AGENDA
COUNCIL MEETING
MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9
April 27, 2021
1:00 pm via GoToMeeting

A. PUBLIC HEARING 1327-21 INTERMUNICIPAL DEVELOPMENT PLAN (MD PINCHER CREEK & COWLEY) - https://mdpinchercreek.ab.ca/content.php?n=380

B. ADOPTION OF AGENDA

C. DELEGATIONS

a) Larry Manley - Bank Stabilization on Indian Farm Creek

D. MINUTES/NOTES

1. Council Committee Meeting Minutes
   - April 13, 2021
2. Council Meeting Minutes
   - April 13, 2021

E. BUSINESS ARISING FROM THE MINUTES

F. UNFINISHED BUSINESS

a) Garry Marchuk – Follow up to Delegation on April 13, 2021

G. COMMITTEE REPORTS / DIVISIONAL CONCERNS

1. Councillor Quentin Stevick – Division 1
2. Councillor Rick Lemire – Division 2
3. Councillor Bev Everts– Division 3
   - ASB March 3, 2021 Minutes
   - FCSS March 29, 2021 Minutes
4. Reeve Brian Hammond - Division 4
5. Councillor Terry Yagos – Division 5

H. ADMINISTRATION REPORTS

1. Operations

a) Operations Report
   - Report from Administration and Public Works dated April 21, 2021

b) Policy C-PW-009 Dust Control (Proposed Revision to Schedule A)
   - Report from Public Works, dated April 21, 2021

c) Fisher Bridge (Bridge File 2488) Located NW26-07-02 WSM -Update
   - Report from CAO, dated April 22, 2021

2. Finance

a) AES Capital Clean-Up – Spray Truck
   - Report from Director of Finance, dated April 21, 2021

b) PW Capital Clean-Up – Generator and Excavator
   - Report from Director of Finance, dated April 21, 2021

3. Planning and Development

a) AES Monthly Reports
   - Reports from AES for April/May 2021

b) Pincher Creek Regional Recreation Master Plan
   - Report from Director of Development and Community Services, dated April 22, 2021

c) Road Closure Bylaw No. 1322-20
   - Report from Director of Development and Community Services, dated April 22, 2021

d) Road Closure Bylaw No. 1329-21
   - Report from Director of Development and Community Services, dated April 22, 2021

4. Municipal

a) Chief Administrative Officer Report
- Report from CAO, dated April 21, 2021

I. CORRESPONDENCE

1. <u>For Action</u>

a) Canada Day Invitation
- Invitation from Kootenai Brown Pioneer Village

b) Eastern Slopes Coal Exploration & Public Consultation on the 1976 Coal Development Policy
- Letter from Town of High River

c) 2021 Community Challenge-Economic Developers Alberta
- Email from Alberta South West

2. <u>For Information</u>

a) Fair Deal Panel
- Letter from Alberta Justice and Solicitor General

b) Montem Resources Alberta Operations Ltd.'s proposed Tent Mountain Project
- Letter from the MD of Ranchland

c) Letter to Minister Madu Support for RCMP
- Letter from Morinville

d) Letter to Minister Madu Support for RCMP
- Letter from County of Paintearth

J. NEW BUSINESS

a) RMA Meeting Member Update

K. CLOSED MEETING SESSION

a) Road Closure and Purchase Request – FOIP Section 17
b) Resident Application for Municipal Planning Commission – FOIP Section 17

L. ADJOURNMENT

Bank Stabilization on Indian Farm Creek

Statement of Problem

This project concerns the bank of Indian Farm Creek which has been steadily eroding and must be stopped to protect a new structure on the Manley acreage.

The proposal by the Manley's is to split costs on the rehabilitation of the bank with the Manley's and the MD of Pincher Creek. To date there has been over $17,000.00 in engineering and Alberta government fees spent by the Manley's to get permission to commence with this project. We have Water Act permission and have submitted a revision of scope to Public Lands. There was one outstanding item for Public Lands and that was First Nations input. They have sent back paperwork to say there is no consultation required. Fisheries have reviewed and have no concerns. Because of the extensive involvement of the MD, which is outlined below, in the drainage concerns and repairs on the acreage in the past, also the "Agreement For The Direction of Surface Water", they are implicated in the continued work with the owners to get the newest damaged area resolved.

This riding facility, that is to be protected from bank erosion, is an integral part of the continuing business plan by the Manley's to grow their horse herd and produce world class horses for the reining industry. To date we have produced from our foundation mare three daughters, one of which has finished in the finals of the National Reined Horse Association (NRHA) Futurity for three-year old's. Her first foal resulted in another finals qualifier as a three-year-old in the NRHA Futurity. The market price of this mare is $60K USD. We currently have 2 half sisters to our latest qualifier and one other 2-year-old in training.

The Manley's continue to show their locally bred horses at Canadian horse shows and in the USA to develop a continuing market for their horses. The riding arena is integral to their continued success.

History

The situation of drainage across the Manley acreage has a lot of history. This history started when the MD straightened out TWP RD 6-4 to go straight west through original drainage of Indian Farm Creek. The date on the bridge over the creek has a name plate date of 1959. When the road was pushed through there was no change in the original water drainage from the original MD road around the low area of the creek drainage. History from verbal conversations with Andy Luco indicated to Manley's that the MD also scrapped off earth fill from Luco's land to use on the road. The land partitioned by the new and old MD roads created a parcel that would be designated as possible acreage and the MD would put an approach onto the land. Luco sold the acreage to Bill Parkinson in the early 1980's and was developed with a house and barn. Manley's bought the acreage in December 1994. In the 1995 rain storm the driveway into the Manley acreage was eroded away when the drainage from the old road swept over the top of the acreage roadway. There is a lot of drainage area to the east of the Manley acreage and ditch drainage from further east. Due to the damage Andy Luco recalled the "arrangement" between him and the MD to manage that approach for the acreage. We went to visit Tom Ferguson who was our MD rep along with some other neighbors to discuss the damage and the arrangement for this acreage. The request considered and accepted by the MD. The MD, Lloyd Sproule and the Manley's to split the costs to reinstall the driveway approach to the acreage. In 1998 another 100-year flood happened and there was so much water flow that the NE corner of the acreage was very

damaged by erosion. The MD repaired the damage and restored the land so that all the next floods have not damaged the area again. An access agreement (Sept 4, 1997) between the MD and Manley's was signed to provide access of any repairs required along the drainage in the future. The SE corner of the acreage was eroding after that from some flow down the ditch where it emptied onto the Manley acreage and this was again repaired by the MD and there has been no issue in this area again to date.

The extent of the erosion on the east bank has been ongoing over many years and this is manifest by the north/south fence which now has had the ground eroded away and is hanging in mid air or the bank is very near the fence. Obviously, this fence was not built close to the bank when it was put in so one could easily assume an erosion of a least 10 linear feet since the fence was put in. I would assume that Andy Luco probably put this fence in, in the early 1980's when the land was sold as an acreage to Bill Parkinson. I have not been able to confirm that statement. Andy Luco has since passed away as we know, and Tom Ferguson is not around to help with some of the history that has gone on. The historical pictures show the extent of the erosion over the years.

Some other past information comes from a former employee of the MD, Norm Minchau. When TWP RD 6-4 was paved in approx. 2008 Norm Minchau suggested that the MD consider taking the flow from going across the Manley acreage and running it south under the road and join the creek in a proper manner. This suggestion was turned down by the MD. See Norm's statement in the attachment.

Erosion Mechanism

The confluence of two water confluences has many effects on erosion if the confluence is not designed correctly. The water flowing across the Manley acreage is an example of what happens when two tangential streams meet and there are no design considerations to erosion. As documented in the two documents attached there is a separation or recirculation zone on the downstream side. This dynamic has caused erosion on the east downstream side of the creek. This is the area that we need to repair. See the MDPI document section two for a description by the science guys of what is generally happening. Also read the abstract from the Utah State University paper which describes the variances in the recirculation area. If more information on this is required, we can have Lorenz Bohnert, an engineer from Volker Stevin, explain this situation further. Lorenz used to work for Alberta Transport in the past and has worked with the MD on past projects.

Solution

Damage to the bank will continue and can only be prevented by installing a preventive riprap on the east bank as identified by the attached drawings. The engineering solution to this situation was started (2017) by Ivan Crapko and taken over by Watt Engineering Consultants after Ivan's death. This engineered solution has been accepted by the Federal environment and water (DFO) and has been yet to be signed off by Alberta Public Lands and Environment, but we believe that with only one outstanding item that this permit will be issued soon.

The preventive measure will not allow more damage to the bank and endangering existing facilities. The riding arena built in 2019 would eventually become endangered with continuing erosion. This was the only location that could be used without spending large amounts of money to create other flat areas for the building. This building is vital to our equine program it must be protected.

This bank repair may be time sensitive to the last two weeks of August when there may be some water disturbance but is allowed by the jurisdictions. Ideally, we would do this when the water level is very low and never touch the water. It can also be done when the creek is frozen and there is no active water flow. But we must be ready for the August window.

Financials

Engineering and Jurisdictional costs	>$17,000.00	This will increase as the engineering input continues	
Boyce Contracting Estimate.	$46, 341.75		
Suggested cost split			
Manley's	Engineering costs & other Boyce costs	$26,435.00 + GST on Boyce quote	
MD	Supply and installation of rock and fabric barrier.	$34,000.00 + GST from Boyce quote	

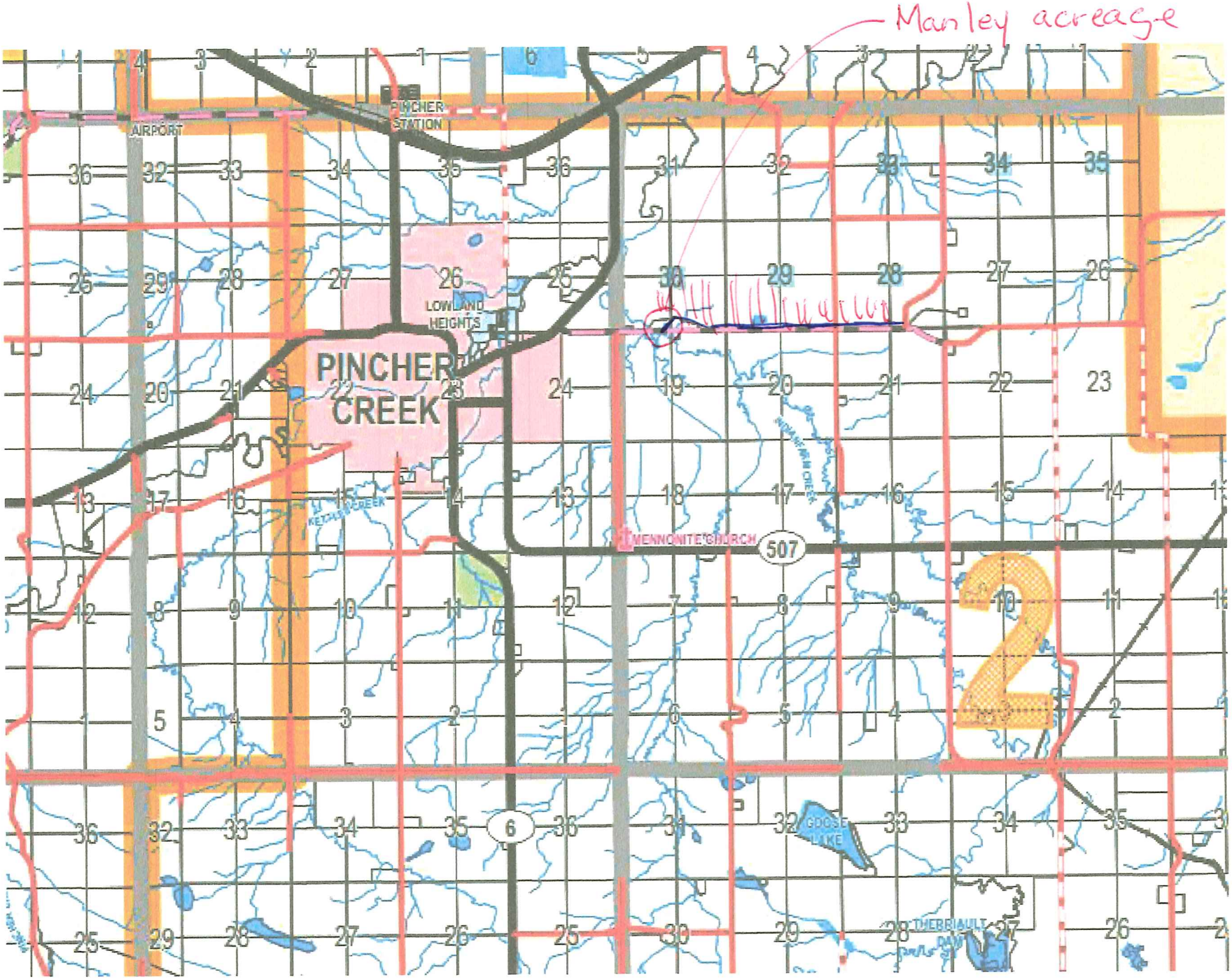
Attachments:

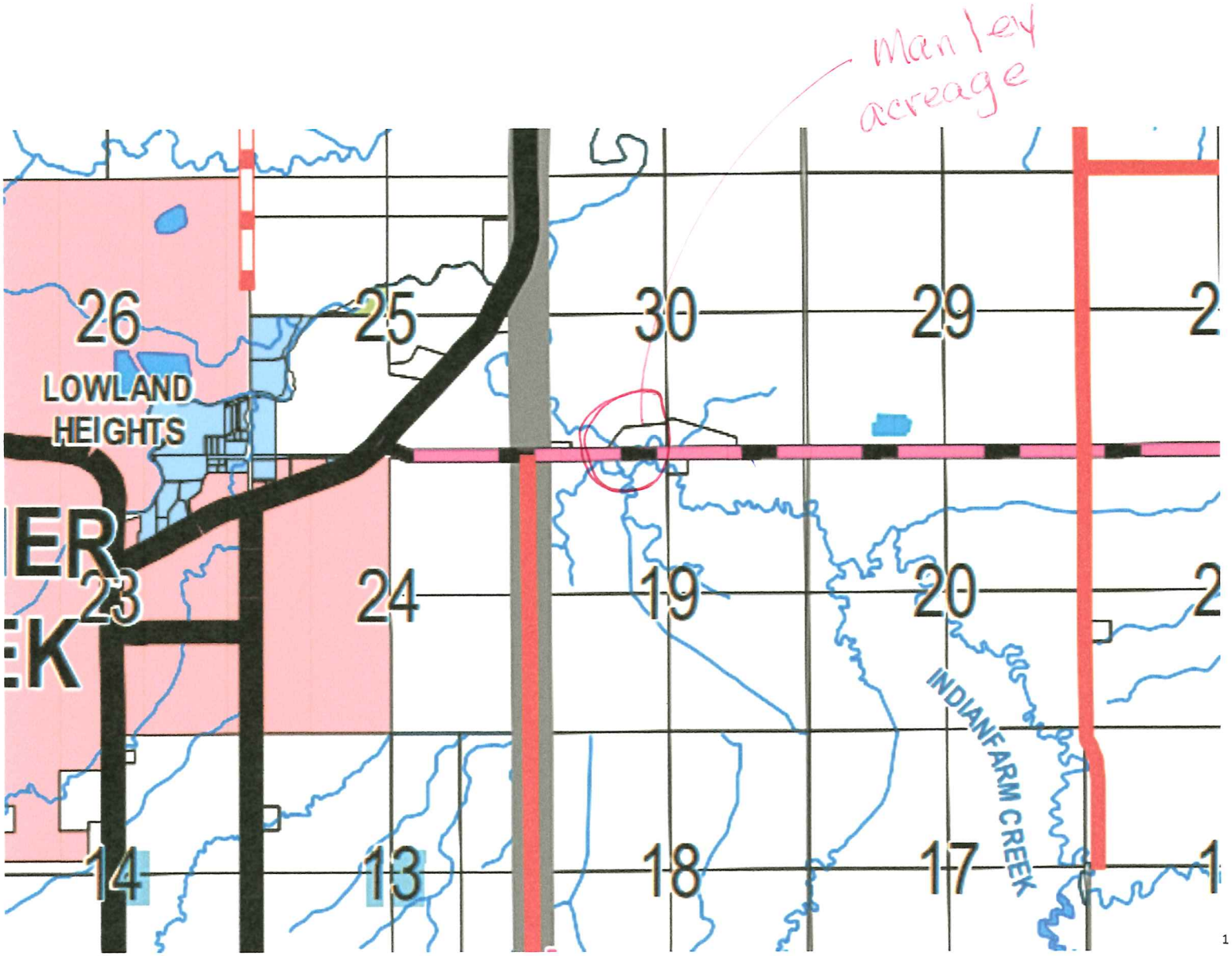
1. Three Google earth screen captures showing the acreage.
2. Three MD maps showing drainage.
3. Watt Engineering drawing showing general arrangement.
4. Agreement for The Direction of Surface Water document.
5. Map showing two acreages formed by the old and new roads.
6. Don Boyce Quote for supply and installation of rip rap.
7. Water Act Approval with Aug 2022 end date.
8. Aboriginal Consultation request which has been fulfilled.
9. Memo from Norman Minchau.
10. Memo from Lorenz Bonhnert.
11. MDPI document on River Confluence in Tidal and Non-Tidal Environments.
12. Utah State University document on Large Eddy Simulation of T-shaped Confluences.


Lowland Heights
785
785
507
785
Pincher Creek No. 9

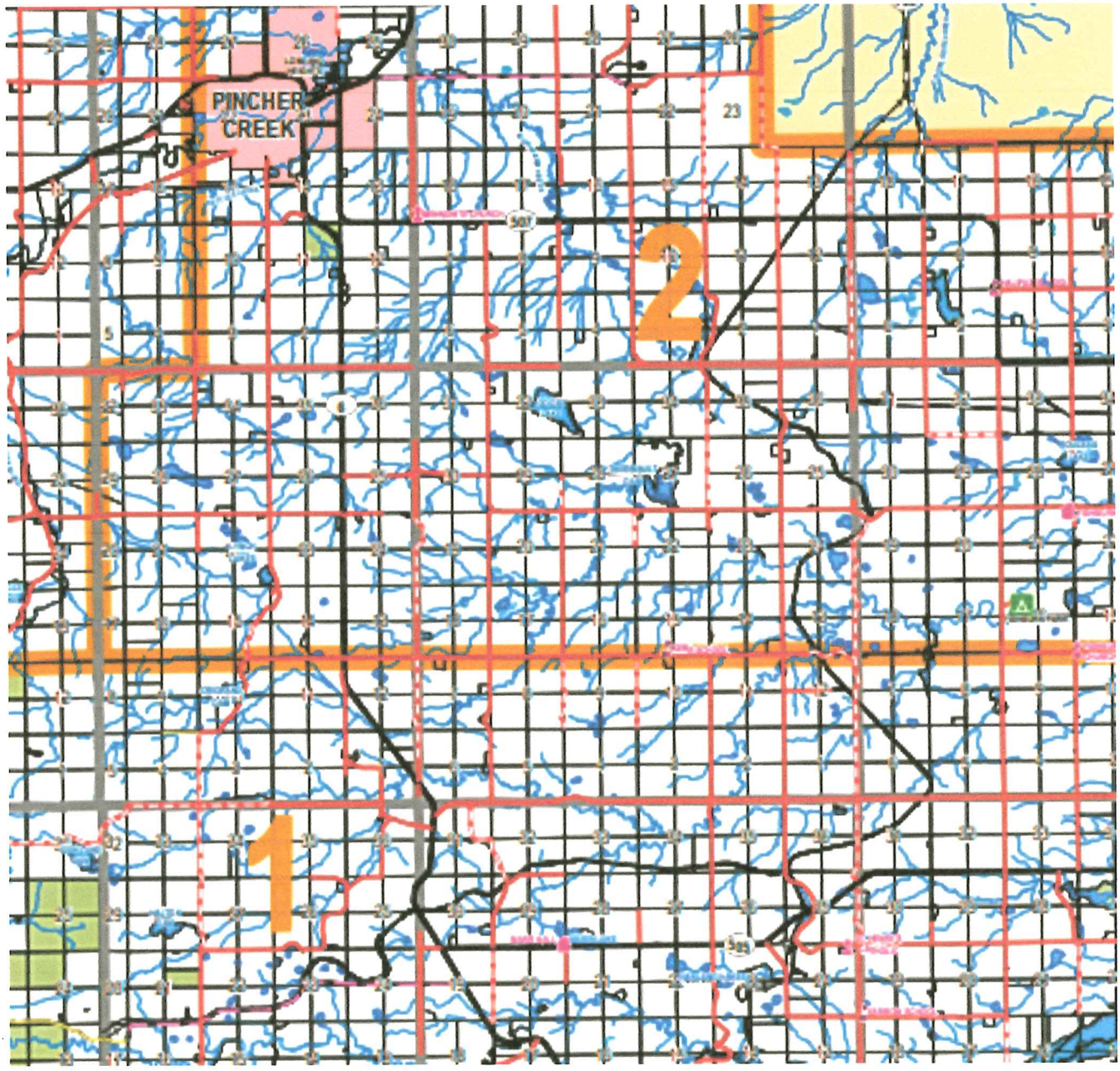

Township Rd 64
Township Rd 64
Township Rd 64
Township Rd 64
Township Rd 64


Township Rd 64
Township Rd 64
Township Rd 64
Township Rd 64
Township

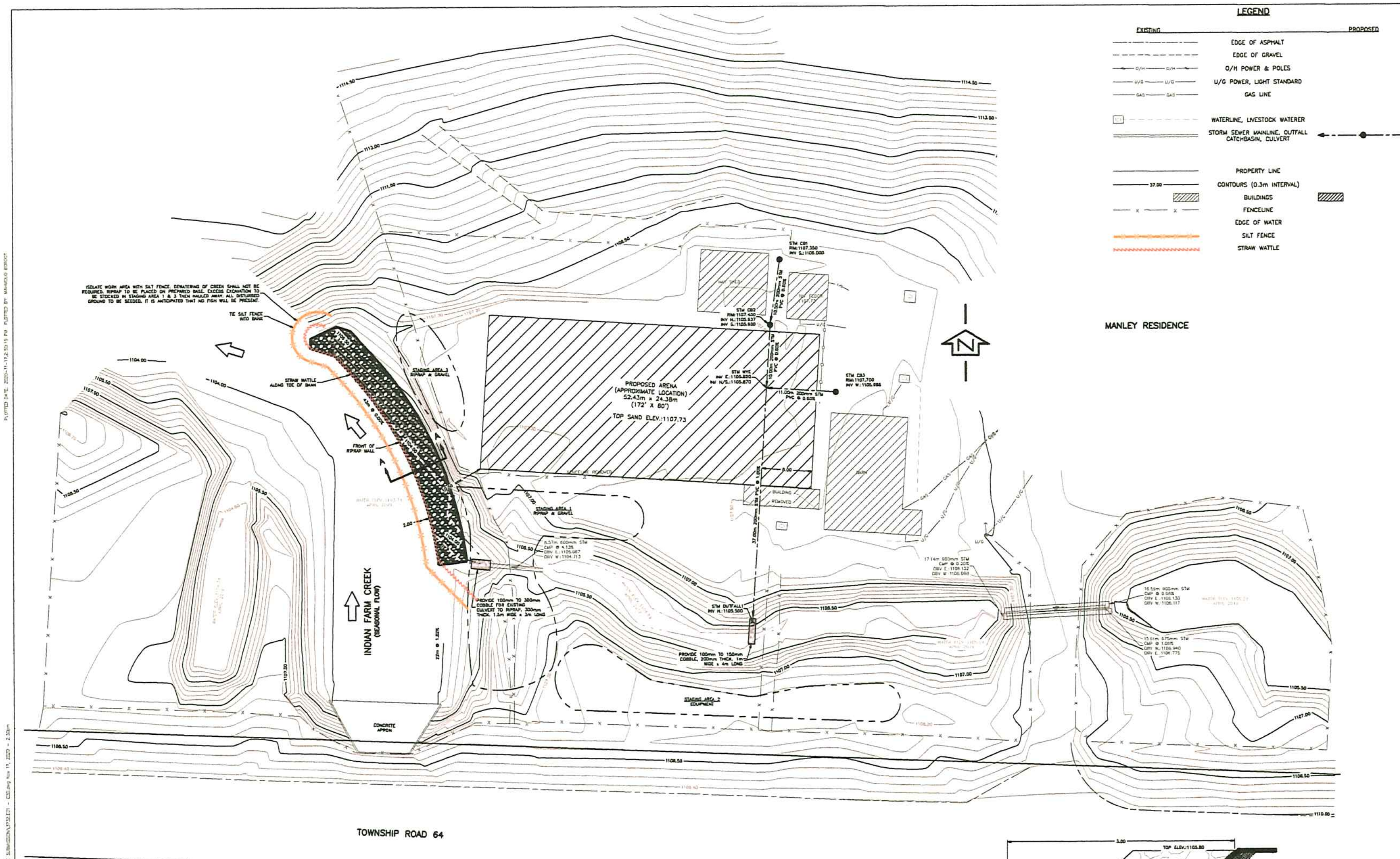

Manley acreage
PINCHER STATION
AIRPORT
LOWLAND HEIGHTS
PINCHER CREEK
MENNONITE CHURCH
507
6
GOOSE LAKE
THERRIAULT DAM
2

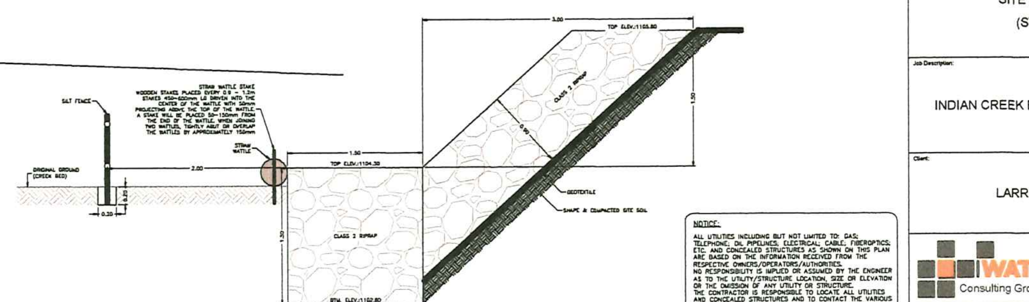

Manley
acreage
26
25
30
29
LOWLAND
HEIGHTS
23
24
19
20
INDIANFARM CREEK
14
13
18
17

1



drainage area





SECTION A–A
(TYPICAL NORTH 30m)
SCALE 1:25

NOTES:

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS
- EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXISTENCE AND LOCATION OF ALL UTILITIES PRIOR TO GROUND DISTURBANCE.
- UTM COORDINATES, NAD83, ORIGINAL GROUND CONTOURS COLLECTED APRIL, 2019.
- ISOLATE CONSTRUCTION AREA FROM STREAM WITH SAND BAG AND SILT FENCE
- NO MACHINERY ALLOWED IN THE WATER
- NO REFUELING WITHIN 20m OF WATER
- SEED DISTURBED AREAS
- PLACE RIPRAP DURING LAST TWO WEEKS IN AUGUST - NO FLOW
- TOTAL VOLUME OF CLASS 2 RIPRAP REQUIRED: 300cu.m.

NOTICE:

ALL UTILITIES INCLUDING BUT NOT LIMITED TO: GAS; TELEPHONE; OIL PIPELINES; ELECTRICAL; CABLE; FIBEROPTICS; ETC. AND CONCEALED STRUCTURES AS SHOWN ON THIS PLAN ARE BASED ON THE INFORMATION RECEIVED FROM THE RESPECTIVE OWNERS/OPERATORS/AUTHORITIES.
NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY THE ENGINEER AS TO THE UTILITY/STRUCTURE LOCATION, SIZE OR ELEVATION OR THE OMISSION OF ANY UTILITY OR STRUCTURE.
THE CONTRACTOR IS RESPONSIBLE TO LOCATE ALL UTILITIES AND CONCEALED STRUCTURES AND TO CONTACT THE VARIOUS OWNERS/OPERATORS/AUTHORITIES FOR ON-SITE INFORMATION AS TO THE ACTUAL LOCATIONS OF ALL EXISTING UTILITIES OR CONCEALED STRUCTURES.
THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE APPROPRIATE OWNERS/OPERATORS/AUTHORITIES OF ITS INTENTION TO CARRY OUT OPERATIONS IN THE AREA.

Engineer's Stamp:

Permit Stamp:

ISSUED

No.	Description	By	Date	Appr

REVISIONS

No.	Description	By	Date	Appr
1	ADDED EROSION CONTROL INFORMATION	CCD	2019/07/08	IDC
2	AS PER WATT	CCD	2020/03/16	IDC
3	UPDATED WORK LIMIT	MB	2020/11/17	IDC

Title:

SITE PLAN & DETAILS
(SW30-6-29-W4)

Job Description:

INDIAN CREEK FARM - BANK PROTECTION

Client:

LARRY & DEB MANLEY

WATT Consulting Group
#310, 3016 - 5 Avenue NE
Calgary, Alberta T2A 6K4
T. 403.273.9001
F. 403.273.3440
www.wattconsultinggroup.com

Drawn: 2018/06/15	Scale: 1:300	Issued 3	Sheets: 1	Total Sheets: 1
Designed: IDC	Date: 2020/03/16			
Draft Chk:	WATT File #:3732.E01	Revision 3		
Design Chk:	Sub File #: 500239			
Approved:	Client File #:			

attn: Larry Manley

AGREEMENT FOR THE DIRECTION OF SURFACE WATER

WHEREAS Larry Paul Manley and Debra Marie Manley (hereinafter referred to as the "Landowner"), the owners of the land legally described as that portion of SW 30 6-29-4, which lies to the south of the surveyed road crossing, said lands as shown on Plan 1471J containing 4.81 Ha (11.9 acres) more or less (hereinafter referred to as the "Property"); and

WHEREAS the Municipal District of Pincher Creek No. 9 (hereinafter referred to as the "M.D.") wishes to redirect surface water draining along Road Plan 1471J onto this Property; and

WHEREAS both parties are willing to enter into an agreement providing for the drainage of such water.

NOW THEREFORE, the parties agree as follows:

1. The Landowner agrees to allow surface water to be directed from Road Plan 1471J located adjacent to the northerly boundary of the Property onto the Property.

2. The Landowner agrees to allow the water to be directed through that area of the Property shown on the map noted as Schedule A, (hereinafter referred to as the ("Watercourse") hereto attached and forming part of this Agreement.

3. The Landowner agrees to allow the M.D. unrestricted access to the Watercourse for the purpose of inspection, carrying out repairs or other related work, or for any other purpose related to the maintenance or repair of the Watercourse.

4. The Landowner agrees to allow this Agreement to be registered in the form of a Caveat against the Property.

5. The M.D. agrees to install rip rap, fieldstone or other erosion control measures as may be required and to repair the erosion control as may be required from time to time to prevent or mitigate water erosion and will perform the work in a timely and workmanlike manner.

6. This Agreement shall continue in force until terminated by the mutual written consent of both parties.

DATED this 4th day of SEPTEMBER, 1997.

LANDOWNER

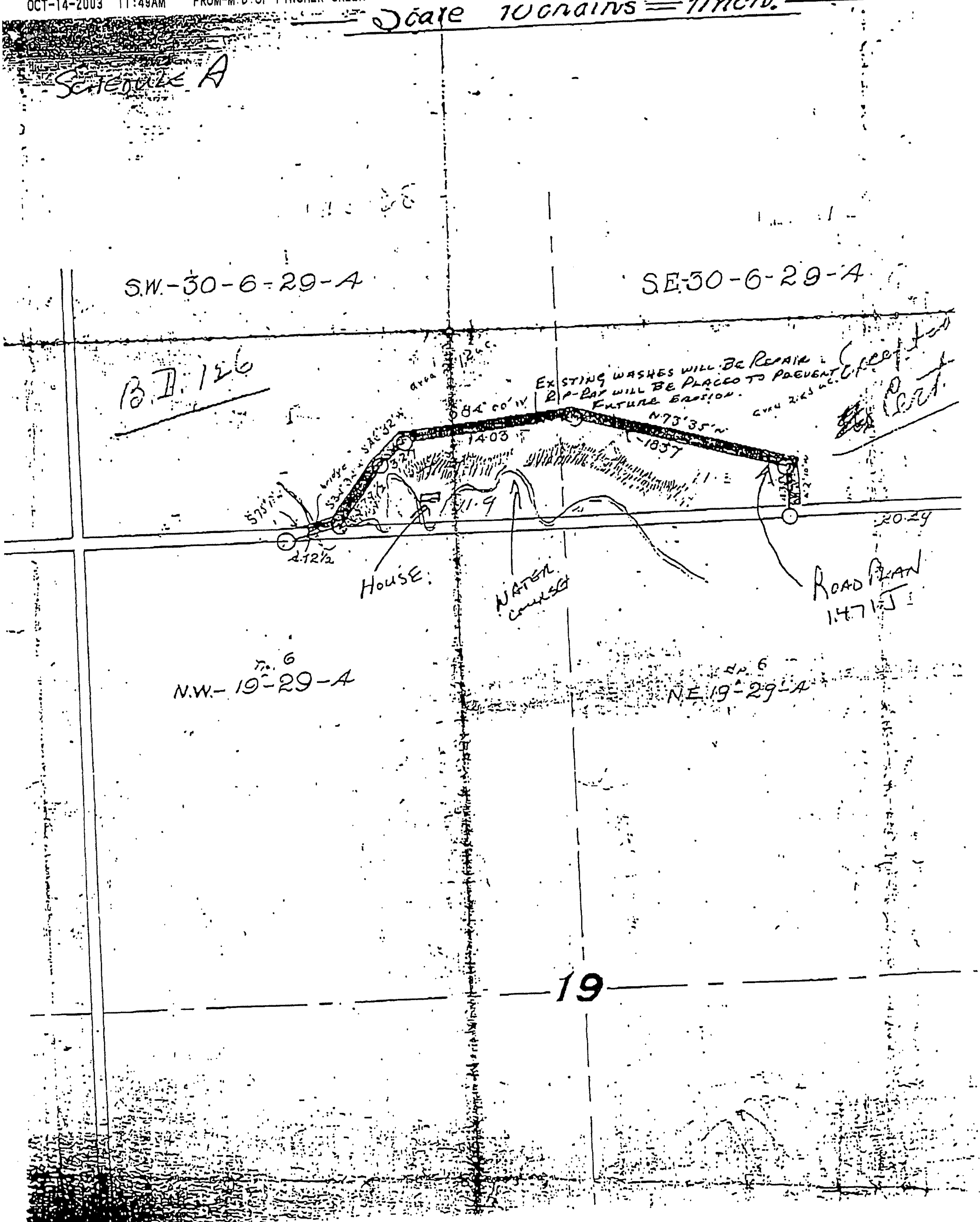
Larry Paul Manley

Debra Marie Manley

MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9

Reeve

Chief Administrative Officer


Scale 10 chains = 1 inch
Schedule A
S.W.-30-6-29-A
SE 30-6-29-A
B.I. 126
Existing washes will be repair & Rip-Rap will be placed to prevent future erosion.
S84°00'W
1403
N73°35'W
1837
2.12½
20.29
House
Water course
Road Plan
1471 J
N.W.-19-29-A
NE 19-29-A
19

DON BOYCE CONTRACTING LTD.

BOX 121
LUNDBRECK, ALBERTA T0K 1H0
Canada

QUOTE

Quote No.: 1
Date: 15/01/2021
Page: 1
Ship Date:

Sold To:

Manley, Larry & Deb
Box 1991
PINCHER CREEK, Alberta T0K 1W0

Ship To:

Manley, Larry & Deb
LUNDBRECK, ALBERTA

Business No.: 11050 2242 RT0001

Item No.	Quantity	Unit	Description	Tax	Unit Price	Amount
			Indian Farm Creek Erosion Protection Supply all equipment, labor and materials to complete placement of approx. 250 m3 of Class2 Rip Rap.	G		
Mobilization	1	LS	Haul Case 210 & Loader In/Out of Site	G	875.00	875.00
Fence Removal	1	LS		G	480.00	480.00
Traffic Signage / Flagman	1	LS	Control Traffic during Rip-Rap Delivery	G	1,255.00	1,255.00
Excavation	1	LS		G	6,825.00	6,825.00
Calss 2 Rip Rap	250	m3	Supply and Place c/w fabric barrier	G	138.80	34,700.00
			Please Note: Owner is responsible for all permits and DFO Approval, fish salvage and turbidity monitoring (If Required).			
			G - GST 5%			
			GST			2,206.75

Shipped by

Comments If you have any questions or need additional information, please call.

Sold By:

Total Amount 46,341.75

Larry Manley

From: Marlin Kennedy <Marlin.Kennedy@gov.ab.ca>
Sent: February 5, 2021 2:49 PM
To: Larry Manley
Subject: Water Act Approval for Indianfarm Creek Bank Stabilization
Attachments: Plan No. 00418571-P001.pdf; Approval 00418571-00-00-signed.pdf

Hi Larry,

The Director authorized your Water Act approval application today.

Attached are the signed approval document and the approved plan for the project.

If you have any problems with the attachments, or have any questions please let me know.

You will also receive formal notification from the Regulatory Approvals Center in Edmonton...perhaps next week or the week after.

Please be advised, the attached approval and approved plan provide you authority under the Water Act to conduct the activity you applied for. They do not provide any authority under the Public Lands Act. Please continue to work with your Lands Officer in regards to your DLO application.

Thank you Larry.

Marlin

Marlin Kennedy
WATER ACT Technologist
Regulatory Assurance Division
South Region - Lethbridge
Government of Alberta

Tel 403-381-5995
Fax 403-381-5337
marlin.kennedy@gov.ab.ca

Alberta

ONLINE RESOURCES:
Approval Applications and Code of Practice Notifications via OneStop - https://www.alberta.ca/environmental-approvals-system-onestop.aspx
Licence Application Forms - https://www.alberta.ca/water-act-forms.aspx#toc-1
Licence Application Submissions – aep.waapplications@gov.ab.ca
Temporary Diversion Licences - https://www.alberta.ca/temporary-diversion-licence.aspx
Water Use Reporting - http://wursoap.gov.ab.ca/WUR/WurHome.aspx
Water Wells - https://www.alberta.ca/groundwater-and-water-wells.aspx
Wetlands - https://www.alberta.ca/alberta-wetland-policy-implementation.aspx

Alberta Environment and Parks

APPROVAL
PROVINCE OF ALBERTA

WATER ACT, R.S.A. 2000, c.W-3, as amended

APPROVAL NUMBER: 00418571-00-00

FILE NUMBER: 00418571

EFFECTIVE DATE: ..... February 4, 2021

EXPIRY DATE: ..... September 1, 2022

WATER BODY: ..... Indianfarm Creek

ACTIVITY LOCATION: ..... SW 30-006-29 W4

APPROVAL HOLDER: ..... Larry and Debra Manley

Pursuant to the *Water Act*, R.S.A. 2000, c.W-3, as amended, an Approval is issued to the Approval Holder to commence, continue and discontinue the following activities:

placing, maintaining, removing, and disturbing works, in or on any land, water or water body;

maintaining, removing or disturbing ground, vegetation or other material in or on any land, water or water body; and

altering direction of flow;

to place rip rap rock along the bank of Indianfarm Creek for the purpose of bank protection

subject to the attached terms and conditions.

Designated Director under the Act: Digitally signed by Dorothy Lok

Dorothy Lok, P.Eng.

Date Signed: February 5, 2021

PART 1: DEFINITIONS

1.0 All definitions from the Act and the Regulations apply except where expressly defined in this Approval.

1.1 In all parts of this Approval:

(a) "Act" means the *Water Act, RSA 2000, c. W-3*, as amended;

(b) "Application" means the written submissions to the Director in respect of application number 001-00418571 and any subsequent applications for amendments of Approval Number 00418571-00-00;

(c) "Director" means an employee of the Government of Alberta designated as a Director under the Act; and

(d) "Regulations" means the regulations, as amended, enacted under the authority of the Act.

PART 2: GENERAL

2.0 The Approval Holder shall immediately report to the Director by telephone any contravention of the terms and conditions of this Approval at 1-780-422-4505.

2.1 The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, the application of such term or condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2.2 The Approval Holder shall not deposit or cause to be deposited any substance in, on, or around the water body that has, or may have, the potential to adversely affect the water body.

PART 3: PARTICULARS

3.0 This Approval is appurtenant to the following:

(a) the undertaking as described as bank protection at the SW 30-006-29 W4 as described in Plan No. 00418571-P001, as specified in Table 3-1.

3.1 The Approval Holder shall only undertake the Activity in accordance with the following plans(s) and report(s) as specified in Table 3-1.

TABLE 3-1: REPORTS AND PLANS

TITLE	DEPARTMENT REFERENCE NUMBER
Larry & Deb Manley Indian Farm Creek – Bank Protection, Site Plan & Details (SW 30-6-29-W4)	00418571-P001

3.2 The Approval Holder shall retain a copy of this approval, and the plan(s) referred to in Table 3-1 at the site of the Activity at all times while conducting the Activity.

3.3 The Approval Holder shall not undertake the Activity in any manner or use any material that causes or may cause an adverse effect on the aquatic environment, human health, property or public safety.

3.4 The Approval Hso older shall not conduct the Activity in the water body between September 1 and August 15 unless the work site is dry or frozen to the ground, or as otherwise authorized in writing by the Director.

3.5 The Approval Holder may only remove or disturb bank vegetation as described in Plan No. 00418571-P001, as specified in Table 3-1.

3.6 During the Activity, the Approval Holder shall maintain a continuous flow of water in the water body.

PART 4: SILTATION AND EROSION CONTROL

4.0 The Approval Holder shall not do or permit anything to be done, nor omit or permit any omissions, which causes or may cause an adverse effect related to:

(a) siltation; or

(b) erosion

as a result of the Activity.

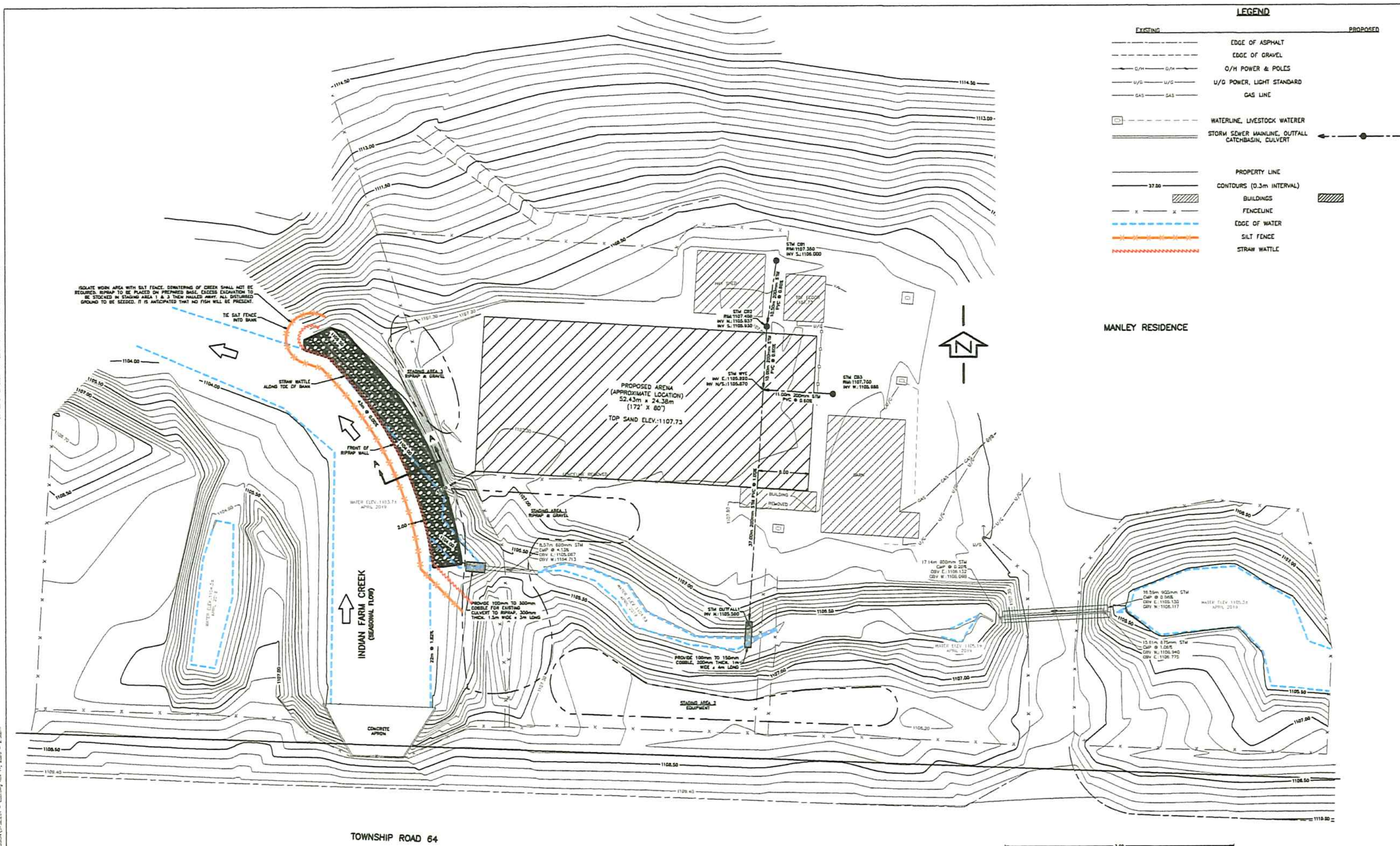
PART 5: CERTIFICATE OF COMPLETION

5.0 A Certificate of Completion is not required for this Activity.

Date Signed: February 5, 2021

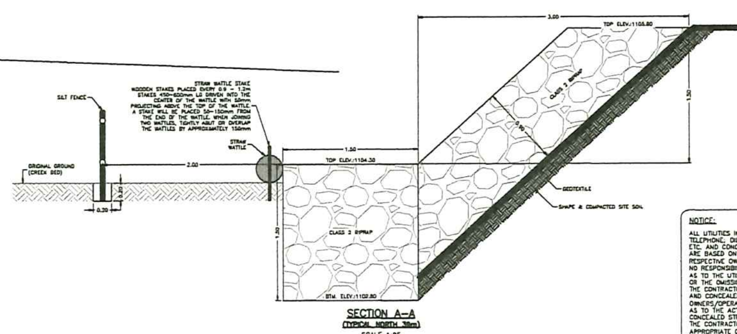
Digitally signed by Dorothy Lok

Designated Director under the Act
Dorothy Lok, P.Eng.



PLAN NO. 00418571-P001

THIS DOCUMENT FORMS PART OF AN AUTHORIZATION ISSUED UNDER THE *WATER ACT*



NOTICE:

ALL UTILITIES INCLUDING BUT NOT LIMITED TO: GAS; TELEPHONE; OIL PIPELINES; ELECTRICAL; CABLE; FIBEROPTICS; ETC. AND CONCEALED STRUCTURES AS SHOWN ON THIS PLAN ARE BASED ON THE INFORMATION RECEIVED FROM THE RESPECTIVE OWNERS/OPERATORS/AUTHORITIES.
NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY THE ENGINEER AS TO THE UTILITY/STRUCTURE LOCATION, SIZE OR ELEVATION OR THE OMISSION OF ANY UTILITY OR STRUCTURE.
THE CONTRACTOR IS RESPONSIBLE TO LOCATE ALL UTILITIES AND CONCEALED STRUCTURES AND TO CONTACT THE VARIOUS OWNERS/OPERATORS/AUTHORITIES FOR ON-SITE INFORMATION AS TO THE ACTUAL LOCATIONS OF ALL EXISTING UTILITIES OR CONCEALED STRUCTURES.
THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE APPROPRIATE OWNERS/OPERATORS/AUTHORITIES OF ITS INTENTION TO CARRY OUT OPERATIONS IN THE AREA.

NOTES:

- ALL DIMENSIONS AND ELEVATIONS ARE IN METERS
- EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXISTENCE AND LOCATION OF ALL UTILITIES PRIOR TO GROUND DISTURBANCE.
- UTM COORDINATES, NAD83, ORIGINAL GROUND CONTOURS COLLECTED APRIL, 2019.
- ISOLATE CONSTRUCTION AREA FROM STREAM WITH SAND BAG AND SILT FENCE
- NO MACHINERY ALLOWED IN THE WATER
- NO REFUELING WITHIN 20m OF WATER
- SEED DISTURBED AREAS
- PLACE RIPRAP DURING LAST TWO WEEKS IN AUGUST - NO FLOW
- TOTAL VOLUME OF CLASS 2 RIPRAP REQUIRED: 300cu.m.

Engineer's Stamp:

Permit Stamp:

ISSUED

No.	Description	By	Date	Appr

REVISIONS

No.	Description	By	Date	Appr
1	ADDED EROSION CONTROL INFORMATION	CCD	2019/07/08	IDC
2	AS PER WATT	CCD	2020/03/16	IDC
3	UPDATED WORK LIMIT	MB	2020/11/17	IDC

Title:

SITE PLAN & DETAILS
(SW30-6-29-W4)

Job Description:

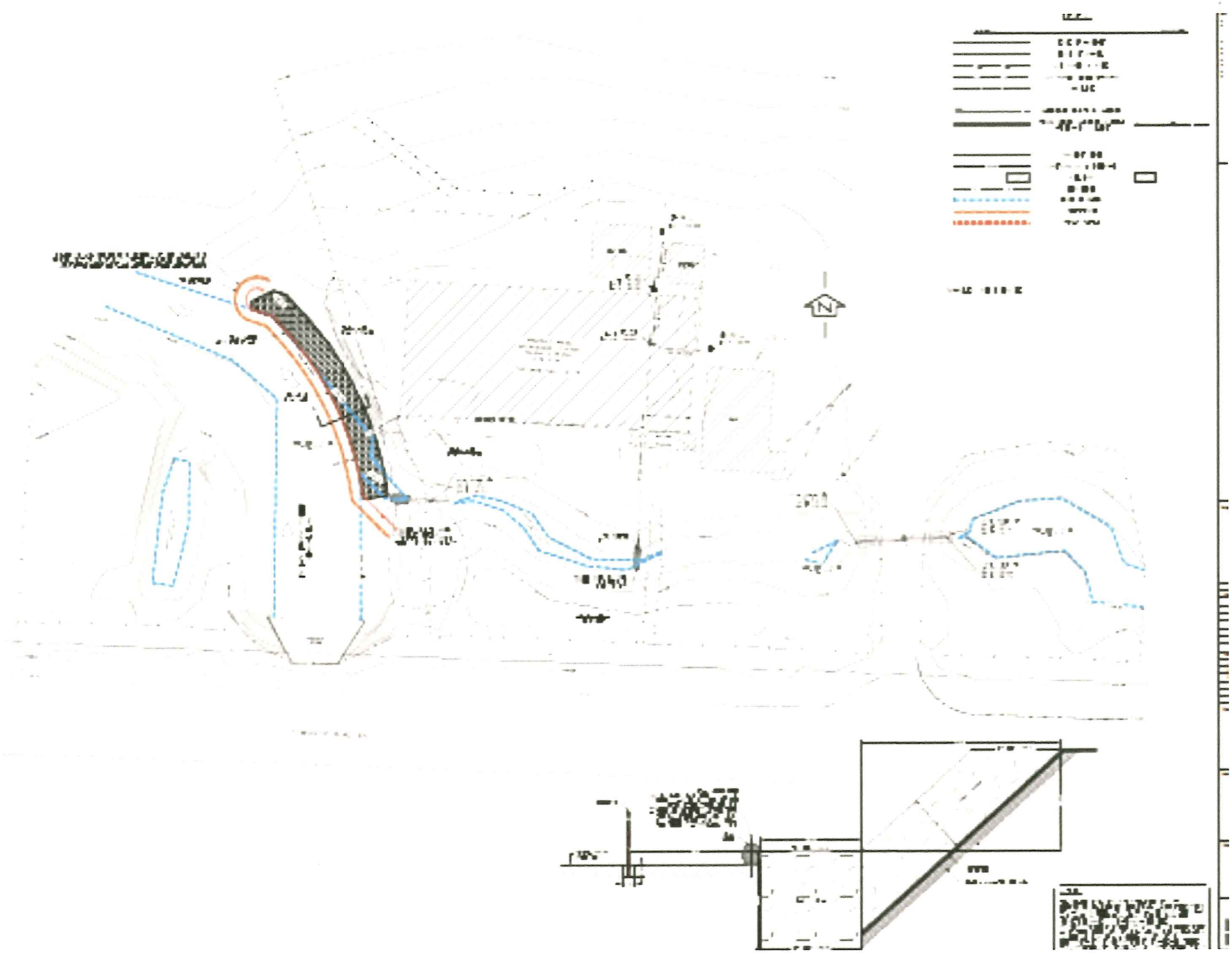
INDIAN CREEK FARM - BANK PROTECTION

Client:

LARRY & DEB MANLEY

WATT Consulting Group
#310, 3016 - 5 Avenue NE
Calgary, Alberta T2A 6K4
T. 403.273.9001
F. 403.273.3440
www.wattconsultinggroup.com

Drawn: 2018/06/15	Scale: 1:300	Issued 3	Sheets: 1	Total Sheets: 1
Designed: IDC	Date: 2020/03/16			
Draft Chk:	WATT File #:3732.E01	Revision 3		
Design Chk:	Sub File #: 500239			
Approved:	Client File #:			



Amendment for Surface Dispositions

Alberta Government

Confirmation Number: 2021000032
First Nations Consultation Number:
Application Supplement Number:
Submission Date: 2021-02-03

Department File Number: **DLO200056**

Landscape Analysis Tool Number: | Tenure Request ☐

Reason for Amendment ☐ Addition / Change in Land / Change Dimension ☐ Deletion of Lands ☐ No Change ☐ Change of Client

☐ Partial Assignment | From/To:

☒ Plan Replacement Only : ☐ *Sketch Plan to Survey Plan* ☐ *Survey Plan to Survey Plan* ☒ *Sketch Plan to Sketch Plan*

☐ Purpose | From: To:

Occupant's Consent ☐ Attached ☒ Not Required

Was a Temporary Field Authorization (TFA) issued for any additions within this amendment? No

Does this application include watercourse crossings regulated under the *Water Act* (Ministerial) Regulations' Code of Practice for Pipelines and Telecommunication Lines Watercourse Crossings? ☐ Yes ☒ No
If yes, the applicable *Water Act* Notice must be submitted with this application.

Does this application impact wetlands? ☐ Yes ☐ No

Applicant: MANLEY, LARRY			Client ID: 1023699001
Address: PO BOX 1991			Tel: (403)627-2948
City/Town: PINCHER CREEK	Province: Alberta	Postal Code: T0K 1W0	Fax:
Applicant File Number: 3732.E01		Applicant Email: larry@imsystems.ca	
Program/Project Name:			
Contact/Agent: Kroeker, Nathan			File Number:
Organization: WATT CONSULTING GROUP LTD.			
Address: 3016 5 AVE NE SUITE 310			Tel: (403)569-8720
City/Town: CALGARY	Province: Alberta	Postal Code: T2A 6K4	Fax:
Email: nkroeker@wattconsultinggroup.com		Contact Alternate Email: nkroeker@wattconsultinggroup.com	

Lands Affected

Add Lands				Delete Lands				Lands Now Required			
Subdivision	Plan	Blk	Lot	Subdivision	Plan	Blk	Lot	Subdivision	Plan	Blk	Lot

Qtr/LS	Sec	Twp	Rge	Mer	Qtr/LS	Sec	Twp	Rge	Mer	Qtr/LS	Sec	Twp	Rge	Mer
										SW	30	6	29	4

Attachments: Consent - N; Code of Practice - N; Application Supplement - N; LAT Report - N; Wildlife Survey - N; Land Standing - N; Cover Letter - N; WAIR - N; WAIF - N;

Remarks:

Larry Manley

From: Moh'd Al-Heneiti <MAl-Heneiti@wattconsultinggroup.com>
Sent: March 5, 2021 3:26 PM
To: Larry Manley
Subject: FW: DLO 200056 - requirements

Importance: High

Hello Larry,
Please see below. thanks

Moh'd

Moh'd Al-Heneiti, B.Eng., P.Eng.
Vice President, Engineering
T 403-273-9001 ext. 712
D 403-569-8712 C 403-829-3117
E mal-heneiti@wattconsultinggroup.com

WATTCONSULTINGGROUP.COM
#310, 3016 - 5 Avenue NE, Calgary, Alberta T2A 6K4

#WEAREWATT

From: Nathan Kroeker <NKroeker@wattconsultinggroup.com>
Sent: March 4, 2021 9:26 AM
To: Moh'd Al-Heneiti <MAl-Heneiti@wattconsultinggroup.com>
Subject: FW: DLO 200056 - requirements
Importance: High

Hi Moh'd,
I got this back from AEP yesterday about the DLO application for Larry Manley. Can you confirm with your client if they have received any requests regarding the First Nations Consultation?
-Nathan

Nathan Kroeker, A.L.S.
Office Resource Manager - Geomatics
T 403-273-9001 ext. 720
D 403-569-8720
E nkroeker@wattconsultinggroup.com

WATTCONSULTINGGROUP.COM

From: Cindy Sanche <Cindy.Sanche@gov.ab.ca>
Sent: March 3, 2021 9:44 AM
To: Nathan Kroeker <NKroeker@wattconsultinggroup.com>
Subject: DLO 200056 - requirements
Importance: High

Good morning,

We cannot proceed with any approval until your client, Larry Manley, completes the requirements asked of him by the ACO.
The First Nations Consultation as not yet been deemed adequate and it is required to be before we can proceed further.

Thank you,

Cindy Sanche
Legal Land Administrator
Applications & Industrial Unit
Public Lands Disposition Management Section
Lands Division
Alberta Environment and Parks
cindy.sanche@gov.ab.ca
P 780.415.4604

Alberta Environment and Parks

Classification: Protected A

Adequacy Assessment

File Number for Consultation: FNC202002632 Date of Submission: 2020/03/30

Client Project Name: Bank Stabilization

The Aboriginal Consultation Office has reviewed the consultation records regarding the proposed projects provided by

MANLEY, LARRY

In accordance with Alberta's First Nations and Metis Settlements policies and guidelines (http://indigenous.alberta.ca/1.cfm), the Aboriginal Consultation Office has determined adequacy for each activity number. The proponent may proceed with their regulatory applications for those activities deemed Adequate.

Be advised that this notice does not grant the client any authority to make application for any use of land not identified within this notification.

Reviewed by: Vanrietschote, Marlene Date of Review: 2021/03/17

Should you have any questions, please contact the reviewer at:

Phone Number: (403)355-2450 Email Address: marlene.vanrietschote@gov.ab.ca

Supporting Comments/Direction:

This advice pertains only to the issuance of the proposed disposition under the Public Lands Act. Authorizations or approvals may be required under the Water Act or EPEA and these authorizations or approvals may require consultation.

Personal information is collected in accordance with Section 33(c) of the Freedom of Information and Protection of Privacy Act. The personal information collected within this form will be used to administer the First Nations/Metis Settlements consultation process. If you have any questions about the collection or use of this information, you can contact the Director, FOIP Services, Indigenous Relations and International and Intergovernmental Relations (780)427-9658.

sment

Disp Type	Program Type	Source Line Spacing	Regulator	Purpose Type	Activity Area/Distance	Land
DLO			AEP	Erosion Protection - Upland Erosion Protection	0.04 HA	South Saska

ATS Legal - From	ATS Legal - To	First Nation(s) / Metis Settlement(s)
SW 30 6 29 4	SW 30 6 29 4	
No Consultation Required		
No Consultation Required		

Disp Type	Program Type	Source Line Spacing	Regulator	Purpose Type	Activity Area/Distance	Land

ATS Legal - From	ATS Legal - To	First Nation(s) / Metis Settlement(s)

Disp Type	Program Type	Source Line Spacing	Regulator	Purpose Type	Activity Area/Distance	Land

ATS Legal - From	ATS Legal - To	First Nation(s) / Metis Settlement(s)

August 28, 2019

Re: Erosion of Indian Farm Creek Banks within the SW 30 – 6 – 29 - W4

Mr. Larry Manley

As per our meeting onsite August 27, 2019 to discuss the erosion of the Indian Farm Creek adjacent to your riding arena.

I would like to bring to your attention the following:

- The Municipal District, through the years has constructed roads in at a minimum two separate locations.
- No culvert has been placed through the existing Tower Road east of the box within the deep fill area.
- The existing old road ditch along the north boundary of your property funnels the runoff water from the farmland to the north through a manmade drainage ditch to the Indian Farm Creek immediately downstream of the box culvert.
- During extreme runoff, the water leaving this manmade ditch and entering the Indian Farm Creek creates a whirlpool and causes erosion to the east creek bank.
- The concentrated water flow resulting from the design of the old road ditch has caused problems to this property in the past. When I was the Public Works Superintendent I met on site with the division Councilor and Disaster Recovery Personnel. It was determined to be an M.D. problem and the area was repaired through the Disaster Recovery Program. However nothing was done to direct the runoff water back to the Indian Farm Creek on the south side of the Tower Road.

In summation it is my opinion that the construction of both the old road and the existing Tower Road along with the borrowing of earth fill from that property has caused the runoff water from the north to not be able to reach the Indian Farm Creek as per the original overland flow prior to road construction.

Taking into consideration the above outlined facts it is my opinion that the Municipal District should be a partner in the armoring of the Indian Farm Creek Banks downstream of the box culvert in SW 30 -6-29—W4

Norman Minchau

Box 2362
Pincher Creek, AB
Ph. 1-403-627-2759

SYNOPTIC OVERVIEW – Larry and Deb Manley Erosion Control Indian Farm Creek – Bank Protection

1. Brief History

- Bank protection is required directly downstream of BF 01533 Bridge Culvert that was constructed in 1959. The structure is a 7650mm x 3700mm BPR (cast-in-place) concrete box x 33.2m invert length.
- Structure is located on a local road SW30-6-29-W4 just east of Pincher Creek
- Bank erosion concern is located on the east bank of the watercourse directly north of BF 01533.

2. References for Required Work to Address Bank Erosion Prior to Spring Run-off

- Reference Material includes Cicon Engineering Site Plan and Details dated 06/15-18.
- Google Earth Aerial Photograph with initial rock riprap key-in line shown schematically and ditch drainage rock slope swale and clay fill infill areas
- Typical Section "Riprap Armouring for Slope"
- Rock Vane streambank stabilization techniques "Best Management Practices" including typical section and plan view of rock vanes.

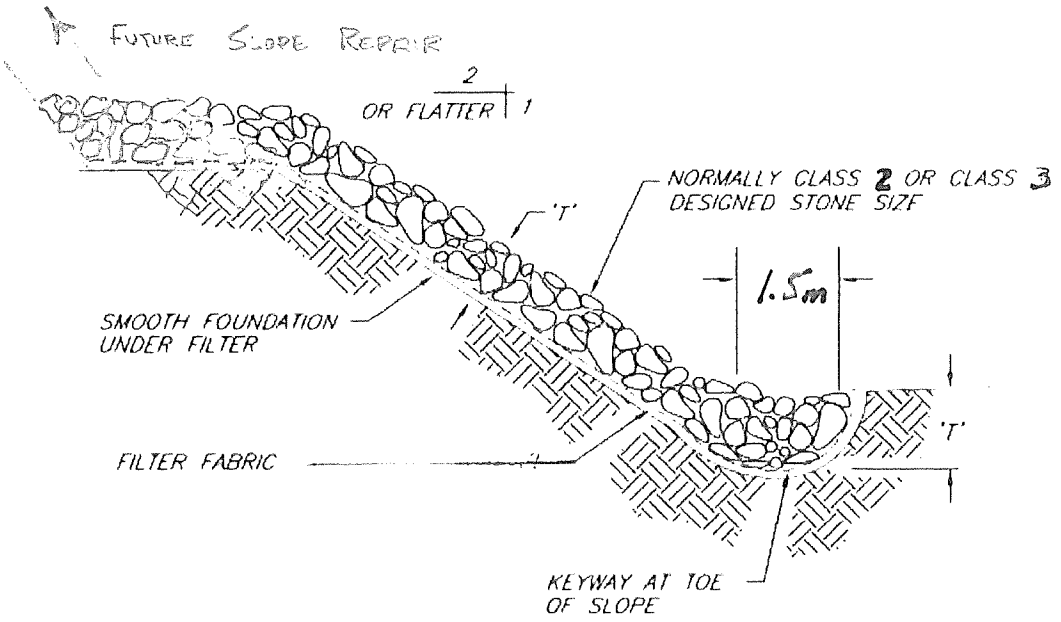
3. Phase 1 of Bank Erosion Repair

- Place Class 2 and 3 rock riprap along the toe of the slope to achieve a curvilinear hydraulic line at the toe of the bank (See Sheet 1)De
- Rock to be placed to match section detail shown on (Sheet 2). Please note rock sizes to be Class 2 and 3. Riprap to be a minimum of 500mm thick and Class 3 rock at the toe to be keyed in to half its depth.
- The intent of the riprap armouring of the slope is to arrest lower slope failure and to stabilize the base of the existing banks to limit erosion during the next high flow event.
- Any areas behind the initial toe key-in should be infilled with compacted clays to re-structure the existing natural slopes to a 2:1 sideslope to a minimum height of 1.7m above the existing key-in edge. As part of Phase 1 a small narrow terrace as shown on the typical section to be constructed and rocked with the balance of the slope and fills being contoured above the rocked terrace to complete the balance of the slope at the 2:1.

- The purpose of the terrace is to arrest any erosion in the lower portion of the slope and to prevent further migration of the stream along the perimeter edge and to protect existing infrastructure at the top of the slope.
- Straw wattles to be installed at the base of the upper slope area to protect the stream from additional fines from washing down the slope into the water course below.
- The area of the slope that intersects the drainage ditch on the north side of the local road also needs to be addressed with the installation of an armoured rock swale to allow flows from the surface drainage ditch to enter the water course flowing over the rock armour and over the Class 2 and 3 armoured bank.
- As an additional measure to protect the northeast embankment we would suggest the installation of at least two rock vanes, one each side of the ditch drainage outlet and a third rock vane as shown on Sheet 1. These rock vanes will assist in protecting the east embankment during high flow events.
- There is a complete rock vane package included in the supplemental information attached with this package. Sketches and sections are also provided.

If you require additional information or clarification, please advise.

Respectfully,



TYPICAL SECTION

NOTE:

1. 'T' = THICKNESS: THICKNESS SHALL BE DETERMINED BY THE ENGINEER.
   MINIMUM THICKNESS = 500 mm.
2. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

RIPRAP ARMOURING FOR SLOPE

FILE: RIPRAP

Journal of
Marine Science and Engineering

MDPI

Review

Flow, Sediment, and Morpho-Dynamics of River Confluence in Tidal and Non-Tidal Environments

Ahmed Bilal [1,†], Qiancheng Xie [2,*,†] and Yanyan Zhai [3,*,†]

[1] College of Water Conservancy and Hydropower Engineering, Hohai University (HHU), Nanjing 210098, China; ahmed.bilal@hhu.edu.cn
[2] Division of Fluid and Experimental Mechanics, Luleå University of Technology (LTU), 97187 Luleå, Sweden
[3] Division of Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark (DTU), 2800 Kgs, 2800 Lyngby, Denmark
* Correspondence: qiancheng.xie@ltu.se (Q.X.); yzhai@mek.dtu.dk (Y.Z.); Tel.: +46-7228-703-81 (Q.X.); +45-9145-8313 (Y.Z.)
† Co-first author: The authors contributed equally to this work.

Received: 9 July 2020; Accepted: 6 August 2020; Published: 7 August 2020

Abstract: River confluences are the key features of the drainage basins, as their hydrological, geomorphological, and ecological nature strongly influences the downstream river characteristics. The river reaches near the coastal zones, which also makes them under the influence of tidal currents in addition to their runoff. This causes a bi-directional flow and makes the study of confluences more interesting and complex in these areas. There is a reciprocal adjustment of flow, sediment, and morphology at a confluence, and its behaviors, differ greatly in tidal and non-tidal environments. Existing studies of the river junctions provide a good account of information about the hydrodynamics and bed morphology of the confluent areas, especially the unidirectional ones. The main factors which affect the flow field include the angle of confluence, flow-related ratios (velocity, discharge, and momentum) of the merging streams, and bed discordance. Hydraulically, six notable zones are identified for unidirectional confluences. However, for bi-directional (tidal) junctions, hydrodynamic zones always remain in transition but repeat in a cycle and make four different arrangements of flow features. This study discusses the hydrodynamics, sediment transport, morphological changes, and the factors affecting these processes and reviews the recent research about the confluences for these issues. All of these studies provide insights into the morpho-dynamics in tidal and non-tidal confluent areas.

Keywords: river confluence; morpho-dynamics; tidal effects; flow patterns; sediment transport

1. Introduction

River confluence is an essential geomorphological node that controls the downstream routing of flow and sediment. In light of its importance, there has been an increased recognition that more attention needs to be paid to the interaction of flow-sediment-morphology. The study of river confluence has seen significant advances mainly regarding their flow features, or the role of morpho-dynamics here, in influencing such features.

Much of the persisting research focuses on the morpho-dynamic evolution of a confluence and their interdependencies on the runoff river. Taylor [1], as a pioneer, worked on the flow characteristics of rectangular channels. Later, Miller [2] investigated, after various field surveys, the relationship between the width, depth, and cross-sectional area of tributaries and post confluence channels for the hilly stream junctions. Mosley [3] discussed the asymptotic behavior of bed features concerning confluence angles and expanded the research topic more scientifically.

Best [4,5] suggested dividing different flow features within a confluence. Yuan, et al. [6] recapped the current level of knowledge and development achieved during studies of uni-directional open channel confluences. Dixon, et al. [7] and Umar, et al. [8] studied the river confluences using remote sensing imagery, a relatively new approach, to study the behaviors in the river reach scale. These studies reaffirm the strength of the hypothesis from Best [4], i.e., to segregate the identifiable confluent hydrodynamic patterns into six flow zones. Further, these works also examined such morphological features as lateral bars attached to banks, deep scour-holes, tributary-mouth bars, and a zone of sediment deposition.

In addition to the natural river confluences, junctions that are there in urban drainage and the irrigation canal systems are examples of confluences in the built infrastructure. Based on different flow and channel characteristics, river confluences are differentiated as those present in (i) upland reaches, (ii) middle reaches, which are represented in the majority of confluences studied so far, and (iii) the reaches near coastal areas, which are called tidal confluences. In terms of flow direction, the tidal confluences are distinct from non-tidal ones because they have a bi-directional continually varying flow, while the others only have a uni-directional flow.

This leads to a general confluence classification based on flow direction, as shown in Figure 1. The classification takes the majority of common confluences into account. However, there are some special confluences sharing characteristics of two or more categories shown in Figure 1. For instance, coastal confluences are not necessarily natural and can also be man-made; even for upstream river confluences, the flow direction is possibly reversed during compound surges from other rivers. These exceptional cases are not considered in the present work.

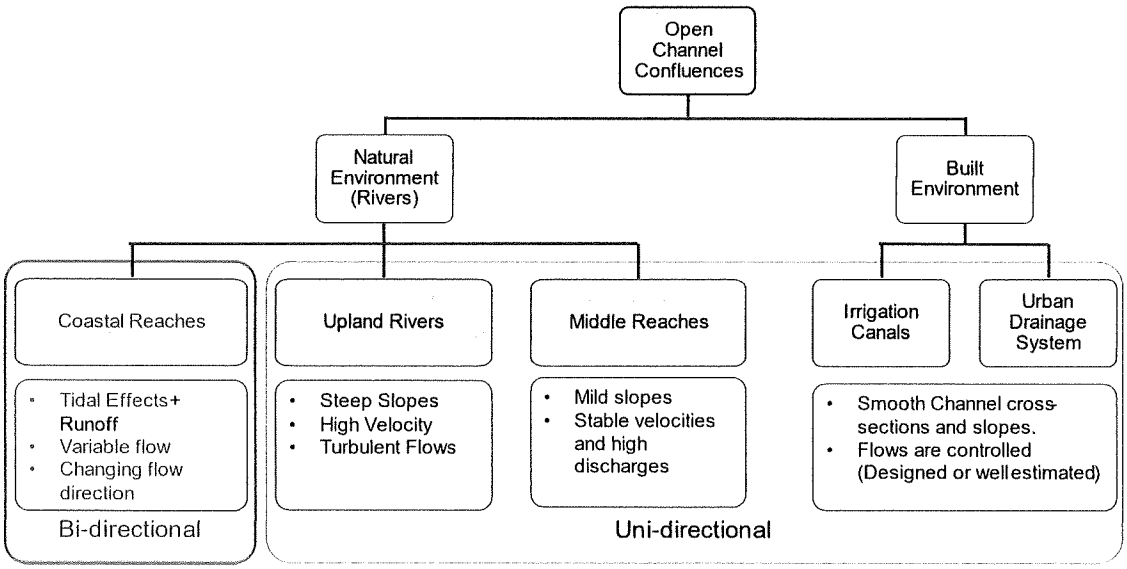


Figure 1. Confluences classification.

Based on the prevailing flow and sediment conditions, a river confluence can be subdivided into a non-tidal and tide-driven one (Table 1). For the former, reducing the river sediment input impacts the entire system dynamics. For the latter, the sediment is subject to both freshwater run-off and the dominating oceanic currents, showing a bidirectional transport feature driven by flood and ebb tides. The resulting morpho-dynamic adaption time in a non-tidal river is usually from months to years. In a tidal environment, there exist two different time scales: the first one is associated with the tidal period and the second one with the morphodynamic evolution. In a tidal period, sediment transport varies to adapt to the instantaneous tidal driven hydrodynamics. Still, if the system is not at equilibrium, although being very weak, a residual sediment transport may be present at the end of each tidal cycle. This latter contribution is responsible for morphological variation, which may be relevant in the long term [9,10].

Table 1. Comparison of the main characteristics between a tidal and non-tidal confluence.

Items	Non-Tidal Confluence	Tide-Driven Confluence
Flow volume timescale	daily/seasonal	hours
Main sediment forcing	river run-off (fresh-water)	tides (salty-water)
Sediment concentration timescale	days–weeks	hours
Sediment transport direction	unidirectional	bidirectional
Morphodynamic adaption time scale	months–years	weeks–months/years

At a confluence, the flow and sediment behaviors and the morphological changes are associated with its unique geometry. Figure 2 shows the definition of confluence geometry. Particularly, the confluence angle (θ) and the bed discordance are the typical geometric factors that affect the confluent morpho-dynamics. In Figure 2, the θ is defined as the angle between two tributaries, measured from upstream. Q (m^3/s) = flow discharge, V (m/s) = velocity, d (m) = water depth, W (m) = channel width, and h_d = elevation difference between the tributary and main channel. The subscripts "1" and "2" represent the tributaries 1 and 2, respectively.

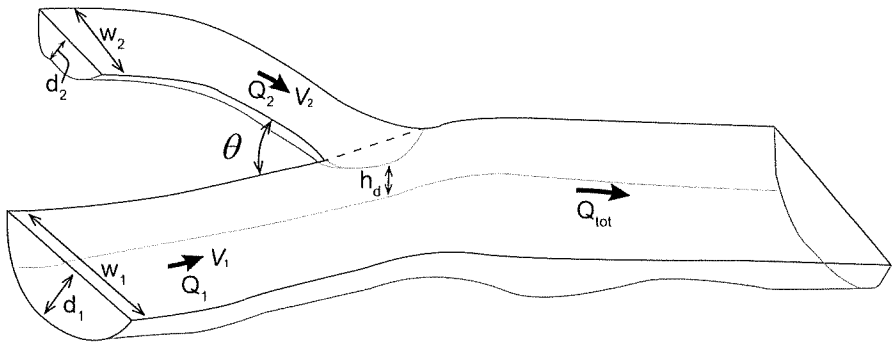


Figure 2. Definition of confluence geometry.

At a confluence, hydrodynamics, sediment transport processes, and channel morphology interplay and modify each other. The output of one process becomes the input for the other two. Each of the different processes adjusts itself and then gives a response or feedback to the system. This amalgamation is happening simultaneously. This continuous cycle of input–output evolves the system. Therefore, it is not reasonable that a river system is studied in isolation, especially for its long-term behavior. The interaction of the three main components affecting each other, is described by Leeder [11] (Figure 3a). This figure, however, is an oversimplification of a complex system. Ashworth and Ferguson [12] suggested a relatively detailed conceptual model for the interaction of different components (Figure 3b). Spatio-temporal variability of these components for a tidal confluence is even more complicated.

Both models emphasize that the hydrodynamics, the carried sediment, and the river morphology are interlinked. This interaction is a never-ending cycle of taking feedback from each other, modifying themselves, and then this modification becoming feedback for other processes. Both of these conceptual models are physically combined, as shown in Figure 4.

Tidal confluences experience simultaneous flow variability, both in magnitudes and directions. Therefore, its flow structure and feature of erosion and deposition are different from those of a non-tidal one. Furthermore, if such a confluence is near an urban area, awareness about the flow and morphological changes will be of practical concern. For example, precautionary measures for infrastructure development around or in such confluences will be more realistic. Bolla Pittaluga et al. [13] worked on the morphological equilibrium of many tidal configurations using a 1D model. Xie, et al. [14] examined the morpho-dynamics of a tidal confluence through field investigations and numerical simulations. Zhou, et al. [15] reviewed the concept of equilibrium and suggested that it can only be found in ideal situations of numerical or physical models. They discussed that since a tidal river undergoes a constant variability of environmental and anthropogenic factors,

equilibrium in such an environment is far from reality. Wolfram, et al. [16] and Gleichauf et al. [17] analyzed the intra-junction flow dispersion at a well-mixed tidal river junction in Sacramento-San Joaquin Delta (USA). A few studies on tidal confluences include the work investigating scour-hole evolution [18–20]. Ferrarin, et al. [21] identified the hole's geomorphological characteristics in tidal rivers and compared them with the ones in the non-tidal environment.

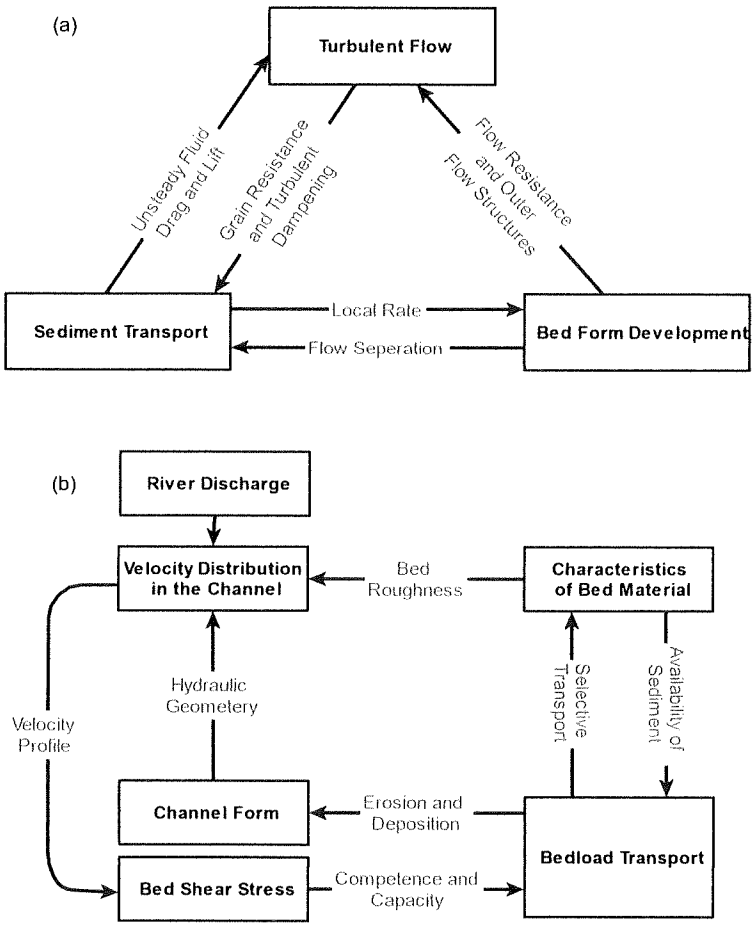


Figure 3. The conceptual relationship between flow, sediment, and morphology at a confluence, as proposed by (**a**) Leeder [11] and (**b**) Ashworth and Ferguson [12].

Field investigations [5,21,22], laboratory experiments [6,23–25], and numerical simulations [14,26–30], complementing each other, are common methods to help understand the morpho-dynamics of a confluence. Bradbrook [31] suggested that combining all three methods would help to understand the confluences more comprehensively. Based on the available literature regarding the confluences in tidal and non-tidal environments, this paper reviews their flow features, sediment transportation, morphological characteristics, and their interactions.

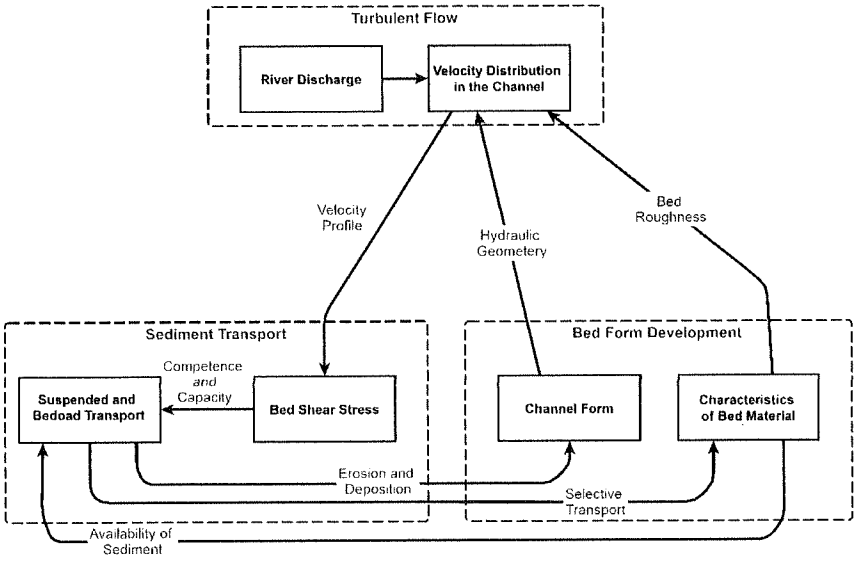


Figure 4. Unification of conceptual models by Leeder [11] and Ashworth and Ferguson [12].

2. Hydrodynamics of River Confluences

At a confluence, the classical viewpoint of flow features is the definition of six identifiable flow zones. Best [4,32] firstly proposed the conventional model, which includes a region of (i) flow stagnation, (ii) flow deflection, (iii) flow separation, (iv) maximum velocity, (v) gradual flow recovery, and (vi) two shear layers (Figure 5). Best [4] mainly discussed these zones on a two-dimensional scale, i.e., a depth-averaged scenario. Each zone's actual size depends on such factors as tributary flow ratio, confluent angle, bed discordance, upstream planform, etc.

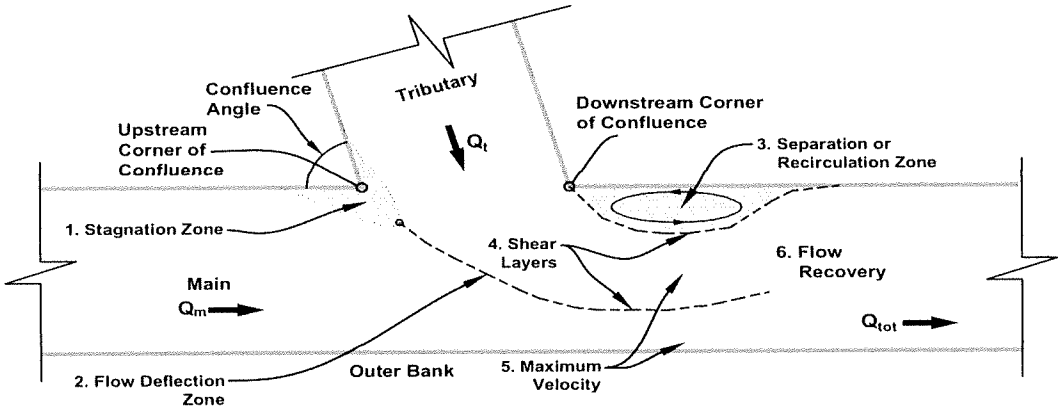


Figure 5. Six identifiable flow zones at a confluence—adapted from Best [32].

2.1. Mixing Zone and Shear Layer

Initial research on confluences deals mostly with the mixing of flows [33]. The mixing often leads to a downstream shear layer, which enhances turbulent mixing. In terms of driving the mixing process in confluences, four main processes are identified: the quasi-2D vortices, helical secondary circulation cells, the bed discordance, and mass transfer [23,34–39]. To meet the requirements of mass conservation, there exists a transfer from the faster, decelerating flow to a slower, accelerating flow [40]. Mixing in the confluent area is also influenced by the secondary flow structures observed with cells of clockwise rotation [41].

The mixing interface position sometimes is visible through the turbidity of the water or is observed indirectly by using proxy approaches. These include using the electronic conductivity [42], differences

in the chemical isotope composition [43], or, as in the Kaskaskia River—Copper Slough confluence, by identification of temperature differences between the two tributaries [44]. These methods may be used to capture the change in the mixing layer position over time.

The "shear layer" is considered as the major zone of a junction, where there is a significant velocity gradient between the two flows (Figure 5). It extends for a substantial distance downstream, from the flow stagnation zone to the flow recovery zone [45]. The shear layer is considered as strongly turbulent, featuring high shear stresses and well-defined coherent flow structures such as Kelvin-Helmholtz instabilities [46]. The existence of a shear layer indicates that the flows of different velocities are running parallel to each other, encouraging the development of Kelvin–Helmholtz instabilities, which can pair up, split, or merge as they move downstream [34]. This results in an enhanced exchange of momentum and mass (e.g., sediment and pollutants) across the shear layer [6].

The shear layer encourages Kelvin–Helmholtz instabilities thereby leading to the eddy generation. However, for a given large θ and a comparable velocity, instead of generating eddies there, Kelvin–Helmholtz instabilities develop on either side of the stagnation zone. As these eddies come from either side of the stagnation zone, they rotate in opposite directions and then merge in the mixing zone [27]. These findings match the observations of wake-generated coherent flow structures around the stagnation zone [47]. Regarding this particular feature, more studies are required to consolidate it. Further research is desirable to determine how dependent this is on the confluence bathymetry, geometry, momentum ratio, and other factors.

2.2. Flow Stagnation

The stagnation zone, as shown in Figure 5, is known as an area of recirculating flow at the upstream junction corner [48,49]. It acts as an obstacle to enhancing the development of wake-generated shear flows around it [27,48,49]. However, it is still not clear how widespread these zones are in natural confluences, what triggers them to form, and whether these causes are associated with the type of confluence.

Rhoads and Kenworthy [48] proposed that it is the low velocity near the tributary banks, which is the cause of the development of this zone. An alternative explanation is that superelevation in the mixing zone or in the stagnation zone itself results in a negative pressure gradient towards the upstream corner, which encourages the lower or negative velocities [50,51]. However, the understanding of the stagnation zone remains still incomplete until more stagnation zones are investigated for their prevalence and mechanics.

2.3. Flow Separation

The flow separation zone, in Figure 5, is an area of lower pressure and flow recirculation at the downstream corner. The zone is known to increase in size with larger θ and higher tributary discharges [52]. From 3D numerical experiments, Huang, et al. [53] identified that the zone of flow separation expands substantially from its minimal at 30° to an angle of 90°. They suggested that the θ increase causes an increased conversion of lateral flow momentum into downstream channel flow momentum. This conversion increases the loss of kinetic energy, which then results in the expansion of the zone and deepening of water surface depression.

Ashmore et al. [22] discussed that in reality, natural confluences have partial or no zone of flow separation due to their banks changing direction more gradually than in simplified flume experiments. Although later field studies support the existence of flow separation zones [54], as yet, it is not clear if the causes proposed by Huang, et al. [53] apply to natural confluences.

In the case of discordant confluences, where there exists a bed level difference between two tributaries, it is found that flow separation on the downstream corner is minimal [55–57]. Studies on flume experiments [58] also confirmed that a concordant confluence has a small flow separation zone that is not present in a similar, discordant case. Biron, et al. [51] found superelevation at the downstream corner of the discordant Bayonne-Berthier confluence and suggested that the upwelling

of flow from the main channel disrupts the formation of a flow separation zone. Its causes may also include the erosion of the downstream corner, in the case of curving banks or the presence of a bar on the downstream corner, disrupting the flow separation [55,57]. In a way, the presence of flow separation is related to many factors, including channel planform, bathymetry, and the interplay of tributaries flow, etc.

2.4. Flow Acceleration and Recovery

The flow acceleration zone is believed to exist due to the constriction of two tributary flows into a smaller total cross-sectional area. Indeed, the early research by Best and Reid [52] found that flow separation zones assist this acceleration by constricting the flow, with near-bed velocities at a 90° confluence up to 1.3 times larger than those at a 15°. Flow acceleration will increase the bed shear stresses and has, therefore, been highlighted as a potential contributing factor to the development or maintenance of scour-holes [59]. The principle of continuity requires that a decrease in channel cross-sectional area results in flow acceleration in the downstream channel. However, the complexity of natural river confluence morphologies means that the flow acceleration zone is not always clearly present or consistent in its form [22,60,61].

Evidence also shows that the stream entering the confluence with the larger velocity gradually widens its share of the common channel width at the expense of the slower stream [40]. It is believed that there is a dynamic adjustment between two streams past their confluence [62]. The faster stream slows down and, to conserve flowrate, expands laterally, thus squeezing the slower stream, which accelerates, to retain its flowrate. Thus, the faster stream decelerates, while the slower stream accelerates, and the line demarcating the two streams migrates laterally toward the side of the lower velocity. Further downstream, the flow convergence pattern diminishes, indicating that the flows become aligned with each other; and also, with the adjustment of the two flows, secondary flows disappear, and a cross-sectional equilibrium is achieved.

2.5. Tidal Flow Pattens

In tidal environments, in addition to the run-off, the confluence is also affected by tides. The shift of the dominant processes between run-off and tides featuring periodical changes in both magnitude and direction induces more degrees of complexity in terms of flow patterns. As a result, the flow patterns in terms of the conventional flow zone definitions are different. Unlike unidirectional confluences, there are limited references available regarding the tidal confluence flow patterns, and its complexity has not drawn much attention [14,18,28].

A recent study performed 3D simulations for a tidal confluence in China [28] to examine the surface flow features based on extensive field measurements. It is noticed that the typical confluent flow patterns change more gradually and repeat in a cycle with the progression of a tidal phase. Therefore, it proposed four noticeable arrangements of hydraulic features and asserted that hydrodynamics of a tidal confluence remain in transition between these four states. These four flow scenarios with respect to the discharge conditions are shown in Figure 6. Figure 7 illustrates the four corresponding flow patterns during a full tidal cycle, i.e., the maximum flood tide, flood to ebb transition, the maximum ebb tide, and finally, ebb to flood transition [28].

Figure 7a corresponds to the hydraulic condition when the discharge near the confluence is at its lower peak. This means that the flow is running from downstream to upstream, and hence, the intersection acts as a bifurcation. A clockwise recirculating eddy appearing on the angled tributary is noticed here. The location of this zone of recirculation, as well as its direction of rotation, change during the next three scenarios (Figure 7b–d). During the peak of the positive flow (Figure 7c) in the main channel after the confluence, the flow behavior resembles that of unidirectional confluences. The hydrodynamics during the transition from positive (ebb) to negative (flood) flow is captured in Figure 7d.

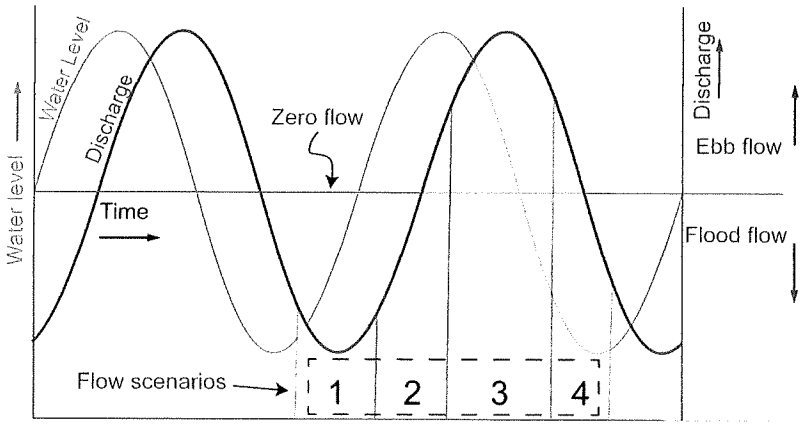


Figure 6. Schematic of flow scenarios used for studying the hydrodynamics of tidal confluences.

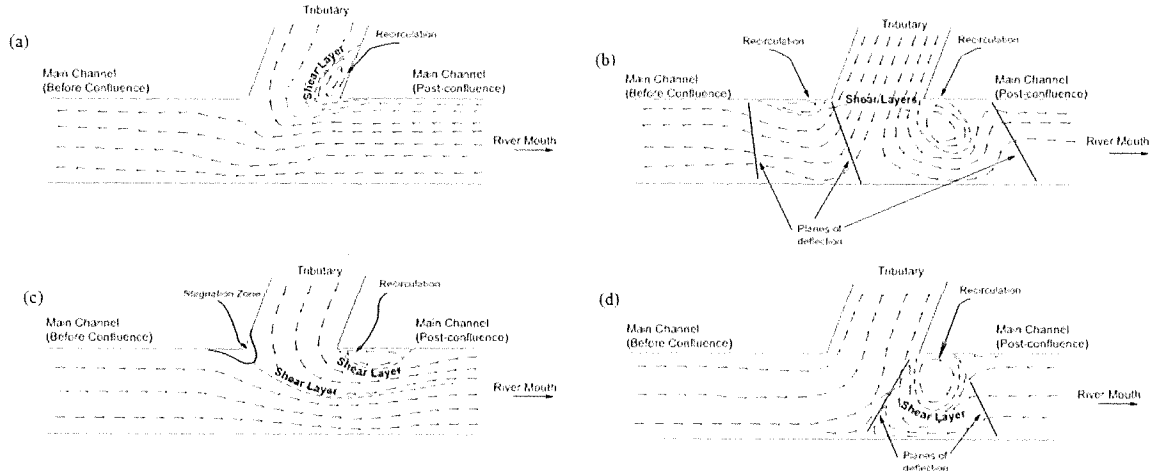


Figure 7. Schematic flow patterns of tidal confluence: (**a**) the maximum flood; (**b**) flood to ebb transition; (**c**) the maximum ebb; and (**d**) ebb to flood transition.

In addition to the tidal flow features, the study captures some interesting observations regarding the hydraulic behavior of the tidal confluence. The most observable behavior of the transition cases is that the change of flow direction in both tributaries does not occur at the same time due to their geometric and hydraulic asymmetry [28]. This non-coherent flow reversal results in a "no slack water" condition at tidal channel intersections.

In a confluence dominated by tides, Xie, et al. [14] also investigated the interaction of runoff and tides. While for the flood tide, the run-off and the tide are in the opposite direction, thus offsetting each other. Apart from the water levels, the confluence flow at the maximum flood tide differs in both flow direction and magnitude from that at the maximum ebb tide, which depends on the tidal flow direction. At the ebb tide, a zone of flow separation also exists close to the left river bank. The prevalence holds that the velocity of the ebb tide is higher than that of the flood tide that is attributed to the addition of runoff and tide.

3. Sediment Transport and Morphology

3.1. Sediment Transport

Many studies have looked into the sediment dynamics of river confluences on a catchment scale. Some of these have looked at the impact of sediment influxes from tributaries into the confluence and have found that it interrupts the general process of downstream fining in the main channel [61,63–67]. The conclusion obtained by Rice [65] is based on an extensive investigation of over 100 confluences.

Benda et al. [68] suggested that the main tributary has a higher chance of causing a sediment discontinuity in the main channel. However, Unde and Dhakal [54] argued that since the grain size for very large tributaries is likely to be similar in both channels, the effect of the tributary sediment input may be reduced. Other artificial factors that have been highlighted for their impacts on the confluence sediment transport include the construction of dams, sluice gates, bridges, and other additional restrictions of flow and sediment upstream [68–70]. The sediment influxes also affect the morphology of the confluence, with large debris fans capable of rerouting the main channel, while significant sediment inputs change the main channel slope [64,68,69]. The slope tends to decrease upstream of a massive sediment influx from a tributary, with a corresponding increase downstream [69].

At a river confluence, in addition to examining the sediment dynamics directly, other theories and hypotheses such as the flow field, the bed shear stress, and stream power theory, etc. also help to understand the sediment mechanics [55]. Several studies have highlighted the role played by turbulence in bedload transport. The turbulent structures generated in the mixing zone are considered to be crucial for potential entrainment and transportation of particles [32,57,71]. However, Boyer, et al. [46] investigated research in the Bayonne-Berthier confluence and found that the maximum bedload transport values are at the edge of the shear layer, rather than in the zone of maximum turbulence. This suggests that the link between strong turbulence and bedload transport may not always be straightforward. In particular, it is noted how the mean velocity and Reynolds shear stress does not accurately explain bedload transport, with variations in the instantaneous values considered more important [71].

Many researchers link the bed shear stress with sediment movement, although this may not always be a reliable indicator of sediment motion [51,72]. Szupiany et al. [60] observed for the Rio Parana confluences that the suspended load transport does not correlate well with bed shear stress but occurs in narrow zones linked to the flow field, the upstream sources of sediment, and in some cases, topographic steering. Assuming that there is a link, Bradbrook, et al. [73] suggested from their CFD results that, under the right circumstances, confluences with a small difference in bed elevation experience sufficient bed shear stress to cause erosion that deepens the tributary step. However, as yet, no studies have followed this up and tested the hypothesis.

In tidal confluences, the amount of bedload is often negligibly small, meaning that the sediment is mainly in suspension with the water, a common feature of many fluvial rivers [74]. The suspended sediment concentration is dependent on the flow discharge, showing an hourly variation. The sediment dynamics are closely linked to the confluent flow dynamics described above. As aforementioned, the cohesive sediment of mud (silt and clay) has completely different dynamics than non-cohesive sediment, consisting of sand. In a tidal environment, cohesive sediment movement is somehow affected by the flocculation, leading to a lower settling velocity [75]. The difference arises from the electrochemical interactions of clay and silt particles, so the cohesiveness of sediment depends on their contents and also the salty water concentration. Laboratory experiments show that sediments become cohesive when the clay and silt contents are over 3%–5% [76].

Interplaying with the freshwater flow, tides penetrating the river lose energy in the bottom boundary layer; this energy dissipation is transformed into bed shear stress (τ_b) [77]. In most studies dealing with the cohesive sediments, bed erosion and deposition are linked to critical shear stresses for erosion ($\tau_{cr,e}$) and deposition ($\tau_{cr,d}$), separately. When $\tau_b < \tau_{cr,d}$, the deposition takes place; while if $\tau_b > \tau_{cr,e}$, erosion occurs. The bottom composition determines the critical shear stress, and cohesiveness augments the critical value by 2–5 times [76] as compared to non-cohesive sediment. This implies that the flow to erode the bed layer with the tidal effect should have more momentum, although the sediment is finer, which is not in line with the findings for the non-tidal river regarding the fine sediment transport.

During flood tide, it is common to observe sediment in a high concentration transporting landward. The sediment deposits easily during the flow reversal, i.e., the shift between flood and ebb tides. A certain amount of particles consolidates and is not re-suspended during the ebb tide [64]. This is the

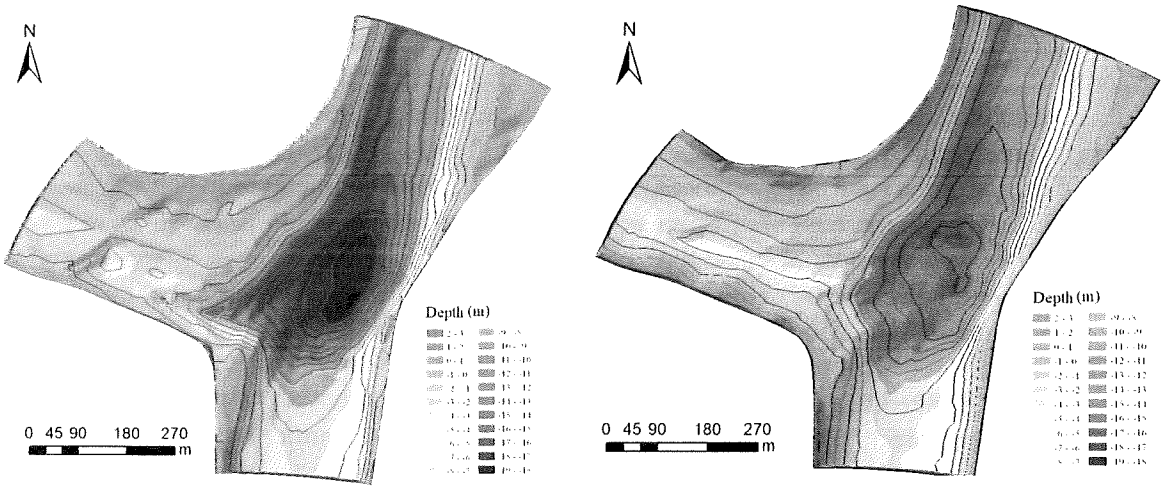
main sediment transport pattern for rivers driven by strong tides. This transport scenario may become the opposite in stormy periods, becoming ebb dominated. For non-tidal rivers during the wet season, the peak freshwater flow with a high sediment concentration may govern the sediment transport in the river [26,78,79]. Some exceptions are subject to the availability of sediment sources.

All of these studies provide insights into the sediment dynamics in tidal and non-tidal confluences. To comprehensively figure out their sediment transport processes is still challenging in the field of geomorphology, especially for the tidal cases. It is advisable to see extensive field measurement data and theoretical progress as foundations to help in understanding the sediment dynamics.

3.2. Morphological Characteristics

3.2.1. Scour-Hole

In a confluence, scour-hole is a common bathymetry feature, shown in Figure 8 as an example. The research was pioneered by Mosley in discussing its morphological features and changes [3]. He found that there is a possibility of scour-hole existence with large θ, strong turbulence, and identical discharges. While Wallis et al. [61] investigated eight confluences and found that scour-hole exists in only five out of those. Bed discordance is regarded as one factor leading to the absence or size reduction in scour-holes [55,58]. It is yet not very clear how the flow behavior and sediment dynamics influence the scour-hole features. This ambiguity in the links between the scour-hole and sediment movement may explain why these are not universal features of river confluences.



(a) (b)

Figure 8. Measured bathymetry of a tidal confluence: (**a**) 2010; (**b**) 2015 (adapted from Xie [80]).

The generation and maintenance of scour-hole encourage much debate in the river confluence research. Many hypotheses have been proposed for the generation of the scour-hole, such as the large flow velocity, strong turbulence, the effect of the shear layer, or the curvature-induced helical circulation [5,59,81–84]. Yuan et al. [6] found that the downwelling flow and upwelling flow involved in helical motions, associated with the intense shear to the bed, are responsible for sediment entrainment and scouring, thereby generating the scour-hole. Rhoads et al. [59] noted that helical flow, shear layer turbulence, and flow acceleration help to maintain the shape of scour-hole by ensuring that it is an area of high bed shear stress. Constantinescu et al. [27] argued that it is helical cells that are most significant to maintain the scour, although they conceded that this could change if the mixing zone produces Kelvin–Helmholtz instabilities.

From the point view of sediment dynamics, it is also speculated that particles from each tributary are routed around the scour-hole, leading to the maintenance of the scour-hole and a zone of maximum

sediment transport at its downstream [5,85]. However, Roy and Bergeron [86] found that particles, regardless of size, could travel through the scour-hole, with particles from both tributaries capable of doing so depending on the flow discharge. Based on the investigation of the Bayonne-Berthier confluence, Boyer et al. [46] argued that the link between strong shear layer turbulence and maintenance of the scour-hole might not be as straightforward as the classical model suggests. In a way, their findings verify that the highest suspended sediment concentration is in the vicinity of the scour-hole. At a given confluence geometry, the likelihood is that all three factors, i.e., turbulence, secondary flow in the form of helical cells, and sediment routing, are linked to each other and affect the scour-hole [87].

Research has also examined the evolution of scour-hole over longer timespans. Scour-hole can rotate, evolve through lateral and streamwise migration, or change in size, with respect to the variation of flow and sediment [85]. In light of the scour-hole infilling, Best and Rhoads [23] hypothesized that, on a larger scale, the migration of tributary bars into the junction dominates the scour-hole infill. There is a tendency for scour-hole development on the braiding planform during flows with a higher magnitude than average; similarly, massive floods will also cause noticeable changes to the planform [88]. If a braid plain is more susceptible to avulsion, then scour-hole would be reworked more frequently, while sediments are less likely to be stored for long periods [89].

In a tidal environment, the alluvial process in terms of scour-hole erosion and deposition is different. Xie et al. [14] and Xie [80] investigated, through the field and numerical studies, the alluvial behaviors of a scour-hole dominated by strong tides (Figure 8). They found that the shifting tidal directions induce the scour-hole migrates in both directions that do not exist in unidirectional run-off flows. The flood tides govern its sediment transport and play a dominant role in the scour-hole deposition, while the ebb tides with run-offs lead to erosion. Ferrarin et al. [21] identified 29 scour-holes by examining their geomorphological characteristics and comparing them with scours in non-tidal ones. It was demonstrated that the maximum depth of the scours is positively correlated with the tidal prism of the channels joining the confluence. As a consequence of changes in the flow regime, their findings also preliminarily revealed, in a century-scale, the morphological dynamics of scouring.

So far, the collective effect of different factors on the confluence morphology has not been well developed. However, there are studies available that empirically state the impact of one particular factor on the morphological changes. For example, Ferrarin et al. [21] and many other studies [90,91] linked the relative scour depth (H_r) with the θ and found that they are positively correlated. The H_r is the ratio of the mean upstream channel depth (H_m) to scour depth (H_{sc}).

$$H_r = \frac{H_m}{H_{sc}} \tag{1}$$

$$H_m = \frac{\sum_1^n H_n}{n} \tag{2}$$

where H_n is the mean water depth of the nth channel, and n is the number of tributaries. Ferrarin et al. [21] noticed that some confluences have three and even more tributaries. Figure 9 shows the relationship between H_r and θ both in tidal and non-tidal confluences. Since many other factors also play their roles, it indicates a 35% dependence ($R^2 = 0.35$) of H_r on the θ.

In view of the tidal scour-hole formation, maintenance and evolution need to be further investigated based on the knowledge available on non-tidal ones.

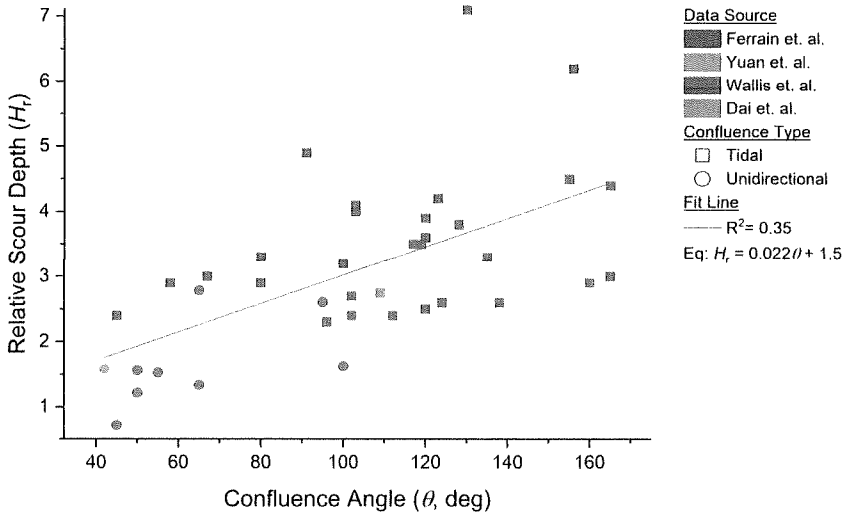


Figure 9. Relationship between H_r and θ. The data source is from studies carried out by Ferrarin et al. [21], Yuan et al. [6], Wallis et al. [61], and Dai et al. [28].

3.2.2. Mid-Channel Bars

Mosley [3] also identified the potential for mid-channel bars to emerge in high angle ($\theta > 60°$) confluences, finding that higher bed elevations and transport rates either side of the scour-hole joined downstream into an area of deposition. It is the combination of scour-hole erosion and sediment routing around it, which favors the deposition [32] and sediment accumulation slightly downstream of the area of maximum bedload transport [85].

A study by Orfeo et al. [92] noticed that for a confluence–diffluence unit on the Rio Parana, the flow starts to diverge at a position at a significant distance upstream from the front of the mid-channel bar. Once a mid-channel bar is in place, the flow field would appear to be conducive to the further deposition of sediment on the front of the bar, thereby encouraging growth. However, for sediments to accumulate in the first place, there must be some initial cause of flow divergence or an alternative process that reduces the downstream flow velocities and encourages sediment deposition. As such, confluence symmetry is believed to be an important factor in determining whether a mid-channel bar will form, due to its impact on flow divergence downstream of the scour-hole [36].

3.2.3. Bank-Attached Bars

There has been limited research into the development of bank-attached bars in river confluences in both the flow stagnation and separation zones [5]. The flow separation zone is known to be an area of lower pressure and recirculating flow, which encourages sediment deposition [83]. The same is true for the lower velocities in the flow stagnation zone at the upstream corner of many confluences.

Parsons et al. [36] suggested that lateral bars are more common features on the asymmetric confluences where there is a flow separation at the downstream corners. A confluence is described as a symmetric one if it has a planform that resembles a "Y" shape; i.e., the centerline of the post-confluence channel bisects the θ in halves [32]. Otherwise, it is regarded as an asymmetric one. However, it is still not clear how often such bars are present at asymmetric confluences and how they evolve with changes in the flow conditions.

4. Key Factors Affecting the Morpho-Dynamics

4.1. Confluence Planform

In terms of the confluence planform, it has symmetric and asymmetric ones, and the major difference is the merging θ of the tributary flows to the post-confluence flow. For the former, both

tributary-flows meet and run to align with the downstream flow direction; for the latter, one tributary flow is forced to turn through a much greater θ than the other. The asymmetry planform encourages a stronger helical circulation cell to develop in its tributary [78], instead of occurring in the confluence [44]. The results from the numerical modeling of both laboratory and natural confluences by Bradbrook et al. [93] and Bradbrook et al. [94] supported this view, with the back-to-back helical cell structure thought to become less representative of the flow field as asymmetry increases.

The planform, with respect to the θ, is an important factor in the strength of secondary flow. Mosley [3] suggested that a large θ enhances the turbulence—a result of the deflected flows from each tributary having a more intensive mixture. Results from the numerical modeling by Bradbrook et al. [56] supported this hypothesis, indicating that secondary flow circulation is much stronger for a confluence with $\theta = 30°$ compared to one with $\theta = 0°$. Ashmore and Parker [78] described this effect as a decrease in curvature radius, where a higher θ causes the flows of the two tributaries to pass through with enhanced turbulence. Penna et al. found that the maximum streamwise flow velocity does not necessarily increase with the θ, and it does not always occur in the contraction zone [95]. This fact is ascribed to the acceleration induced by the lateral flow that approaches the post-confluence channel. Furthermore, it is also evidenced that the higher the θ, the more extended the retardation zone and the lower the velocities in this region [95].

Symmetric or asymmetric planforms have a significant effect on both the hydrodynamic and morphodynamic features [96]. Parsons et al. [36] suggested that confluence symmetry is the key factor in the development of mid-channel bars. An example of this is the approximately symmetrical Mula-Kas confluence, where a partly vegetated mid-channel bar has developed [54]. At an asymmetric junction, Mosley [3] found that the scour-hole resides on a line that bisects the θ; erosion occurs on the bank opposite the tributary and deposition occurs at the downstream corner of the tributary. This encourages the development of a lateral bar on the corner, rather than the mid-channel bars that tend to develop at symmetric confluences [32,36]. The combined processes encourage the lateral migration of the downstream channel, ultimately resulting in the evolution of a symmetrical confluence planform [23,97].

Laboratory experiments of Mosley [3] confirmed that an increase in θ bolsters the depth and cross-sectional area of the scour-hole. In some confluences with smaller θ, e.g., less than 15°, there may not be an obvious scour-hole [5]. The augmentation in scour-hole depth with increasing θ is considered to be non-linear [23]; the most considerable growth in scour depth is expected as the θ comes close to 90° [3]. A possible explanation is that the greater routing of sediment around the scour-hole at higher θ supports its larger size to be maintained [5]. There is also evidence that the θ influences the position and shape of the scour-hole. Best and Rhoads [23] noted that the thalweg of a scour-hole tends to be positioned on a line bisecting the θ, and Ashmore and Parker [78] found that scour-holes move from trough to basin shapes at larger θ. The θ is, therefore, an important planform factor in determining the confluence morphology.

It may be noted that the effect of confluence planform on its morpho-dynamics cannot be treated in isolation. Evaluation of a junction—symmetric or asymmetric—also depends on other governing factors, such as the ratio of discharge, velocity, momentum, etc.

4.2. Ratio of Velocity, Discharge, and Momentum

At a confluence, it is common that one tributary is dominated by the other one due to the difference in flow input, resulting in unidentical morpho-dynamics features. To illustrate the behavior, velocity ratio V_r [62], the discharge ratio Q_r [82], and the momentum ratio M_r [98] are defined, given by:

$$V_r = \frac{V_1}{V_2} \tag{3}$$

$$Q_r = \frac{Q_1}{Q_2} \tag{4}$$

$$M_r = \frac{\rho_1 Q_1 V_1}{\rho_2 Q_2 V_2} \quad (5)$$

where, ρ (kg/m^3) = water density. The subscript 'r' represents the ratio.

In a confluence, a large ratio of two tributary velocities (i.e., where the V_r is much higher or much less than 1) highly affects the flow field compared with the θ, especially when $\theta > 30°$ [56,78]. However, with a smaller θ, this does not seem to hold valid. Bradbrook et al. [73] found very little cross-stream flow at parallel confluences, even when there are large differences in flow velocity between the tributaries. Therefore, the extent to which the V_r affects the flow field depends on the confluence planform.

The Q_r of two tributaries is also considered to play an important role in determining the location and strength of secondary circulations [27,73], as well as the mixing layer position [44] and its associated zone with higher turbulence and shear stress [98]. The Q_r is regarded to boost the migration of flow structures in river confluences. Rhoads and Kenworthy [44] discussed the variation of the mixing layer position at the Kaskaskia River—Copper Slough confluence subjected to different Q_r.

Research has highlighted the potential role played by the timing of the flood peaks from the tributaries. If the tributary flood peak arrives first, then bars can form at the tributary mouth [70]. On the other hand, when the flow peaks in the main channel, there can be a backwater effect in the tributary, with this slack water being an ideal place for the deposition of fine sediments [54,69,70,99]. These tributary mouth bars may also be affected by the Q_r, with the bar expected to migrate into the main channel, or to retreat in line with the main channel bank, depending on the M_r [57]. This migration could then have a similar effect on the nature of the scour-hole downstream [46]. Variations in the Q_r also have an impact on the position of the scour-hole. When the discharge of one channel dominates, the scour-hole is expected to migrate to align with the dominant channel [32,78]. It is evident from these results that the Q_r is significant not only for shaping the flow hydrodynamics [100] but also influences the sediment delivery and morphology [41].

In addition to the V_r and Q_r, the M_r is also considered important during the discussion about the hydraulics of the confluent zones. For instance, its effect should be taken into account when assessing the formation, duration, and strength of helical cells [27]. Examples of this effect are discussed in the research by Rhoads and Kenworthy [44] for the confluence of the Kaskaskia River formed by joining of its tributary stream—Copper Slough. They found that when dominant, the flow from Copper Slough causes a single, strong helical cell on the tributary side (much like in a meander bend). In contrast, the dominant Kaskaskia River gives only a weak convergence at the surface of the mixing interface [44]. A high momentum ratio pushes the mixing interface towards the right bank [44,100], especially at low flow. Meanwhile, with a low M_r, the mixing interface moves closer to the center.

4.3. Bed Discordance

When two tributaries have their bed elevations at a different level, it is called bed discordance (Figure 2). The bed discordance ratio D_r is defined as

$$D_r = \frac{h_d}{d_2} \quad (6)$$

The first investigations of bed discordance were performed on a parallel, discordant flume confluence by Best and Roy [34], with observations showing that the flow separates over the step, disrupting the mixing layer and causing far more rapid mixing in the shallow tributary.

Bed discordance has a significant impact on the confluence flow field, as shown in Figure 10. The shear layer, indicated by hatched shade, starts at the corner of the bed with higher elevation and gradually spreads vertically. A little far from the bed is a zone of upwelling, which is below the mixing layer, as shown in the gray shaded area [34]. Discordant confluences are considerably different from concordant ones, as shear layer distortion is considered more significant than the presence of scour-holes and helical cells [60]. The flow separation that occurs at discordant confluences distorts

the vortices in the mixing layer [34,50,58,71], which encourages the faster mixing of the two flows, especially at low flows [42,50,57,101]. This increase in mixing speed at low flows may well be a function of the increased relative size of the step (compared to the water depth). Gaudet and Roy [101] argued that when river levels are shallow, water from the tributary with the higher bed elevation can flow over the water from the deeper tributary, causing a more rapid mixing of the two flows.

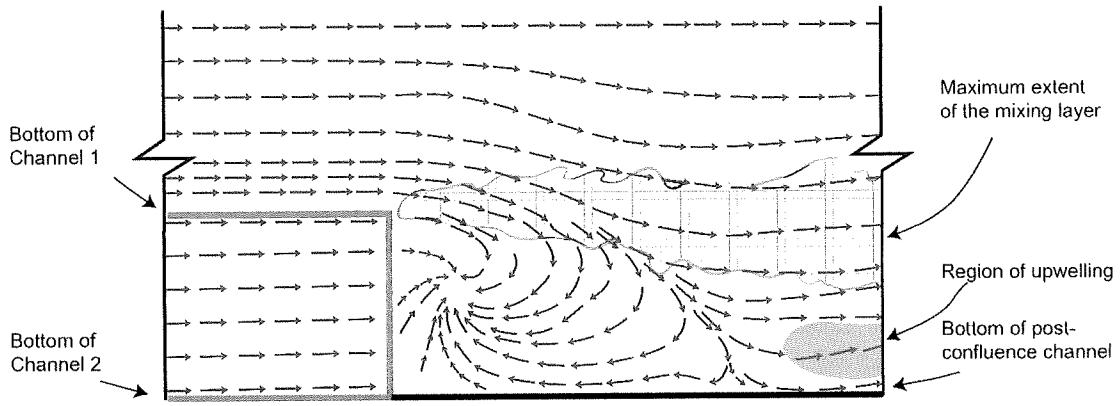


Figure 10. Flow fields at the bed of a discordant river confluence (Adapted from Best and Roy [34]).

It is suggested that bed discordance is commonly caused by the formation of tributary mouth bars [102], which have steep avalanche faces descending into the confluence scour-hole. Arguably the most important effect on the sediment dynamics and morphology is the tendency for a discordant bed to discourage the development of a scour-hole. With experiments on a 30° flume confluence, Biron et al. [58] found no evidence of helical cell generation or scour-hole growth. However, De Serres et al. [57] found that the highest flows on the Bayonne-Berthier, cause the development of a small but noticeable scour-hole. A possible explanation for this is that the higher water depths weaken the effect of the bed discordance. There is, hence, no clear relationship between bed discordance and scour-hole.

Bed discordance at river confluences can also affect the development of other morphological features such as lateral bars. Where there is a significant step, it is known that the near-bed flow from the main channel passes under the tributary flow before being upwelled at the downstream corner [55,57,58,71]. This naturally provides a potential sediment transport path for main channel sediments to reach the downstream junction corner and form a lateral bar. Leite Ribeiro et al. [83] proposed that in the case of significant bed discordance, this process is facilitated by coarse sediment, which is passed to the post confluence channel from the tributary and joins this near-bed flow towards the downstream corner. Sukhodolov et al. found that flow at a discordant alluvial confluence with a velocity ratio larger than 2 exhibits jet-like features, thereby having important implications for morphodynamic processes [103].

In sum, bed discordance has an essential effect on the flow regime, sediment motion, and the resulting morphology in a confluence. Given the evidence that the effect of bed discordance varies with the river stage [57], it also provides a possible cause for confluence evolutions subjected to tidal and non-tidal flows. Changes to the overall discharge, river-runoff or tides, flowing through the confluence in relation to bed discordance, require further explorations that will help the understandings of morpho-dynamics.

5. Conclusions

Confluence, as a natural component in river systems, controls the routing of flow and sediment and geomorphological stability. Existing research provides a good account of information about morpho-dynamics of the river junctions, especially the unidirectional (non-tidal) ones. In bi-directional flows, the shift of the dominant processes between run-off and tides featuring periodical changes in

both magnitude and direction makes the confluence behaviors more complex. To date, limited research has been conducted for tidal confluences.

In the tidal and non-tidal environments, a thorough review of river confluences, in terms of flow, sediment, and morphology, has been summarized and discussed. Main conclusions include:

(1) There is a reciprocal adjustment of flow, sediment, and morphology at a confluence, and its behaviors differ greatly in the tidal and non-tidal environments. It is not reasonable that a river system, in terms of the three components, is studied in isolation, especially for its long-term behavior.

(2) Six notable hydraulic zones are identified for unidirectional confluences; of particular research interest is the separation zone and the shear layer. However, in tidal confluences, the flow patterns in terms of the conventional flow zone definitions are different. The flow zones always remain in transition and repeat in a tide cycle, showing four different arrangements of hydrodynamic features.

(3) Typical morphological features in the confluence, e.g., scour-hole, mid-channel bars, and bank attached bars, are investigated. Particularly, in the tidal and non-tidal environment, the relationship between scour-hole depth and confluence angle is revealed, showing a positively correlated feature.

(4) Turbulence and secondary circulation are enhanced with an increase in confluence angles with discharge and velocity ratios much greater or lower than one, and with the existence of bed discordance. In turn, this increased secondary flow also affects the morphology of the confluent areas.

All of the available research provides insights into the morpho-dynamics in tidal and non-tidal confluences. To comprehensively determine their behaviors is still challenging in the field of geomorphology, especially for the tidal cases. It is advisable to see extensive field measurement data and theoretical progress as foundations to help in understanding the sediment dynamics in the future. Some recommendations on future research prospects are put forward: (a) the effect of confluence angle (very acute/obtuse angles), tidal type (diurnal/ semi-diurnal), and bed discordance on near-surface flow features and morphological changes needs further exploration; (b)the study of 3D confluent flow structures during different tidal phases in a large river system is desired; (c) the scour-hole features, typically the morphology pattern, its presence, and evolution need extensive investigation.

Author Contributions: A.B., Q.X., and Y.Z. contributed equally to the writing of the manuscript. A.B. and Q.X. drafted the original manuscript, with modifications from Y.Z. The tables and figures were produced by A.B. and Q.X. The manuscript was revised by Q.X. and Y.Z., with assistance from A.B. All authors have read and agreed to the published version of the manuscript.

Funding: The authors were all supported by the Chinese Scholarship Council (CSC), and Q.X. was also funded by the Swedish StandUp for Energy project.

Acknowledgments: The authors would like to thank James Yang at the Royal Institute of Technology (KTH), T. Staffan Lundström at Luleå University of Technology (LTU), and Wenhong Dai at Hohai University (HHU) for their supervisions and comments that have improved the quality of the article. Q.X. thanks David R. Fuhrman at Denmark Technical University for the host and assistance during the visit as a guest researcher.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Taylor, E.H. Flow characteristics at rectangular open-channel junctions. *Trans. Am. Soc. Civ. Eng.* **1944**, *109*, 893–902.
2. Miller, J.P. *High Mountain Streams: Effects of Geology on Channel Characteristics and Bed Material*; State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology: Socorro, NM, USA, 1958.
3. Mosley, M.P. An experimental study of channel confluences. *J. Geol.* **1976**, *84*, 535–562. [CrossRef]
4. Best, J.L. Flow Dynamics and Sediment Transport at River Channel Confluences. Ph.D. Thesis, University of London, London, UK, 1985.
5. Best, J.L. Sediment transport and bed morphology at river channel confluences. *Sedimentology* **1988**, *35*, 481–498. [CrossRef]
6. Yuan, S.; Tang, H.; Xiao, Y.; Qiu, X.; Xia, Y. Water flow and sediment transport at open-channel confluences: An experimental study. *J. Hydraul. Res.* **2018**, *56*, 333–350. [CrossRef]

7. Dixon, S.J.; Smith, G.H.S.; Best, J.L.; Nicholas, A.P.; Bull, J.M.; Vardy, M.E.; Sarker, M.H.; Goodbred, S. The planform mobility of river channel confluences: Insights from analysis of remotely sensed imagery. *Earth-Sci. Rev.* **2018**, *176*, 1–18. [CrossRef]
8. Umar, M.; Rhoads, B.L.; Greenberg, J.A. Use of multispectral satellite remote sensing to assess mixing of suspended sediment downstream of large river confluences. *J. Hyd.* **2018**, *556*, 325–338. [CrossRef]
9. Lanzoni, S. Long-term evolution and morphodynamic equilibrium of tidal channels. *JGR* **2002**, *107*. [CrossRef]
10. Seminara, G.; Lanzoni, S.; Tambroni, N.; Toffolon, M. How long are tidal channels? *JFM* **2010**, *643*, 479–494. [CrossRef]
11. Leeder, M.R. On the interactions between turbulent flow, sediment transport and bedform mechanics in channelized flows. In *Modern and Ancient Fluvial Systems*; Collinson, J.D., Lewin, J., Eds.; Blackwell Scientific Publications: Oxford, UK, 1983. [CrossRef]
12. Ashworth, P.J.; Ferguson, R.I. Interrelationships of channel processes, changes and sediments in a proglacial braided river. *Geogr. Ann. Ser. A Phys. Geogr.* **1986**, *68*, 361–371. [CrossRef]
13. Pittaluga, M.B.; Tambroni, N.; Canestrelli, A.; Slingerland, R.; Lanzoni, S.; Seminara, G. Where river and tide meet: The morphodynamic equilibrium of alluvial estuaries. *J. Geophys. Res. Earth Surf.* **2015**, *120*, 75–94. [CrossRef]
14. Xie, Q.; Yang, J.; Lundström, S.; Dai, W. Understanding morphodynamic changes of a tidal river confluence through field measurements and numerical modeling. *Water* **2018**, *10*, 1424. [CrossRef]
15. Zhou, Z.; Coco, G.; Townend, I.; Olabarrieta, M.; van der Wegen, M.; Gong, Z.; D'Alpaos, A.; Gao, S.; Jaffe, B.E.; Gelfenbaum, G.; et al. Is "Morphodynamic Equilibrium" an oxymoron? *Earth-Sci. Rev.* **2017**, *165*, 257–267. [CrossRef]
16. Wolfram, P.J.; Fringer, O.B.; Monsen, N.E.; Gleichauf, K.T.; Fong, D.A.; Monismith, S.G. Modeling intrajunction dispersion at a well-mixed tidal river junction. *J. Hydraul. Eng.* **2016**, *142*, 04016019. [CrossRef]
17. Gleichauf, K.; Wolfram, P.; Monsen, N.; Fringer, O.; Monismith, S. Dispersion mechanisms of a tidal river junction in the sacramento–san joaquin delta, california. *San Fr. Estuary Watershed Sci.* **2014**, *12*, 1–23. [CrossRef]
18. Ginsberg, S.S.; Perillo, G.M.E. Deep-scour holes at tidal channel junctions, Bahia Blanca Estuary, Argentina. *Mar. Geol.* **1999**, *160*, 171–182. [CrossRef]
19. Ginsberg, S.S.; Perillo, G.M.E. Characteristics of tidal channels in a mesotidal Estuary of Argentina. *J. Coast. Res.* **2004**, *20*, 489–497. [CrossRef]
20. Gomez, B.; Cui, Y.; Kettner, A.J.; Peacock, D.H.; Syvitski, J.P.M. Simulating changes to the sediment transport regime of the Waipaoa River, New Zealand, driven by climate change in the twenty-first century. *GPC* **2009**, *67*, 153–166. [CrossRef]
21. Ferrarin, C.; Madricardo, F.; Rizzetto, F.; Kiver, W.M.; Bellafiore, D.; Umgiesser, G.; Kruss, A.; Zaggia, L.; Foglini, F.; Ceregato, A.; et al. Geomorphology of scour holes at tidal channel confluences. *J. Geophys. Res. Earth Surf.* **2018**, *123*, 1386–1406. [CrossRef]
22. Ashmore, P.E.; Ferguson, R.I.; Prestegaard, K.L.; Ashworth, P.J.; Paola, C. Secondary flow in anabranch confluences of a braided, gravel-bed stream. *Earth Surf. Process. Landf.* **1992**, *17*, 299–311. [CrossRef]
23. Best, J.L.; Rhoads, B.L. *Sediment Transport, Bed Morphology and the Sedimentology of River Channel Confluences*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 45–72. [CrossRef]
24. Biswal, S.K.; Mohapatra, P.K.; Muralidhar, K. Flow separation at an open channel confluence. *ISH J. Hydraul. Eng.* **2010**, *16*, 89–98. [CrossRef]
25. Canelas, O.B.; Ferreira, R.M.L.; Guillén-Ludeña, S.; Alegria, F.C.; Cardoso, A.H. Three-dimensional flow structure at fixed 70° open-channel confluence with bed discordance. *J. Hydraul. Res.* **2019**, *58*, 434–446. [CrossRef]
26. Biron, P.M.; Robson, C.; Lapointe, M.F.; Gaskin, S.J. Comparing different methods of bed shear stress estimates in simple and complex flow fields. *Earth Surf. Process. Landf.* **2004**, *29*, 1403–1415. [CrossRef]
27. Constantinescu, G.; Miyawaki, S.; Rhoads, B.; Sukhodolov, A.; Kirkil, G. Structure of turbulent flow at a river confluence with momentum and velocity ratios close to 1: Insight provided by an eddy-resolving numerical simulation. *Water Resour. Res.* **2011**, *47*. [CrossRef]
28. Dai, W.; Bilal, A.; Xie, Q.; Ahmad, I.; Joshi, I. Numerical modeling for hydrodynamics and near-surface flow patterns of a tidal confluence. *J. Coast. Res.* **2020**, *36*, 295–312. [CrossRef]

29. Xie, Q.; Yang, J.; Lundström, T.S. Field studies and 3D modelling of morphodynamics in a meandering river reach dominated by tides and suspended load. *Fluids* **2019**, *4*, 15. [CrossRef]
30. Dordevic, D. Numerical study of 3D flow at right-angled confluences with and without upstream planform curvature. *J. Hydroinformatics* **2013**, *15*, 1073–1088. [CrossRef]
31. Bradbrook, K.F. Numerical, Field and Laboratory Studies of Three-Dimensional Flow Structures at River Channel Confluences. Ph.D. Thesis, University of Cambridge, Cambridge, UK, 1999.
32. Best, J.L. The morphology of river channel confluences. *Prog. Phys. Geogr.* **1986**, *10*, 157–174. [CrossRef]
33. Mackay, J.R. Lateral mixing of the Liard and Mackenzie rivers downstream from their confluence. *CaJES* **1970**, *7*, 111–124. [CrossRef]
34. Best, J.L.; Roy, A.G. Mixing-layer distortion at the confluence of channels of different depth. *Nature* **1991**, *350*, 411–413. [CrossRef]
35. Lane, S.N.; Parsons, D.R.; Best, J.L.; Orfeo, O.; Kostaschuk, R.A.; Hardy, R.J. Causes of rapid mixing at a junction of two large rivers: Río Paraná and Río Paraguay, Argentina. *J. Geophys. Res. Earth Surf.* **2008**, *113*, 1–16. [CrossRef]
36. Parsons, D.R.; Best, J.L.; Lane, S.N.; Kostaschuk, R.A.; Hardy, R.J.; Orfeo, O.; Amsler, M.L.; Szupiany, R.N. Large river channel confluences. In *River Confluences, Tributaries and the Fluvial Network*; Rice, S.P., Roy, A.G., Rhoads, B.L., Eds.; John Wiley & Sons: Chichester, UK, 2008; pp. 73–91.
37. Sukhodolov, A.N.; Schnauder, I.; Uijttewaal, W.S.J. Dynamics of shallow lateral shear layers: Experimental study in a river with a sandy bed. *Water Resour. Res.* **2010**, *46*, 1–18. [CrossRef]
38. Vermaas, D.A.; Uijttewaal, W.S.J.; Hoitink, A.J.F. Lateral transfer of streamwise momentum caused by a roughness transition across a shallow channel. *Water Resour. Res.* **2011**, *47*, 1–12. [CrossRef]
39. Guillén-Ludeña, S.; Franca, M.J.; Alegria, F.; Schleiss, A.J.; Cardoso, A.H. Hydromorphodynamic effects of the width ratio and local tributary widening on discordant confluences. *Geomorphology* **2017**, *293*, 289–304. [CrossRef]
40. Uijttewaal, W.S.J.; Booij, R. Effects of shallowness on the development of free-surface mixing layers. *Phys. Fluids* **2000**, *12*, 392–402. [CrossRef]
41. Tang, H.; Zhang, H.; Yuan, S. Hydrodynamics and contaminant transport on a degraded bed at a 90-degree channel confluence. *Environ. Fluid Mech.* **2017**, *18*, 443–463. [CrossRef]
42. Biron, P.M.; Ramamurthy, A.S.; Han, S. Three-dimensional numerical modeling of mixing at river confluences. *J. Hydraul. Eng.* **2004**, *130*, 243–253. [CrossRef]
43. Bouchez, J.; Lajeunesse, E.; Gaillardet, J.; France-Lanord, C.; Dutra-Maia, P.; Maurice, L. Turbulent mixing in the Amazon River: The isotopic memory of confluences. *Eearth Planet. Sci. Lett.* **2010**, *290*, 37–43. [CrossRef]
44. Rhoads, B.L.; Kenworthy, S.T. Flow structure at an asymmetrical stream confluence. *Geomorphology* **1995**, *11*, 273–293. [CrossRef]
45. Biron, P.M.; Lane, S.N. *Modelling Hydraulics and Sediment Transport at River Confluences*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 17–43. [CrossRef]
46. Boyer, C.; Roy, A.G.; Best, J.L. Dynamics of a river channel confluence with discordant beds: Flow turbulence, bed load sediment transport, and bed morphology. *J. Geophys. Res. Earth Surf.* **2006**, *111*, 1–22. [CrossRef]
47. Rhoads, B.L.; Sukhodolov, A.N. Lateral momentum flux and the spatial evolution of flow within a confluence mixing interface. *Water Resour. Res.* **2008**, *44*, 1–17. [CrossRef]
48. Rhoads, B.L.; Kenworthy, S.T. Time-averaged flow structure in the central region of a stream confluence. *Earth Surf. Process. Landf.* **1998**, *23*, 171–191. [CrossRef]
49. Rhoads, B.L.; Sukhodolov, A.N. Spatial and temporal structure of shear layer turbulence at a stream confluence. *Water Resour. Res.* **2004**, *40*, 1–13. [CrossRef]
50. Rhoads, B.L.; Sukhodolov, A.N. Field investigation of three-dimensional flow structure at stream confluences: 1. Thermal mixing and time-averaged velocities. *Water Resour. Res.* **2001**, *37*, 2393–2410. [CrossRef]
51. Biron, P.M.; Richer, A.; Kirkbride, A.D.; Roy, A.G.; Han, S. Spatial patterns of water surface topography at a river confluence. *Earth Surf. Process. Landf.* **2002**, *27*, 913–928. [CrossRef]
52. Best, J.L.; Reid, I. Separation zone at open-channel junctions. *J. Hydraul. Eng.* **1984**, *110*, 1588–1594. [CrossRef]
53. Huang, J.; Larry, J.W.; Yong, G.L. Three-dimensional numerical study of flows in open-channel junctions. *J. Hydraul. Eng.* **2002**, *128*, 268–280. [CrossRef]
54. Unde, M.G.; Dhakal, S. Sediment characteristics at river confluences: A case study of the Mula-Kas confluence, Maharashtra, India. *Prog. Phys. Geogr. Earth Environ.* **2009**, *33*, 208–223. [CrossRef]

55. Biron, P.M.; Roy, A.G.; Best, J.L.; Boyer, C.J. Bed morphology and sedimentology at the confluence of unequal depth channels. *Geomorphology* **1993**, *8*, 115–129. [CrossRef]
56. Bradbrook, K.F.; Lane, S.N.; Richards, K.S.; Biron, P.M.; Roy, A.G. Role of bed discordance at asymmetrical river confluences. *J. Hydraul. Eng.* **2001**, *127*, 351–368. [CrossRef]
57. De Serres, B.; Roy, A.G.; Biron, P.M.; Best, J.L. Three-dimensional structure of flow at a confluence of river channels with discordant beds. *Geomorphology* **1999**, *26*, 313–335. [CrossRef]
58. Biron, P.; Best, J.L.; André, G.R. Effects of bed discordance on flow dynamics at open channel confluences. *J. Hydraul. Eng.* **1996**, *122*, 676–682. [CrossRef]
59. Rhoads, B.L.; Riley, J.D.; Mayer, D.R. Response of bed morphology and bed material texture to hydrological conditions at an asymmetrical stream confluence. *Geomorphology* **2009**, *109*, 161–173. [CrossRef]
60. Szupiany, R.N.; Amsler, M.L.; Parsons, D.R.; Best, J.L. Morphology, flow structure, and suspended bed sediment transport at two large braid-bar confluences. *Water Resour. Res.* **2009**, *45*, 1–19. [CrossRef]
61. Wallis, E.; Nally, R.M.; Lake, P.S. A Bayesian analysis of physical habitat changes at tributary confluences in cobble-bed upland streams of the Acheron River basin, Australia. *Water Resour. Res.* **2008**, *44*, 1–10. [CrossRef]
62. Cushman-Roisin, B.; Constantinescu, G.S. Dynamical adjustment of two streams past their confluence. *J. Hydraul. Res.* **2019**, *2019*, 1–9. [CrossRef]
63. Benda, L. Confluence environments at the scale of river networks. In *River Confluences, Tributaries and the Fluvial Network*; Rice, S.P., Roy, A.G., Rhoads, B.L., Eds.; John Wiley & Sons: Chichester, UK, 2008; p. 466. [CrossRef]
64. Ferguson, R.; Hoey, T. *Effects of Tributaries on Main-Channel Geomorphology*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 183–208. [CrossRef]
65. Rice, S.P. Which tributaries disrupt downstream fining along gravel-bed rivers? *Geomorphology* **1998**, *22*, 39–56. [CrossRef]
66. Rice, S.P.; Kiffney, P.; Greene, C.; Pess, G.R. *The Ecological Importance of Tributaries and Confluences*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 209–242. [CrossRef]
67. Rice, S.P.; Rhoads, B.L.; Roy, A.G. *Introduction: River Confluences, Tributaries and the Fluvial Network*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 1–9. [CrossRef]
68. Benda, L.; Veldhuisen, C.; Black, J. Debris flows as agents of morphological heterogeneity at low-order confluences, Olympic Mountains, Washington. *GSAMB* **2003**, *115*, 1110–1121. [CrossRef]
69. Curtis, K.E.; Renshaw, C.E.; Magilligan, F.J.; Dade, W.B. Temporal and spatial scales of geomorphic adjustments to reduced competency following flow regulation in bedload-dominated systems. *Geomorphology* **2010**, *118*, 116–129. [CrossRef]
70. Musselman, Z.A. The localized role of base level lowering on channel adjustment of tributary streams in the Trinity River basin downstream of Livingston Dam, Texas, USA. *Geomorphology* **2011**, *128*, 42–56. [CrossRef]
71. Biron, P.; Roy, A.G.; Best, J.L. Turbulent flow structure at concordant and discordant open-channel confluences. *Exp. Fluids* **1996**, *21*, 437–446. [CrossRef]
72. Bridge, J.S.; Gabel, S.L. Flow and sediment dynamics in a low sinuosity, braided river: Calamus River, Nebraska Sandhills. *Sedimentology* **1992**, *39*, 125–142. [CrossRef]
73. Bradbrook, K.F.; Biron, P.M.; Lane, S.N.; Richards, K.S.; Roy, A.G. Investigation of controls on secondary circulation in a simple confluence geometry using a three-dimensional numerical model. *Hydrol. Process.* **1998**, *12*, 1371–1396. [CrossRef]
74. Dai, W.; Bilal, A.; Xie, Q.; Zhai, Y. Numerical Simulation of a Deep-Scour Hole in a Tidal River Confluence Using Delft 3D. In Proceedings of the 37th IAHR World Congress, Kuala Lumpur, Malaysia, 13–18 August 2017; pp. 633–638.
75. Gaucherel, C.; Frelat, R.; Salomon, L.; Rouy, B.; Pandey, N.; Cudennec, C. Regional watershed characterization and classification with river network analyses. *Earth Surf. Process. Landf.* **2017**, *42*, 2068–2081. [CrossRef]
76. Jung, K.; Marpu, P.R.; Ouarda, T. Impact of river network type on the time of concentration. *Arab. J. Geosci.* **2017**, *10*, 1–17. [CrossRef]
77. Seo, Y.; Schmidt, A.R. Application of Gibbs' model to urban drainage networks: A case study in southwestern Chicago, USA. *Hydrol. Process.* **2014**, *28*, 1148–1158. [CrossRef]
78. Ashmore, P.E.; Parker, G. Confluence scour in coarse braided streams. *Water Resour. Res.* **1983**, *19*, 392–402. [CrossRef]

79. Best, J.L. Flow dynamics at river channel confluences: Implications for sediment transport and bed morphology. In *Recent Developments in Fluvial Sedimentology*; Ethridge, F.G., Flores, R.M., Harvey, M.D., Eds.; SEPM Society for Sedimentary Geology: Tulsa, OK, USA, 1987; Volume 39, p. 371.
80. Xie, Q. Field Measurements and Numerical Simulations of Sediment Transport in a Tidal River. Ph.D. Thesis, Luleå University of Technology, Luleå, Sweden, 2019.
81. Guillén-Ludeña, S. *Hydro-Morphodynamics of Open-Channel Confluences with Low Discharge Ratio and Dominant Tributary Sediment Supply*; EPFL: Lausanne, Switzerland, 2015.
82. Guillen-Ludena, S.; Franca, M.J.; Cardoso, A.H.; Schleiss, A.J. Evolution of the hydromorphodynamics of mountain river confluences for varying discharge ratios and junction angles. *Geomorphology* **2016**, *255*, 1–15. [CrossRef]
83. Leite Ribeiro, M.; Blanckaert, K.; Roy, A.G.; Schleiss, A.J. Flow and sediment dynamics in channel confluences. *J. Geophys. Res. Earth Surf.* **2012**, *117*, 1–19. [CrossRef]
84. Sukhodolov, A.N.; Rhoads, B.L. Field investigation of three-dimensional flow structure at stream confluences: 2. Turbulence. *Water Resour. Res.* **2001**, *37*, 2411–2424. [CrossRef]
85. Ashmore, P.E.; Gardner, J.T. *Unconfined Confluences in Braided Rivers*; John Wiley & Sons, Ltd.: Chichester, UK, 2008; pp. 119–147. [CrossRef]
86. Roy, A.G.; Bergeron, N. Flow and particle paths at a natural river confluence with coarse bed material. *Geomorphology* **1990**, *3*, 99–112. [CrossRef]
87. Tancock, M.J. The Dynamics of Upland River Confluences. Ph.D. Thesis, Durham University, Durham, UK, 2014.
88. Bertoldi, W.; Zanoni, W.L.; Tubino, M. Assessment of morphological changes induced by flow and flood pulses in a gravel bed braided river: The Tagliamento River (Italy). *Geomorphology* **2010**, *114*, 348–360. [CrossRef]
89. Lancaster, S.T.; Underwood, E.F.; Frueh, W.T. Sediment reservoirs at mountain stream confluences: Dynamics and effects of tributaries dominated by debris-flow and fluvial processes. *GSAMB* **2010**, *122*, 1775–1786. [CrossRef]
90. Kjerfve, B.; Shao, C.-C.; Stapor, F.W. Formation of deep scour holes at the junction of tidal creeks: An hypothesis. *Mar. Geol.* **1979**, *33*, M9–M14. [CrossRef]
91. Sambrook-Smith, G.H.; Ashworth, P.J.; Best, J.L.; Woodward, J.; Simpson, C.J. The morphology and facies of sandy braided rivers: Some considerations of scale invariance. In *Fluvial Sedimentology VII*; Blum, M.D., Marriott, S.B., Leclair, S.F., Eds.; Wiley-Blackwell: Hoboken, NJ, USA, 2005; pp. 145–158. [CrossRef]
92. Orfeo, O.; Parsons, D.R.; Best, J.L.; Lane, S.N.; Hardy, R.J.; Kostaschuk, R.A.; Szupiany, R.N.; Amsler, M.L. Morphology and flow structures in a large confluence-diffluence. In Proceedings of the International Conference on Fluvial Hydraulics, Lisbon, Purtagal, 6–8 September 2006; pp. 1277–1282.
93. Bradbrook, K.F.; Lane, S.N.; Richards, K.S. Numerical simulation of three-dimensional, time-averaged flow structure at river channel confluences. *Water Resour. Res.* **2000**, *36*, 2731–2746. [CrossRef]
94. Bradbrook, K.F.; Lane, S.N.; Richards, K.S.; Biron, P.M.; Roy, A.G. Large Eddy Simulation of periodic flow characteristics at river channel confluences. *J. Hydraul. Res.* **2000**, *38*, 207–215. [CrossRef]
95. Penna, N.; De Marchis, M.; Canelas, O.; Napoli, E.; Cardoso, A.; Gaudio, R. Effect of the junction angle on turbulent flow at a hydraulic confluence. *Water* **2018**, *10*, 469. [CrossRef]
96. Riley, J.D.; Rhoads, B.L.; Parsons, D.R.; Johnson, K.K. Influence of junction angle on three-dimensional flow structure and bed morphology at confluent meander bends during different hydrological conditions. *Earth Surf. Process. Landf.* **2015**, *40*, 252–271. [CrossRef]
97. Bryan, R.B.; Kuhn, N.J. Hydraulic conditions in experimental rill confluences and scour in erodible soils. *Water Resour. Res.* **2002**, *38*, 1–13. [CrossRef]
98. Constantinescu, G.; Miyawaki, S.; Rhoads, B.; Sukhodolov, A. Numerical analysis of the effect of momentum ratio on the dynamics and sediment-entrainment capacity of coherent flow structures at a stream confluence. *J. Geophys. Res. Earth Surf.* **2012**, *117*, 1–21. [CrossRef]
99. Thompson, C.J.; Croke, J.C.; Purvis-Smith, D. Floodplain sediment disconnectivity at a tributary junction and valley constriction site in the Fitzroy River basin, Queensland, Australia. *Geomorphology* **2011**, *125*, 293–304. [CrossRef]
100. Schindfessel, L.; Creelle, S.; De Mulder, T. Flow patterns in an open channel confluence with increasingly dominant tributary inflow. *Water* **2015**, *7*, 4724–4751. [CrossRef]

101. Gaudet, J.M.; Roy, A.G. Effect of bed morphology on flow mixing length at river confluences. *Nature* **1995**, *373*, 138–139. [CrossRef]
102. Ludeña, S.G.; Cheng, Z.; Constantinescu, G.; Franca, M.J. Hydrodynamics of mountain-river confluences and its relationship to sediment transport. *J. Geophys. Res. Earth Surf.* **2017**, *122*, 901–924. [CrossRef]
103. Sukhodolov, A.N.; Krick, J.; Sukhodolova, T.A.; Cheng, Z.; Rhoads, B.L.; Constantinescu, G.S. Turbulent flow structure at a discordant river confluence: Asymmetric jet dynamics with implications for channel morphology. *J. Geophys. Res. Earth Surf.* **2017**, *122*, 1278–1293. [CrossRef]

Large-Eddy Simulations of T-shaped Open-Channel Confluences With Different Downstream Channel Widths

Pedro Xavier Ramos
Ghent University, pedro.ramos@ugent.be

Laurent Schindfessel
Ghent University

João Pedro Pêgo
University of Porto

Tom De Mulder
Ghent University

7th International Junior Researcher and Engineer Workshop on Hydraulic Structures, IJREWHS'19, B. HEINER and B. TULLIS (Eds), Report 3, U.S. Bureau of Reclamation, Denver, CO, USA - ISBN 978-0-578-69809-0
https://doi.org/10.26077/z99p-xs05

Large-Eddy Simulations of T-shaped open-channel confluences with different downstream channel widths

Pedro Xavier RAMOS
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, Sint-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium, Email: Pedro.Ramos@UGent.be.
Laurent SCHINDFESSEL
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, Sint-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium.
João Pedro PÊGO
Faculty of Engineering – University of Porto, Rua do Dr. Roberto Frias, 4200-465 Porto, Portugal.
Tom De MULDER
Hydraulics Laboratory, Department of Civil Engineering, Ghent University, Sint-Pietersnieuwstraat 41 B5, Ghent B-9000, Belgium.

Abstract: Confluences of open-channel flows are common in nature as well as in urban drainage networks and in hydraulic structures. The complex hydrodynamics is often studied in schematized, right-angled confluences. In this paper, the influence of the downstream channel width onto time-averaged and turbulent flow features will be investigated numerically, based on Large-Eddy Simulations. For one flow situation, i.e. flow ratio and downstream Froude number, two geometries will be compared: a discordant width case, which was studied experimentally by Yuan et al. (2016) in a flume with a wider downstream channel than the upstream mean and tributary channels, and the corresponding concordant width case, in which the downstream channel has the same width as the confluent channels. The widening of the downstream channel turns out to reduce the backwater effects, the flow contraction and the associated water surface depression. Moreover, the three-dimensionality of the recirculation zone in the mean flow is enhanced due to complex flow patterns, resulting in a reduced width and length of the recirculation zone in the lowest third of the water column. Finally, the respective cores of high values of the dimensionless TKE and Reynolds shear stress, that persist over the water column, have lower peak values in the discordant width case and the shape of those cores is more distorted, especially near the bed.

Keywords: *open-channel confluence; unequal widths; Large-Eddy Simulation; CFD.*

INTRODUCTION

Confluences of open-channel flows are ubiquitous features in fluvial networks, urban drainage networks and even in hydraulic structures (e.g. outfalls, fish passes). Confluences are important

locations in those networks as they regulate the water levels, the mixing phenomena of the incoming flows and the transport and deposition of sediments, pollutants and nutrients (Best, 1987; Biron et al. 1996; Boyer et al. 2006; Rice et al., 2008; De Serres et al. 1999; Ludeña et al. 2017; Cushman-Roisin and Constantinescu, 2019).

The flow features in the confluence hydrodynamics zone (CHZ) are complex and are often studied in schematized geometries consisting of straight branches and sharp junction corners. Best (1987) developed a conceptual model discerning the features indicated (in planform) in Figure 1: a flow stagnation zone, a flow deflection zone, a flow recirculation zone (RZ), a zone of maximum velocity, a gradual flow recovery area and shear layers. The characteristics of these (three-dimensional) flow features depend, among other factors, upon the confluence angle between the inflowing branches, the ratio of the inflowing momentum fluxes, the tailwater Froude number and the bed elevation discordance (e.g. Đorđević, 2013; Biron et al. 1996; Penna et al. 2018; Birjukova-Canelas et al. 2019).

Among the schematized geometries, the right-angled confluences of a main channel and a tributary channel have been investigated the most extensively. The experimental data of Weber et al. (2001) pertain to lab experiments in such a T-shaped confluence with horizontal and concordant beds (i.e. no bed elevation discordance is present between the main and the tributary channels) and concordant widths (i.e. the post-confluence channel has the same width as the incoming channels). These data have been used frequently for validation of numerical models. By means of validated numerical models, the mean (i.e. time-averaged) and turbulent flow features in the CHZ can then be studied in more detail in similar or variant geometries and flow conditions as were studied experimentally (e.g. Huang et al., 2002; Constantinescu et al. 2001; Yang et al., 2013; Schindfessel et al., 2015; Ramos et al., 2019a,b).

For many years, the study of Weber et al. (2001) was one of the few studies investigating experimentally the flow structure of a T-shaped open-channel confluence. More recently, Yuan et al. (2016) experimentally studied a right-angled open-channel confluence with a wider post-confluence channel and adopting a higher time-resolution of the velocity measurements.

The present paper wants to contribute to assessing the effects of width discordance between the confluent channels on the confluence flow features. To this end, a numerical model based upon Large-Eddy Simulations will be first set up and validated for one of the flow cases investigated experimentally by Yuan et al. (2016) in the confluence with a wider downstream channel, which will be further referred to as the discordant width case. Then, the model will be adapted to simulate the corresponding concordant width case (i.e. the downstream channel will be narrowed to have the same width as the upstream channels).

The effect of width discordance onto the water surface elevations, the three-dimensional

structure of the recirculation zone and some turbulent flow features will then be assessed.

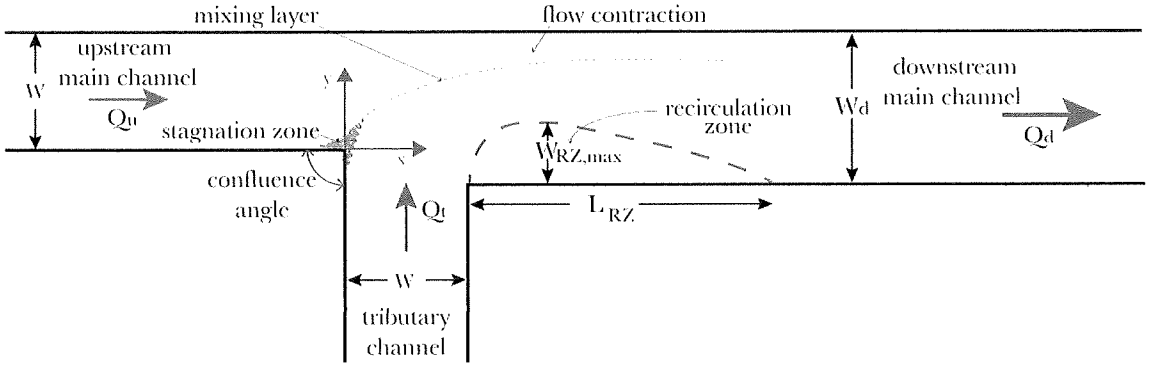


Figure 1. Schematic plan-view of the flow features in a right-angled open-channel confluence with channels of equal width (after Best, 1987) with coordinate system, nomenclature and recirculation zone dimensions at a given elevation z above the bed.

HYDRAULIC CONDITIONS

In this work, a right-angled confluence of open channels with a rectangular cross-section and with horizontal and concordant beds is considered. Let W be the width of the main upstream channel and the tributary channel and W_d the width of the downstream (i.e. post-confluence) channel (Figure 1). Two cases will be studied, having a different width discordance ratio:

$$\omega = W/W_d \quad (1)$$

The discordant width case (ω=0.75) has a wider downstream channel than the upstream channels (Figure 1) and corresponds to the lab experiment with fixed, horizontal and concordant beds by Yuan et al. (2016), which is referred to in the latter paper as "case two". The associated hydraulic conditions are given in Table 1, in which the discharge ratio is defined as follows:

$$q = Q_u/Q_d = Q_u/(Q_u + Q_t) \quad (2)$$

where Q_u and Q_t are the incoming discharge of the main channel and the tributary, respectively, and Q_d is the downstream discharge. The downstream Froude number is given by:

$$Fr_d = U_d/\sqrt{g h_d} \quad (3)$$

where $U_d=Q_d/(h_d W_d)$ is the cross-sectionally averaged downstream velocity, h_d the downstream flow depth and g the gravitational acceleration.

Table 1. Flow case with discordant width (ω=0.75) experimentally investigated by Yuan et al. (2016)

Q_u [l/s]	Q_t [l/s]	Q_d [l/s]	q [-]	W [m]	W_d [m]	ω [-]	h_d [m]	U_d [m/s]	Fr_d [-]
3.9	6.0	9.9	0.40	0.30	0.40	0.75	0.163	0.152	0.12

The concordant width case (ω=1.00) has a downstream channel width which is identical to the width of the upstream channels. Note that the concordant width case has not been investigated experimentally by Yuan et al. (2016). It will be simulated at the same hydraulic conditions (q, Fr_d) as the discordant width case (ω=0.75). As a consequence, the downstream water depth and cross-sectionally averaged velocity in the concordant width case (Table 2) differ from the discordant width case values (Table 1). Note that for both the discordant and the concordant width case, the origin of the coordinate system (Figure 1) is at the upstream confluence corner (x=0, y=0) and at bed elevation (z=0).

Table 2. Flow case with concordant width (ω=1.00)

Q_u	Q_t	Q_d	q	W	W_d	ω	h_d	U_d	Fr_d
[l/s]	**[l/s]**	**[l/s]**	**[-]**	[m]	[m]	**[-]**	[m]	**[m/s]**	**[-]**
3.9	6.0	9.9	0.40	0.30	0.30	1.00	0.197	0.167	0.12

NUMERICAL METHODOLOGY

Large-Eddy Simulations within the OpenFOAM toolbox

The numerical simulations in the present contribution are conducted within the three-dimensional computational fluid dynamics (CFD) software OpenFOAM, version 5.0. A Large-Eddy Simulation approach is adopted, requiring to solve the spatially-averaged continuity and Navier-Stokes equations, governing an unsteady, incompressible and viscous flow. As a Subgrid Scale Model (SGS), the standard Smagorinsky model is used, with a constant C_s of 0.158. In the OpenFOAM toolbox, the governing equations are discretized using the Finite Volume Method (FVM). The selected discretization schemes are second order accurate in time and space. The discretized equations are coupled and solved using the PISO algorithm.

Boundary conditions

In the present work, a rigid-lid approach is adopted as free surface treatment. This implies that the free surface is replaced by a frictionless and impermeable upper boundary of the computational domain. Ramos et al. (2019a) indicates that the implementation of a flat rigid-lid within the simulation of an open-channel confluence might not be valid close to the contracted section (i.e. adjacent to the recirculation zone) because the flow undergoes an acceleration that causes the water surface to drop substantially. With that in consideration, the present LES (Large-Eddy simulations) are run with a curved rigid-lid, approximating the numerical mesh height to the real flow depth. This curved rigid-lid will be defined by simulating first a flat rigid-lid (at an elevation z_{lid} above the bed) case and then converting the predicted time-averaged pressure field (P) onto the lid into an elevation of a virtual free surface (h), according to Equation (4):

$$h\,(x,y) = z_{lid} + \frac{P(x,y,z_{lid})}{\rho g} \quad (4)$$

Note that the latter equation implicitly assumes the hydrostatic pressure law to hold. On both the flat and the curved rigid-lids, zero shear stress and zero normal velocity conditions are imposed on the lids. The foregoing approach is further explained in Ramos et al. (2019a). In the present study, the low downstream Froude number of Fr_d = 0.12 (Table 1 and Table 2) suggests that the water surface variations are less pronounced as compared to the confluence flow cases studied in Ramos et al. (2019a), in which Fr_d, was 0.37. Nevertheless, the abovementioned methodology will be applied in this paper and only results of curved rigid-lid simulations will be shown.

For each of the two cases, ω=0.75 and ω=1.00, an impression of the adopted curved rigid-lid shape is given in Figure 2, by means of three longitudinal transects along the main and downstream channel.

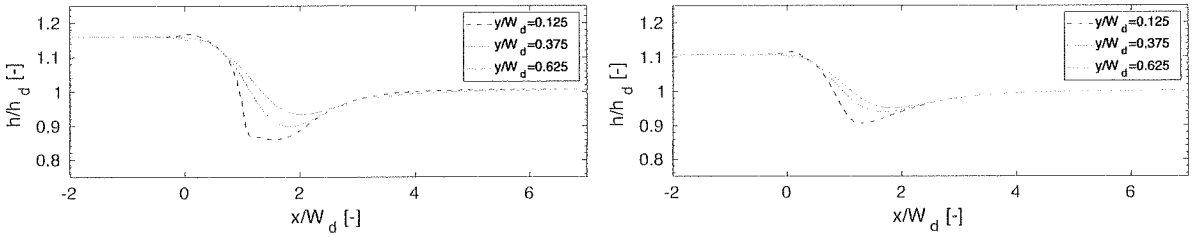


Figure 2. Curved rigid-lid shape indicated by three longitudinal transects along main and downstream channel (left: ω=1.00, right: ω=0.75).

In the present LES simulations, the wall boundary layers will not be fully resolved, with wall functions being adopted instead (see also Schindfessel *et al.*, 2015). This approach requires the first node to be located at $z^+ \approx 30-300$ (Rodi, Constantinescu and Stoesser, 2013; Schindfessel, 2017).

Since a LES resolves a relatively big part of the turbulence and to approach the model to reality, the inlet velocity should also be turbulent and fully developed. In the present numerical set up, this is achieved by means of a so-called precursor simulation, which basically means that a periodic channel is simulated and its turbulent velocity is used as an inlet condition.

For the pressure variable, a zero value is imposed at the outlet and a zero gradient at the inlets (x/W_d=-5; y/W_d=-5), the walls and the rigid-lid. For the subgrid-scale viscosity a zero gradient is imposed everywhere, except at the walls, where the aforementioned wall model is implemented.

Mesh

A block-structured mesh has been defined for the present numerical investigation (Table 3) after a mesh sensitivity analysis of the results. Grading of the cell size is adopted, yielding a higher resolution in the confluence zone and a smooth transition between the different blocks. The mesh for a flat rigid-lid simulation is deformed for the subsequent curved rigid-lid

simulation, based upon the methodology suggested by Rameshwaran and Naden (2004), and adopted and described in Ramos et al. (2019a): along each vertical grid line (i.e. the z direction), the highest grid point is shifted to coincide with the curved surface defined by Equation (4), whereas the near-wall point is kept in place in order to maintain the dimensionless wall-normal distance, z^+, constant and apply the wall function always under the same circumstances. The grid points in between are gradually redistributed along the vertical gridline (see Figure 4 in Ramos et al., 2019a). Our mesh sensitivity analysis shows that a coarser resolution than adopted in this paper will miss the secondary currents, like it is reported for another open-channel confluence in Ramos et al. (2019a) and in open-channel flows in general by Talebpour and Liu (2019). Therefore, special care was devoted to the mesh independence in terms of secondary flow results.

Table 3. Number of mesh cells for each simulation.

Case	upstream channels	main and tributary		downstream channel			total
	longitudinal (length=5W)	lateral (W=0.30 m)	vertical (h_d=0.18 W)	longitudinal (length=8 W)	lateral (W=0.40 m)	vertical (h_d=0.18 W)	number of cells
ω=0.75	600	100	45	850	120	25	4.2×10^6
ω=1.00					90		3.7×10^6

Model verification

The mesh used in the present paper (Section 3.4) is defined on the basis of a mesh sensitivity and independency analysis, as well as on the validation described in Section 4. Like it was already stated, as a consequence of the use of wall functions, the wall-normal distance of the first grid cells along the sidewalls and the bed should meet the criterion $30<z^+<300$. This condition is met for all the simulations, with z^+ being usually above 30, except for the zones of low flow velocity. These minor exceptions are expected and accepted, especially in the stagnation zone (McSherry et al., 2013; Schindfessel et al., 2015). To obtain the LES results presented in this paper, the simulations have advanced more than 600 seconds, before the data collection started. This initialization time corresponds to 33T (where $T=12W/U_d$ is an approximate flow-through time for the 12W long main channel). Data collection and time-averaging span an additional 75T of simulation (1350 s).

Computational resources

The simulations were computed on a 2×16-core Intel E5-2670 (Sandy Bridge @ 2.6 GHz). The total computational cost of the simulation is approximately 4200 CPU hours. Since the numerical domain is decomposed in 36 sub-domains, the real computational time, due to the parallel processing capabilities, is of 116 hours for each simulation.

RESULTS

Validation of the simulations

Figure 3 depicts the time-averaged horizontal velocity fields near the free surface (red arrows) and near the bed (black arrows) as predicted by the present simulation with discordant widths and as measured by Yuan et al. (2016) in the laboratory. The discrepancies, especially regarding the near bed flow (black arrows), between the LES results and the experiments suggest that the RZ is wider in the simulations. The simulated and measured velocities have the same order of magnitude and, despite the aforementioned discrepancies, the agreement is satisfactory.

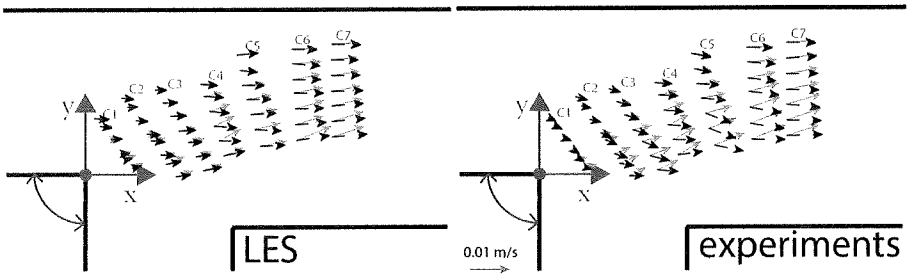


Figure 3. Horizontal velocity fields in the discordant width case (ω=0.75), close to the bed (z/h_d=0.12; black arrows) and close to the free surface (z/h_d=0.8; red arrows), as predicted by the LES simulation (left) and measured by Yuan et al. 2016 (right).

The turbulent kinetic energy (TKE) is shown in Figure 4 for the experiments and in the simulations of the case with ω=0.75. The vertical profiles are located in the cross-sections (C2, C3 and C5) depicted in Figure 3, more specifically in the location where the measured TKE assumes its maximum value in the experimental data of (Yuan et al. 2016). Note that in Figure 3, the vertical coordinate z is non-dimensionalized with respect to the local water depth, h'. The agreement is fair.

Figure 4.b shows the vertical profiles of the measured and simulated Reynolds shear stress ($\overline{u'v'}$) in the same locations as in Figure 4.a. Typically, the higher values occur at about half-depth, both in the experiments and in the simulations. Again, the results suggest a fairly confident validation of the simulations.

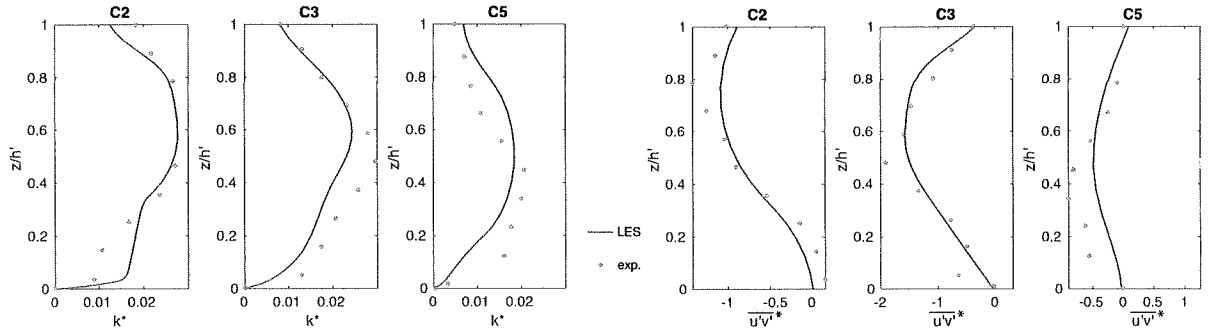


Figure 4. a. (left) Vertical profiles of dimensionless TKE ($k^*=TKE/U_d^2$) in the core of the mixing layer in the discordant width case ($\omega=0.75$); b. (right) Vertical profiles of the dimensionless (with respect to 10^6 x U_d^2) Reynolds shear stress ($\overline{u'v'}$) in the core of the mixing layer in the discordant width case ($\omega=0.75$).

Water surface elevations

In order to assess the influence of the width discordance onto the water surface elevations, the curved rigid-lids (Figure 2) of the discordant and concordant width cases can be compared. It is obvious that the backwater effect is lower in the discordant width case, because of the wider downstream channel. Similarly, the water surface dip in the flow contraction (and recirculation) zone, is less pronounced in the discordant width case.

Mean flow

Based on the time-averaged flow fields, the RZ dimensions (i.e. the maximum width $W_{RZ,\,max}$ and the length L_{RZ}, see Figure 1) are determined by applying the *isovel method* (see e.g. Qing-Yuan et al., 2009; Schindfessel et al., 2015). This means that the RZ boundaries are retrieved from the calculated contourline corresponding to a zero longitudinal velocity component, where its maximum excursion from the downstream channel's inner bank determines $W_{RZ,max}$, while its downstream intersection with the aforementioned bank determines L_{RZ}. Table 4 summarizes the time-averaged dimensions of the RZ in three horizontal planes, with different elevations above the bed, for both the discordant width and the concordant width cases. Note that the predicted near surface (i.e. at $z/h_d=0.80$) value of $W_{RZ,max}= 0.27W_d$ for the discordant width case is slightly larger than the experimental value of $W_{RZ,max}= 0.23W_d$ at the water surface (see Fig. 3b in Yuan et al., 2016).

Table 4. RZ dimensions (see Figure 1).

	ω=1.00 (W_d=0.30m; h_d=0.197m)		**ω=0.75 (W_d=0.40m; h_d=0.163m)**	
Location	L_{RZ}	$W_{RZ,max}$	L_{RZ}	$W_{RZ,max}$
z/h_d=0.12	$2.50W_d$	$0.23W_d$	$1.52W_d$	$0.13W_d$

z/h_d=0.50	2.49W_d	0.24W_d	1.76W_d	0.27W_d
z/h_d=0.80	2.48W_d	0.24W_d	1.84W_d	0.27W_d

As was already deduced by observation of Figure 3, the RZ dimensions in the discordant width case seem to be substantially smaller near the bed as compared to higher in the water column. Moreover, the near bed value of $W_{RZ,max}$ may even be somewhat smaller than predicted (see section 4.1), which means that the 3D effects in the RZ shape are even more pronounced than the simulations suggest. For the concordant width case, however, Table 4 shows that the simulated RZ dimensions do not change significantly over the flow depth.

As can be seen from the vertical sections near the inner bank of the downstream channel (Figure 5), the differences between the RZ dimensions of the discordant and concordant width cases are related to differences in flow structure. More specifically, a pronounced upwelling flow occurs in the discordant width case (around $x/W_d \approx 1.3$) which results near the bed in a longitudinal extent of the RZ that does not start at the downstream confluence corner. In other words: the total length of the RZ is smaller than the $L_{RZ}=1.52W_d$ value indicated in Table 4 (which represents the distance from the downstream corner to the point where the u=0 isoline reattaches to the wall).

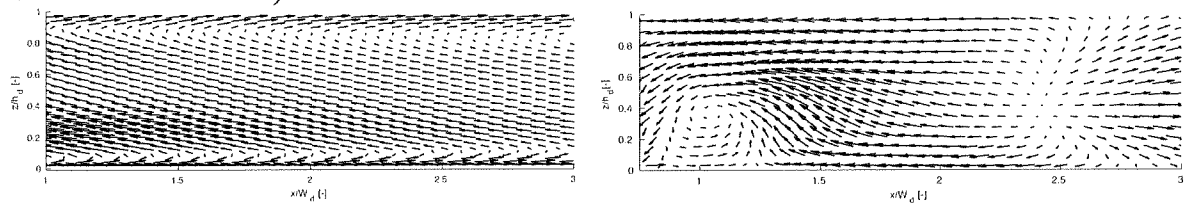


Figure 5. Time-averaged velocity vectors (*u,w*) in a vertical section near the inner bank of the downstream channel (left: section at y/W_d=0.0375 for ω=1.00 case, right: section at y/W_d=-0.2125 for ω=0.75 case).

The top panels of Figure 6 show mean flow streamlines originating from locations at an elevation of z/h_d=0.12 in the upstream main channel. It is clear that the flow contraction is lower in the discordant width case. Similarly, the bottom panels of Figure 6 show mean flow streamlines originating from locations at an elevation of z/h_d=0.12 in the tributary channel, revealing complex flow behaviour. By means of similar streamline plots originating at different elevations above the bed (not shown) it was found that hardly any fluid from the upstream main channel enters the recirculation zone.

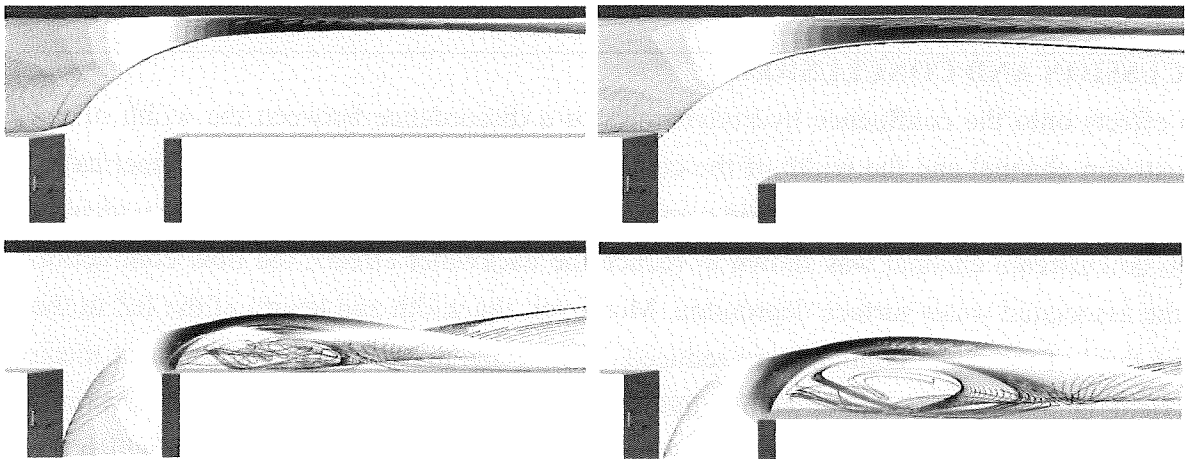


Figure 6. Streamlines of mean flow. Left panels: concordant width case (ω=0.75), right panels: discordant width case (ω=0.75). Top panels: streamlines originating from upstream main channel at an elevation of z/h_d=0.12. Bottom panels: streamlines originating from tributary channel at an elevation of z/h_d=0.12.

Turbulent flow

In Figure 7a, the cross-sectional distribution of the dimensionless TKE and dimensionless Reynolds shear stress ($\overline{u'v'}$), respectively, is presented in three different cross-sections. In every cross-section, a core of higher values persists over the flow depth. Note that the lateral position of those TKE and $\overline{u'v'}$ cores do not coincide.

The concordant width case shows higher values of the dimensionless TKE and $\overline{u'v'}$ (Figure 7b) of the abovementioned cores. The results also show a more pronounced distortion of those cores over the water depth, in the discordant width case. This happens already quite upstream ($1/4<x/W_d<1$). This higher degree of tilting may be linked to the reduced dimensions of the mean flow recirculation zone (RZ) in the near bed zone.

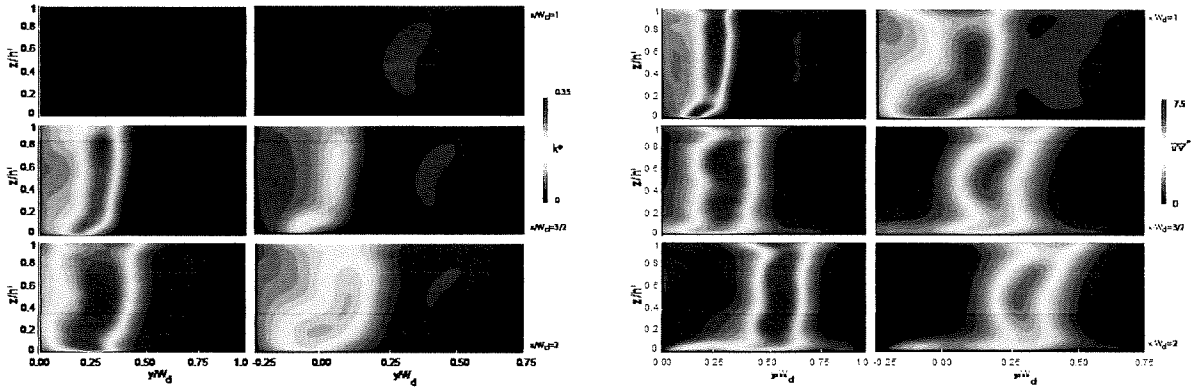


Figure 7. a. (left) Cross-sectional distribution of dimensionless TKE ($k^*=TKE/U_d^2$) for the concordant (ω=1.00, left) and discordant (ω=0.75, right) width cases in three cross-sections (x/W_d=1;3/2;2) of the downstream channel; b. (right) Cross-sectional distribution of dimensionless (with respect to $10^6 \times U_d^2$) Reynolds shear stress ($\overline{u'v'}$) for the concordant (ω=1.00, left) and discordant (ω=0.75, right) width cases in three cross-sections (x/W_d=1/2;3/2;2) of the downstream channel.

DISCUSSION AND CONCLUSIONS

The effects onto the confluence hydrodynamics of a discordance between the width of the downstream channel and the width of the confluent channels were investigated numerically, for one flow situation (i.e. one flow ratio q and downstream Froude number Fr_d). The widening of the downstream channel was shown to reduce the backwater effects, the flow contraction and the associated water surface depression. Moreover, the width and length of the RZ in the lowest third of the water column were reduced. This seems to be related to a complex mean flow field, including important upwelling motions. To some extent, the foregoing observations are comparable to what was found in confluences with discordant bed elevation, in which the tributary is shallower than the main channel (Biron et al., 1996; Ramos et al., 2019b). In the latter case, however, the RZ was found to be fed by mean flow coming from both the tributary and the upstream main channel (Best and Roy, 1991; Ramos et al., 2019b), whereas in the present case, only the tributary mean flow contributes. With respect to the dimensionless TKE and Reynolds shear stress, the widening of the downstream channel was shown to reduce the peak values in the respective cores of these turbulent quantities. Moreover, the shape of those cores was found to be more distorted, especially in the near bed zone. In future research, it is worth investigating whether the aforementioned observations induce a distortion of the mixing layer between the merging flows, as suggested by Biron et al. (1996) in the context of discordant bed confluences. In addition to this, the possible intermittent and/or periodic character of the flow features discerned in the time-averaged flow (Bradbrook et al., 2000; Parsons, 2003; Yoshimura et al., 2016) should be studied. Finally, the dependency of the effects of width discordance on the flow ratio needs to be investigated. To this end, the developed numerical model for the discordant width flume of Yuan et al. (2016) will be further validated at different flow ratios, based on the experimental data reported in Yuan et al. (2016) and Tang et al. (2018).

ACKNOWLEDGEMENTS

This work was performed using the computational facilities of the HPC infrastructure of Ghent University.

REFERENCES

Best, J. L. and Roy, A. G. (1991). Mixing-layer distortion at the confluence of channels of different depth. Nature, 350(6317), 411. doi.org/10.1038/350411a0.

Best, J.L. (1987). Flow dynamics at river channel confluences: implications for sediment transport and bed morphology. In: Ethridge, F.G. Flores, R.M. Harvey, M.D. (Eds.), Recent developments in

fluvial sedimentology. Spec. Publ. Soc. Sediment. Geol. SEPM 39, 27-35. doi.org/10.2110/pec.87.39.0027.

Birjukova-Canelas, O., Ferreira, R. M., Guillén-Ludeña, S., Alegria, F. C. and Cardoso, A. H. (2019). Three-dimensional flow structure at fixed 70° open-channel confluence with bed discordance. Journal of Hydraulic Research, 1-13. doi.org/10.1080/00221686.2019.1596988

Biron, P., Best, J.L. and Roy, A.G. (1996). Effects of bed discordance on flow dynamics at open channel confluences. Journal of Hydraulic Engineering, ASCE, Vol. 122(12), 676-682. doi.org/10.1061/(ASCE)0733-9429(1996)122:12(676).

Boyer, C., Roy, A. G. and Best, J. L. (2006) Dynamics of a river channel confluence with discordant beds: Flow turbulence, bed load sediment transport and bed morphology. Journal of Geophysical Research: Earth Surface, 111(F4). doi.org/10.1029/2005JF000458.

Bradbrook, K.F., Lane, S.N., Richards, K.S., Biron, P.M. and Roy, A.G. (2000). Large Eddy Simulation of periodic flow characteristics at river channel confluences. Journal of Hydraulic Research, 38(3), 207-215. doi.org/10.1080/00221680009498338.

Constantinescu, G., Miyawaki, S., Rhoads, B., Sukhodolov, A. and Kirkil, G. (2011). Structure of turbulent flow at a river confluence with momentum and velocity ratios close to 1: Insight provided by an eddy-resolving numerical simulation. Water Resources Research, 47(5).

Cushman-Roisin, B. and Constantinescu, G.S. (2019). Dynamical adjustment of two streams past their confluence. Journal of Hydraulic Research, 1-9. doi.org/full/10.1080/00221686.2019.1573765.

De Serres, B., Roy, A. G., Biron, P. M. and Best, J. (1999) Three-dimensional structure of flow at a confluence of river channels with discordant beds. Geomorphology, 26(4), 313-335. doi.org/10.1016/S0169-555X(98)00064-6.

Đorđević, D. (2013) Numerical study of 3D flow at right-angled confluences with and without upstream planform curvature. Journal of Hydroinformatics, 15(4), 1073-1088. doi.org/10.2166/hydro.2012.150.

Yoshimura, H., Fujita, I., Ichiro Moriguchi, R. (2016) Numerical and experimental investigations of unsteady separation zone generated at a right-angled confluence. RiverFlow16, doi.org/10.1201/9781315644479-251.

Huang, J., Weber, L.J. and Lai, Y.G. (2002) Three-dimensional numerical study of flows in open-channel junctions. Journal of Hydraulic Engineering, 128(3), 268-280.

Parsons, D. R. (2003). Discussion of "Three-dimensional numerical study of flows in open-channel junctions" by Jianchun Huang, Larry J. Weber, and Yong G. Lai. Journal of Hydraulic Engineering, 129(10), 822-823.

Penna, N., De Marchis, M., Canelas, O. B., Napoli, E., Cardoso, A. H. and Gaudio, R. (2018) Effect of the junction angle on turbulent flow at a hydraulic confluence. Water 10(4), 469-491.

Qing-Yuan, Y., Xian-Ye, W., Wei-Zhen, L., & Xie-Kang, W. (2009). Experimental study on characteristics of separation zone in confluence zones in rivers. Journal of Hydrologic Engineering, 14(2), 166-171.

Rameshwaran, P. and Naden, P. S. (2004) Three-dimensional modelling of free-surface variation in a meandering channel. Journal of Hydraulic Research, 42, 603–615.

Ramos, P.X., Schindfessel, L., Pêgo, J.P. and De Mulder, T. (2019a) Flat vs. curved rigid-lid LES computations of an open-channel confluence. Journal of Hydroinformatics, 21, no.2: 318-334. doi.org/10.2166/hydro.2019.109

Ramos, P.X., Schindfessel, L., Pêgo, J.P. and De Mulder, T. (2019b) Rigid-lid LES predictions of secondary ow in an open-channel confluence with concordant and discordant beds. 38th IAHR World Congress, Panama.

Rice, S., Roy, A., & Rhoads, B. (2008). River confluences, tributaries and the fluvial network. John Wiley & Sons.

Rodi, W., Constantinescu, G. and Stoesser, T. (2013). Large-eddy simulation in hydraulics. CRC Press.

Schindfessel, L., Creëlle, S. and De Mulder, T. (2015). Flow patterns in an open channel confluence with increasingly dominant tributary inflow. Water, 7(9), 4724-4751. doi.org/10.3390/w7094724.

Tang, H., Zhang, H. and Yuan, S. (2018). Hydrodynamics and contaminant transport on a degraded bed at a 90-degree channel confluence. Environmental Fluid Mechanics, 18(5), 1293-1295. http://dx.doi.org/10.1007/s10652-018-9612-x

Talebpour, M. and Liu, X., 2019. Numerical investigation on the suitability of a fourth-order nonlinear k-ω model for secondary current of second type in open-channels. Journal of Hydraulic Research, 57(1), pp.1-12.

Weber, L. J., Schumate, E. D. and Mawer, N. (2001) Experiments on flow at a 90° open-channel junction. Journal of Hydraulic Engineering, 127(5), 340-350. doi.org/10.1061/(ASCE)0733-9429(2001)127:5(340).

Winant, C. D., and Browand, F. K. (1974). "Vortex pairing: The mechanism of turbulent mixing layer growth at moderate Reynolds number," Journal of Fluid Mechanics, 63, 237-255.

Yang, Q. Y., Liu, T. H., Lu, W. Z. and Wang, X. K. (2013) Numerical simulation of confluence flow in open channel with dynamic meshes techniques. Adv. Mech. Eng., 5, 860431.

Yuan, S., Tang, H., Xiao, Y., Qiu, X., Zhang, H. and Yu, D. (2016) Turbulent flow structure at a 90-degree open channel confluence: accounting for the distortion of the shear layer. Journal of Hydroenvironmental Research, 12, 130-147.

MINUTES
COUNCIL COMMITTEE MEETING
MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9
Tuesday, April 13, 2021 11:00 am
Via GoToMeeting

Present: Deputy Reeve Rick Lemire, Councillors Terry Yagos, Quentin Stevick and Bev Everts.

Staff: CAO Troy MacCulloch, Director of Development and Community Services Roland Milligan, Director of Finance Meghan Dobie and Executive Assistant Jessica McClelland.

Absent: Reeve Brian Hammond

Deputy Reeve Rick Lemire called the meeting to order, the time being 11:00 am.

1. Approval of Agenda

   Councillor Quentin Stevick

   Moved that the agenda for April 13, 2021 be approved as presented.

   Carried

2. Riversdale Resources - Grassy Mountain Project

   Keith Bott, Community Relations Advisor with Riversdale Resources, along with Jackie Woodman, Alisdair Gibbons and Gary Houston attended the meeting at this time to present an update on the Grassy Mountain Project. Their updated powerpoint presentation is attached to and forming part of these minutes.

3. Closed Session

4. Adjournment

   Councillor Terry Yagos

   Moved that the Committee Meeting adjourn, the time being 12:02 pm

   Carried

RIVERSDALE
RESOURCES

Municipal Update
MD of Pincher Creek
April 13, 2021

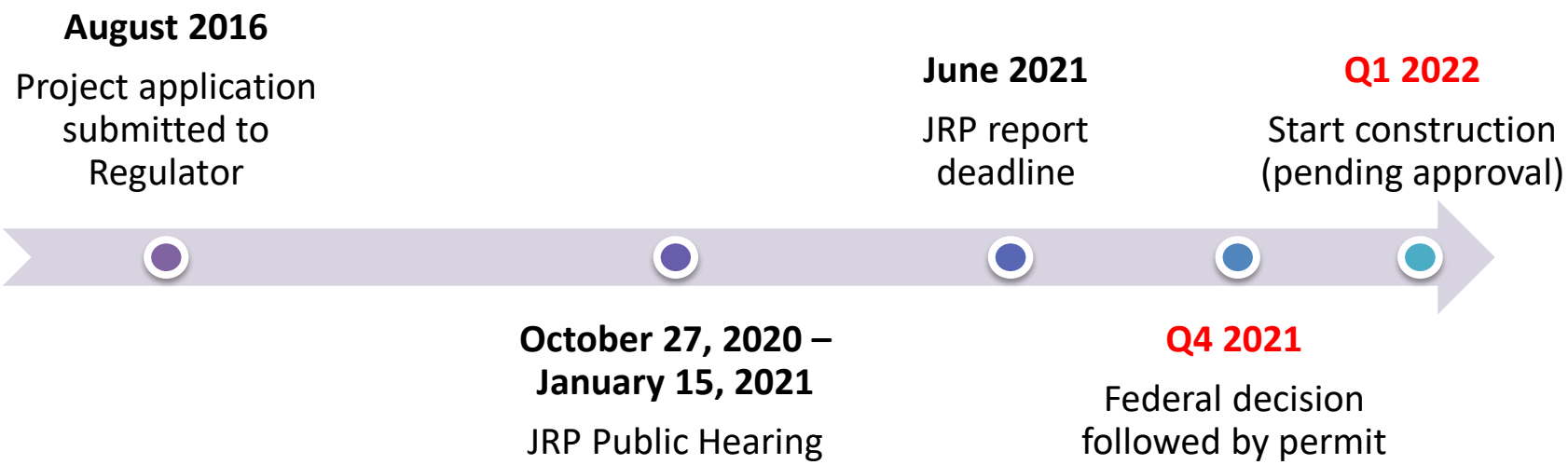
Agenda

- Hearing Summary & Regulatory Timeline
- 1976 Coal Policy
- What's New?
  - Office
  - Employment Numbers
  - COVID-19 Response
- Water Quantity & Water Quality

Hearing Summary

- **Public Hearing**
  - Start – October 27
  - End – December 2
  - Total days: 29
- **Written Final Argument**
  - Benga closing argument – December 15
  - Participant closing arguments – January 8
  - Benga response submission – January 15

Regulatory Timeline

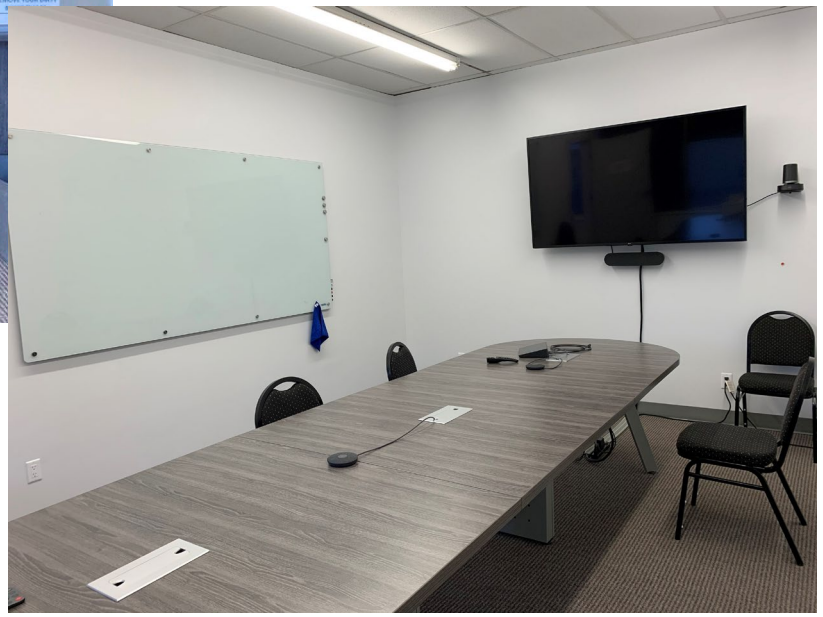


1976 Coal Policy

- Grassy Mountain = **Category 4**
- Was Grassy Mountain impacted by the rescission of the Coal Policy?
  - **NO**
- Is Grassy Mountain impacted by the reinstatement of the Coal Policy?
  - **NO**

What's New?

New
Office Space
in Blairmore



Current Staffing Numbers

Permanent Roles: 32.5		Project Staff: 14
CEO	**Sr Mgr. Maintenance**	**Project Director**
• Head of Marketing	• Maintenance Project Engineer	• Project Engineer
CFO	**Sr Mgr. Human Resources**	**Construction Mgr.**
• Sr Mgr. Commercial	• HR Admin	• Construction Coordinator
• Contracts & Procurement Mgr.	**Interim Mgr. PR**	• General Superintendent
• Contracts Mgr.	• Sr Advisor Indigenous Relations	**Engineering Mgr.**
• Contracts Admin	• Piikani Nation Coordinator	• Project Engineer (X3)
• Controller	• Communications Coordinator	• Civil Engineering Lead
• Sr Accountant	• Community Advisor (0.5)	**Project Controls Mgr.**
• Accountant	**Sr Mgr. SH&E**	• Sr Planner/Scheduler
• Sr Legal Counsel	• Sr Advisor Environment	• Document Control Lead
Executive Vice President	• Enviro Coordinator	• Project Coordinator
• Admin Assistant	• Enviro Technician	
Interim Mgr. Tech Services	• Safety Advisor	
• Mining Engineer (X3)		
• Sr Geologist		
• Geologist II		

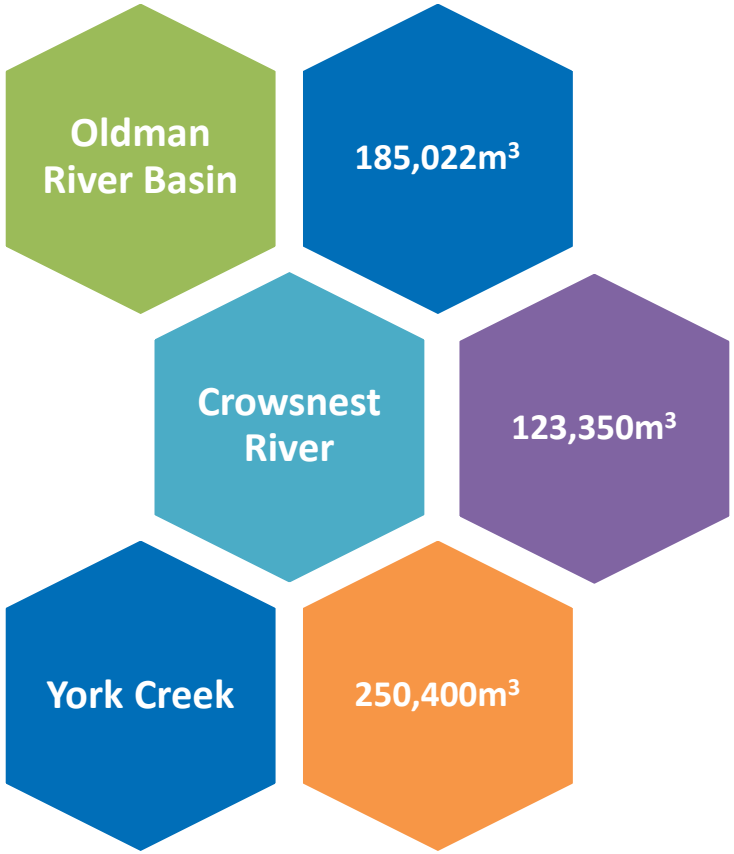
Our COVID-19 Response

- **June 30**
  - Provincial government reduces restrictions as case counts from "first wave" subside
- **August 3**
  - Riversdale SH&E meets with Ministry of Labour (OHS) to review pandemic response
  - Staff move into new Blairmore office
  - ~70% staff return to the office
- **October 22**
  - "Red Dot" initiative (designated seating) and mandatory masks in office
- **November 13**
  - Staff headcount reduced to 50% in Blairmore and Calgary offices
  - Using Noco fogger in all common areas
- **November 23**
  - Public Health State of Emergency
- **December 11**
  - Blairmore and Calgary offices closed
  - All staff working from home
- **April 2021**
  - Some staff back in the office

Water Quantity

Current Water Diversion License Applications:

- Allocation of water available for industrial purposes
  - **Oldman River Basin Water Allocation Order**
  - **185,022m^3** (150 acre-feet)
- Transfer of license from Devon Canada:
  - **Crowsnest River**
  - **123,350m^3** (100 acre-feet)
- Temporary transfer of license held by Municipality of Crowsnest Pass:
  - **York Creek**
  - **250,400m^3** (203 acre-feet)



Total: 558,772m^3

Water Quantity

Water captured from:
- Precipitation
- Snowmelt
- Groundwater

No water will be taken or diverted from creeks or rivers

Water Uses

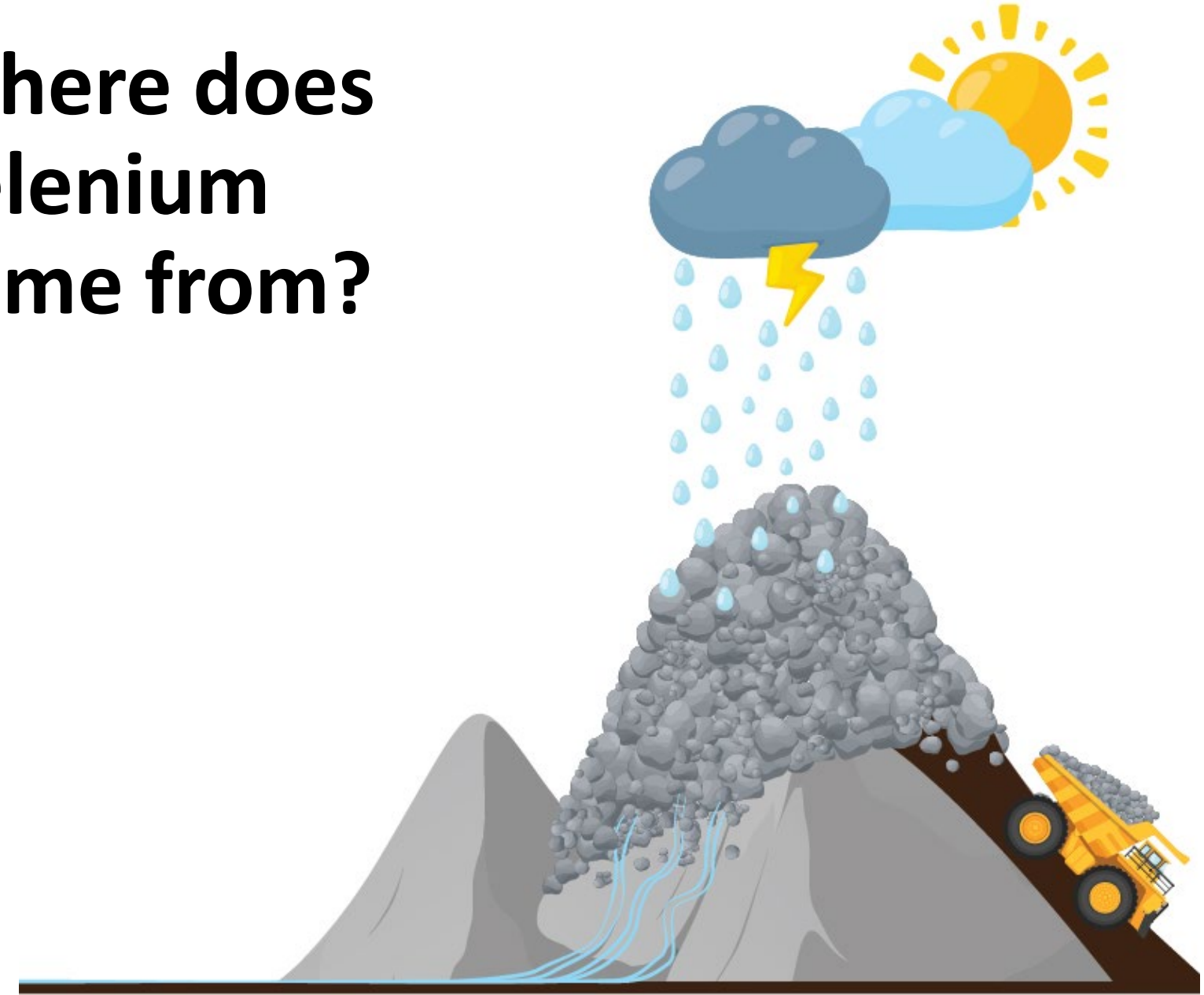
- Coal Processing Plant
- Dust Management
- Evaporation from Ponds
- Washing Equipment
- Potable Supply

Water leaving on coal:
~3.3% of clean coal
= 150,000m^3/year

Maximize water re-use and re-cycle

Water Quality

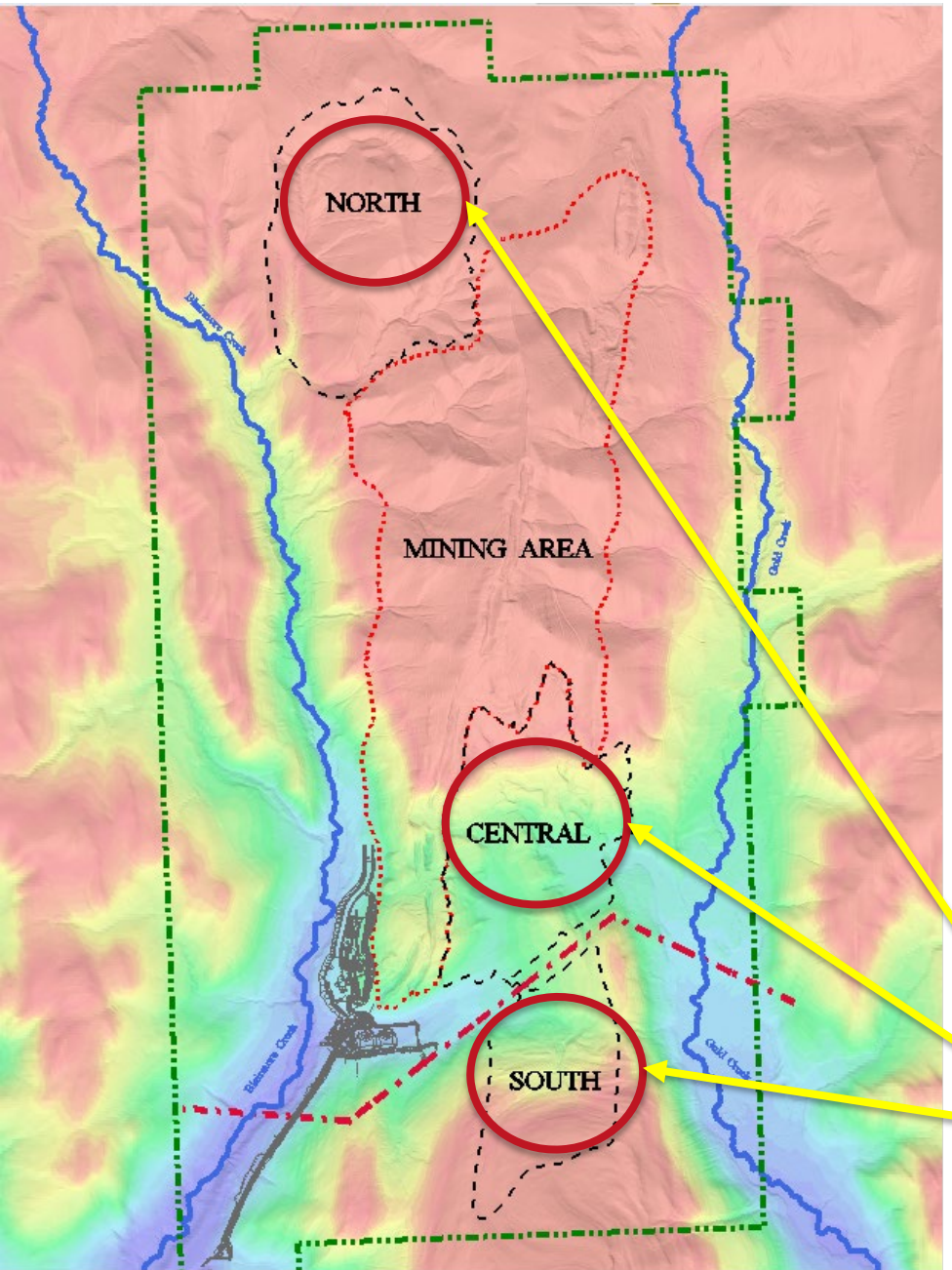
Where does Selenium come from?



Understanding Historical Mining Practices

Historic issues due to lack of knowledge at the time:

- Waste rock placed in valleys close to waterways
- No water capture or treatment
- Mines not designed from the beginning with selenium in mind



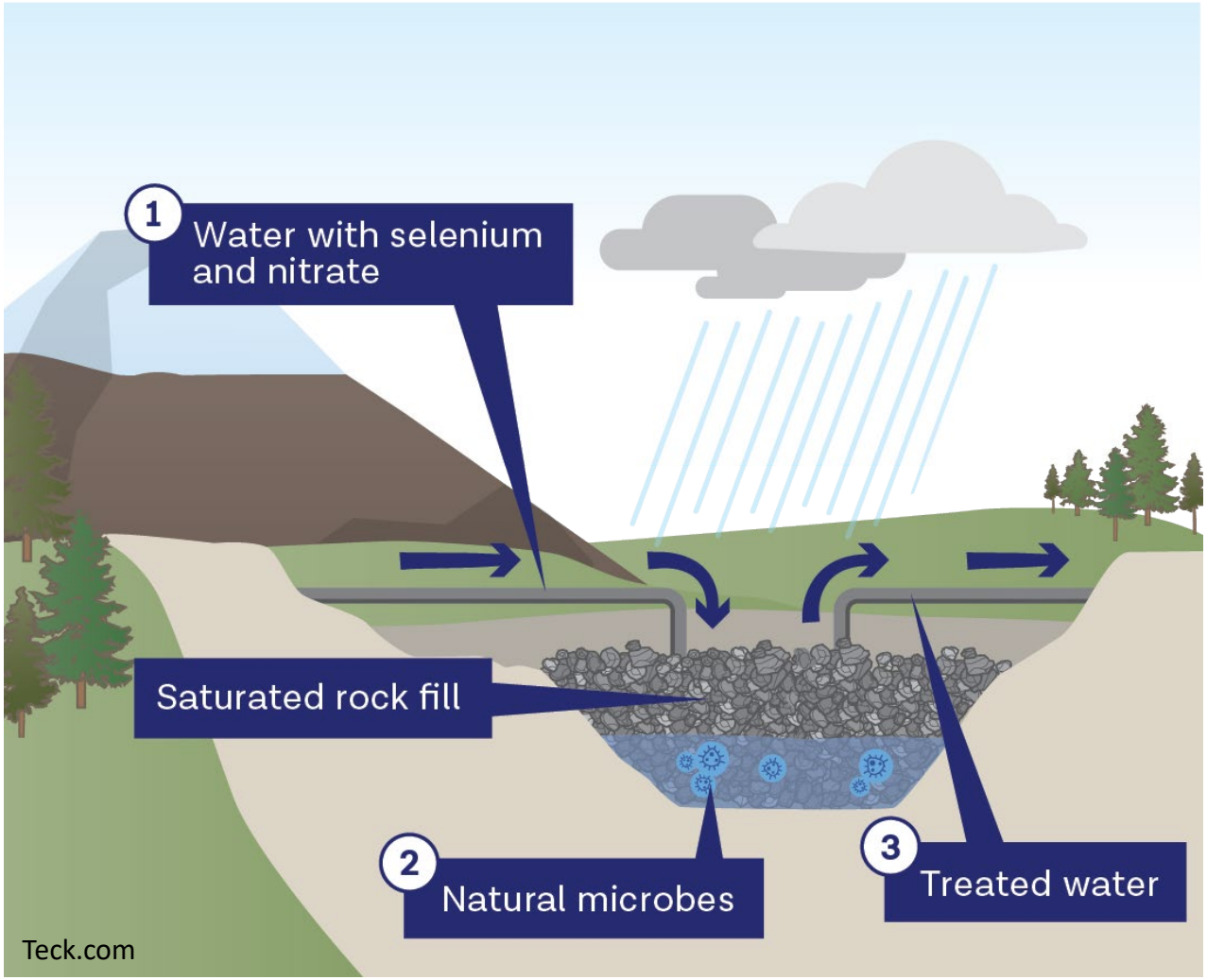
What is Riversdale Doing Differently?

- This project is being specifically designed to safely and effectively manage selenium
- Rock is being placed in high, isolated areas, away from streams
- Contact water is being captured and treated using modern selenium treatment technology
- Water is being monitored and tested on-site and in adjacent water bodies

High ridges, away from creeks

Saturated Backfill Zone (SBZ)

How does it work?



- Teck's Elkview Saturated Rock Fill can treat up to **20 million litres** of water per day
- Grassy Mountain will treat **7.5 million litres** per day

Saturated Backfill Zone (SBZ)

Why choose this method?

Riversdale has chosen saturated backfill technology because SBZ's:

- **are quicker to build and less complex to operate**
- **have lower capital and operating costs**
- **treat larger volumes of water**
- **use less energy**
- **require smaller environmental footprints**

Water Quality Summary

As a modern mine, Grassy Mountain is proposing to manage selenium by:

- Storing ex-pit rock in high isolated areas away from streams
- Storing as much rock as possible in the pit submerged under water
- Using modern selenium treatment technology (Saturated Backfill Zone)
- Conducting baseline monitoring and ongoing monitoring of water on site and in the adjacent water bodies

Rigorous Regulatory Review

- The Grassy Mountain Project has been thoroughly reviewed by several regulatory agencies in an extensive five-year process
- Conditions and ongoing performance of the Project will be overseen by competent federal and provincial regulators
- Indigenous communities will also monitor the Project and provide feedback and recommendations all the way through to final reclamation


Questions?
Thank You
RIVERSDALE
RESOURCES
Benga Mining Limited Operating as Riversdale Resources

MINUTES
MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9
REGULAR COUNCIL MEETING
APRIL 13, 2021

The Regular Meeting of Council of the Municipal District of Pincher Creek No. 9 was held on Tuesday, April 13, 2021, at 1:00 pm, via GoToMeeting.

PRESENT Deputy Reeve Rick Lemire, Councillors Terry Yagos, Quentin Stevick and Bev Everts.

STAFF CAO Troy MacCulloch, Director of Development and Community Services Roland Milligan, Director of Finance Meghan Dobie and Executive Assistant Jessica McClelland.

ABSENT Reeve Brian Hammond

Deputy Reeve Rick Lemire called the meeting to order, the time being 1:00 pm.

A. ADOPTION OF AGENDA

Councillor Quentin Stevick 21/164

Moved that the Council Agenda for April 13, 2021 be amended to include:

- Information:
  - Volunteer Appreciation Virtual Event Information
- Closed Session:
  - Personnel Update – FOIP Section 17

And that the agenda be approved as amended.

Carried

B. DELEGATIONS

a) Expedition Management Consulting Ltd – Regional Recreation Master Plan

Justin Roseau and Drew Ziegler attended the meeting at this time to present to MD Council the draft Regional Recreation Master Plan. Council had the opportunity to review and ask questions of the consultants. The finalized plan will be brought to Council for approval at a later time.

Justin Roseau and Drew Ziegler left the meeting at this time, the time being 1:30pm

b) Beaver Mines Pathway System

Garry Marchuk, with the Beaver Mines Community Association, attended the meeting at this time to update Council on the Community Associations plans to work towards funding for a pathway system in the hamlet of Beaver Mines. At present time the association is looking at casinos and other funding opportunities and requests seed money to be able to put towards a potential pathway system. While Council supports the idea of a pathway system, currently this project is unbudgeted for. Council requests that Mr. Marchuk continue to update Council on funding opportunities and partnership ideas to see the pathway project into fruition.

Garry Marchuk left the meeting at this time, the time being 1:40 pm.

c) TELUS

Matt Mosby and Theresa Lynn with TELUS attended the meeting at this time to update Council on the upcoming projects with TELUS in the MD.
Matt Mosby and Theresa Lynn left the meeting at this time, the time being 2:30 pm.

C. MINUTES

1. Committee Meeting Minutes

Councillor Quentin Stevick 21/165

Moved that the Minutes of the Committee Meeting on March 23, 2021 be approved as presented.

Carried

Minutes
Regular Council Meeting
Municipal District of Pincher Creek No. 9
April 13, 2021

2. Council Meeting Minutes

Councillor Terry Yagos 21/166

Moved that the Minutes of the Council Meeting on March 23, 2021 be approved as presented.

Carried

D. BUSINESS ARISING FROM THE MINUTES

E. UNFINISHED BUSINESS

F. COMMITTEE REPORTS / DIVISIONAL CONCERNS

1. Councillor Quentin Stevick – Division 1
2. Councillor Rick Lemire – Division 2
   a) FCSS
   b) Pincher Creek Foundation
3. Councillor Bev Everts– Division 3
   a) Pincher Creek Library
   b) ASB
4. Reeve Brian Hammond - Division 4
5. Councillor Terry Yagos – Division 5
   a) ASB

Councillor Terry Yagos 21/167

Moved to accept the Committee Reports and information.

Carried

Public Works Superintendent Eric Blanchard attended the meeting at this time to discuss the call logs, and left the meeting at 2:40 pm.

G. ADMINISTRATION REPORTS

1. Operations

a) Operations Call Log

Councillor Quentin Stevick 21/168

Moved that Council receive the call log as information.

Carried

b) Bridge File #224 – Lank Bridge

Councillor Terry Yagos 21/169

Moved that Council approve the use of additional MSI funds in the amount of $60,604 for bridge file #2224 – Lank Bridge.

Carried

2. Finance

a) August 2020 Snake Trail Fire

Councillor Terry Yagos 21/170

Moved that Council extend the 90 day window by an additional 90 days for balances owed from the August 2020 Snake Trail Fire;

- AND THAT Council direct Administration to work with landowners from the August 2020 Snake Trail Fire regarding insurance coverage/windows;
- AND FURTHER that Council invite the Fire Chief to present on the August 2020 Snake Trail Fire to MD Council and rate payers on May 11, 2021.

Carried

b) Pincher Creek Emergency Services Commission (PCESC) Fire Response – Outstanding Invoices Part 2 (Invoices MD-50-20 and MD-50-21)

Councillor Bev Everts 21/171

Moved that in regards to invoices MD-50-20 and MD-50-21, Council approve the following:

- That as per the current agreement, the MD pay invoices MD-50-20 and MD-50-21 to the Pincher Creek Emergency Services Commission,
- AND THAT in an effort to ensure insurance coverage windows are not missed, Administration be directed to bill landowners for fire response as incurred;
- AND THAT Council direct Administration to work with landowners to submit claims to insurance providers;
- AND THAT Council direct Administration to advise landowners, that should they require an adjustment to the amount owed for fire response, to write a letter to MD Council and attach proof of denied insurance coverage;
- AND FURTHER THAT Council, in an effort to bridge the gap until changes are made at PCESC, direct Administration to refresh Bylaw 1201-10 to adjust for the above said changes and other proposed changes deemed necessary.

Carried

c) 2021 Tax Rate Bylaw (Bylaw 1328-21)

Councillor Quentin Stevick 21/172

Moved that Bylaw 1328-21, being the Bylaw to authorize the rates of taxation to be levied against assessable property within the MD of Pincher Creek for the 2021 taxation year, be given first reading.

Carried

Councillor Bev Everts 21/173

Moved that Bylaw 1328-21, being the Bylaw to authorize the rates of taxation to be levied against assessable property within the MD of Pincher Creek for the 2021 taxation year, be given second reading.

Carried

Councillor Terry Yagos 21/174

Moved that Bylaw 1328-21, being the Bylaw to authorize the rates of taxation to be levied against assessable property within the MD of Pincher Creek for the 2021 taxation year, be presented for third reading.

Carried Unanimously

Councillor Bev Everts 21/175

Moved that Bylaw 1328-21, being the Bylaw to authorize the rates of taxation to be levied against assessable property within the MD of Pincher Creek for the 2021 taxation year, be given third and final reading.

Carried

3. Development and Community Services

a) Agricultural Environmental Services Monthly Report

Councillor Terry Yagos 21/176

Moved that the Agricultural Environmental Services Monthly Report for March and April 2021 be received as information.

Carried

b) Road Closure Bylaw 1325-21 – Adjacent to SW 6-8-1 W5M

Deputy Reeve Rick Lemire left the chair and declared a conflict of interest, the time being 3:20 pm. Councillor Bev Everts assumed the chair in his absence.

Councillor Terry Yagos 21/177

Moved that Council give second reading to Road Closure Bylaw 1325-21.

Carried

Councillor Terry Yagos 21/178

Moved that Council give third reading to Road Closure Bylaw 1325-21.

Carried

Deputy Reeve Rick Lemire returned to the meeting and assumed the chair, the time being 3:26 pm.

c) Intermunicipal Development Plan, Bylaw 1327-21 (MD of Pincher Creek and Village of Cowley)

Councillor Terry Yagos 21/179

Moved that Council give First Reading to Bylaw 1327-21, being the Intermunicipal Development Plan for the Municipal District of Pincher Creek No. 9 and the Village of Cowley;

AND FURTHER, that the required Public Hearing be scheduled for April 27, 2021, at 1:00 pm.

Carried

d) Development Permit 2021-17 Hiawatha Campground

Councillor Quentin Stevick 21/180

Moved that Development Permit No. 2021-17, for the placement of a new Manufactured Home to replace an existing manufacture home, be approved, subject to the following Condition(s) and Variance(s):

1. That this development meets the minimum provisions as required in Land Use Bylaw 1289-18.
2. That the home be finished from the floor level to the ground within 90 days of placement. All finish material shall either be factory fabricated or of equivalent quality, so that the design and construction complements the dwelling to the satisfaction of the development authority
3. That the home be placed on a permanent foundation (e.g. grade beam), or a basement which satisfies the requirements of the Alberta Safety Code.

Carried

Minutes
Regular Council Meeting
Municipal District of Pincher Creek No. 9
April 13, 2021

4. Municipal

a) Chief Administrative Officer Report

Councillor Bev Everts 21/181

Moved that Council receive for information, the Chief Administrative Officer's report for the period of March 24, 2021 to April 12, 2021.

Carried

b) Lastuka Road Agreement and Culvert

Councillor Quentin Stevick 21/182

Moved that in regards to the request from Dennis Lastuka,

1. Council receive the letter from Mr. Lastuka
2. Deny the request of the land owner that the culvert on his property become a bridge file for the MD.
3. MD Staff are willing to work with Mr. Lastuka to develop an emergency egress plan
4. Deny item 3 as it would be contrary to our current development agreement
5. Not consider item 4, as we are not the owners of the culvert, nor do we want the responsibility for maintenance or replacement as per our current development agreement.

Carried

c) Amendment to CPO Agreement

Councillor Terry Yagos 21/183

Moved that Council approve amending the CPO agreement with the Town of Pincher Creek to allow the CPO's covered by this agreement to endorse MD Bylaw 1256-14, being the noise Bylaw within the MD of Pincher Creek.

Carried

H. CORRESPONDENCE

1. For Action

a) Letter of Support Request Pincher Creek Family Resource Society

Councillor Bev Everts 21/184

Moved that Council grant a letter of support request for the Pincher Creek Family Resource Society in their application to the Community Initiatives Program Grant.

Carried

b) Letter of Concern – Benga Mining/Riversdale Resources Ltd. – Cornell Van Ryk

Councillor Bev Everts 21/185

Moved that Council send a letter to Cornell Van Ryk thanking him for bringing his concerns forward and engaging the MD regarding Riversdale Resources/Benga Mining project.

Carried

c) Canadian Rural and Remote Housing and Homelessness Symposium

Administration to send the information to the FCSS coordinator.

d) Seniors Week Declaration

Deputy Reeve Rick Lemire declared that following:

In honour of the past, present and future contributions of the seniors of this community and throughout Alberta, I hereby declare June 7 – 13, 2021 to be Seniors' Week in the MD of Pincher Creek.

Administration will arrange for the local seniors facilities to be made aware of this declaration.

e) Letter of Concern – Coal Mining - Gordon and Mary Bayer

Councillor Bev Everts 21/186

Moved that Council send a letter to Gordon and Mary Bayer thanking them for bringing thier concerns forward regarding Riversdale Resources/Benga Mining project,

AND THAT they be provided the contact information for the correct staff at Riversdale Resources/Benga Mining and be encouraged to bring his concerns to them directly.

Carried

f) Alberta Public Works Association Right of Way Committee

Council discussed the Alberta Public Works Association Right of Way Committee and expressed that if any member of Council wanted to attend, they were encouraged to.

2. For Information

Councillor Quentin Stevick 21/187

Moved that the following be received as information:

a) Oldman River Basin Water Allocation Order
   - Letter from Alberta Minister of Environment and Parks
b) Protection for the Rocky Mountains-Eastern Slopes and Watersheds from Water Contamination and Excessive Use
   - Joint letter from MD of Ranchland/MD of Pincher Creek
c) Volunteer Appreciation Virtual Event
   - Information has been placed on MD social media/website. Administration will forward invitation to community groups in the MD.

Carried

I. NEW BUSINESS

a) 2021 Election

Councillor Bev Everts 21/188

Moved that Maureen Webster, be appointed as Returning Officer for the 2021 Municipal Elections, and Jessica McClelland be appointed as Deputy Returning Officer;
AND THAT an advance vote is held for the 2021 municipal election;
AND FURTHER THAT voting for an incapacitated elector at home is provided during advance voting days, during the hours of regular voting.

Carried

Minutes
Regular Council Meeting
Municipal District of Pincher Creek No. 9
April 13, 2021

J. CLOSED SESSION

Councillor Quentin Stevick 21/189

Moved that Council move in to closed session to discuss the following, the time being 4:02 pm:

a) Personnel – FOIP Section 17

Carried

Councillor Terry Yagos 21/190

Moved that Council open the Council meeting to the public, the time being 4:44 pm.

Carried

K. ADJOURNMENT

Councillor Terry Yagos 21/191

Moved that Council adjourn the meeting, the time being 4:45 pm.

Carried

_____
DEPUTY REEVE

_____
CHIEF ADMINISTRATIVE OFFICER

From: garry marchuk
To: Jessica McClelland
Subject: Re: Letter from MD
Date: April 19, 2021 6:01:47 PM

Reeve and Council,
Thank you for the quick response to funding for a pathway system in the Community of Beaver Mines. It seems that our ask was more than the MD was prepared to spend at this time. Instead of asking for more money for this much needed project we would ask the MD for the monies (30 thousand) that was already approved and set aside for these pathways back around 2015. Councillor Yagos will know the dates better as he referred to them at the last meeting.
This money doesn't even have to be physically transferred to the Beaver Mines Community Association. All we need from the MD is a letter of commitment from the MD saying that the 30 thousand will be put towards the pathway system in 2022 when the sewer/water project is completed.
There are Federal and Provincial grants that are available that the Beaver Mines Community Association can apply for (and have a good chance getting) if this seed funding which has already been approved be provided to the community.
Yes , there will always be other grants that come into being.
It would seem to be in the best interests of the MD to provide this seed funding so that the Community could apply for grants to pay for the bulk of funding to put a pathway system into the Hamlet.
The commitment has already been made, the funds approved. All we are really asking is that the MD fulfill their promise and give Beaver Mines a letter of support so that we can proceed with the grant application process. Building a better, safer and healthier community at the same time saving the rate payers of the MD of Pincher Creek a substancial amount of tax payer dollars by applying for these grants.
Once again I thank you for your consideration in this matter and look forward to hearing from you.
Beaver Mines Community association
Garry Marchuk

Sent from my iPad

From: Troy MacCulloch
Sent: April 19, 2021 3:31 PM
To: Garry Marchuk (garrymarchuk@yahoo.ca) <garrymarchuk@yahoo.ca>
Cc: Lynn Calder (calderlm@yahoo.ca) <calderlm@yahoo.ca>
Subject: update

Hi Garry,

Got your phone message. Leave it with me for a day or two. I have a call out to MPE to review the ground disturbances related to our project with an eye to review the proposed routes from the 2015 plan. I have also checked with Meghan again, as I know we have discussed this in the past, but there is no resolution nor money put aside in a reserve at this time. Council talked about it, and that is recorded in the minutes, but there is no current budgetary allocation nor fund established in reserve for this project. So… I want to have my meeting with MPE to see how best to manage this and see where the gaps are after that and then approach the BMCA to see if we can move forward together on a plan.

I would like to see if we can make the proposed plan of 2015, in the orange dotted line, that starts behind your place, goes east to 774 and then south along 774 to castle as far as 8th street in the MR on the north and west side of the hwy. This would be MD built and maintained, similar to a sidewalk and would be part of our hamlet infrastructure.

This way the future proposed walkways can be a joint effort and built with the BMCA as a partner and done as a park improvement…?

This is our plan for now – I want to chat with some folks around here and make sure it makes sense and does not contradict any of our rules or regs before I pitch it to you and your board.

Will be in touch soon,

troy

Troy A. MacCulloch, CMML, FSAScot
Chief Administrative Officer
Municipal District of Pincher Creek No. 9
1037 Herron Drive, PO Box 279
Pincher Creek, AB T0K 1W0
Phone: 403.627.3130
cao@mdpinchercreek.ab.ca

From: Troy MacCulloch
Sent: April 19, 2021 3:35 PM
To: Garry Marchuk
Cc: Lynn Calder
Subject: update to update

I should also mention that between 5th and 8th street we will be staying in the MR, adjacent to 774, and not going behind the houses contrary to the original plan. Just so that is clearly understood from the start.

Look forward to discussing this more once we have more info to go on.

troy

Troy A. MacCulloch, CMML, FSAScot
Chief Administrative Officer
Municipal District of Pincher Creek No. 9
1037 Herron Drive, PO Box 279
Pincher Creek, AB T0K 1W0
Phone: 403.627.3130
cao@mdpinchercreek.ab.ca

BEAVER MINES TRAIL STUDY

M.D. OF PINCHER CREEK NO.9

LEGEND

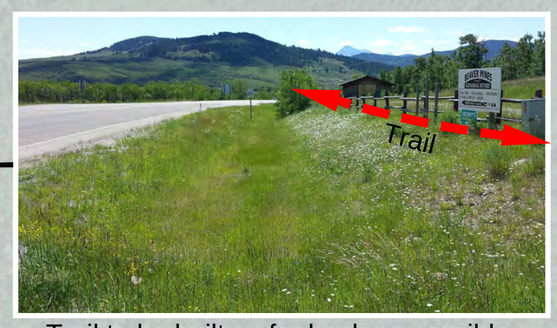
- PROPOSED WALKING TRAIL (1620.01m)
- FUTURE WALKING TRAIL (793.20m)
- STREET CONNECTION
- M.D. OWNED PROPERTY
- PRIVATELY OWNED PROPERTY
- REST AREA
- HAMLET BOUNDARY
- AERIAL PHOTO DATE: 2012

HWY 507

HWY 507

Trail development is dependant on MD's overall plan for this parcel

3 ST



Trail to be built as far back as possible

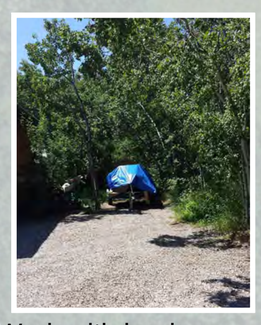
For trail development adjacent to highway, consult AAMDC document "Trails in Alberta Highway Rights-of-Way Policies, Guidelines, and Standards"

Environmentally significant area
This area west of the Hamlet is considered regionally significant as montane valley habitat for ungulates.

Minimal disturbance during trail construction will allow natural vegetation to enhance user experience

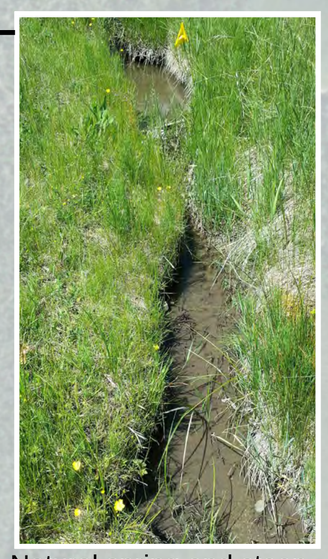
Existing crosswalk provides trail access for lots on east side of highway

4 ST



Work with landowners who may have utilized closed lane as private storage areas

Existing access



Natural spring and steep embankment need culvert and built up trail to even out grade

2 AVE

HWY 774

Existing park with trail network

Beaver Mines monument to be incorporated into trail system as rest area

1 AVE

5 ST

Proposed Rest Area

Proposed crosswalk

Tree and underbrush clearing necessary, survey stakes may be needed.

Trails will be developed perpendicular to the natural slope. Drainage culverts may be needed.

Existing park as rest area

Existing crosswalk

Set of lanes closed 2009

Culvert extension for ditch crossing

7 ST

Proposed crosswalk

Set of lanes closed 1983

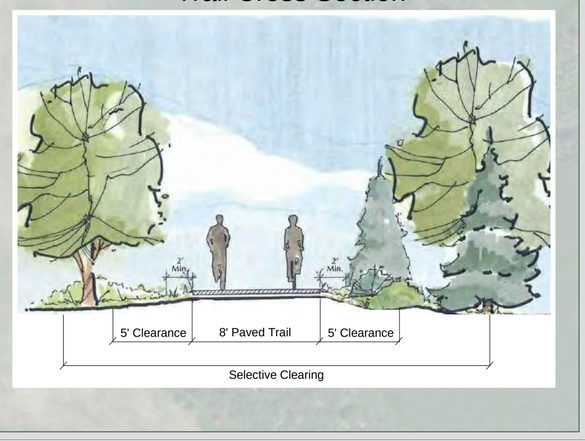
8 ST

Highway 774 may be taken over by the MD from AT. If this happens all decisions on crosswalks and construction near the highway will be at the prerogative of council.

Dog stations needed throughout the trail system

Rest areas need park furniture including bench and garbage/recycling cans

Trail Cross Section



OLDMAN RIVER REGIONAL SERVICES COMMISSION

Meeting Minutes
of the
Agricultural Service Board – Municipal District of Pincher Creek No. 9
March 3, 2021 – MD Council Chambers
Via GoToMeeting

Present: Chair Frank Welsch, Councillor Bev Everts, Councillor Terry Yagos, Vice Chair Martin Puch, and Member David Robbins.

Also Present: CAO Troy MacCulloch, Director of Development and Community Services Roland Milligan, Agricultural Fieldman Shane Poulson, and Executive Assistant Jessica McClelland.

Frank Welsch called the meeting to order at 1:40 pm.

A. ADOPTION OF AGENDA

Councillor Bev Everts 21/010

Moved that agenda be amended to include:

- Business Arrising – Additional Deadstock Bin
- Correspondence Information - Alberta Farm Fresh Producers Association

Carried

B. DELEGATION

C. MINUTES

Councillor Bev Everts 21/011

Moved that the minutes of February 3, 2021 be approved as presented.

Carried

D. BUSINESS ARISING FROM THE MINUTES

1. Delegations Presentation Review from February 3, 2021
    - Kelly Cooley, Weed Survey of Alberta Parks Land in MD

    Administration was directed to look into entering into a Memorandum of Understanding (MOU) to possibly utilize the MD summer staff, or hire contractors for the weed issues within the Alberta Parks Land in the MD.

    - Linkage Ag Solutions, Assessing Alternative Solutions to Managing Biological Materials

Councillor Terry Yagos 21/012

Moved that the ASB accept the report from Linkage Ag Solutions as information.

Carried

2. Draft Letter re: Knapweed in Waterton National Park

Martin Puch 21/013

Moved that the draft letter on knapweed in Waterton Lake National Park be approved and sent.

Carried

3. Draft Policy 605 – Livestock Industry

David Robbins 21/014

Moved that draft revisions to Policy 605 – Livestock Industry, be changed as discussed and forwarded to Council for their final approval.

Carried

4. Additional Deadstock Bin

Councillor Bev Everts 21/015

Moved that administration look into the prospect of facilitating a virtual meeting with residents on an information session for the deadstock program with Waterton Biospere;

AND THAT an agenda item be the possibility of an addition bin for Division #4;

AND THAT the information on a meeting be brought back to the ASB meeting on April 7, 2021.

Carried

E. UNFINISHED BUSINESS

F. 2021 AES DEPARTMENT REPORT

David Robbins 21/016

Moved to accept the departmental report from the Agricultural Fieldman for February and March 2021.

Carried

G. CORRESPONDENCE

1. FOR ACTION

a. Dutch Elm Disease Prevention/Control Measures and Responsibilities and Authority under the APA

Councillor Bev Everts 21/017

Moved that the Agricultural Fieldman coordinate an inventory within the MD and the Town of Pincher Creek for Dutch Elm disease prevention control measures,

AND THAT the Agricultural Fieldman ensure the Crowsnest Pass Ag Fieldman is also aware of the program.

Carried

b. Alberta Farm Safety Center – Request for Funding

Councillor Bev Everts 21/018

Moved that the Alberta Farm Safety Center be approved for funding in the amount of $1000 for 2021.

Carried

2. For Information

Councillor Terry Yagos 21/019

Moved that the following be received as information:

a. Quinoa Growers Wanted Poster
b. Foothills Forage and Grazing Association – AGM Invitation

Carried

Martin Puch 21/020

Moved that the following be received as information:

c. 2020 Crop Survey Results
    1) Cereal survey-2020 final draft
    2) Blackleg survey 2020 final draft
    3) Clubroot Survey 2020 final draft
    4) Lentil survey 2020 final draft
    5) Onion-Garlic 2020 final draft
    6) Pea survey 2020 final draft

David Robbins 21/021

Moved that the following be received as information:

d. 2020 ASB Resolutions
- https://agriculturalserviceboards.com/2021-resolutions/

e. Moisture Situation Update as of February 2, 2021
1) Map 1 90 Day Temperature Departure as of January 2021
2) Map 2 Snow Packs Relative to Long Term Normal
3) Map 3 180 Day Precipitation Accumulations Relative to Normal

Councillor Bev Everts 21/022

Moved that the following be received as information:

f. Alberta Farm Fresh Board Nominations

Carried

H. NEW BUSINESS

J. NEXT MEETING

April 7, 2021

K. ADJOURNMENT

Councillor Terry Yagos 21/023

Moved to adjourn the meeting, the time being 3:05 pm.

Carried

_____ _____

ASB Chairperson ASB Secretary

Pincher Creek and District

FCSS Family and Community Support Services

Box 2841, Pincher Creek, Alberta, T0K 1W0 Telephone 403-627-3156 - fcss@pinchercreek.ca

FCSS Board Meeting, March 29, 2021 – Virtual 6:30 PM
Minutes – Signature Copy

1.) Call to order: Kathy Verhagen called the meeting to order at 6:35 PM

Board Members Present: Kathy Verhagen, Bev Everts, Don Anderberg, Alice Wagenaar, Roxanne Debroux

Absent with Regret: Stephanie Smith, Mary Kittlaus

Staff present : David Green

Confirmation of Quorum: A quorum was present

2.) Approval of Agenda

Motion 12 / 262 / Wagenaar
That the agenda be approved as amended: Items 4g and 4h are added
Carried

3.) Approval of Minutes of February 16, 2021
Motion 12 / 263 / Anderberg
That the Minutes of February 16, 2021 be approved as amended (change of date for next Board Meeting).
Carried

4.) <u>New and on-going Business</u>

a.) Food Bank – update, reporting obligations: Alice reported that the Food Centre is operating very well. The Policies and Procedures Manual is being drafted. Client numbers have been stable and the food supply is good.
David read a March 4 letter from the FCSS Association of Alberta confirming the following: "Our understanding is that you may use the funds to purchase supplies you may need but the funds can't be used to pay future wages".

On that basis, the remaining COVID Grant funds will be forwarded to the Food Centre to enable the purchase of supplies going forward.

Motion 12 / 264 / Everts
That the Food Centre report be received as information.
Carried

b.) Emergency FCSS COVID grants – David will verify that the Lion's Club will submit the required reporting to FCSS for the "milk and eggs" coupon grant.

c.) Website development – Mountain Drift has completed the "core layout" for the FCSS website and will populate the site with data starting this week. The site will not go "live" until the Board has had the opportunity to review content. David will send information to the Board as it becomes available.

d.) Audit / Annual Report - The Government of Alberta FCSS Annual Reporting Template is finally available for use. Prior to the template being available, David completed a draft for the Auditors and will transfer the data into the template this week. Deadline for submission of the report is June 30.

e.) Community Information Night Report - The Board discussed the Community Information Night. By most accounts, the event was a success. A large amount of timely and accurate community information was shared by Council and Administration. There will be a debrief in the next few days to discuss process and outcomes.

NOTE: CHANGE OF AGENDA ORDER

4 g) SASCI timeline for Fund Development position: The Board has requested information regarding the timeline for the hiring for the Fund Development Coordinator. (SASCI received a 2021 grant of $8,000.00 from FCSS to assist with this project.)

Don reminded the Board that both Councils are involved in the discussion about this position. It was agreed that James Van Leeuwen, SASCI President, would be invited to attend the April 19 Board Meeting.

h) Social Needs Assessment and Community Health Needs Assessment: The Board discussed public response to these assessments. David indicated that copies of each have been picked up from the Town reception desk (9 SNA and 12 CHNA) and that both studies are available on the Town and MD websites.

Don reminded the Board that the studies will play a role in the Community Economic Development Strategy. Don also reminded the Board that the geographic boundaries were different for each assessment and so the data has to be interpreted with that in mind.

Bev indicated that the information contained in both assessments will be valuable for Councils in the next Council term (establishing priorities).

David will distribute the Power Point summaries from each report to the Interagency Group.

4 f) Year-end reporting (projects)

Allied Arts Council: The Board reviewed the report and expressed appreciation for the creative approach to programming given the COVID restrictions present through 2020. It was noted that the Arts Council engages the services of professional art teachers and an Art Therapist to assist with program design and operation. The AAC grant for 2020 was $10,519.00. David will ask for clarification on the Budget Sheet and the profit and loss statement.

Early Childhood Coalition: The Board reviewed the report and recognized the value of the ECC organization as it operated to the end of June of 2020. At that time, COVID impacts combined with discontinuation of Provincial funding to close the program. The program director was able to blend remaining program functions with those of the Family Centre. The $3,865.32 surplus has been used to assist the Family Centre with webinar and Town Hall Play Space development.

Family Centre: The Board appreciated the detail presented in the report. Programming continues to be innovative and well-received by families in our community. (Ten separate programs were described.) The Family Centre operates with strong partnerships in the community. The Board requested clarification on Account 5075 Accounting / Audit Fees - $7,252.81.

Historical Society Education Program: The “2020 Highlights” portion of the report described the dramatic negative impact of COVID. The society moved quickly to mitigate that impact through the purchase of audio and video recording equipment and an on-line hosting space. Virtual programming was established using several platforms. Some on-site programming continued when some restrictions were lifted through June and July. The museum programs are very much appreciated by many schools throughout the region. The $1,978.82 surplus is of little concern.

Healthy Families Home Visitation (Napi Friendship Association): This program was severely impacted by the COVID pandemic The program manager and the Napi Board agreed to “deliver essential services with minimal direct contact with the general public”.The HFHV office was relocated to the Coordinator’s home. Because of the nature of the HFHV service, the coordinator became a member of the Pincher Creek Regional Emergency Management Organization COVID team. Other partnerships were maintained. Throughout the year, program clients increased in number. The Napi financial statements are pending.

St Michael’s School Roots of Empathy request: COVID made it impossible to conduct a full term of the Roots of Empathy program (the program operated from January to mid-March) This resulted in a budget surplus. The organization is requesting that the

funds be used to purchase Sensory Equipment for use in the school. Sensory equipment is used to combat stress and anxiety and provides an opportunity for students to learn self-calming strategies through the use of soothing light, sound and other sensory equipment. The preferred quote received for the equipment totaled $3,566.43.

Motion
12 / 265 / Anderberg
That the Board approve the use of the surplus Roots of Empathy funds for the purchase of the Sensory Equipment as per the quotation provided.
Carried

The Board agreed to complete the review of year-end reports at the April 19 meeting.

5.) Date for Next Board Meeting – April 19, 2021 – 6:30 PM

7.) Adjournment: There being no further business, Alice declared the meeting adjourned at 8:30 PM.

Read and approved this 19th day of April, 2021

Approved April 19, 2021
Motion 12/267

Coordinator **Director**

M.D. OF PINCHER CREEK NO. 9

OPERATIONS REPORT

Current Public Works Activity

- Road Maintenance – Roads are being graded in all Divisions.
  - Public Works has six (6) graders out on the roads doing maintenance.
- Snow fence crew removing Temporary snow fence in all divisions for the next couple weeks.
- Public Works are currently organizing, and cleaning up the site yard.
- Temporary repair being completed on Station Street in Pincher Station.
- Drainage improvements in Division No.2, near Fishburn Hall Completed.
- Washout road re-built project on RR29-2 95% completed.
  - Road need gravelling. (Has been on Call Log Since 2019)
- First Aid Training for most PW employees April 23 and April 26-27 2021.
- Compressed work week to begin May 03, 2021.
- New full Time OP2's and Seasonal to start May 03, 2021.
- Gravel program to start May 17, 2021 and run for 8 weeks.
- Spring Clean up Schedule for May 24 in Beaver Mines & May 25-26 in Lundbreck.
- Planning in progress for work on Gladstone Road, Old Airport Road and Willow Valley for the heavy maintenance crew. Expected start May 17, 2021 depending on training and weather.
- Permanent snow fence to be installed on Sorge Road by the end of May.
- Few culverts on the list to be repaired or replaced when equipment is available.
- Dust control contract awarded to Kortech. Expected start date June 14, 2021.
- Culvert Washout replacement on Carbondale Road on April 26-27, 2021
- Bridge Deck and Guard rail cleaning to start end of May.
- Working on call log items daily.

Capital Projects Update - Bridges

- **Bridge File 75009 – Wild Cat Ranch**
  - Tender awarded
  - Land negotiations are almost complete
  - Construction set for July – Sept 15

    Once date is determined with contractor – media and resident notifications will go out

- **Bridge File 75377 – Local Road over Screwdriver Creek**
  - Tender awarded
  - Construction set for Aug 15 – Sept 01 (fish window)

    Once date is determined with contractor – media and resident notifications will go out

- **Bridge File 74119 – Pony Truss Bridge**
  - Tender awarded
  - Construction set for completion by Sept 15

    Once date is determined with contractor – media and resident notifications will go out

- **Bridge File 2224 – Lank Bridge**
  - Tender awarded – additional funds req'd approved by Council on Apr 13, 21
  - Construction set for completion by Sept 15
    Once date is determined with contractor – media and resident notifications will go out

- **Bridge File 75265 – Local Road over Heath Creek**
  - Tender awarded for engineering in 2021
  - Have requested updated proposed construction costs to be ready for September for 2022 budget discussions
  - Construction set to commence in 2022

- **Bridge File 7743 – Local Road over Gladstone Creek**
  - Tender awarded for engineering in 2021
  - Have requested updated proposed construction costs to be ready for September for 2022 budget discussions
  - Construction set to commence in 2022

- **Bridge File 2488 – Fisher Bridge**
  - Have received two proposals for engineering - still to be reviewed
  - Engineering to be completed in 2021 due to change in rating since first inspected
  - Construction/replacement/removal options to be presented to Council for action in 2022

Roads

- **Lundbreck – 1st, 2nd, & 3rd Street – Construction Summer 2021**
  – April 20th 2021, Design was reviewed and Eric approved re-design with curbs and gutter to reduce cost to had the extra section of 1st street where we had drainage concern.
  - Tender to be out on May 03, 2021
  Once date is determined with contractor – media and resident notifications will go out

- **Bruder Hill - Construction Summer 2021**
  - Eric approved scope change #2 To include topographic and post construction legal survey.
  - Topographic survey was completed April 7 2021 and geotechnical drilling was completed April 14 2021. Wood to provided detailed design by April 30th 2021
  Once date is determined with contractor – media and resident notifications will go out

- **Gladstone Road – Construction Summer 2021**
  – The proposed road construction on the road is to happen in the Summer of 2021. Drainage improvement on east ditch. Road surface to be ripped, material will be windrow to the side, Rock picker to remove rock from windrow, lay material back, compact with grid and smooth drum, Re-gravel and apply MG 30 as a stabilizer.
  Once dates are determined – media and resident notifications will go out

- **Cabin Hill Road - Engineering only for 2021**
  Wood Engineering to design the Local Road - Design option have been reviewed. I approved SC#2 to include post construction legal survey. Topographic survey was completed April 8-9 and Geotechnical drilling was completed April 15-16

- **Hucik Hill Road – Construction Summer of 2021 (May 15 – June 30)**
  The work is located at Range Road 1-4 and would be to excavate, add a French drain, ditch grading and stabilize the slope on the east side of the road. The work would be done by internal forces or contractor depending on equipment availability.
  Once date is determined – media and resident notifications will go out

- **Landfill Road – RR 1-5.**
  The proposed work is being reconsidered and a revised plan will come back to Council for consideration

Transfer Station

- The MD and the Town have been working on possible locations
  Due to the 300m setback requirements established in the Subdivision and Development Regulation, site selection proving to be a difficult task.
- Prepare a Development Permit to present to the Town on a chosen site.
- Develop a Plan B that will include the redesign of the current site to accommodate both the Waste Transfer and Standpipe.

Large Capital and other Water Projects

- **Lundbreck Lagoon Aerated System**
  - Tender awarded
  - Aerators have arrived
  - AEP approval is pending but expected shortly and Fortis has their permits for power
  - The proposed construction of a new aeration system is set for May 3, 2021.
  - AMWWP funding is eligible but not if we start work before we receive the grant

- **Beaver Mines Water Distribution, Collection and Wastewater Treatment System.**
  - The drawings and the tender package for the Water Distribution, Collection System and Wastewater Treatment System by our Consultants are now complete.
  - Proposed project of start construction is in late June of 2021 with a proposed completion in 2022.
  - The MD has requested a budget update from our consultants regarding possible adjustments due to rising material costs. Will be ready for 1st meeting in May.

- **Beaver Mines Forcemain & Lift Station**
  - The drawings and the tender package by our Consultant are ready
  - Proposed project of start of construction is late June with completion expected in early 2022.

Once draft approval is granted

We have planned one final meeting of both engineering firms to review tenders, dates, common lay down areas and points of intersection. This info will then be shared with the CAG and shortly thereafter, Tenders will be released for bidding.

We are also planning another open house to walk everyone interested, through the process of where we began and where we sit today and what the proposed next steps are for this project. This will probably be at Coal Fields School again or virtual.

- **Lead Management Plan - Lundbreck**
  - Randy is working with AEP to set up sample collection, resident and media engagement
  - Lead Mgmt plans are now a requirement of AEP for drinking water.

- **Dam Study**
  - RFP for Dam Safety Review Closed at 1400, April 20, 2021
  - The MD received seven (7) proposals prior to the deadline. We will be putting a three member Project Evaluation Board together to review the proposals.

- **Standpipes (Cowley and PC)**
  - I have asked Mike K to put this back out for pricing as what was previously presented will not work with what was intended. We need cash and card, not everyone needing to set up an account with our Admin. Once we have pricing this will come back for Council to determine if we proceed or leave it for next years capital budget.

Recommendation:

That the Operations report, which includes the call log and the gravel program plan for 2021, for the period April 13, 2020 to April 27, 2020 is received as information.

Prepared by: Eric/Roland/Troy  Date: April 21, 2021

Submitted to: Council Date: April 27, 2021

MUNICIPAL DISTRICT OF PINCHER CREEK No. 9

2021 Gravel Program
INTERNAL USE ONLY

N

NOTE: the MD boundary continues through to the BC - Alberta border.

LEGEND

- TOWNSHIP LINES
- DIVISION BOUNDARIES
- PRIVATE LAND
- TOWNS & VILLAGES
- HAMLETS
- ABORIGINAL LAND
- CROWN LAND
- WATER
- CAMPGROUNDS & RECREATION AREAS
- COMMUNITY HALLS
- FORMER SCHOOL SITES
- CHURCHES
- HABITATION LOCATION
- PRIVATE CAMPGROUND

Access

- Primary Highways
- Secondary Highways
- MD Arterial Roads
- MD Collector Roads
- MD Local Roads
- Province Local Roads
- MD Streets
- MD Unimproved Roads
- Private Roads
- Private Campground Roads
- Provincial Campground Roads
- Province Streets
- Castle Mt. Streets
- Resource Roads

2021 Road Graveling

Arterial roads: 121.083 km
- Volume at 100 m3/km = 12,108.30 m3
- Volume at 150 m3/km = 18,162.45 m3

Collector roads: 129.337 km
- Volume at 100 m3/km = 112,933.70 m3
- Volume at 150 m3/km = 19,400.55 m3

Local roads: 150.251 km
- Volume at 100 m3/km = 15,025.10 m3
- Volume at 150 m3/km = 22,537.65 m3

Unimproved roads: 6.454 km
- Volume at 100 m3/km = 645.40 m3
- Volume at 150 m3/km = 981.10 m3

Total length of roads to be graveled: 407.08 km

Total volume at 100 m3/km = 40,708.00 m3
Total volume at 150 m3/km = 61,062.00 m3

Scale: 1 : 65,000
When printed on 42x60 inch paper

Kilometers
0 2.5 5 10

Information depicted is subject to change, therefore the MD Of Pincher Creek assumes no responsibility for descrepancies at time of use.

Produced by the MD Of Pincher Creek 2021-04-21
ProjectFile: C:\GIS\WorkSpace\PUW\DivisionMaps_Graveling\ProjectFiles\2021GravelProgram.mxd

	DIVISION	LOCATION	APPROACH NUMBER	CONCERN/REQUEST	ASSIGNED TO	ACTION TAKEN	REQUEST DATE	FOLLOW UPDATE	COMPLETION DATE
1995	Division 2	NW23 T5 R29 W4	#5313	Wetland/shoulder of road & drainage problem	Eric Blanchard	Completed	July 16, 2019	Work in progress	April 15, 021
2502	Division 2	SE07 T5 R28 W4	-	Feels the south side of bridge needs rip wrap put in before flooding season so creek doesn't turn direction	Eric /Bob M	-	October 30, 2020	Need to install 30 CM of Rip Rap on the West side of the South Abutment. Will be completed outside the RAP (Aug 16-31)	Aug 16-31 2021
2505	Pincher Stn	Seed Plant	-	Culvert at the plant needs fixing	Eric	to be assess	November 2, 2020	Will be done weather permitting	Spring 2021
2507	Division 5	NW12 T7 R3 W5	#3029	TWP7-2 to Burmis Lake Pot Holes need to be filled	Brad	Too cold & Wet	Fall 2020	Followed up with him on Feb 24, 2021	Spring 2021
2590	Division 3	SW35 T5 R2 W5	#3504 RR2-2	Apparently operator left a big mess along fence line	Brad	To be completed	January 13, 2021	Tony T is aware of it, it will be addressed when conditions permit	
2625	Division 3	SW31 T5 R1 W5	#5520 HWY 775	RQ Driveway to be graded	Tony T/Jonathan	-	March 12, 2021	Too wet still snow Operator unable to do it at this time, will be completed when condition are favorable	
2626	Division 1	NE26 T4 R30 W4	#3015 TWP4-5	No maintenance on snow fence for years as Bison in field Bison are no longer there,RQ maintenance RR30-1	Tony N	To Be completed	March 15, 2021	Will be schedule to be repair in April	April
2627	Division 3	SE25 T5 R1 W5	RR1-0	Wanting gravel & grading on TWP1-0 & RR5-4	Shawn	-	March 16, 2021	Assessed and grader not able to get in as too muddy	
2636	Division 3	-	Gladstone road	RQ Road to be graded end of Gladstone	Eric	Completed	April 6, 2021	Will work on it April 12-16, Still had lots of frost	April 14, 021
2640	Division 4	WC Ranches	by Glider Strip	To put in another approach & possible culvert	Jonathan	-	March 31, 2021	Being assessed and work to be done	
2641	Division 5	-	End of hard surface	Reporting a big pothole off Hwy 3 - N. Burmis - 3Klms	Eric	-	April 1, 2021	To be done weather and conditions permitting	
2642	Lundbreck	401 Robinson Ave	East lane	Trailer is being moved out alley is in poor shape grader & Gravel requested	Jonathan	Completed	April 12, 2021	Unable to do as alley is too low	April 14, 2021
2643	Division 3	Gladstone Road	-	Big Potholes on Gladstone very dangerous	Jonathan	Completed	April 13, 2021	Work completed and Kudos to our crew	April 14. 2021
2644	Division 5	SE11 T8 R3 W5	#3103 TWP8-1A	RQ road to be graded (driveway bus turn around)	Jonathan	-	April 14, 2021	To be assessed	
2645	Division 2	-	-	RQ to remove snow fence S. of Nickles feed lot In future does not want snow fence in his property	Eric	Completed	April 14, 2021	Snow fence has bee ask to remove S. Fence	April 15, 021
2646	Division 3	NW3 T6 R2 W5	-	Ask to have snow Fence removed by next week	Tony N	Completed	April 15, 2021	Snow fence crew advised	April 21, 2021
2647	Division 3	-	-	Asking about Lynx Creek Road closure		Completed	April 15, 021	Advised	April 15, 021
2648	Division 5	-	-	Asking about Fishers Bridge	Eric	Completed	April 15, 2021	Explained we are still assessing repair need and cost	April 15, 021
2649	Division 1	SE28 T4 R28 W4	-	Ask to have snow fence out by early next week	Tony N	Completed	April 16, 2021	Snow fence crew advised	April 19, 2021
2650	Division 1	SW13 T3 R30 W4	across from Jason Jacks	Re snow fence concerned about holes from posts not being filed in	Tony N.	-	April 16, 2021	To be complete	
2651	Division 1	West Kerr	-	Culvert on West Kerr Road - hole is getting dangerous	Eric	-	April 19, 2021	temporary fixed, Culverts to be replace in June	

	DIVISION	LOCATION	APPROACH NUMBER	CONCERN/REQUEST	ASSIGNED TO	ACTION TAKEN	REQUEST DATE	FOLLOW UPDATE	COMPLETION DATE
				Indicates Completed					
				Indicates Defered to Spring					
				indicates On the To Do List					

Recommendation to Council

TITLE: POLICY C-PW-009 DUST CONTROL	
PREPARED BY: Eric Blanchard	**DATE: April 20, 2021**
DEPARTMENT: Public Works	
Department Supervisor / **Date**	**ATTACHMENTS:** • Policy C-PW-009 Dust Control • Schedule A (original) • Schedule A (revised)

APPROVALS:

Department Director	Date	CAO	Date
			Apr. 21, 2021

RECOMMENDATION:

That Council approve Policy C-PW-009, and schedule A- Dust Control as presented.

BACKGROUND:

Annually, Council reviews and updates Policy C-PW-009 Dust Control and Schedule A to provide direction to Public Works for this year.

In 2021, the dust control program will be completed using two different products, Calcium Chloride and MG30. Installation and supply to be completed by the product supplier with the assistance of our divisional grader operator. The intent is to complete the program sooner with more efficiency to allow residents additional benefit from the dust control and allow Public Works additional time to complete other projects.

Council annually requests that Public Works apply Dust Control to roads that are considered by Council to be required without need for the resident to pay. These locations are approved by Council annually and are for a number of reasons including; roads that access parks or locations where a high amount of traffic regularly travels, locations where inclines or traffic patterns generate wash board, where the application of dust control product lessens the wash board, and/or for other reasons.

FINANCIAL IMPLICATIONS:

Previously approved budgeted amount for 2021 is $350,000.

TITLE: DUST CONTROL

Approved by Council	Date: February 22, 2011
Revised by Council	Date: June 26, 2018
Revised by Council	Date: May 14, 2019
Revised by Council	Date: May 26, 2020
Revised by Council	Date: *November 24, 2020*

PURPOSE OF POLICY

To clarify and prioritize within budget limitations the areas in which dust control suppressants may be applied on MD controlled roadways in ongoing efforts to ensure public safety, quality of life, and to realize road maintenance cost reductions.

POLICY STATEMENT

1. The MD dust control program is regulated by the dust control policy. Additional application of dust control products are available to residents on a user pay basis.
    a. No warranty is provided for dust control. The person requesting the service shall be charged a fee, as per C-FIN-529, Fees and Charges, each time the dust control product is applied on the road.

2. Dust control is meant to control dust on the roadways, not to eliminate it completely. When dust control products are applied, the substance will adhere to the gravel surface. These products retain moisture (from rain, humidity), which weighs down the dust particles, making them less likely to become airborne after a vehicle has passed over the area.

DEFINITIONS

3. For the purpose of this policy, the following definitions shall apply:
    a. "MD" shall mean and refer to the Municipal District of Pincher Creek No. 9.

CONDITIONS FOR SERVICE

4. The MD will not apply dust suppression product to private property and will only apply dust suppression product for corporate entities with Council approval.
5. Companies having a road use agreement will be required to control dust with water as and when required. The Public Works Superintendent will monitor their activities and dust levels.

6. Dust suppression on roads using water only is at the discretion of the Public Works Superintendent.
7. *The primary dust control suppressants of the MD will be Lignosulfonate, MG 30 (magnesium), and Calcium Chloride. All dust abatements will meet the approved requirements of the Alberta Transportations highway maintenance specifications.*
    a. Testing of new products will be conducted annually to determine if they provide a more durable surface, or are more cost effective.
8. Public Works will apply dust control to the roads in Schedule "A" to Policy C-PW-009 as approved by Council annually prior to doing the MD's arterial roads.
    a. Private requests and other areas to ensure the roads with the most traffic are done prior to lower use roads.
9. Residents who are looking to have their dust suppression done prior to the MD completing the roads identified in Schedule "A" can contract approved service providers to apply one of the approved products.
    a. *Prior to any work being done on MD roads, approved service providers will be required to complete a hold harmless agreement.*
10. Prior to residential dust control being applied, the resident must fill out and sign an agreement to purchase materials or services form.

    a. To allow for product ordering and timelines, agreements shall be completed prior to the application deadline of May 1 each year. No service is guaranteed for requests received after this date.

11. In order to complete this work in a timely manner, Public Works may utilize alternate service providers, *when required and as per discretion of the Public Works Superintendent. Approved service providers are listed in Appendix B*

Brian Hammond
Reeve

Troy A. MacCulloch
Chief Administrative Officer

Please use this Schedule For Council	Project #	Road Name	Location	KMs
2	**502**	Burmis Lake Road	12-7-3-w5	?
3	**530**	Burmis Mountain Hill	7-7-2 W5	0.50
7	**307**	Castle River Rodeo Grounds	27 - 6 - 2 W5	1.40
8	**508**	Catonio Road Hill	24-7-2 W5	0.30
9	**309**	Christy Mines Road	5513 RR1 South to the Bridge at Pincher Creek	2.50
10	**210**	Crook Road on hill	East from Hwy 6	0.50
11	**411**	Gerald Lewis	NW 32-7-29 W4M	0.10
12	**312**	Gladstone Road	Gladstone Road North End Ne 1 6 2 W5 Was .4 km	Not Approved 2019
13	**513**	Glen Road	Entire Road	2.10
14	**214**	Hochstein Hill	26-5-29 W4M	1.00
15	**315**	South Landfill Road	SW 5-7-1 W5M - Intersection	0.50
15	**315A**	South Landfill Road	SW 3-7-1 W5M - Residents	0.50
15	**315B**	South Landfill Road	SW 8 7 1 W5 Gun Club	0.50
16	**416**	Sandeman (Subdivision Traffic)	SW 6-8-3 W4M north of Hwy 510	1.50
18	**118**	Kerr Road Hass	West of Hwy 6 NE 10 5 30 W4	0.20
19	**119**	Kerr Road	East of Hwy 6 Ends at Buck Jack / Sgt Wilde NE 11 5 29 W4	0.50
20	**520**	Lundbreck Falls Road	A Frame up the road Anderson Hill) 21-7-2 W5M	1.10
22	**522**	North Burmis Road	NE 25 & 36 7 3 W5 Was 2.7 km	Not Approved 2019
24	**324**	Old Cook Place	5-7-1 W5M	0.30
25	**325**	Old Cook Place (going north on road past Crayford's)	6-7-1 W5M	0.10
26	**326**	Pincher Colony jug handle	27-6-30 W4M	0.50
27	**427**	Summerview feedlot Top of hill & North	11-7-29 W4M DELETED	0.00
28	**528**	Talon Peak	13-7-3 W5M	0.20
54			7-2B Off off Rg RD 3-0	0.75
29	**429**	Upper Tennessee	36-7-30 W4M	0.40
30	**130**	Waterton Colony Hill	3-4-28 W4	1.00
31	**531**	Willow Valley - Hwy 22	11-9-2 W5M	0.20
32	**132**	Twp Rd East of Hwy 6 (Brody)	nw 31 4 29 w4	0.30
33	**133**	Twp Rd West of Hwy 6	nw 31 4 29 w4	0.20
34	**434**	Twp Rd 8-2 East of Hwy 785	sw 18 8 28 w4	0.30
35	**435**	Twp Rd. 8-2 West of Hwy 785	ne 12 8 29 w4	0.20
36	**436**	RR 29-1 South of Hwy 785	nw 24 7 29 w4 DELETED	0.00
37	**437**	RR 29-1 North of Hwy 785	sw 25 7 29 w4	0.30
38	**438**	Snake Trail North Hwy 510	sw 2 8 1 w5	0.20
39	**439**	Lank Bridge Hill	sw 16 9 1 w5	1.50
40	**440**	Old Airport Road West of Hwy 510	sw 4 8 1 w5	0.20
41	**441**	Ashvale Hill North of Hwy 510	ne 36 7 30 w4	0.90
42	**542**	Waldron Flats East of Hwy 22	se 12 10 2 w5	0.40
43	**543**	Chapel Rock West of Hwy 22	ne 34 8 2 w5	0.20
44	**444**	Welsch Road North of Hwy 510	nw 33 7 29 w4	0.20

Please use this Schedule For Council	Project #	Road Name	Location	KMs
45	**545**	Connelly Road West of Hwy 22	SE 3 8 2 W5	0.20
46	**546**	Parker Road East of Hwy 22	NE 10 8 2 W5	0.20
47	**547**	Lundbreck East Street	Past the concrete plant	0.40
48	**148**	Tony Bruder Hill	W 14 4 29 w4	1.00
49	**149**	Twin Butte Road East of Hwy 6	Sw 4 4 29 w4 (Past Walper)	0.20
50	**250**	Alberta Ranch Road West of Hwy 6	Ne 23 5 3 W4	0.20
51	**251**	Jenkins Road South of Hwy 507	nw 35 5 28 w4	0.20
52	**552**	Wood Avenue South of 3A to Reservoir	Water Tower	0.45
53	**353**	Canyon Bridge west to top of hill	Approaches to Castle Bridge Div 3	0.40
	D*	Miscellaneous Public Works Discretion		*10.00*
		Total		34.80
	First Digit - Division			
	Next Digits = Council Schedule #			0.00

2021 - Schedule A to C-PW-009

DRAFT

W.O.#	Description/Road Name	Location	Km's	Div
CA01	Burmis Mountain Hill	7-7-2-W5	0.50	5
CA02	Castle River Rodeo Grounds	27-6-2-W5	1.40	3
CA03	Catonio Road Hill	24-7-2-W5	0.30	5
CA04	Christy Mines Road	5513 RR 1-1 South to the bridge at Pincher Creek Ranches Twp Rd 5-4	2.50	3
CA05	Crook Road on hill to prevent washboard	East from Hwy 6	0.50	2
CA06	Gerald Lewis	NW 32-7-29-W4	0.10	4
CA07	Glen Road	Entire Road	2.10	5
CA08	Hochstein Hill	26-5-29-W4	1.00	2
CA09	South Landfill Road	SW 5-7-1-W5 - Intersection	0.50	3
CA10	South Landfill Road	SW 3-7-1-W5 - Residents	0.50	3
CA11	South Landfill Road	SW 8-7-1-W5 - Gun Club	0.50	3
CA12	Sandeman (Subdivision traffic)	SW 6-8-29-W4 north of Hwy 510	1.50	4
CA13	Kerr Road Hass	West of Hwy6	0.20	1
CA14	Kerr Road	East of Hwy 6	0.50	1
CA15	Lundbreck Falls Road	21-7-2-W5	1.10	5
CA16	Old Cook place	5-7-1-W5	0.30	3
CA17	Old Cook place (going north on road past Crayford's)	6-7-1-W5	0.10	3
CA18	Pincher Colony jug handle	27-6-30-W4	0.50	3
CA19	Talon Peak - From RR3-0 to End of estate	13-7-3-W5	2.10	5
CA20	Upper Tennessee	36-7-30-W4	0.40	4
CA21	Waterton Colony Hill	3-4-28-W4	1.00	1
CA22	Willow Valley - Hwy 22	11-9-2-W5	0.20	5
CA23	Twp Rd East of Hwy 6 (Brody)	NW31-4-29-4	0.30	1
CA24	Twp Rd West of Hwy 6	NW31-4-29-4	0.20	1
CA25	Twp Rd 8-2 East of Hwy 785	SW18-8-28-4	0.30	4
CA26	Twp Rd 8-2 West of Hwy 785	NE12-8-29-4	0.20	4
CA27	RR 29-1 North of Hwy 785	SW25-7-29-4	0.30	4
CA28	Snake Trail North Hwy 510	SW2-8-1-5	0.20	4
CA29	Lank Bridge Hill	SW16-9-1-5	1.50	4
CA30	Old Airport Road west of Hwy 510	SW4-8-1-5	0.20	4
CA31	Ashvale Hill North of Hwy 510	NE36-7-30-4	0.90	4
CA32	Waldron Flats east of Hwy 22	SE12-10-2-5	0.40	5
CA33	Chapel Rock west of Hwy 22	NE34-8-2-5	0.20	5
CA34	Welsch Rd north of Hwy 510	NW33-7-29-4	0.20	4
CA35	Connelly Rd west of Hwy 22	SE3-8-2-5	0.20	5
CA36	Parker Rd East of Hwy 22	NE10-8-2-5	0.20	5
CA37	Lundbreck East Street	SE26-7-2-W5	0.40	5
CA38	Tony Bruder Hill	W14-4-29-4	1.00	1
CA39	Twin Butte Rd east of Hwy 6	SW4-4-29-4	0.20	1
CA40	Alberta Ranch Rd west of Hwy 6	NE23-5-30-4	0.20	2
CA41	Jenkins Rd south of Hwy 507	NW35-5-28-4	0.20	2
CA42	Wood Avenue South of 3A to Reservoir	Lundbreck water tower	0.45	5
CA43	Canyon Bridge to crest of hill on West	SE24-6-2-W5	0.40	3
CA44	Hucik Hill	SW28-8-1-W5	0.30	4
CA45	McRae Pit - Texas Gate to pit entrance	SW21-6-1-W5	0.70	3
CA46	McCulloch Pit - Hwy 22 to pit entrance	SE34-7-2-W5	0.60	5
CA47	Gladstone - TR6-2 down to Mill Creek Church	NE1-6-2-W5	0.70	3
CA48	Gladstone - Cold mix to top of hill Pass Mill creek Bridge	SW23-5-2-W5	0.80	3
CA49	Gladstone - Haglen Road Hill	SE22-5-2-W5	0.45	3

Miscellaneous Public Works Discretion	***10.00***
Total	**39.50**

2021 Revised/Added

Recommendation to Council H1c

TITLE: Fisher Bridge (Bridge File 2488) Located NW26-07-02 W5M - Update	
PREPARED BY: CAO	**DATE: April 21, 2021**
DEPARTMENT: Admin	
Department Supervisor / **Date**	**ATTACHMENTS:** **1. November 16, 2020 Recommendation to Council**

APPROVALS:

Department Director	**Date**	**CAO**	**Date** 22 April 2021

RECOMMENDATION:
That Council approves the proposal for engineering services for design, construction and post construction work as a change in scope to the November 24, 2020 Resolution. And that Council make recommendation to administration as to the expected incremental life expectancy that this project should generate.

BACKGROUND:
At their November 24, 2020 meeting, Council passed Resolution 20/432 "That Council approves Bridge File 2488 repairs early in 2021, through the Bridge Reserve (6-12-0-742-6740)."

Based on new assessments of the bridge, both abutments require some repair and the north abutment may be irreparable. This change of the scope of work is significant and could require funds in excess of the Council approved budget and will push the timeline for repair beyond "early in 2021".

In a conversation with Alberta Transportation, it was confirmed that the bridge location is required in the ultimate plan scenario of the Highway 3 Upgrade and Twinning project. As such, maintaining a bridge structure at this location over the long term is required.

The bridge structure is significantly compromised, and the cost of additional life span of the bridge post construction is high. Options for additional life span of the bridge post construction ranges from 10-25-50 -75 years depending on the construction option chosen.

FINANCIAL IMPLICATIONS:
The financial implications of the November 24, 2020 Resolution are estimated at $120,000 to be funded out of the Bridge Reserve.

Recommendation to Council

Funding the repair of the bridge in 2021 will require significant additional funds ranging from $500,00 to $1,500,000 depending on the additional life span option chosen. Engineering for the project is likely to be in excess of $75,000 and as such needs to be tendered.

This project is closely aligned with the Provinces Strategic Transportation Infrastructure Program (STIP) Local Road Bridge Program (LRB). To make use of this program, an application to Alberta Transportation LRB would need to be made prior to Nov. 30, 2021 for construction in 2022. Although this extends the closure of the bridge until 2022, the high cost of repair justifies the delay.

• Pincher Creek Library Board.- Blanche Lemire, Sandra Baker and Mike Barkwith
• Municipal Planning Commission - Jim Welsch (*Administration to continue to advertise to find a second member at large)

Carried

c) MOST Grant Update

CAO Troy MacCulloch updated Council on the MOST Grant, and requested that Council have their suggestions of community organizations available for the December 8, 2020 meeting to allow time for letters to be drafted to determine the needs of the community.

F. COMMITTEE REPORTS / DIVISIONAL CONCERNS

1. Councillor Quentin Stevick – Division 1
   a) Remembrance Day at Twin Butte
2. Councillor Rick Lemire – Division 2
   a) Pincher Creek Emergency Services Commission
   b) Remembrance Day at MD Office
3. Councillor Bev Everts– Division 3
   a) Agricultural Service Board
   b) Alberta Southwest next date is December 4, 2020 *Councillor Yagos will attend
   c) Remembrance Day at MD Office
4. Reeve Brian Hammond - Division 4
   a) Crowsnest Pincher Creek Landfill Association
5. Councillor Terry Yagos – Division 5
   a) Pincher Creek Emergency Services Commission

Councillor Terry Yagos 20/430

Moved to accept the Committee Reports and information.

Carried

Public Works Superintendent Eric Blanchard attended the meeting at this time.

G. ADMINISTRATION REPORTS

1. Operations
   a) Operations Report

Councillor Quentin Stevick 20/431

Moved that Council receive for information:
- Public Works Call logs, dated November 19, 2020
- Capital Budget Summary, dated November 19, 2020
- Program Capital Budget Projects Status, dated November 19, 2020
- Gladstone Valley – Post Incident

Carried

Eric Blanchard left the meeting at this time, the time being 2:22 pm.

b) Fisher Bridge

Councillor Quentin Stevick 20/432

Moved that Council approves the Bridge File 2488 repairs in early 2021, through the Bridge Reserve (6-12-0-742-6740).

Carried

Recommendation to Council

TITLE: AES Capital Clean-Up - Spray Truck	
PREPARED BY: Meghan Dobie	**DATE: April 20, 2021**
DEPARTMENT: Finance	
Department Supervisor / **Date**	**ATTACHMENTS:** **1. 2019 Capital Budget Detail**

APPROVALS:

Department Director	Date	CAO	Date
	April 21, 2021		21 Apr. 2021

RECOMMENDATION:

That Council approve the $15,000 capital purchase for hydraulics, pumps and installation on the AES spray truck, and for the purchase to be funded from the equipment reserve.

BACKGROUND:

The AES road side sprayer, was included in the 2019 capital budget. It was estimated to cost $131,500 and was to be funded out of the equipment reserve.

In 2019 the truck was purchased for $60,080, however the purchase for the attachment was not made.

In 2020 Council passed the following resolution, "moved that Council approve the $50,000 capital purchase for a tank/spay boom attachment, and for the purchase to be funded through the equipment reserve".

2020 actuals came in at $68,280 due to an increase in costs as result of COVID-19. COVID-19 drastically increased supply constraints resulting in higher prices.

In 2021, to finalize the AES spray truck, $15,000 will be incurred for hydraulics, pumps and installation.

As per section 248(1) of the MGA, a council resolution is required for any capital purchase not included in the 2021 budget.

FINANCIAL IMPLICATIONS:
$15,000 equipment reserve

Capital Project

Project Name	**Sprayer truck with tank/sprayer boom**
Project Number	AG-01
Priority	
Service Area	Agriculture & Environmental Services - Equipment
Project Description	Rebuild and upgrade the Agriculture Department roadside unit. This roadside unit is used for spraying large patches of weeds along roadsides, around signs and other infrastructure.
Project Cost	Truck – 2 ton: $66,000 Deck: $11,000 Boom: $10,350 Tank & pump: $6,600 Injection system: $28,550 Contingency: $9,000 Total cost: $131,500
Funding Sources	Equipment Reserve
Timeline	Purchased and outfitted in 2019
Rationale for the need	The current roadside unit is out of date. • Truck needs heavier suspension, more room and new safety equipment. • Deck needs more length, new lighting and safety equipment. • Boom needs replacement. • Tank and pump are both 20 plus years old and need to be replaced. • Injection system is still mostly good but components need replacing and if the component cannot be paired with the new technology (specifically, GIS and cabling), then it will become immediately out of date and/or obsolete.
Impact on future operating costs	
Impact on other departments	
Implications of deferring this project	This equipment is more than 20 years old and out of date. Replacements have been pushed back for several years. The alternative is to perform repairs and replacements that may not be satisfactory in the short term and certainly not satisfactory for the long term.
Treatment of asset replaced	Public Works will use the chassis and deck; it is ready for use as it is. The sprayer equipment will be auctioned.
Other options to recommendation	

Recommendation to Council

TITLE: PW Capital Clean-Up – Generator and Excavator	
PREPARED BY: Meghan Dobie	**DATE: April 19, 2021**
DEPARTMENT: Finance	
Department Supervisor / **Date**	**ATTACHMENTS:** **1. 2020 Capital Budget Standby Generator**

APPROVALS:

	April 19, 2021		19 Apr, 2021
Department Director	**Date**	**CAO**	**Date**

RECOMMENDATION:
That Council approve the $60,000 capital purchase for the Standby Generator and an additional $8,500 for the Excavator, and further;

That Council approve the funding of these capital items through the equipment reserve.

BACKGROUND:
As per section 248(1) of the MGA, a council resolution is required for any capital purchase not included in the 2021 budget.

Standby Generator:

The Standby Generator was included in the 2020 capital budget. It was estimated to cost $60,000 and was to be funded through the equipment reserve. In 2020, where possible, the MD delayed capital spending as a result of extending tax deadlines and managing cash flow. Therefore the purchase of the standby generator was pushed out and was not included in the 2020 financials. The estimated purchase price of the generator currently sits at $55,973, plus an additional $1,200 (estimate) for the concrete pad.

Excavator:

As the Council meeting held November 10, 2020, Council moved (RES 20/405) the purchase of new excavator in 2020 for $315,000 and for the purchase to be funded through the equipment reserve. However, the MD has incurred additional charges of $8,500 for protection shroud.

FINANCIAL IMPLICATIONS:
$68,500 from the Equipment Reserve

Project Name	Standby Generator
Project Number	
Priority	5 - High
Service Area	Public Works - Equipment
Project Description	Standby Generator (3 Phase large generator) for water intake from the reservoir
Project Cost	$60,000
Funding Sources	Reserve - Water Infrastructure
Timeline	Complete in 2020
Rationale for Need	There is currently no back up power option for the intake pumps as they were upsized to accommodate Beaver Mines and Castle water infrastructure.
Impact on future operating costs	
Impact on other departments	
Treatment of asset replaced	
Implications of deferral	In the event of a power outage for more than 3 days, reservoirs would be empty. The M.D. would have to rely on the availability of a rental generator of this size to be available. There is risk associated with not being able to get a generator in time, therefore 4 communities could be without water.
Other options to Recommendation	

AES, April, 2021

- April 1, fire extinguisher inspections (professional), deadstock bins
- April 2, STAT (Good Friday)
- April 5, STAT (Easter Monday)
- April 6, dam inspections (water levels, accessibility etc.)
- April 7, PW Safety meeting, ASB meeting
- April 7 – 9, spray units, rentals & shop maintenance, cleaning, prep etc.
- April 7 – 9, preparing administrative, safety & mapping equipment (computers, tablets, GIS, Spots etc.)
- April 8, dam regulatory review meeting
- April 9, resumes and interviews (if needed) , shop work, safety (bistrainer, SDS's)
- April 12, safety training scheduling, bistrainer courses
- April 13, setting up crew scheduling for May weed work
- April 14, 15, mental health safety meeting
- April 14, JHS meeting, scheduling
- April 15, setting up crew scheduling for June weed work, mowing schedules for admin/PW
- April 16, biocontrol meeting
- April 19, orientation and safety for first crew member
- April 20, records and mapping, safety (truck kits)
- April 20 – 23, equipment and facilities prep
- April 22 – 23, reporting, funding documents
- April 21, provincial ASB webinar
- April 22, South-West Invasives Managers (SWIM) meeting
- April 23, dams, reporting
- April 27 – 30, equipment and facilities prep
- April 28, go over rental equipment procedures, First Aid kit inspections (professional)
- April 29, deadstock (bin assessments, reporting, etc.)
- April 29 – 30, getting safety documents ready and available for crew on May 3rd
- April 30, crew work/training schedule for May, equipment prep (ready for use prep)

Sincerely,

Shane Poulsen,
Agricultural Fieldman

AES, May, 2021

- May 3, Orientation of seven summer crew
- May 4, Safety Binders Review, Safe Work Procedures review (SWP's), general crew preparation
- May 5, SWP's & emergency response plans (binders), reporting, Working Alone protocols
- May 6, SDS & label binders, vehicle and equipment assignments, JHS site inspection (airport facilities)
- May 7, shop SWP's, HAS shop/office crew review, CFIA permit renewals
- May 10, start ten hour days/four day week, PW water & shop safety, first aid kits and fire extinguisher inspections
- May 11, respirator fit/hearing testing, truck kits, emergency response plans, admin mowing and weeding
- May 12, Volker Stevin meeting, sprayer training, tech & data management, mapping orientation, JHS meeting (Jesson)
- May 13, MRF equipment training, records training, Safety meeting, gophers & strychnine inspections
- May 14, Friday off
- May 17, crews assigned to Divisions, reporting, industrial sites (gravel pits) orientation, deadstock bin cleanout
- May 18, Premix labelling, rental equipment, Wild Caraway inspections and control, facilities orientation
- May 19, weed ID training, authorized assistant, Bistrainer courses, Dames Rocket Inspections, dam (Therriault) orientations & inspections
- May 20, Premix sales, mapping, gravel pits, equipment training, rental equipment, , biocontrol inspections (Dalmatian Toadflax)
- May 21, Friday off
- May 24, STAT Holiday
- May 25, ASB package, start with Pincher Creek inspections, visits and control, Lundbreck visits & control
- May 26, Oldman River (downstream of dam) inspections and control, Boulder Run pick & spray (with Alberta Parks in the general vicinity)
- May 27, Premix sales, mapping, UTV Training, airport mowing, watercourse inspections and control
- May 31, biocontrol releases (Leafy Spurge), Hoary Cress inspections & control, provincial reporting

Sincerely,

Shane Poulsen,
Agricultural Fieldman

Recommendation to Council

H3b

TITLE: **PINCHER CREEK REGIONAL RECREATION MASTER PLAN**	

PREPARED BY: Roland Milligan		**DATE: 2021-04-21**	
DEPARTMENT:			
			ATTACHMENTS: 1. **Link to Pincher Creek Regional Recreation Master Plan:** https://mdpinchercreek.ab.ca/content.php?n=386
Department Supervisor		**Date**	

APPROVALS:

	2021/04/21		22 Apr, 2021
Department Director	**Date**	**CAO**	**Date**

RECOMMENDATION:

That Council accept as presented, the Pincher Creek Regional Recreation Master Plan, dated March 30, 2021.

BACKGROUND:

At a Joint Town of Pincher Creek and MD of Pincher Creek Council Meeting on January 30, 2020, the Town and MD initiated discussions on the development of a Regional Recreation Master Plan (the Plan).

In June 2020, Expedition Management Consulting was awarded the tender to complete a Regional Recreation Master Plan. Several community consultation sessions, stakeholder interviews, citizen surveys, and in- person sessions were completed. In March, 2021 the Draft Recreation Master Plan was again shared with both Council(s), and also taken to the public for feedback.

From the Plan: *"The Town and Municipal District (M.D.) are committed to the continuation of high-quality services and sound planning to ensure that the region is viewed as an attractive place to grow up, raise a family, enjoy retirement, and lead an active, healthy lifestyle. To assist in achieving this commitment, the Town and M.D. have completed a comprehensive Regional Recreation Master Plan. The plan will provide a firm steppingstone for continued planning in the region, guide future investment in recreation, parks, and culture, and support the long-term success of the region".*

The final Plan was received on March 30, 2021,(https://mdpinchercreek.ab.ca/content.php?n=386) and has been accepted by the Town at their Committee of the Whole Meeting on April 7, 2021.

FINANCIAL IMPLICATIONS: None

Recommendation to Council

TITLE:	**Road Closure Bylaw No. 1322-20 Adjacent to NE 6-6-1 W5M**

PREPARED BY: Roland Milligan			**DATE: April 21, 2021**
DEPARTMENT: Planning and Development			
			ATTACHMENTS: 1. **Bylaw No. 1322-20** 2. **GIS Aerial** 3. **Surveyor's Sketch of Final Configuration**
Department Supervisor		**Date**	

APPROVALS:

	2021/04/21		22 Apr. 2021
Department Director	**Date**	**CAO**	**Date**

RECOMMENDATION:

That Council give second reading to Road Closure Bylaw No. 1322-20;

Further, that Council give third and final reading to Road Closure Bylaw No. 1322-20.

BACKGROUND:

On May 14, 2019 Council granted the request of Barry and Carla Morgan to close a portion of Road Plan No. 041 0705 located within NW 5-6-1 W5M, and a portion of statutory road allowance located between the NW 5-6-1 W5M and NE 6-6-1 W5M .***(Attachments No. 1)***.

The applicant submitted the required road closure fee and is responsible for all costs associated with the closure, purchase and consolidation with their adjacent parcel ***(Attachment No. 3)***. The applicant's surveyor supplied the wording for the road closure bylaw required to close the portions of Road Plan 041 0705 and the portion of adjacent statutory road allowance.

Road Closure Bylaw No. 1322-20 received first reading at the December 2, 2020 Council meeting. The required Public Hearing was held on January 12, 2021.

The bylaw was then forwarded to Alberta Transportation for the Minister's approval. The MD received the signed bylaw from the Province on April 14, 2021 ***(Attachment No. 2).***

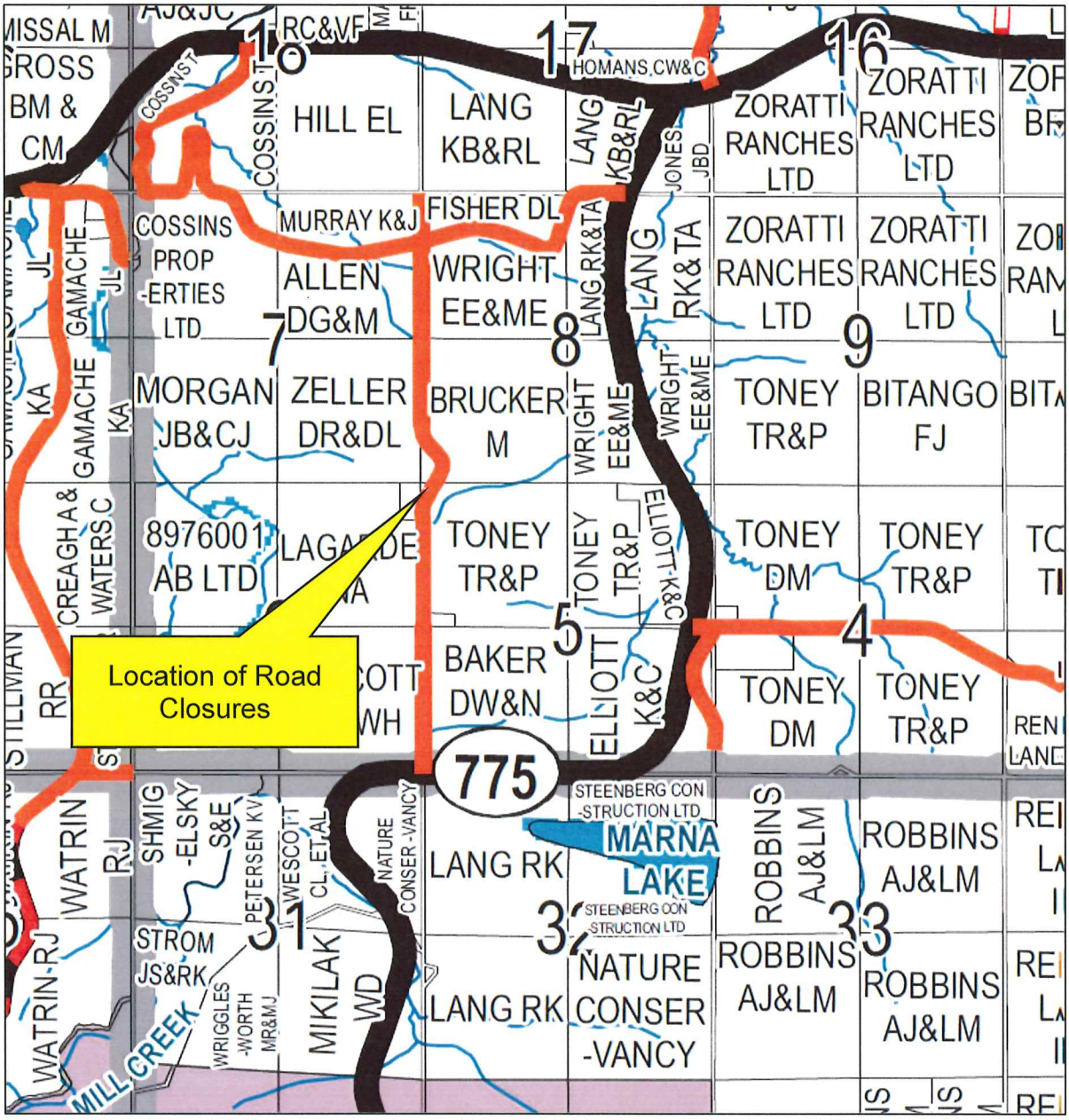
The bylaw is being presented for second and third and final reading.

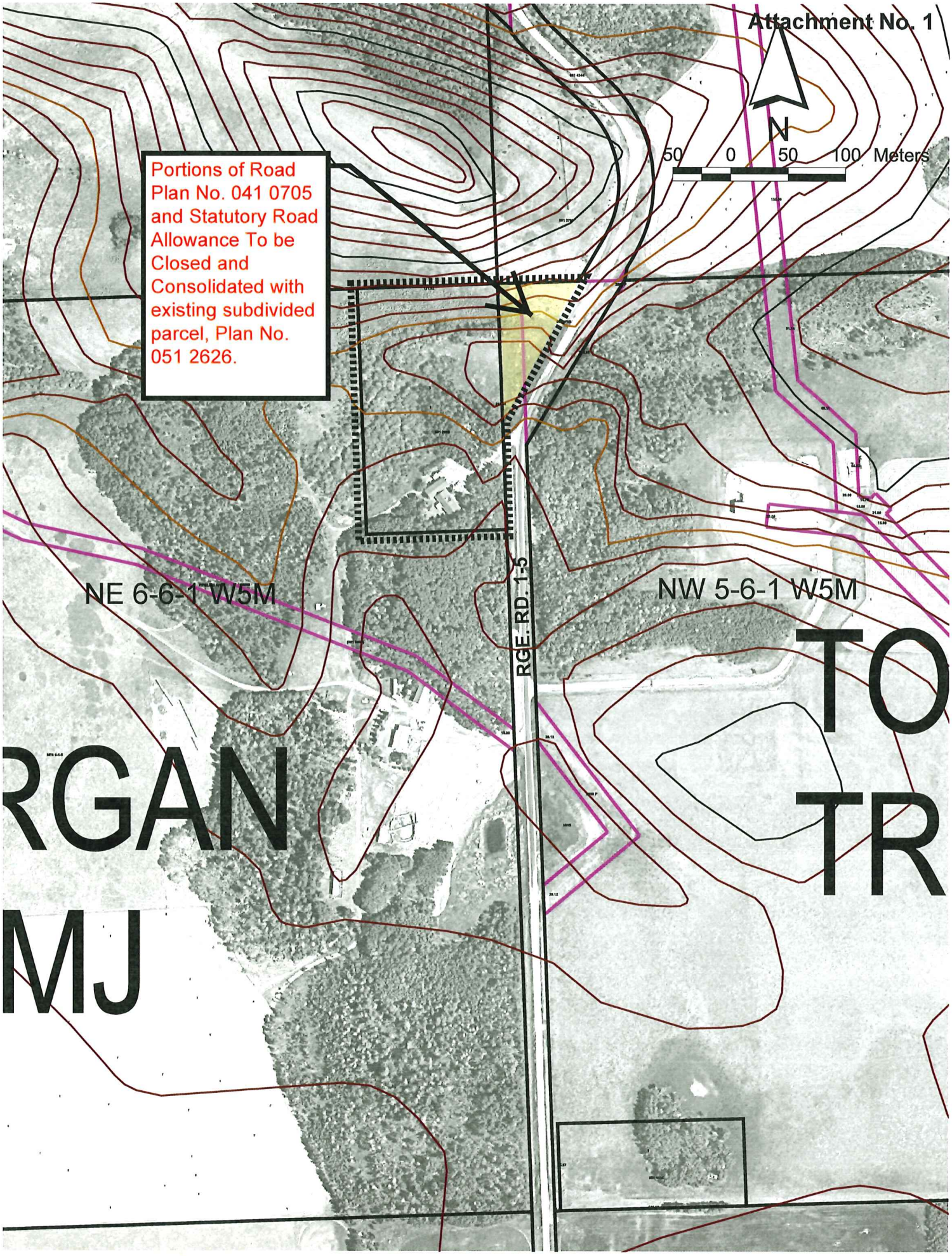
FINANCIAL IMPLICATIONS:

None. The applicant is responsible for all costs associated with this closure and consolidation.

Recommendation to Council

Location Map




Attachment No. 1
N
50 0 50 100 Meters
Portions of Road Plan No. 041 0705 and Statutory Road Allowance To be Closed and Consolidated with existing subdivided parcel, Plan No. 051 2626.
NE 6-6-1 W5M
NW 5-6-1 W5M
RGE. RD. 1-5
RGAN
MJ
TO
TR

Attachment No. 2

MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9
BYLAW NO. 1322-20

A Bylaw of the Municipal District of Pincher Creek No. 9 in the Province of Alberta, for the purpose of closing a portion of a public roadway in accordance with Sections 22 and 606 of the *Municipal Government Act*, Revised Statutes of Alberta 2000, Chapter M-26, as amended.

The Council of the Municipal District of Pincher Creek No. 9 of the Province of Alberta, duly assembled, hereby enacts as follows:

WHEREAS the lands described below are no longer required for public travel;

AND WHEREAS application has been made to Council to have the roadway closed;

AND WHEREAS the Council of the Municipal District of Pincher Creek No. 9 deems it expedient to provide for a bylaw for the purpose of closing to public travel certain roads, or portions thereof, situated in the said municipality, and thereafter disposing of same;

AND WHEREAS the advertising requirements of Section 606 of the Act have been complied with;

NOW THEREFORE be it enacted that the Council for the Municipal District of Pincher Creek No. 9 in the Province of Alberta does hereby close to Public Travel and creating title to and disposing of the following described highways, subject to rights of access granted by other legislation.

FIRSTLY:
THAT PORTION OF GOVERNMENT ROAD ALLOWANCE LYING ADJACENT TO N.E. ¼ SEC. 6, TWP. 6, RGE. 1, W5M AND N.W. ¼ SEC. 5, TWP. 6, RGE. 1, W5M
FORMING PART OF LOT 3, BLOCK 1, PLAN _____
CONTAINING 0.201 HECTARES (0.50 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

SECONDLY:
THAT PORTION OF ROAD PLAN 041 0705
FORMING PART OF LOT 3, BLOCK 1, PLAN _____
CONTAINING 0.202 HECTARES (0.50 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

Received first reading this 8th day of December, 2020

_____
REEVE

(Seal)

_____
CAO

APPROVED this _____ day of _____, 20___.

_____
MINISTER OF TRANSPORTATION

Received second reading this _____ day of _____, 20 ___.

Received third reading this _____ day of _____, 20 ___.

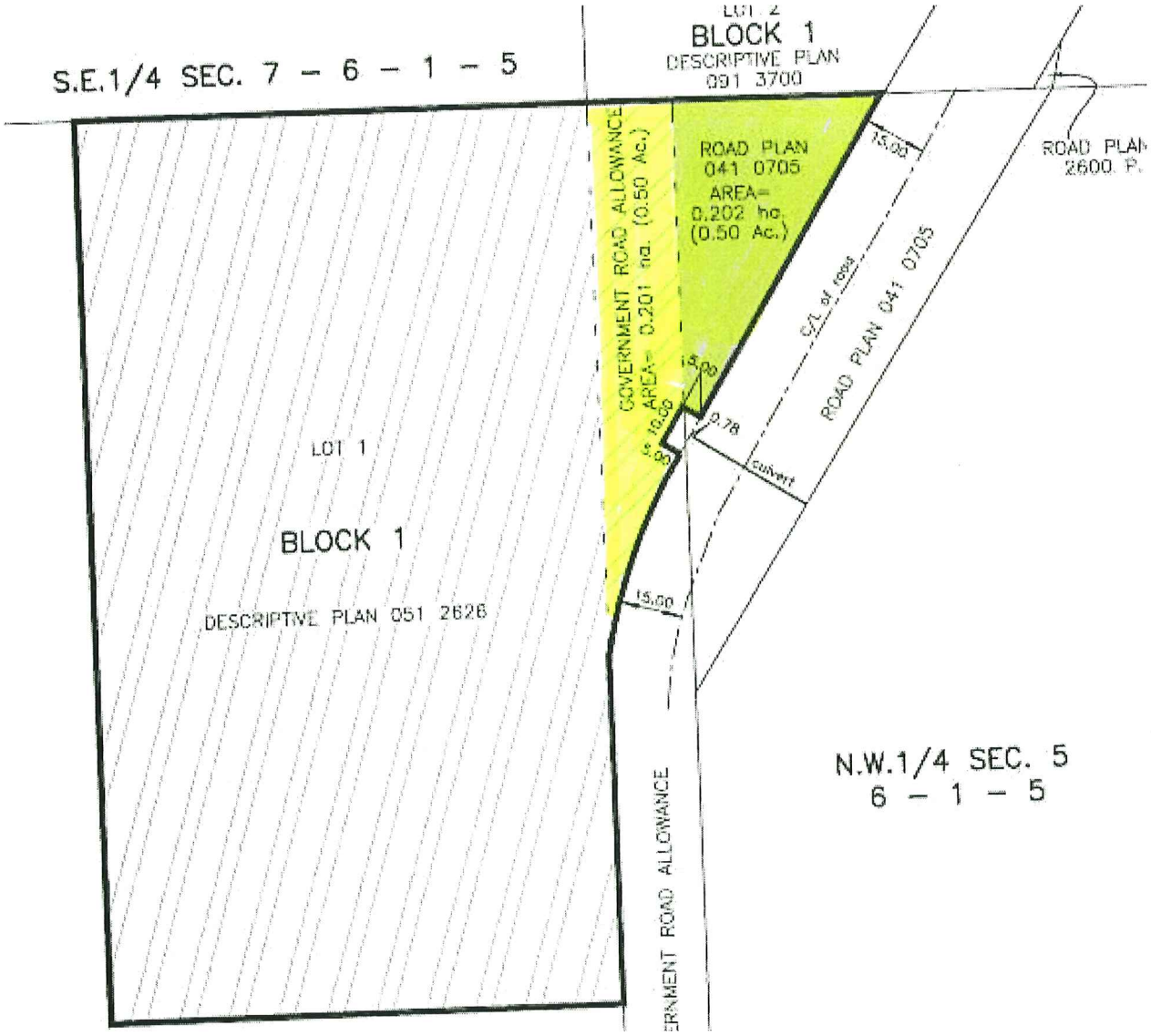
_____
REEVE

(Seal)

_____
CAO

Attachment No. 3

Surveyor's Sketch Showing Final Configuration



Recommendation to Council

H3d

TITLE:	**ROAD CLOSURE BYLAW NO. 1329-21 MUNDELL, ADJACENT TO NE 26-4-30 W4M**
PREPARED BY:	**Roland Milligan**
DATE:	**April 20, 2021**
DEPARTMENT:	**Development and Community Services**

			ATTACHMENTS: 1. **Bylaw No. 1329-21** 2. **Aerial plan showing portion of Road to be closed.**
Department Supervisor		**Date**	

APPROVALS:

Roland Milligan	2021/04/20		22 Apr. 2021
Department Director	**Date**	**CAO**	**Date**

RECOMMENDATION:

That Council give First Reading to Road Closure Bylaw No. 1329-21, being a bylaw to close a portion of Statutory Road Allowance lying adjacent to NE 26-4-30 W4M;

And further, that Council schedule the required Public Hearing for May 25, 2021, at 1:00 pm.

BACKGROUND:

At the March 9, 2021 Council meeting, the M.D. approved a request to close, purchase, and consolidate a portion of undeveloped statutory road allowance (the Road) adjacent to a 0.56 ha (1.40 acres) parcel within the NE 26-4-30 W4M, owned by Scott and Annamaria Mundell.

The road is undeveloped and forms the east boundary of the parcel ***(Attachment No. 2)***. Closing the road and consolidating it with the adjacent parcel will result in a parcel of 0.83 ha (2.05 acres). The applicants have paid the required road closure fee and engaged the services of an Alberta Land Surveyor to complete the process.

Road Closure Bylaw No.1329-21 ***(Attachment No. 1)*** was prepared and is being presented for first reading. To meet the advertising requirements of the *Act*, we are suggesting that the required Public Hearing be held on May 25, 2021 at 1:00 pm..

FINANCIAL IMPLICATIONS:

If approved, all costs would be the responsibility of the applicant.

Attachment No. 1

MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9

A BYLAW OF MD OF PINCHER CREEK FOR THE PURPOSE OF CLOSING TO PUBLIC TRAVEL AND CREATING TITLE TO AND DISPOSING OF PORTIONS OF A PUBLIC HIGHWAY IN ACCORDANCE WITH SECTION 22 OF THE MUNICIPAL GOVERNMENT ACT, CHAPTER M26, REVISED STATUTES OF ALBERTA 2000, AS AMENDED.
WHEREAS, the lands hereafter described are no longer required for public travel,

WHEREAS, application has been made to Council to have the roadway closed, and

WHEREAS, the Council of MD OF PINCHER CREEK deems it expedient to provide for a bylaw for the purpose of closing to public travel certain roads or portions thereof, situated in the said municipality and thereafter creating title to and disposing of same, and

WHEREAS, notice of intention of Council to pass a bylaw has been given in accordance with Section 606 of the Municipal Government Act, and

WHEREAS, Council was not petitioned for an opportunity to be heard by any person claiming to be prejudicially affected by the bylaw

NOW THEREFORE BE IT RESOLVED that the Council of MD OF PINCHER CREEK in the Province of Alberta does hereby close to Public Travel and creating title to and disposing of the following described highways, subject to rights of access granted by other legislation.

ALL THAT PORTION OF GOVERNMENT ROAD ALLOWANCE LYING ADJACENT TO N.E.1/4 SEC. 26-4-30-4 AND FORMING PART OF LOT 1, BLOCK 2, PLAN _____
CONTAINING 0.263 HECTARES (0.65 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

Received first reading this _____ day of _____, 20__.

_____
Chief Elected Official *Seal*

_____
Chief Administrative Officer

Approved this ____ day of _____, 20__

_____
Minister of Transportation

Received second reading this _____ day of _____, 20__.

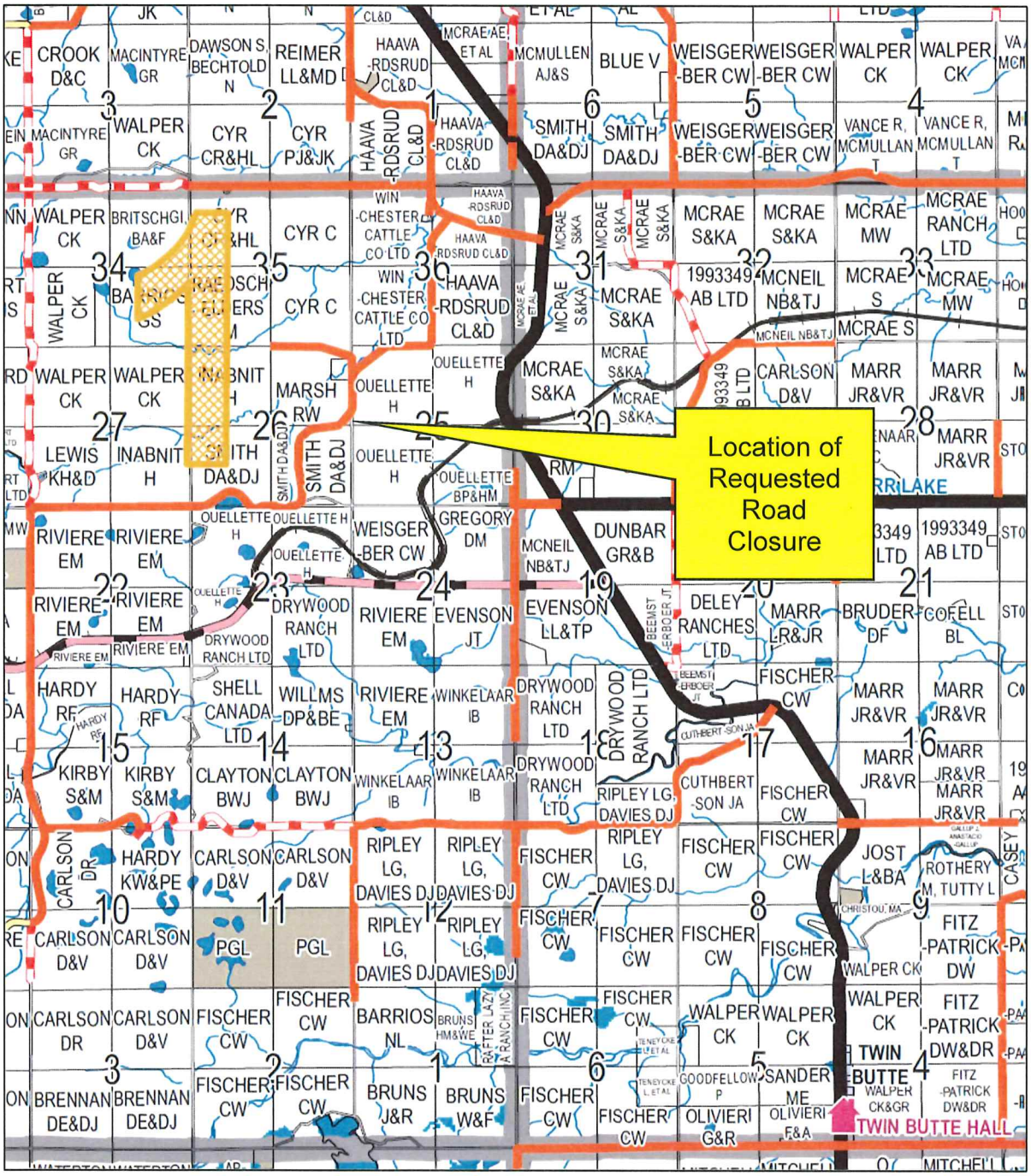
Received third reading and finally passed this _____ day of _____, 20__.

_____
Chief Elected Official *Seal*

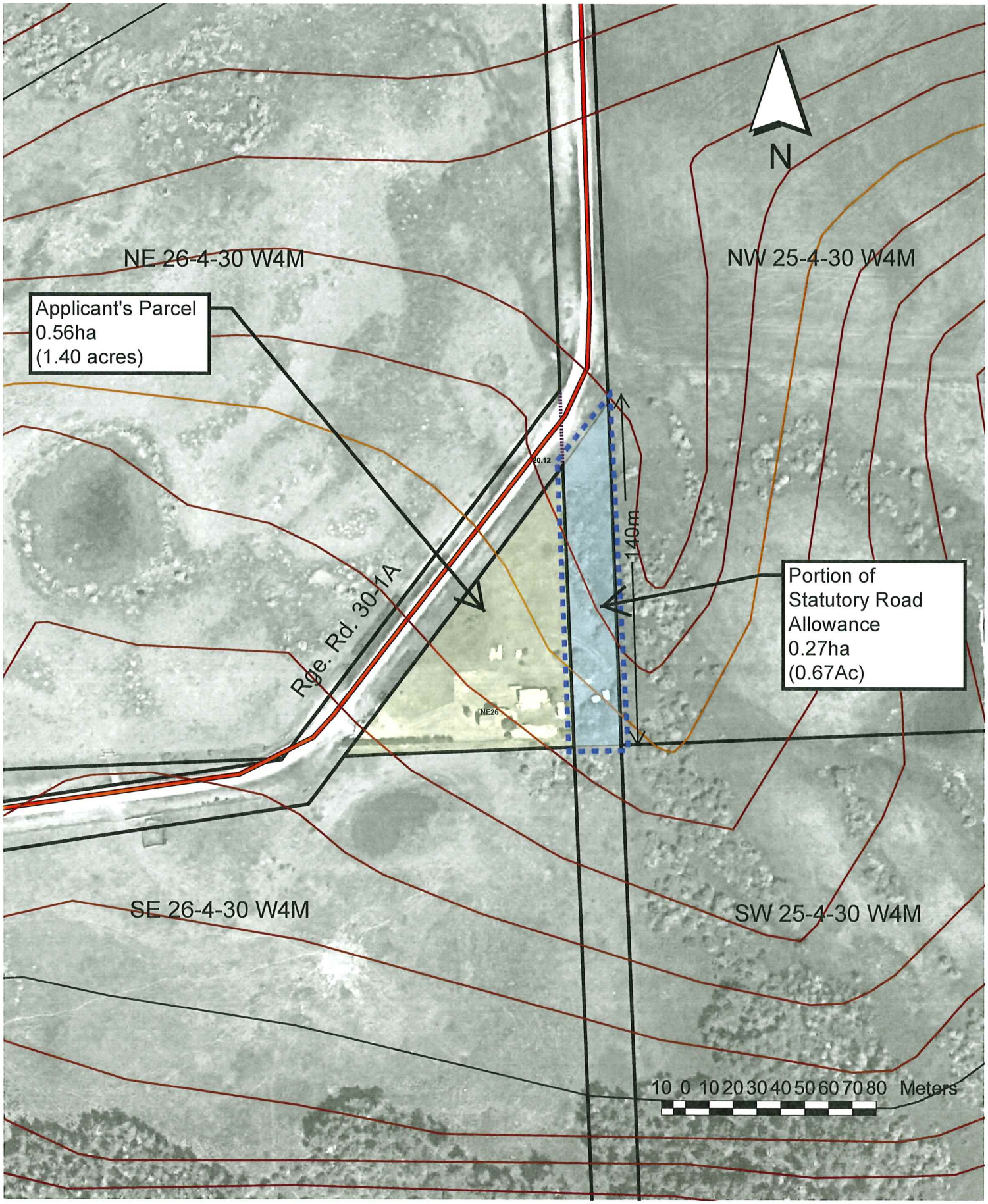
_____
Chief Administrative Officer

Recommendation to Council

Portion of MD Ownership Map



Attachment No. 2



CHIEF ADMINISTRATIVE OFFICER'S REPORT

Apr. 14 –Apr. 27, 2021

Discussion

Apr. 14	Post Council follow-up with SMT (Senior Mgmt Team) and Exec Asst
	BM Project Meeting with Banner Engineering
	MCCAC (Municipal Climate Change Action Centre) Meeting
	Joint Health and Safety
	Tender Openings for Bridge Files 75009 & 75377
Apr. 15	Meeting with resident regarding temporary work space agreement
	Tender review with Contracted PM Reedyk and Roseke Engineering
Apr. 16	Meeting with Municipal Affairs regarding Conditional Land Agreement
	Meeting with MPE Engineering for BM Project update
Apr. 19	HR issue/investigation
	Vertical Church Meeting with regards to Emergency Shelter MOU
	CPO Agreement Amendment with CAO Wilgosh
Apr. 20	Discharge of Caveats on Land Agreements for Project in BM
	Joint AB North and AB South Health and Safety Conference
	Site visits at Fisher Bridge with Engineer and Contracted PM (Proj. Mgr)
	Water Utility meeting (Meghan, Eric Randy Kat and myself)
Apr. 21	Operation Report preparation with Roland and Eric
	Meeting with AEP Regional Management
	Volunteer Appreciation
Apr. 22	Meeting with Jeff Gutsell regarding Water Licenses
	HR Incident Investigation wrap-up
Apr. 23	Alberta Assoc of Police Governance AGM - virtual
Apr. 26	SMT (Senior Mgmt Team) and Exec Asst

- Numerous other meetings throughout this period to address any issues or tasks from the Apr. 13th meeting.

Upcoming Meetings

- May 3 - PCESC Mediation begins
- May 4 - Planning Subdivision and MPC
- May 5 - ASB
- May 6 - Airport Inspection
- May 13 - RMA Member Visit

RECOMMENDATION:

That Council receive for information, the Chief Administrative Officer's report for the period Apr 14, 2021 – Apr. 27, 2021.

Prepared by: Troy MacCulloch, CAO Date: Apr. 21, 2021

Respectfully presented to: Council Date: Apr. 27, 2021

Letters from last Council:

1. Gordon and Mary Mayer – thank you regarding their letter of concern on coal mining
2. Fire Chief Cox – invitation to attend May 11th Council meeting
3. Pincher Creek Family Resource Center – letter of support
4. Expedition Management Consulting – thank you for attending meeting
5. Garry Marchuk – Beaver Mines Pathway Project
6. Riversdale Resources – thank you for attending meeting and supplying local contact info
7. TELUS – thank you for attending meeting and future collaboration for rural connectivity
8. Cornell Van Ryk – thank you regarding his letter of concern on coal mining & water issues
9. Snake Trail Fire Update – Mark Burles/East Slope Design/Sheldon Smithens/James Welsch/Carol Ann White
10. Letters and Invoices to residents for additional fires in Burmis corridor and Beaver Mines

From: Kootenai Brown
To: Jessica McClelland
Subject: Canada Day
Date: April 21, 2021 1:10:13 PM

Hi Jessica,

Pending the forecasted lifting of restrictions, the Museum is tentatively planning to have Canada Day as it looks like we could be able to have a 500 person outdoor event by then. If we are allowed to proceed we would like the Reeve or an MD Council member partake in the Opening Ceremony like previous years and bring greetings from the MD. Please advise if someone will be able to participate that day.

Thank you,

Laura Korbett
Museum Administrator
Kootenai Brown Pioneer Village
403-627-3684

--

309B Macleod Trail SW
High River, Alberta Canada T1V 1Z5
P: 403.652.2110 F: 403.652.2396
www.highriver.ca

April 19, 2021

VIA E-MAIL

OFFICE OF THE MAYOR

M.D. of Pincher Creek No. 9
Mr. Brian Hammond
PO Box 279
Pincher Creek, AB T0K 1W0
Email: info@mdpinchercreek.ab.ca

Attention: Reeve Brian Hammond

RE: Eastern Slopes Coal Exploration & Public Consultation on the 1976 Coal Development Policy

Dear Your Worship & Members of Council:

The Province has initiated the public consultation process for all Albertans to provide their voice as it relates to Coal Development on the Eastern Slopes of the Rockies. However, this iconic landscape remains threatened due to continued exploration activities.

The Town of High River is requesting your support to encourage the Province and the Alberta Energy Regulator to cease all exploration on Category 2 lands within the Eastern Slopes of the Rockies. In addition, we want to encourage all municipalities to actively participate in the public consultation process to ensure our opinions and the voices of our residents are heard. Protection of this valuable landscape and the watersheds that will be impacted by any coal development activity is important to every resident of Alberta.

At the April 12, 2021 Regular Meeting of Council, the following resolution was adopted:

> ***BE IT RESOLVED THAT*** *Council direct Administration to draft a letter to be signed by the Mayor and sent to Premier Jason Kenney and Minister Sonya Savage requesting that the Alberta Energy Regulator stop all activities associated with Coal Exploration Permits on the Category 2 lands that were approved prior to February 8, 2021;*
>
> ***AND THAT*** *given that public consultation that has begun regarding coal mining on the Eastern Slopes, Council requests that these coal exploration projects be put on hold by the Alberta Government until final decisions have been made regarding the extraction of coal on the Eastern Slopes of Alberta or the elimination of the extraction of coal, especially given the destruction that exploration causes and the effects on our landscapes and our watersheds;*
>
> ***AND THAT*** *Council direct Administration to draft a letter to be signed by the Mayor and sent to all municipalities in Alberta encouraging them to also send letters to Premier*

Kenney and Minister Savage supporting the stoppage of exploration activities on the Eastern Slopes.

***AND FURTHER THAT** the Town of High River also encourages all municipalities to participate fully in the ongoing Public Consultation Process, including Phase 1, which is the gathering of information that the committee will use to draft the actual Public Consultation process.*

The Town has sent letters to Premier Kenney and Minister Savage requesting that the Alberta Energy Regulator stop all activities associated with Coal Exploration Permits on the Category 2 lands that were approved prior to February 8, 2021. In addition, these letters request that the coal exploration projects be put on hold until final decisions have been made about the extraction or the elimination of extraction of coal from the Eastern Slopes, following a meaningful public consultation process.

The Town of High River is respectfully requesting your continued support and that you consider writing to Premier Kenney and Minister Savage requesting that all exploration activities on the Eastern Slopes of the Rockies be ceased, pending the outcome of a meaningful public consultation process. We are encouraging you and your communities to actively participate in the public consultation process to ensure your views are shared.

It is our responsibility to ensure our communities and our residents have the opportunity to share their views as it relates to resource development along the Eastern Slopes. Thank you for your ongoing support and commitment regarding this important initiative for Alberta.

Sincerely,

Craig Snodgrass
Mayor

CS/cp/kr

International Economic Development Week
2021 Community Challenge in Alberta

We all know that economic development is critical.

It is the foundational work that helps to create jobs, support businesses, and improve the quality of life in communities large and small.

These days everyone is talking about the importance of economic development because we are all feeling the impact the pandemic is having on the Alberta economy, and we recognize how this practice is bolstering municipalities, helping them recover.

AUMA is joining Economic Developers Alberta (EDA) to help amplify this important work by inviting you to take part in the 2021 Community Challenge by having your community officially proclaim May 9 to 15 as International Economic Development Week.

It's easy; here's how:

1. Customize the attached sample resolution
2. Have your Council/Mayor officially proclaim the week in your community and sign the resolution
3. Share the proclamation with local media, and on your social media pages. Don't forget to tag us @edaalberta.
4. Email admin@edaalberta.ca and it will be added to the EDA website.

Our Goal: To have at least 25 Alberta communities, large and small, proclaim May 9 – 15, 2021 International Economic Development Week.

Your involvement in the 2021 Community Challenge gives you a voice. It lets your community know you value the contribution of economic development, and helps you strengthen support for the work your economic development staff does throughout the year.

For more information on International Economic Development Week, visit the EDA website: www.edaalberta.ca/Economic-Development-Week.

Sample City/Town/Village Resolution for Economic Development Week

Resolution

WHEREAS, the International Economic Development Council is the largest professional economic development organization dedicated to serving economic developers; and

WHEREAS, for almost 50 years, Economic Developers Alberta has been Alberta's leading economic development network, committed to advancing the economic development profession by providing resources, professional development and networking opportunities; and

WHEREAS, economic developers promote economic well-being and quality of life for their communities by creating, retaining, and expanding jobs that facilitate growth, enhance wealth, and provide a stable tax base; and

WHEREAS, economic developers stimulate and incubate entrepreneurism in order to help establish the next generation of new businesses, which is the hallmark of Alberta's economy; and

WHEREAS, economic developers are engaged in a wide variety of settings including rural and urban, local, state, provincial, and federal governments, public-private partnerships, chambers of commerce, universities, and a variety of other institutions; and

WHEREAS, economic developers attract and retain high-quality jobs, develop vibrant communities, and improve the quality of life in their regions; and

WHEREAS, economic developers work in the City/Town/Village of _____; and

NOW, THEREFORE, BE IT RESOLVED that the Mayor does hereby recognize May 9-15, 2021 as "Economic Development Week" in ____, and remind individuals of the importance of this community celebration which supports the expansion of career opportunities and improving quality of life.

BE IT FURTHER RESOLVED that the Mayor is authorized and directed to transmit an appropriate copy of this resolution to Economic Developers Alberta in support of these provincial celebrations.

_____

Mayor

ALBERTA
JUSTICE AND SOLICITOR GENERAL

Office of the Minister
Deputy Government House Leader
MLA, Edmonton - South West

AR 45229

April 6, 2021

Reeve Brian Hammond
MD of Pincher Creek
1037 Herron Avenue
PO Box 279
Pincher Creek AB T0K 1W0

Dear Reeve Hammond:

Thank you for your letter of March 15, 2021, regarding the Summit on Policing, held on February 17, 2021. As Minister of Justice and Solicitor General, I appreciate the opportunity to respond.

During my presentation, I highlighted the Government of Alberta's commitment to conduct further study into the Fair Deal Panel's recommendation to create an Alberta provincial police service to replace the RCMP. Justice and Solicitor General, along with its project contractor PricewaterhouseCoopers (PwC), is currently conducting a feasibility study on the costs, benefits, and structure of a potential Alberta provincial police service.

The Fair Deal Panel consulted with tens of thousands of Albertans and heard about many rural Albertans' frustrations with the RCMP and additionally, consulted with policy experts and undertook research to inform its recommendations. As indicated in the Fair Deal Panel's report, that although many Albertans express their appreciation and respect for the work of hardworking rank and file members in the RCMP who serve our communities, many Albertans are also frustrated with the challenges of a police force that is ultimately managed in Ottawa.

The Government of Alberta has an obligation to listen to the concerns of its citizens, undertake a thorough study of the topic, and make an informed decision on whether an Alberta provincial police service can improve the safety and security of Albertans and their property. Through this

.../2

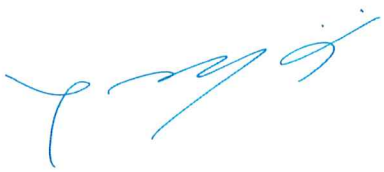
study, we also have a responsibility to see if there are new approaches to provincial policing that can provide greater value for taxpayers, while strengthening the connection between police and communities they serve.

Police have an essential role in protecting our communities – which is why we will ensure police funding is used to keep Albertans safe. As part of the study, PwC has been asked to develop a model of provincial policing that increases citizen input, enhances connections to the community, improves services, leverages efficiencies, reduces bureaucracy, and does not impose additional costs on municipalities.

PwC is expected to present their report to the provincial government on April 30, 2021. If the Alberta government decides to proceed with further analysis, Justice and Solicitor General will conduct further study and engagement, which will include local policing perspectives from municipal partners.

Thank you again, for taking the time to write. I look forward to working with you further as we ensure all Albertans feel safe, secure, and protected in their communities.

Yours very truly,



Kaycee Madu, QC
Minister

cc: Roger Reid, MLA, Livingstone-Macleod

MUNICIPAL DISTRICT OF RANCHLAND NO. 66

P.O. Box 1060, NANTON, ALBERTA T0L 1R0 • Ph. 403-646-3131 Fax 403-646-3141

By Regular Mail and Email: *ec.ministre-minister.ec@canada.ca*

iaac.vancouver.aeic@canada.ca

March 23, 2021

The Honourable Jonathan Wilkinson
Minister of Environment and Climate Change
Fontaine Building, 2nd Floor
200 Sacré-Coeur Boulevard
Gatineau, QC K1A 0H3

Dear Sir:

Re: Montem Resources Alberta Operations Ltd.'s Tent Mountain Project

As the Council of the Municipal District of Ranchland No. 66 we have concerns regarding the potential of this Mine (**Tent Mountain Project)** creating contamination in the Oldman River Basin Water Shed in category 2 lands, as those lands are defined in The Coal Development Policy for Alberta (the "1976 Coal Policy").

Our Municipality is seeking an impact assessment of Montem Resources Alberta Operations Ltd.'s proposed Tent Mountain Project ("Tent Mountain") pursuant to section 9(1) of the Impact Assessment Act.
We repeat the submissions made in the March 2, 2021 correspondences sent by the Blood Tribe/Kainai and Siksika Nation, copies of which are enclosed.

The March 2, 2021 correspondences provide sound bases for you to exercise your discretion under section 9(1) and require an impact assessment of Tent Mountain. The arguments contained in the letters outline your expansive jurisdiction over Tent Mountain, notwithstanding that the project is 75 tonnes/day short of the threshold set out in section 18(a) of the Physical Activities Regulations.

In addition to the arguments contained in the March 2, 2021 correspondences, the Municipality provide the following rationale for exercising your jurisdiction accordingly.

Species at Risk Act

Tent Mountain is in designated critical habitat for both the bull trout and Westslope cutthroat trout. The designations were issued under two separate Recovery Strategies, incorporated under section 44 of the Species at Risk Act. The Westslope cutthroat trout recovery strategy was incorporated December 12, 2019 and the bull trout recovery strategy was incorporated September 10, 2020.

Enclosed are extracted portions of both recovery strategies.

The following watersheds contain critical habitat and are directly impacted by Tent Mountain (among others):

- Castle River (page 41 of the Westslope cutthroat trout recovery strategy; page 79 of the bull trout recovery strategy);
- Crowsnest River (page 42 of the Westslope cutthroat trout recovery strategy; page 82 of the bull trout recovery strategy); and
- Oldman River (page 48 of the Westslope cutthroat trout recovery strategy; page 96 of the bull trout recovery strategy).

Each of these watersheds will be directly impacted by Tent Mountain. Significantly, the Castle River watershed will suffer a catastrophic impact should the project proceed. It is one of the most significant watersheds for both species.

The Recovery Strategies also set out a list of activities likely to destroy critical habitat. The list includes water extraction, mechanical forest removal, linear disturbances, mining and off highway vehicle use.

Each activity is contemplated in Tent Mountain. We refer you to part 4.3 of the Westslope cutthroat trout recovery strategy and Part 5 of the bull trout recovery strategy, enclosed.

Selenium, a chemical element released in watersheds from coal mining activities, is known to cause debilitating deformities in Westslope cutthroat trout and bull trout. Tent Mountain is in the headwaters for a significant portions of the species' critical habitat and will catastrophically impact downstream populations.

Section 58 of the Species at Risk Act sets out a prohibition on the destruction of any critical habitat for an aquatic species:

Destruction of critical habitat

58(1) Subject to this section, no person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species — or of any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada — if

(b) the listed species is an aquatic species;

Successive courts have held that your ministry and the Minister of Fisheries, Oceans and the Canadian Coast Guard, not only have the jurisdiction to protect the critical habitat for aquatic species listed under the Species at Risk Act—you are legally required to. The Federal Court of Appeal in Canada (Fisheries and Oceans) v David Suzuki Foundation held as follows:

> [117] Section 57 of the SARA provides in no uncertain language that the purpose of section 58 is to ensure that all the critical habitat is protected by provisions in, or measures under, an Act of Parliament or by a protection order issued under subsections 58(1) and (4) of the SARA. Surely this is an indication that there must be some equivalence between the two contemplated means of protection. They need not be the same, but surely they must have the same objective. Pursuant to subsection 58(1), the objective of a protection order is to ensure that "no person [...] destroy any part of the critical habitat of any listed endangered species or of any listed threatened species [...] if the listed species is an aquatic species". Provisions in, or measures under, an Act of Parliament should thus – in principle – achieve the same objective if they are to be resorted to as a substitute to a protection order.
>
> [emphasis in original]

In addition to your jurisdiction to legally protect critical habitat, your ministry and the Minister of Fisheries, Oceans and the Canadian Coast Guard have the jurisdiction to issue protection orders under section 80 of the Species at Risk Act.

In Le Groupe Maison Candiac Inc. v Attorney General of Canada, the Federal Court of Appeal confirmed that you have the jurisdiction to issue protection orders under section 80 for species within provincial jurisdiction:

> [2] The appellant has challenged each of these conclusions before us. It essentially argued that the Federal Court made an error of law in concluding that the enabling statute suppresses an "evil" within the meaning of 91(27) of the Constitution Act, 1867, 30 & 31 Victoria, c. 3 (U.K.), reproduced in R.S.C., 1985, App II, No. 5 (Constitution Act, 1867) and does not encroach on provincial jurisdiction. It also argued that the Federal Court erred in considering that the concepts of disguised or de facto expropriation did not apply in this case.
>
> [3] Having carefully weighed the arguments of the parties and considered the applicable law, I am of the view that this appeal should be dismissed.

Your government's jurisdiction to protect species listed under the Species at Risk Act provides a sound basis to require an impact assessment. An assessment is the most comprehensive mechanism available to evaluate the impact of Tent Mountain on the critical habitat of listed species. It is necessary in this case because Tent Mountain's impact over both species will be significant.

Preamble to the Impact Assessment Act

Legislative "preambles are relied on most often in statutory interpretation to reveal legislative purpose, either directly by setting out the purposes of the legislation or indirectly by describing the evils or concerns that motivated the legislature": Sullivan, Ruth, Statutory Interpretation at p 162 – 165. In this regard, the preamble to the Impact Assessment Act is telling:

> Whereas the Government of Canada is committed to fostering sustainability;
>
> Whereas the Government of Canada recognizes that impact assessments provide an effective means of integrating scientific information and Indigenous knowledge into decision-making processes related to designated projects;
>
> Whereas the Government of Canada recognizes the importance of public participation in the impact assessment process, including the planning phase, and is committed to providing Canadians with the opportunity to participate in that process and with the Information they need in order to be able to participate in a meaningful way;
>
> Whereas the Government of Canada is committed, in the course of exercising its powers and performing its duties and functions in relation to impact, regional and strategic assessments, to ensuring respect for the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the Constitution Act, 1982, and to fostering reconciliation and working in partnership with them;
>
> Whereas the Government of Canada is committed to implementing the United Nations Declaration on the Rights of Indigenous Peoples;
>
> Whereas the Government of Canada recognizes that impact assessment contributes to Canada's ability to meet its environmental obligations and its commitments in respect of climate change;
>
> And whereas the Government of Canada recognizes the importance of regional assessments in understanding the effects of existing or future physical activities and the importance of strategic assessments in assessing federal policies, plans or programs that are relevant to conducting impact assessments;

Three themes are highlighted in the preamble to the Impact Assessment Act. They are, in order of prominence: indigenous relations, protecting the environment and public participation. Each of those elements add further bases to requiring an impact assessment over Tent Mountain.

The March 2, 2021 correspondences outline the importance placed upon the Tent Mountain lands to First Nations. They articulate the historical and current reliance upon those lands.

The remaining themes are noteworthy. The environment is a key factor, both in terms of contributions to climate change and the destruction of physical and aquatic spaces.

As highlighted by this correspondence, there is a clear desire for public participation in the decision to approve Tent Mountain. The diversity of voices concerned about Tent Mountain is, on its own, sufficient to ground your powers under section 9(1). Your ability to require an impact assessment may be predicated on "public concerns related to those effects warrant[ing] the designation" as that phrase is found in section 9(1).

A chorus of voices have spoken against expanded coal mining in the Eastern Slopes. There is clearly a public concern about development and that concern merits an impact assessment.

The preamble provides further support for requiring an impact assessment in this case. Evaluating Tent Mountain through the Impact Assessment Act falls within the express purpose of the Act.

Cumulative Effects

The March 2, 2021 correspondences outline the cumulative effects associated with Tent Mountain.

We as the Municipality representing grazing lease holders and residents are not directly affected by Tent Mountain. However, the cumulative affects associated with multiple heavy resource extraction projects does have a direct impact on our infrastructure and services to our residents.

Our residents currently draw water from the Oldman and Livingston Rivers for their and their livestock's survival. Further pressure on those watersheds will impact our clients because water will need to be reallocated to accommodate the addition of Tent Mountain's industrial output.

There is a dearth of water in South Western Alberta.

There is no capacity to support this project.

Closing Remarks

The purpose of this correspondence was twofold: to provide you with further bases to found your jurisdiction to require an impact assessment of Tent Mountain and to inform you that a diverse array of Canadians seek further participation in the Tent Mountain approval process. These two facts support you exercising your discretionary authority to require an impact assessment.

Yours very truly,

Reeve;

Ron Davis

Encl.:

March 2, 2021 correspondence sent by Blood Tribe/Kainai
March 2, 2021 correspondence sent by Siksika Nation
Extracts of the Westslope Cutthroat Trout Recovery Strategy
Extracts of the Bull Trout Recovery Strategy.

Cc:
Janet Shaw, Impact Assessment Agency of Canada (janet.shaw@canada.ca)
Reeve Hammond, Municipal District of Pincher Creek No. 9
Mayor Painter, Municipality of Crowsnest Pass
Shireen Ouellet (souellet@montem-resources.com)
Robert Drummond (robert.drummond@justice.gc.ca)

KAINAIWA

Tribal Government & External Affairs
Box 60
Standoff, AB T0L1Y0
Phone: (403) 737-3753
Fax: (403) 737-2336

March 2, 2021

Via email
(ec.ministre-minister.ec@canada.ca)
(iaac.vancouver.aeic@canada.ca)

Attn: The Honourable Jonathan Wilkinson
Minister of Environment and Climate Change
Environment and Climate Change Canada: Pacific and Yukon Office
401 Burrard Street, Vancouver, BC V6C 3R2

Re: Request for federal review of Montem Resource's Tent Mountain Project

---

On behalf of the Blood Tribe/Kainai I write to request that the Minister designate Montem Resources' Tent Mountain Project ("Tent Mountain" or the "Project") for an impact assessment under section 9(1) of the *Impact Assessment Act*, SC 2019, c 28, s 1 (the "**Act**").

The Eastern Slopes of the Rocky Mountain have long been an area critical to the practice of Kainai rights, including harvesting, trade and spiritual practices. The traditional practices conducted on the land and waters are integral to Kainai's physical and cultural wellbeing. The Project is also within the headwaters of the Oldman River Basin which is source water to our community.

The cumulative impact of various activities including agricultural development, the development and expansion of municipalities, the transfer of lands to private landholders, conservation areas, tourism and recreation, and mining and other industrial activities have resulted in much of Kainai's traditional territory being taken up by

activities that are inconsistent with the practice of Kainai's Treaty rights and culture. Kainai is becoming increasingly concerned with the level of proposed development, and particularly coal development, in and around the Eastern Slopes.

Kainai submits that Tent Mountain should be designated for federal review because the project:

- has a capacity near a threshold set out in the Project list – Tent Mountain is designed to release 4,925 raw tonnes per day, which is exceptionally close to the 5,000 tonnes per day threshold set out in s. 18(a) of the Physical Activities Regulations, SOR/2019-285;
- is located in an environmentally sensitive area - notably, it is located in the Livingstone Hills Land Management Zone protected by the Livingstone-Porcupine Hills Footprint Land Management Zone, which is part of the internationally significant "Crown of the Continent Ecosystem" an ecologically significant area that comprises the headwaters of North America's three great watersheds;
- may contribute to pollution of drinking water for Kainai's on-reserve population as well as Alberta's general population;
- may adversely impact areas of federal jurisdiction including: Indigenous peoples, federal reserve lands, transboundary waters, and fish and fish habitat.
- may significantly and adversely affect Kainai's ability to practice Aboriginal and Treaty rights; and
- will contribute to the cumulative impacts of coal and other development on both the BC and Alberta sides of the provincial border.

In addition, Kainai submits the proposed provincial review by the Alberta Energy Regulator is insufficient to appropriately identify the impacts to areas of federal jurisdiction, including on Kainai's rights.

Details of the above concerns are set out below.

The Project

Tent Mountain is a coal mine proposed by Montem Resources Alberta Operation Ltd., a subsidiary of the Australian company Montem Resources Limited. If approved, the 750 ha Tent Mountain project area will be located 26 km west of Coleman, Alberta, within the municipality of Crowsnest Pass. The Project will include a 14-year open-pit mining program at the site, a new coal handling and processing plant adjacent to mine operations, and a loading facility located primarily in BC. This site previously hosted an operating mine from 1948 to 1983, and as such, already has an applicable mine permit (C85-16G) and an Environmental Protection and Enhancement Act approval (No. 47679).

Due to these existing permits and an environmental assessment that occurred sometime in the 1970s, we understand that Montem Resources initially expected to commence project operations without an additional environmental assessment. However, on January 8, 2021, the Alberta Energy Regulator determined that given the substantial changes to the previously authorized activity that would be required, a new provincial Environmental Impact Assessment would be necessary.

Tent Mountain requires a federal review

Following the guidance set out by the Impact Assessment Agency of Canada (the "**Agency**") we provide the following information in support of the request to designate Tent Mountain for federal review.

a. The project capacity is exceptionally close to the threshold for federal review

Section 18(a) of the Physical Activities Regulations, SOR/2019-285 sets out that any coal mine with a coal production of 5,000 tonnes per day or more is subject to a federal review. Tent Mountain is designed to release 4,925 raw tonnes per day. Therefore, the Tent Mountain project is only 75 tonnes per day below the threshold.

By skirting just below the thresholds for federal designation, Tent Mountain is just narrowly avoiding a federal impact assessment.

Taken together with the other proposed projects in the area, most notably North Coal's Michel Coal Project proposed directly adjacent to Tent Mountain on the BC side, the coal production capacity in this area, and the related environmental impacts, are slated to increase significantly. The proximity to the threshold and the significant coal development in the area gives rise to the need for a federal review.

b. The project is in an environmentally or otherwise sensitive location

The Project is located within areas identified as environmentally significant and of significant importance to Indigenous peoples and Albertans.

The Project is located within the area managed by the Livingstone-Porcupine Hills Land Footprint Management Plan (the "Livingstone-Porcupine Hills Plan" or the "Plan") - a sub-regional plan (under the South Saskatchewan Regional Plan) that provides direction for the long-term cumulative effects of development or other activities on public lands in the area.[1] The Livingstone-Porcupine Hills Plan:

> outlines a system to minimize the extent, duration and rate of cumulative footprint to achieve landscapes with health, functioning ecosystems that provide a range of benefits to communities and all Albertans.[2]

The Plan recognizes the impacts of the use of the area for forestry, mining, grazing, tourism, and recreational activities and identifies how these "uses transform the landscape from its natural condition and contributes to the overall disturbance and human footprint".[3] To manage the area, which includes the eastern slopes of the Rocky

---

[1] Government of Alberta, "Livingstone-Porcupine Hills Land Footprint Management Plan" (2018), [Livingstone-Porcupine Hills Plan]; Note: Specifically, Tent Mountain is located within the Livingstone Public Land Use Zone.
[2] Livingstone-Porcupine Hills Plan, p 3.
[3] Livingstone-Porcupine Hills Plan, p 3.

Mountains, the Government of Alberta, in the South Saskatchewan Regional Plan, set out a management intent which states:

> The management intent for public land in the Eastern Slopes is for integrated management that incorporates the objectives for biodiversity and healthy, functioning ecosystems, to achieve multiple objectives. Watershed management and headwaters protection is the highest priority. Forests will be managed with this as the highest priority (including water storage, recharge and release functions) … Other values such as biodiversity, forest ecosystem resiliency (natural disturbance patterns) and timber supply will be key secondary management priorities [citations omitted].[4]

This complex landscape is "an integral part of the internationally significant Crown of the Continent Ecosystem" an ecologically important area that "comprises the headwaters of North America's three great watersheds (the Saskatchewan, Missouri and Columbia River systems) and is recognized as critical to the protection of wildlife, landscapes and water".[5]

In addition to recognizing the important ecological areas and environmental features of the area, the Livingstone-Porcupine Hills Plan also notes that the area includes the "hunting and gathering, and ceremonial places that lie within traditional territories of multiple First Nations" and notes that the "Livingstone and Porcupine Hills area provided sustenance, materials, medicines, and sacred places for First Nations since time immemorial and is expected to continue to do so for generations yet to come".[6] Further strengthening the potential impact to Aboriginal and Treaty rights by development in the area, the Plan identifies the intimate connection amongst Indigenous peoples and the land and the risk for continued use due to "climate change, industrial development, and unmanaged recreational use".[7]

---

[4] Livingstone-Porcupine Hills Plan, p 4.
[5] Livingstone-Porcupine Hills Plan, p 5.
[6] Livingstone-Porcupine Hills Plan, p 25.
[7] Livingstone-Porcupine Hills Plan, p 25.

The Livingstone-Porcupine Hills Plan is intended to be "consistent with First Nations ability to continually exercise their Treaty rights and to acknowledge and maintains the relationship that Indigenous Peoples have with the land and the importance of their activities on the land".[8] Projects like Tent Mountain make this objective very difficult to achieve.

The Project Summary also notes that the Project area is at the headwaters of a drainage area that feeds the Crowsnest River and is part of the Oldman River Basin. The Proponent concedes that "[t]here are significant water quantity concerns in the Oldman River Basin for the use of water for industrial purposes" continuing that "[t]here are only limited amounts of groundwater available as the Project area is at higher elevations".[9]

Issues with selenium and other metals associated with runoff water from mine operations elevate this concern.[10] The Proponent states that these water quality concerns may be mitigated, and even improved, by a modern water management regime that meets or exceeds the licensed requirements but this remains to be seen. Kainai's experience is that modern water management regimes for coal projects have not been effective in improving water quality in the region. This is of particular concern for Kainai as the Oldman River Basin provides drinking water for the approximately 8,500 Kainai members living on Kainai's reserve lands.[11]The Project Summary also provides that the Project is located in management zones for Grizzly bear, Bighorn sheep, Mountain goat, Limba pine, and Whitebark pine. The Grizzly bear is a species of

---

[8] Livingstone-Porcupine Hills Plan, p 25.
[9] Project Summary, p 14, PDF p 16.
[10] Note: Recognition of the water issues associated with coal mining have been noted in recent news articles: Croteau, Jill. Environmental groups warn Alberta about Elk Valley coal mine contamination, *Global News* (2 February 2021), online: <https://globalnews.ca/news/7611152/environmental-groups-alberta-elk-valley-coal-contamination/>.
[11] Statistics Canada, *Aboriginal Population Profile, 2016 Census: Blood Tribe* <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/abpopprof/details/page.cfm?Lang=E&Geo1=AB&Code1=2016C1005418&Data=Count&SearchText=Blood%20Tribe&SearchType=Begins&B1=All&GeoLevel=PR&GeoCode=2016C1005418&SEX_ID=1&AGE_ID=1&RESGEO_ID=1>

special concern listed under Part 4 of the *Species at Risk Act* and Whitebark pine is listed as an Endangered Species under Part 2 of the *Species at Risk Act*.

These environmental impacts will also adversely affect Kainai's ability to exercise their Treaty rights and related cultural practices. For instance, Bighorn sheep are a species of cultural importance to Kainai. Impacts to the Bighorn sheep wintering range will likely have corresponding impacts on Kainai's ability to practice its treaty rights in relation to bighorn sheep. It is critical that these impacts be adequately considered and assessed.

c. *The project has the potential to cause adverse effects that are of concern to Kainai and fall within federal jurisdiction*

Tent Mountain may cause adverse effects to a number of resources that fall within the jurisdiction of the federal government, including fish and fish habitat, migratory birds, changes to the environment outside of Alberta, and importantly, adverse impacts on Kainai's Aboriginal and Treaty rights.

As Tent Mountain is in the early stages of exploration and environmental assessments have not yet been completed to determine the specific impact of this mine on the environment, we ask that you consider the precautionary principle noted as Principle 4 in the Sustainability Guide[12] and mandated in s. 6(1)(l) of the Act.

i. *The project has the potential to cause adverse impacts on Kainai section 35 rights*

Section 9(2) of the Act explicitly lists adverse impacts on the rights of Indigenous peoples as something that the Minister may consider when making a designation decision. Tent Mountain has the potential to cause adverse impacts to Kainai's ability to exercise their Aboriginal and Treaty rights.

Kainai are members of the Blackfoot Confederacy and made treaty with the British Crown in 1877 under the Blackfoot Treaty, also referred to as Treaty 7. Tent Mountain is

[12] Cite: https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act/guidance.html

within the traditional territory of Kainai.[13] The area in and around Tent Mountain was used extensively by Kainai for travel, trade, harvesting, and ceremonial purposes, and continues to be an area of importance for the exercise of Treaty rights and related cultural practices.[14]

The taking up of lands within Blackfoot traditional territory for coal mining, urban development, farming, and the loss of available crown land to oil and gas extraction and forestry has increased the importance of the foothills and front ranges of the Rocky Mountains for Kainai. The few remaining landscapes within Blackfoot territory where Kainai can still hunt, gather, trap, fish and camp include the Crowsnest Pass and Elk River valleys, which are at risk of destruction from large-scale coal projects like Tent Mountain.[15] Kainai continues to hunt for elk, mule deer, bighorn sheep, moose and occasionally bear in the foothills and front slopes of the Rocky Mountains.[16]

The adverse effects to wildlife habitat, migratory birds, and fish and fish habitat outlined above will further impede Kainai's ability to carry out their hunting and fishing rights.

In addition to hunting, the Crowsnest Pass and East Kootenays are currently used by Blackfoot people to harvest a variety of food and medicinal plants.[17] Blackfoot people continue to travel through the Crowsnest Pass, Sparwood, and Fernie areas to pick a variety of plants for food and medicinal purposes including roots, stems, leaves, and berries. Gathering plants for food, for medicines, and to use as fuel or for building materials brings Blackfoot people in touch with sacred sites.[18]

Tent Mountain may also interfere with Kainai's ability to carry out important religious, legal, and cultural practices.[19] Blackfoot spiritual leaders and harvesters continue to use Crowsnest Pass, Elk Valley and upper Old Man River valley to obtain materials for

---

[13] Dermot O'Connor, *Review of the Literature on Blackfoot Use and Occupancy of the Crowsnest Pass & East Kootenays,* Oak Road Concepts, (May 2020), p 2 [Oak Road Report].
[14] Oak Road Report, p 3.
[15] Please see enclosed cumulative impacts report produced by IEG for the Grassy Mountain Project, which identifies the diminishing lands available for Aboriginal and Treaty rights practice.
[16] Oak Road Report, p 22.
[17] Oak Road Report, p 23.
[18] Oak Road Report, p 23.
[19] Oak Road Report, pp 23-24.

sacred materials such as ochre paint, pipestone, and rare plant species. Special locations for collection of these materials are still visited regularly by Blackfoot people, emphasizing the continued connection of these places to Blackfoot culture, spirituality, and material culture.[20] Seasonal pilgrimages and gathering expeditions to sacred sites in these areas demonstrate the ongoing centrality of the Crowsnest Pass in Blackfoot culture, spirituality, and traditional knowledge. Cultural transmission is integral to the ability of Kainai to pass down their ways of life.

More information about the Blackfoot's historic and continued use of this area can be found in the *Review of the Literature on Blackfoot Use and Occupancy of the Crowsnest Pass & East Kootenays* by Dermot O'Connor, to be considered in support of this request.

ii. The project may adversely affect aquatic species, fish and fish habitat

Kainai is concerned that Tent Mountain may have effects on aquatic species. Although the Proponent has not yet provided sufficient information to determine the extent of the impact on fish and fish habitat, similar proposed mines in the area have been determined to have detrimental effects on the high-value habitat of the Westslope Cutthroat trout, and other fish species of importance.

In BC, Teck's Fording River Operations have already had adverse effects on this species, with recent surveys showing a 93 percent decline in the Westslope Cutthroat trout population just downstream of its Fording River mine.[21]

The Initial Project Description for the Fording River Extension Project, recently designated for federal review, highlighted potential effects on aquatic species as defined in subsection 2(1) of the *Species at Risk Act*, including the effects on the westslope cutthroat trout. Also noted in that project, recent monitoring of certain sensitive benthic invertebrate communities has shown that mine exposure results in adverse effects like

[20] Oak Road Report, pp 23-24.
[21] Paul Fischer, "Teck proposal to expand B.C.'s largest coal mine raises alarm about pollution on both sides of border", *The Narwhal* (17 June 2020) online: <thenarwhal.ca/teck-expand-castle-mountain-largest-coal-mine-selenium-pollution/>.

reductions in the abundance of certain species (e.g. mayflies), and increased tissue selenium concentrations.[22]

iii. The project will have impacts across provincial borders

Although Tent Mountain is located along the provincial border on the Alberta side, its proximity to the BC Border means that it has the potential to cause environmental changes across the provincial border. For instance, Tent Mountain will impact the wildlife habitats of species such as bighorn sheep. Bighorn sheep habitat lies on both sides of the Rocky Mountains. Impacts to that habitat on the BC side of the border may have impacts on the viability of the species more generally.

In addition, Tent Mountain may also create interprovincial impact through the pollution of the Oldman River, which flows across Alberta into Saskatchewan.

Selenium pollution has been a major issue with coal mines in this area. Across the border in BC, the Elk Valley Water Quality Plan, established by Teck and the BC Government, monitors selenium and other pollution from the mines in an attempt to stabilize and then reduce selenium quantities in the rivers. A recent release of previously unreported Government of Alberta data found that water samples taken from 1998 through 2016 averaged six (6) times higher selenium downstream from the Cheviot Mine than in upstream samples. For Gregg River and Luscar Creek, the pollution was even starker with samples average nine (9) and eleven (11) times higher selenium content, respectively.[23]

Additionally, the US Environmental Protection Agency is currently calling for a review of Teck Coal Limited's contamination of the Kootenai watershed, which flows across Montana and Idaho. Moreover, the Tribal Councils of the Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho also requested that the Fording River Extension, the addition to the Fording River Operations, be designated for a federal

---

[22] Teck Coal Limited, "Initial Project Description: Castle Project" (March 2020), pp 60-61 <link>.
[23] Bob Weber, "Contaminant from coal mines already high in some Alberta rivers: unreported data", *Global News* (25 January 2021) online: <https://globalnews.ca/news/7597303/alberta-rivers-coal-mines-contamination/>.

impact assessment due to potential cross-border impacts including contamination of transboundary waters.[24]

Although the impacts of Tent Mountain appear to be on the Oldman River Basin, which does not flow directly into the United States, it flows across Alberta into Saskatchewan. Moreover, the Oldman River Basin is source water for drinking water systems and agriculture for Kainai's reserve – a supply for approximately 8,500 people on the largest First Nation reserve in Canada. Environmental impacts beyond the jurisdiction where the project is taking place and affecting Indigenous people and reserve lands fall well within the federal government's jurisdiction and should be reviewed by the federal government.

In addition to cross border environmental concerns, it appears the Tent Mountain project itself spans the AB-BC provincial border. The Project Summary notes in the project description that a new coal handling and processing plant will be built "immediately adjacent to the mine operations" and a loading facility will be "located primarily within the Province of BC".[25]

d. The Project will contribute to the already significant level of cumulative development in the area

Given the significant level of historical, ongoing and future planned development, it is critical that the cumulative impacts of this development on both sides of the Alberta-British Columbia Border be adequately assessed. Please see Figure 2 below depicting the current total anthropogenic footprint from a cumulative effects assessment conducted for the Grassy Mountain Project in 2018.

---

[24] Letter from the Tribal Councils of the Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho to the Honourable Jonathan Wilkinson (12 May 2020) online (pdf): <iaac-aeic.gc.ca/050/documents/p80702/134822E.pdf>.

[25] Montem Resources, "Resuming Activities – Tent Mountain Mine Coal Handling and Processing Plan Project Description, Project Summary Table (February 2021), p 1, PDF p 3.

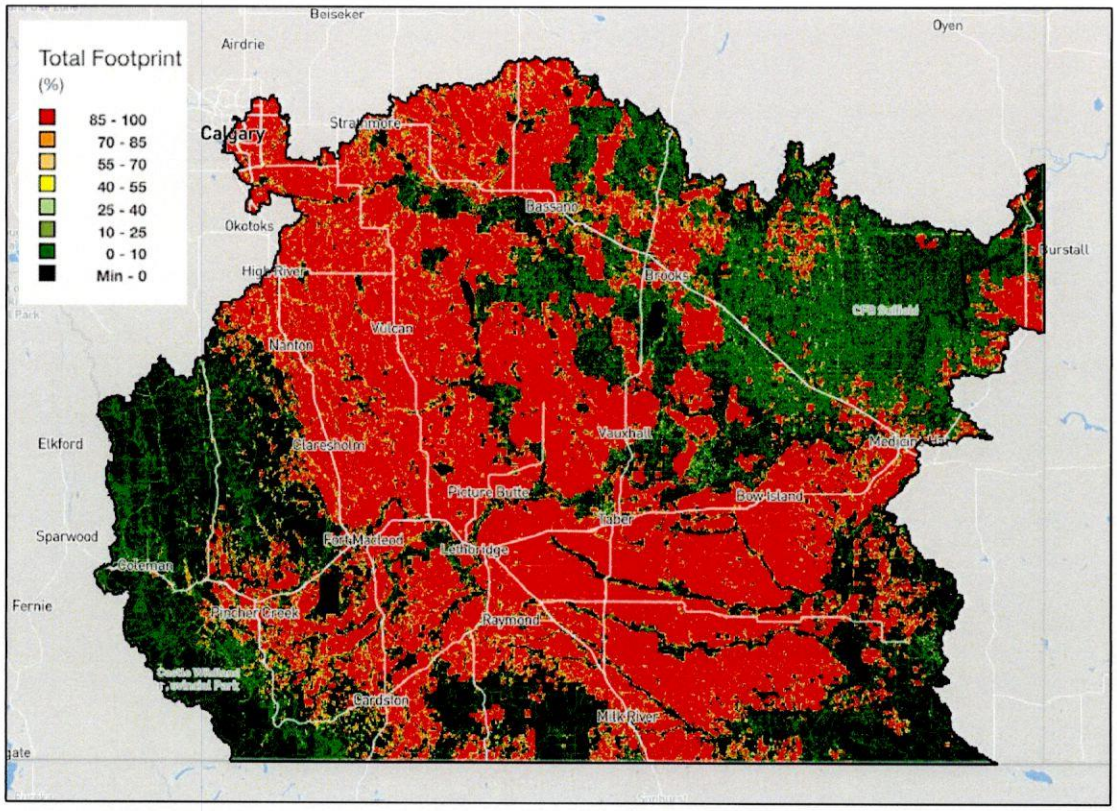


Figure 2 - Current total anthropogenic footprint in the regional study area. Red indicates high intensity footprint while green indicates low intensity footprint. The legend shows the proportion of each pixel occupied by footprint features.[26]

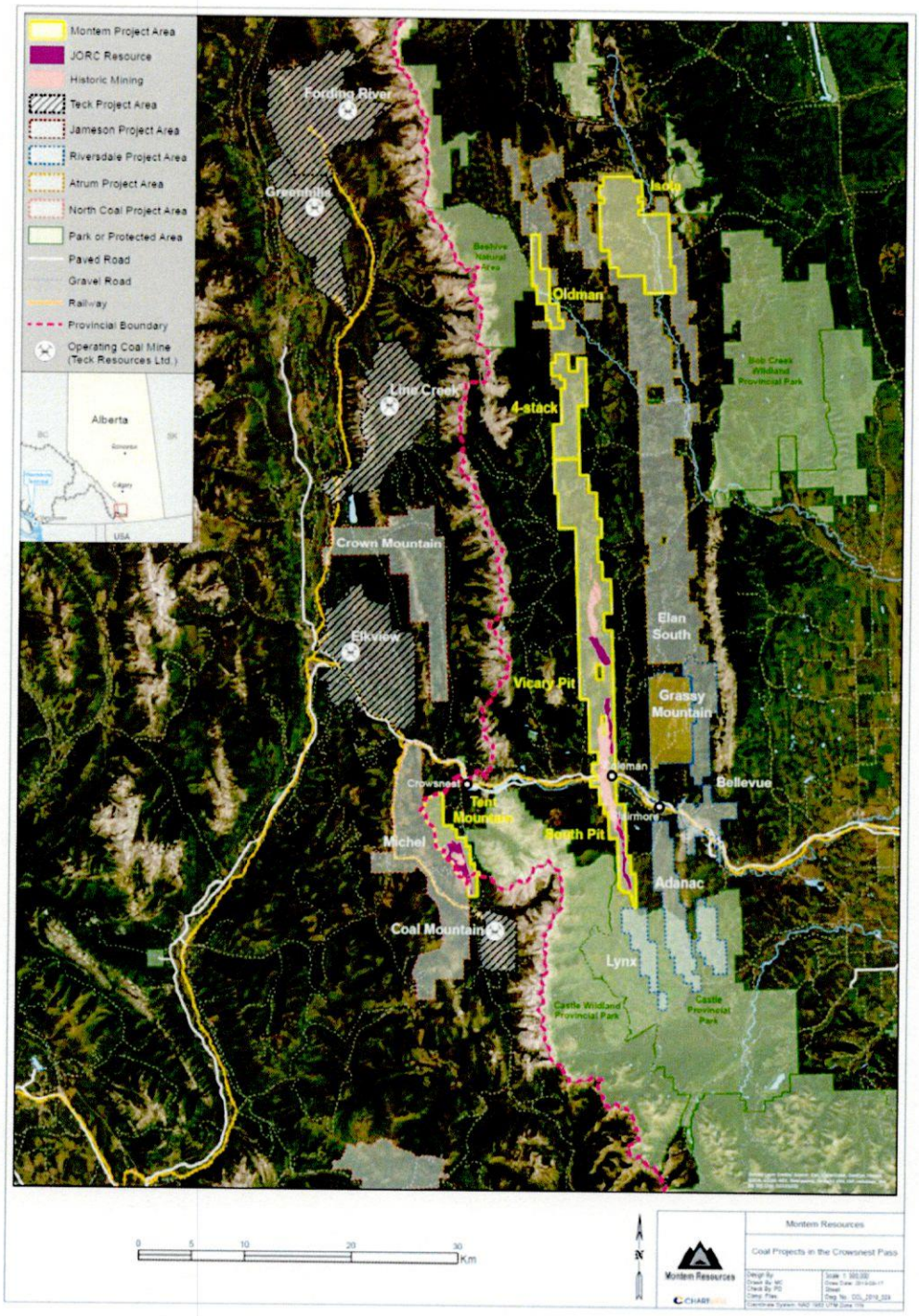
Coal has been mined in the Elk Valley since the late 1890s, with the Elk Valley coalfield being one of the major coal-producing areas in Canada. This specific site has already been mined for nearly 40 years.

Other projects planned in the vicinity of Tent Mountain include North Coal's Michel Coal Project, an expansion of Teck's Fording River Operations, Atrum's Isolation South Lease, NWP's Crown Mountain Mine, and Riversdale Resource Limited's Grassy Mountain Coal Mine. This is in addition to the already existing projects including Teck's Line Creek Mine, Greenhills Mine, Elkview Mine, and Coal Mountain Mine. As well as Montem Resource's 10,000 ha Chinook Project near Coleman, Alberta, which it is

[26] IEG Consulting, "Cumulative effects assessment for Kainai First Nation" (9 November 2018) Figure 2, p 8, PDF p 17.

pushing to develop, and its exploration projects: Isola, 4-Stack, and Oldman located further north of Tent Mountain and Chinook.

Please see below for a regional overview of the coal projects in the area.



As noted, North Coal's Michel Coal Project is located directly adjacent to Tent Mountain on the BC side of the border. Please see the Michel Coal Project boundary outlined in green.

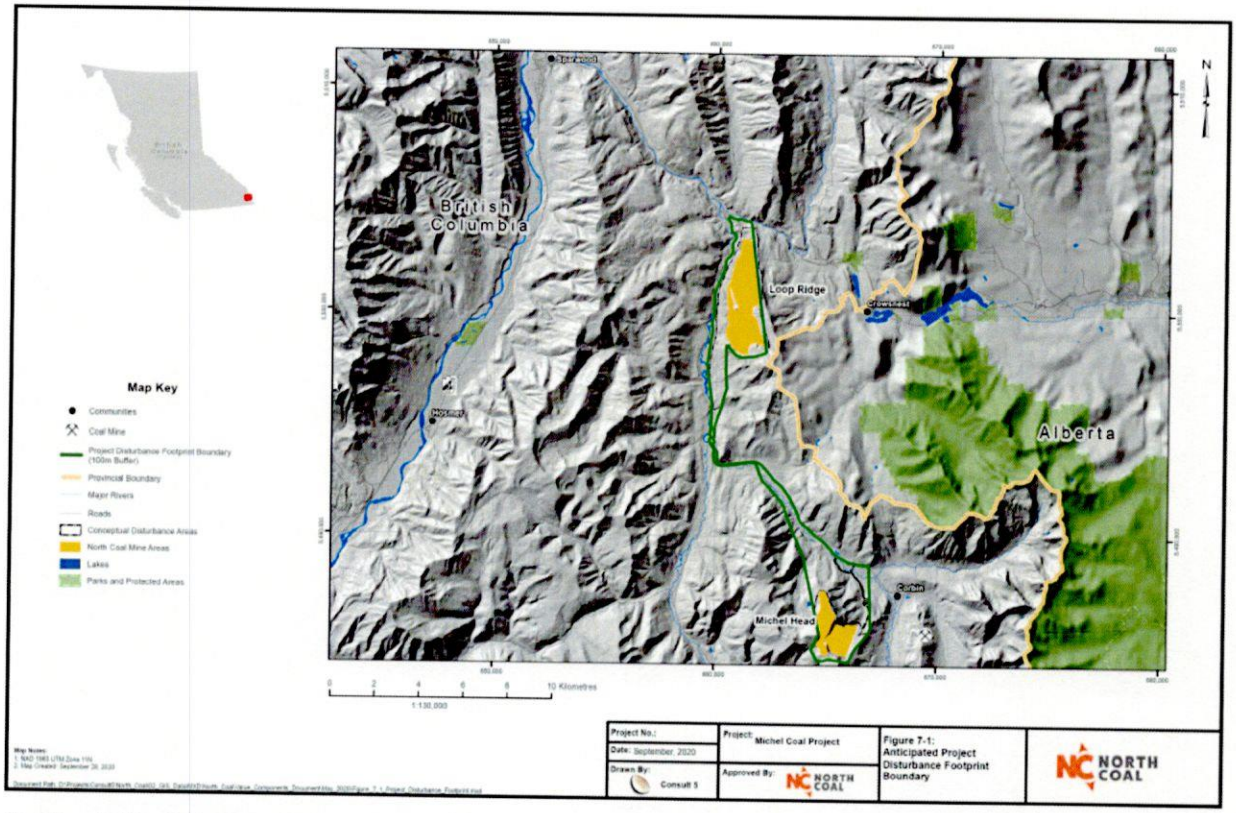


Figure 7-1: Anticipated Project Disturbance Footprint Boundary

Despite this extreme proximity, neither the Tent Mountain project Terms of Reference nor the Project summary expressly deal with the presence of the Michel Coal Project.

The cumulative impact of this activity has the potential to significantly and adversely impact the ecological integrity of the area, and Kainai's ability to use this area for the practice of their Aboriginal and Treaty rights now and well into the future. The combination of cumulative effects from existing and potential projects and the international effects of these mining activities requires assessment by the federal government.

e. *Concern with regulatory approach*

i. *Insufficient Terms of Reference*

In addition to the concerns set out above, Kainai has significant concerns that the draft Terms of Reference document prepared by Montem is insufficient. We note several areas of concern, including:

- the lack of reference to impacts to Aboriginal or Treaty rights;
- insufficient reference to environmentally sensitive context in which the Project is located;
- insufficient discussion of transboundary impacts;
- insufficient discussion of the proximity to North Coal's Michel Coal Project; and
- insufficient weight given to specific concerns around drinking water and water quality.

Further to this designation request, we anticipate providing a supplemental report with a preliminary review of the Terms of Reference, providing further detail with respect to Kainai's concern in this regard.

ii. *Montem's view of the Project as restarting an existing mine is troubling*

It is apparent from Montem's Project Summary that they view the project as having little impact to new lands due to their plan to 'restart' a mine on previously disturbed sites. When contemplating impacts to vegetation and wetlands, Montem notes that "much of the Project area is previously disturbed lands, either by previous mining operations or by other activities in this historically active area, there is very limited areas of undisturbed vegetation".[27] They make the same assertion with regard to soils, finding that "there are limited native soils present".[28] They again make the same assertion with fish and other invertebrates.

---

[27] Project Summary, p 12, PDF p 14.
[28] Project Summary, p 12, PDF p 14.

Kainai takes issue with this approach. If the baseline data collected reflects a significantly disturbed mine area with no wildlife, plants, or fish that shows only the adverse impact the previous mining operation had on the environment. The baseline data should not reflect a previously disturbed mine that operated for decades, but the site before mining began. This will give an accurate picture of what the impacts of mining on the site have been, and what the impacts will continue to be if mining continues.

Closing

There are strong indicators that Tent Mountain will have significant adverse effects that the Minister should consider in exercising their discretion to designate the Project under s. 9(1). Some of these effects include impacts on Kainai's Aboriginal and Treaty rights, environmental impacts that cross provincial borders, harmful cumulative effects from multiple projects in the area (including the directly adjacent Michel Coal Project), and adverse effects on fish and fish habitat, adverse effects on species of special importance, and environmentally sensitive conservation lands.

In addition to the concerns raised above, there are significant concerns related to the significant coal development in the area. This includes several operating coal mines in BC, a series of proposed coal mines in BC, and a push for mining on the eastern slopes of the Rocky Mountains. A push that led the Alberta Government to, without appropriate consultation, rescind a decades old Coal Policy that protected these areas. Although that decision has since been temporarily revoked subject to improved consultation, the area remains under immense pressure from coal development.

We also note again that the production capacity is only 75 tonnes per day below the threshold for automatic federal review.

Given all of these factors and the potential impacts of this project on multiple areas of federal jurisdiction, Kainai request that Tent Mountain be designated by the Minister under the discretion provided in s 9(1) of the Act.

Blood Tribe/Kainai

Per:

Makiinima/Chief Roy Fox

CC:

Janet Shaw, Impact Assessment Agency of Canada (janet.shaw@canada.ca)
Shireen Ouellet (souellet@montem-resources.com)
Mike Oka, Kainai (Blood Tribe), Consultation Manager (mike.oka@bloodtribe.org)
Clayton Leonard, JFK Law, (cleonard@jfklaw.ca)
Jeff Langlois, JFK Law, (jlanglois@jfklaw.ca)

Encl.

Government of Alberta, "Livingstone-Porcupine Hills Land Footprint Management Plan" (2018)

Dermot O'Connor, *Review of the Literature on Blackfoot Use and Occupancy of the Crowsnest Pass & East Kootenays,* Oak Road Concepts, (May 2020)

IEG Consulting, "Cumulative effects assessment for Kainai First Nation" (9 November 2018)

Montem Resources, "Resuming Activities – Tent Mountain Mine Coal Handling and Processing Plan Project Description, Project Summary Table" (February 2021)

Montem Resources, "Proposed Terms Of Reference Environmental Impact Assessment Report For Montem Resources Proposed Tent Mountain Project" (3 February 2021)

Town of • Ville de
MORINVILLE

From the Office of the
MAYOR

April 16, 2021

The Hon. Kaycee Madu
Minister of Justice and Solicitor General
424 Legislature Building
10800 - 97 Avenue
EDMONTON, AB T5K 2B6

Dear Minister Madu:

Re: Town of Morinville Support for RCMP

Our Council is not supportive of the Government of Alberta's initiative to replace the RCMP with an Alberta Provincial Police Service (APPS). Our opinion is that there are other, more effective ways to achieve the outcomes identified through the *Police Act* review. Indeed, improving the public's trust in policing, ensuring an effective complaint process, and improving Indigenous peoples' relationships are important objectives.

There are, however, several considerations that cause justifiable concern:

- The Fair Deal Panel recommends establishing an APPS despite 65% of respondents indicating non-support;
- The necessity for a new model is unclear when there is little substantiated dissatisfaction with the RCMP but rather some areas for improvement have, rightfully, been identified;
- Transition costs are poorly understood, and ongoing operating costs will inevitably rise. Municipalities currently bear the majority of policing costs and are not able or willing to accept any additional increases. As you know, municipalities have limited means to increase revenues, receiving only 8-10 cents for every tax dollar collected. Continuing to do more with less is untenable.

There has not been compelling evidence that an APPS would result in better outcomes, particularly with the expected increase in costs. The Town of Morinville has a collaborative relationship with the local RCMP detachment and is satisfied with the level of service and degree of responsiveness received. As such, Council encourages the Government of Alberta to abandon the transition study and redouble efforts to work with the RCMP to achieve better outcomes.

Sincerely,

Barry Turner
Mayor

10125 - 100th Avenue, Morinville, Alberta, T8R 1L6 Tel (780) 939-4361 Fax (780) 939-5633
Email: mayor@morinville.ca Web: www.morinville.ca

CC The Honourable Jason Kenney, Premier
Dale Nally, MLA for Morinville-St. Albert
Dane Lloyd, MP for Sturgeon River-Parkland
Curtis Zablocki, Commanding Officer for Alberta, RCMP
AUMA Members
RMA Members

County of Paintearth No. 18

#1 Crowfoot Drive, Crowfoot Crossing
Box 509 Castor, AB T0C 0X0
P: 403.882.3211
F: 403.882.3560
www.countypaintearth.ca

April 21, 2021

Honourable Kaycee Madu
Minister of Justice and Solicitor General
424 Legislature Building
10800-97 Avenue
Edmonton, Alberta T5K 2B6

Dear Minister, Madu:

Re: County of Paintearth's Support for the RCMP

Our Council wishes to advise they are also not in support of the Government of Alberta's initiative to replace the RCMP with an Alberta Provincial Police Service (APPS) as affirmed in Mayor Turner's letter from the Town of Morinville.

Council agrees that by revising the *Police Act*, the outcomes as identified through the review can be achieved such as improving the public's trust in policing, ensuring an effective complaint process, and having a more harmonious relationship between the police and all communities within Alberta.

Council too has concerns with the province establishing an APPS despite 65% of respondents indicating non-support. The costs of transitioning to an APPS are unknown and the increased operating costs will undoubtedly be borne by the municipalities. The municipalities are currently bearing a substantial amount of policing costs and are not willing to accept unknown additional increases that will be inevitable from a transition to an APPS. This simply cannot be done within a short time frame to offer the expertise and services currently provided to Albertans by the RCMP.

Our County has developed a collaborative relationship with our local RCMP detachment over many years and is satisfied with the level of service and degree of responsiveness received and their involvement with the communities located in the County. Council echoes and encourages the Government of Alberta to abandon the transition study and redouble efforts to work with the RCMP to achieve better outcomes.

Yours truly,

COUNTY OF PAINTEARTH NO. 18

Stan Schulmeister
Reeve

cc: The Honourable Jason Kenney, Premier
MLA Nate Horner, Drumheller- Stettler
MP Damien Kurek, Battle River-Crowfoot
Mr. Curtis Zablocki, Commanding Officer for Alberta, RCMP
AUMA Members
RMA Members

From: Gerald Rhodes <gerald@rmalberta.com>
Sent: April 21, 2021 12:59 PM
Cc: Cindy Carstairs <cindy@rmalberta.com>; RMA Board Dist <AAMDCBoardDist@aamdc.com>
Subject: NEW - RMA District Virtual Engagement Sessions - Register Now!

CAOs & Reeves/Mayors - Please Distribute to Full Councils

Reeves, Mayors, Councillors, & CAOs

In the RMA's member approved Strategic Direction "Championing & Advocating on Municipal & Rural Issues" and "Facilitate Networking & Educational Opportunities" are primary roles for the RMA. More specifically "Engaging our members to identify emerging issues and needs" is identified as a key strategic priority.

As we continue to be limited in ability to meet face-to-face, we want to leverage the technology that we are now all familiar with to provide the opportunity to connect members with each other and with our board and staff to facilitate these roles and strategic priority. We all have missed all the one & one and small group dialogues that would have occurred at District meetings and Conventions over the last year which we know is where the real sharing, learning, and connections are made. We therefore know that there is a lot that we as your association are missing that is important to you that we don't know about… that we don't know what we don't know. As a result we ask that you bear with us to try something new to do something about it.

To address the issue we will be hosting new District Virtual Engagement sessions from May

14 to 17, 2021 with each district. During these virtual sessions, you will engage with the fellow municipal councillors and CAOs in your district. In addition your RMA Director, President, and Vice-President will be on-hand to facilitate discussion to engage and learn about your issues and priorities. This will not be like a District meeting where we talk to you. Instead it will be you sharing with your peers and us as we all together determine the issues at play in rural Alberta. The RMA commits to following up with what is learned inserting the priorities into our annual planning cycle that commences in June and reporting back to the membership.

The dates for each upcoming District Virtual Engagement Session are as follows:

- District 1: Friday, May 14, 2021 at 8:30 - 10:00 am
- District 2: Monday, May 17, 2021 at 10:30 am – 12:00 pm
- District 3: Monday, May 17, 2021 at 1:00 – 2:30 pm
- District 4: Friday, May 14, 2021 at 10:30 am - 12:00 pm
- District 5: Monday, May 17, 2021 at 8:30 – 10:30 am

To aid in planning, we are requesting that individual councillors and CAOs register in advance to attend their district session. As there will be breakout groups to facilitate issue dialogue and input gathering each participant will need to attend using an individual device so they can participate in this ZOOM based activity. There will therefore not be an option to attend via telephone nor the ability to do this activity as a group as this will not allow for the break out groups with others for in-depth information gathering, sharing, and learning that we are trying to evoke. For those that have taken EOEP courses over the last year, the breakout groups will be similar to what is used in the EOEP virtual courses. It will be set up to allow every participant to present ideas and discuss/learn from the others in the breakout groups.

Registration is available here - https://rmalberta.com/advocacy/rma-district-virtual-engagement-sessions/

If you aren't sure which district your municipality is in, please visit our **Members Map**. Please note, if you are part of the Regional Municipality of Wood Buffalo, you will now participate in District 5.

The deadline to register is May 7, 2021. For further information or assistance, please contact Cindy Carstairs at cindy@rmalberta.com or 780.955.4095

We look forward to seeing you in May!

Gerald Rhodes, CLGM, MBA, CAE
Executive Director

RMA RURAL MUNICIPALITIES of ALBERTA

Office: 780.955.4077
Cell: 780.893.3783
Scheduling: 780.955.4076
RMAlberta.com

2510 Sparrow Drive, Nisku, Alberta T9E 8N5 780.955.3639