosses through disturbed area and forest N of river and through forest S of river - affects 2 Natural Areas	
	Track structure within forest is ~ 139 m long	Track structure within forest is ~457 m long	+ 4 M ~ approximately 4 X higher cost, based on five X the area
	Requires restoration of 0.6 ha of forest	Requires restoration of 3.0 ha of forest	
	Affects rare plants	Affects rare plants	
	Keeps disturbance to floodplain wildlife movement corridor at locations of existing disturbance	Introduces a new structure into floodplain wildlife movement corridor on both sides of river, and in locations that are naturally vegetated	+ 1 M (+)restoration costs for Mill Creek
	Results in net decrease of bridge piers in river	Results in net increase of bridge piers in river	
	Abandoned Mill Creek avoided	Construction temporarily disturbs abandoned Mill Creek and alignment crosses creek twice, may occupy creek bed	(-) Would not require north bank groundwater monitoring program (negligible)
	Requires work in landfill (contaminants)	Largely avoids landfill (contaminants).	

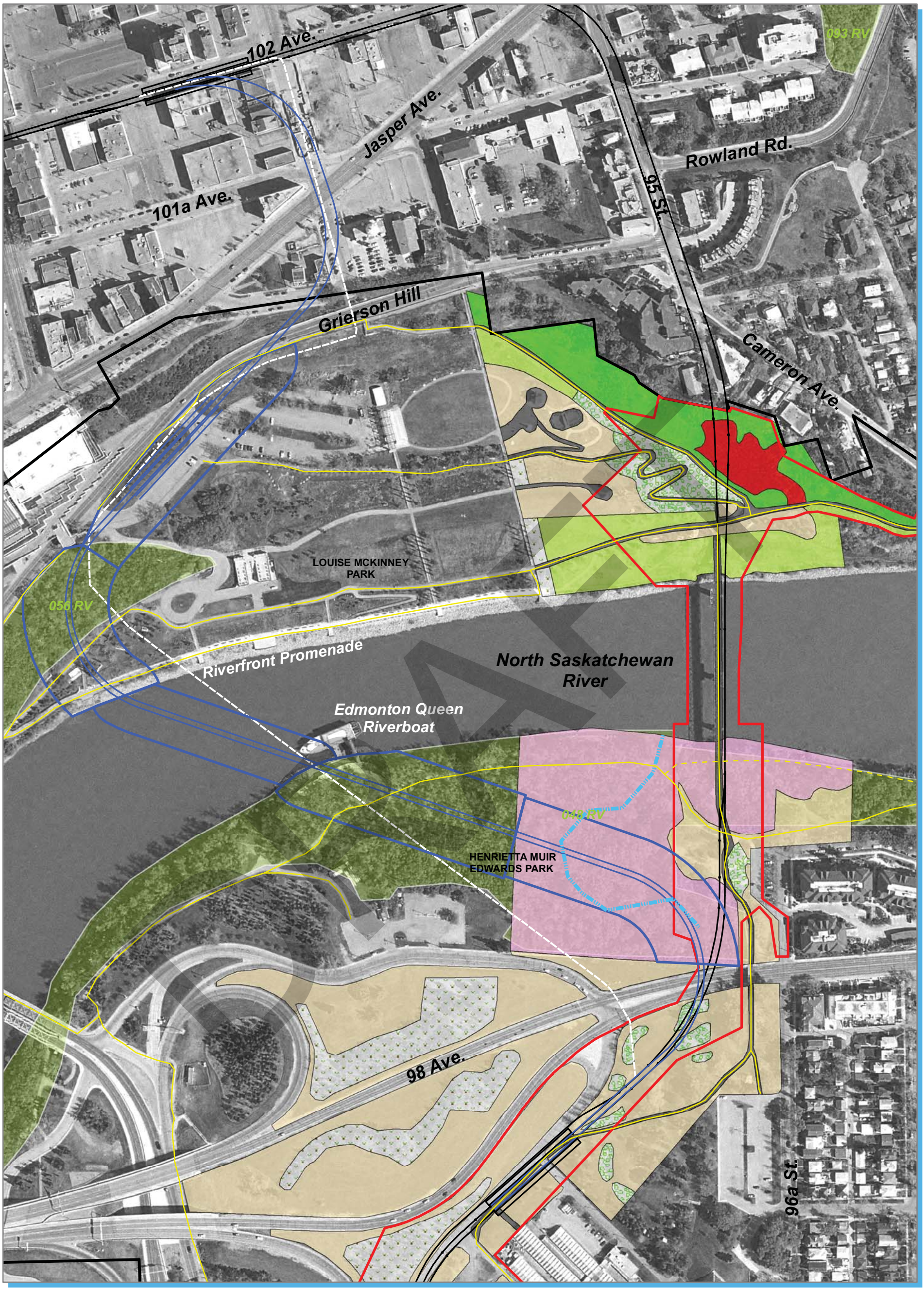
Table 1 : Conceptual level analysis of alternate alignment proposed through river valley

Issues	Existing Option (Base comparison)	Proposed Option	Cost Delta Order of Magnitude
Geotechnical	▪ Alignment is situated on the more stable eastern flank of the Grierson Hill slide. No slope movements were recorded since slope monitoring started in 2010. Slope stabilization measures are required along a limited stretch of the valley slope to enhance stability. ▪ The Tawatinâ Bridge will span over a large portion of the north riverbank to minimize the impact of any potential future slope movement and to eliminate foundation elements in the old waste dump. ▪ No indications of the presence of historic coal mine workings along the alignment.	▪ Nearly 300 m of the alignment is located on the central part of the Grierson Hill slide (Figures 1 & 3), where the magnitude and rate of slope movement are typically the highest. Detailed geotechnical studies and stabilization measures along an extended section of the slope/alignment will be required ▪ The alignment along Grierson Hill Road runs close to the slide scarp (Figures 1 & 3). Stability of the valley slope will be very sensitive to any additional fill loading. An elevated structure will likely be necessary in the Louise McKinney Park. ▪ The proposed alignment runs along the northern limit of the old waste dump. A geotechnical investigation should be carried out to delineate the extents of existing uncontrolled fills and waste material. The proposed alignment intersects historic coal mine workings (Figures 2 & 3). Previous test holes drilled in the vicinity of the alignment identified subsurface voids and timber (Figure 2). Geotechnical evaluations and mitigation measures will be required to protect the LRT tunnel and structures from the adverse effects of potential collapse of coal mine rooms/shafts. Substantial additional costs due to stabilizing 300m of instable slope vs 40m plus uncertainty due to coal mines in the vicinity	+ 50 M
Land	Base case	No need for land east of 96 St south of 102 Ave. Need land on SW corner of 102 Ave and 96 st for tunnel (could be easement) Salvation Army Building would have to be purchased due to portal and tunnel construction. Land required SW 96 St/Jasper Avenue Land required north limit of Louis McKinney Park	City to provide

Table 1 : Conceptual level analysis of alternate alignment proposed through river valley

Issues	Existing Option (Base comparison)	Proposed Option	Cost Delta Order of Magnitude
102 Avenue Portal	Located between 96 St and 95 St.	Located between 97 St and 96 St	Structure Costs similar
North River Bank Portal	Located on east end of LMP above the pedestrian trails	Located below Grierson Hill in LMP in the centre of the Grierson Hill slide. (See Geotechnical)	Structure Costs similar
		Total Order of Magnitude Delta Cost =	+80 M + Land costs

Figure 1 – Proposed Alignment



Legend

- Proposed Alignment Adjusted (AECOM)
- Assumed Project Area (*derived from EISA area*)
- Citizen Suggested Alignment
- Proposed LRT (Current)
- Project Area (Current)
- Shared Use Pathway
- Granular Pathway
- Adandoned Mill Creek*
- Bylaw 7188 Boundary
- City of Edmonton River Valley Natural Areas (2010)

**National Hyrdological Network, GeoBase (2009)*

Natural Communities

- Caragana (C)
- Grassland (G)
- Grassland/Shrub (G/S)
- Balsam Poplar (P1)

Manicured Communities

- Lawn
- Garden
- Planted Bed

Pathway/Structure

- Pathway/Structure

N

0 25 50 100 Meters

1:3,000

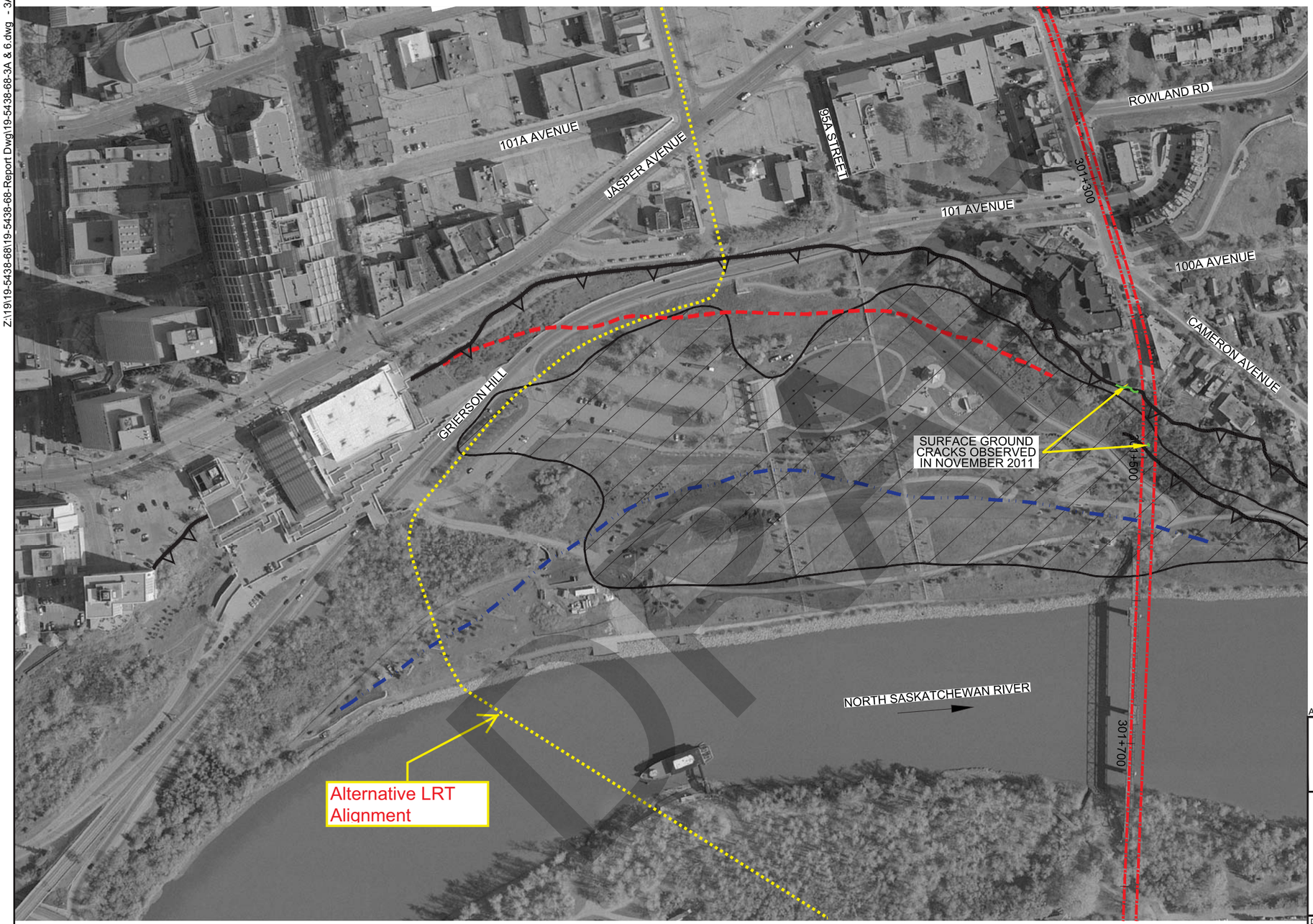
Comparison of Affected River Valley Resources

Aerial Photograph Date: May 2012
Date Map Created: 05 February 2014

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

Figure 2

Z:\19\19-5438-68\19-5438-68-Report Dwg\19-5438-68-3A & 6.dwg - 3A - Mar. 14, 2012



N
W E
S

LEGEND

- GRIERSON HILL USED AS A WASTE DUMP FOR EDMONTON BETWEEN 1911 AND 1940
- PRESENT DAY SLOPE CREST / SCARP
- SLOPE CREST IN 1887 (BEFORE FAILURE)
- TOE OF RIVERBANK IN 1987 (BEFORE FAILURE)
- PROPOSED LRT ALIGNMENT

0 25 50 75 100 150 200 m
SCALE 1:3000

AIR PHOTO PROVIDED BY CH2M HILL CANADA LTD.

AECOM

EDMONTON SOUTHEAST LRT EXTENSION
PRELIMINARY GEOTECHNICAL INVESTIGATION

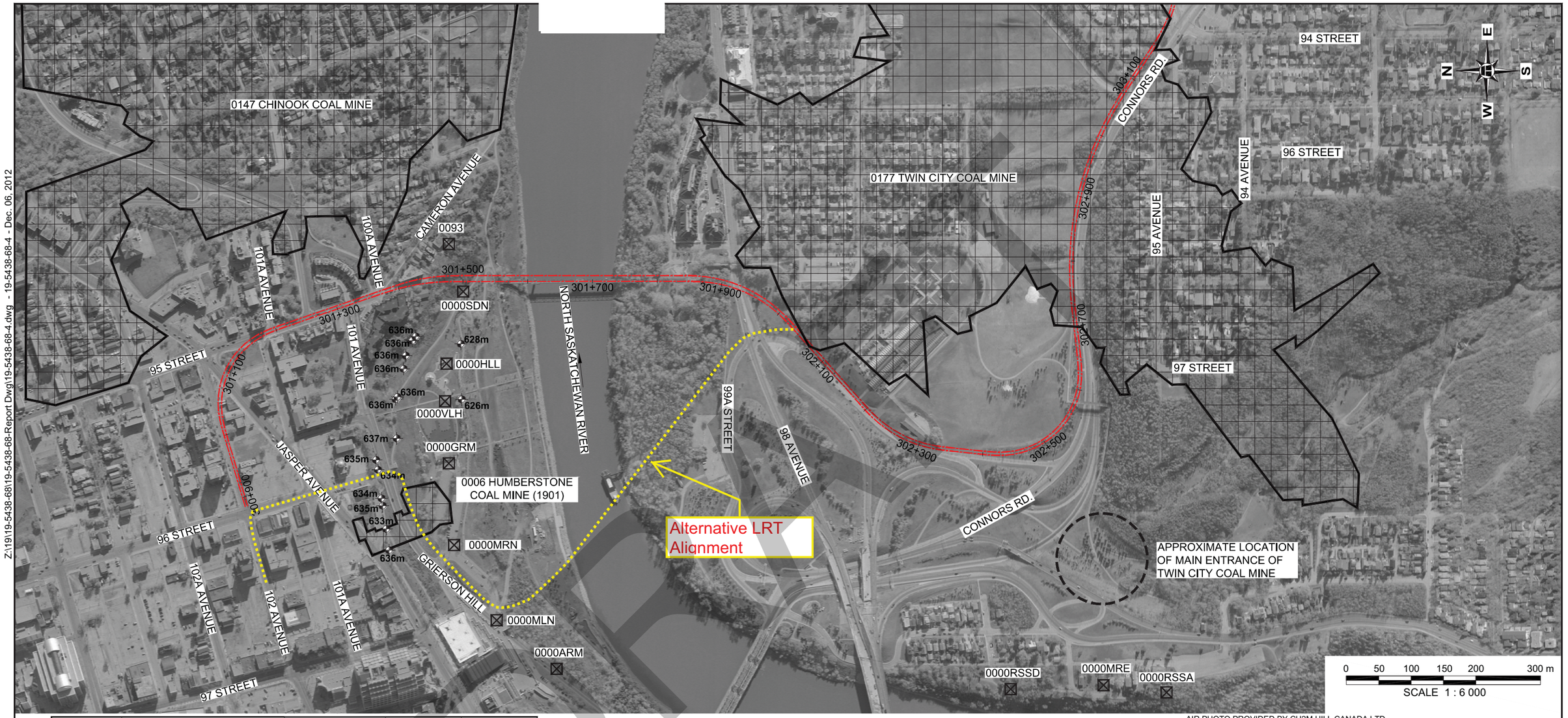
GRIERSON HILL SLIDE - PLAN VIEW

DWG No. 19-5438-68-3A

DRAWN BY	KLW
DESIGNED BY	MB
APPROVED BY	HER
SCALE	1:3000
DATE	MARCH 2012
FILE No.	19-5438-68

THURBER ENGINEERING LTD.

Figure 3



AIR PHOTO PROVIDED BY CH2M HILL CANADA LTD.

MINE No.	MINE NAME	LIFESPAN FROM	LIFESPAN TO	PRODUCTION (10^3 tonnes)	LOCATION AND/OR EXTENT UNCERTAIN
0006	HUMBERSTONE	1886	1902	8.7	YES
0093	CAMERONS	1904	1906	<0.1	YES
0147	CHINOOK	1907	1930	610.8	NO
0177	TWIN CITY	1908	1921	460.8	NO
0000SDN	SANDISON'S	1892	1893	0.5	YES
0000HLL	HALL AND MORAN	1887	1892	?	YES
0000VLH	VOLLRATH'S	1896	1897	?	YES
0000GRM	CLIFF STREET	1892	1896	1.7	YES
0000MRN	MORAN'S	1892	1901	4.4	YES
0000MLN	McLEAN AND ROBERTSON	1882	1884	0.2	YES
0000ARM	ARMSTRONG'S	1892	1893	?	YES
0000MRE	MOORE AND ROSS	1880	1883	0.2	YES
0000RSSD	ROSS	1880	1883	<0.1	YES
0000RSSA	ROSS	1883	1883	?	YES

LEGEND

LARGE TO MAJOR COAL MINE

MINOR COAL MINE

PROPOSED LRT ALIGNMENT

632m PREVIOUS (1958) TEST HOLES THAT INTERSECTED COAL MINE WORKINGS. ELEVATION OF WORKINGS SHOWN IN METERS.

REFERENCES:

EBA ENGINEERING CONSULTANTS LTD., 1981. GRIERSON HILL STABILIZATION STUDY. REPORT SUBMITTED TO THE CITY OF EDMONTON, ENGINEERING DEPARTMENT/PARKS AND RECREATION.

ERCB, 2010. COAL MINE ATLAS - OPERATING AND ABANDONED COAL MINES IN ALBERTA. SERIAL PUBLICATION ST45.

TAYLOR, R.S., 1971. ATLAS: COAL-MINE WORKINGS OF THE EDMONTON AREA. ALBERTA BULLETIN - COMMERCIAL PRINTER LTD., ALBERTA

AECOM

EDMONTON SOUTHEAST LRT EXTENSION
PRELIMINARY GEOTECHNICAL INVESTIGATION

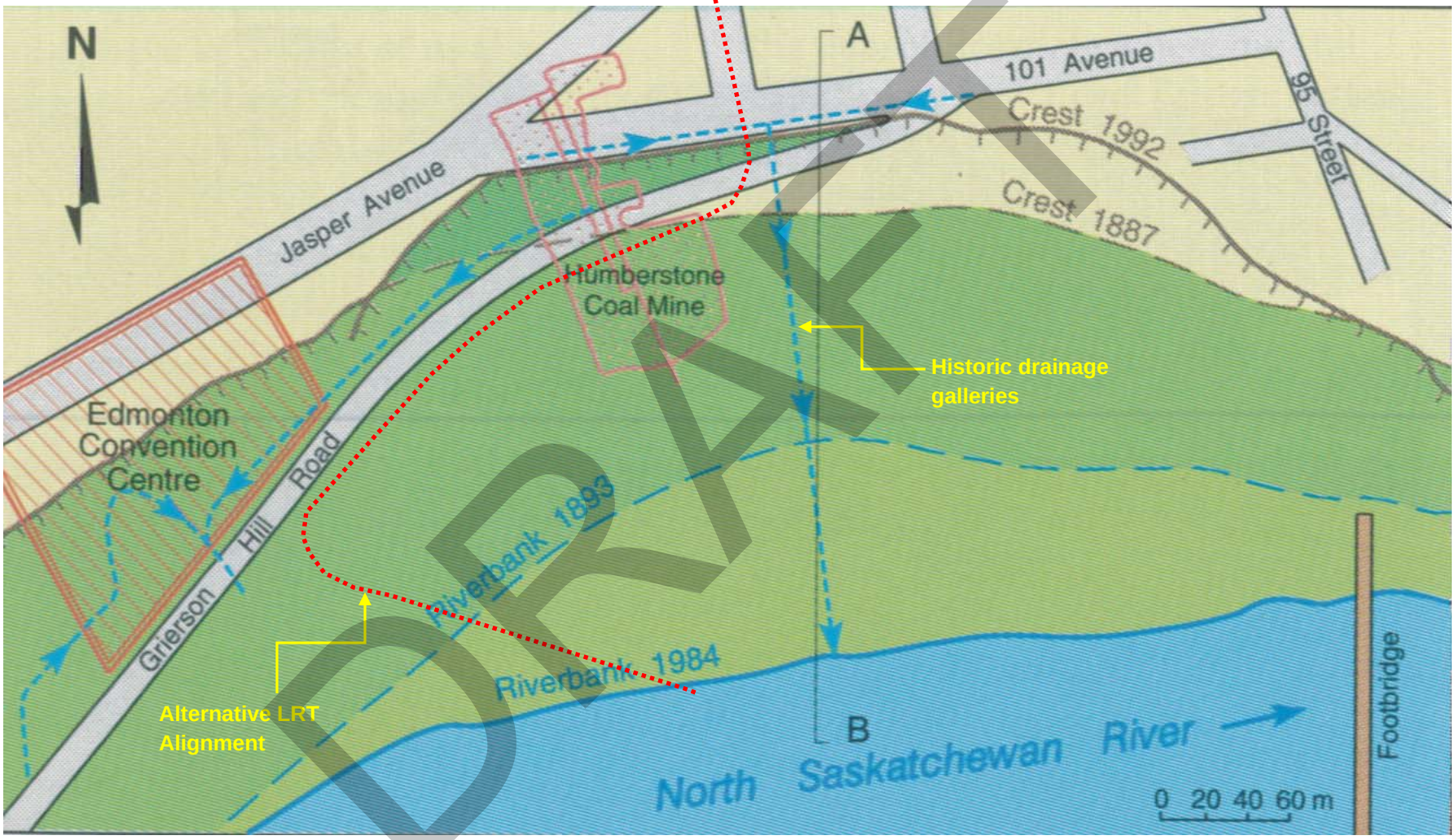
SITE PLAN SHOWING HISTORIC COAL MINE WORKINGS

DWG No. 19-5438-68-4

DRAWN BY	KLW
DESIGNED BY	MB
APPROVED BY	HER
SCALE	1:6000
DATE	MARCH 2012
FILE No.	19-5438-68

THURBER ENGINEERING LTD.

Figure 4



Godfrey, J.D., 1993. Edmonton Beneath Our Feet: A Guide to the Geology of the Edmonton Region. Edmonton Geological Society.

Figure 5