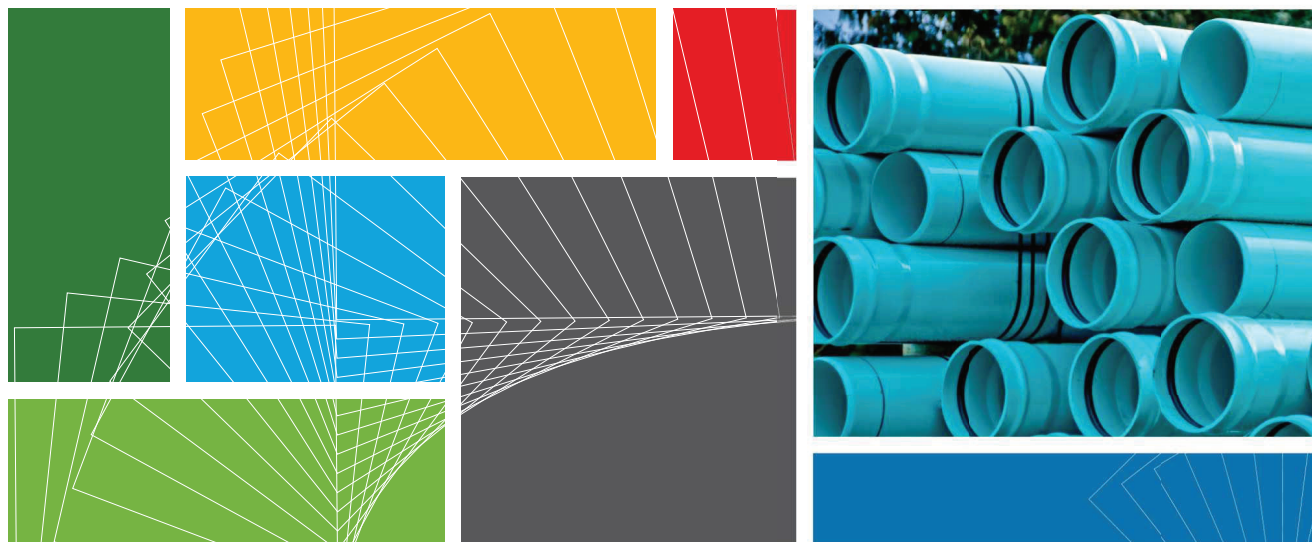




The City of Fort Saskatchewan

Final Report

Fort Saskatchewan Secondary Water Supply Study

January 2021

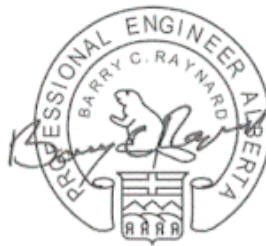




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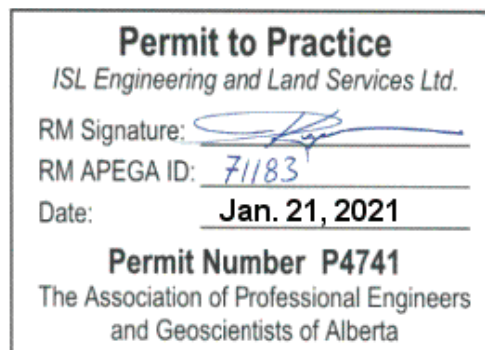
Corporate Authorization

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2021-01-20

Barry Raynard, M.Eng., P.Eng.
Manager, Municipal/Water Resources Engineering



Executive Summary

EPCOR Water Services supplies potable water to 12 of the 13 Edmonton Metropolitan Regional Board municipalities. Its regional customers are referred to the Regional Water Customers Group and the relationship between both entities are regulated by the Alberta Utilities Commission. The Regional Water Customers Group includes:

- the Capital Region Northeast Water Services Commission,
- the Capital Region Southwest Water Services Commission,
- the Capital Region Parkland Water Services Commission,
- Strathcona County,
- the City of St. Albert,
- Sturgeon County, and
- the Town of Morinville.

The City of Fort Saskatchewan receives all its water through two transmission mains that are owned and operated by the Capital Region Northeast Water Services Commission. The City of Fort Saskatchewan is currently investigating the feasibility of secondary alternative water sources outside of the Capital Region Northeast Water Services Commission due to concerns from the City with current water rates being charged to the City, and the lack of control over how the rates are set.

The only servicing options available to the City include the following:

1. Construct a transmission main from the Northside Meter Vault and be directly serviced from EPCOR. The potential northern alignments range from 5 to 8 km in length.
2. Construct a transmission main from the Southside Meter Vault. This would require upgrades to the Strathcona County network that would likely extend back all the way to the 34 Street Booster Station making it unfeasible to service Fort Saskatchewan from Strathcona. The minimum length required assuming upgrades throughout the Strathcona County network is over 25 km in length.

EPCOR has indicated that they are not willing to supply water to the City of Fort Saskatchewan as a new member of the Regional Water Customers Group; however, they are willing to explore the potential of supplying water to the City as a commercial customer, and determine if there is a business case to do so. Fort Saskatchewan will need to enter confidential negotiations with EPCOR to determine if there is a case for acquiring water from EPCOR as a commercial customer. The current commercial rates for users that exceed 5,000 m³/month is \$0.9827/m³.

Analysis of various northern alignments showed that it is technically feasible to construct a water transmission main from the end of EPCOR's transmission main at Highway 15 and 33 Street NE to the City of Fort Saskatchewan's Westpark Reservoir. The secondary transmission main was sized and costed to ensure reasonable head losses and velocity while providing two times the average day demand (conservative for the fill rate) up until the year 2035, based on projections provided by the City of Fort Saskatchewan. If the design capacity was lowered and excess demands were supplemented by the Commission, then the overall project cost could be reduced.

The existing pumping capacity at the Westpark Reservoir is a constraint to the amount of water that the City can obtain from EPCOR. This constraint can be addressed by either upgrading the reservoir pumping capacity, selecting a transmission main alignment that can also be used to supply a future reservoir along the south edge of the City, or by supplementing the demands by continuing to purchase water from the Commission. While the existing pumping capacity can meet existing average day demands, during maximum day scenarios and during future scenarios, the CRNWSC will need to supplement the flows provided by the Westpark Reservoir.

Three northern alignments were considered and are shown on Figure ES.1:

1. Alignment 1 begins at the existing Northside Meter Vault and travels east across highway 15 until it crosses Lamoureux Dr where it splits into alignment 1a and 1b. Alignment 1a continues approximately 400 meters east before it turns south to cross the existing railway and the North Saskatchewan River. Alignment 1b follows Lamoureux Dr south across the railway and turns east to avoid landowner properties before crossing the river. Once the alignments have crossed the River, alignment 1b turns east to meet alignment 1a and moves southwest near the Westpark Lift Station along the residential walking trail. The alignment continues along the walking trail and crosses 95a Avenue before turning west into the Westpark Reservoir.
2. Alignment 2 crosses pathways and River Valley Drive on the south side of the River. Several horizontal bends are incorporated at this location to reduce the impact on the existing trails and it may be more practical to open cut the water line at this location. The alignment then turns northeast to follow the rear property lines of houses along Valleyview Ridge and turns sharply south along an existing walking trail, with the corner again being a possible open cut location. The waterline crosses Westpark Dr and Woodbend Way before turning east along another walking trail. The alignment follows this walking trail until it meets Westpark Blvd and continues down the north side of the road before it turns north east into the parking lot for the reservoir and private residences.
3. Alignment 3 follows the same path as Alignment 2 until it crosses south of the River. From this point, it heads south along River Valley Drive and again requires several tight bends to reduce the impact to the existing pathway. This is also a possible location to implement open cut installation of the watermain. The alignment continues south, on the east side of the Dow Baseball Fields and turns east on Township Road 543. It continues east on the south side of Wilshire Blvd until reaching Highway 21 and turning north. It then crosses Westpark Blvd and turns north toward Westpark Reservoir.

A summary of costs is shown in Table ES.1 for all three alignments.

Table ES.1: Cost Summary of Northern Alignments

Cost Item (\$)	Alignment 1	Alignment 2	Alignment 3
Subtotal	\$3.22M	\$3.42M	\$4.75M
Engineering & ROW Registration (15%)	\$0.48M	\$0.51M	\$0.71M
Contingency (30%)	\$0.97M	\$1.03M	\$1.42M
Total	\$4.67M	\$4.96M	\$6.88M

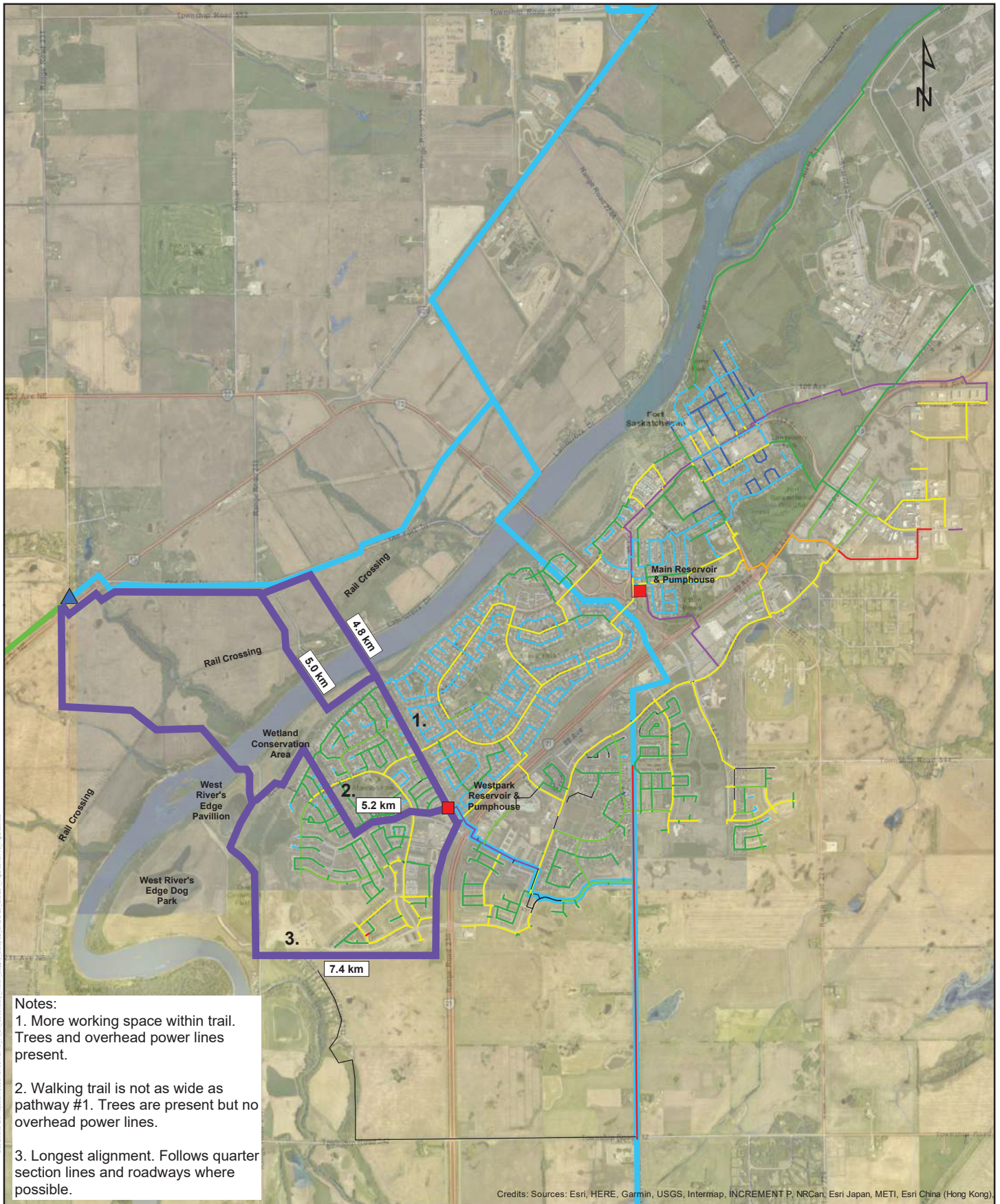
Based on all the above considerations, if EPCOR and the City decide there is a business case to pursue a secondary water supply then the following conclusions can be made regarding the potential northern alignments:

- Alignment 1 offers the most cost-effective option to convey water to the Westpark Reservoir.
- Alignment 3 is the most expensive but provides the potential to construct a new reservoir along this section of the proposed transmission main. With the additional pumping capacity in the new reservoir, the City could increase its use of the new transmission main to 100% of the City's demands.
- The City noted that it preferred to connect to Westpark Reservoir as it best aligns with the intended scope of a secondary water supply line. With this preference, Alignment 1 is the most cost-efficient option.
- Due to the pumping constraints at the Westpark Reservoir pumphouse, the City will need to rely on the Commission to meet its maximum day, peak hour, and future demands. Based on these pumping constraints and the design of the transmission main to two times the 2035 average day demand, the transmission main will be oversized if the pumping capacity isn't increased. The City has two options to reconcile this constraint:
 1. The secondary transmission main diameter could be reduced to supply a fill rate that is commensurate to the pumping capacity of the Westpark Reservoir. This option would reduce the cost of the transmission main but would not allow for the secondary water transmission main to provide maximum day, peak hour or future demands.

2. The secondary transmission main could be oversized for the short term until a point in the future where the City could upgrade its pumping capacity at Westpark Reservoir to increase its supply directly from EPCOR.

Based on the information provided in the report, ISL recommends the following:

1. The City of Fort Saskatchewan should use the information presented herein (design flows, cost of transmission main) as the basis for negotiating with EPCOR to determine if there is a potential business case for obtaining water from EPCOR as a commercial customer.
2. If there is a potential business case for acquiring water from EPCOR, the design flow rate, pipe size, and alignment should be reviewed, and the cost estimate updated. The updated cost estimate should then be used to finalize the business case.



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Legend

Water Mains

Owner

- CRNWSC
- EPCOR
- Municipal
- Potential Alignment
- Fort Saskatchewan Reservoirs

Water Mains Diameter

- ▲ Meter Vaults
- 300 mm
- 250 mm
- 200 mm
- 150 mm
- <= 100 mm
- Unknown
- 450 mm
- 400 mm
- 350 mm

FIGURE ES.1

SECONDARY WATER SOURCE
- POTENTIAL NORTH
ALIGNMENTS

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1.0 Introduction

1.1 Study Purpose

The City of Fort Saskatchewan (City) engaged ISL Engineering and Land Services (ISL) to undertake a study to investigate the feasibility of obtaining a second source of supply other than the Capital Region Northeast Water Services Commission (CRNWSC). The request is understood to arise over concerns with the current water rates being charged to the City, and the lack of control over how the rates are set.

1.2 Background Information

EPCOR Water Services (EPCOR) supplies potable water to 12 of the 13 Edmonton Metropolitan Regional Board (EMRB) municipalities. EPCOR treats water from the North Saskatchewan River at its E.L. Smith and Rosedale Water Treatment Plants (WTP) and pumps treated water to its customers in the City of Edmonton and to its regional customers. The regional customers are collectively known as the Regional Water Customers Group (RWCG) and include the following:

- the CRNWSC,
- the Capital Region Southwest Water Services Commission (CRSWSC),
- the Capital Region Parkland Water Services Commission (CRPWSC),
- Strathcona County,
- the City of St. Albert,
- Sturgeon County, and
- the Town of Morinville.

The Alberta Utilities Commission (AUC) regulates the relationship between EPCOR and the RWCG.

Unlike other urban municipalities bordering the City of Edmonton that have a direct connection to EPCOR (Strathcona County, St. Albert, Morinville and Sturgeon County), the City of Fort Saskatchewan (City) currently obtains all its potable water from the CRNWSC. The CRNWSC and the City are serviced via two water transmission mains, including:

- the 400 mm transmission main south of the North Saskatchewan River that is supplied by Strathcona County, and
- the 900 mm transmission main north of the river that is supplied by EPCOR Water Services (with a 300 mm connection across the river to the City).

The CRNWSC 2016 Master Plan proposes two new connections from the 900 mm transmission main to supply the City, including:

- a 400 mm connection west of the river to the existing 400 mm river crossing connecting to the Main Reservoir and Pumphouse, and
- a new 400 mm transmission main crossing the river and connecting to the Westpark Reservoir and Pumphouse.

It is understood that neither of these connections have been made to date.



1.3 Scope of Work

The study intends to answer the following questions:

1. What secondary options are there to supply water to the City other than the CRNWSC?
2. Can the City connect to these water supply sources? If so, when, and how does the City connect?
3. If the City was able to connect to a secondary water source, what are the potential costs / impacts to operations?
4. Where are the connection points to a secondary water supply source? What would be the most economical alignment to connect?
5. Are there any potential partnerships available within the region?

2.0 Summary of Regional and Fort Saskatchewan Water Systems

2.1 CRNWSC Network

The existing CRNWSC and regional network is shown on **Figure 2.1**. The CRNWSC consists of two primary transmission mains coming from Edmonton, named the Northside Line and the Southside Line. The Northside Line originates from the old Northside Meter Vault near Moran Lake (northeast of the intersection of Manning Drive NW and Anthony Henday Drive). The Southside Line originates from the Southside Meter Vault located west of the intersection of Highway 21 and Township Road 534. The 900 mm concrete Northside Line and the 400 mm steel Southside Line merge just northeast of Highway 15 north of Fort Saskatchewan where the combined line continues northwards. The CRNWSC services the following list of customers:

- Fort Saskatchewan,
- portions of Strathcona County,
- Sturgeon County,
- Gibbons,
- Bon Accord,
- Redwater,
- Highway 28 / 63 Regional Water Services Commission, and
- The John S. Batiuk Water Commission.

The original Northside Meter Vault consisted of a 400 mm diameter butterfly flow control valve and a 250 mm diameter check valve which is always typically open. The new Northside Meter Vault is located much closer to the City of Fort Saskatchewan and has recently been designed. Its design parameters are not fully known; however, existing pressure boundary conditions are known and are summarized in **Table 2.1**. The new Northside Meter Vault is indicative of the new boundaries of ownership between EPCOR and the CRNWSC.

Table 2.1 CRNWSC System Pressure Boundary Conditions

System Pressure	Value (kPa)
Typical Range	520 – 550
Minimum Pressure	480
Maximum Pressure	620

Notes:

1. Information provided by the City of Fort Saskatchewan.

Flow supply and demand for the CRNWSC is summarized in **Table 2.2** which shows that the CRNWSC experiences approximately 5% of water loss.



Table 2.2 CRNWSC System Flow Summary

Consumer	Volume (m ³)
Fort Saskatchewan	2,521,500
All other CRNWSC Members	1,391,240
Other Commissions (Non-Members)	2,440,000
Total	6,352,740
Supplier	Volume (m ³)
Strathcona (Southside Meter Vault)	350,000
EPCOR (Northside Meter Vault)	6,002,740
Losses (5%)	317,637
Total	6,670,377

Notes:

1. Information provided by the City of Fort Saskatchewan for 2018.

The Southside Meter Vault distinguishes the end of the Strathcona County water network and the beginning of the Southside Line of the CRNWSC. Overall, the amount of flow supplied from the Southside Line is very small in comparison to the overall regional demand since most of the flows are fed through the Northside Line. The valves within the Southside Meter Vault can easily be closed and opened based on the demand.

The Main Reservoir is located east of the Highway 15 exit ramp onto 95 Street. The CRNWSC services the Main Reservoir and Pumphouse through a 170 m, 400 mm diameter steel fill line. The fill line passes through a 250 mm pressure control valve and a 250 mm flow control valve prior to entering the Main Reservoir. The CRNWSC Master Plan, Associated Engineering 2016, indicates that the current Main Reservoir filling rates are set at 29.1 L/s and 66.7 L/s.

The Westpark Reservoir and Pumphouse was constructed in 2000 and is located northwest of Highway 21 and Westpark Boulevard, adjacent to a residential area walking trail. It is serviced by a 2,260 m long lateral that is 300 mm in diameter (PVC DR 18) that passes through a 200 mm pressure control valve and a 200 mm flow control valve. This lateral pipe turns west off the Southside Line parallel to Meadowview Drive towards Southfort Drive, north towards Southfort Boulevard, and then west along Southfort Boulevard towards the reservoir. The CRNWSC Master Plan, Associated Engineering 2016, indicates that the current Westpark Reservoir filling rates are set at 36.1 L/s and 55.6 L/s.

The CRNWSC Master Plan (Associated Engineering 2016) proposed two upgrades to improve the servicing to Fort Saskatchewan including a 400 mm main coming off the Northside Line and connecting directly to the Westpark Reservoir and Pumphouse along the existing residential walking path (originally intended to be constructed in 2020). Another upgrade includes upgrading the 300 mm main with a 400 mm main from the CRNWSC line northeast of Highway 15 towards the Main Reservoir (originally intended to be constructed in 2017). Based on discussions with the City of Fort Saskatchewan, it is understood that neither of these upgrades have been completed yet. The locations of these proposed upgrades have been annotated on **Figure 2.2** which shows a more detailed view of the Fort Saskatchewan water network.

2.2 Fort Saskatchewan Water Network

Figure 2.2 shows the existing Fort Saskatchewan network including the CRNWSC connection points and the locations of the two existing reservoirs, the Westpark Reservoir and Pumphouse and the Main Reservoir and Pumphouse. Based on the existing Fort Saskatchewan GIS database, the Main Reservoir and Pumphouse appears to have two 450 mm discharge headers, one flowing north along 95 Street and then northeast along 99 Avenue, and the other flowing southeast across 89 Avenue (Highway 21).

Westpark Reservoir and Pumphouse has a 400 mm distribution main heading west to Westpark Drive and a 450 mm discharge header heading southeast parallel to the fill line alignment across Highway 21. The Westpark Pumphouse and Reservoir was constructed in 2000 but was expanded in 2013 and is summarized in **Table 2.3**.

Table 2.3 Westpark Reservoir and Pumphouse Properties

Property		Value
Storage Capacity (m ³)		10,000
Reservoir Bottom (m)		626.890
P-10 Distribution Pump	Capacity (L/s)	60.0
	Total Dynamic Head (m)	45.7
P-11 Distribution Pump	Capacity (L/s)	60.0
	Total Dynamic Head (m)	45.7
P-12 Fire Pump	Capacity (L/s)	303.0
	Total Dynamic Head (m)	46.0

Notes:

1. Information from Fort Saskatchewan Water Master Plan, 2009.
2. 2013 upgrades provided by the City of Fort Saskatchewan.

Similarly, a summary of the Main Reservoir and Pumphouse is provided in **Table 2.4**.

Table 2.4 Main Reservoir and Pumphouse Properties

Property		Value
Storage Capacity (m ³)		13,640
Reservoir Bottom (m)		625.600
P-1 Standby Pump	Capacity (L/s)	189.4
	Total Dynamic Head (m)	53.0
P-2 Distribution Pump	Capacity (L/s)	94.7
	Total Dynamic Head (m)	53.0
P-3 Distribution Pump	Capacity (L/s)	94.7
	Total Dynamic Head (m)	53.0

Notes:

1. Information from Fort Saskatchewan Water Master Plan, 2009.

Beside the two reservoirs, there is also the elevated water tank located at the southeast corner of 101 Street and 96 Avenue which is filled by the Main Reservoir and Pumphouse. Details regarding the elevated water tank are summarized in **Table 2.5**.

Table 2.5 Fort Saskatchewan Water Tower Properties

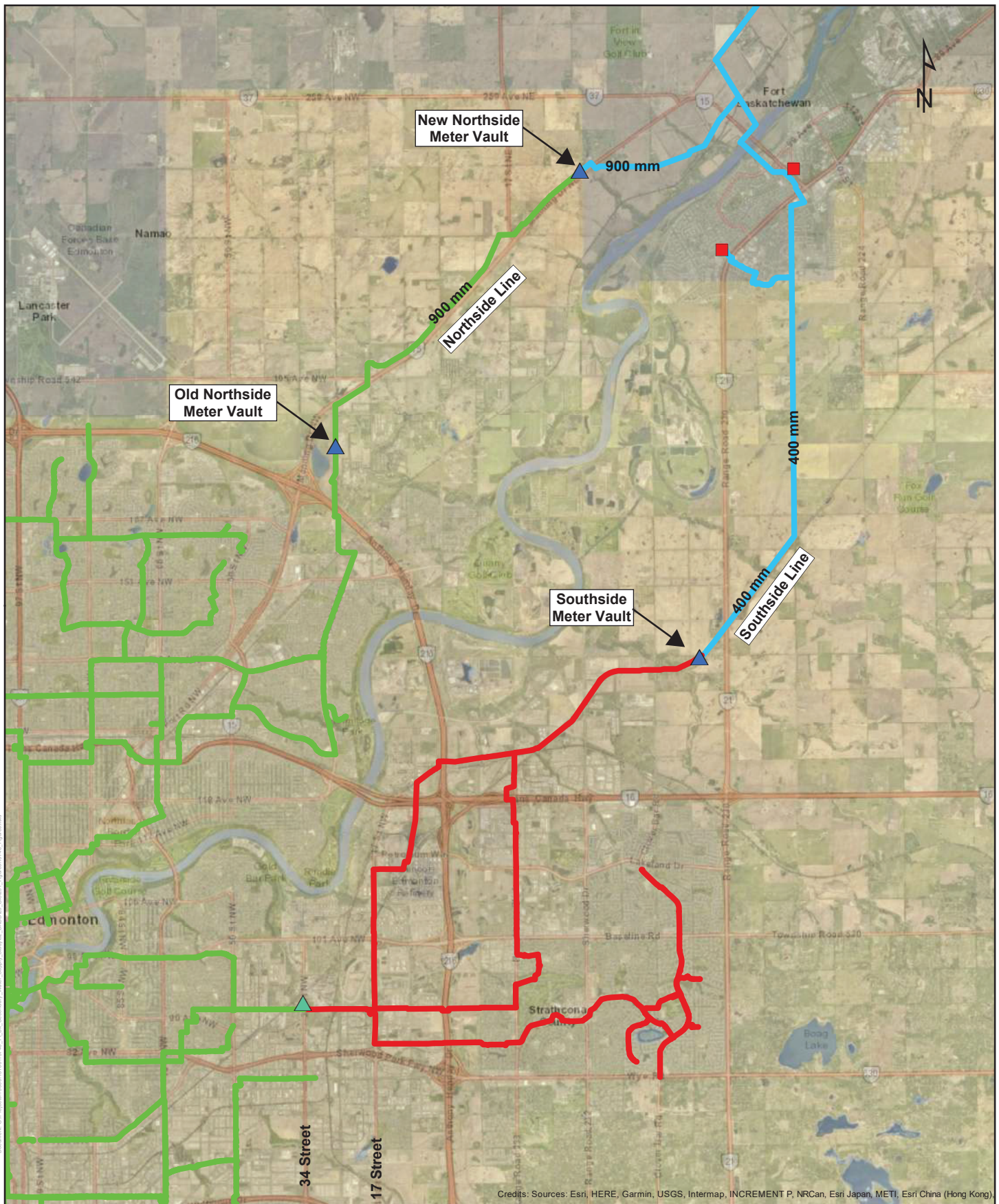
Property	Value
Ground Elevation (m)	626.7
Maximum Water Elevation (m)	670.0
Minimum Water Elevation (m)	665.50
Outgoing Pressure Range (kPa)	381 – 425
Storage Capacity (m ³)	946
Inlet / Outlet Diameter (mm)	250
Internal Tank Diameter (m)	12.192

Notes:

1. Information from Fort Saskatchewan Water Master Plan, 2009.



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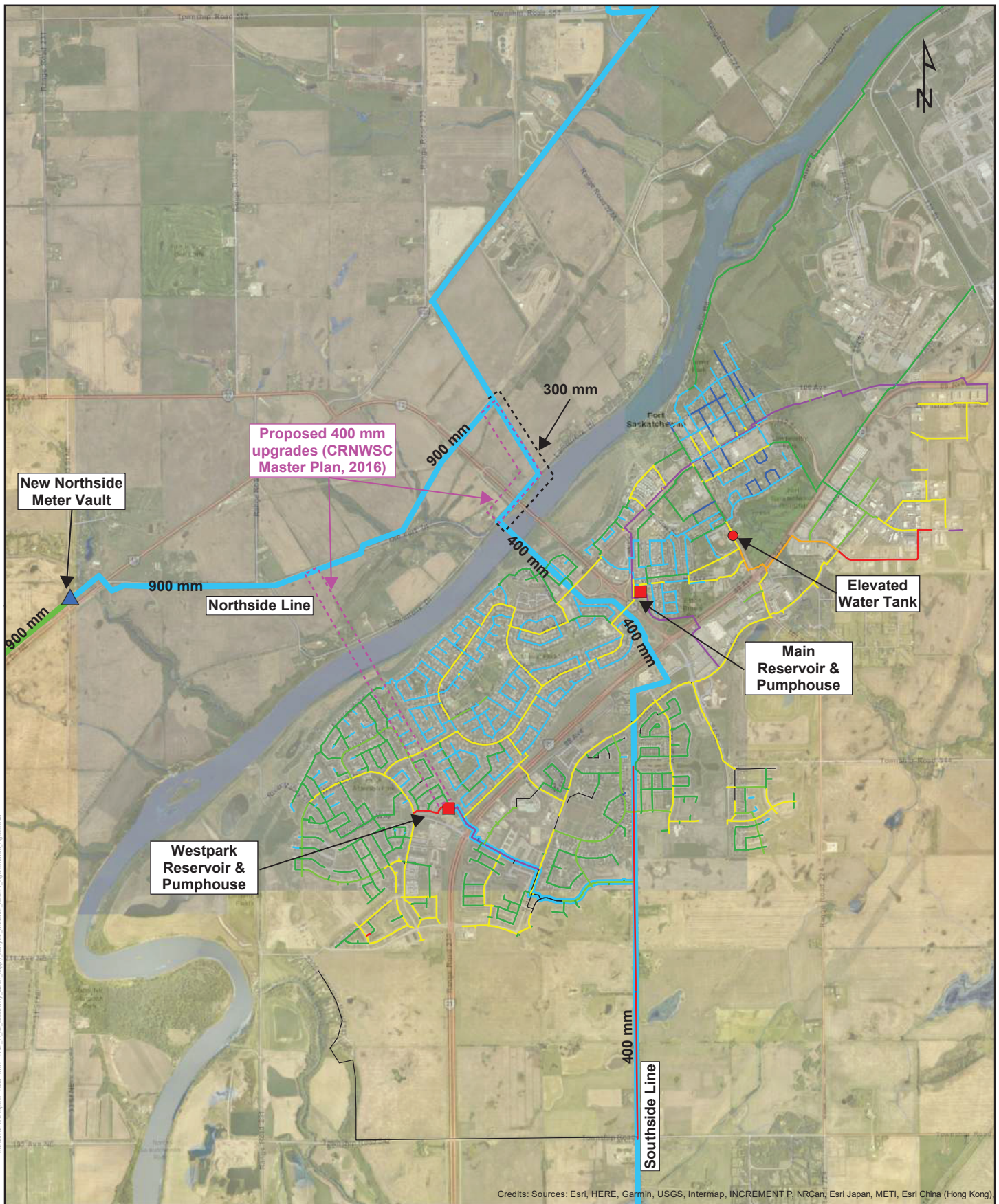


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Legend

- | | |
|--------------------|--------------------------------|
| Water Mains | ■ Fort Saskatchewan Reservoirs |
| Owner | ▲ Meter Vaults |
| — CRNWSC | ▲ 34 Street Booster Station |
| — EPCOR | |
| — Municipal | |

FIGURE 2.1
 EXISTING CRNWSC &
 REGIONAL WATER NETWORK



0187.575 750 1,125 1,500 Metres
 CANA83-3TM114 1:45,000



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Legend

Water Mains

Owner

- CRNWSC
- EPCOR
- Municipal
- Fort Saskatchewan Reservoirs
- ▲ Meter Vaults

Water Mains

Diameter

- 250 mm
- 200 mm
- 150 mm
- 400 mm
- 350 mm
- 300 mm
- <= 100 mm
- Unknown

FIGURE 2.2

EXISTING FORT
 SASKATCHEWAN WATER
 NETWORK & CRNWSC
 PROPOSED UPGRADES

Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong).

3.0 Future Water System Requirements

3.1 Flow Projections

From Table 2.2, it is shown that about 95% of the flows come from the Northside Line and only 5% come from the Southside Line. Overall, Fort Saskatchewan demands approximately 2,521,500 m³ annually. **Table 3.1** summarizes the existing flows and future flow projections based on population projections provided by the City and the Fort Saskatchewan design standards.

Table 3.1 Fort Saskatchewan Existing and Future Flows

Fort Saskatchewan Demands				
Parameter	Units	2020	2030	2035
Population		28,112	38,742	43,016
Minimum Day	(m ³ /d)	2,952	4,068	4,517
	L/s	34.2	47.1	52.3
	L/c/d	105		
Average Day	(m ³ /d)	7,871	10,848	12,044
	L/s	91.1	125.6	139.4
	L/c/d	280		
Maximum Day	(m ³ /d)	15,743	21,696	24,089
	L/s	182.2	251.1	278.8
	L/c/d	560		
Maximum Day + Fire Flow (233 L/s)	L/s	415.2	484.1	511.8
Peak Hour	(m ³ /d)	23,614	32,543	36,133
	L/s	273.3	376.7	418.2
	L/c/d	840		

Notes:

1. ADD per capita rate selected based on discussions with the City of Fort Saskatchewan.
2. The original table assumed 360 L/c/d based on the work completed by MPE.
3. Population data provided by the City of Fort Saskatchewan.

3.2 Storage Requirements

Fort Saskatchewan currently has three sources of potable water storage in the Westpark Reservoir and Pumphouse, the Main Reservoir & Pumphouse, and the Elevated Water Tower. Existing potable water storage is summarized in **Table 3.2**.

Table 3.2 Existing Reservoir Storage within Fort Saskatchewan

Fort Saskatchewan Existing Storage (m ³)	
Westpark Reservoir & Pumphouse	10,000
Main Reservoir & Pumphouse	13,640
Elevated Water Tower	946
Total Existing Storage	24,586



Fort Saskatchewan requires reservoir storage equal to the fire storage plus two times the average day demand. Comparing this to Part 2 Guidelines for Municipal Waterworks (2013) and the Fire Underwriter's Survey (1999), this requirement is the most conservative. **Table 3.3** shows the storage requirements over the next 15 years. Storage Requirements based on Fort Saskatchewan Design Standards.

Table 3.3 Fort Saskatchewan Storage Requirements

Fort Saskatchewan Storage Requirements				
Parameter	Units	2020	2030	2035
ADD	(m ³)	7,871	10,848	12,044
Fire Flow	(L/s)	233		
Fire Duration	(hr)	5		
Fire Storage	(m ³)	4,194		
Storage Required	(m³)	19,937	25,890	28,283

As shown, the existing storage capacity within Fort Saskatchewan will need to be upgraded sometime close to 2030.

3.3 Pumping Requirements

The City's water distribution system has two distribution pumps at 60 L/s at the Westpark Reservoir plus two pumps with 94.7 L/s capacity at the Main Reservoir. Thus, the total pumping capacity with all distribution pumps operating is about 309 L/s (excluding the fire pumps and contribution from the water tower). The secure pumping capacity, with the largest distribution pump out of service, is only 215 L/s which is safely above the estimated 2020 maximum day demand of 182 L/s but below the 2020 peak day demand of 273 L/s.

It is therefore anticipated that the City will need to upgrade its distribution pumping capacity soon, presumably between 2020 and 2030.

3.4 Discussion / Impact on Secondary Water Supply Source

Based on the above brief assessment of the City's existing water infrastructure and future water system demands, the following issues need to be considered when developing a secondary water supply:

- The 2035 ADD flow rate in **Table 3.1**, combined with an appropriate peak demand factor, should be used as the maximum design flow rate for the secondary supply. This will give the City the flexibility to meet up to 100% of its demands from the secondary supply up to 2035.
- The City will need to add storage and pumping capacity to its distribution system in the short to medium term. This could include upgrades to storage and pumping capacity at either the Westpark or Main Reservoirs, or more likely to the construction of a new reservoir and pumphouse within the distribution system.
- The City has indicated that one potential location for a new reservoir would be along the south edge of the City on the west side of Highway 21.

4.0 Development of Potential Secondary Water Sources

4.1 Secondary Water Source Options

As previously noted, EPCOR provides water treatment for all municipalities in the region and supplies water to various municipalities and water commissions in the area. Apart from the CRNWSC, the water transmission systems in the vicinity of Fort Saskatchewan are:

- EPCOR,
- Strathcona County,
- Hwy 18/63 Regional Water Services Commission, and
- John S. Batiuk Water Commission.

The two water commissions are supplied by the CRNWSC and thus would have higher water costs and offer the City with less control over how water rates are set. As a result, the only feasible options for the City of Fort Saskatchewan to obtain a secondary supply of treated potable water are EPCOR and Strathcona County.

4.2 Overview of Potential Alignments of Secondary Water Sources

Criteria for selecting a secondary water source alignment needs to consider the following:

- overall alignment length,
- accessibility to Westpark and/or Main Reservoir & Pumphouse,
- land use and owners, and
- whether EPCOR or Strathcona County is the secondary water supplier instead of the CRNWSC.

Both the Main Reservoir and Pumphouse and the Westpark Reservoir and Pumphouse were considered as potential connection points for the new transmission main and are described in further detail in Section 5.0. For the overview of potential northern and southern alignments, it was assumed that the transmission main would connect to the Westpark Reservoir as it is a closer tie-in point for both northern and southern alignments.

Figure 4.1 shows four potential conceptual alignments to service the Westpark Reservoir directly from EPCOR, starting at the New Northside Meter Vault. The alignments avoid watercourses where possible, follow quarter section lines / roads where possible, and only pass through the residential walking trails within the Westpark neighbourhoods. Overall, the shortest possible length is 4.8 km and the longest length is 7.4 km. Based on the conceptual alignments, Option 1a is the best alignment as it follows the existing alignment for as long as possible, maintains the shortest length, and follows the simplest alignment through the walking trails in the Westpark neighbourhood.

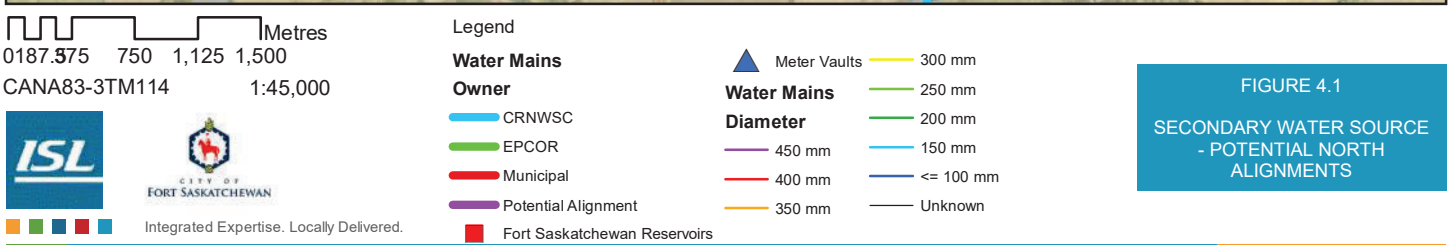
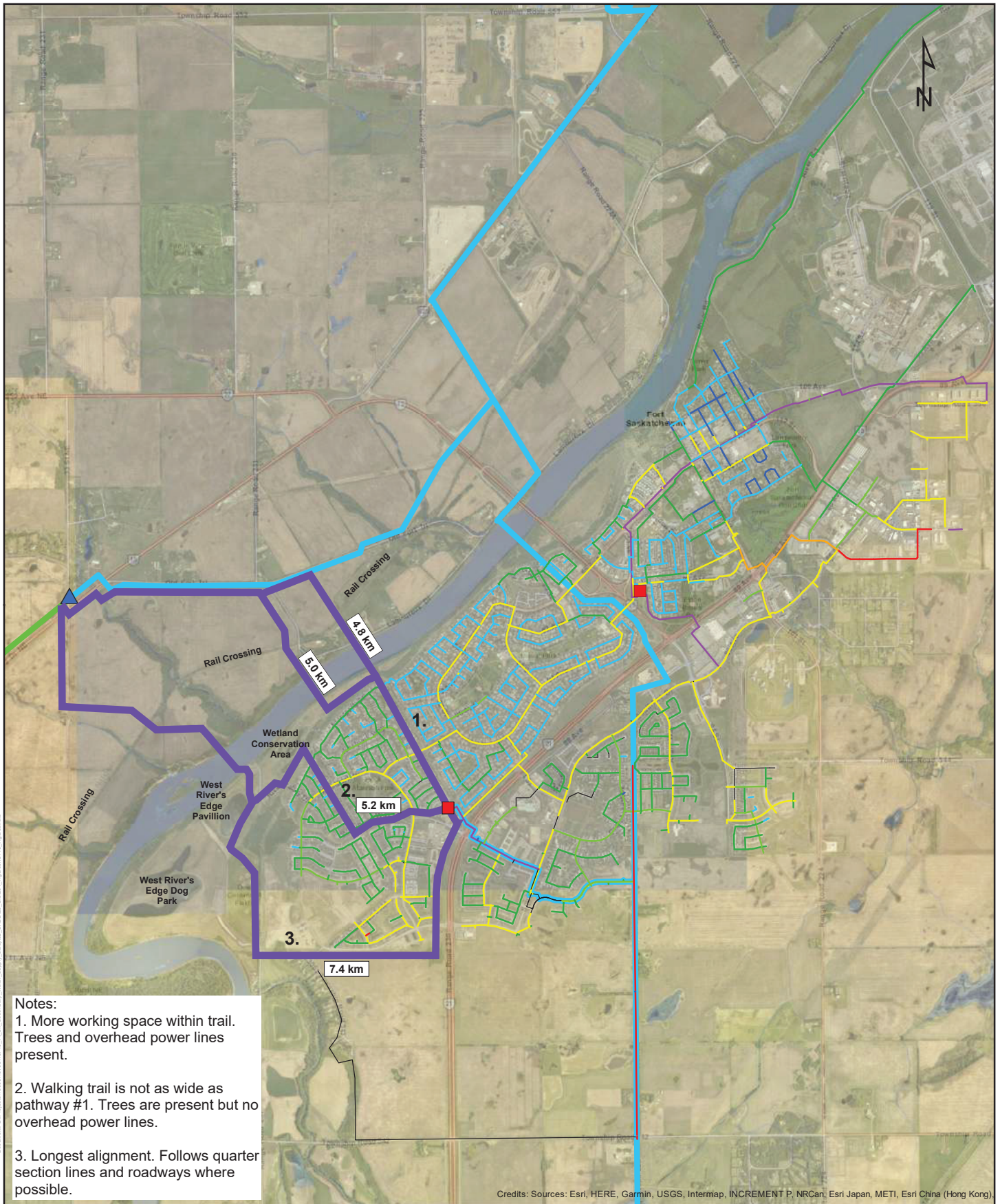
Figure 4.2 shows the same northern alignments discussed above along with several potential southern alignments to service the Westpark Reservoir directly from EPCOR. Overall, the minimum length required to service Westpark Reservoir and Pumphouse is at least 24.5 km, which is approximately five times longer than the northern alignments. The twinning could begin at the Southside Meter Vault, but the length of twinning / upgrading required within the Strathcona County network would likely match the length of twinning required to service Fort Saskatchewan from EPCOR regardless.

4.3 Preferred Options

Due to the overall length of twinning required, the requirement of Strathcona County to upgrade their network to service Fort Saskatchewan, and the potential political risks of requesting a secondary water source from another CRNWSC member, the option of obtaining water from Strathcona County is not considered to be feasible. As a result, the only source of supply that will be considered will be EPCOR via the northern alignments.



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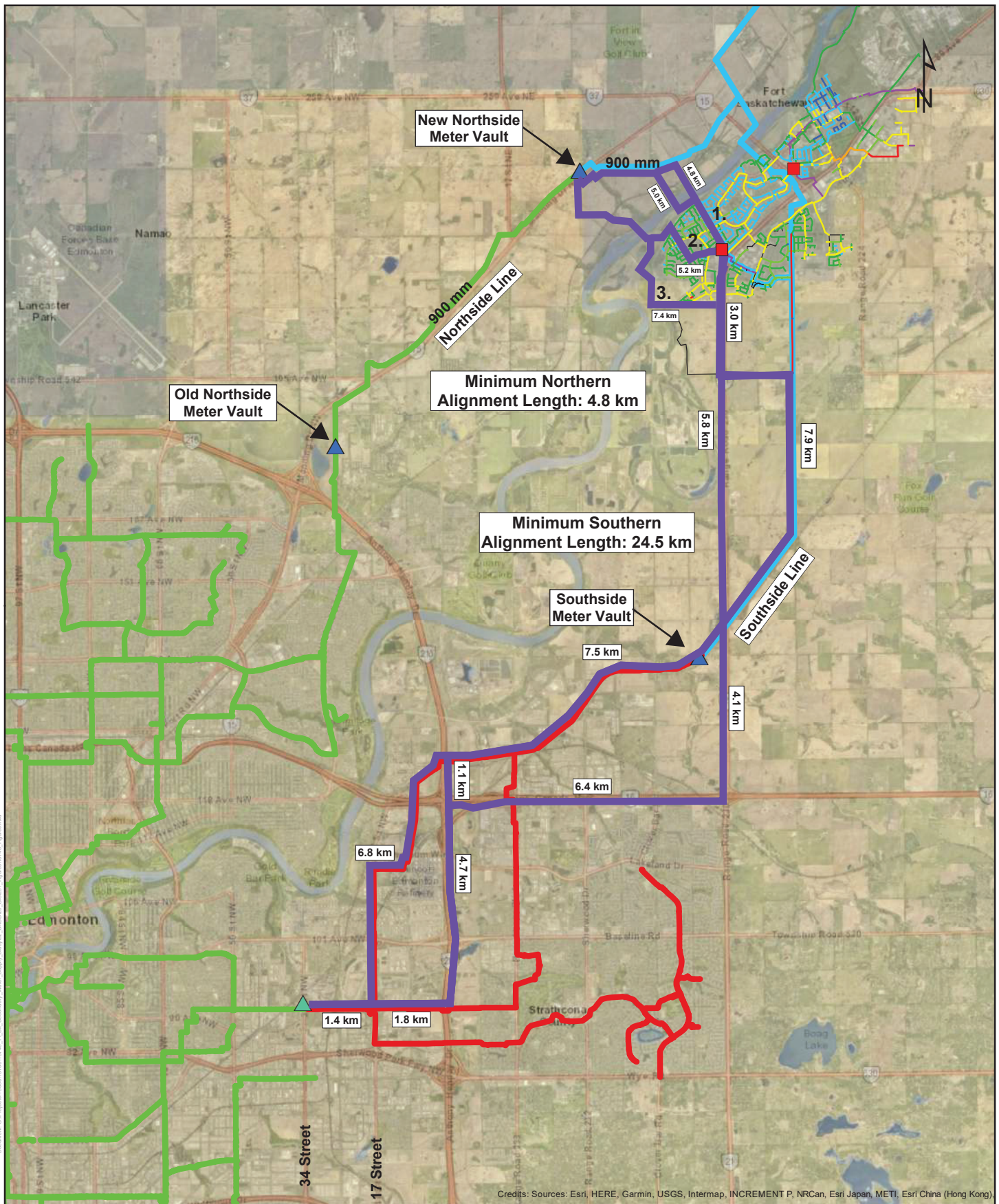


FIGURE 4.2

SECONDARY WATER SOURCE
- POTENTIAL NORTH & SOUTH
ALIGNMENTS

5.0 Conceptual Design of Transmission Main

5.1 Overall Concept

The proposed transmission main would connect to the existing 900 mm EPCOR transmission main near Highway 15 (Manning Drive) and 33 Street NE. It would extend east through Sturgeon County, across the North Saskatchewan River, go through or around the Westpark subdivision, and connect to the Westpark Reservoir. Treated water would flow using the differential pressure between EPCOR's transmission main and the reservoir inlet.

The transmission main cannot connect directly to Fort Saskatchewan's water distribution system as there needs to be an air brake between the incoming EPCOR supply and the City's distribution system. This is to protect the EPCOR transmission system from potential contamination.

5.2 Transmission Main Hydraulics

Hydraulic calculations for the northern alignments have been provided below which show the head losses and downstream pressures at the Westpark Reservoir using the various proposed alignments. **Table 5.1** summarizes the hydraulic losses within the northern alignments. The ranges provided for velocity, head loss, and downstream pressure are based on an assumed reservoir fill rate equal to two times the ADD value for 2020, 2030 and 2035 where the future demands cause higher pipe velocities and head losses with lower downstream pressure. As the overall demands increase, all alignments can achieve 250 kPa at the very least while maintaining pipe velocities less than 2.0 m/s.

Table 5.1 Summary of Estimated Head Losses in Northern Alignments

Alignment	Length (km)	Diameter (mm)	Velocity (m/s)	Head loss (m)	Downstream Pressure at Westpark Reservoir (kPa)
1a	4.8	450	1.1 – 1.8	13.0 – 28.7	403 – 556
1b	5.0	450	1.1 – 1.8	13.6 – 29.8	391 – 551
2	5.2	450	1.1 – 1.8	14.1 – 31.0	379 – 545
3	7.4	450	1.1 – 1.8	20.1 – 44.2	250 – 487

Notes:

1. Reservoir fill rates are typically limited to 1.4 – 1.5 times the ADD. Using 2.0 times the ADD is conservative.
2. Head losses are calculated using the Hazen-Williams method with a friction factor of 130.
3. HGL at Northside Meter Vault taken as 700.5 m based on Boundary Conditions provided by the City. Typical operating pressures are around 535 kPa with an estimated ground elevation of 646 m based on Google Earth LiDAR.

The following conclusions have been made regarding the hydraulic loss calculations:

- Option 1a appears to be the most robust as it maintains the strongest pressures and has the shortest length.
- Based on the reservoir storage capacity analysis presented in Section 3.2, future storage may be required by approximately 2030. Because of this, Option 3 may prove to be a viable candidate as its alignment follows the southern edge of the City where new land has recently been annexed by the City, providing opportunity for a new reservoir and pumphouse for efficient servicing of the annexed lands.

5.3 Pipeline Design Considerations

The hydraulic grade line (HGL) for the pipeline would range from approximately 700.5 m at the EPCOR connection to 671.2 to 684.5 m at the Westpark Reservoir. The transmission system would operate under design pressures of 250 kPa to 865 kPa. The highest pressures would occur at the North Saskatchewan River crossing, with pipe elevations of about 603 m. At the river crossing, there is an estimated 800 – 900 m of transmission main that is expected to be at or above 690 kPa (100 psi).



The pipeline design will need to consider these design pressures in the selection of minimum wall thickness. Either PVC or HDPE pipe could be used. Steel pipe could also be considered for the river crossing section due to the higher design pressures.

The following valves are expected to be required for the transmission main:

- One or two isolation valves,
- Two air valves (combination air vacuum and air release valve) at the crest of the river, and
- A blow off valve near the river crossing.

These design parameters will be refined during preliminary design.

5.4 Constructability

It is expected that the pipeline would be installed almost entirely using horizontal directional drill (HDD) construction, with the only exceptions being case bore auguring at the railway crossing and short sections of open cut construction.

All alignments require one crossing of the North Saskatchewan River which is assumed to be HDD with steel pipe. The length of the crossing at 350 m is expected to result in axial pressures on the pipe that are too high for PVC or HDPE pipe.

Each alignment also includes one crossing of an existing railway which is assumed to be a case bore installation as required by railway standards.

The majority of the pipeline length would be installed by HDD using either PVC or HDPE pipe. It will be more cost efficient to utilize a smaller HDD equipment than that required for the river crossing. It has been assumed that the maximum pull length of HDD for a smaller rig will be about 250m. This can vary depending on the geotechnical conditions and equipment that will be used. It has been assumed that each trenchless installation will require a pit and working area of approximately 10 meters wide by 20 meters long.

5.5 Horizontal Alignments

As discussed, four primary horizontal alignments were investigated at a high level to review constructability as well as potential landowner conflicts. These potential alignments are shown on **Figures 5.1 through 5.31** and are indicated as alignment 1a, 1b, 2 and 3.

It has been assumed that a 10-meter-wide right of way will be required to complete the installation. The location of the 10-meter-wide right of way has been indicated except in areas where there is an existing waterline, pathway or roadway as it is assumed that these locations are already within a City right of way. It should also be noted that only the location of City owned utilities has been provided for the proposed alignments and that a thorough utility search will need to be completed prior to finalizing any alignment.

Key findings of each alignment are summarized below.

5.5.1 Alignment 1a and 1b

Alignment 1a and 1b generally follow similar paths with the exception of the crossing location of the North Saskatchewan River. Both alignments have been proposed due to potential conflicts with landowners north of the River. The alignment begins at the existing Meter Vault and travels east across highway 15 until it crosses Lamoureux Dr where it splits into alignment 1a and 1b.

Alignment 1a continues approximately 400 meters east before it turns south to cross the existing railway and the North Saskatchewan River. Alignment 1b follows Lamoureux Dr south across the railway and turns east to avoid landowner properties before crossing the river. Once the alignments have crossed the River, alignment 1b turns east to meet alignment 1a and moves southwest near the Westpark Lift Station along the residential walking trail. The alignment continues along the walking trail and crosses 95a avenue before turning west into the Westpark Reservoir.

This alignment does not require a large amount of surface restoration with minimal tree clearing required at the river crossing as well as path removal required at pit locations along the walking trail. The final length of piping turning west into the reservoir is a possible location to complete open cut excavation as this is the final tie in point.

The overall length of these alignments is approximately 4.8 km and it is estimated that a total of 24 pits will be required with potential for 1 open cut section.

5.5.2 Alignment 2

Alignment 2 also begins at the existing Meter Vault but travels south across highway 15 along a landowner boundary for approximately 900 meters. It then turns east and crosses the existing railway at a near 90-degree angle as required by the railway standards. The alignment then turns southeast to cross the North Saskatchewan River.

The alignment crosses pathways and River Valley Drive on the south side of the River. Several horizontal bends are incorporated at this location to reduce the impact on the existing trails and it may be more practical to open cut the water line at this location. The alignment then turns northeast to follow the rear property lines of houses along Valleyview Ridge and turns sharply south along an existing walking trail, with the corner again being a possible open cut location. The waterline crosses Westpark Dr and Woodbend Way before turning east along another walking trail. The alignment follows this walking trail until it meets Westpark Blvd and continues down the north side of the road before it turns north east into the parking lot for the reservoir and private residences.

This alignment also does not require a large amount of surface restoration with minimal farmland being disturbed for trenchless technology pits as well as vegetation clearing at the river crossing. Again, some path interruptions will be required once inside City limits.

The overall length of this alignment is approximately 5.2 km and it is estimated that a total of 19 pits will be required with potential for 2 open cut sections.

5.5.3 Alignment 3

Alignment 3 follows the same path as alignment 2 until it crosses south of the River. From this point, it heads south along River Valley Drive and again requires several tight bends to reduce the impact to the existing pathway. This is also a possible location to implement open cut installation of the watermain. The alignment continues south, on the east side of the Dow Baseball Fields and turns east on Township Road 543. It continues east on the south side of Wilshire Blvd until reaching Highway 21 and turning north. It then crosses Westpark Blvd and turns north toward Westpark Reservoir. Similar to Alignment 1a and 1b, the final length of watermain could be open cut to reduce the number of trenchless pits.

This alignment does require some road closures near the DOW Baseball Fields and on Township Road 543 and will require restoration of these road surfaces along with the same restoration north of the River as Alignment 2.

The overall length of this alignment is approximately 7.4 km and it is estimated that a total of 30 pits will be required with potential for 2 open cut sections.



5.6 Hydraulic Considerations – Fort Saskatchewan Distribution System

The preferred option for a secondary water supply would be to connect to the Westpark Reservoir, as it represents the shortest length of transmission main. However, connecting it to only the Westpark Reservoir would limit the supply to the capacity of the Westpark Reservoir distribution pumps, which are currently 60 L/s each. The options to address this are:

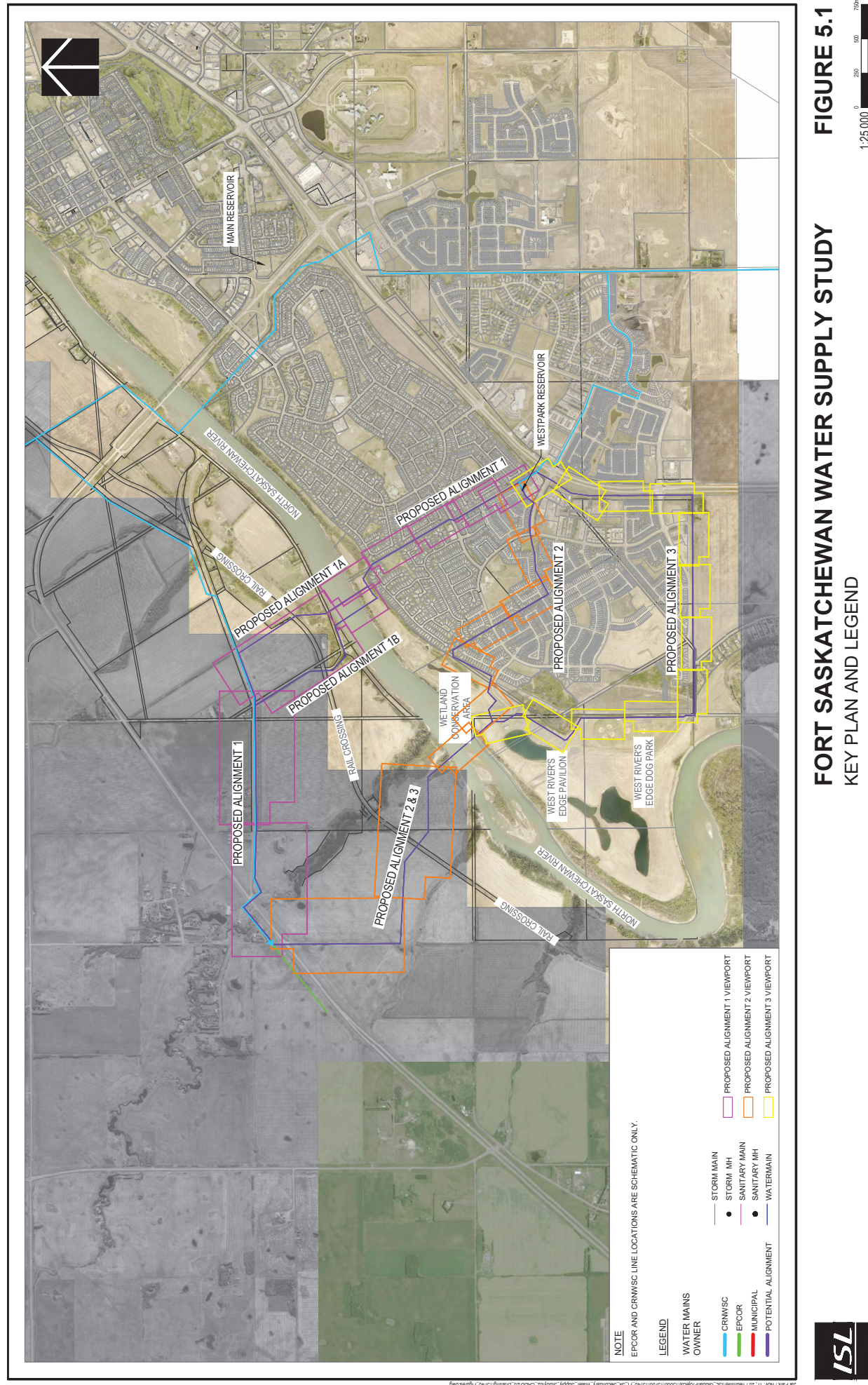
4. Upgrade the pumping capacity at the Westpark Reservoir by adding an extra 80 L/s in pumping capacity to provide just over $2035 \text{ ADD} \times 1.4$ (total of 200 L/s). The order of magnitude cost for this type of upgrade is \$1M but could be more if structural upgrades to the pumphouse are required.
1. Extend the proposed transmission main to connect to the Main Reservoir instead of the Westpark Reservoir. This option is expected to cost an additional \$1M or more as compared to connecting to the Westpark Reservoir.
2. The secondary source could be connected to Westpark Reservoir, maximizing its use, and relying on the Main Reservoir supplied from the CRNWSC for the rest of the City's water needs. This would result in the current City's average day demands being met by the new EPCOR connection if both distribution pumps operated 24/7 (based on ADD of 91 L/s and two pumps at 60 L/s each). This would drop to about 67% of the current demands if only one pump was utilized at a time.
3. Utilize Alignment 3 (south) and construct a new reservoir along this section of the proposed transmission main. With the additional pumping capacity in the new reservoir, the City could increase its use of the new transmission main to 100% of the City's demands.

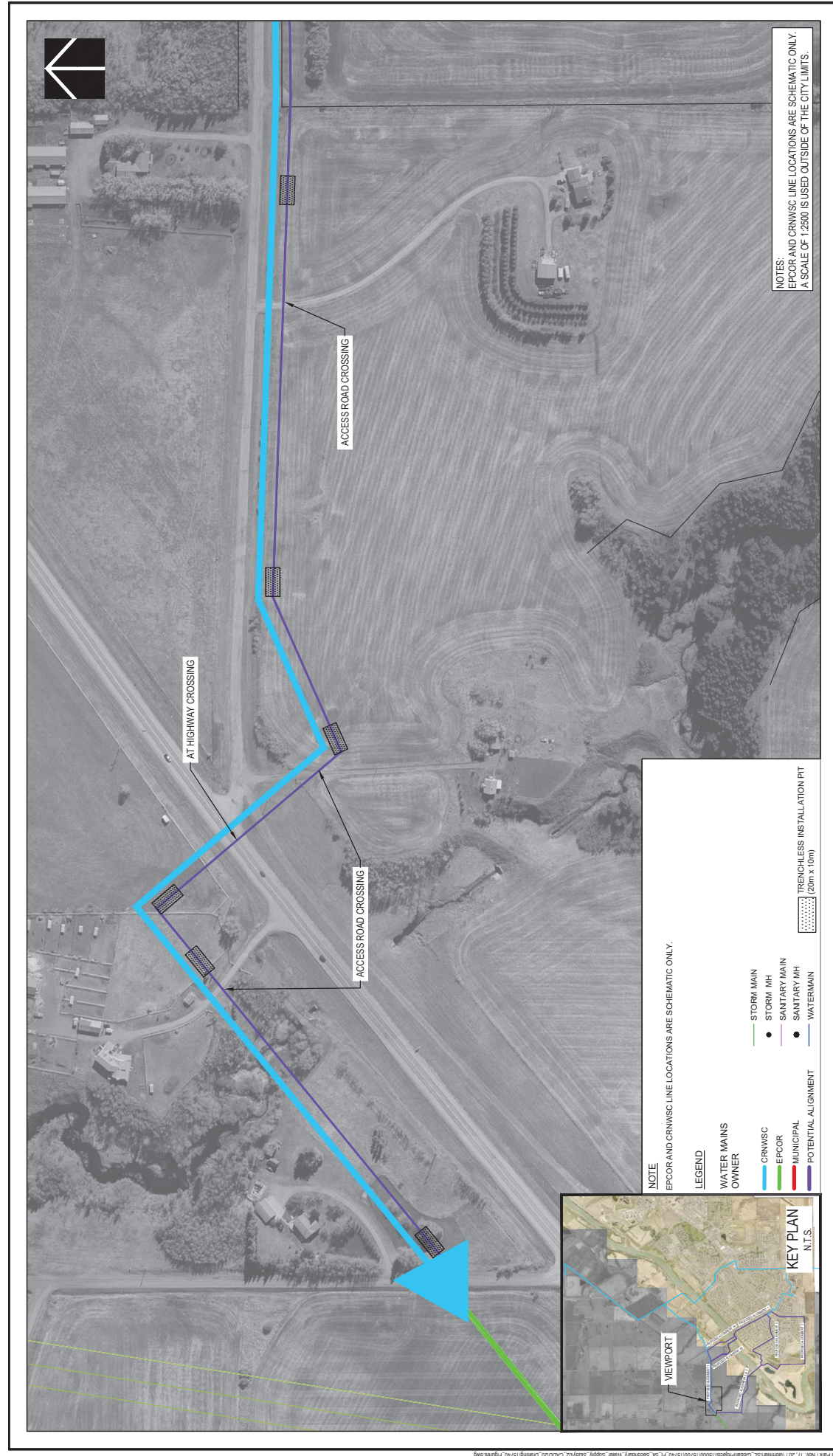
The City has indicated that it prefers Option 3 above as it best aligns with the intended scope of a secondary water supply line. In this case, the City should use the capacity of the Westpark Reservoir distribution pumps as the basis for maximum supply from EPCOR in its financial analysis. Some of the key issues that the City should consider for Option 3 include:

- Should the City operate one or two distribution pumps at a time? Operating only one distribution pump at a time would limit the secondary supply to about 60 L/s, which is small compared to the future average day or maximum day demands.
- If the City operated both pumps continuously, it would be reliant on the CRNWSC to meet the rest of its peak demands (at 182 L/s MDD the reliance on the CRNWSC is approximately 62 L/s whereas at 273 L/s PHD the reliance is approximately 153 L/s), which could negatively impact the CRNWSC, as it would result in the City drawing demands in excess of 1.4 times ADD during peak demand periods.
- The City could choose to use both pumps during peak demand periods only as a way to distribute its peak demands on both the EPCOR and CRNWSC supply lines equitably.
- The supply line described in Section 5.5 above is sized for 2035 ADD times a peaking factor of 2.0 and would be oversized if the outflows are limited to the existing Westpark Reservoir distribution pumping capacity.
- The Westpark Reservoir pumping capacity could be increased at any time in the future to increase its supply from EPCOR.

Selecting the south alignment (Alignment 3) for the secondary supply line (Option 4 above) would provide the City with the flexibility to construct a new reservoir and pumphouse along the new supply line and thus expand its distribution pumping capacity to maximize the water that is supplied by EPCOR and optimize its use of the proposed transmission main.

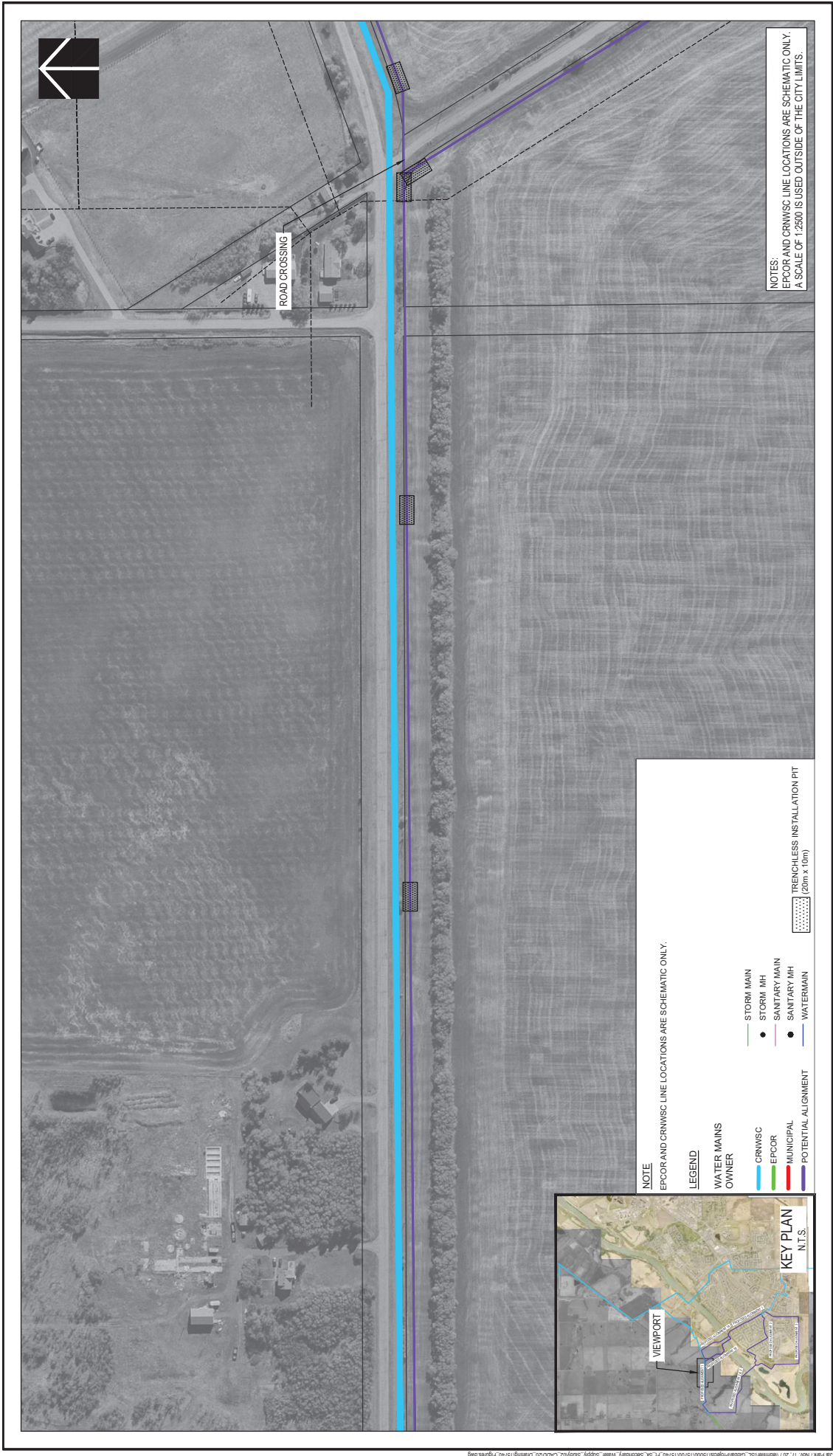
It should be noted that chlorine residual is not expected to be an issue within the Westpark Reservoir as the water would be turned over quickly. It could be an issue at the Main Reservoir and/or the Water Tower, depending on how much water continues to be supplied from the CRNWSC to the Main Reservoir.





FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 1
VIEWPORT 1

NOVEMBER 2020

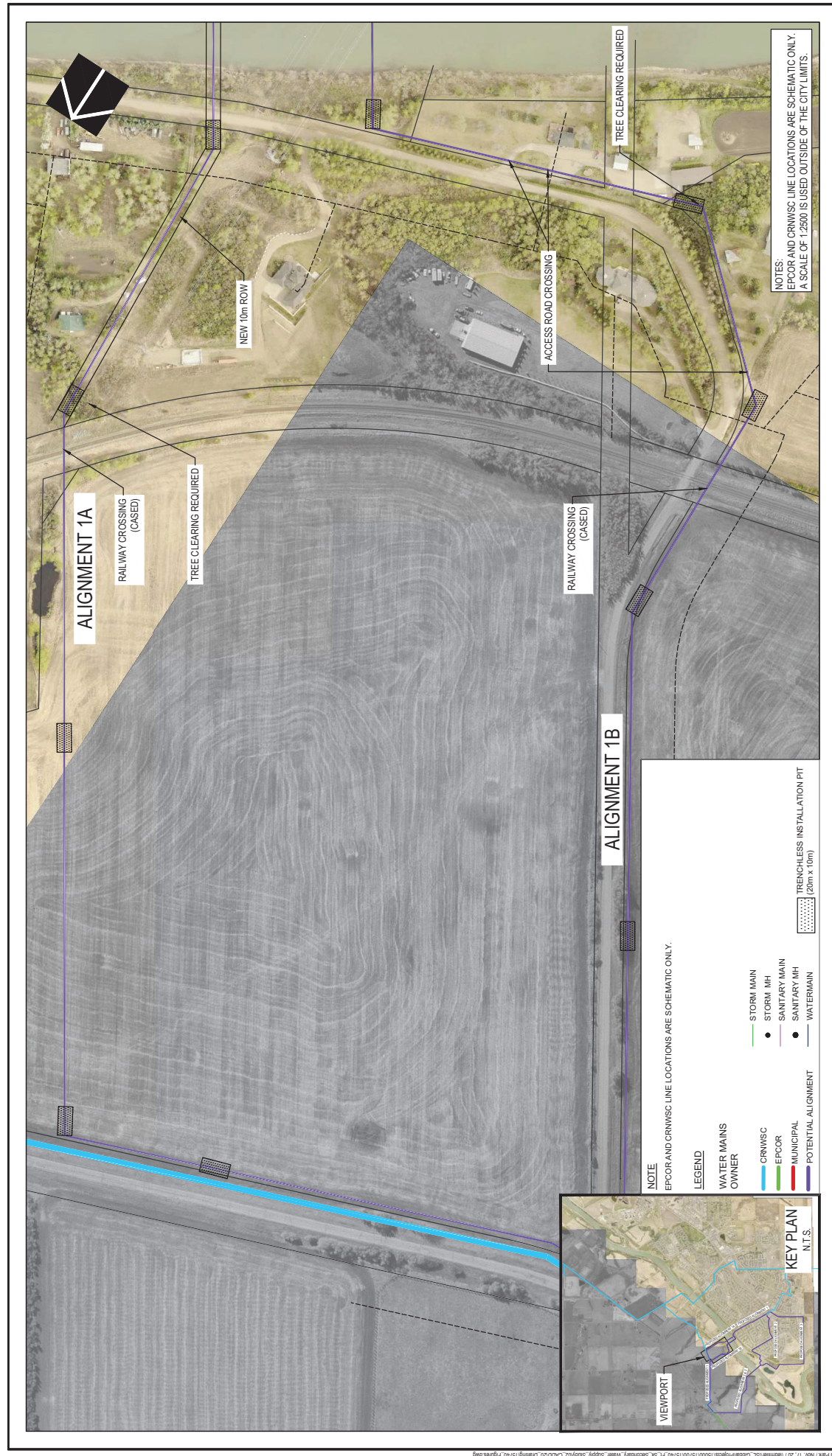


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT I
VIEWPORT 2

FIGURE 5.3

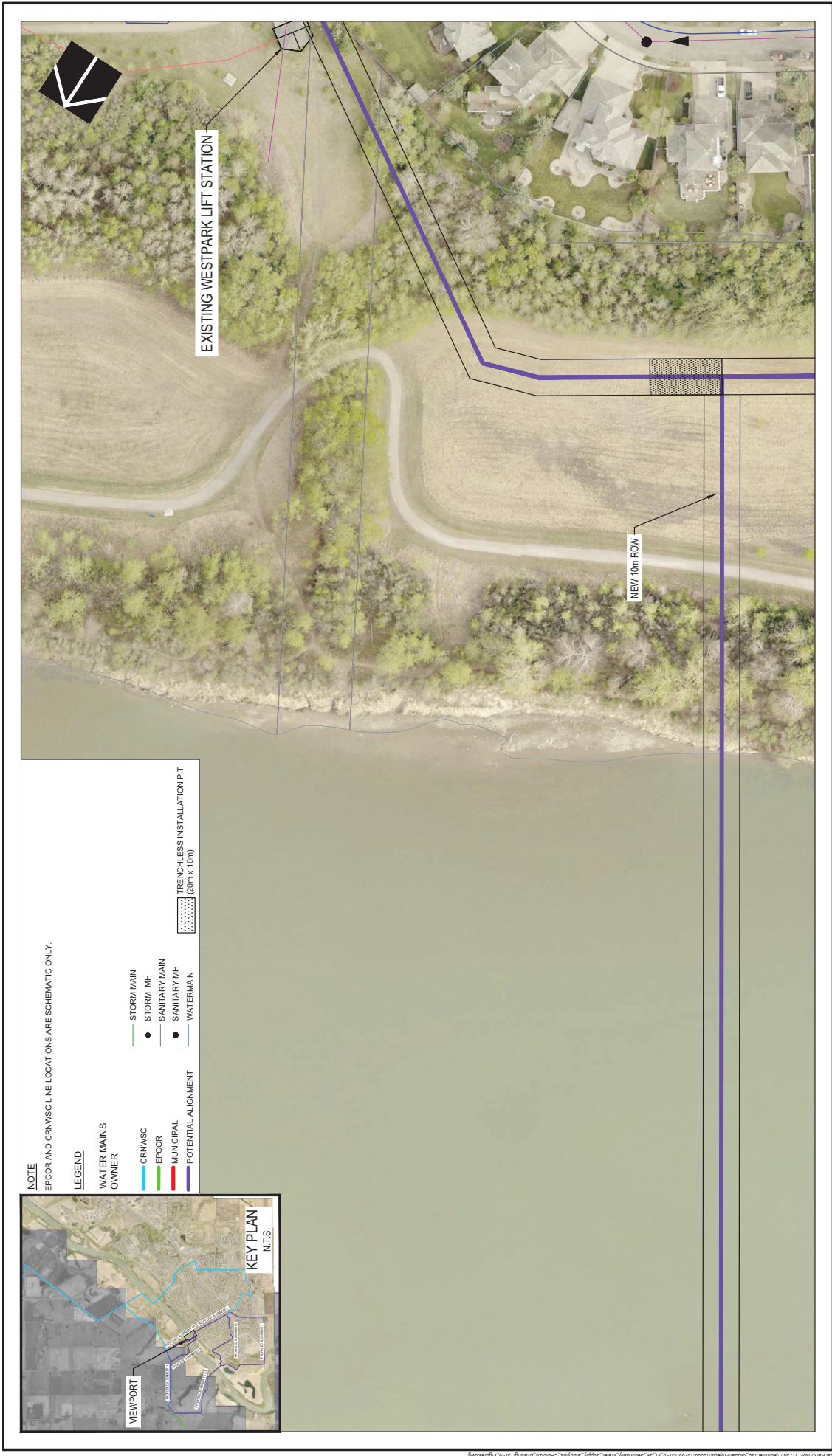
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FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 1
VIEWPORT 3

NOVEMBER 2020

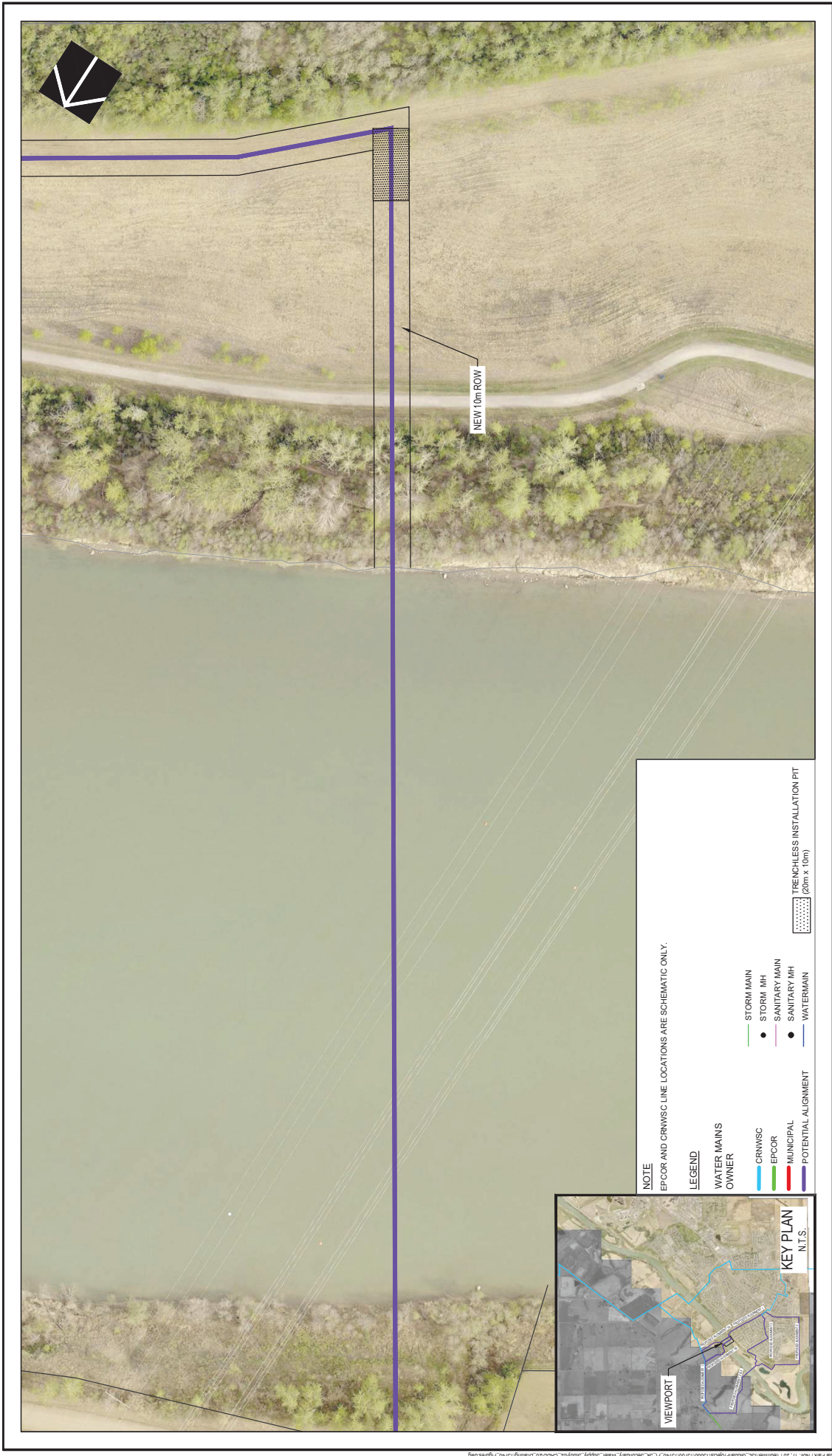


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 1
VIEWPORT 4A

FIGURE 5.5

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NOVEMBER 2020





FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 1
VIEWPORT 7

FIGURE 5.9

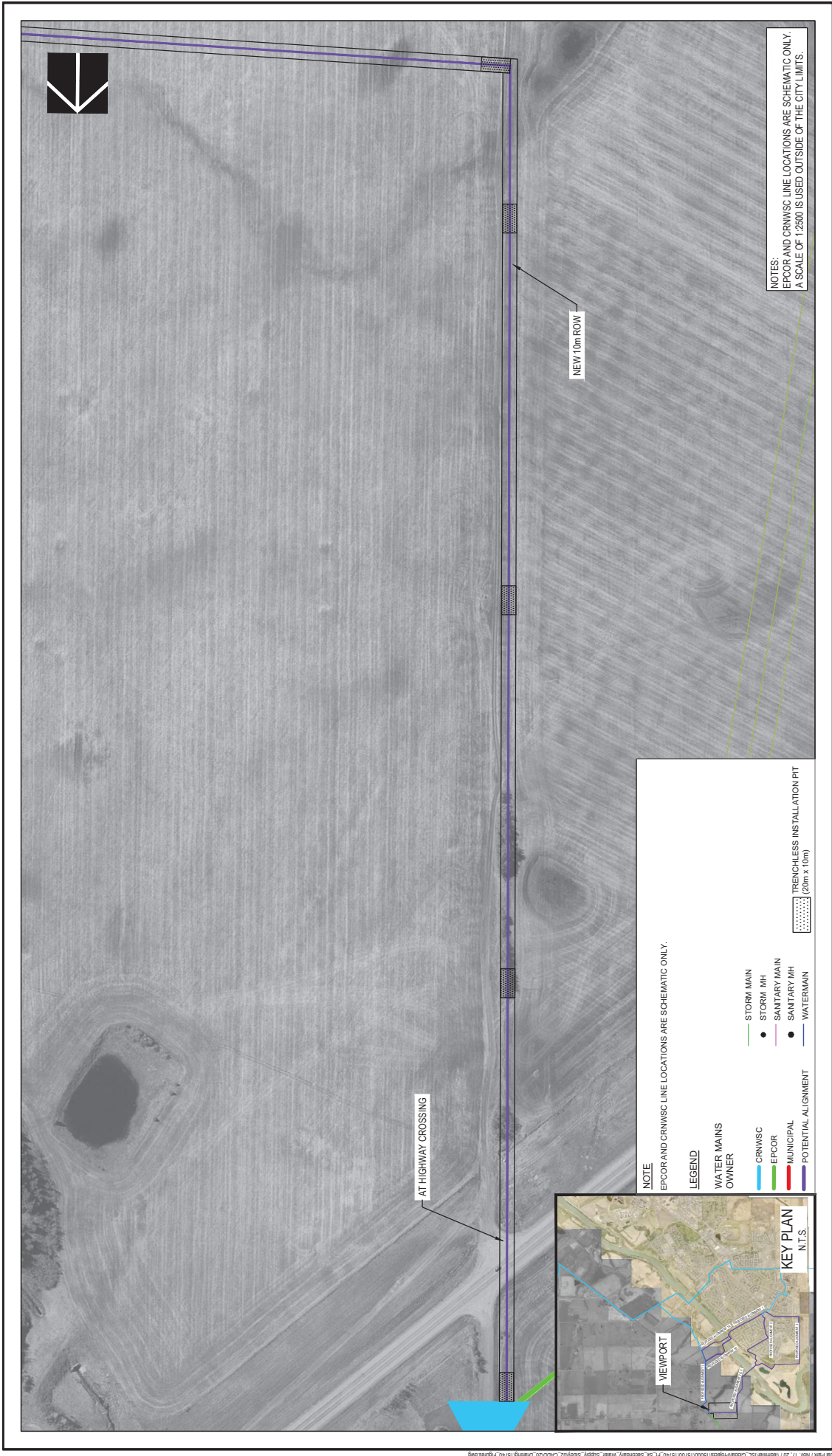
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FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 1
VIEWPORT 8

FIGURE 5.10



FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 1

FIGURE 5.11

NOVEMBER 2020

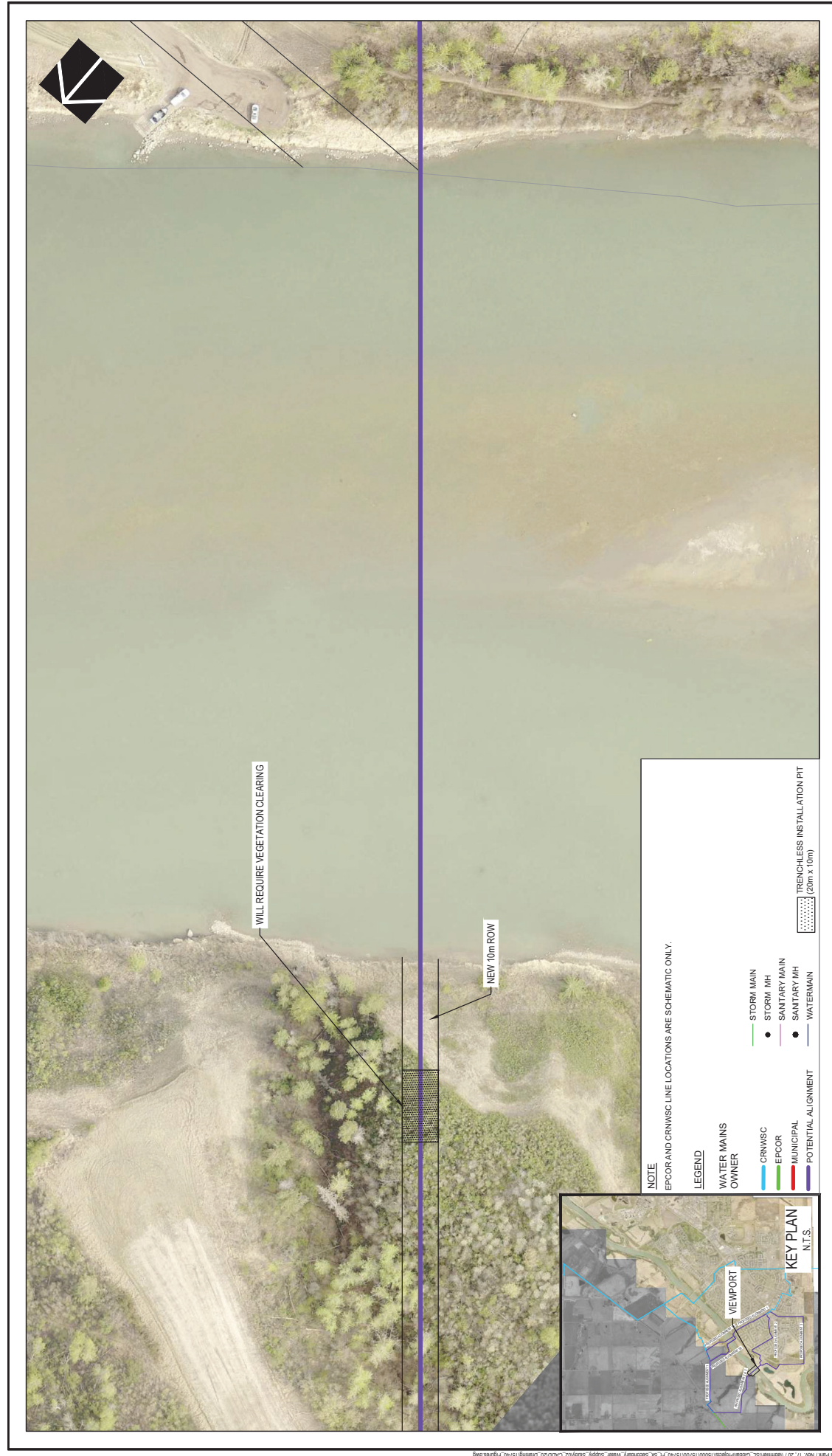


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 2

FIGURE 5.12

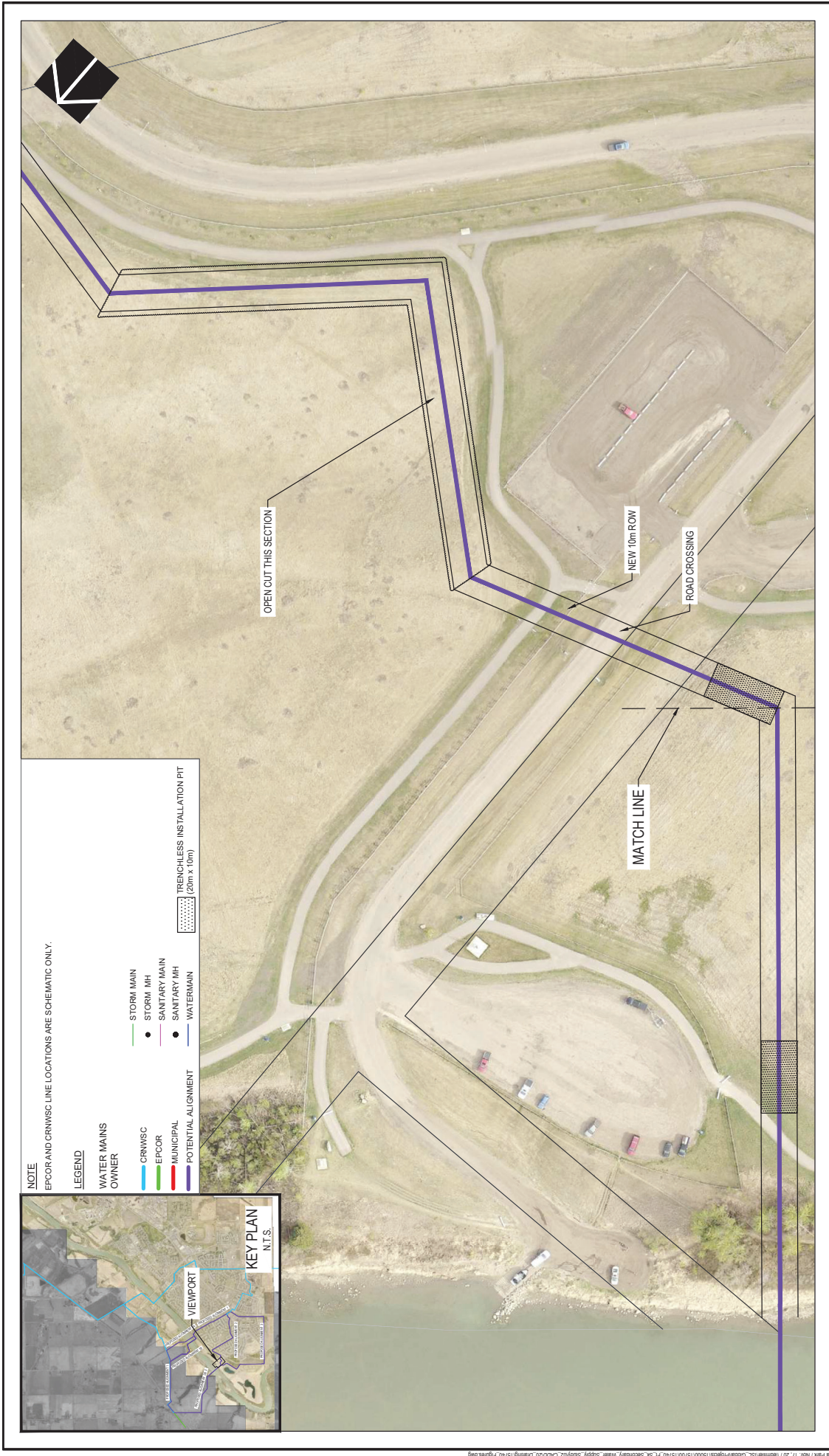
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NOVEMBER 2020



FORT SASKATCHEWAN CONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 3

NOVEMBER 2020

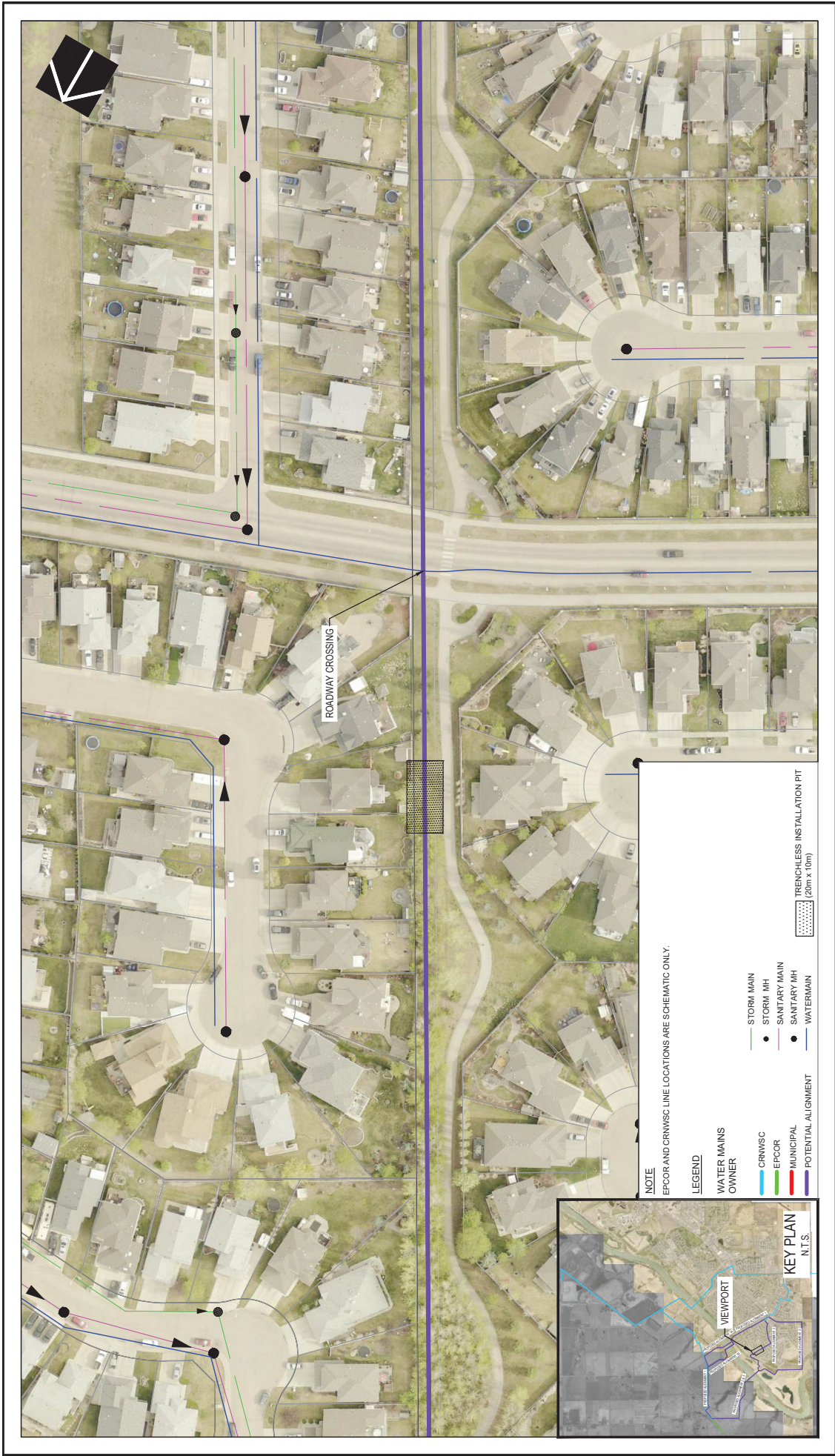


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 4

FIGURE 5.14

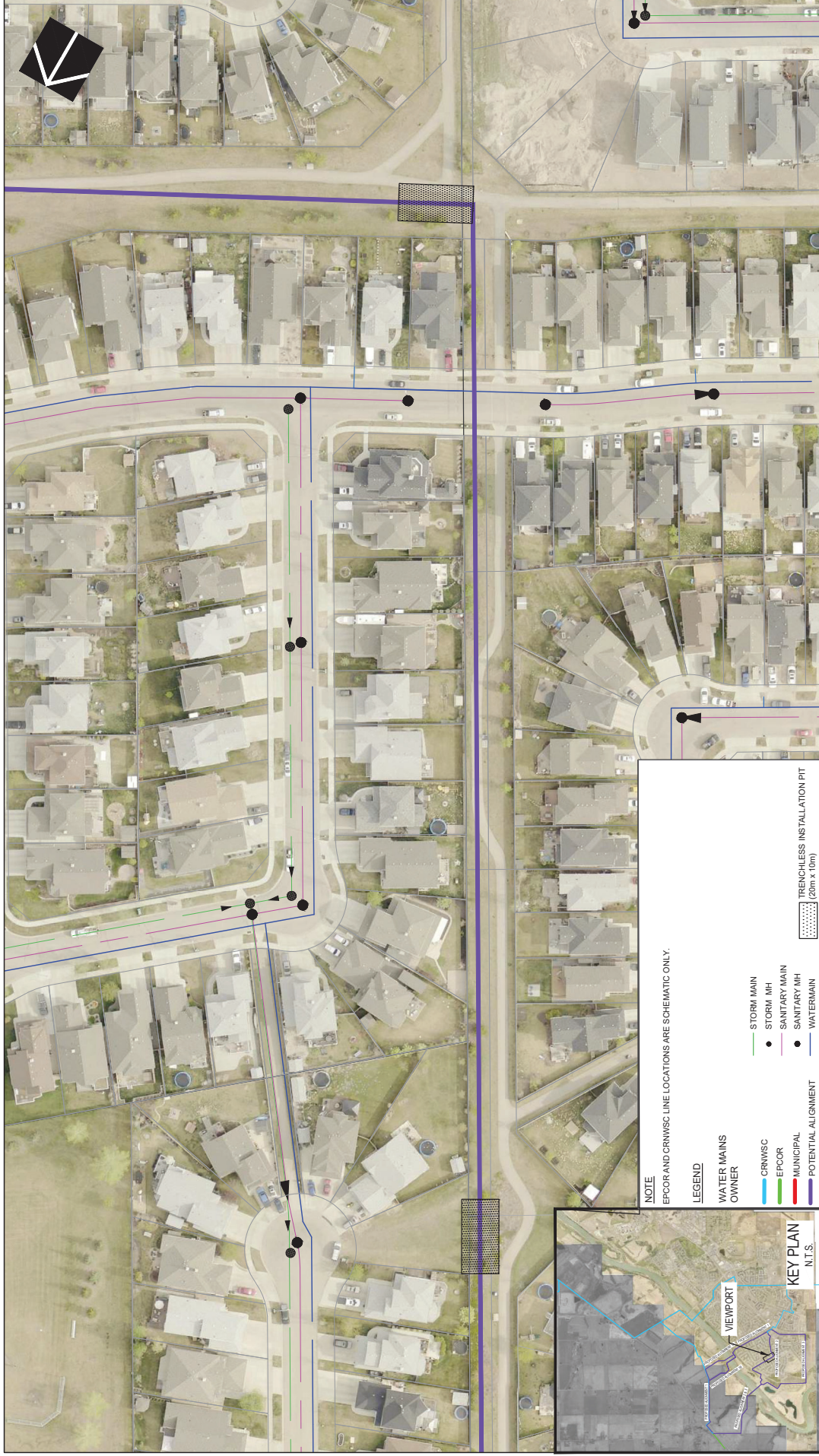
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NOVEMBER 2020



FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 6

FIGURE 5.16



FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 7

FIGURE 5.17

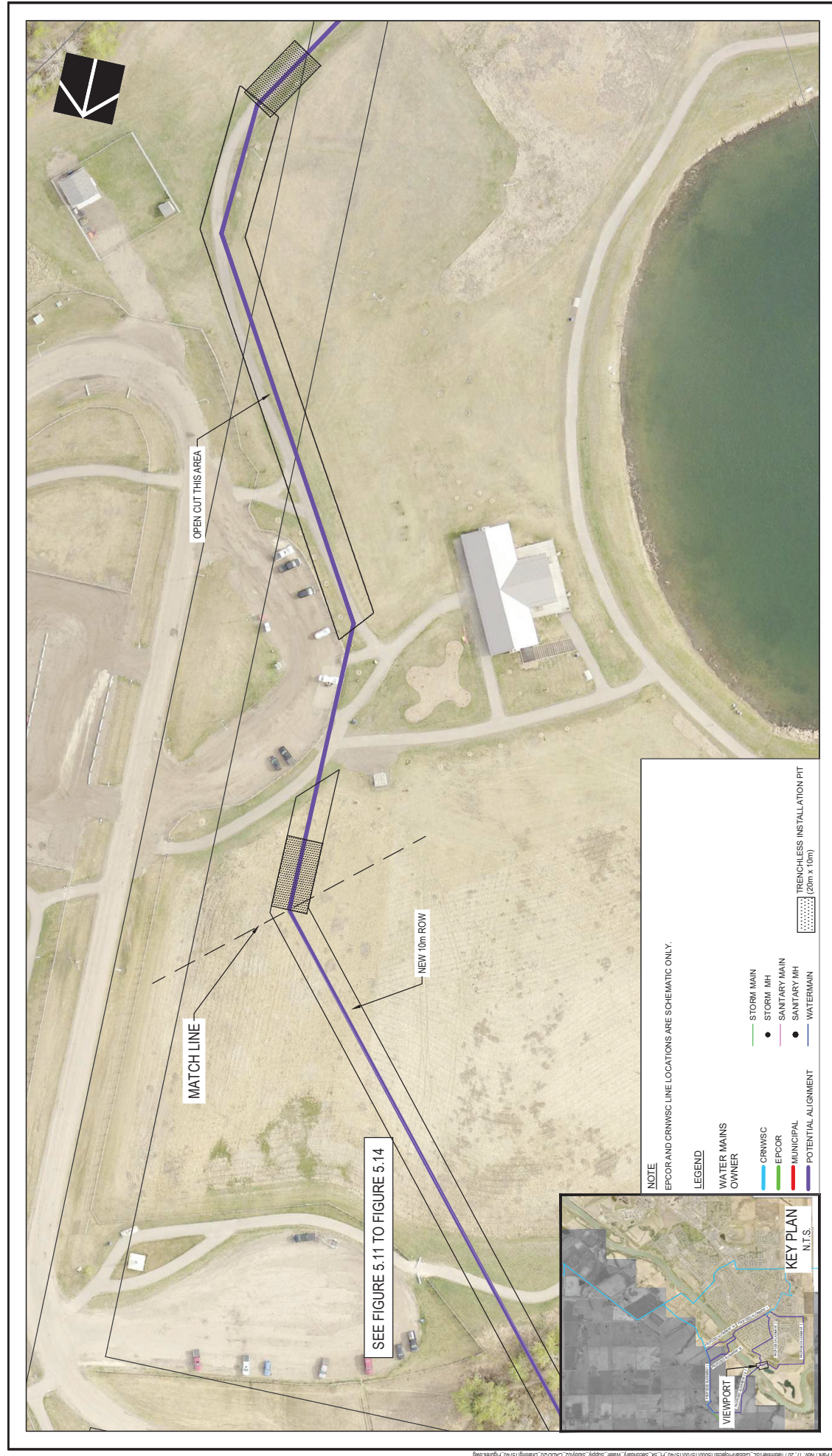
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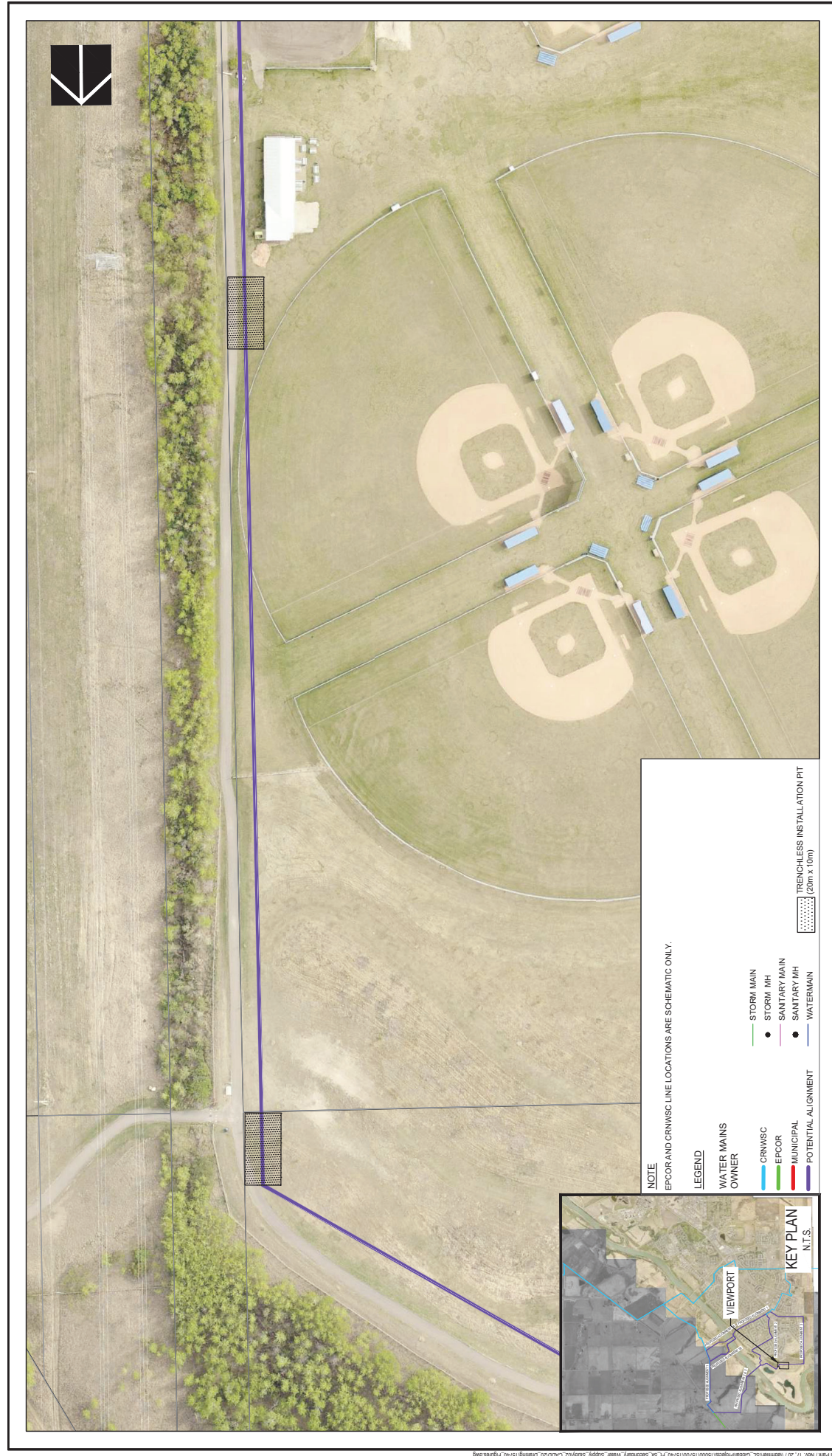
FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 2
VIEWPORT 9

FIGURE 5.19

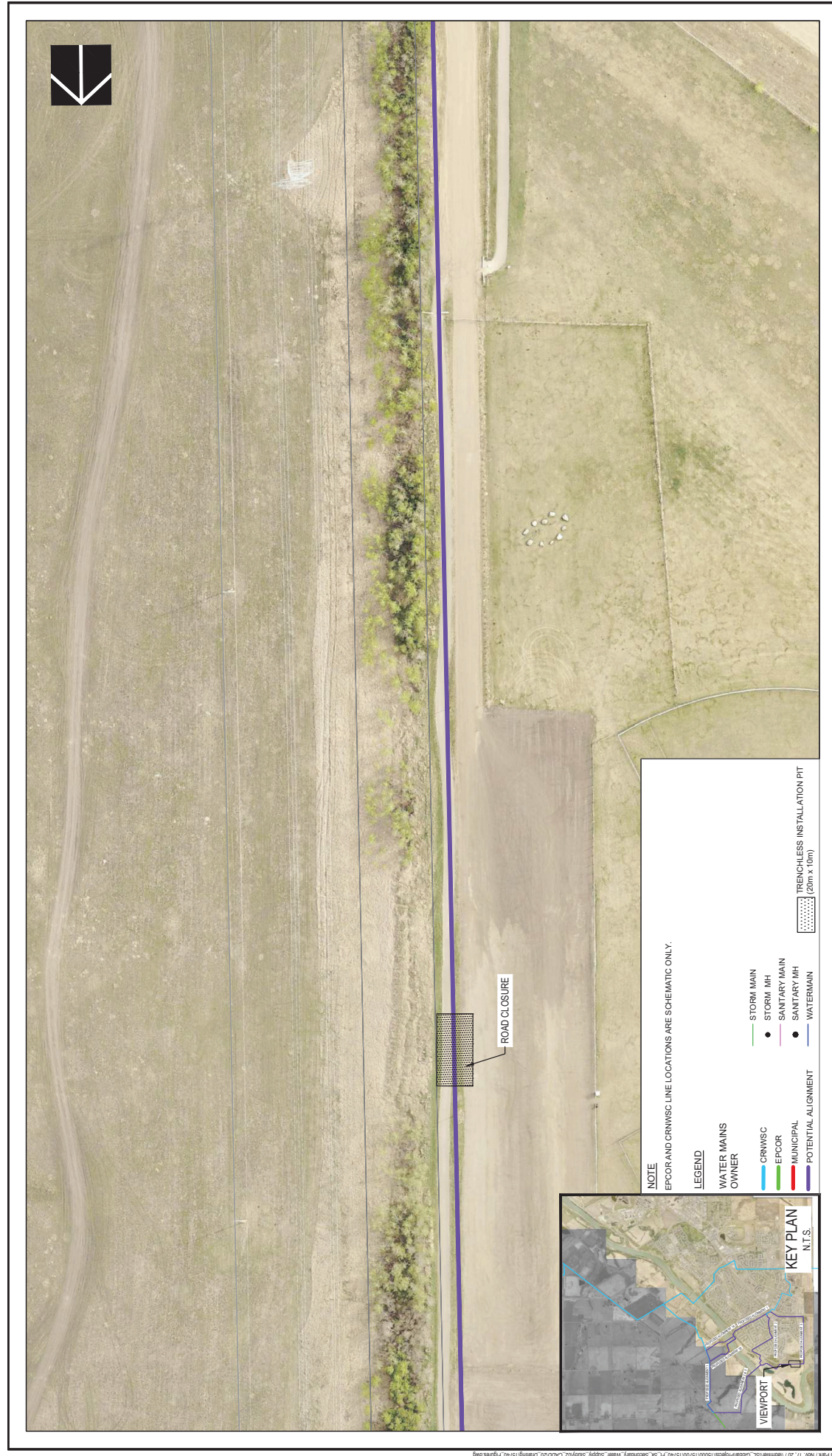


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 3
VIEWPORT 1

NOVEMBER 2020



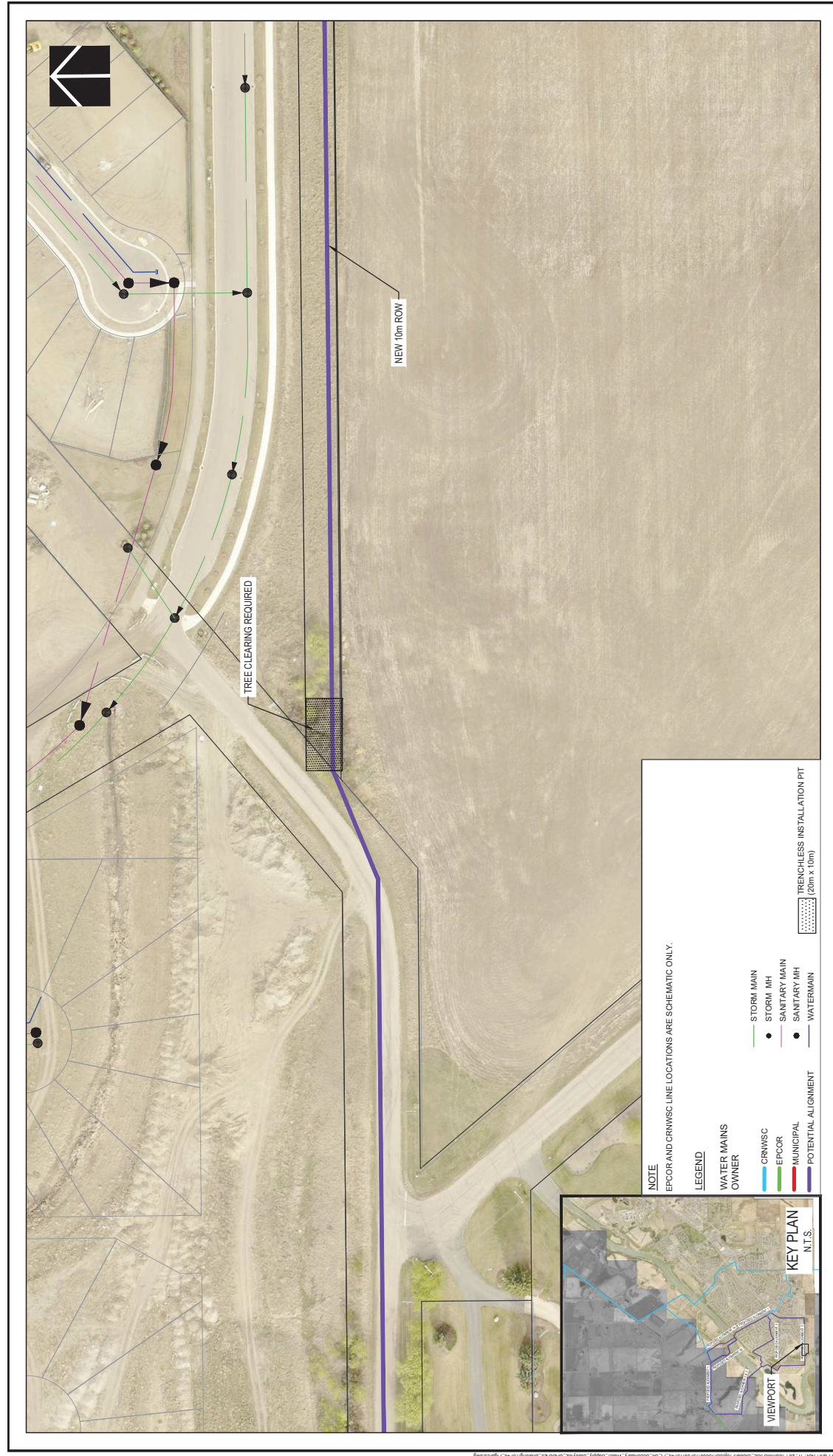
FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 3
VIEWPORT 3

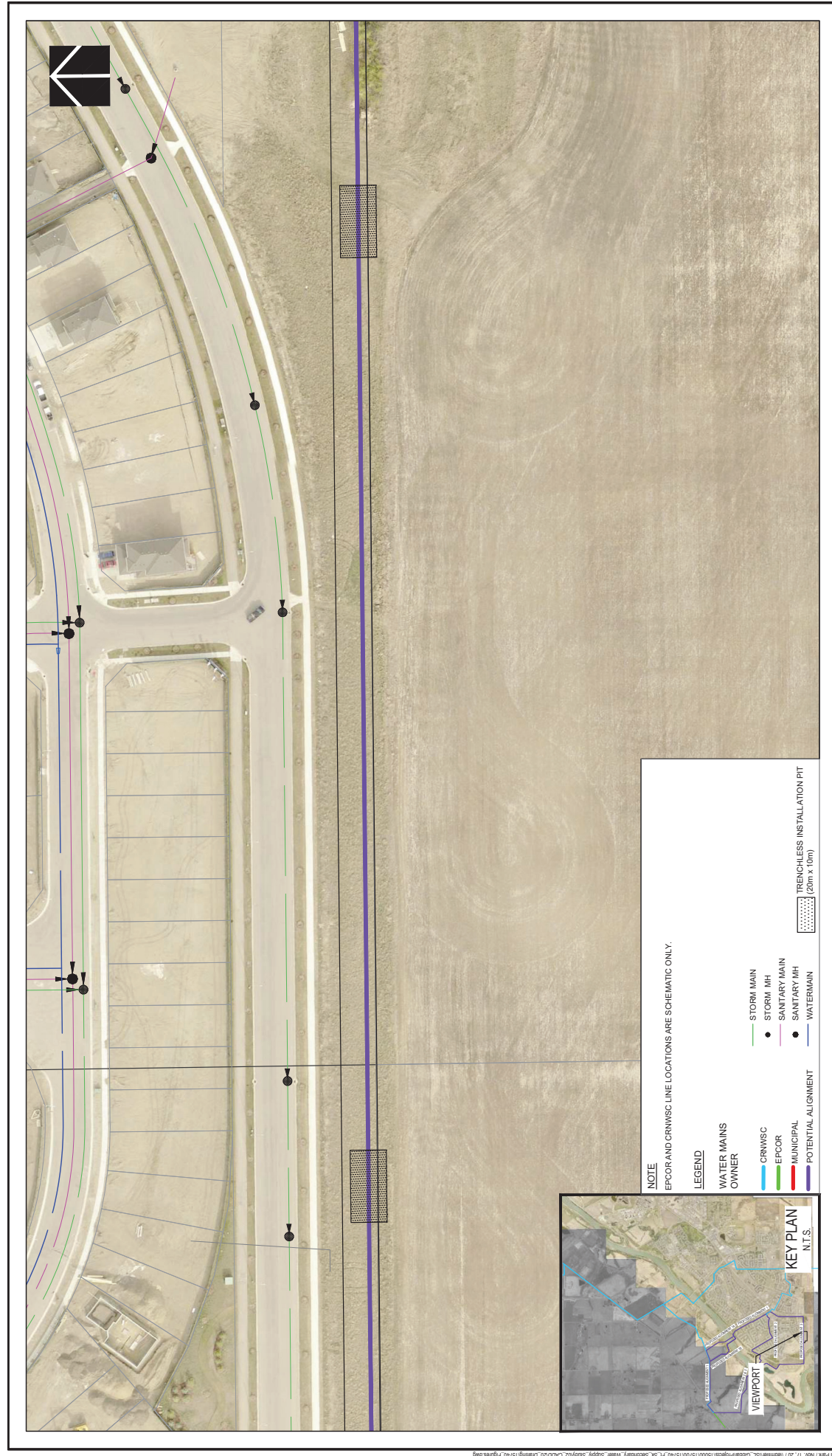




FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 3
VIEWPORT 5

FIGURE 5.24





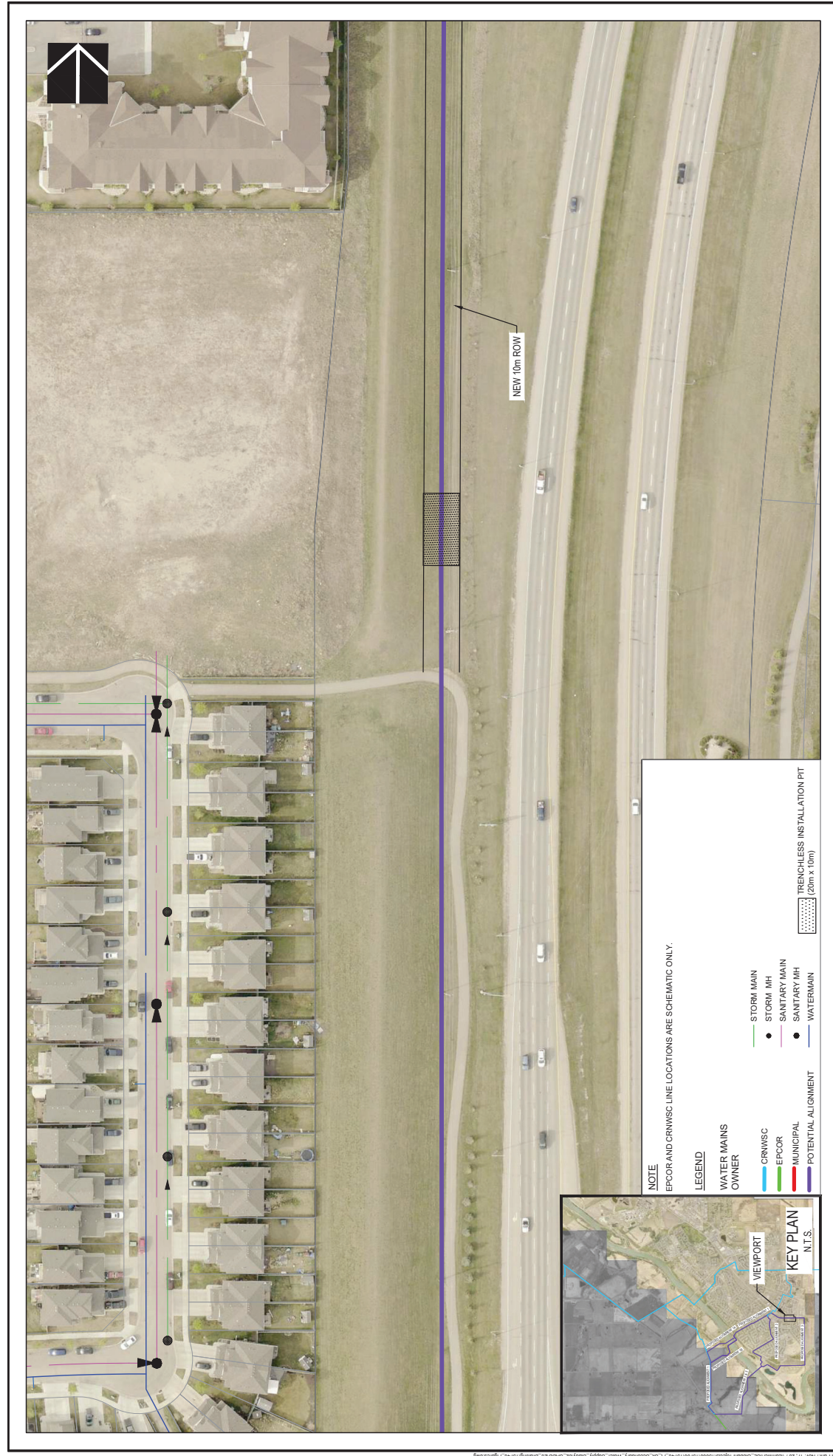


FORT SASKATCHEWAN SECONDARY WATER SUPPLY STUDY
PROPOSED ALIGNMENT 3
VIEWPORT 9

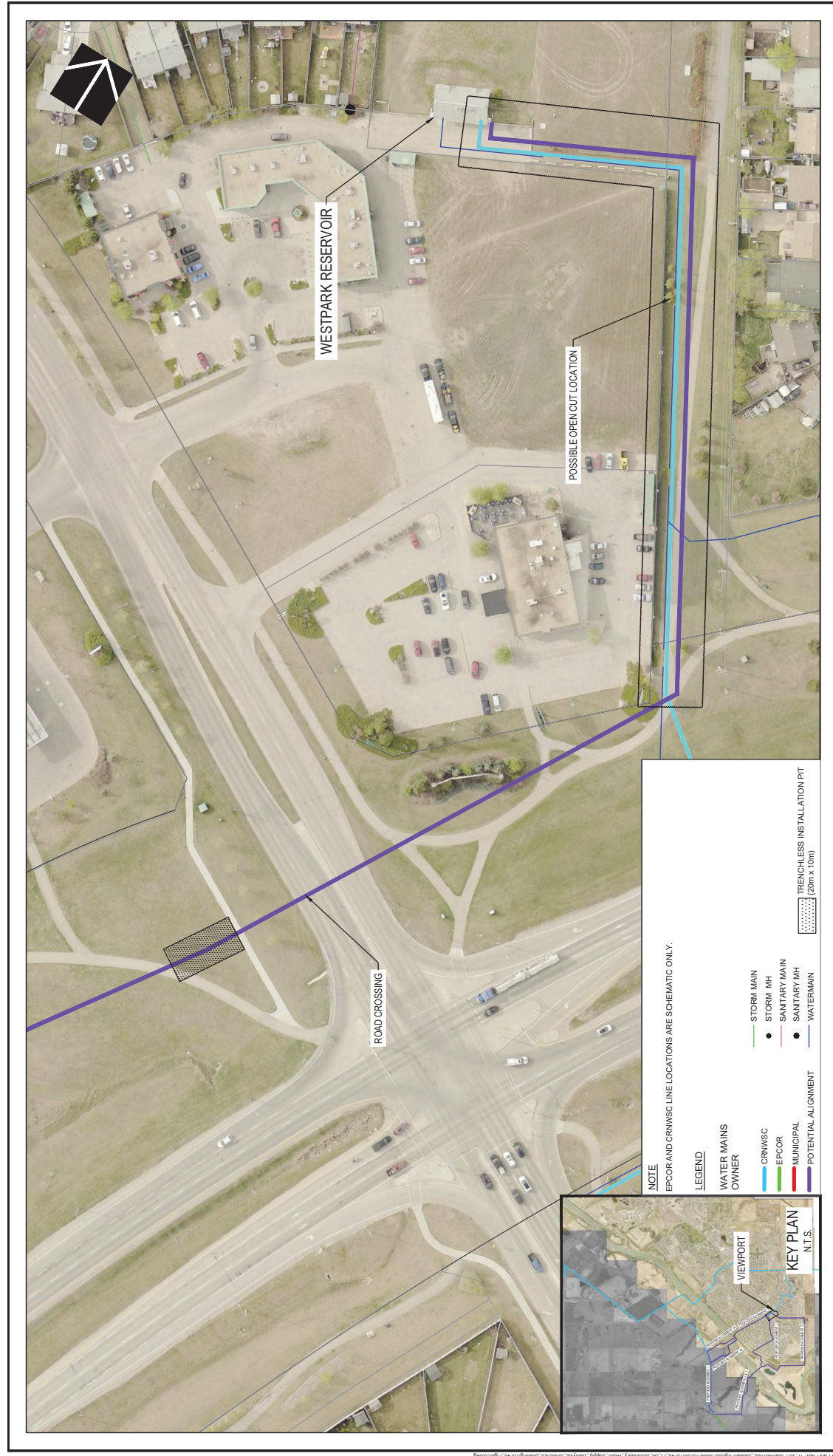
FIGURE 5.28

1:1000 0 10 20 30m

NOVEMBER 2020







FORT SASKATCHEWAN WATER SECONDARY SUPPLY STUDY
PROPOSED ALIGNMENT 3
VIEWPORT 12

FIGURE 5.31

0 10 20 30
 1:1000

NOVEMBER 2020

6.0 Transmission Main Cost Estimates

An analysis of the probable cost associated with each of the alternate alignments has been conducted to help the City understand the level of effort required to complete installation along each alignment. **Tables 6.1 through 6.3** for each alignment. Alignment 1a and 1b are the most cost-effective alignment followed by alignment 2, with alignment 3 being the highest cost option. Some notes regarding the cost estimates include:

1. Unit prices shown are all-inclusive and include cost items like mob, demob, commissioning, pressure testing, etc.
2. Land acquisition costs have not been included in the cost estimates.

Table 6.1 Cost Estimates for Alignment 1a/1b

Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Horizontal Directional Drilling (HDPE Piping)	m	4300	560	2,408,000
Case Bore Crossings (Railway)	m	75	5,000	375,000
Horizontal Directional Drilling for River Crossing (Steel Piping)	m	350	800	280,000
Open Cut Installation	m	75	630	47,250
Surface Clearing and Restoration	LS	1	109,500	109,500
Sub Total				3,219,750
Engineering Cost including Right of Way Registration	LS	1	15%	482,963
Contingency	LS	1	30%	965,925
Total				4,668,638

Table 6.2 Cost Estimate for Alignment 2

Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Horizontal Directional Drilling (HDPE Piping)	m	4550	560	2,548,000
Case Bore Crossings (Railway)	m	75	5,000	375,000
Horizontal Directional Drilling for River Crossing (Steel Piping)	m	350	800	280,000
Open Cut Installation	m	225	630	141,750
Surface Clearing and Restoration	LS	1	75,500	75,500
Sub Total				3,420,250
Engineering Cost including Right of Way Registration	LS	1	15%	513,038
Contingency	LS	1	30%	1,026,075
Total				4,959,363



Table 6.3 Cost Estimate for Alignment 3

Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Horizontal Directional Drilling (HDPE Piping)	m	6,620	560	3,707,200
Case Bore Crossings (Railway)	m	75	5,000	375,000
Horizontal Directional Drilling for River Crossing (Steel Piping)	m	350	800	280,000
Open Cut Installation	m	355	630	223,650
Surface Clearing and Restoration	LS	1	160,000	160,000
Sub Total				4,745,850
Engineering Cost including Right of Way Registration	LS	1	15%	711,878
Contingency	LS	1	30%	1,423,755
Total				6,881,483

7.0 EPCOR Discussions

ISL and the City of Fort Saskatchewan held a virtual meeting (via MS Teams) on September 30, 2020 to discuss the potential for the City to connect directly to the 900 mm EPCOR transmission main near Manning Drive and 33 Street NE. The following is a summary of the discussions:

1. The branch of EPCOR that provides water to the Regional Water Customers Group is not in favour of EPCOR supplying water to the City of Fort Saskatchewan as a new member of the RWCG as it would have a negative impact on one of the current members, the CRNWSC. Also, there is no financial incentive for EPCOR to do so as the revenue generated would be the same, with a portion of its CRNWSC billings being transferred to the City of Fort Saskatchewan (no change in total volume or cost per cubic metre). **Thus, EPCOR is not willing to supply water to the City on the same terms as it supplies water to rest of the region.**
2. EPCOR would be willing to sell water to the City of Fort Saskatchewan as a commercial customer if the arrangement did not violate the current agreement between the CRNWSC and the City. The rates as a commercial customer would be set by an agreement between the parties and it would not be regulated by the Alberta Utilities Commission.
3. EPCOR referred the City to its website for a listing of the current commercial water rates. The current (November 2020) commercial rates from EPCOR's website are summarized as follows:
 - a. 0 – 25.0 m³/month: \$1.6728/m³,
 - b. 25.1 – 100.0 m³/month: \$1.6728/m³,
 - c. 100.1 – 1000.0 m³/month: \$1.5427/m³,
 - d. 1000.1 – 5000.0 m³/month: \$1.2211/m³, and
 - e. ≥ 5,000.0 m³/month: \$0.9827/m³.
4. The following options for EPCOR supply were discussed:
 - a. EPCOR sells water to the City near the end of its transmission main (CRNWSC northside meter vault), with the City building the transmission main at its cost,
 - b. EPCOR constructs the transmission main and sells water to the City at the City's reservoir, incorporating the cost of the transmission main into the rates, or
 - c. EPCOR constructs the transmission main and takes over the operation of the City's water system (EPCOR suggestion).
5. The rates charged by EPCOR would be impacted by the following:
 - a. Guaranteed minimum annual volume of water that the City would purchase,
 - b. Maximum peak rate as a ratio of the average annual volume supplied,
 - c. The cost of the transmission main (if to be constructed by EPCOR), and
 - d. The length of the contract (10 to 20-year contract required).
6. EPCOR is willing to enter into confidential negotiations with the City on an agreement if the above information is supplied and there is a business case for EPCOR. The rate would be likely be higher than that charged to the regional customers, but it is not known if it would be lower than what the City is currently paying the CRNWSC.



8.0 Other Considerations

Throughout the course of this study several issues related to a potential secondary water supply were identified. These are summarized below, along with potential next steps for the City to consider in pursuing a secondary water supply.

Right-of-Way Acquisition in Sturgeon County

The first 1 to 2 km of the transmission main would be in Sturgeon County, who are also members of the CRNWSC. The County may not be willing to provide an alignment for the transmission main along County roadways, and it may be necessary to obtain right-of-way entirely from private landowners. Land acquisition costs have been excluded from the cost estimates provided in Section 6.0.

CRNWSC Agreement

It is understood that the City has obtained a legal opinion regarding the current CRNWSC agreement and determined that the City can obtain part of their water supply from another source.

Peak Water Demands

As a member of the Regional Water Customers Group, the CRNWSC and its members are required to limit their water use during peak demand periods to 1.4 times its ADD (note: exact peaking factor may fluctuate). Municipal demands more than this rate are required to be supplied by municipal reservoirs.

If the City of Fort Saskatchewan was to obtain its water from both the CRNWSC and EPCOR, it will be important to plan and operate the system in a way that meets the City's obligations to both entities. This may restrict the amount of water that can be purchased from EPCOR to less than the full Westpark Reservoir pumping capacity during normal operations, so that the City can balance the flow from each source during peak demand periods.

Potential Partnerships

The potential for the City partnering with other entities was discussed during the study. The City asked if it would be feasible for the City to supply water to the John S. Batiuk Water Commission. This water commission's is supplied from the CRNWC pumps north of the City of Fort Saskatchewan, and the transmission main crosses the river in the northeast part of the City. This idea has several practical constraints, including the length of transmission main required to connect, and the need for the City provide the needed pumping capacity. It is not practical for the City to supply water to the Batiuk Water Commission.

There do not appear to be any other partnerships that would enable the City to either reduce its water supply costs or develop revenue through the resale of water to other entities. Bulk sales of potable water to industries within the City's boundaries was not investigated.

9.0 Conclusions and Recommendations

9.1 Conclusions

1. EPCOR and Strathcona County are the only two entities in the area that could potentially provide a secondary water supply to the CRNWSC.
2. The Strathcona County transmission mains do not have capacity to service the City of Fort Saskatchewan, and the County is currently investigating options for supplying water to its proposed Bremner development.
3. EPCOR has indicated that they are not willing to supply water to the City of Fort Saskatchewan as a new member of the Regional Customers Water Group regulated by the Alberta Utilities Commission.
4. EPCOR is willing to explore the potential of supplying water to the City as a commercial customer, and to determine if there is a business case to do.
5. It is technically feasible to construct a water transmission main from the end of EPCOR's transmission main at Highway 15 & 33 Street NE to the City of Fort Saskatchewan's Westpark Reservoir.
6. The existing pumping capacity at the Westpark Reservoir is a constraint to the amount of water that the City can obtain from EPCOR. This constraint can be addressed by either upgrading the reservoir pumping capacity or selecting a transmission main alignment that can also be used to supply a future reservoir along the south edge of the City. While the existing pumping capacity can meet existing ADD demands, during MDD or PHD scenarios and during future scenarios, the CRNWSC will need to supplement the flows provided by the Westpark Reservoir.
7. The transmission main pipe size and cost estimates included in this report would allow the City to obtain all its water from EPCOR to the year 2035. The transmission main cost could be reduced if a lower design capacity was used.
8. It is not known if a business case can be made for the City to obtain water from EPCOR as a commercial customer. The City would need to enter confidential negotiations with EPCOR to determine the cost of water and any other terms in a potential agreement.

9.2 Recommendations

1. The City of Fort Saskatchewan should use the information presented herein (design flows, cost of transmission main) as the basis for negotiating with EPCOR to determine if there is a potential business case for obtaining water from EPCOR as a commercial customer.
2. If there is a potential business case for acquiring water from EPCOR, the design flow rate, pipe size, and alignment should be reviewed, and the cost estimate updated. The updated cost estimate should then be used to finalize the business case.