7.1.2.2 Growth Management Action Plan, August 2024

Watson & Associates Economists Ltd. and WSP prepared the Township of Wellington North Growth Management Action Plan, dated August 16, 2024 (Growth Management Action Plan) on behalf of the Township to guide the Township through long-term growth management in the delivery of municipal services, infrastructure requirements, urban land needs and land use planning policy, economic development and financial stability. As opposed to the Growth Plan (February 2018), which was used to inform the County of Wellington on the Township's growth priorities as the County completed the MCR and draft Official Plan Amendments, the purpose of the Growth Management Action Plan is to develop a vision for growth and provide direction for implementation of the preferred growth scenario presented in the Growth Plan (2018), which informed the County's MCR (2022).

It is noted that The Growth Management Action Plan provides a summary of the population, housing and employment forecasts from the County's MCR (2022), for which the projected population for Arthur is the same as was presented in the Phase 1 MCR Report (refer to Table 2 of this Report); however, the total household value and population density changed/updated, as summarized in Table 3. A copy of the Growth Management Action Plan is provided in Appendix C.

Table 3 - Summary of Population and Household Growth Anticipated for Arthur, per the Growth Management Action Plan

Year	Population	Households					Persons Per Unit
		Low Density	Medium Density	High Density	Other	Total	
2026	3,500	940	140	240	10	1,330	2.63
2031	3,900	1,060	170	260	10	1,500	2.60
2036	4,200	1,110	200	280	10	1,600	2.63
2041	4,400	1,140	200	310	10	1,660	2.65
2046	4,700	1,200	240	330	10	1,780	2.64
2051	4,800	1,240	250	340	10	1,840	2.61

7.1.3 Township Operation

The cost to operate and maintain the Township's water and wastewater systems are recovered from operating (non-rate) revenues (i.e., administrative fees, etc.) and through direct billing to customers (rate revenues). Currently, only non-residential water customers are metered in terms of water usage. Residential customers are billed based on a (flat) base charge calculated based on the full costs associated with managing the Township's water and wastewater systems over a ten year period and considers various cost components including operation and maintenance, customer growth, water consumption volume, asset management, capital expenditures (necessary for growth and asset renewal), capital inflation, inflation and market competition and pricing.

DFA Infrastructure International Inc. prepared the 2020 Water and Wastewater Rate Study and O.Reg. 453/07 Financial Plan (Rate Study) for the Township of Wellington North, dated

November 13, 2020 to conduct a comprehensive review of its water and wastewater services rate structure review. The Rate Study determined the full cost to service water and wastewater over a ten year period between Calendar Years 2021 through 2030 and calculated corresponding rates to adequately fund the cost of the Township's municipal water and wastewater systems, through fair and equitable treatment of its ratepayers.

7.2 Technical Environment

7.2.1 Existing Requirements

7.2.1.1 Storage

Storage requirements for the municipal water systems in Ontario are based on MECP Water System Design Guidelines (2008) and require municipal storage facilities to be designed to allow maintenance of adequate flows and pressures in the distribution network during peak hour demand and to meet the Maximum Day Demand (MDD) during fire and emergency events. The calculation for the storage requirement of a water system is as follows:

Total Treated Water Storage Requirement = A + B +C

Where: A = Fire Storage (MECP suggested flow/duration based on population)

B = Equalization Storage (25%) of MDD

C = Emergency Storage (25% of A+B)

Fire storage allows the system to achieve flow rates and volume necessary to effectively fight fires and is based on population specific fire flow rate and duration, as indicated in Table 8-1 of the MECP's Drinking Water Systems Design Guidelines (2008). Equalization storage provides water to the system during peak demand periods. Emergency storage is intended to provide a safety factor for the water storage.

The existing total system storage volume is 1,137m^3, equal to the storage volume of the Spheroid Tower. As previously noted, the Charles Street Tower has reached the end of its service life and has been excluded from the total storage capacity.

7.2.1.2 Distribution Network and System Pressures

The horizontal infrastructure (i.e., watermains) and the associated capacity of the distribution network is a factor of the water storage operating ranges and demands within the water system. The Arthur water system operates based on a hydraulic grade line (HGL), a critical concept for understanding water pressure and distribution. The HGL is a theoretical line representing the height to which water would rise in a column due to the pressure at any given point in the system. It reflects the potential energy within the system, indicating the water pressure available at various locations.

Consistent with MECP Design Guidelines (2008), the normal pressure in water distribution networks should fall within the range of 40 psi to 100 psi during normal demand periods, and typical operating pressures within the range of 50 psi to 70 psi. Additionally, available fire flows within the network should maintain a minimum residual pressure of 20 psi under MDD conditions, with the municipal wells running at the rated capacity, which represents the maximum water taking capability of the system, consistent with the normal accepted industry standard for firefighting (MECP, 2008).

As watermain approaches the end of its service life, with the occurrence of corrosion and scale build-up or breaks, there are impacts to the hydraulic performance of the distribution network, including reduced flows and pressures.

Pressure within the existing water distribution network is maintained within an optimal range of 40 to 100 psi, as per MECP guidelines. This range ensures that the water supply remains sufficient for domestic use and fire protection without causing damage to the infrastructure. Pressures below MECP's recommended range can result in insufficient water supply, while pressures above MECP's recommended range can cause infrastructure damage.

Topography significantly impacts pressure distribution in the existing distribution network. Higher elevations experience lower water pressure whereas lower elevations generally have higher pressures as the difference between the HGL elevation and the ground elevation is greater (i.e.,, the HGL is at a higher elevation than the ground elevation).

The municipal infrastructure (i.e., water towers), as discussed earlier, is designed to manage and balance pressure across the community. Ensuring a consistent pressure level is necessary to maintain adequate service and meet fire flow requirements. Fire flow capability is a critical part of the system's operation, ensuring sufficient water pressure and flow rate for firefighting purposes.

The existing Arthur water system distribution network by watermain size and expected fire flow capabilities is presented on Figure 8 and the existing watermain material and typical system pressure is presented on Figure 9.

7.2.1.3 Historical Demands

The total annual volume of raw water pumped from the Arthur municipal wells between calendar years 2019 through 2023 is summarized in Table 4. Maximum Day Demand is expected to vary yearly as it is attributed to many factors. Water demands often increase during dry weather as a result of consumers using water to water gardens, lawns, etc., during seasonal operations (i.e., municipal recreation services such as splash pad) or during extreme cold weather events where tap water is run (trickle flow) continuously to prevent water services from freezing, or during system maintenance events (i.e., watermain flushing and reservoir cleaning), emergency events (i.e., fire protection) or system failures (i.e., watermain breaks). Water demands typically decrease in the event of a loss of significant users (i.e., industrial) or when water conservation measures are implemented.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

N

JUNCTION FIRE FLOW RANGE

- 70 - 80 L/s
- 80 - 103 L/s
- 103 - 200 L/s
- 200 - 350 L/s

FIGURE 8

EXISTING EXPECTED FIRE FLOW CAPABILITIES OF THE EXISTING ARTHUR MUNICIPAL WATERMAIN DISTRIBUTION NETWORK

SCALE 1:10,000
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

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TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

JUNCTION PRESSURE RANGES

- 40 - 50 psi
- 50 - 60 psi
- 60 -70 psi
- 70 - 80 psi

FIGURE 9

EXISTING TYPICAL SYSTEM PRESSURE WITHIN THE EXISTING ARTHUR MUNICIPAL WATERMAIN DISTRIBUTION NETWORK

SCALE 1:10,000
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

Table 4 – Summary of the Total Annual Volume of Raw Water Pumped from the Arthur Municipal Wells

	Treated Volume Pumped				
	2019	**2020**	**2021**	**2022**	**2023**
Total Volume Pumped (m^3)	394,313.79	371,882.63	365,993.37	361,192.61	375,188.61
Change (m^3)	+14,943.27	-22,431.16	-5,889.26	-4,800.76	+13,996
Total Rainfall (mm)[1]	651.00	648.40	798.20	520.70	711.30

[1]When ambient temperature is >0ºC as reported at the Mount Forest Environment and Climate Change Canada - Meteorological Service of Canada, Climate ID6145504

The following Table 5 summarizes the average day demand (ADD) for each month of the last 5 years.

Table 5 – Summary of the Average Day Demand Over the Most Recent 5 Years for the Arthur Water System

Month	**Historical Average Day Demand (m^3/day)**				
	2019	**2020**	**2021**	**2022**	**2023**
January	1,006.3	1,028.9	879.1	899.1	925.5
February	1,018.6	1,010.9	918.5	905.4	958.4
March	1,052.0	1,007.5	962.3	869.6	972.7
April	1,029.5	890.8	935.8	870.3	998.5
May	1,077.2	1,021.1	1,084.2	962.7	1,092.9
June	1,153.9	1,156.1	1,187.0	1,109.6	1,219.6
July	1,237.1	1,228.1	1,065.2	1,138.9	1,151.3
August	1,117.9	1,104.1	1,107.2	1,052.3	1,093.0
September	1,109.9	1,048.7	1,032.2	1,069.2	1,116.9
October	1,083.7	1,012.0	984.5	1,024.7	1,060.1
November	1,056.0	958.7	958.3	1,001.4	949.1
December	1,016.5	832.6	913.5	966.4	922.5
Average	**1,079.9**	**1,025.0**	**1,002.3**	**989.1**	**1,038.4**
Maximum	**1,237.1**	**1,228.1**	**1,187.0**	**1,138.9**	**1,219.6**

The following Table 6 summarizes the max day demand (MDD) for each month of the last 5 years.

Table 6 – Summary of the Maximum Day Demand Over the Most Recent 5 Years for the Arthur Water System

Month	**Historical Maximum Day Demand (m^3/day)**				
	2019	**2020**	**2021**	**2022**	**2023**
January	1,108.4	1,138.8	1,040.9	1,056.2	1,074.5
February	1,123.1	1,120.5	1,065.6	1,065.0	1,079.1
March	1,173.0	1,494.8	1,116.9	1,020.4	1,118.1
April	1,153.7	1,086.6	1,130.2	1,143.1	1,225.3
May	1,209.2	1,503.2	1,423.0	1,226.1	1,491.6
June	1,359.3	1,472.0	1,541.7	1,558.0	1,535.0
July	1,477.9	1,572.0	1,376.8	1,447.0	1,436.1
August	1,421.4	1,309.9	1,405.8	1,257.3	1,431.7
September	1,240.3	1,212.2	1,187.1	1,225.5	1,402.3
October	1,228.4	1,172.7	1,257.2	1,293.9	1,278.2
November	1,219.7	1,203.8	1,167.5	1,169.5	1,153.8
December	1,162.1	1,020.9	1,197.4	1,196.0	1,089.6
Average	**1,239.7**	**1,275.6**	**1,242.5**	**1,221.5**	**1,276.3**
Maximum	**1,477.9**	**1,572.0**	**1,541.7**	**1,558.0**	**1,535.0**

7.2.1.4 Historical Reserve Capacity

The hydraulic reserve capacity for a water system is based on the system's Firm Capacity. Using Firm Capacity to determine the hydraulic reserve capacity ensures sufficient redundancy in the system for water supply and treatment in case of an equipment/facility failure. Reserve Capacity Calculations (RCC) are completed in accordance with the requirements outlined in the MECP Procedure D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants, dated March 1995. The MECP Design Guidelines for Drinking Water Systems (2008) recommends that the Source Capacity of a water supply system should be greater than the MDD so that daily demand can be met if storage is offline.

A summary of the RCC (firm capacity) and source reserve capacity for Arthur's water system over the last 4 years is presented in Table 7. The RCC is typically calculated such that the residential and ICI demands are separated, to establish a more accurate per person expected demand. However, for the purposes of this report, the residential and ICI demands will not be separated, as the detailed expected ICI growth for the urban area of Arthur is not known at this time. Taking this approach will leave the historic ICI demands embedded and included in the existing and future demand projections.

Table 7 – Summary of the Reserve Capacity Calculations for Arthur's Water System Over the Last 5 Years

Data Year	**2020**	**2021**	**2022**	**2023**
RCC Year	**2021**	**2022**	**2023**	**2024**
Firm Capacity (m^3/day)	2,255	2,255	2,255	2,255
3-Year Average MDD (m^3/day)	1,521	1,531	1,557	1,545
(Firm) Reserve Capacity (m^3/day)	**734**	**724**	**698**	**710**
Occupied & Serviced Households (Each)	918	968	1,093	1,229
Persons Per Existing Residential Unit (Capita)	2.40	2.40	2.60	2.60
Population Served (Capita)	2,203	2,323	2,842	3,195
MDD Per Capita[1] (m^3/day/capita)	**0.690**	**0.659**	**0.548**	**0.483**

[1] MDD per capita includes demand from employment lands.

Per Table 7, the 3-Year Average MDD has been relatively consistent for the recent (4-years) RCC, even though the serviced population has increased over the same period. This is likely due to large ICI users or other uses (watermain flushing, fire flows, etc.) with consistent demands that exceed residential water demands.

Per MECP design guidelines, the typical domestic use water demand should be in the range of 0.225 to 0.450 m3/day/capita. Given that the MDD in Arthur is significantly influenced by its ICI users, the per capita MDD is assumed to be an overestimated representation of equivalent residential usage. It is noted that the per capita MDD has consistently decreased based on the recent (4-years) RCC, which is likely due to the increase in population and residential service connections, which are expected to have much lower demands based on efficiencies in water usage for new developments. The current MDD per capita (0.483 m3/day/capita) is approaching the high end of the typical domestic use water demand (0.450 m3/day/capita) and can be used as a conservative approach for estimate future water demands.

7.2.2 Projected Requirements

7.2.2.1 Demands

A summary of the forecasted water demands is presented in Table 8. The projected demands assume population growth in Arthur will be in accordance with the projections presented in the MCR (Watson & Associates Economists Ltd, January 31, 2022) and assumes the per capita water demands remain consistent with existing conditions (i.e., 2023, MDD per capita of 0.483 m3/day/capita). It is noted the projected persons per residential unit presented in the Growth Management Action Plan differed from the MCR; however, the total population remained the same, therefore, there were no impacts to the calculated theoretical total system MDD.

Table 8 – Summary of the Projected Water Demands of the Existing and Future Population of Arthur

	Projected Demands and Reserve Capacity						
	2023 (Existing)	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Firm Supply Capacity (m^3/day)	**2,255**						
Population Served (Capita)	3,195	3,500	3,900	4,200	4,400	4,700	4,800
Persons Per Residential Unit (Each)	2.6	2.63	2.60	2.63	2.65	2.64	2.61
Per Capita MDD (m^3/day/capita)	0.483						
Total System MDD (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Utilization (%)	69%	75%	84%	90%	94%	101%	103%
Firm Reserve Capacity (m^3/day)	**710**	**563**	**369**	**224**	**128**	**-17**	**-66**

The MECP Design Guidelines for Drinking Water Systems (2008) recommends that the Source Capacity of a water supply system should be greater than the MDD so that daily demand can be met if storage is offline. Further, exceedance of the system's Firm Capacity indicates that there is insufficient redundancy in the system for water supply and treatment in case of an equipment/facility failure. Based on the forecasted water demands presented in Table 8, the Arthur water supply system will be exceeding 75% utilization by 2026, nearing capacity by 2036, with a deficit predicted by 2046. The 75% threshold is typically a milestone to initiate the implementation of the necessary infrastructure to continue meeting the MDD of the system.

7.2.2.2 Storage

Per Section 7.3.3.1 of this Report, MECP Design Guidelines for Drinking Water Systems (2008) require municipal water storage facilities to be designed to allow maintenance of adequate flows and pressures (component B, equalization storage) in the watermain distribution network during peak hour water demand and to meet critical demands during fire (component A, fire storage) and emergency events (component C, emergency storage).

The calculated storage requirements for the existing and future population in Arthur, assuming population growth is in accordance with the projections presented in the MCR (Watson & Associates Economists Ltd, January 31, 2022), is presented in Table 9.

Table 9 – Summary of Projected Water Storage Requirements of the Existing and Future Population of Arthur

	Projections						
Calendar Year	**2023 Existing**	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Projected Serviced Population (Capita)	3,195	3,500	3,900	4,200	4,400	4,700	4,800
MDD (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Duration (hours)	2	2	2	2	2	2	2
Fire Flow (L/s)	111	117	123	128	131	136	137
A - Fire Storage (m^3)	799	842	886	922	943	979	986
B – Equalization Storage (m^3)	386	423	472	508	532	568	580
C – Emergency Storage (m^3)	296	316	339	357	369	387	392
Total Storage Required (m^3)	1,482	1,582	1,696	1,787	1,844	1,934	1,958
Existing Storage (m^3)	1,364	1,137[1]					
Storage Remaining (m^3)	-118	-445	-559	-650	-707	-797	-821

[1]The existing storage for the 2023 considers the 227m^3 capacity of the Charles Street multi-leg tower; however, as this has reached the end of its service life, it is not considered in the total system storage capacity for the projected future storage capacity needs.

As per Table 9, the storage volume requirements to support the future growth indicate that the existing available storage is insufficient to meet the projected needs of the future population to 2051. Further, it is calculated that the existing storage capacity of the Arthur water system is deficient in meeting the required storage for the existing population; however, given that there is currently surplus Firm Reserve Capacity, the system maintains a sufficient water supply capacity to service the existing population. A storage volume of at least 900 m^3 is needed to ensure there is enough water storage capacity within the Arthur water system to service the projected future population to at least calendar year 2051.

7.2.2.3 System Pressures

Future development areas as contemplated within the 2018 Growth Plan,2020 Water and Sanitary Systems Technical Study – Arthur (Technical Study) and Growth Management Action Plan (2024) generally surround the existing built-up area of Arthur and these future development areas are located at higher topographic elevations than the existing community.

Watermain extensions will be required to service future developments. The design of the extensions will provide interconnection and looping for the existing water distribution network and will be determined at the preliminary stage of future developments. Although Arthur has a relatively consistent topography, the future development areas to the north and northeast of the existing built-up area are at higher elevations than the rest of the community. Consistent with the Technical Study (refer to Appendix D), the projected pressures within the watermain distribution network were reviewed for various development scenarios. It was determined that the available pressure within the watermain distribution network would ultimately be reduced to the lower end and below the optimal minimum pressure (40 psi) of the normal operating range for development of lands sited on lands at higher elevations, which may result in end user complaints relating to sufficient flows and pressures. A summary of the expected pressures within the anticipated watermain distribution network is provided in Table 10.

A summary of the expected pressures within the anticipated watermain distribution network within future development areas based on the water level within the existing spheroid water tower is provided in Table 10.

Table 10 – Summary of Expected Pressures within the Watermain Distribution Network for Future Development Areas

Pressure (PSI)		Ground Elevation											
		469.0	**468.5**	**468.0**	**467.5**	**467.0**	**466.5**	**466.0**	**465.5**	**465.0**	**464.5**	**464.0**	**463.5**
Tower Water Level	494.0	35.6	36.3	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4
	494.5	36.3	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1
	495.0	37.0	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8
	495.5	37.7	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5
	496.0	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2
	496.5	**39.1**	**39.8**	**40.5**	**41.2**	**42.0**	**42.7**	**43.4**	**44.1**	**44.8**	**45.5**	**46.2**	**46.9**
	497.0	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6
	497.5	40.5	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4
	498.0	41.2	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1
	498.5	42.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8
	499.0	42.7	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8	50.5
	499.5	43.4	44.1	44.8	45.5	46.2	46.9	47.6	48.4	49.1	49.8	50.5	51.2

Per Table 10, if the water level within the existing tower is half full (i.e., elevation of 496.5 m above mean sea level [amsl]), the theoretical pressure at any ground elevation above 468 m amsl will be less than 40 psi. Operating pressures improves as the water level in the storage facility increases; however, it is still at the lower end of the optimal operating range. It is noted that the future development lands to the north and east of the existing built-up area are at elevations of 461 m to 470 m amsl. Therefore, an increase to the HGL and operating range of the storage facility should be considered to improve pressures within the watermain distribution network to adequately service future development areas.

To further assess this, the Township and Triton Engineering completed a System Pressure Testing assessment in the summer of 2024 to assess the existing system's operating levels and consider potential improvements to service existing and future development lands. A copy of the System Pressure Testing Report is included in Appendix E. The assessment determined that the HGL in the water system should be increased by 3.0m to a high-water level (HWL) of 501.73m in the future, to ensure that future development areas have adequate pressure. It was further determined that existing areas, such as those near Schmidt Drive and Eliza Street, exhibit pressures close to the minimum acceptable threshold of 40 PSI, indicating an opportunity for improvement. A 3.0m increase in the HGL would improve pressures within the existing system and is not expected to result in pressures exceeding the 100 PSI (689.5kPa) threshold within the existing or future distribution system. Therefore, it would be reasonable to design the future water system to have a low-water level (LWL) equal to the existing LWL (493.303m) and future HWL to be 3 metres above the existing HWL (498.703m) for a future HWL of 501.703m and a future operational range of 8.4m to manage and balance pressure across the community (including future development lands).

7.3 Social Environment

The Township of Wellington North is the most northerly Township in Wellington County, and the community of Arthur is the most southerly urban centre in the Township. Arhtur is designated as “Canada’s Most Patriotic Village” by the Toronto Star newspaper in its November 2, 1942 edition and through formal confirmation of its patriotism in 2002 by David Tilson, MPP for Dufferin-Peel-Wellington-Grey, as he stated in the Ontario Legislature.

Per the Township’s 2024 Strategic Plan (Do/Able Consulting, October 2023), residents in the Township “enjoy the benefits of a small-town atmosphere, a wealth of conservation land and natural areas, and highly rated community services.” Community services include emergency, environmental, arts and culture, recreation, transportation related services and support for small and large businesses.

Per the Township’s 2024 Strategic Plan, prepared by Do/Able Consulting and dated October 23, 2023, Township residents are satisfied with the quality of life within and the services provided by the Township. Members of the community that participated in the planning process for the Township’s strategic plan supported the goal of “building a safe, sustainable and welcoming community,” which the Township intends to achieve through three strategic priorities, as follows:

- shape and support sustainable growth
- deliver quality, efficient community services aligned with the Township’s mandate and capacity
- enhance information sharing and participation in decision-making.

7.4 Cultural Heritage Environment

Cultural heritage resources include archaeological resources, built heritage resources and cultural heritage landscapes.

7.4.1 Built Heritage Resources and Cultural Heritage Landscapes

Cultural Heritage Landscapes and Built Cultural Heritage Resources are geographical areas and built resources which may or may not have been modified by human activity and are identified as having cultural heritage value or interest by a community. Areas can include resources such as structures, buildings, archaeological sites, natural elements, groups of elements and properties (i.e., neighbourhoods, main streets, gardens, etc.) with cultural value or interest under the Ontario Heritage Act, or have been included or protected by registers, official plans, zoning by-laws or other land use planning mechanisms.

Within Arthur, the lands and premises at the property of 181 Tucker Street is designated as being of architectural and historical value or interest under the Ontario Heritage Act. Additionally, the Arthur River Trails, which opened in 2013 are used year-round by residents and visitors for recreational use, and is an important cultural resource within the Study Area. The Grand River is a designated Canadian Heritage River System, with cultural heritage resources. There is a historical structure located at MacPherson Park (corner of George Street and Francis Street) honoring the history of Arthur, entitled “Founding of Arthur”, which was erected by the Archaeological and Historical Sites Board, Department of Public Records and Archives in Ontario. Another built heritage resource includes Arthur’s Cenotaph, located at the corner of George Street and Frederick St, which was unveiled in 1923, to honor soldiers who fought in World War I, and later World War II and peace keeping missions. The Charles St multi-leg water tower may have historical and cultural significance as a landmark within the Study Area.

Per the Township’s Municipal Cultural Plan Update (MDB Insight, November 2021), the Township *is home to several natural heritage and cultural heritage assets. Cultural heritage assets such as plaques and monuments, public art, and cemeteries commemorate the history and stories of Wellington North’s residents. Murals such as* [Arthur’s] *Jones Baseline offer an approach to the history of relationships between Indigenous groups and the communities they have interacted with. Other significant murals include the Patriotic Mural in Arthur, Canada’s Most Patriotic Village,* Pioneer Mural and Freedom Isn’t Free Mural. *Local stories are the “DNA of culture” and are intangible cultural resources that contribute to Wellington North’s arts and culture. Key intangible assets include Arthur “Canada’s Most Patriotic Village,” Wellington North as a Fashion Destination, The Roxy Theatre and The History of Hotels.*

Consistent with the Ministry of Citizenship and Multiculturalism (MCM) requirements, the *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* is used to determine if a project area is a recognized heritage property or may be of cultural heritage. . Although the Study Area is located within a Heritage River Watershed (Grand River Watershed) and contains buildings or structures that are 40 or more years old, it is interpreted that if there is no work planned to occur adjacent to the Grand River or buildings and/or structures that are more than 40 years old, then these particular criterion are not met. Once the area that may be impacted by project activities is identified, the checklist will be completed, as described in the following sections.

7.4.2 Archaeological Resources

Consistent with MCM requirements, the *Criteria for Evaluating Archaeological Potential, A Checklist of the Non-Specialist* is used to determine if a project area may contain archaeological resources. The potential for archaeological resources existing with the Study Area given there are present or past water sources within 300 m at certain locations along the Study Area boundaries, presence of property recognized for cultural heritage value and evidence of early historic transportation routes and historic settlement. Once the area that may be impacted by project activities is identified, the checklist will be completed, as described in the following sections.

8.0 Phase 2 – Shortlist Evaluation of Alternative Solutions

As part of Phase 2 of the planning process, the reasonable alternative solutions are evaluated, with consideration of the effects of the alternatives on the environment (natural, economic, technical , social, and cultural), leading to identification of the preliminary recommended solution.

The shortlist evaluation of alternative solutions is based on the ability of the alterative solution to address the issues identified in the Problem/Opportunity Statement and is summarized in Table 11, as follows:

Table 11 – Shortlist Evaluation of Alternative Solutions

Alternative Solutions		Problem Statement Components		Problem Statement Addressed? (Alternatives 2 and 3 need to satisfy corresponding component)
		Increase Water Supply Redundancy to Support Expected Population Growth	Increase Water Storage to Support Expected Population Growth	
Baseline/General Alternatives	1a – "Do Nothing"	No	No	No
	1b – Limit Community Growth	No	No	No
	1c – Reduce Water Demand/Implement Conservation Measures	No	No	No
Water Supply Alternatives	2a – Increase Water Taking from Existing Municipal Wells	Yes	Not Applicable	Yes
	2b – Addition of New Well(s) to the Existing Municipal System	Yes	Not Applicable	Yes
Water Storage Alternatives	3a – Construct a New Water Storage Facility to Supplement the Existing Municipal Water Storage Facilities	Not Applicable	Yes	Yes
	3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Storage Facility	Not Applicable	Yes	Yes
	3c – Construct a New Water Storage Facility and Decommission Both Existing Water Storage Facilities	Not Applicable	Yes	Yes

Note: If Problem Statement is satisfied (i.e., "Yes") = Alternative is shortlisted for further evaluation.

Consistent with Table 11, Alternatives 2a and 2b are carried forward for further evaluation with respect to addressing the water supply component of the Problem/Opportunity Statement and Alternatives 3a, 3b and 3c are carried forward for further evaluation with respect to addressing the water storage capacity component of the Problem/Opportunity Statement. It should be noted that further evaluation of the short-listed alternative solutions will identify a preliminary preferred water supply alternative and water storage alternative that will together best address the Problem/Opportunity Statement. It should be noted that Baseline/General Alternative 1c should be considered as a key component of the identified preliminary preferred alternative solutions, since its implementation is expected to extend the service life of the existing and future increased water supply and storage capacities.

9.0 Evaluation of Water Supply Alternatives

R.J. Burnside & Associates Limited (Burnside) was retained by the Township in 2021 to complete an assessment and initial exploration for a new water source, per the recommendations of the Arthur Water and Sanitary Systems Technical Study (November 2020) and Reserve Capacity Calculations for Arthur's Water System, to support the eventual associated Class EA project. Burnside's well exploration study included a desktop evaluation of background information, including local overburden and bedrock geology; alternatives for additional water, well exploration; and a summary of conclusions and recommendations. The results of the study are documented in the report by Burnside entitled Arthur Preliminary Well Exploration Assessment (May 6, 2021) (Well Exploration Assessment), summarized in the following section. A copy of the Well Exploration Assessment is provided in Appendix H.

9.1 Alternative 2a - Increase Water Taking From Existing Wells

Per the Well Exploration Assessment, Well 7B currently uses less than half of the available drawdown of the well. It is expected that Well 7B could produce more than 35 L/s. Wells 8A and 8B are also expected to be capable of producing significantly more water that is currently permitted. It is ideal that these wells are drilled into separate aquifers because should one aquifer become contaminated, the other source would not be impacted. The issue with increasing water taking from these existing wells is the existing concentrations of iron and manganese.

Water sourced from Well 7B has an elevated concentration of iron and water sourced from the Well 8A/8B site has elevated concentrations of manganese, both being metals that affect the aesthetic water quality. Health Canada proposed Guidelines for Canadian Drinking Water Quality for Iron, with the consultation period ending November 28, 2023. Health Canada also proposed Guidelines for Canadian Drinking Water Quality for Manganese, dated May 10, 2019, which remains a guideline. Should the guideline for manganese be adopted as a standard, water sourced from Well 8A/8B would require a new treatment process, which would involve the construction of a larger pumphouse and discharge of wastewater from the treatment process for treatment.

The existing wells (7B, 8A and 8B) are located in relatively remote areas outside of the existing developed area of Arthur.) There are no sanitary sewers in the proximity of the existing municipal wells, therefore, there is nowhere to discharge wastewater from water treatment processes, if required. Watermain connecting the existing wells to the distribution system are potential sources of failure as there is only one transmission line (no looping) leading from the water sources and the length of the transmission line/watermain increases failure opportunities and maintenance costs for this asset.

Increasing the capacity of the permitted water taking at Well 7B would also require the construction of a new Well 7C, to provide mechanical duplication of 7B. Increasing the capacity at the Wells 8A/8B site could be achieved through operating the wells together, which could be obtained through a Category 3 PTTW amendment following testing completed under a MECP EASR registration. Alternatively, a new, deeper test well could be drilled at the Wells 8A/8B site to determine if the deep bedrock in this area can produce sufficient capacity of water whose manganese concentrations would likely be lower than at the existing Wells 8A/8B. If so, water from a deep bedrock well could be used to replace existing Wells 8A/8B or blended. Either of these options to increase water taking at either or both well sites would require additional testing.

Per Burnside's Well Exploration Assessment, the following conclusions and recommendations were made regarding increasing water taking from existing wells.

Conclusions:

- The deep overburden contact aquifer, located between 40 and 70 m below grade, where the existing Wells 7B and 8A/8B draw water has high capacity with the potential for significant expansion (on existing or additional sites).
- Increasing the permitted capacity from the Well 7B site would require testing to increase the PTTW rate, and a second well to duplicate the water source in case the existing Well 7B were to fail and would be expensive given the requirement to expand the existing pump house and construction of a treatment system to remove iron.
- Increasing the permitted capacity from Wells 8A/8B would require testing and treatment system to remove manganese.

Recommendations:

- The cost to treat water sourced from Wells 8A/8B for the removal of manganese should be investigated, including the disposal of water from the treatment process.
- The cost to treat water sourced from Well 7B for the removal of iron should be investigated, including the disposal of water from the treatment process.
- A second well should be constructed at the Well 7B site to provide mechanical duplication.

Wellington Source Water Protection, Risk Management division, also provided comment on Source Water Protection in relation to increasing water taking from existing wells, as follows:

- Well 7B is currently pumping at less than half its available drawdown. Pumping more capacity at this well would likely increase the size of the WHPA, but would not change the orientation of the WHPA, or increase the vulnerability. The WHPA-A would not change, and due to the low to moderate vulnerability scoring it would likely only result in a small number of properties that may potentially have DNAPL threats. However, with the increased capacity, whether due to increasing pumping from 7B, a new well (7C) would have to be drilled as back up. This well would likely increase the area of the WHPA-A but would be unlikely to impact any new properties.

- Wells 8A/B could be pump concurrently to increase capacity. Pumping more capacity at this well would likely increase the size of the WHPA, but would not change the orientation of the WHPA, or increase the vulnerability. The WHPA-A would not change, and due to the low to moderate vulnerability scoring, it would likely only result in a small number of properties that may potentially have DNAPL threats. However, due to increased levels of manganese in the water at this location, expensive treatment may be required. Should the Township choose to drill these wells deeper to avoid the manganese, the size and orientation of the WHPA could change drastically, affecting many properties both within the urban boundary and in the rural areas surrounding Arthur.

The *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* was completed for the existing well site properties. Although the existing well sites are located within a Heritage River Watershed (Grand River Watershed), it is interpreted that this criterion is not met because the sites are not adjacent to the Grand River and the response to this box on the checklist can be marked as ‘no’. A copy of the checklist is provided in Appendix F.

The *Criteria for Evaluating Archaeological Potential, A Checklist for the Non-Specialist* was completed for the existing well site properties, and determined that there is low potential for archaeological resources to exist due to recent, extensive and intensive disturbance. A copy of the checklist is provided in Appendix G.

9.2 Alternative 2b - Addition of New Well(s)

Based on the growth projections and RCC for Arthur’s water system, the criteria for siting a new well included the following:

- Water production of at least 10 L/s.
- Water quality that meets or exceeds the current and future Ontario Drinking Water Standards, for the following parameters: sulphate, iron and manganese.

It was determined that exploration for a new well should occur at the north end of the Study Area, on Township property (corner of the unopened Wells St road allowance and Macauley St) based on Burnside’s detailed review of the exiting background information, including studies completed by adjacent municipalities, history of municipal wells (Wells 1 to 6, currently abandoned), and review of the MECP water well record database for wells within the Study Area and within the surrounding 5 km of the Study Area. A summary of the background conditions in the north end of the Study

Area, as it relates to water production is as follows, consistent with the Burnside Well Exploration Assessment:

- The overburden gravel aquifer (Lower Sediments) is not reported.
- Top of bedrock is located at approximately 50 m below grade.
- The bottom of the carbonate aquifer is approximated at 180 m below grade.

The area at the existing Wells 8A/8B site was also identified as a potential area for well exploration given that it is Township property and is equipped with existing water source infrastructure. If a bedrock test well drilled at this site does not have the capacity to produce a water capacity of at least 10 L/s, then an additional exploration site on Township property at the extreme south end of the Jones Baseline road allowance would be explored, given that it is Township property in an area with the potential to produce a high-capacity water supply.

Per Burnside's Well Exploration Assessment, the following conclusions and recommendations were made regarding the exploration for the addition of new well(s).

Conclusions:

- Exploration for a bedrock water source is preferred over increasing capacity within the deep overburden as it is anticipated that a bedrock water source would contain less iron and manganese and therefore not require construction of a treatment system.
- Exploration for a bedrock water source (in the deep carbonate bedrock aquifer) outside of the Arthur core area is preferred, given that it is anticipated to provide better water quality and source capacity as compared to existing and/or abandoned municipal wells.

Recommendations, in order of implementation:

- A test well should be drilled in the north end of the Study Area on Township property (intersection of unopened roads Wells St and Macauley St).
- A test well should be drilled at the Well 8A/8B site, following exploration in the north end of the Study Area.
- If drill at the Well 8A/8B site does not provide favourable results, drilling at the south end of the Jones Baseline road allowance should be considered.

9.3 Well Exploration and Short-Term Pumping Test

Consistent with the conclusions and recommendations in Burnside's Well Exploration Assessment, exploration for a new water source, in the north end of the Study Area, outside of the urban core, was the next step in evaluating the water supply alternatives. Therefore, Well Initiatives Limited (Well Initiatives) was retained by the Township as the licensed well contractor to support the well exploration process.

9.3.1 Test Well TW1-21 Construction and Preliminary Testing

Burnside and Well Initiatives initiated drilling on Township property at the southeast corner of the Macauley St and Wells St intersection in November 2021. Sampling of the overburden identified a relatively thick permeable layer of sand and gravel in the lower sediments that was recommended for testing with a test well. A 150 mm diameter test well, identified as TW1-21, was constructed to a depth of 42.4 m below grade, with a 150 mm diameter stainless-steel water well screen installed between 42.7 m and 47.5 m below grade, in the most permeable and productive part of the thick sand and gravel aquifer. Following installation of TW1-21, it was pumped with compressed air for two days to develop the stainless-steel well screen before initiating the short-term pump test.

The location of TW1-21 is shown on Figure 10. The TW1-21 site is bounded by cultivated fields; however, lands to the east are within the Arthur urban boundary and are zoned industrial, lands to the north (within the urban boundary) are zoned as future development, and lands to the west of Wells St are outside of the Arthur urban boundary and are zoned as agricultural.

A short-term pump test was completed at TW1-21 on November 21, 2021, which included pumping rates of up to 25 L/s and the collection of water samples to test the quality. Water quality results indicated concentrations of iron, manganese and nitrate at less than half the allowable limits in the Ontario Drinking Water Standards and less than half of the concentrations currently present at water produced from the existing municipal wells. Based on Burnside's review of the water well database, there are no other wells drilled into the same aquifer, within a 2 km radius of TW1-21.

Given that the short-term pump test at TW1-21 met the criteria of water production of at least 10 L/s, and promising initial water quality sample results, long-term pump testing was recommended by Burnside as the next step in evaluation of TW1-21 to confirm water production capability and water quality at this site. It was proposed long-term pump testing include continuous pumping for an approximate duration of one week, combined with water level monitoring of existing municipal wells and private wells in the area immediately surrounding the TW1-21 area, as well as detailed water sampling for quality analysis.

Details of the initial well exploration are provided in Burnside's Technical Memorandum – Arthur Well Exploration Update 1, TW1-21 Construction and Preliminary Testing (Technical Memo), dated January 4, 2022, which is provided in Appendix I. This Technical Memo was received by Township Council at their January 10, 2022 meeting.

The *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* was completed for the TW1-21 site and determined that there is low potential for built heritage or cultural heritage landscape within the right-of-way and surrounding lands. A copy of the checklist is provided in Appendix F.

The *Criteria for Evaluating Archaeological Potential, A Checklist for the Non-Specialist* was completed for TW1-21 site and immediate surrounding area and determined that there is low potential for archaeological resources to exist for the area to the north of the TW1-21 site/Macauley

Street right-of-way. A copy of the checklist is provided in Appendix G. The lands to the south of the Macauley St right-of-way are clear of any archaeological concern, based on the findings of the Stage 1-2 Archaeological Assessment completed for the site, as documented in the Stage 1-2 Archaeological Property Assessment of the West Half of the Proposed North Arthur Industrial Lands (2094940 Ontario Inc), dated October 15, 2021, as prepared by AMICK Consultants Limited, which was accepted into the Ontario Public Register of Archaeological Reports on October 20, 2021 (AMICK File #2020206/MHSTCI Project Information Form Number P058-1960-2021, MHSTCI File Number 0013389).

9.3.2 TW1-21 Long-Term Pumping Test

In accordance with their recommendations in the Technical Memorandum, Burnside proceeded with the long-term pumping test at TW1-21 in 2022. Details of the long-term pumping test are documented in the report by Burnside entitled *Hydrogeological Report in Support of Arthur Water Supply Environmental Assessment* (Rev 1. November 2022) (Hydrogeological Report), which is attached to this report in Appendix J. A summary of the long-term pumping test is provided in the following sections:

9.3.2.1 TW1-21 Testing

Variable rate testing was completed at TW1-21 on November 29, 2021 during the short-term pumping test to determine the production capacity of the test well and inform the parameters for the long-term pumping test. Burnside prepared a pumping test design report to meet the requirements of and register the test in the Environmental Activity Sector Registry (EASR) on May 16, 2022. Per the design report and registry (Reg. No. R-011-9152754560), the maximum rate of taking permitted was 42 L/s for seven days; however, the actual long-term pumping test consisted of pumping at a rate of 23 L/s for 6 days (144 hours, starting at 9:10 AM on June 18, 2022 and ending at 9:15 AM on June 24, 2022), including pre- and post- test monitoring. Water pumped from TW1-212 during the test was discharged to Farley Creek, downstream of the monitoring locations. The pumping test occurred during a period of below average precipitation that experienced 70 percent of the historical normal for precipitation.

9.3.2.2 Well Monitoring

Burnside reviewed the MECP well records database to identify wells within 2.5 km of TW1-21. They then completed a door-to-door well survey for those identified within 2.5 km of TW1-21 to review additional details of the wells (i.e., permission to access, depth, location, accessibility, etc.). Burnside obtained permission to monitor 14 private wells, including four shallow monitoring wells, to support the long-term pumping test at TW1-21. They also notified all residences within 1 km of TW1-21 of the long-term pumping test, with emergency contact information to report any impacts.

Monitoring of the private wells and TW1-21 included a combination of manual water level measurements, automatic water level recorders and sonic water level meters. A 50 mm diameter monitoring well, drilled to the same depth as TW1-21, identified as MW1-21, was installed 7 m south of TW1-21 for monitoring by manual and automatic methods during the long-term pumping test. The existing municipal wells (7B, 8A and 8B) and their associated monitoring wells were also monitored as part of the long-term testing and was completed using the SCADA system and automatic water level recorders, in accordance with the Township's PTTW monitoring program.

The response of the wells being monitored, including at TW1-21 and MW1-21, as part of the test were measured before, during and after the pumping test and were recorded relative to ground surface, well depth and approximate pump depth to approximate drawdown caused by the pumping test, with consideration of seasonal water level declines. The response observed at TW1-21 and MW1-21 were similar, with the static water level at MW1-21 being 0.03 m lower than at TW1-21 prior to the test and 1.54 m less during the test, with similar recovery trends. The static water level in TW1-21 was 8.63 mbgs prior to testing (i.e., total drawdown of 14.56 m), 23.19 mbgs during testing and 8.56 mbgs 36-hours post-testing.

Both TW1-21 and MW1-21 are completed in relatively thick and permeable portion of an overburden aquifer and the response observed at both locations was typical of a leaky confined aquifer with a limiting boundary. Based on Burnside's interpretation of the distance drawdown analysis, the results are representative of a regional discontinuous contact aquifer, with slightly more drawdown observed at wells upgradient of TW1-21. Reduced recovery is interpreted to be due to seasonal water level decline in the regional aquifer.

The response observed at private wells followed similar response trends as TW1-21 and a delayed recovery that is interpreted to be influenced by seasonal water level declines and increased water taking during an extended period drought in 2022.

One report of interference, at 8580 County Road 14, was noted during the test, where sand production was observed. Production of sand is common at this location under heavy pumping scenarios, as the well pump at this location is equipped with a flow restrictor and was installed higher than typical above the bottom of the well. Another report of interference (loss of pressure) was reported at 8580 County Road 14; however, it was determined the well had been running for an extended period.

TOWNSHIP OF WELLINGTON NORTH

ARTHUR WATER SYSTEM SUPPLY REDUNDANCY AND STORAGE CLASS EA

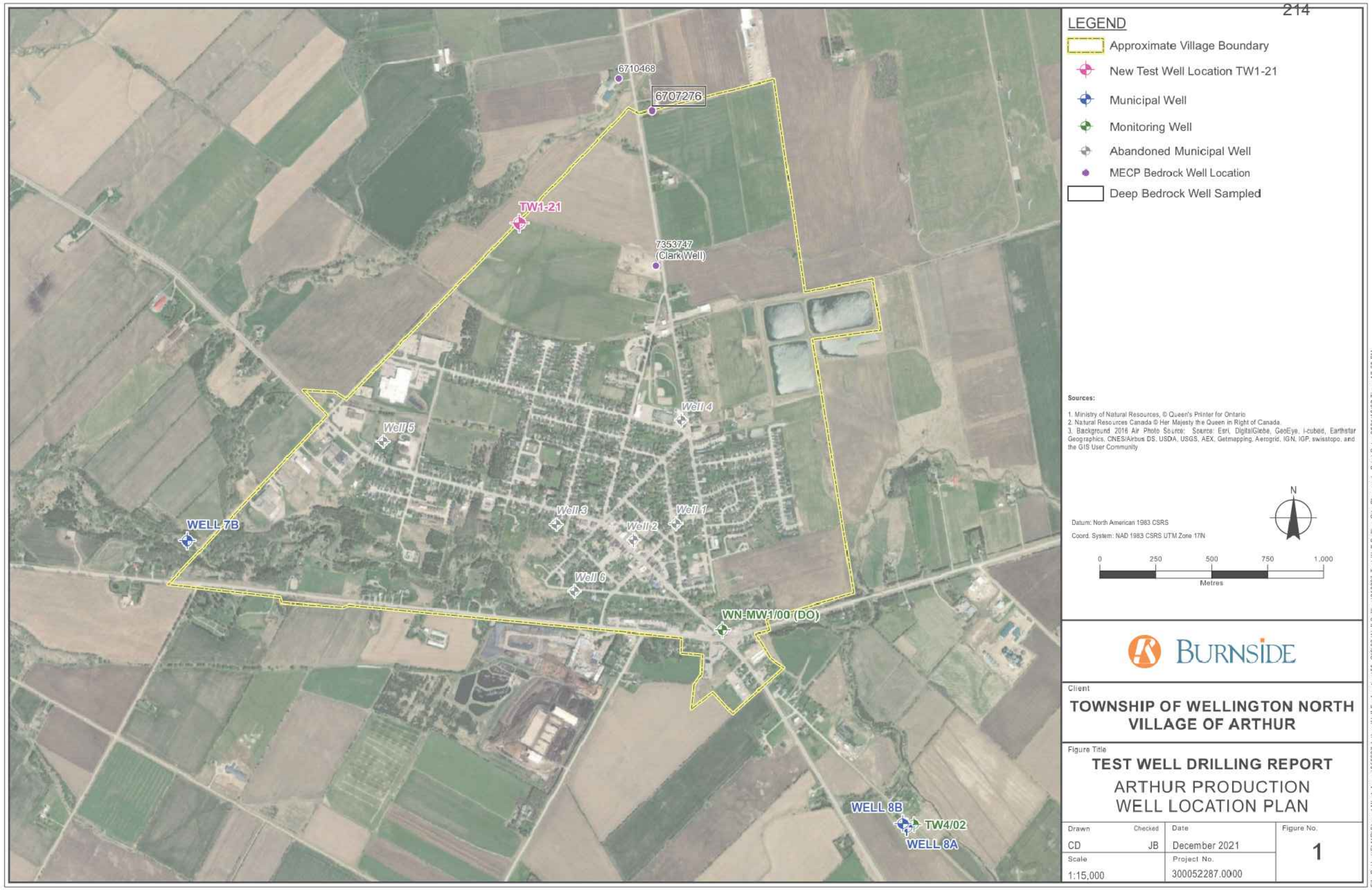

FIGURE 10

TW1-21 LOCATION

NOT TO SCALE
T4003A

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

r:\wellington north – twsp of\t4003a – arthur water system class ea\cad and survey\6. figures\t4003a-fig-010 figure 10.dwg – 2025-05-16 – mwolfer

There was no observable response at the monitoring wells completed in the shallow overburden (between 4 m and 11 m below grade). At municipal Well 7B, a total drawdown of 1.2 m was observed during the pumping test; however, production from Well 7B also increased at the same time. Therefore, there is no interpreted response to the pumping test at Well 7B. Wells 8A and 8B showed a decline in static water levels during the pumping test; however, the decline is interpreted to be because of increased water consumption during a period of drought. Therefore, there is no interpreted response to the pumping test at Wells 8A and 8B.

Projected impacts (drawdown) on the closest surrounding bedrock wells of pumping at TW1-21 to meet the demands of the future population (in 2045 based on continued pumping at the average day demand) was estimated by Burnside to be between 4 m and 8 m, which is within the available drawdown limits of these wells, except for the well located at 8580 County Road 14. Upgrades to or replacement of the well noted to experience interference during the pumping test (at 8580 County Road 14) are expected to be required prior to the start of pumping from a permanent production well at the TW1-21 site.

Monitoring of private (domestic and commercial), municipal wells and associated monitoring wells also included water quality monitoring for analysis of general chemistry pre-test and post-test. Water quality monitoring at TW1-21 included the following, completed at various frequencies throughout the long-term pumping test:

- Continuous ultraviolet light transmission (UVT) and turbidity
- General chemistry, e. coli, and total coliforms
- *Cryptosporidium* spp., *Giardia* spp., pigment-bearing algae and diatoms (PBADs)
- Ontario Drinking Water Quality Standards (ODWS)

Water quality monitoring at TW1-21 during the test including daily samples for analysis of general chemistry, including major ions and metals. Analytical results were stable, with only slight changes in quality around day 3 of pumping. Concentrations of arsenic were more than half (61 to 74 percent) of the OWDS Maximum Acceptable Concentration (0.01 mg/L) but within range of health-related guideline limits. It is expected that water produced from TW1-21, and immediate area will continue to produce water with similar arsenic concentrations. The arsenic concentrations observed would require quarterly sampling/monitoring and treatment if TW1-21 was developed into a municipal well site.

Like water quality in water produced at Wells 7B, 8A and 8B, sodium in the water produced at TW1-21 during the pumping test was above the health guideline limit of 20 mg/L at an average concentration of 24.2 mg/L. Hardness as calcium carbonate ($CaCO_3$) was measured to be an average of 148.8 mg/L, which is above the ODWS operational guideline of 80-100 mg/L; however, less than the typical concentrations observed at Well 7B (309 mg/L) and Wells 8A/8B (187 mg/L).

There were no detections of e. coli, PBADs, *Cryptosporidium* spp. or *Giardia* spp. from TW1-21. Total coliform was detected in the sample collected from TW1-21 at the end of the pumping test at low concentration (2 cfu/100 mL). Therefore, based on interpretation of these results by Burnside, there is separation of the surface water and deep overburden aquifer, indicating a secure source of groundwater.

Turbidity monitoring results (average of 0.4 NTU) were below the ODWS MAC (1 NTU). UVT monitoring results fluctuated between 92 and 95 percent.

Water quality analysis of surrounding private wells does not show direct links to quality observed at TW1-21.

9.3.2.3 Surface Water Monitoring

Burnside installed a staff gauge (SG1) and piezometer (PZ1, 0.9 m deep) in Farley Creek, located approximately 150 m west of TW1-21, to monitor creek flow and shallow groundwater levels beneath the creek during the long-term pumping test at TW1-21. Farley Creek flows northeast to southwest and is a tributary of the Conestoga River.

During the pumping test, the water level in Farley Creek measured at SG1 declined, likely due to seasonally dry conditions. No response to the pumping test was also observed at PZ1, given that groundwater level trends were maintained prior to, during and after the test.

Monitoring of Farley Creek also included water samples for quality analysis (general chemistry) from PZ1 and SG1 before and at the end of pumping and compared to water quality at TW1-21. Analytical results for samples collected at PZ1 indicated no impact on the water quality of the shallow groundwater table. Further, the results are indicative that agricultural land use has not impacted the shallow groundwater table, based on the relatively low nitrate and sulphate concentrations. Analytical results for samples collected at SG1 were consistent between the sampling events are typical of surface water, indicative of impacts for surrounding land use. Given the differences in quality composition between the surface water quality and quality at TW1-21, there does not appear to be a link.

9.3.3 Conclusions and Recommendations

Per Burnside's Hydrogeological Report, the following conclusions and recommendations were made regarding the long-term pumping test completed at TW1-21.

Conclusions:

- Long-term pumping of TW1-21 at a rate of 23 L/s for 6 days resulted in a drawdown of 14.56 m.
- Interpretation of the pumping test data indicate the deep overburden aquifer at TW1-21 is leaky, confined, and is extremely permeable in the local area and thins and permeability decreases away from the TW1-21 site.
- A drawdown of up to 3.3 m was observed at nearby water supply wells monitored before, during and after the pumping test.
- Water quality results indicate the deep aquifer in the lower sediments is a secure source of groundwater (not directly influenced by surface water).

- Water quality results at TW1-21 indicate that hardness, iron and manganese concentrations are lower than water produced at existing municipal wells.
- Arsenic concentrations are less than the ODWS standard (10 ug/L); however, are more than half of the MAC, which therefore would require quarterly sampling and additional effort in terms of operation, monitoring, and maintenance.
- If TW1-21 becomes a permanent water supply source, it is recommended that the permanent pumping station be sized and designed to remove or reduce arsenic from the water to prevent or mitigate exceedance of the ODWS for arsenic, in the event that treatment is required in the future if the ODWS standard is reduced to 5 ug/L.

Recommendations:

- TW1-21 should be considered as a potential municipal water source.
- Development of the TW1-21 site would require the following:
  - Construction of two 250 mm diameter production overburden wells.
  - Short-term step testing and 6-hour tests to confirm production capacity of at least 30 L/s.
  - Monitor and define arsenic concentrations from the production wells while being pumped at the design flow rate.
  - Pumphouse design to consider appropriate treatment for secure groundwater (Category 1) and arsenic removal.
  - Amend the existing PTTW for the Arthur water supply system to include the two new wells at a continuous rate of 27 L/s, with the Hydrogeological Report and well construction report for the new production wells as supporting documentation.
  - Install automatic water level recorders in MW1-21 and 8590 Wellington Road 14 well to monitor water levels and confirm the aquifer response for one year prior to municipal pumping at the TW1-21 site.
  - Drill a new private well at 8580 Wellington Road 14 to ensure their well supply is not interrupted once municipal pumping begins and water levels decline.
  - Perform an additional well survey of all wells within 1.5 km of the TW1-21 site to document baseline conditions and identify well interference issues, if any, to support the PTTW application.

9.4 Identification of the Water Supply Preferred Solution

Evaluation of Alternatives 2a and 2b was completed on a comparative basis, based on specific considerations for the categories of the environment, including natural, economic, technical, and socio-cultural, as follows:

Natural Environment

- Water quality/quantity
- Water resources
- Natural heritage features

Technical Environment

- Ease of implementation
- Servicing/operation

Socio-Cultural Environment

- Aesthetics
- Land Use
- Property Acquisition
- Cultural heritage resources (Archaeological resources, built heritage resources and cultural heritage landscapes)

Economic Environment

- Capital and Life Cycle Costs

A summary of the comparative analysis is provided in Table 12.

Table 12: Evaluation of Water Supply Alternatives, Comparative Analysis

Environment Category	Alternative 2a – Increase Water Taking from Existing Well(s)	Alternative 2b – Addition of a New Well
Natural	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure. • Impacts to surface/groundwater quality and quantity are not anticipated as Wells 7B, 8A/8B are existing. • Increasing pumping and adding a back-up well at Well 7B or increasing pumping at Wells 8A/8B is likely to increase the size of the existing WHPA and area of WHPA-A and affect several new properties that may have DNAPL threats. • Further study is required to delineate vulnerable areas and amend the respective Source Protection Plan.	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure. • Impacts to surface/groundwater quality and quantity are not anticipated as Wells 7B, 8A/8B are existing. • The new well would change the size and orientation of the WHPA and could affect many (future) properties within and outside the urban boundary. Properties within a 100 m radius may be subject to requirements including septic inspections, manure application prohibitions and risk management plans for agricultural activities. • Further study is required to delineate vulnerable areas and amend the respective Source Protection Plan.

Environment Category	Alternative 2a – Increase Water Taking from Existing Well(s)	Alternative 2b – Addition of a New Well
Social	• Will provide increased supply redundancy, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.	• Will provide increased supply redundancy, which is a requirement for continued growth to meet the requirements of the Provincial Policy Statement.
Cultural	• There is low potential for built heritage or cultural heritage landscape and low potential for archaeological resources on the properties of the existing wells. Mitigation measures are not required.	• There is low potential for built or cultural heritage landscape at the TW1-21 site and immediate surrounding land. The lands to the south of the TW1-21 site are clear of any archaeological concern (as documented in the Stage 1-2 Archaeological Property Assessment of the West Half of the Proposed North Arthur Industrial Lands (2094940 Ontario Inc), dated October 15, 2021, as prepared by AMICK Consultants Limited, which was accepted into the Ontario Public Register of Archaeological Reports on October 20, 2021 (AMICK File #2020206/MHSTCI Project Information Form Number P058-1960-2021, MHSTCI File Number 0013389)) and there is low potential for archaeological resources on the lands immediately to the north of the TW1-21 site. Mitigation measures are not required.
Technical	• Existing wells have elevated iron (Well 7B) and manganese (Wells 8A/8B), which affect aesthetic water quality. • Water may require treatment if the proposed guidelines for iron and manganese are adopted as a standard and will include wellhouse expansion and treatment systems. • Mechanical duplication would be required at Well 7B, to improve system redundancy. • Given the methodology of calculating Firm Capacity, increasing capacity at existing wells without the addition of a new well supply will not increase	• The site is in a future development area that will eventually require water system infrastructure regardless of siting a municipal well at the proposed location and is not considered to be in a relatively remote location like existing Wells 7B, 8A/8B. • Construction of a new wellhouse and treatment system for arsenic will be required. • Can likely achieve a rated capacity of 2,332 m^3/day, which will satisfy project demands beyond calendar year 2051.

Environment Category	Alternative 2a – Increase Water Taking from Existing Well(s)	Alternative 2b – Addition of a New Well
	Firm Capacity, even with mechanical duplication at the Well 7B site, and therefore is not considered feasible. • Volume of additional capacity is unknown and requires investigation.	
Economic	• Will require the expansion of well houses, treatment facilities, sanitary sewers for discharge • of wastewater from treatment process, drilling and development of a new well. • It is uncertain if expansion of existing facilities would provide sufficient firm capacity for future development and therefore, additional water supply capacity at a new source may also be required, at additional cost. • It is expected that costs will be comparable to those anticipated for Alternative 2b.	• Will require development of two production wells at TW1-21 site, construction of a well house and associated appurtenances including treatment facilities, watermain extensions and sanitary sewer extensions for discharge of wastewater from treatment process. • Estimated Capital Cost: $3.3M - $4M, including treatment system, wellhouse, infrastructure extensions.

Consistent with Table 12, anticipated impacts to the cultural, natural, social, technical and economic environments are similar between Alternatives 2a and 2b and can be minimized via mitigation measures; however, Alternative 2b is the most prepared to meet the requirements of the future growth scenario. Therefore, Alternative 2b – Addition of a New Well is the preferred solution to address the water supply and redundancy component of the Problem/Opportunity Statement (*The existing Arthur water system requires water supply redundancy and additional water storage to support expected population growth).* Well exploration and the associated drilling of TW1-21, testing and monitoring, was assessed based on the following criteria:

- Water production of at least 10 L/s.
- Water quality that meets or exceeds the current and future Ontario Drinking Water Standards, for the following parameters: sulphate, iron and manganese.
- Exploration for a bedrock water source is preferred over increasing capacity within the deep overburden as it is anticipated that a bedrock water source would contain less iron and manganese and therefore not require construction of a treatment system.
- Exploration for a bedrock water source (in the deep carbonate bedrock aquifer) outside of the Arthur core area is preferred, given that it is anticipated to provide better water quality and source capacity as compared to existing and/or abandoned municipal wells.

The following criteria indicate that TW1-21 should be considered as a new source of municipal water:

- Located outside of the Arthur urban core.

- The ability to produce water at a rate of 27 L/s during the long-term pumping test.
- An interpreted secure source of groundwater having water quality that meets the current and future ODWS for sulphate, iron, and manganese.

It should be noted that the bedrock was not explored due to the positive results at TW1-21 in the deep overburden, in terms of capacity and water quality for sulphate, iron and manganese.

Consistent with the recommendations in Burnside's Hydrogeological Report, additional exploration and well development is recommended near the TW1-21 site, as TW1-21 is considered a potential source of municipal water. Given the location of TW1-21 is within the future road allowance, a new well should be located outside the right-of-way on adjacent private property, which will require legal permission from the property owner(s) to enter and conduct all necessary fieldwork activities.

It should be noted that *Alternative 1c – Reduce Water Demand/Implement Conservation Measures* should be considered as a key component in the implementation of the preferred alternative, since a reduction in water demands via conservation measures is expected to extend the service life of the existing and future increased water supply and storage capacities of the Arthur water supply system.

An evaluation of potential impacts resulting from the implementation of Water Supply *Alternative 2b – Addition of New Well(s) to the Existing Municipal System* is provided in Section 13.

10.0 Evaluation of Water Storage Alternatives

Additional water storage is required to support the existing community and expected population growth in Arthur. Section 7.3.2.2 and 7.3.2.3 of this Report summarizes the preliminary estimate of water storage volume required for the projected population growth in Arthur and considerations for pressures within the water distribution network, respectively.

Adequate water storage facilities are required in a municipal water system to ensure sufficient flows and pressures during peak hour demands, critical demands during fires, infrastructure failure events such as watermain breaks and power outages and to provide redundancy during maintenance operations. Storage facilities are designed to have distinctive storage layers, each serving a particular purpose. The equalization storage layer is located at the top of the storage facility and is usually cycled on a daily basis to meet peak demands, ensuring adequate pressure throughout the distribution network. Emergency storage is defined as the water level in the storage facility above which 20 psi can be maintained within the distribution network and is typically used only during fire and emergency events. To meet current and future water demands, water storage facilities are typically designed for extended planning horizons as they are difficult to expand, and economies of scale are significant.

It should be noted that an increase in the HGL of approximately 10 meters, to a maximum operating level of 510 meters, would provide an overall pressure increase of 14 psi within the existing water distribution network and achieve a normal pressure within the range of 40 psi to 100 psi within the future development areas of Arthur. This would also improve the fire flow capability throughout the system whilst also keeping maximum system pressure under the acceptable limit of 100 psi within the entire distribution network.

The type of storage facility selected is influenced by several factors, including but not limited to function, elevation/topography, life cycle costs and the volume of storage required.

Siting the system storage requires evaluation of various factors, including but not limited to:

- Land availability and ownership.
- Proximity to the existing water distribution system.
- Site elevation.
- Potential impacts on adjacent properties.
- Potential impacts on natural and heritage features.
- Type of facility being considered.

The three main types of water storage facilities that are commonly used in Ontario are elevated tank/water tower, ground level or partially buried reservoir with booster pumping provisions and standpipe with booster pumping provisions. Each type has their own advantages and disadvantages that should be weighed out in evaluating and selecting a storage facility to design and implement.

Elevated Storage/Water Tower

Elevated storage/water towers provide water storage in a tank that is mounted on a support system. In recent years, the support or pedestal is usually constructed of reinforced concrete. In the past, many elevated tanks were supported by steel structures. The most prominent advantage of an elevated tank is the ability to store all the contents at a height where it is available to feed the distribution system by gravity and provide adequate and uniform pressure to the distribution system. Filling of such a facility is typically provided by high lift pumps at well sites, or booster pumps within the distribution system, which increase system pressures.

In addition to providing storage for the water system, elevated tanks minimize the need for continuous and emergency high lift pumping, thereby making the system more energy efficient. Often, elevated tanks are used to control the operation of the supply pumps at each of the well sites such that the elevated tank can supply water to the system during peak electricity rate periods, allowing the supply pumps to fill the tank during off peak times, resulting in cost savings and less stress on the electrical grid.

An elevated tank typically has lower operating and maintenance costs when compared to alternatives that require booster pumping due to:

- Reduced pumping during peak electrical periods resulting in lower energy costs.
- Less and simplified mechanical and control equipment reducing operating staff time for process set-up, checks and maintenance, and reduced capital cost for equipment replacement.

There are different types of elevated storage/water towers, including spheroid, multi-column, composite and composite glass-lined. Spheroid elevated towers are a spherical water storage tank that is elevated and supported by a single cylindrical pedestal with a flared conical based (i.e., Freud Spheroid Tower). Multi-column towers (traditional design) provide a steel elevated tank that is supported by columns and cross-braces (i.e., Charles Street Multi-Leg tower). Composite water towers are considered modern, having a steel elevated storage tank supported by a large diameter steel-reinforced concrete tower base on a concrete foundation. Composite glass-lined towers are the newest type of water storage facility that has a glass-lined elevated steel tank (glass fused to steel coating) supported by a large diameter steel-reinforced concrete tower base on a concrete foundation.

In terms of new construction, composite towers are the most common given that its design provides an economical solution with reduced maintenance costs (i.e., only the steel tank requires painting at a frequency of every 20 years as opposed to the entire structure of a spheroid or multi-column tower), interior access to the elevated tank (as opposed to the Spheroid Tower and Multi-Leg tower, which only have exterior access) and valuable structural properties. Composite glass-lined towers have reduced maintenance requirements than the composite tower; however, the life expectancy has not been confirmed given that it is a relatively new design. Additionally, it is susceptible to damage from seismic activity, wind and ice and does not provide interior access. Therefore, the composite tower is considered the preferred elevated storage design.

As mentioned, the steel portion of the elevated tank of a composite tower does require periodic maintenance to ensure that the coating continues to adequately protect the steel. This requires the tank to be taken off line for interior cleaning, inspection and re-coating. Under ideal design conditions, elevated tanks are normally located at a high elevation in the system to minimize the required height of the support pedestal thereby reducing capital costs. The initial capital cost for an elevated tank is typically higher than for a ground level reservoir or standpipe complete with booster pumping.

From an aesthetic perspective, these facilities are often utilized as a community focal point and community identification/ “way finding” or “way marking” if they are located in a visible area near main entrance roads to the community. However, they also create shadows which can be a negative impact for nearby property owners. An elevated water tower may also provide the municipality with the possibility of revenue generation through renting space for the installation of communications antennae.

Ground Level or Partially Buried Reservoir and Booster Pumping Station

Reservoirs typically require a larger site footprint compared to an elevated tank as their height is less than or equal to their diameter. Most reservoirs require booster pumps to maintain system pressures. When there is no elevated storage on the system, booster pumps must operate continuously. As a result, this storage alternative does not improve upon the energy efficiency of the existing system. Further, this type of storage facility has more mechanical parts than other types of storage facilities due to the requirement for pumping. As a result, there are greater operating and maintenance costs. Depending on the configuration of the reservoir, it could be built in phases with additional volume added to meet system storage requirements. Revenue generation is limited with this type of facility as the height is typically not sufficient for the installation of antennae.

Standpipe and Booster Pumping Station

Standpipes are typically taller than their diameter. They are usually constructed of steel and contain water in the entire height of the structure. They are designed such that only the top few metres of the facility volume is available by gravity to maintain system operation/pressures. Booster pumps are often installed at standpipes to utilize the majority of the storage volume during emergency and fire flow conditions. Depending on the cost of the required pumping system, a standpipe may cost less than an elevated tank while providing some energy savings compared to a ground level reservoir.

Standpipes are not as energy efficient as elevated towers due to the small storage volumes available for system pressure maintenance. The requirement for pumps also results in higher operating and maintenance costs compared to an elevated tank. However, standpipes have two of the same disadvantages as elevated tanks in that they are difficult to expand and they can shade adjacent properties. Similar to Elevated tanks, there is some potential for revenue generation with a standpipe.

Preferred Type of Water Storage Facility

Based on the description of the main types of water storage facilities (provided in Section 10.0), the composite elevated water storage facility is a better option compared to other alternatives (ground level or partially buried reservoir and booster pumping station or standpipe and booster pumping station) due to the combination of gravity-fed pressure, energy efficiency, cost savings, lower maintenance requirements, and additional community benefits.

10.1 Alternative 3a – Construct a New Water Storage Facility to Supplement Existing Storage Facilities

In this scenario, the existing Spheroid and Multi-Leg towers would remain in operation and a new water storage tower would be constructed to provide additional storage capacity for the water system. As previously indicated and supported by the CIR for the June 2025 cleaning and inspection by Landmark Municipal Services the existing Multi-Leg tower has reached the end of its service life and it is recommended to be removed from service. Therefore, this alternative is not considered for further evaluation given that the existing Multi-Leg tower needs to be decommissioned and therefore does not impact the decisions made in this Class EA.

Consistent with Section 7.4.2 of this Report, *the Criteria for Evaluating Archaeological Potential, A Checklist of the Non-Specialist* determined the potential for archaeological resources to exist with the Study Area given there are present or past water sources within 300 m at certain locations along the Study Area boundaries, presence of property recognized for cultural heritage value and evidence of early historic transportation routes and historic settlement. Once the area that may be impacted by project activities is identified (i.e., when the site for a new water storage facility is determined), the Checklist will be completed.

10.2 Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower

In this scenario, the existing Spheroid tower would remain in operation, and a new water storage tower would be constructed to provide additional storage capacity for the water system. In addition to providing additional water storage capacity, a new elevated storage facility would provide an opportunity to improve pressures within the water distribution network in the future and allow for servicing of future development in the lands to the north and east of the existing built-up areas of Arthur, if constructed in a location at a higher elevation than the existing spheroid water tower.

The difficulty of implementing this strategy is that the towers in a given pressure zone typically need to be operating at the same HGL, similar to existing conditions. Therefore, in maintaining the existing Spheroid Tower, and operating a new tower at a higher HGL would require a separate pressure zone be established. Creating multiple pressure zones in a system increases the operating complexity and infrastructure requirements.

Although the CIR for the 2024 cleaning and inspection of the Spheroid Tower did not note any significant issues; the Spheroid Tower is aging (was constructed in 1969 and commissioned in 1970) and it is expected that the cost to maintain this asset will eventually outweigh the cost to replace it. Assuming an 80-year service life, the Spheroid Tower will have reached its theoretical service life by 2050. Therefore, consideration of constructing a new tower at a higher elevation (which is expected to provide sufficient pressures to future development lands to the north and east of the exiting built up area) should be considered.

As presented in the System Pressure Testing Report (refer to Appendix E), it would be reasonable to design the future water system to have the LWL equal to the existing LWL (493.303m) and future HWL (FHWL) to be 3 metres above the existing HWL (498.703m) to provide a FHWL of 501.703m and a future operational range of 8.4m. Therefore, allowing the new system to operate at the existing HWL of 498.703m until the Spheroid tower is due for decommissioning and maintaining one pressure zone while both are operating together.

Operating the system with two towers presents several benefits including redundancy and reliability, allowing the pressure within the system to be sustained in the event of one of the towers being offline due to maintenance or a failure. This type of system also improves pressure management and fire flow capacity as the pressure and volume source is available from multiple locations within the system. Additionally, it improves the energy efficiency as the pumped water does not need to travel as far to reach one of the storage facilities.

The *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* determined that the Multi-Leg Tower would require Cultural Heritage Evaluation if there is a potential to be impacted by project activities (refer to Appendix F). It is noted that the decommissioning of the Multi-Leg tower will occur regardless of the outcome of this Class EA, and therefore does not impact the decisions made in this Class EA.

Cultural Heritage Evaluation of the Multi-Leg tower will be completed as part of the future decommissioning project (outside the scope of this Class EA).

The Criteria for Evaluating Archaeological Potential, A Checklist for the Non-Specialist (refer to Appendix G) determined there is low potential for archaeological resources to exist at the Multi-Leg Tower site given that the project area has been subjected recent, extensive and intensive disturbance.

Consistent with Section 7.4.2, there is the potential for archaeological resources to exist with the Study Area given there are present or past water sources within 300 m at certain locations along the Study Area boundaries, presence of property recognized for cultural heritage value and evidence of early historic transportation routes and historic settlement. Once the area that may be impacted by project activities is identified (i.e., when the site for a new water storage facility is determined), the Checklist will be completed.

10.3 Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities

In this scenario, both the existing Multi-Leg and Spheroid towers would be decommissioned and replaced with a single new elevated tower located at a higher HGL than the existing Spheroid and Multi-Leg towers. This new tower would be designed to provide sufficient storage capacity to address the immediate and future water storage requirements of the existing and future population to at least Calendar Year 2051 and would provide sufficient pressures within the watermain distribution network for the future development areas to the north and east of the existing built-up area, within the urban boundary.

It is anticipated that the new water tower can be constructed at a higher elevation than the existing water storage towers, resulting in an overall pressure increase throughout the watermain distribution network. This increase will ensure that all current and future development areas, as outlined in the 2018 Growth Plan and the 2020 Water and Sanitary Systems Technical Study, receive adequate water pressure and fire flows.

The future development areas, particularly those in the most northern and eastern extent of the urban area, are situated at higher topographic elevations than the existing community. Without an increased HGL, these areas would experience lower water pressures, ranging from 24 to 30 psi, which are below acceptable standards for residential developments. The new elevated tower, with an HGL of 510 meters, is expected to provide sufficient pressure to all future development areas.

The *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* determined that the Multi-Leg Tower and Spheroid Tower sites would require Cultural Heritage Evaluation if there is a potential to be impacted by project activities. It is noted that the decommissioning of the Multi-Leg tower will occur regardless of the outcome of this Class EA, and therefore does not impact the decisions made in this Class EA. Cultural Heritage Evaluation of the Multi-Leg tower will be completed as part of the future decommissioning project (outside the scope of this Class EA).

The Criteria for Evaluating Archaeological Potential, A Checklist for the Non-Specialist (refer to Appendix G) determined there is low potential for archaeological resources to exist at the Spheroid and Multi-Leg Tower sites given that the project area has been subjected recent, extensive and intensive disturbance.

Consistent with Section 7.4.2 of this Report, the Criteria for Evaluating Archaeological Potential, A Checklist of the Non-Specialist determined the potential for archaeological resources to exist with the Study Area given there are present or past water sources within 300 m at certain locations along the Study Area boundaries, presence of property recognized for cultural heritage value and evidence of early historic transportation routes and historic settlement. Once the area that may be impacted by project activities is identified (i.e., when the site for a new water storage facility is determined), the Checklist will be completed.

10.4 Identification of the Water Storage Preferred Solution

Evaluation of Alternatives 3b and 3c was completed on a comparative basis, based on specific considerations for the categories of the environment, including natural, economic, technical, and socio-cultural, as follows:

Natural Environment

- Natural heritage features

Technical Environment

- Ease of implementation
- Servicing/operation

Socio-Cultural Environment

- Aesthetics
- Land Use
- Property Acquisition
- Cultural heritage resources (Archaeological resources, built heritage resources and cultural heritage landscapes)

Economic Environment

- Capital and Life Cycle Costs

A summary of the comparative analysis is provided in Table 13.

Table 13: Evaluation of Water Storage Alternatives, Comparative Analysis

Environment Category	Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower	Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities
Natural	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure.	• Potential impacts to vegetation, wildlife and their habitat are rated as minor. Natural heritage assets will continue to existing with or without the installation of proposed infrastructure.
Social	• Will provide increased water storage capacity, which is a requirement for	• Will provide increased water storage capacity, which is a requirement for

Environment Category	Alternative 3b – Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower	Alternative 3c – Construct a New Water Storage Facility and Decommission Both of the Existing Water Storage Facilities
	continued growth to meet the requirements of the Provincial Policy Statement.	continued growth to meet the requirements of the Provincial Policy Statement.
Cultural	• Depending on the location selected for siting a new water storage facility, archaeological assessment and cultural heritage evaluation may be required. The appropriate Checklists are required to be completed for the proposed site. • A Cultural Heritage Evaluation Report would be required to support the decommissioning of the future Multi-Leg Tower (outside the scope of this Clas EA). It is noted that the decommissioning of the Multi-Leg tower will occur regardless of the outcome of this Class EA, and therefore does not impact the decisions made in this Class EA.	• Depending on the location selected for siting a new water storage facility, archaeological assessment and cultural heritage evaluation may be required. The appropriate Checklists are required to be completed for the proposed site. • A Cultural Heritage Evaluation Report would be required to support the decommissioning of the Spheroid and Multi-Leg Towers. It is noted that the decommissioning of the Multi-Leg tower will occur regardless of the outcome of this Class EA, and therefore does not impact the decisions made in this Class EA.
Technical	• Retaining the spheroid tower allows the operational advantage of a two-tower system to be retained once the Multi-Leg tower is decommissioned and the remaining service life of the spheroid tower can be realized.	• A single tower system reduces storage redundancy and will sacrifice the remainder of the service life of the existing spheroid tower.
Economic	• Estimated New Tower (1,000 m^3 capacity) capital cost is between $5M and $6.5M. • Estimated Spheroid Refurbishment Capital Cost is between $2M and $2.5M. • Operational Cost: No change anticipated for the existing system as there would be no additional facilities to operate.	• Estimated New Tower (2,000 m^3 capacity) capital cost is between $7M and $8.5M. • Estimated existing spheroid demolition costs: $1M. • Operational Cost: Marginal operation cost reduction from the existing system.

Consistent with Table 13, anticipated impacts to the cultural, natural and social environments are similar between Alternatives 3b and 3c. Alternative 3b – *Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower* is identified as the preferred solution to address the water storage component of the Problem/Opportunity Statement as it is the alternative that is most prepared to meet the requirements of the future growth scenario and offers an operational advantage over a single tower system. Retaining the Spheroid Tower while constructing and implementing a new tower provides a strategic advantage in terms of cost efficiency and operational continuity. By keeping the Spheroid Tower operational until it reaches the end of its service life, the community can defer some of the capital costs associated with constructing and maintaining additional new infrastructure. It is noted that maintenance of the existing Spheroid Tower is required, as noted in the CIR for the 2024 cleaning and inspection, including increased security at the site (site security fencing and locks), various accessories and improvement to the bell landing floor, full removal and replacement of the tank exterior system (25-30 year solution) when deemed cosmetically required, and full removal and replacement of the tank interior within the next 2 to 4 years (25-30 year solution). This allows for a phased implementation approach, which will address the increased pressure demands of future development lands at higher elevations whilst also improving overall system reliability. Further to this, the new tower can be designed such that it is operated at a lower elevation (until the existing Spheroid tower is decommissioned), reducing energy losses within the distribution network.

Additionally, operating the new elevated tower alongside the existing Spheroid Tower provides a reliable water storage system. Placing the tower strategically near future development areas, at a higher elevation, would further allow these areas to operate at a higher HGL in the future and the existing Spheroid Tower would continue to support current demands, maintaining adequate pressure and fire flow capabilities across the existing urban boundary. This dual-tower operation not only enhances the system's redundancy and reliability but also ensures a smoother transition and integration of new infrastructure, mitigating risks of supply disruptions during the development phases. Ultimately, this approach aligns with the community's long-term growth plans, balancing immediate infrastructure needs with future scalability and resilience.

It should be noted that Alternative *1c – Reduce Water Demand/Implement Conservation Measures* should also be considered as a key component of the identified preferred alternative solution, since its implementation is expected to extend the service life of the existing and future increased water supply and storage capacities.

10.4.1 Siting of Storage Facility

Per MECP design guidelines, consideration in choosing a site for a water storage facility includes:

- Pressures within the water distribution network (including topography) and water demands throughout the distribution network
- Pumping and transmission costs
- Safety considerations
- Aesthetic concerns
- Future expansion, and
- Site access.

MECP recommends that a water tower is placed in the area of the highest water demand and/or low pressure and ideally with the tower at the topographically highest elevation of the serviced area; however, should also consider whether the placement will be located in the centre or on the extremity of the service area and impacts to pressures as well as pumping and transmission costs. Safety considerations include proximity (i.e., at least 15 m) to potential sources of contamination (i.e., sewers, drains, septic tanks, tile fields, standing water, etc).

Typically, a minimum 0.5 ha site is required for an elevated water storage tank, and a Geotechnical Investigation is required to confirm the subsurface conditions to support an elevated water storage tank and construction requirements.

Based on MECP recommendations for storage facility siting, it is recommended that an Elevated Storage Facility be installed within the future development area adjacent to the unopened Macauley Street right-of-way or near/within the same site as the new well at TW1-21 site, so that the new well can be used to fill the tower increasing energy efficiency. As described in Section 9.3.3, the TW1-21 site and immediate surrounding area is understood to have low potential for built heritage or cultural heritage landscape, as well as low potential for archaeological resources at the property and immediate surrounding lands to the north. There is no archaeological concern for the immediate surrounding lands to the south, based on the findings of the Stage 1-2 Archaeological Assessment completed for the site, as documented in the Stage 1-2 Archaeological Property Assessment of the West Half of the Proposed North Arthur Industrial Lands (2094940 Ontario Inc), dated October 15, 2021, as prepared by AMICK Consultants Limited, which was accepted into the Ontario Public Register of Archaeological Reports on October 20, 2021 (AMICK File #2020206/MHSTCI Project Information Form Number P058-1960-2021, MHSTCI File Number 0013389).

Prior to confirming final sizing of the storage facility, the Township should consider the life expectancy of the Spheroid Tower and potential development beyond 2051, since the economies of scale are significant with these facilities, and they are not expandable.

11.0 CONSULTATION PROGRAM

11.1 General

Consultation with affected parties is a key component of the environmental assessment process. Public involvement at the onset of a project allows early identification of concerns/information, improves project understanding, and focuses planning and decision making.

Proponents undertaking a Schedule “B” Class EA are required to engage in a screening process that includes a mandatory minimum of two points of contact with stakeholders (i.e., agencies, interest groups, Indigenous Communities and the public). The proponent has the freedom to tailor the consultation program, including the methods of contact, to suit the project and stakeholder needs; however, the minimum requirements must be met and must ensure that stakeholders are aware of the project and have ample opportunity to provide input related to project.

The first mandatory point of contact is during Phase 2 of the Class EA process, after the project problem/opportunity statement has been identified, an inventory of existing environmental resources and local sensitivities that may be impacted by alternative solutions have been identified. The purpose of the first point of contact is to review potential issues, and invite public input to assist in selection of a preferred solution. Although the Class EA Schedule is typically selected by the proponent before the first point of contact is made, the input from the first point of contact will confirm or change the Schedule and determine how the project proceeds. The mandatory first point of contact is the same for Schedule B and C projects and Schedule A projects do not require formal contact with the public.

The second mandatory point of contact is made at the completion of the planning process in the form of a Notice of Completion. The purpose of the Notice of Completion is to formally advise the public and agencies of the 30-calendar day (minimum) review period before the proponent will proceed to design and construction of the recommended preferred alternative solution. Prior to implementation of a project, the proponent is obligated to consider and address any concerns that are presented from the stakeholders. Ultimately, the Minister makes the final decision on all comments/concerns/input, if any, as to whether the project requires a higher level of assessment (i.e., Part II Order granted, but only if it applies to potential adverse impacts to constitutionally protected Aboriginal and treaty rights), if it should be approved with conditions, or if it can proceed without conditions.

The Aboriginal and Treaty Rights Information System (ATRIS) was consulted to search for Indigenous Communities within a 50 km radius of the Study Area and the Metis Nation of Ontario, Mississaugas of the New Credit First Nation, Six Nations of the Grand River Territory, Haudenosaunee Development Institute and Saugeen Ojibway Nation were included in the stakeholder contact list. The stakeholder contact list was updated to include the Chippewas of Nawash First Nation and Saugeen First Nation, following receipt of MECP acknowledgement of the Notice of Commencement.

11.2 Notice of Commencement

A Notice of Study Commencement (Notice) was posted in the July 13th and 20th, 2023 issue of the Wellington Advertiser, which is a free press weekly newspaper that is distributed throughout Wellington County. The Notice was also posted on the Township's website on July 13th, 2023 and distributed in a letter (via mail and/or email) to approval agencies, Indigenous Communities (via registered mail), utility suppliers, municipalities, and potentially interested stakeholders. The purpose of the Notice was to create awareness of the project and act as an invitation to participate in the EA screening process. A copy of the Notice and stakeholder contact list that the notice was distributed to is provided in Appendix K.

Comments were received from MECP, MNRF, MCM, DFO, GRCA Indigenous Affairs, Métis Nation of Ontario, Six Nations of the Grand River Territory and private stakeholders in response to the Notice of Commencement. In general, the comments included acknowledgement of receipt of the notice and provided background information and guidance on requirements for the project or requested to be added to the Project Contact List. A summary of the comments received following distribution and advertisement of the project Notice of Commencement is provided in Appendix K.

11.3 Public Information Centre

Consistent with the requirements of the Class EA process for Schedule 'B' projects, formal (mandatory) contact with project stakeholders took place in the form of a Public Information Centre (PIC). The PIC was held on November 26, 2024 between the hours of 5:00 pm and 7:00 pm, at the Arthur Area Curling Club (160 Domville St, Arthur). Notice and invitation to the PIC were included in the November 14 and 21, 2024 issues of the Wellington Advertiser newspaper and was distributed to the stakeholder contact list via various methods of delivery (e.g., email, hard copy letter, or registered mail).The Notice of PIC was also posted to the Township's website and its social media pages. A copy of the Notice of PIC and the stakeholder contact list that it was distributed to is included in Appendix L.

The purpose of the PIC was to present the background/existing inventory of the environment, including results of any studies that were conducted to assist in the evaluation, the alternative solutions to address the problem statement, anticipated impacts (positive and negative) to the environment, mitigation measures to reduce or eliminate negative impacts, and the preliminary preferred alternative solution based on the comparative evaluation matrix and information collected as of the PIC date. A copy of the information boards that were on display at the PIC are provided in Appendix L. A copy of the attendance sheet for the PIC is also included in Appendix L. A summary of questions, comments and/or concerns received in response to the PIC and how these items were addressed by the Proponent are provided in Appendix L. Although comment sheets were available at the meeting, none were submitted at or following the meeting. None of the feedback received concerned potential adverse impacts to constitutionally protected Aboriginal and treaty rights.

As noted in Appendix J, the Township will consult with residents/owners of private property impacted by the project, as required, during the next phase of the project to finalize the details for the design and implementation of the preferred alternative.

11.4 Notice of Completion

The second point of mandatory contact is the Notice of Completion, which was published in the December 4, 2025 issue of the Wellington Advertiser newspaper and was also distributed to review agencies (via registered mail and email), Indigenous Communities (via registered mail and email) and public stakeholders (via regular mail and/or email) on December 4, 2025.

A copy of the Notice of Completion, template for notifications, and the distribution list is provided in Appendix M. This Project File Report was filed for public review, through the Township website and hardcopy at the Township office, starting on December 4, 2025.

Consistent with MECP's recommendations, each of the Indigenous Community contacts on the distribution list for the Notice of Completion were contacted via email and phone call as a follow-up on the letters/notices that were circulated for the Class EA.

Responses to the Notice of Completion were received from GRCA, MECP, MCM, Mississaugas of the Credit First Nation, and Six Nations of the Grand River Territory. A summary of the correspondence received in response to the Notice of Completion and how these items were addressed by the Proponent are provided in Appendix M. None of the feedback received concerned potential adverse impacts to constitutionally protected Aboriginal and treaty rights.

12.0 RECOMMENDED PREFERRED ALTERNATIVES

Alternative 2b – *Addition of New Well(s)* and Alternative 3b – *Construct a New Water Storage Facility and Decommission the Existing Multi-Leg Tower* have been identified as the recommended preferred alternatives to address the Problem/Opportunity Statement, *The existing Arthur water system requires water supply redundancy and additional water storage to support expected population growth.*

12.1 Project Implementation

As determined by this Class EA and documented in this Report, water supply redundancy and additional water storage is required for the Arthur water system to support expected population growth. Sections 7.3.2.1 and 7.3.2.2 provide a preliminary estimate of the water supply capacity and storage volume, respectively, required for each of the planning horizons. The sizing of the water storage facility will be completed during detailed design.

13.0 POTENTIAL IMPACTS

13.1 Natural Environment

Potential impacts to vegetation, wildlife and their habitats are rated as minor for implementation of the preferred alternatives. Mitigation measures can be used to avoid any adverse impacts to wildlife and habitat.

Further study is required following completion of this Class EA to delineate vulnerable areas and amend the Grand River Source Protection Plan.

13.2 Economic Environment

Implementation of the preferred Alternative supports the intent of the Growth Plan, consistent with the projections in the MCR.

13.2.1 Capital Costs

Implementation of Alternatives 2b and 3b requires the construction of a new municipal well and water storage facility, as well as associated infrastructure (well house, contact chamber, etc.), connection to the associated existing water distribution network and associated permitting and the repair and maintenance costs as estimated by Landmark Municipal Services. The total preliminary estimated capital cost of the infrastructure as described above is estimated to be between $19,730,000 and $21,951,000. A breakdown of the estimated costs is provided in Appendix N. These costs are subject to change based on the detailed design considerations of the infrastructure. Additionally, the distribution network connection length may be increased, or decreased, depending on the layout of the adjoining development areas.

13.3 Technical Environment

In addition to implementation of the preferred Alternatives, it is recommended that the Township explore opportunities to reduce water demands/implement water conservation measures to extend the service life of the supply and storage capacity of the Arthur water system.

13.3.1 Supply

Evaluation of Alternative 2b to meet the demands of the existing and future population to Calendar Year 2051 is summarized in Table 14.

Table 14 – Evaluation of Alternative 2b to Meet the Demands of the Existing and Future Population

Projected Serviced Population	**2023 (Existing)**	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**
Projected Supply Requirements (m^3/day)	1,545	1,692	1,886	2,031	2,127	2,272	2,321
Arthur Well 7 Capacity (m^3/day)	1,961						
Arthur Well 8A/8B Capacity (m^3/day)	2,255						
Existing Source Capacity (m^3/day)	4,216						
Existing Firm Capacity (m^3/day)	2,255						
Existing Firm Reserve Capacity (m^3/day)	710	563	369	224	128	-17	-66
Existing % Firm Reserve Capacity Utilization	69	75	84	90	94	101	103
TW1-21 Capacity (m^3/day)	2,333						
New Source Capacity (m^3/day)	6,549						
New Firm Capacity (m^3/day)	4,216						
New Firm Reserve Capacity (m^3/day)	2,671	2,524	2,330	2,185	2,089	1,944	1,895
% Firm Reserve Capacity Utilization	37	40	45	48	50	54	55

13.3.2 Storage

Based on Table 9, it has been determined that at least 900 m^3 of storage capacity is required to meet the storage requirements of the projected future population to Calendar Year 2051, while the capacity of the Spheroid Tower remains in service. It is recommended that the storage requirements continue to be updated on an annual basis to monitor the water storage needs of the existing and future population as the Spheroid Tower approaches the end of its service life to determine the capacity requirements for the Spheroid Tower replacement storage facility.

13.3.3 Distribution Network

In order to connect the new well and storage facility to the existing municipal system, approximately 1,670 m of 300 mm diameter watermain and associated appurtenances including treatment facilities/reservoir, pressure controls and wellhouse will need to be constructed. Associated utilities and road/easement/servicing corridor restorations would also be required as part of the connection.

13.4 Social Environment

13.4.1 Community

Implementation of the Alternatives 2b and 3b will permit the extension of water services to new developments, which is a requirement for continued growth to meet the requirements of the PPS and Growth Plan. Construction of the preferred alternatives may result in visual disturbance to adjacent properties and will be reviewed during detailed design.

13.5 Cultural Heritage Environment

13.5.1 Built Heritage Resources and Cultural Heritage Landscapes

Although the Study Area is located within a Heritage River Watershed (Grand River Watershed), the TW1-21 site and immediate surrounding area where it is expected that the new well and water tower will be located is not adjacent to the Grand River. Therefore, this project area is interpreted as having low potential for built heritage or cultural heritage landscape (refer to Appendix F for a copy of the Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes Checklist for the TW1-21 site).

It is noted that the decommissioning of the Multi-Leg tower will occur regardless of the outcome of this Class EA, and therefore does not impact the decisions made in this Class EA. A Cultural Heritage Evaluation Report will be completed in the future to support the future decommissioning of the Charles St Multi-Leg tower, which is outside the scope of this Class EA.

13.5.2 Archaeological Resources

There is no archaeological concern for the lands to the south of the TW21-1 site (as documented in the Stage 1-2 Archaeological Property Assessment of the West Half of the Proposed North Arthur Industrial Lands (2094940 Ontario Inc), dated October 15, 2021, as prepared by AMICK Consultants Limited, which was accepted into the Ontario Public Register of Archaeological Reports on October 20, 2021 (AMICK File #2020206/MHSTCI Project Information Form Number P058-1960-2021, MHSTCI File Number 0013389)), and there is low potential for archaeological resources for the lands to the immediate north of the TW1-21 site (refer to Appendix G for a copy of the Criteria for Evaluating Archaeological Potential Checklist for the TW1-21 site).

13.6 Source Water Protection

Wellington Source Water Protection, Risk Management, provided a Memorandum, entitled Preliminary Assessment of Source Protection Implementation Requirements for a Potential New Well Site, dated June 25, 2024. The purpose of the Memorandum was to evaluate the potential source protection implementation requirements for TW1-21.A copy of the Memorandum is provided in Appendix O.

As stated in the Memorandum, any changes to a municipal drinking water system (i.e., new well expansion of an existing well, etc.) requires the delineation of wellhead protection areas, updates to vulnerability scoring, and other reference layers, in accordance with the Clean Water Act and Safe Drinking Water Act. Additionally, the corresponding Source Protection Plan must be updated to include the changes prior to the distribution of water to the public. Updates to the Grand River Source Protection Plan to incorporate the new WHPAs must be completed through a public process.

A summary of expected results from adding TW1-21 to the Arthur municipal drinking water system is as follows:

- The WHPAs for TW1-21 is assumed to run generally to the northeast and short distance to the southeast of the well location, consistent with the current orientation of the existing WHPAs for existing wells 7B and 8A/8B.
- Properties expected to be impacted by the new WHPAs include agricultural and rural residential; however, may overlap existing WHPA Zone D of existing Well 7B, which impacts an existing industrial area of Arthur.
- It is likely that the vulnerability scores outside of the WHPA Zone A for TW1-21 would remain low (i.e. WHPA Zones B, C and D having vulnerability scores of 6, 4, and 2, respectively).
- Properties within a 100 m radius of the new well (TW1-21 location) may be subject to a number of requirements, including septic inspections, manure application prohibitions, risk management plans for agricultural activities and for chemical handling/storage and education requirements. Conditions/restrictions (i.e., no private servicing) will be applicable to developments created within 100 m of the new well.
- If a backup generator is to be incorporated into the design of the new well, spill containment and risk management measures would be required.

The wellhead protection area for TW1-21 should be delineated using the original model used to develop the WHPAs for Arthur Wells 7B and 8A/8B.

13.7 Climate Change

The MECP Guide entitled Considering Climate Change in the Environmental Assessment Process guide, dated October 2017 was consulted as part of the planning for this Class EA project to consider the impacts of this project on climate change, the impacts of climate change on this project, and associated mitigation and adaptation measures.

13.7.1 Project's Impact on Climate Change

The project will generate limited greenhouse gas emissions during construction and occasionally during operation, by carbon dioxide emissions from heavy vehicles and backup generator during power outages/emergency situations. It is expected that all construction equipment and backup generator will be in good working/efficient condition, minimizing greenhouse gas emissions.

Vegetation removal during construction will be limited, including tree removals. The anticipated well and storage facility site, is adjacent to the municipal right-of-way, on undisturbed private property with tall grasses. The watermain construction required to connect the new well and storage facility to the existing distribution network will occur either within an existing or unopened road right-of-way. There is an opportunity for the design of the new well and storage facility site to incorporate landscaping to compensate for any vegetation removal and provide carbon sinks.

Additionally, the associated pump house building does not need to be heated or cooled to typical human comfort levels as it is not occupied. In the summer, the water circulating in the pumphouse and the water tower will act as a heat sink to keep the buildings cool in the summer. In the winter, the buildings only need to be heated between 10°C and 15°C to keep the building from freezing.

Given the anticipated impacts on climate change, it is understood that this project is sufficiently minor in scale.

13.7.2 Impact of Climate Change on Project

Extreme weather events (i.e., extreme temperatures, winds, precipitation) may occur and impact the operation, structural integrity, and utilities of the new well and storage facility. Impacts to operation include reliability, continuity, maintenance, and to utilities including communications, drainage/wastewater, and fire and safety. Temporary loss of service or function due to climate related extremes may occur; therefore, a backup generator will be included in the design of the new well and pumphouse, so that impacts are mitigated. Other adaptations to mitigate impacts from climate change will include consideration of temperature extremes, building materials, building floor elevation to mitigate impacts from flooding, etc.

Climate change may affect the local water supply over time. Operation of the proposed municipal well and associated municipal water system will be in accordance with the applicable Permit to Take Water and drinking water permits. Annual reporting of water takings is required by the PTTW and is used to determine changes in capacity over time, which may be attributed to climate change, given changes in weather conditions (i.e., less snowfall, timing of snow melt, increase in drought, reduced soil moisture, etc.).

13.8 Excess Soil Management

Implementation of the project will require some excavating for construction of the wellhouse, well site and foundation/footing of the storage facility and for watermain installation. Excess soils management investigations will be completed during detailed design of the project, as required by and in accordance with the Ontario Regulation (O. Reg.) 406/19: On-Site and Excess Soil Management.

14.0 MITIGATING MEASURES

During well exploration and development of the proposed well site and construction of the new water storage facility, the following mitigating measures will be implemented to minimize impacts on the environmental features on adjacent lands:

- Provide notification of construction activities and construction schedule to surrounding properties.

- Minimize vibrations, dust and odours during construction.
- Install and maintain sediment and erosion control measures to minimize impacts on surrounding properties, streams and wetlands.
- Ensure construction activities will be undertaken during the hours specified in the Township's Noise By-Law.
- Employ a wildlife ecologist to undertake an active nest survey to establish nest protection zones if tree removal or trimming should be required during the generalized nesting period of April 1 to August 31.
- Implement a monitoring program, as part of an eventual Permit To Take Water for the proposed well to examine the potential for longer term impacts to environmental features and to assess the potential for impact during dry annual conditions, as well as to assess long-term effects on the bedrock system (and potential private well interference).
- Inform Contractor to stop work and report to MCM, any potential archaeological resources if any, found during construction and consult with Indigenous Communities.
- Restrict idling of construction equipment, as practicably possible, during construction to reduce greenhouse gas emissions.
- Operate equipment that is energy efficient, so as to conserve energy and reduce greenhouse gas emissions.
- Incorporate landscaping into the restoration of the well and storage facility site to compensate for vegetation removal during construction and create carbon sinks for greenhouse gas emitted during operation.
- Design and restore the well and storage facility site so that it is compatible with and minimizes aesthetic disturbances to adjacent properties.
- Construct the new facilities to provide clearance from the 100-year floodline.
- Complete required geotechnical investigations during detailed design and incorporate the recommendations into the design of structural components of the project.
- Minimize the volume of excess soil to be generated during construction of the project and reuse excess material, on site, as reasonably practicable. This will also reduce associated hauling efforts required.
- Manage excess soil in accordance with O. Reg. 406/19.
- Dispose of waste generated during construction in accordance with MECP requirements.
- Provide emergency backup power via a standby diesel generator with on-site fuel storage, weatherproof and noise enclosure, designed to applicable regulations including MECP air and noise regulations.
- Incorporate stormwater management into the design to mitigate potential impacts from flooding and extreme weather conditions.
- Implement a spills management and response plan for during construction and operation, as well as an operation and maintenance manual for the facilities.
- As part of planning for the decommissioning of the Multi-Leg Tower, it is recommended the Township explore alternative ways to honour its legacy.

15.0 Anticipated Approvals

Approvals, permits and requirements for implementation of this Project during design and/or construction are expected to include the following:

- Permission to enter private property for the purpose of well exploration and associated studies.
- Permit to Take Water.
- Environmental Activity and Sector Registry.
- Site Plan Approval.
- Rezoning applications for proposed use.
- Building Permit.
- Approvals from applicable agencies for associated work (i.e., TSSA, Electrical Safety Authority).
- Utilities (i.e., gas, hydro, communications, etc.).
- Updated Source Water Protection Plan with new WHPAs.
- Drinking Water Works Permit Amendment.
- Municipal Drinking Water License Amendment.
- MECP Form 1 for new watermain.

16.0 Additional Studies Required

It is anticipated that the following studies will be required during the next phase of the Project:

- Well Exploration and associated pumping tests to support application for production well PTTW approval.
- Geotechnical investigation.
- Water Conservation Opportunities.

17.0 Next Steps

It is anticipated that the next phase of the Project will include but not be limited to the following tasks:

- Consult with the Township to prepare an implementation strategy for required water system infrastructure upgrades, including phasing and scheduling. This strategy will depend primarily on development timing and funding sources.
- Township should proceed with well exploration adjacent to the TW1-21 site, outside of the municipal right-of-way and continue with development, assuming anticipated favorable well exploration results. Development of the new well is expected to include the following:
    - Construction of two 250 mm diameter production overburden wells
    - Short-term step testing and 6-hour tests to ensure production capacity of at least 30 L/s.

- Monitor and define arsenic concentrations from the production wells while being pumped at the design flow rate.
- Pumphouse design to consider appropriate treatment for secure groundwater (Category 1) and arsenic.
- Amend the existing PTTW for the Arthur water supply system to include the two new wells at a continuous rate of 27 L/s, with the Hydrogeological Report and well construction report for the new production wells as supporting documentation.
- Install automatic water level recorders in MW1-21 and 8590 Wellington Road 14 well to monitor water levels and confirm the aquifer response for one year prior to municipal pumping at the new well site.
- Drill a new well at 8580 Wellington Road 14 to ensure that their well supply is not interrupted once municipal pumping begins.
- Perform an additional well survey of all wells within 1.5 km of the new well site to document baseline conditions and identify well interference issues, if any, to support the PTTW application.

* Complete the next steps/recommendations provided in the Memorandum from Wellington Source Water Protection (refer to Appendix O), including:
    - WHPA delineation and vulnerability assessment
    - Enumeration of the treat activities on the properties within the new WHPAs
    - Meeting between Grand River Source Protection Region and Grand River Source Protection Authority to discuss the Project and ensure the updated Assessment Report, including WHPA delineation and vulnerability assessment meets the requirements pursuant to the *Safe Drinking Water Act* and *Cean Water Act*.
    - Section 34 amendment to the corresponding Assessment Report and Source Protection Plan, including public consultation and Provincial approval.
* Applications for PTTW approval for the new well.
* Preliminary and detailed design of required infrastructure including well pumping/treatment facilities, transition watermains, storage facilities and booster pumping/pressure control facilities.
* Acquisition of land for development of the municipal well, storage facility and associated provisions.