Summary of Community Liaison Group Comments and Responses on the Centre Wellington Tier 3 Water Budget and Local Area Risk Assessment Draft Final Water Quantity Threats Analysis and Climate Change Assessment

Prepared by Grand River Conservation Authority,
Township of Centre Wellington,
Wellington Source Water Protection,
and Matrix Solutions Inc.

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Centre Wellington

DRINKING WATER SOURCE PROTECTION
Our Actions Matter

LAKE ERIE SOURCE PROTECTION REGION

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1 Introduction

The Centre Wellington Tier 3 Water Budget Study provided a quantitative assessment of current and future risks to the Township's municipal drinking water wells. The study also resulted in the delineation of a Water Quantity Wellhead Protection Area for the Township's municipal wells, also referred to as a WHPA-Q.

The Water Budget Study showed that all future groundwater takings, and land use changes which limit the ability of water to soak into the ground (called groundwater recharge), could potentially affect the availability of water for the Township's municipal supply. This does not mean that groundwater takings located within the WHPA-Q necessarily impact groundwater levels at the municipal wells, but signifies that additional study is needed for new water takers within the WHPA-Q.

To support future water supply and help ensure future water availability, the outcomes of the Tier 3 study support the development of water quantity policies under the Clean Water Act within the WHPA-Q. The objective of these policies is to improve the sustainability of future supplies as they are developed. Tier 3 study results do not direct the Township with the development of future water supply or timelines.

Stakeholder and community consultation has been an important component of the Centre Wellington Tier 3 Study. A Community Liaison Group (CLG) was formed at the outset of the project; the group is comprised of local stakeholders and residents. The purpose of the CLG is to provide feedback and advice to the Tier 3 Project Team at key milestones in the study, and support efforts to keep the broader community informed about the project and its progress.

A draft Water Quantity Threats Analysis and Climate Change Assessment were prepared in early 2020, representing a key milestone in the project process. These studies mark the completion of technical work for the Tier 3 study.

2 Summary of Community Liaison Group Comments and Questions

The draft Water Quantity Threats Analysis and Climate Change Assessment were presented to CLG members in May 2020. Time was provided for the CLG to review and comment on the contents of the reports before the documents were finalized. Seventeen (17) correspondences, containing broad and detailed comments were received by members of the CLG as listed below. The attached Appendix contains a complete list of comments and questions received.

1. May 18, 2020; Subject line: Centre Wellington Tier 3 comment; Sent to: Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Kathryn Baker

2. May 19, 2020; Subject line: Comments on climate change report; Sent to: Sonja Strynatka

3. May 22, 2020, Subject line: Centre Wellington Tier 3 Preliminary Threats Analysis, Sent to Sonja Strynatka, Martin Keller, Colin Baker

4. May 23, 2020, Subject line: correction from Friday – C.W. Tier 3 Threats Analysis, Sent to Sonja Strynatka, Martin Keller, Colin Baker

5. May 23, 2020; Subject Line: Community Liaison Group – Meeting follow up; Sent to: Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Sarah Wilhelm

6. May 28, 2020, Subject line: Centre Wellington's May 25 Council Meeting, Sent to Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker and Kathryn Baker;

7. May 28, 2020, Subject line: Fwd: Centre Wellington's May 25 Council Meeting, Sent to Centre Wellington Mayor and Council members (Kelly Linton, Ian MacRae, Kirk McElwain, Neil Dunsmore, Steven VanLeeuwen, Stephen Kitras, Bob Foster), Andrew Goldie, Colin Baker and Kyle Davis

8. May 29, 2020, Subject line: Fwd: Centre Wellington's Tier 3 Water Budget, Sent to Sonja Strynatka, Martin Keller, Kathryn Baker, Colin Baker, Kyle Davis

9. June 1, 2020, Subject line: the Tier 3 and WSMP numbers, Sent to Sonja Strynatka, Martin Keller, Colin Baker, Kyle Davis; Plan

10. June 3, 2020; Subject line: Community Liaison Group – Meeting follow up; Sent to: Sonja Strynatka

11. June 3, 2020, Subject line: Tier 3 comments, Sent to Sonja Strynatka, Martin Keller, Kyle Davis

12. June 7, 2020, Subject line: May 20th meeting, Sent to Martin Keller, Sonja Strynatka, Kyle Davis

13. June 15, 2020, Subject line: Centre Wellington tier 3 (series of four emails to send the two Hunter letter reports, Appendix A Part 1 and 2 and Appendix B), Sent to Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Kathryn Baker

14. June 25, 2020, Subject line: Centre Wellington's water system, Sent to Aldo Salis, Sarah Wilhelm

15. July 8, 2020, Subject Line: Centre Wellington Tier 3, Sent to Sonja Strynatka, Martin Keller

16. July 13, 2020, Subject line: Fwd: Centre Wellington Tier 3, Sent to Colin Baker and Kyle Davis

17. July 13, 2020, Subject line: Update Report on the Township's water system, Sent to Brett Salmon

Based on the emails received, the following themes were identified:

- Water Supply Master Plan and the Tier 3 Study Connections
- Water Quantity Threats Analysis
- Tier 3 Data
- Climate Change
- Growth, Development, and Water Management Connection
- Water Quantity Policy Development
- Prioritization of Water for Agriculture Use
- Best Management Practices
- Groundwater Monitoring
- Source Water Quality Wellhead Protection Areas

The following are the project team's responses to address the comments received for each of these themes.

Water Supply Master Plan and the Tier 3 Study Connections

The Tier 3 Study and Water Supply Master Plan (WSMP) are scoped under different frameworks but are moving towards the same goal - ensuring there is enough water for the Township of Centre Wellington to meet the water demands of the communities of Elora and Fergus. The conclusions of both studies are the same, new water supplies are needed to service population and employment growth in the Township. The WSMP has identified that, based on growth projections, new water supplies may be needed by 2026 to meet peak demands whereas the Tier 3 study identifies new water supplies may be needed between 2031 to 2036 to meet average annual demand. As a result, the Township has already started work, with Council approval, on various options to increase the Township's water supply. The projects have benefited from shared resources as Township staff led the WSMP and were active participants on the Tier 3 project. Additionally, Matrix Solutions, the water budget consultants, were involved in both projects.

The Tier 3 study used average annual demand to complete a higher level analysis to determine whether the existing municipal system was at risk of not being able to meet existing and future average annual demands. Average annual demand is the recognized approach to calculating Risk Assessments in Tier 3 studies (http://www.waterbudget.ca/waterbudgetguide; page 98). Average annual demand is used for modelling purposes as peak or permitted rates are often not a rate that a well can sustain on a continuous basis but are required for short-term variations in demand. The average annual demand of 9,030 cubic metres used for the Tier 3 analysis is taken directly from the Water Supply Master Plan (2019). Through the WSMP, municipalities determine the preferred solution to obtain additional water supply (i.e., water conservation and efficiency,

optimization of existing water supply wells, and additional groundwater wells), when those water supplies are needed, and identifies where new water supplies could be located. The WSMP has identified that, based on growth projections, new water supplies may be needed by 2026 to meet peak demands whereas the Tier 3 identifies new water supplies may be needed between 2031 to 2036 to meet average annual demand. Although different dates, new water supplies are needed, at the earliest by 2026. As a result, the Township has already started work, with Council approval, on various options to increase the Township water supply.

The results of the Tier 3 analysis identified an area (the WHPA-Q) that needs additional measures to ensure the Township has enough water for future growth and demand. Source Protection Plan policies are currently being developed in a process led by the Township and Wellington County. Policies, once included in a revised Plan supported by the Lake Erie Source Protection Committee and approved by the Minister of the Environment, Conservation and Parks, will direct the Township, County and the Ministry to take actions to ensure the Township is able to meet future demands.

The Township also calculates future water demands based on existing peak water demands, approved but yet to be constructed development units, infill/intensification, and re-zoning applications as set out in provincial guidance documents D-5 Planning for Sewage and Water Services (1996) and D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants (1995). The Township updates these calculations annually to determine the surplus capacity available in, not only the water system, but also at the wastewater treatment plants in Elora and Fergus. These updated calculations were incorporated into the WSMP.

With regard to comments provided by Hunter and Associates on the WSMP, the commenting period for the WSMP is now closed and therefore comments received are outside of the WSMP environmental assessment process. Regarding the comments on the Township's 2019 water system operational data, this data is reviewed by licensed Water Operations and compliance staff and professional geoscientists. The operational data is also reported to the Ministry of the Environment, Conservation and Parks through the Drinking Water Supply System Annual Reports in accordance with requirements under the Safe Drinking Water Act and Groundwater Monitoring Program Biennial Reports in accordance with requirements under the Township's Permit To Take Water #4856-9KBH5A. If there are specific concerns that you would like to discuss related to the 2019 operational data, please contact Colin Baker, Managing Director of Infrastructure Services, at the Township to arrange a time to meet.

Water Quantity Threats Analysis

The purpose of the draft Water Quantity Threats Analysis Process was to assess the root of what may have triggered the Significant Risk level for the municipal wells that was identified as a part of the Tier 3 Water Budget and Risk Assessment Study. For Centre Wellington, a current lack of municipal drinking water system infrastructure (i.e., new supply wells) to support future water needs was identified as the largest risk. As the

Threats Analysis was being completed, the project team started with analyzing larger picture scenarios, such as changes in land use (which may lead to reduction in recharge to the deep aquifer), prolonged drought, and different water use categories such as domestic and agricultural water users, to evaluate their relative impact to the municipal supply. After these scenarios were evaluated and their potential impact compared against each other, the relative impact of domestic and agricultural water users, and changes to the amount of water recharging as a result of changing land use was minimal when compared to the increased water demand scenario related to population growth.

Unlike the Tier 3 study, the Risk Management Measures Evaluation Process is not required under the Clean Water Act but is provided as an additional tool to support policy development. The insights from the Tier 3 study allowed the project team to tailor the process to target the measures most likely to be impactful. For example, the Tier 3 study results showed that groundwater levels in the municipal wells were not highly sensitive to increases in impervious surfaces resulting from future development (e.g., roads, parking lots, buildings). As a result, the Water Quantity Threats Analysis focused on assessing the potential impact of other water takings such as agricultural and domestic water use on the municipal supply. The Water Quantity Threats Analysis results provided a better understanding of the relative impact of increased water takings to support future demand versus the various other scenarios presented in the report. Had some of the other scenarios showed a potential impact to the water supply, further study – possibly including a Risk Management Measures and Evaluation Process – would have been completed to further evaluate these scenarios and assess their relative impact in more detail.

Insights from the Tier 3 study and Water Quantity Threats Analysis results have been used to guide the development of draft water quantity policies such that these policies are most effective in addressing the risks identified within Centre Wellington.

Tier 3 Data

A number of comments received provided an assessment of days in 2018 where water levels in the Centre Wellington municipal wells were, below the average annual level used in the Tier 3 study. These comments identify days where the amount of available drawdown could be less than the amount of simulated drawdown predicted as part of the Water Quantity Threats Analysis.

In practice, the Township does not pump at an average rate from each well. The Township must respond to daily operational and maintenance requirements as well as the varying maximum daily water demands of the community. Pumping a specific well to a water level that is close to its safe drawdown level likely comes with a trade-off with less pumping at another well. The Tier 3 model is helpful in assessing a more preferential pumping rate distribution at the municipal wells. However, the subtleties of day-to-day operations cannot be captured in Tier 3 modelling so optimization scenarios use average annual pumping rates to provide insights to municipalities to inform their operational planning (i.e., WSMP).

The Tier 3 study, as with most technical studies, collected its data in the early phases of the project and therefore did not assess or incorporate 2019 pumping data. The project team is aware of the new 2019 data, and this will be included in future model updates.

Climate Change

The potential effects of climate change on the water quantity available for the Centre Wellington municipal drinking water system was assessed during this study. The study found that climate change would likely increase winter rainfall in Southern Ontario (less precipitation as snow, fewer and shorter periods of frozen ground), which would result in increased regional groundwater levels. A climate change assessment specific to potential effects on the water needs of agricultural irrigations was outside the scope of this study. If needed, further assessment of climate change impacts could be considered in a future update to the study, as part of an iterative and continuous improvement process.

All groundwater simulations evaluated the impacts assuming future municipal pumping (i.e., "Allocated Rates" as described in the Tier Three Risk Assessment [Matrix 2020b]). Text to this effect will be added to the Climate Change Assessment's executive summary and conclusions for improved clarity.

The following text will also be added to the executive summary to provide clarity: "While the cumulative effects related to climate change, locally reduced recharge as a result land use change within Fergus and Elora, and future municipal pumping were included in this assessment, other scenarios that include future changes to non-municipal water takings (e.g., increased agricultural takings) were not assessed at this time." Further, the conclusions will be updated to indicate that "The future climate scenarios, representing projections of future temperature and precipitation, provide no evidence that climate change up to the period of the 2050s would reduce average annual recharge rates in Centre Wellington. No additional risk from climate change to the Centre Wellington municipal water supply wells is expected". The text will also be further updated as "These results are based on the modelling approach employed, ***the future pumping rates applied***, and the GCMs selected for this assessment."

In the Climate Change Assessment, the simulation results suggest (see Section 2.5.2 of Matrix [2020a]) that leakage of water to the lower bedrock formations, which are interpreted to be the main source of water for the municipal wells, may range between approximately 11,000 and 13,000 m^3/day. By comparison, future (2031 to 2036) average municipal demands are estimated to be on the order of 8,523 to 9,969 m^3/day (AECOM 2019). This indicates that leakage to the lower bedrock formations will be more than the average municipal water pumping from the lower aquifer.

We acknowledge that increased climate variability is likely, along with increased risk of flooding. The hydrologic assessment completed to estimate effects on climate change does consider surface water effects; however, the analysis and discussion presented in the Climate Change Assessment is limited to its effect on the water balance relating to groundwater recharge. Our experience with a number of different climate

models near the study area illustrates this variability; however, increased average groundwater recharge rates are observed across nearly all the scenarios.

This Climate Change Assessment specifically focused on the simulated impacts to groundwater quantity at the Centre Wellington municipal wells and considers multiyear periods where groundwater recharge is higher or lower than average (e.g., the 1960s drought). However, the Centre Wellington groundwater supply is currently within a deeper bedrock aquifer which is less sensitive to seasonal and annual climate fluctuations, and this is also consistent with longer term monitoring data.

Growth, Development, and Water Management Connection

In drafting the water quantity policies, the project team considered the connections between growth, development, and water management. A policy framework has been proposed that seeks to work between these perceived silos. For instance, there are a number of land use planning policies directed to the County including policies that provide recommendations for changes to the Official Plan related to water taking and recharge reduction. There are also policies that encourage interagency cooperation between the different water management agencies including the municipalities, Conservation Authorities and the Province and policies directed to the Province itself related to prescribed instruments and communication with the other agencies.

Additionally, the Province recently released their water quantity management framework for public consultation (which ended August 2nd, 2020). As the Province decides on how to implement this framework, the project team will look to further link the policies to any new or revised provincial direction.

Water Quantity Policy Development

Regarding comments related to policy approaches and implementation including population growth, the project team is currently organizing a further CLG meeting (tentatively scheduled for late August / early September 2020) where we will discuss draft policies. Draft policy text was presented to the Lake Erie Source Protection Committee on June 25, 2020.

In drafting these policies, the project team considered the connections between growth and development and water management and have proposed a policy framework that seeks to connect the various local and provincial government agencies that have responsibilities in these areas. For instance, there are a number of land use planning policies directed to the County including policies that provide recommendations for changes to the Official Plan related to water taking and recharge reduction. There are also policies that encourage interagency cooperation between the different water management agencies including the municipalities, Conservation Authorities and the Province and policies directed to the Province itself related to prescribed instruments and communication with the other agencies.

We suggest that all CLG members consider submitting comments related to the draft policy text following the CLG meeting. The current work addressing water *quantity* will be captured in a further update to the Wellington chapter of the Source Protection Plan and Assessment Report. Formal public consultation will be undertaken at that time and any comments received will be considered by the Lake Erie Region Source Protection Committee prior to submitting the plan update to the Ministry.

Prioritization of Water for Agricultural Use

Concerns were raised that Tier 3 and Water Quantity Threats Analysis did not consider the future water needs of the agricultural community. The contemplation of these concerns was beyond the scope of our studies. However, prioritization of water use is one of the topics in the recently released Provincial water quantity management framework that was available for public consultation until August 2nd, 2020. The province has proposed that most agricultural water uses would be considered one of the highest priority uses. In the draft source protection water quantity policies for the County of Wellington, the project team identified the need for a policy related to how water uses are prioritized in Ontario. The project team is currently reviewing if the province's proposal meets local needs or if additional action regarding prioritization should still be requested of the province.

Best Management Practices

The benefits of best management practices such as maintaining groundwater recharge are discussed on page 10 of the Preliminary Water Quantity Threats Analysis report. The report recommends that policies should be developed to ensure that groundwater recharge is maintained to support water levels, water quality, and ecological function. Additional text will be added: "While many best management practices, such as those implemented in the Rural Water Quality Programme, are designed to improve water quality they have the additional benefit of maintaining groundwater recharge and concurrently reducing surface water runoff."

Groundwater Monitoring

The Township maintains a network of groundwater monitoring wells separate from the municipal pumping wells. The Township monitoring program includes both water quality and water level monitoring in both groundwater monitoring wells and municipal pumping wells. As part of future work to assess the capacity of the current municipal wellfield and potential new municipal well locations, it is anticipated that additional monitoring wells will be installed over the next few years. Currently, the monitoring well network is confined mostly to the urban area of Elora and Fergus; the Township is currently assessing where to expand the monitoring network including in areas outside of the urban boundary including within areas of the modelled quality WHPAs. There will be opportunity for some private well owners including farms, homes and businesses, to participate in the Township monitoring programs. This participation occurs during pumping tests for new or expanded municipal water takings. As the Township progresses with its groundwater exploration optimization programs for new water supply, the Township will reach out to you at the appropriate time to discuss this further. In the meantime, if you have any additional questions on the

Township's monitoring program, please contact Colin Baker, Managing Director of Infrastructure Services, at the Township.

Source Protection Water Quality and Wellhead Protection Area Concerns

The June 15, 2020 email provided comments from Gary Hunter, P. Eng., related to the water *quality* portion of work done under the Clean Water Act, 2006 to protect municipal drinking water sources; e.g., revisions to wellhead protection areas (WHPA) and Issue Contributing Area (ICA) delineation. An update to the Wellington chapter of the Grand River Source Protection Plan and Assessment Report addressing water *quality* aspects has been submitted to the Ministry of the Environment, Conservation and Parks, for their review and approval, in early May 2020. This followed pre-consultation with agencies and formal public consultation between January 13 and February 26, 2020, including two public meetings on February 6 and 12, 2020 at Elora Hall and the Marden Community Centre. All public comment received during that time, including submissions from Save Our Water, were considered by the Lake Erie Region Source Protection Committee and included in the submission package to the Ministry.

At this point, the Lake Erie Region has submitted the Grand River Source Protection Plan update respecting water *quality* for Wellington County to the Ministry for review. The project team is aware that Save Our Water has sent these comments directly to the Ministry including Source Protection Programs Branch that oversee the review of the updated and the Ministry will consider them as part of their review.

For clarity, in response to comments about the pumping rates used for delineating the quality WHPAs and ICAs, the MECP technical rules provide the project team flexibility and discretion in choosing an appropriate pumping rate. The project team proactively chose pumping rates that are higher than the current, pumping rates, to be protective of the water supply that would be required to accommodate expected population growth, but maintained rates at a level that the numerical model could still support. This resulted in WHPAs and ICAs that are larger than the current capture zones, therefore providing additional protection to the future sources of drinking water. The larger WHPAs and ICAs also will ensure that currently existing activities that would otherwise be outside the vulnerable areas can be addressed so potential impacts can be prevented or minimized.

REFERENCES

AECOM Canada Ltd. (AECOM). 2019. 'Township of Centre Wellington, Water Supply Master Plan'. Draft prepared for The Township of Centre Wellington. Kitchener, Ontario`. July 2019.

AquaResource Inc. 2011. Water Budget & Water Quantity Risk Assessment Guide; Drinking Water Source Protection Program. Prepared for The Ontario Ministry of Natural Resources and the Ontario Ministry of the Environment. October 2011.

Matrix Solutions Inc. (Matrix). 2020a. Centre Wellington Tier Three Water Budget, Final Risk Assessment Report. V 3.0. Prepared for Grand River Conservation Authority. Guelph, Ontario. April 2020.

Matrix Solutions Inc. (Matrix). 2020b. Township of Centre Wellington Preliminary Water Quantity Threats Analysis. Version 0.5. Prepared for Grand River Conservation Authority. Guelph, Ontario. March 2020.

Ontario Ministry of the Environment and Climate Change. (MOECC). 2017. Technical Rules: Assessment Report, Clean Water Act, 2006. November 20, 2008. Amended on December 12, 2008 (administrative amendments), November 16, 2009 (EBR Posting Number EBRO10-7573), and December 2, 2013 (Technical Bulletin). Updated on June 23, 2017. Published on May 19, 2016. 2017. https://www.ontario.ca/page/technical-rules-assessment-report

Appendix
Community Liaison Group Comments and Questions

Centre Wellington Tier 3 Water Budget and Local Area Risk Assessment Study
Water Quantity Threats Analysis & Climate Change Assessment – Community Liaison Group
Comment and Questions

1. **May 18, 2020; Subject line: Centre Wellington Tier 3 comment; Sent to: Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Kathryn Baker**
   There appears to be no evidence in the Peer Review Comments that these reviewers or any other readers were familiar with Water Supply Master Plan conclusions, despite the WSMP providing the necessary context for this risk assessment. It is never stated for the reader (Ministry) in the Final Tier 3 Risk Assessment that the current wells pumping to the average daily rates as assessed could never happen. And so, given what is presented here, how is the reader going to understand this?

   There is a disconnect between the Tier 3 and the WSMP.

   This Risk Assessment is based on an average daily well production of 9,060 m3/day pumped from our EXISTING well system up to some time around 2032.

   Here is the critical point – **if our wells pumped 9,060 m3/day as an average, these wells would have to accommodate a Firm Infrastructure Capacity of 16,000 m3/day. But we have a Firm Infrastructure Capacity of only 10,000 m3/day.**

   According to the WSMP, to get to infrastructure firm capacity that could provide an average of 9,060 m3/day we will need 3 new wells. And we will need a new Permit to Take Water. This, then, is an EXPANDED well system, which the Tier 3 did not assess.

   Matrix does not explain that because of a shortage of firm operational capacity, the average daily capacity, or “Allocated rates,” that this assessment is based on will only be achieved when the water system is supported by three additional wells, for which new municipal water sources are required. This was not made clear in the report.

   This disconnect results in a huge gap between water system capacity as this is presented in the Water Supply Master Plan and water system capacity as implied in the Tier 3 Risk Assessment.

   The WSMP recommends commencing “immediately” with developing 2 new wells. (WSMP, Executive Summary, p. viii). This timeframe is based on the determination that the maximum day demand is closely approaching the firm capacity of the existing system.

   The recommended timeline for adding to the existing 8 producing wells is as follows: the first well in 2020, a second well in 2022, the third in 2026, a fourth in 2031, a fifth well in 2036-7, and a sixth in 2040 in order to be prepared for population beyond 2041. (WSMP p. 120) The attached WSMP Figure 2 shows the designed maximum day demand and increased firm capacity with the addition with each new well up to 2041.

   Given this timeline, the Tier 3 conclusion: “The estimated future water demand is greater than what can be *reliably* supplied by the current municipal wells” (p. 49, italics are mine) is a

misleading understatement that is clearly not unexpected by anyone. So is a reference to the WSMP's "*suggestion* that the future demand will exceed the supply potential of the existing wells" (Threats Analysis p. 1, italics are mine).

Garry Hunter's report on Centre Wellington's water system 'Potable Water Sources 2018 to 2041 and beyond' recommends the first new well be in place by 2026, with up to 5 additional wells, depending on conservation measures, required to meet water demands to 2041. (This report uses conservative lower pumping rates to facilitate the permitting process, and an update to this report is being prepared.)

Any statements that imply that the existing municipal water system could, perhaps, supply water service until 2031 to 2036 are misleading and erroneous.

The Tier 3 conclusion, that that Centre Wellington's current water supply system does not have the ability to meet future demands, and therefore the Water Quantity Risk Level is elevated to "Significant" is the correct conclusion. But it is not helpful if the Tier 3 Risk Assessment stands alone without the Water Supply Master Plan.

Recommendations: - that an Addendum be produced explaining Water Supply Master Plan conclusions and timelines for the municipal well system expansion to put this report in context, and

- that the Tier 3 acknowledge to agencies and decision-makers that the two reports be read together.

Otherwise, who is going to connect the dots.

Given the number and timeframe for new wells, and the Tier 3 recommendation that the municipality complete further Tier 3 scenario assessments of risk when they have located, evaluated and tested future supply wells, which involves monitor wells as well as the pilot wells, this process will necessarily be with us for a long time.

Page 1 in the Introduction has a misinformative footnote for the word 'Allocated rates', which references the Technical Rules 2017 definition, without stating that for this particular Tier 3 the term was redefined from the permitted volume of 15,030 m3/day to 9,060 m3/day.

Wording in Scenario 2, again, does not clarify for the reader that the current configuration of wells and pumps could not, as a whole, interrelated operating system, achieve 9,060 m3/day to supply average day water needs to 2031 to 2036.

The Threats Analysis advises that future changes in water level drawdown, which range from 1.5 to 24.2 m compared to current pumping, will require the municipality to monitor regularly to ensure they can meet the increased pumping rates. With this simulated drawdown, wells

E3, F1, F4 and F7 would not have been able to accommodate 2019 minimum water levels (from Township daily water level data).

This is particularly the case for well F1, for which the simulated water level drawdown is 11.4 metres. This well, on most days throughout 2019, had daily minimum levels of less than 10 metres to the low-level lockout, and so on most days in 2019 could not have accommodated this drawdown. On a day in September 2019, water level at this well was within 1 metre of the low-level lockout while it pumped 1,557 m3/day, which is not near AECOM's planned maximum rate of 2,250 m3/day for this well. With the simulated drawdown, F1 would not be able to be pumped to the 2019 pumping rate.

Similarly, the simulated water level change at well E3 is 7 metres, where this well had daily minimum water levels within 7 metres of the low-level lockout about 30% of days in 2019. Daily minimum water levels have been consistently low at F4 also.

A spread out wellfield with more wells would spread out the drawdowns at the existing wells.

A full Risk Management Measures Evaluation Process was not undertaken for this Tier 3, and nor was a Threats Management Strategy. It seems that the Matrix team made an exceptional effort with this Tier 3, but then did not follow through with a fulsome analysis of policies and recommendations to balance and weigh our particular supply and demand situation in Centre Wellington.

Policies 3 and 5 address possible declines in groundwater discharge to surface water flows such as coldwater streams. Modelling for the WSMP predicts some impacts to wetlands and rivers with municipal pumping. The Threats Analysis recommends that the municipality implement policies to monitor surface water flows and maintain the existing water budget, water quality, and ecological functions of surface water features. Environmental Assessments are carried out during potential well investigations, but not as ongoing processes. Although this is admirable policy, how is the municipality to do this?

The Threats Analysis concludes that, to manage water quantity risk, we should focus on the management of municipal water takings. Of the six policy approaches listed, I do not see **limiting population growth** as a measure that could decrease future demand. **This would seem the obvious solution to a demand management problem.**

Right now our subdivision planning application pipeline extends out 10 to 20 years, in some cases to 2041. It is at this level that future demand for water could most easily be managed. There is good reason to be cautious about growth and any more subdivision approvals.

There are no surprises in the policy recommendations. But strategies for water management surely exist outside of the Source Protection toolbox, which could be tailor-made to benefit

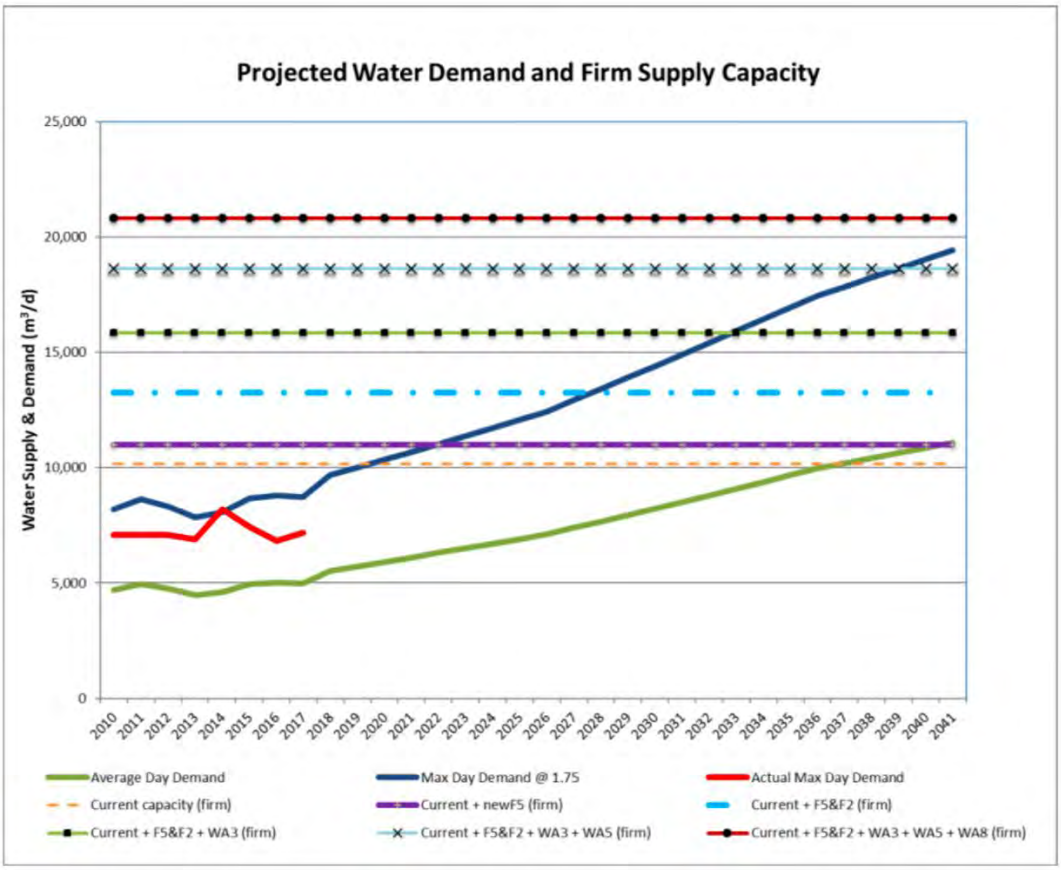
this municipality. What process does this go to now to develop those strategies, and who is responsible: municipality, county, province?

At Centre Wellington's May 4 Council Meeting, Council approved allocating surplus municipal funds to a Covid-19 Reserve Fund to cover the expected operating shortfall in revenue in 2020 as a result of the current situation. The chief financial manager so far expects a deficit of $600,000 to 800,000. Most municipalities would be in a comparable situation.

We are looking at spending $3 to 6 million for each new greenfield well. When we have time to take stock after we get back to a new normal, we may find the best way to manage operational costs for future water is a slower growth status quo and fewer wells. This may require revised strategies that include taking the effects from the current situation into account.

With the Water Supply Master Plan and the Tier 3 Water Budget and Risk Assessment in place, the municipality understands the threats to our drinking water supply and the strategies and infrastructure required to reduce these threats. Now the torch is passed to the municipality, and the very difficult work begins of implementing the recommendations of both reports, if this community intends to keep pace with the demand that is coming. All of this has a price that will not be covered by water rates and development charges. The Township has a challenging task ahead.

Figure 2. Implementation of Water Supply Alternatives - Firm Capacity



2. May 19, 2020; Subject line: Comments on climate change report; Sent to: Sonja Strynatka

As you can see I have major reservations about the generalizations that have been made as much as I might like them to be true. Thanks and good luck with discussions and clarifications involved in a final report.

"This study reflects a very detailed application of climate change modelling. The predictions relative to temperature and precipitation are most interesting.

However, the statements in the executive summary and conclusions need further clarification for completeness. It should be clearly stated that the results and conclusions relate only to water recharge at the levels of water use in the study period of 1960 to 2005 under the projected climate effects in the 2050s. It would be the subject of further study to assess recharge at levels of water use at levels expected in the next decade. The caution required about additional data and modelling being continuously updated seems most appropriate. The scientifically correct expression of the conclusion however would more

appropriately be stated along the lines that no evidence was found that expected climate change impacts on temperature and precipitation would reduce recharge rates of the wells in Centre Wellington at the levels of use in the time period studied.

It would also be useful to expand the executive summary to note that climate change effects studied were limited to temperature and precipitation. Other effects of climate change such as the possible change in agricultural practice to more water intensive crops as temperatures increased were beyond the scope of this study. Additional changes into the future such as changes in land use to more aggregate extraction were also beyond the scope of this study.

There is intriguing information in the results that recharge rates to the aquifer may be less than demand by 2031, a topic that would require a completely new study. "

3. **May 22, 2020; Subject line: Centre Wellington Tier 3 Preliminary Threats Analysis, Sent to Sonja Strynatka, Martin Keller, Colin Baker**
   Thank you very much for the virtual meeting on Wed. This was very informative, and I was glad that more of the stakeholder group attended, to make it worthwhile for all of everyone's efforts.

   I wondered if you would mind passing along to David Van Vliet this information concerning the drawdowns and minimum water level days at our wells. He mentioned in his presentation that he would check the data from my comment. But I realize now that the number I used for Well F1 was incorrect, and if David was going to take time to check it would help if he had the correct date and volume. So I have corrected it here, and while I was at it, provided the numbers for all our wells. This is from the township's 2019 water levels and well pump records provided from an FOI request. Matrix may have been using 2018 data to compare with the simulated water level change in Table 2. But the data from 2018 and 2019 seem similar, although the minimum water levels at well F1 were much lower in 2019 than 2018.

   If there are mistakes here, I apologize. I double-checked everything and tried to be as accurate as possible.

   I am not understanding how these minimum water levels at wells E1, E3, E4, F1, F4 and F7 fit with the conclusions. An explanation would be helpful, as I am probably not understanding some basic concept.

   Well E1:

   Simulated water level change with future pumping is 21.3 metres.

In 2019 this well had daily minimums with less than 21 metres remaining to the low level lockout for about 360 out of 365 days

The lowest day was January 17 when E1 pumped 847 m3, with 5 metres left to the low level lockout.

Well E3:

Simulated water level change with future pumping is 7.1 metres

In 2019 this well had daily minimums with less than 7 metres to the low level lockout for about 175 out of 365 days.

The lowest day was Sept. 17 when there was 2.8 metres remaining to the low level lockout when it pumped 416 m3.

Well E4:

Simulated water level change with future pumping is 22.7 metres.

In 2019 this well had daily minimums with less than 22.7 metres to the low level lockout for about 120 days out of 365 days. Data for this well shows pumping for only 191 days in 2019, which may reflect no actual pumping or no transponder information. So it is hard to assess normal ‘pump on’ daily minimums.

The lowest day was July 10 when it pumped 846 m3, with 14.9 metres remaining to the low level lockout.

Well F1:

Simulated water level change with future pumping is 11.4 metres

In 2019 this well had daily minimums with less than 11.4 metres to the low level lockout for about 350 out of 365 days.

The lowest day was June 29 when it pumped 972 m3, with 4.9 metres remaining to the low level lockout.

Well F4:

Simulated water level change with future pumping is 9.9 metres.

F4 minimum water level was 2.4 metres to the low level lockout on Aug. 12, when it pumped 1,561 m3.

We have not yet received FOI data on all F4 water levels for 2019.

Well F5:

Simulated water level change with future pumping is 1.5 metres.

In 2019 this well, except for about 2 days, had a minimum above 1.5 metres.

Well F5 had a lowest daily minimum of .84 metres to the low level lockout on July 15 when it pumped 687 m3.

Well F6:

Simulated water level change with future pumping is 6.5 metres.

Well F6 could accommodate this drawdown, as on the lowest day, Jan. 9, the level was 10.39 metres to the low level lockout.

Well F7:

Simulated water level change with future pumping is 24.2 metres.

In 2019 this well had daily minimums with less than 24 metres to the low level lockout about 334 out of 365 days.

Lowest day was Sept. 30 when it pumped 482 m3, and there was 7 metres remaining to the low level lockout.

4. **May 23, 2020; Subject line: correction from Friday – C.W. Tier 3 Threats Analysis, Sent to Sonja Strynatka, Martin Keller, Colin Baker**

I apologize

I am embarrassed to say that the information I asked you to forward to David Van Vliet yesterday was incorrect. This is concerning the Tier 3 simulated drawdown at each of the municipal wells compared to 2019 minimum water levels. I realize now that I had used 2018 dates for the minimum water levels at each well with the 2019 pumping volumes. It didn't seem to make logical sense, and now I see why.

Would you be so kind as to please forward this information to David instead.

I'm sorry for the inconvenience.

Well E1:

Simulated water level change with future pumping is 21.3 metres.

In 2019 this well had daily minimums with less than 21 metres remaining to the low level lockout for about 350 out of 365 days.

The lowest day was August 6 when E1 pumped 1157 m3, with 10 metres left to the low level lockout.

Well E3:

Simulated water level change with future pumping is 7.1 metres

In 2019 this well had daily minimums with less than 7 metres to the low level lockout for about 215 out of 365 days.

The lowest day was August 6 when E3 pumped 951 m3 with 2.5 metres remaining to the low level lockout.

Well E4:

Simulated water level change with future pumping is 22.7 metres.

In 2019 this well had daily minimums with less than 22.7 metres to the low level lockout for about 120 days out of 365 days. Data for this well shows pumping for only 191 days in 2019, which may reflect no actual pumping or no transponder information. So it is hard to assess normal ‘pump on’ daily minimums.

The lowest day was February 5 when it pumped 973 m3, with 17 metres remaining to the low level lockout.

Well F1:

Simulated water level change with future pumping is 11.4 metres

In 2019 this well had daily minimums with less than 11.4 metres to the low level lockout for 350 out of 365 days.

The lowest day was Sept. 26 when it pumped 1157 m3, with .91 metres remaining to the low level lockout.

Well F4:

Simulated water level change with future pumping is 9.9 metres.

F4 minimum water level was 2.4 metres to the low level lockout on Aug. 12, when it pumped 1,561 m3.

We have not yet received FOI data on all F4 water levels for 2019.

Well F5:

Simulated water level change with future pumping is 1.5 metres.

This well could accommodate the drawdown, as the lowest day, August 25, the level was 3 m to the low level lockout.

Well F6:

Simulated water level change with future pumping is 6.5 metres.

Well F6 could accommodate this drawdown, as the lowest day, January 21, the level was 10 metres to the low level lockout.

Well F7:

Simulated water level change with future pumping is 24.2 metres.

In 2019 this well had daily minimums with less than 24 metres to the low level lockout 315 out of 365 days.

Lowest day was January 25 when it pumped 1190 m3 with 9 metres remaining to the low level lockout.

5. **May 23, 2020; Subject Line: Community Liaison Group – Meeting follow up; Sent to: Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Sarah Wilhelm**
Thanks for this. I won't be submitting further comments. This is just a short note to say thanks for the webinar last week. In many ways, it responded well to my questions and comments earlier regarding whether and who ought to undertake an analysis of trade-offs between amount and rate of absolute population growth to address future water demand against amount and rate of increase in infrastructure capacity to deliver future water supply.

In particular, I should apologize for using the word 'punting' to refer to not proceeding with what seemed to me at the time an obvious venue for undertaking such an analysis. An RMMEP/TMS sounded logical, but I appreciate better the constraints of a myriad of potential policy approaches and that the technical studies had, in fact, gone above and beyond as it was.

I was encouraged, in particular, to see among the policy approaches some indication that the path forward sh/could put planning for water sustainability ahead of growth and development; that the Project team is committed to interagency/government collaboration where, say, policies and practices to deliver water infrastructure and to deliver smart growth may reside in different “silos”; and that using the modeling tools developed under the Tier 3 project, with continued resourcing, sh/could provide for sound, quantitative evidence-based land-use planning. Notwithstanding that the 2018 Discussion Paper notes that using land-use policy frameworks, perhaps in combination with other approaches, to address water sustainability is “untested”, it seems reasonable that we could expect a strong recommendation going forward to the SPC to do just that.

6. **May 28, 2020; Subject line: Centre Wellington’s May 25 Council Meeting, Sent to Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker and Kathryn Baker**
   Now that I see an article in our local paper about Monday's Council meeting, I am no longer politely and respectfully bewildered by the Tier 3. I am shocked by the wording of the Conclusion that was presented to the CLG group last Wednesday and to Council on Monday. After 4 years and a $1 million spent on Centre Wellington's Tier 3 Water Study, did no one think that it might be a good idea to read the Executive Summary of our Water Supply Master Plan? Did no one think it might be worthwhile checking to see what the capacity of our water system is, before concluding that this water can flow into it?

   In our Water Supply Master Plan it is not written in bold lettering with a box around it that Centre Wellington's water system is now at capacity. But the information is there.

   Table 1, page ii states that we will be in a deficit by 2026. (This year 2026 is the timeline that the residents group respectfully recommended be used in the Final Tier 3 report.)

   However, the WSMP also states that this Table 1 does not take Firm Capacity into account. Table 2, on page vi, states that our Maximum Day Demand will exceed our Maximum Day Capacity <u>in 2019</u>. (Year MDD > MDC - 2019) Therefore the recommendation is that implementation of new wells commence IMMEDIATELY. p.viii.

   <u>This WSMP 2019 timeline is far different from the Tier 3’s 2031 to 2036 timeline.</u>

   Fortunately for us, in the meanwhile, some major water main leaks have been repaired and 2019 population growth was less than forecasted, so we now have a buffer of additional water and a few years to get new wells online.

   It is one thing for the Tier 3 to say there is enough water available in the municipal aquifer. This was always understood from the Tier 3. It is quite another thing to make assumptions about our water system and say that our system has the capacity to use this water to service the community into the future. It is not up to the Tier 3 to analyze the design and operation

of our water system. This is the job of the Water Supply Master Plan. We now have a complete mis-match of conclusions.

Last Wednesday I asked the question “How is the Ministry supposed to know that there is a disconnect between the Water Supply Master Plan and the Tier 3?” Kathryn Baker from the Ministry explained that the Ministry has both reports and would be able to sort this out. Obviously, this is not enough. I should have also asked the question “How are our councillors and residents supposed to know this?”

At Monday’s council meeting, Sonja, I wish that you had qualified the conclusion presented, because now everyone is confused. Last Wednesday David Van Vliet from Matrix explained “There is uncertainty about this 2031 to 2036 timeline, because of not knowing when the system’s ability to meet the peak demand ends and when our current system runs out,” and he agreed that the limiting factor here is having extra capacity to meet the maximum day needs of the municipality. In fact we know when the peek demand ends. This is not a mystery, as explained above.

I am dismayed about this conclusion as stated, not only personally, but because you can’t image a community and a Township Council more in need of correct information about our current water system than this one.

Therefore, I am requesting that you provide a written explanation for the Ministry, for our residents and for our councillors. I request that you state clearly that this Tier 3 timeline is not based on the actual future needs as are required for the management and operation of the municipal water system; that this assessment only takes into account ‘average’ day needs and not the ‘maximum' volumes that are required capacity for a water system, and it is understood that the Township will need additional water capacity much sooner, and in fact the Township needs more wells right now.

To explain how this disconnect came about, the Tier 3 assessment was based on an Average Day water taking of 9,060 m3/day. Centre Wellington's WSMP recommends the Township use a 1.75 multiplier between Average Day and Maximum Day (the Tier 3 acknowledges and states this ratio on page 32). This is not an unreasonable ratio. This means that our current water system, with an existing Maximum Day capacity of 10,160 m3/day could support an Average Day water volume of no more than (10,160 divided by 1.75) 5,806 m3/day. There is a huge difference between 9,060 m3/day and 5,806 m3/day.

You can’t put water flow into a water system where it doesn’t fit!!!

Unfortunately, as of today, I also feel compelled to write to the Ministry.

Given all that has happened in this community regarding water, I need a reply and a clear explanation of why the Tier 3 did not use information from the Centre Wellington Water Supply Master Plan, which has been approved by Council.

7. **May 28, 2020; Subject line: Fwd: Centre Wellington's May 25 Council Meeting, Sent to Centre Wellington Mayor and Council members (Kelly Linton, Ian MacRae, Kirk McElwain, Neil Dunsmore, Steven VanLeeuwen, Stephen Kitras, Bob Foster), Andrew Goldie, Colin Baker and Kyle Davis**
   Dear Mayor Linton Linton and Councillors,

   Please see the attached email sent to the Tier 3 group following the CLG meeting last Wed., your Council meeting on Monday, and the article in the newspaper today.

8. **May 29, 2020; Subject line: Fwd: Centre Wellington's Tier 3 Water Budget, Sent to Sonja Strynatka, Martin Keller, Kathryn Baker, Colin Baker, Kyle Davis**
   I don't usually send emails that are such rants as yesterday.

   Here is what I sent to the other Ministry people involved.

   Hi Dan,

   The residents of Centre Wellington appreciate the Ministry's financial support for Centre Wellington's Tier 3 study and inclusion of stakeholders in the process.

   Unfortunately, the study has recently generated a few questions. The issue is that there is now a disconnect between our Tier 3 Water Budget Study and our Water Supply Master Plan (WSMP).

   The Tier 3 concludes that the current water supply system can meet future average water demand until 2031 to 2036. However, because the water supply system does not have the ability to meet future demands until 2041, this raises the Water Quantity Risk Level to Significant.

   In contrast to this 2031 to 2036 timeframe, the WSMP concludes that the current water supply system was anticipated to reach its system capacity in 2019, and the municipality is now in immediate need of a new well. The WSMP recommends that the Township proceed towards getting a new well onto the system immediately, with two wells needed by 2022, and then an additional well every 5 years after that until 2041. And so by the 2031 to 2036 timeframe this will not be the current water system, but will be an expanded system, which doesn't exist yet and so could not be assessed by the Tier 3. This WSMP conclusion is based on technical investigations of the wells and various other operational constraints on the current water system.

The conclusion was not anticipated before the WSMP study began, and the Township started immediately with work plans and getting capital projects approved to replace two wells and get more water online. In the meantime, repair of some large water main leaks and lower than forecasted population growth means that we now have some buffer in the water system.

The intention was that these two water studies would rely on each other for information; the WSMP to assess future water demand and the supply capacity of the wells, and the Tier 3 to assess the sustainability of the municipal aquifer to meet those demands. The WSMP study concluded in July, 2019, and the Tier 3 Risk Assessment Draft Final was issued in November 2019. We saw the Final Tier 3 Risk Assessment in March.

Something disconcerting recently regarding the Tier 3 conclusion was a comment by David Van Vliet of Matrix (Tier 3) at the May 20, 2020 Citizen Liaison Group meeting, where he stated “There is uncertainty about this 2031 to 2036 timeline, because of not knowing when the system’s ability to meet the peak demand ends and when the current system runs out.” He agreed that the limiting factor here is having the extra capacity to meet the maximum day needs of the municipality. However, had he been familiar with the WSMP's Executive Summary, he would know that the peak demand was already anticipated to be approximately equal to Firm Capacity in 2019. Furthermore, there is no mention of this uncertainty about the timeline in the Tier 3. (This meeting is now online for a short time.)

Here is where I think the disconnect came about. The Tier 3 assessed a volume of water as an Average Day which is actually very close to the current water system’s Firm Capacity. Of course some of this Firm Capacity has to be held in reserve to cover such things as water main breaks, fire events, filling water towers, water main flushing – all the things that contribute to designing a Maximum Day contingency (in fact Centre Wellington's Average Day to Maximum Day ratio is 1.75). Maximum Days cannot exceed Firm Capacity. All of this means that this water, although available, simply can’t be used on an Average Day basis.

The work of the Water Supply Master Plan is to determine the future infrastructure needs to meet future drinking water requirements. And the work of the Tier 3 is to do a water budget and determine the risk to our municipal water supply sources, but not, I should think, to make conclusions on the operational capacity of the water system. In principle, these two studies should align with each other. Instead, they appear to be at odds in their conclusions.

No one has satisfactorily answered the question that as residents we been asking: “How is the Ministry supposed to know about this disconnect between the two reports?” And so we are letting you know. We want you to know about this issue because we think these conflicting conclusions are really important.

I am also writing to advise you that Garry Hunter is just finishing up a review letter on the Tier 3 Water Budget Study, which I would like to send to you.

9. June 1, 2020; Subject line: the Tier 3 and WSMP numbers, Sent to Sonja Strynatka, Martin Keller, Colin Baker, Kyle Davis; Plan

I'm afraid I am being bothersome by sending you yet another email. But I do see where the discrepancy is between these two water studies and wanted to share it.

The Water Supply Master Plan in the Executive Summary does indeed provide 9,060 m3/day as an estimated average annual system capacity. And under that number it refers the reader to Table 5.2 on page 60 to see how this number fits into the system's operating conditions.

Table 5.2 (Table 1 in the Executive Summary) shows that in 2026, the year the system slides into a deficit situation for maximum days, the highest average day available to the system will be 7,105 m3/day. It shows the remaining approximately 2,000 m3/day of average day volume as surplus required to be held in reserve for the maximum days.

Table 1 also, under the maximum day column, indicates that the planned maximum day demand in 2018 would be 10,017 m3/day (the actual number is shown in Table 2).

Table 2 in the Executive Summary moves beyond average and maximum day demands to system capacity and to the firm capacity of the existing water system. This number looks beyond preparedness for maximum days, to dire events. What if one well had to be taken offline for some reason, such as long-term maintenance? or if there was a contamination event? Which we don't want to think about, but could happen. While the total capacity of the water system is 12,410 m3/day, our firm capacity, which considers the largest well off the system, is 10,160 m3/day. This is now a different story. Table 2 also indicates that the year the planned maximum day demand will exceed firm capacity is 2019.

Table 3 then moves on to the proposed water supply projects. The timeline here follows their recommendation on page viii (Next Steps) that because maximum day demand (10,017 m3/day) is now close approaching the firm capacity of the water system (10,160 m3/day) we start immediately getting new water onto the system.

Both of these numbers – 10,017 m3/day and 10,160 m3/day – are now pretty close to that 9,060 m3/day we started out with as an annual average day.

It all comes down to preparedness. We want to be prepared both for potential maximum demand (water main breaks, fires) and firm capacity (a well offline).

I was thinking, that if you or I were going on a holiday and we looked up to see the annual average daily temperature of where we're going and packed according to that, we'd probably find we hadn't prepared well enough.

Similarly, if we ran our household expenses based on the annual average daily expenditure, and suddenly a tree fell on the roof, we wouldn't have enough in reserve for a new roof. Of course we have insurance and bank loans. Water systems don't have insurance or bank loans to fall back on. We have to know we have enough for any contingency that could come along.

For that 9,060 m3/day number – it is very helpful to know that the aquifer can sustain this volume of water taking.

I hope that this makes some sense. It's constraining to have to do everything by email, and not just a chat.

10. **June 3, 2020; Subject line: Community Liaison Group – Meeting follow up; Sent to: Sonja Strynatka**

I have reviewed the presentations and would appreciate if you could add a brief addendum to the comments on the Climate Change portion of the report.

"In addition to the comments raised earlier, I would like to add the need for recognition in the conclusions about the effects of climate change that further study and attention will be required to consider the increased variability in climate that is expected. There is for example the report on the CBC today (June 2) about the need to anticipate increased flooding as a result of increased precipitation with climate change and the extreme variability in daily levels of rainfall. Such changes in types and timings of precipitation could have a major impact on water flows and recharge rates. There are already discussions about mitigation effects for flooding and insurance policies for flooding and parallel discussions and anticipation for aquifer levels would seem appropriate . I think it would also be very appropriate to recognize that although the overall predictions are quite positive there may still be patterns of climate effects that could be problematic. There are already examples where there are multi-year patterns of insufficient or excessive rainfall within the climate changes that have already occurred."

11. **June 3, 2020; Subject line: Tier 3 comments, Sent to Sonja Strynatka, Martin Keller, Kyle Davis**

In addition to the emails sent in the past week or so are the following comments:

First of all, again we acknowledge the enormous amount of work and effort that has gone into the Tier 3 project. We appreciate the involvement of stakeholders throughout the process, and recognize that this has added to the time and effort involved.

1. We have come to this process in good faith, and now there is a mismatch with the Water Supply Master Plan that seems to us to be a serious issue. We know these two studies were working in tandem, each one informing the other as they went along. So now to find an apparent disconnect between them is concerning. We would appreciate some explanation

by which the Tier 3 is reconciled with the Water Supply Master Plan, in language that can be understood by residents and councillors, and by the Ministry. We feel the Ministry needs some guidance in sorting this out. Certainly the residents and councillors do, because we're all anxious for information about water.

2. We are pleased that the Stakeholder engagement continues. We had assumed this ended with the Risk Assessment and are glad for the opportunity for engagement into the next phase.

12. June 7, 2020; Subject line: May 20th meeting, Sent to Martin Keller, Sonja Strynatka, Kyle Davis

I I wanted to apologize for my lack of participation in the meeting on May 20th. I recognize everyone's valuable time.

I was able to listen to the full meeting and all of the presentations – very informative.

From the agricultural perspective the comments would be:
From a Consumptive Water use perspective:

- How will water use be prioritized
    - uses that primarily recharge back into the same aquifer
    - agriculture water used for food production prioritized over water that leaves the aquifer for resell.
- How will future climate change concerns be addressed for agriculture with the possible need of field irrigation and the associated water taking?

There was mention of Best Management Practices. The GRCA already provides the Rural Water Quality programming to encourage BMPs. The promotion of the BMPs has provided benefits to water quality, but can the benefits to water recharge be promoted/messaged more in the report – e.g. strategies that reduce erosion/water loss into surface water and promote ground water recharge.

Our Specific Actions –
Monitoring – the modelling is self-limiting. I recognize true monitoring is costly, but is really to only true measure that other regions have invested heavily in. Comments would be:

- Are there any long term plans for digging monitoring wells within the municipality (not solely existing municipal well monitoring data)
- Monitoring of water quality and levels need to be monitored outside of the urban boundary to truly see if the increased demands on deeper municipality accessed wells are impacting more shallow aquifers that farms would be tapping into for on farm wells. This would be more in keeping with the WHPAs area of monitoring.
    - Can agriculture play a role with GRCA or Source Water to monitor water quality and levels on farm private wells?

13. **June 15, 2020; Subject line: Centre Wellington tier 3 (series of four emails to send the two Hunter letter reports, Appendix A Part 1 and 2 and Appendix B), Sent to Sonja Strynatka, Martin Keller, Kyle Davis, Colin Baker, Kathryn Baker**
    I am submitting two letters, both dated June 10, 2020, from Hunter and Associates, addressed to Concerned Citizens of Fergus and Elora. In separate emails I will send Appendices A and B, which apply to both letters. The letters complement each other. The Tier 3 Review letter begins with a glossary of water infrastructure terms (average day, maximum day, firm infrastructure capacity, etc.), showing that these terms are not independent variables. There is a mathematical relationship between them based on water system operational rules and engineering practices.

    The second letter is a new Forecast Report on water infrastructure requirements up to 2041. The 2019 production and servicing numbers demonstrate a full year of reduced water leakage and also the serviced population less than predicted. The reduced water usage means starting from a new baseline for water availability, lower per capita water use and water demand. These factors translate into fewer new wells required by 2041 than were anticipated in Hunter's 2018 report.

    A factor determining infrastructure requirement is water distribution. Like the Water Supply Master Plan, the Tier 3 Assessment assumes functional integration of the Fergus and Elora Water Systems. Given the uncertainty regarding full integration, the conclusion is: "If the Aboyne Booster Station is not demonstrated under operational conditions to have a bi-directional water transfer capability of 2,000 m3/day, a municipal well will be required in the very near term (immediately) to service the Elora settlement."

    System capacity numbers in these letters are close to the Water Supply Master Plan's: "The Fergus / Elora Wellfield has a current demonstrated Total Operational Capacity at about 12,181 m3/day and Maximum Day Demand / Firm Infrastructure Capacity at about 10,354 m3/day. For comparison, the WSMP Total Infrastructure Capacity is a similar 12,410 m3/day and Firm Capacity is a similar 10,160 m3/day."

    Some quotes from the Tier 3 Review letter:

    - "The Average Day Demand and Maximum Day Demand are not independent variables but have a fixed relationship through the Average Day Demand multiplier (Hunter 1.62, WSMP 1.75)".

    - "The Draft WSMP appears to have been misquoted with respect to the inferred Infrastructure Capacity of the Fergus / Elora Wellfield."

    - "Hunter estimates indicate that Fergus / Elora Water Supply Firm Infrastructure Capacity will be exceeded about 2026 and the July 2019 WSMP in 2019 (Table 2, p. vi)"

- The Tier 3 committed project objectives to guide future land use planning in Centre Wellington to year 2041 have not been satisfied. The situation is, however, “for proper land use planning, Centre Wellington is mandated now, not sometime later, to conform to Provincial and County Growth Plan policies to 2041 and beyond. The Centre Wellington planning application pipeline for Fergus and Elora communities already extends beyond the Year 2030 approaching 2041.”

I would like to distribute hard copies if you could tell me where to mail them.

Thank you for your time and consideration of the Tier 3 Review letter.

14. June 25, 2020; Subject line: Centre Wellington’s water system, Sent to Aldo Salis, Sarah Wilhelm

It was good to see you, Sarah, representing the County at the Centre Wellington Tier 3 Meeting on May 20. Planning the water system is all about planning for the County population growth numbers.

You would have gathered that Centre Wellington has two water studies, the Water Supply Master Plan and the Tier 3, and that there is a disconnect between therm. Over the past few years the two water studies proceeded simultaneously, each informing the other as they progressed, using the same shared data. It is hard to understand, then, why they are not in sync.

The WSMP concludes that the current water supply system was anticipated to reach its system capacity in 2019, and the municipality is now in immediate need of a new well. The WSMP recommends that the Township proceed towards getting a new well onto the system immediately, with two wells needed by 2022, and then an additional well every 5 years after that until 2041.

In contrast, the Tier 3 concludes that the current water supply system can meet future average water demand until 2031 to 2036. This is a huge difference! Something is clearly wrong.

I was not pleased with Kathryn Baker’s response, from the Ministry, who said it is okay, because the Ministry will have both studies – they can sort this out. Why should the Ministry have to sort this out? And how should our councillors and residents know which is correct? And how should the County know what to think? Why didn’t the authors of the reports sort this out themselves? And why weren’t they asked to?

Then the pandemic happened and everyone's mind was rightly focused on that instead.

So it was left to residents, and the answer is really very simple: the Tier 3 used a pumping rate for the existing water system that it is not possible for the existing water system to pump.

Here is what happened:

The Water Supply Master Plan's Draft Final report states 9,060 m3/day as the estimated average annual system capacity, and directly below this number is a Table indicating how much of this 9,060 m3 can be used, and by what date. The Table shows that the existing water supply system won't be able to use this number as an average annual day pumping rate. Before we could pump at this average day volume, we will need new wells to have enough water for maximum days.

<u>The disconnect between the two water studies occurred when this higher number was incorporated into the Tier 3 study assuming it could be used with the existing water system.</u>

The critical issue is that the average day pumping rate and the peak day pumping rate are not independent variables; there is a mathematical connection between them. Ontario's Drinking Water System Guidelines suggest a 1.8 multiplier for a population our size, so the WSMP's factor of 1.75 is not unreasonable. The rationale for using a fixed ratio between average and maximum days is to have a system designed to be prepared at all times for such contingencies as broken water mains, fire, filling a water tower, etc.

<u>Reviewing the Water Supply Master Plan Executive Summary –</u>

Table 1 shows that in 2026, the year the system slides into a deficit situation for maximum days, the highest average day pumping rate will be 7,105 m3/day. The remaining approximately 2,000 m3 is surplus needed for the maximum day demand.

Table 1 also, under the maximum day column, indicates 10,017 m3/day (the actual number is shown in Table 2) as the current planned maximum day demand.

Table 2 deals with system capacity and the firm capacity of the existing water system. This firm capacity number looks beyond preparedness for maximum days to a situation if one well was taken offline for some reason, such as long-term maintenance or a contamination event. While the total capacity of the water system is 12,410 m3/day, our firm capacity, which considers the most significant well offline, is 10,160 m3/day. Table 2 also indicates 2019 as the year the planned maximum day demand will exceed firm capacity.

Table 3 addresses the proposed water supply projects. The timeline here follows their recommendations that since maximum day demand (10,017 m3/day) is fast approaching the firm capacity of the water system (10,160 m3/day) we should start immediately introducing new water into the system.

Both 10,017 m3/day and 10,160 m3/day are now very close to the Tier 3 average day pumping rate of 9,060 m3/day, which it used to assess the current water system for their Risk Assessment. Clearly, this average day pumping rate is not going to happen with the existing water system.

By 2031 to 2036 when Centre Wellington achieves the Tier 3 pumping rate of 9,060 m3/day there will already be 3 more wells on the system.

We are waiting for a response from the Tier 3 team but have gathered that this could be a while yet.

Prior to this mix-up with the Tier 3 Final Report, I had intended to send you a Science and Policy Brief prepared by Centre Wellington residents, so I have attached this here for your information.

15. July 8, 2020; Subject Line: Centre Wellington Tier 3, Sent to Sonja Strynatka, Martin Keller

I was just wondering if you had any response yet to the questions we submitted before the May 20 Citizen Liaison Group meeting.

Also, as a follow up could you indicate when we might have a response to Garry Hunter's Tier 3 Review Letter?

It seems that with all of these various reports on our water system one number remains fairly constant through all of them – the capacity of the water system.

Prior to the Water Supply Master Plan, back in 2012-13, Golder Associates did an extensive study and pump test to determine the capacity of the municipal water system. Here are the numbers:

Golder's Well Field Capacity Assessment establishes system capacity at 12,496 m3 / day.
AECOM's Water Supply Master Plan establishes system capacity at 12,410 m3 / day.
Hunter's 2020 update report establishes system capacity at 12,181 m3 / day.

Firm capacity pumping rates (with one well offline) are likewise very similar.

Golder's Assessment establishes a firm capacity / maximum day pumping rate of (12,496 - 1711) 10,785 m3 / day.

The Water Supply Master Plan establishes a firm capacity / maximum day rate of 10,160 m3 / day. Hunter's 2020 report establishes a firm capacity / maximum day rate of 10,394 m3 / day.

With well system capacity numbers fairly consistent, it is still puzzling that the Tier 3 used an average day pumping rate that is not compatible.

16. **July 13, 2020; Subject line: Fwd: Centre Wellington Tier 3, Sent to Colin Baker and Kyle Davis**
    Please note the communication with Sonja below, with the timeline for a response to our Tier 3 questions.

    I do wish that Matrix had simply used 2026 as a timeline for new wells. That simple difference would most likely have prevented all of this work for everyone.

17. **July 13, 2020; Subject line: Update Report on the Township's water system, Sent to Brett Salmon**
    Please find attached Garry Hunter's report on the water system that updates with 2019 information and forecasts to 2041.

    One reason for the updated forecast is the watermain leakage repairs in 2018, with 2019 being the first full year showing the additional water supply. Also, pre-repairs there were higher per capita water use numbers, which the Water Supply Master Plan carried to 2041. The lower per capita rates make a big difference.

    This report was submitted to the township June 11 at the same time as a report on the Tier 3. The two reports complement each other, and two Appendices apply to each of them. I have just attached one of the Appendices, which has tables 2 and 3 which might be helpful with this report.

    Thank you for considering this.

HUNTER and ASSOCIATES
Environmental and Engineering Consultants
www.hunter-gis.com
gisinfo@hunter-gis.com
35 Years of Service

June 10, 2020 Our File: 16-401

[redacted]

E-MAIL

Re: 'Tier 3 Review Letter'
Centre Wellington Tier 3 Risk Assessment Review

Dear [redacted],

As you are aware, the 'Tier 3 project' (Tier 3) has been a collaboration between the Ministry of the Environment, Conservation and Parks (MECP), Grand River Conservation Authority (GRCA), Matrix Solutions Inc and Peer Reviewers from the University of Waterloo, University of Western Ontario, and University of Guelph. Input was provided from the Township of Centre Wellington and its Water Supply Master Plan Consultant AECOM Canada Ltd. Comments were also received through a Citizen Liaison Committee and directly from Nestle Waters Canada.

This Tier 3 Review questions and challenges the Scenario Model Flows assigned to the existing Fergus/ Elora Wellfield Infrastructure as excessive and beyond the capacity of the existing water supply system. The Risk Assessment must be challenged on the basis of the utilization of unrealistic water taking scenarios that do not reflect the existing Fergus / Elora operational Water Supply Infrastructure Constraints. **In essence, the Tier 3 is assessing 2041 Water Demands against a 2019 Water Supply Infrastructure system and the proposed water takings do not fit.**

As a result of this, Wellhead Protection Area drawdowns are overestimated, Issue Contributing Areas are exaggerated and Source Water Protection Areas are distorted, exaggerated and extended (elongated).

The accompanying Hunter and Associates '2019 Update Forecast Letter' provides Fergus / Elora 2019 Municipal Water Production, Updated Demand Forecasts and revised New Well Infrastructure Requirements to the Year 2041 and beyond. The supporting external Figures and Tables to these Tier 3 and 2019 Update Forecast Letter Reports are provided in separate common shared Appendices A & B.

1. Documents Reviewed

This letter provides a review of the following documents. The Matrix documents below are characterized generally as **'Tier 3 Reports'** in this text. **Italicized text herein are quotes from the documents below.**

Tier 3 and Other Modelling Reports

- Lake Erie Source Protection Region. May 20, 2020. *Centre Wellington Tier Three Water Budget Assessment*. Community Liaison Group Meeting #5, Webinar, Wednesday, May 20, 2020.
- Matrix Solutions Inc. March 2020. *Centre Wellington Tier Three Water Budget Final Risk Assessment Report*. Prepared for Grand River Conservation Authority.
- Matrix Solutions Inc. March 2020. *Township of Centre Wellington Municipal Water Supply Climate Change Assessment*. Prepared for Grand River Conservation Authority.
- Matrix Solutions Inc. March 2020. *Township of Centre Wellington Preliminary Water Quantity Threats Analysis*. Prepared for Grand River Conservation Authority.
- Matrix Solutions Inc. November 2019. *Centre Wellington Tier Three Water Budget Draft Final Risk Assessment Report*. Prepared for Grand River Conservation Authority.
- Centre Wellington. October 21, 2019. *Report to Committee of the Whole. Prepared by Kyle Davis, Risk Management Official, for Mayor Linton and Members of Council. Re: Source Protection Plan Update - Proposed Chloride Management Policies for Centre Wellington Wellhead Protection Areas.*
- Matrix Solutions Inc. April 4, 2019. *Groundwater Flow Modelling to Support the Township of Centre Wellington Water Supply Master Plan*. Prepared for AECOM and Township of Wellington.
- Matrix Solutions Inc. April 4, 2019. *Letter Report prepared for AECOM Canada re: Centre Wellington Water Supply Master Plan - Simulated Yields for Expanded Water Supply System with Additional Wells in New Locations and Potential Impacts to the Yields of Existing Wells.*
- Matrix Solutions Inc. April 4, 2019. *Letter Report prepared for AECOM Canada re: Centre Wellington Water Supply Master Plan - Simulated Peak Pumping Yields in the Current and Future Well Configuration Models*.
- Matrix Solutions Inc. November 2018. *Township of Centre Wellington Wellhead Protection Area Delineation, Issue Contributing Area Delineation, and Vulnerability Scoring Report, Lake Erie Source Protection Region*
- Golder Associates. September 2013. *Township of Centre Wellington, Well Field Capacity Assessment*.

Water Supply Reports

- Centre Wellington. February 18, 2020. *Water and Wastewater 2019 Annual Reports.*

  Attachments:
  - *IS2019-32 Notice of Re-Consultation Letter*
  - *IS2019-32 Draft Updated Grand River Source Protection Plan and Assessment Report*
  - *IS2019-32 Draft Updated Grand River Source Protection Plan and Assessment Report, part 2*
- Hunter and Associates. September 25, 2019. *Letter to Concerned Citizens - Fergus and Elora re: Fergus/ Elora Potable Water Sources 2041 and beyond Supplementary Report*.
- AECOM. July 2019. *Township of Centre Wellington Water Supply Master Plan - Draft (WSMP)*.
- Hunter and Associates. November 2018. *Fergus / Elora Potable Water Sources 2018 to 2041 and beyond*. Prepared for: Concerned Citizens of Fergus and Elora / Salem, Township of Centre Wellington. (Executive Summary, Volume 1 Text, Volume II Figures and Tables, Volume III Appendices.

- Watson & Associates Economists Ltd. May 5, 2015. *Wellington County Population, Household and Employment Forecast Update, 2011-2041 (Final)*.

2. All Models are Wrong but Some are Useful

Regarding COVID-19 modelling, Dr. Sanjay Gupta of Cable News Network (CNN) has frequently stated that all models are wrong but that some models are useful. This Tier 3 is no exception to this truism as confirmed by the included extensive uncertainty analysis. Indeed, the Tier 3 Modelling was justified on the basis that the prior Golder (2013) was wrong or could be improved. The Golder Modelling was also previously justified because the previous modelling was wrong or could be improved. Groundwater Model updates in the Fergus /Elora area are occurring at approximate decade intervals.

Municipal Planners and Risk Managers must be aware that Wellhead Protection Area, Issue Contributing Area and Source Protection Area Map boundary designations are estimates. They are not frozen and will change with new input information, model assumptions, software and protocols. Centre Wellington Tier 3 is no exception.

3. Tier 3 Modelling 2016 to 2020

The Tier 3 modelling is dependent on the very valuable and fundamental Golder 2012 production well pump and shutdown tests. It is also relying on the nearby high quality multilevel deep monitoring well record established as part of the Golder (2013) work and Centre Wellington's continuous water level monitoring. **However, all modelling is compromised by the absence of high-quality deep bedrock wells beyond the existing Fergus and Elora Wellfields and throughout the remainder of the modelling domain.**

There is no reason to question the Tier 3 Draft Final Plan Statement (p. vii):

> **"*....while there is uncertainty in the key model parameter hydraulic conductivity, the estimates developed during the calibration exercise are close to the best estimates possible given the available monitoring data and conceptual model.*"**

The Water Resources and Hydrogeological Peer Reviews of the new Tier 3 Reports have been comprehensive. **However, there has been no apparent independent Peer Review of the Water Supply Infrastructure scenario inputs and conclusions.**

The Tier 3 model input is not always transparent, and the conclusions are not fully reconciled with the high-quality Centre Wellington multi-decade water production, well water level monitoring history and Water Supply Infrastructure constraints.

However, the model must be challenged based on the employment of non-factual (fictitious) unrealistic water taking scenarios that do not reflect the existing Fergus / Elora operational Water Supply Infrastructure Constraints.

4. Basic Water Supply Infrastructure Concepts (Nomenclature)

In the Tier 3 Reports, there is no clear articulation and understanding and indeed there is confusion in the important water supply infrastructure concepts of Average Annual Day Demand (steady state), Aquifer Sustainability, Peak Multiplier, Maximum Day Demand (transient), Firm Infrastructure Capacity, Total Infrastructure Capacity and relationships to the Permit To Take Water. **These parameters are not independent variables and have defined mathematical relationships based on Water Supply System operational rules and engineering practices. Appendix A, Fig A.1 visually demonstrates these dependent relationships. The Tier 3 lacks a glossary of terminology.**

In the context of the Fergus / Elora individual wells and wellfields, the following operational definitions have been applied by Hunter. All quantities are in m^3/day except per capita demand expressed as L/day/capita and Serviced Population in persons.

- Centre Welling estimates **Actual Serviced Populations** on an annual basis. **Forecast Service Populations** are based on Watson (2015) with an additional allowance for municipal connection of private wells in settlement areas to 2041 (Hunter, November 2018, s6.0).

- **Total Infrastructure Capacity** cannot exceed Permit to Take Water limits and in practice will include an operational margin of safety to avoid any regulatory exceedance and shortfalls due to actual installed pumping infrastructure, decrease in well performance and declining wellfield ambient water levels.

- **Actual Average Daily Production (Steady State)** is determined from historical Centre Wellington pumping records for individual production wells.

- The current **Forecast Average Day Demands** are based on 2019 Per Capita Water Consumption of 237 L/day declining in future years at the rate of 1.0 L/year/capita to reflect continuing conservation and land-use intensification (Appendix A, Table A.3).

- **Per Capita Water Consumption** is based on Centre Wellington Serviced Population estimates. The 2019 population values are off the Forecast trend (lower) and therefore the derived per capita demand may also be lower (Appendix A, Fig A.1).

- **Aquifer Sustainability** is a measure of the groundwater capability to sustain long-term average annual withdrawals (production) without adverse stress. 'Aquifer Sustainability' should not be confused with 'Pumping Infrastructure Capacity'. The term 'Aquifer Capacity' should be avoided to reduce confusion.

- **The Average Day to Maximum Day (peak day) multipliers** decline from 1.62 in 2019 to 1.50 in the Year 2041 to reflect a growing population base and additional wells (Appendix A, Table A.3).

- **The Maximum Day Demand (Transient)** is equal to or less than the Firm Infrastructure Capacity.

- **Firm Infrastructure Capacity**, for forecast calculation convenience is herein defined at 85% of Total Infrastructure Capacity to approximate the maximum producing well out of service.

- The concept of '**Average Day Capacity**' has little practical significance in Water Supply Infrastructure Design except as directly related to Maximum Day Demand and Firm Infrastructure Capacity. **This term is misleading and should be avoided.**

- In 2026, the Annual Average Day Demand cannot exceed about 64% of the Firm Infrastructure Capacity or 54% of the Total Infrastructure Capacity. It will not exceed about **43% of the Permit to Take Water Quantity (6,435 m^3/day). This value is the highest Annual Average Day Demand this existing Fergus / Elora water system can achieve** (Appendix A, Fig A.1).

- **Comparison of Average Day Demand to Permit to Take Water Maximum Day Quantity as a measure of remaining water supply system capacity is very misleading**.

5. Permit to Take Water #4856-9KBH5A

The Ministry of the Environment Permit to Take Water #4856-9KBH5A dated June 23, 2014 and currently in effect for Fergus and Elora states in the following extracts:

3.1 Expiry

This Permit expires on June 30, 2024. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the period and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

3.3 Notwithstanding the Total Taking specified in Table A of Condition 3.2, ***the daily Total Taking from the well field (based on annual average) shall not exceed 9,018,648 LPD (60% of the Total Taking) until the well field capacity assessment report required under Condition 4.2 is completed and approved by the Director.***

4.2 ***The Permit Holder shall submit to the Director for approval, a detailed scope of work to be undertaken for a wellfield capacity assessment at the Total Taking specified in Condition 3.2, in a calendar year following exceedance of 50% of the Total Taking of 15,031,080 LPD. If 50% of the permitted Total Taking is not exceeded by December 31, 2019, then a detailed scope of work shall be submitted to the Director by June 30, 2020.***

Upon acceptance of the scope of work by the Director, the well field capacity assessment shall be undertaken by the Permit Holder. ***The final well field capacity report shall be provided to the Director for review on or before December 31, 2023 or at a minimum of six months prior to the Permit to Take Water expiry or amendment.***

Table A (from PTTW #4856-9KBH5A)

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	F1 Well	Well Drilled	Municipal	Water Supply	1,273	24	1,833,120	365	17 550406 4839507
2	F2 Well	Well Drilled	Municipal	Water Supply	1,137	6	409,320	365	17 550597 4839942
3	F4 Well	Well Drilled	Municipal	Water Supply	1,364	24	1,964,160	365	17 550021 4840805
4	F5 Well	Well Drilled	Municipal	Water Supply	1,818	24	1,963,440	365	17 551829 4839068
5	F6 Well	Well Drilled	Municipal	Water Supply	1,364	24	1,964,160	365	17 549225 4841523
6	F7 Well	Well Drilled	Municipal	Water Supply	1,364	24	1,964,160	365	17 548181 4839697
7	E1 Well	Well Drilled	Municipal	Water Supply	1,209	24	1,740,960	365	17 545850 4837407
8	E3 Well	Well Drilled	Municipal	Water Supply	1,364	24	1,964,160	365	17 547138 4835868
9	E4 Well	Well Drilled	Municipal	Water Supply	1,364	15	1,227,600	365	17 545447 4834896
						Total Taking:	15,031,080		

5.1 Permit to Take Water Constraints / Triggers

The 60% annual average taking in PTTW s3.3 above corresponds to 9,019 m^3/day. The 50% Total Taking in PTTW s4.2 above corresponds to a 7,515 m^3/day annual average taking.

The above 50% annual average taking corresponds to the Year 2031 in Appendix A, Table A.3. The 60% yearly average taking corresponds to about Year 2041 in Appendix A, Table A.3. **These average annual daily takings cannot be attained except by reducing the peak day multipliers, which would be unacceptable to the ratepayers of Centre Wellington due to frequent water pressure losses, diminished flows and compromised fire protection.**

5.2 Existing Infrastructure Capacity

The existing 2019 Total and Firm Infrastructure Capacity will be exceeded by about the Year 2026 per Appendix A, Table A.3 forecast. **The corresponding Annual Average Demand upper limit (capacity) of the Fergus / Elora Wellfield is 6,435 m^3/day.**

6. Groundwater Modelling Wellfield Flow Assumptions (2006 to 2020)

6.1. Golder Groundwater Model (2013)

Golder in its Wellfield Capacity Assessment (September 2013) undertook predictive numerical modelling based on the 2012 existing municipal Fergus / Elora Wellfield. This Wellfield is little changed from 2012 to 2019. **Golder (2013)** Appendix 1, Table 1.2 in Scenario B for Year 2028 (Steady State) **utilized an average annual pumping of 7,170 m^3/day**. This value is consistent with Appendix A Table A.3 for about the Year 2029. However, the origin and derivation of this 7,170 m^3/day flow is unknown.

For Golder (2013) Scenario D 'Transient Pumping at Current Permitted Rates' Golder utilized **15,108 m^3/day** for the Maximum Day. This pumping corresponds with the Maximum Day Demand / Firm Infrastructure required beyond the Year 2041 in Hunter Table A.3 and the Permit to Take Water in effect.

However, the Golder Scenario B Average Day Demand at 7,170 m^3/day and the Scenario D at 15,108 m^3/day each exceed the Total and Firm Infrastructure Capacity of the existing Fergus / Elora Wellfield. These incorrect modelling scenarios will produce increased local Wellfield drawdowns and distorted and exaggerated WHPAs and Source Protection Areas.

6.2 Matrix Solutions (November 2018) *Township of Centre Wellington Wellhead Protection Area Delineation, Issue Contributing Area Delineation, and Vulnerability Scoring Report*, Lake Erie Source Protection Region

This report's conclusions state:

This report describes the application of a calibrated groundwater flow model to complete work needed to update the groundwater vulnerability assessment for the Elora and Fergus well fields in Centre Wellington. Products of this work include updated WHPAs, adjusted aquifer vulnerability mapping, aquifer vulnerability scoring, and ICA delineation for the Elora and Fergus well fields. The updated WHPAs were based on groundwater capture zones delineated using the Centre Wellington Tier Three Assessment groundwater flow model and backward and forward particle tracking methods. The WHPAs have been adjusted to account for the influence of model uncertainty. (pg 26)

6.2.1 Tier 3 Model Main Objectives

This report also states:

The Township of Centre Wellington (Centre Wellington) recently completed the characterization and groundwater numerical modelling phases of a Tier Three Water Budget Assessment (Centre Wellington Tier Three Assessment; Matrix 2017a, 2018a) that includes updates to the conceptual and numerical models within and surrounding the municipal well fields of the communities of Fergus and Elora. The Tier Three groundwater flow model (Tier Three model) represents the latest model for the area and was based on local and regional characterization work. The model was then calibrated to long-term (steady-state) and time-varying (transient) pumping conditions. (pg 1)

Using the Tier Three model, the main objectives for this project were to update the capture zones and vulnerable areas for the Centre Wellington municipal wells; update the vulnerability mapping and scoring within the vulnerable areas; and delineate Issue Contributing Areas (ICAs) where drinking water issues have been identified. (pg 1)

The separate Fergus and Elora water distribution systems were combined into the single, Centre Wellington distribution system in October 2005 with the Aboyne Booster Station. The current water supply system provides drinking water to approximately 19,330 residents in Elora and Fergus (MOECC 2016). (pg 2)

6.2.2 Wellhead Protection Areas (WHPA)

A WHPA is a term used to describe scientifically based capture zones delineated for water supply wells. A capture zone is the area of land surrounding a groundwater extraction well

where water and contaminants located at and below the ground surface may travel toward that well within a defined period. The Technical Rules (MOECC 2017) require that the following WHPAs for water quality be delineated for each municipal drinking water supply well (pg 5 & 6):

- *WHPA-A: the surface and subsurface area centred on the well with an outer boundary identified by a radius of 100 m.*
- *WHPA-B: the surface and subsurface areas within which the time-of-travel to the well is less than or equal to 2 years but excluding WHPA-A.*
- *WHPA-C: the surface and subsurface areas within which the time-of-travel to the well is greater than 2 years, but less than or equal to 5 years.*
- *WHPA-D: the surface and subsurface areas within which the time-of-travel to the well is greater than 5 years, but less than or equal to 25 years.*

6.2.3 WHPA Pumping Rates

The calibrated Centre Wellington Tier Three FEFLOW model is referred to as the Base Case scenario in this study. The municipal pumping rates assigned for WHPA delineation were agreed upon with Centre Wellington personnel and are consistent with the wellfield capacity estimates being developed for the "Centre Wellington's Water Supply Master Plan" project (AECOM 2018). The final pumping rates applied in the Base Case model are provided in Table 3 (below) alongside capture zone delineation rates applied in the 2006 WHPA delineation study (Golder 2006a) and maximum permitted rates. (pg 9 & 10)

Notwithstanding the above statement, there is no audit trail or derivation in either the Tier 3 or the Draft WSMP of the source of the 2018 Revised Pumping Rates of 10,400 m^3/day (Table 3 below) later stated as 9,060 m^3/day.

Table 3 Comparison of Pumping Rates Used in Wellhead Protection Areas Delineation

Well Name	2006 Original WHPA Pumping Rate (Golder 2006a; m^3/day)	2018 Revised WHPA Pumping Rate (m^3/day)	Maximum Permitted Rate (m^3/day)
E1	1,120	1,500	1,741
E3	981	900	1,964
E4	1,227	1,200	1,228
F1	974	1,300	1,833
F2	630	400	409
F4	1,113	1,200	1,964
F5	736	1,000	1,963
F6	870	1,300	1,964
F7	1,961	1,600	1,964
Total	**9,612**	**10,400**	**15,031**

Both the original 2006 WHPA Pumping Rates of 9,612 m^3/day and the revised steady state 2018 Pumping Rates of 10,400 m^3/day shown in Table 3 significantly exceed the estimated Average Annual Demand (capacity) of the existing Fergus / Elora Wellfield of about 6,435 m^3/day for the Year 2026 (Appendix A, Table A.3). **It is not possible to pump the existing Fergus / Elora Wellfield Infrastructure at the corresponding Maximum Day Demand rates implied by the specified 2006 original or 2018 revised WHPA pumping rates.**

It is also not possible to pump the existing Fergus / Elora Wellfield at Tier 3 specified Maximum Permitted Rate of 15,031 m^3/day. The Fergus / Elora Wellfield has a current demonstrated Total Operational Capacity at about 12,181 m^3/day and Maximum Day Demand / Firm Infrastructure Capacity at about 10,354 m^3/day (Appendix A, Table A.2). For comparison, the Draft WSMP Total Infrastructure Capacity is a similar 12,410 m^3/day and Firm Capacity is a similar 10,160 m^3/day (Table 2, July 2019).

The Tier 3 Specified Permit to Take Water Pumping Rate of 15,031 m^3/day corresponds to about the Year 2031 in the WSMP Maximum Day Demand and to beyond 2041 in Appendix A, Table A.3 updated Maximum Day Demand forecast.

Furthermore, the Average Day Demand and Maximum Day Demand are not independent variables but have a fixed relationship through the Average Day Demand multiplier (Hunter 1.62, WSMP 1.75). **The 1.45 multiplier (15,031 / 10,400) calculated for the Tier 3 specified WHPA Rates is not realistic.**

The model forcing of these excessive rates on the existing Fergus / Elora Wellfield Infrastructure will result in distorted and exaggerated Wellhead Protection, Source Protection and Issue Contributing Area designations (Appendix A, Fig A.5). These WHPA model scenarios must be rerun with real-world infrastructure constrained flows.

6.2.4 Sensitivity Analysis

A sensitivity analysis was completed to estimate the effects of model parameter uncertainty on the size and shape of the predicted capture zones. (pg 10)

The sensitivity analysis involved adjusting the calibrated Base Case model parameters and evaluating the change in particle tracking results used to delineate the capture zones. Three additional model scenarios were created .....

The Tier 3 Sensitivity and Uncertainty Analysis Scenarios should also have included operationally constrained Fergus / Elora Wellfield flow scenarios.

6.2.5 Issue Contributing Area (ICA) Delineation

An ICA is defined as the area within the WHPA that is currently contributing water to the wells having water quality issues. (pg 24)

Table 8 Pumping Rates Used in Issues Contributing Area Delineation *(pg 25)*

Well Name	Existing Condition ICA Pumping Rates (2016 to 2017 Average) (m^3/day)	Future Condition ICA Pumping Rates (same as WHPA rates) (m^3/day)
E1	1,218	1,500
E3	556	900
E4	301	1,200
F1	925	1,300
F2	0	400
F4	956	1,200
F5	220	1,000
F6	479	1,300
F7	753	1,600
Total	**5,406**	**10,400**

The Existing Condition ICA Pumping Rate of 5,406 m^3/day includes an estimated leakage quantity of 500 m^3/day in the Elora Water Distribution System that was subsequently repaired in March 2018.

The Future Condition ICA Pumping Rate (same as the WHPA rates) of 10,400 m^3/day is beyond the Annual Average Demand rate (9,421 m^3/day) forecast by Hunter for 2041 (Appendix A, Fig A.3) and less than the July 2019 Draft WSMP forecast Average Demand Rate of 11,104 m^3/day for 2041. These average rates significantly exceed the 2026 Infrastructure Capacity of the existing Fergus / Elora Wellfield estimated at 6,435 m^3/day Average Daily Demand for an integrated water supply system (Appendix A, Fig A.3). **These Tier 3 ICA Contributing Areas are not factual and are overestimated.**

7. Draft Water Supply Master Plan (2019)

7.1 WSMP Groundwater Flow Modelling (April 2019)

The Tier 3 based Groundwater Flow Modelling to Support Centre Wellington Water Supply Master Plan (Matrix, April 2019) in Table 1 reports 2016 Average Annual Pumping Rates at 5,102 m^3/day and the existing (prior) WHPA rate (Golder 2006) at 9,612 m^3/day. These Golder 2006 WHPA steady state average annual rates exceed the existing Fergus / Elora Wellfield Infrastructure Capacity. The Fergus / Elora 2006 Wellfield Infrastructure is similar to that of 2019.

The 9,612 m^3/day rate is similar to the Hunter Annual Average Demand of 9,421 m^3/day in 2041 (Appendix A, Table A.3). However, the derivation of this rate is unknown.

7.2 Simulated Yields April 4, 2019

In a letter from Matrix dated April 4, 2019 to AECOM 'Simulated Yields for Expanded Water Supply System with Additional Wells in New Locations', selected Scenario 3a (Table 2) illustrates the existing Fergus and Elora Wellfield with **Pumping Rates at 9,060 m^3/day (not the previous 10,400 m^3/day) and three new wells A3, A5 and A7 (Appendix A, Fig A.4) with proposed pumping rates at 5,500 m^3/day for a new total of 14,560 m^3/day. Again, the source and derivation of the 9,060 m^3/day pumping rate is unknown.**

Table 2 Scenario 3a (Including Wells A3, A5, A7) - Set-Up, Simulated Heads, and Resulting Remaining Head above Setpoint

Well Name	Safe Drawdown Elevation/ Setpoint (m asl)	Boundary Condition Type	Proposed Pumping Rate (m^3/day)	Simulated Head (m asl)	Remaining Head above Setpoint (m)
E1	338.0	Specified Pumping	1,500	334.8	-3.2
E3	348.0	Specified Pumping	900	356.1	8.1
E4	325.0	Specified Pumping	1,000	343.4	18.4
F1	345.0	Specified Pumping	1,300	371.1	26.1
F4	352.0	Specified Pumping	1,300	366.1	14.1
F5	350.0	Specified Pumping	400	387.8	37.8
F6	378.0	Specified Pumping	700	386.5	8.5
F7	355.0	Specified Pumping	1,960	360.2	5.2
Subtotal			**9,060**		
A3	244.7	Specified Pumping	2,000	359.5	114.8
A5	266.0	Specified Pumping	2,000	383.2	117.2
A7	284.9	Specified Pumping	1,500	365.4	80.5
Subtotal			**5,500**		
Total			**14,560**		

These are very high steady state pumping rates exceeding the existing (2019) Infrastructure Capacity and the Annual Average Day Demands far beyond 2041. Utilization of the WSMP Average Annual Day Demand Multiplier of 1.75 would result in a Maximum Day Demand of (14,560 x 1.75) 24,480 m^3/day without application of a Firm Capacity contingency. **The comparison of these steady state (Average Annual) water takings to the remaining heads above the well setpoints has little practical relevance and is misguided.**

A second April 4, 2019 Letter 'Simulated Peak Pumping Yields in the Current and Future Well Configuration Models', Table 2, including modified Wells F2 and F5 is presented below.

Table 2 Simulated Peak Pumping Yields in Future Well Configuration Model

Estimated Yield (m^3/day)		(C) 18 hour pumping		(D) 24 hour pumping	
Line	**Well Names**	**Days 1 to 3 Initial Peak Yield**	**Days 4 to 7 Short Term Yield**	**Days 1 to 3 Initial Peak Yield**	**Days 4 to 7 Short Term Yield**
1	E1	2,000	1,750	1,750	1,700
2	E3	1,700	1,550	1,650	1,550
3	E4	1,900	1,950	2,050	1,950
4	**F1**	**1,300**	**1,300**	**1,300**	**1,300**
5	**F2**	**2,750**	**2,600**	**3,400**	**3,100**
6	**F4**	**1,650**	**1,550**	**2,000**	**1,800**
7	F5	1,450	1,400	1,750	1,650
8	F6	2,050	1,600	2,100	1,750
9	F7	2,550	2,300	2,900	2,700
10	Total Conservation Yield	17,350	16,000	18,900 (2)	17500
11	Combined Total Yield	17,750	16,500	19,150	17,650
12	First Day Total Conservation Yield	19,600 (1)		24,400 (1)	

(1) 2041 demand exceeded
(2) 2041 demand considered met

These Peak Pumping Rates, except F1, for the most part, exceed observed Maximum Day Pumping rates for the existing Wellfield Infrastructure and exceed Permit to Take Water Quantities. Furthermore, there is no Firm Capacity contingency applied.

It is not credible to believe that elevation setpoints in several existing wells will not be exceeded at these Maximum Day pumping rates, especially with the combined rates for proximal wells F1, new F2 and F4.

7.3 Draft Water Supply Master Plan (July 2019)

The July 2019 Draft WSMP contains several Groundwater Alternatives Tables based on additional modelling simulations completed to address the firm capacity of the water supply system. **In this simulation, the most significant producing Well Area 5 was identified as the out of service well to calculate Firm Capacity. The WSMP reported that the simulated result indicated that Well E1 draws down below its setpoint elevation and that all other wells do not draw down below their respective setpoints.**

WSMP Groundwater Supply Alternative Tables 5.8 and 5.9 are reproduced with modifications below:

Table 5.8: Groundwater Supply Alternative Summary
Construct Four New Wells

Well ID	Average Annual Capacity (m^3/day)	Peak Capacity (m^3/day)	Multiplier
Existing Well Sites			
E1	1,500	1,900	
E3	900	1,050	
E4	1,000	1,550	
F1	1,300	2,250	
F2	-	-	
F4	1,300	1,400	
F5	400	700	
F6	700	1,600	
F7	1,960	1,960	
Subtotal (Existing)	**9,060**	**12,410**	
New Well Sites			
A3	**2,000**	**2,800**	
A5	**2,000**	**2,800**	
A7	**1,500**	**2,100**	
A8	**1,550**	**2,170**	
Subtotal (New)	**7,050**	**9,870**	
Total	**16,110**	**22,280**	**1.38**
Firm Capacity	**14,110**	**19,480**	
2041 Demand	**11,104**	**19,433**	**1.75**
Surplus / Deficit	**3,006**	**47**	

Table 5.9: Groundwater Supply Alternative Summary
Replace F2 and Construct Three New Wells

Well ID	Average Annual Capacity (m^3/day)	Peak Capacity (m^3/day)	Multiplier
Existing Well Sites			
E1	1,500	1,900	
E3	900	1,050	
E4	1,000	1,550	
F1	1,300	2,250	
F2	1,850	2,590	
F4	1,300	1,400	
F5	400	700	
F6	700	1,600	
F7	1,960	1,960	
Subtotal (Existing)	10,910	15,000	
New Well Sites			
A3	2,000	2,800	
A5	2,000	2,800	
A8	1,550	2,170	
Subtotal (New)	5,550	7,770	
Total	16,460	22,770	1.38
Firm Capacity	14,460	19,970	
2041 Demand	11,104	19,433	1.75
Surplus / Deficit	3,356	537	

It is apparent in Table 5.8 that the existing well 'Average Annual Capacity' subtotal of 9,060 m^3/day is the assumed WHPA steady state average annual water taking rate which may be traced back through the Tier 3 Reports to the similar Golder (2006) WHPA rates. This same non-factual 'Average Annual Capacity Rate' also underpins Table 5.9. This 'Average Annual System Capacity has little practical relevance in the determination of Wellfield Infrastructure Capacity. As previously explained, these WHPA rates are not possible within the existing Fergus / Elora Wellfield infrastructure. Similarly, the Peak Capacity Rates for several individual wells are not credible.

These estimates indicate an illogical Wellfield peak day multiplier of 1.38 versus the 1.75 Max Day ratio recommended by the WSMP itself (pg 25). Average Annual and Maximum Daily Demand are not independent variables as assumed by the WSMP.

There is no audit trail or transparency back to the Tier 3 Model or other source. **However, it appears the Tier 3 Model is using the WHPA Steady State Average Annual Rates to assess the drawdowns to established individual well setpoint elevations and not the stated transient Peak Capacities. The source of the average annual Peak Capacities in Table 5.8 and 5.9 is unknown.**

Capacity water takings for the proposed new constructed greenfield individual wells appear overly optimistic (WSMP Table 5.8, pg 83) and exceed all existing municipal individual well Permits to Take Water in the Fergus / Elora area. Maximum Capacity at F1 is significantly overestimated. Permit to Take Water Increases are required for F1, E1 and E4 to produce at the specified maximum day rates.

An initial new well pumping at 2,800 m^3/day will not increase Firm Capacity beyond about 1,800 m^3/day. These proposed new well high pumping rates may result in adverse pumping interferences with nearby private wells.

The proposed WSMP New Well A3 Pumping at Average Annual and Peak Rates of 2,000 and 2,800 m^3/day will adversely impact any proposed Middlebrook Well future takings.

The proposed Draft WSMP Average Annual Peak Capacities for the existing wells are not credible considering the operational 'pump on' water level history (Appendix B, Fig 2010.7 to 2019.7 incl). Furthermore, no proposal for modification of existing wells to accommodate drawdowns below existing setpoint elevations is provided in the WSMP.

7.4 Centre Wellington October 21, 2019 Report to the Committee of the Whole

The Grand River Source Protection Area Draft Updated Assessment Report of October 3, 2019, as included in the Centre Wellington October 21, 2019 Report to the Committee of the Whole on pg 6-55 and 6-56 (Tables 6-20 and 6-21) specify the following steady state pumping rates (10,400 m^3/day) utilized to delineate the Wellhead Protection Areas in L/Day but revised herein to m^3/day for Fergus/Elora Wells.

	m^3/d		m^3/day	m^3/day
F1	1,300	E1	1,500	
F2	400	E3	900	
F4	1,200	E4	1,200	
F5	1,000			
F6	1,300			
F7	1,600			
Subtotal	**6,800**		**3,600**	
Total				**10,400**

Notwithstanding the above statement, there is no audit trail or derivation presented in either the Tier 3 or WSMP Reports for this 10,400 m^3/day WHPA rate.

The capture zones and WHPAs delineated for this study are based on a Base Case scenario model and three alternative uncertainty scenarios developed as part of a sensitivity analysis (pg 6-59).

7.4.1 Base Case Scenario

The calibrated Centre Wellington Tier 3 FEFLOW model is referred to as the Base Case scenario. The municipal pumping rates assigned for WHPA delineation are consistent with the wellfield capacity estimates being developed for the "Centre Wellington's Water Supply Master Plan" project (AECOM 2018). The final pumping rates applied in the Base Case model are provided in Table 6-20 and Table 6-22. (pg 6-59)

7.4.2 Sensitivity Scenarios

A sensitivity analysis was completed to estimate the effects of model parameter uncertainty on the size and shape of the predicted capture zones. (pg 6-59)

- *The first sensitivity scenario tested a decrease in the effective porosity of the bedrock production aquifer from 0.03 to 0.01.*
- *Sensitivity Scenario 2 included the lower porosity of Scenario 1 and also included increasing the production bedrock aquifer conductivity values by a factor of 1.5.*
- *Sensitivity Scenario 3 also included the lower porosity of Scenario 1 and included decreasing the confining bedrock aquitard conductivity values by 20%.*

Virtual particles can be released in a groundwater flow model and tracked forward or backward in time through the subsurface for various time intervals. The computed pathlines travelled by these particles are projected to the ground surface and plotted on a plan view map. Time-of-travel capture zones are subsequently created by drawing polygons around the well and the particle pathlines for specific time intervals. As such,

capture zones represent the land areas beneath, which water and contaminants located at and below ground surface may migrate toward a well within a specified period. (pg 6-59 and 6-60)

The Tier 3 Sensitivity and Uncertainty Analysis Scenarios should also have included operationally constrained Fergus / Elora Wellfield flow scenarios.

7.4.3 Delineation of Centre Wellington Wellhead Protection Areas

WHPA-A through WHPA-D were delineated for the nine Centre Wellington wells as seen in Map 6-24. The Elora WHPAs are elongated and extend towards the north (e.g., Well E1) and portions of others (i.e., Well E3) extend to the east. The WHPA-D extends approximately 25 km upgradient to the north. The Fergus WHPAs are more radial compared to the Elora WHPAs, with the WHPA-D extending approximately 7 km to the northeast. (pg 6-60)

Uncertainty in the delineation of the WHPAs was addressed through the simulation of multiple scenarios. The scenarios for WHPA delineation produced similarly shaped capture zones, which were all encompassed in the final WHPA delineation. Further, the reliability of the delineated WHPAs is supported by the reasonability of the calibrated model. The groundwater flow model is calibrated using model parameters that reflect hydraulic field tests and have values that are within expected ranges for the various hydrogeological units. (pg 6-65)

However the Draft Updated Assessment Report did not consider Uncertainty in the selected pumping rates (steady state flows).

The existing 2019 Fergus / Elora Wellfield cannot be pumped at an Average Annual rate of 10,400 m^3/day because of Maximum Daily Demand and Firm Capacity operational rules and practice constraints. This average pumping rate is higher than the 2041 Annual Average Demand of 9,421 m^3/day (Appendix A, Table A.3). It is close to the WSMP 2041 Average Annual Capacity of 11,104 m^3/day with 4 additional wells online (Table 5.8, pg 83).

8. Tier 3 Water Budget Final Risk Assessment Report (March 2020)

8.1 Wellhead Protection Areas WHPA-Q1 / WHPA -Q2 and Source Protection Designations

The WHPA Map (Matrix Fig 7) is a potentially useful and fundamental Tier 3 Map. However, the audit trail to this map from the modelling data input and assumptions is not readily transparent, and the water taking scenarios are questioned.

My understanding from Table 6 pg 31 is that the existing total Average Annual Water Taking rate for the calendar Year 2018 is 5,103 m^3/day as tallied for the Fergus / Elora individual production wells.

In the Tier 3 model scenario the unknown source Average Annual 9,060 m^3/day was allocated back to the individual Fergus / Elora municipal production wells as shown in Table 6 and incorrectly characterized as 'capacity'. This 9,060 m^3/day Annual Average Taking is equivalent to about the Year 2033 in the Draft WSMP Demand Scenario (Tier 3 Table 7 pg 32) or to about the Year 2041 in the updated Hunter Demand Scenario (Appendix A, Table A.3). **The resultant Tier 3 WHPA map, therefore, incorrectly allocates and forces all the 2041 Growth Average Day Demand to the existing Fergus / Elora Wellfields.**

The WHPA modelling scenario and allocation of Average Annual Takings of 9,060 m^3/day to the existing Fergus / Elora Wellfield Infrastructure are fictitious, misleading and not possible without extensive existing well modification and likely unsustainable local drawdowns. This modelling scenario does not even appear to conform to the Tier 3 interpretation of the strict 2017 Technical Rules under the Clean Water Act (2006).

8.2 Future Demand Uncertainty

Tier 3 March 2020 Final Risk Assessment Report, section 7.4.3.4 'Future Demand Uncertainty', on page 49 states:

The estimated future water demand is greater than what can be reliably supplied by the current municipal wells. This circumstance, which would increase the municipal demand to a level that is unsustainable with the current infrastructure, results in High uncertainty with respect to the Risk Level. As a result, the Risk Level is increased to Significant. Groundwater model scenarios completed in support of the WSMP indicate that the future demand estimate can be met by the installation of new additional municipal supply wells*. These results suggest that the ability to meet*

future demands is due to insufficient water supply infrastructure (i.e., municipal wells) and not an inadequacy of the groundwater resource or the sustainability of that resource.

The Tier 3 Final Report should contain a similar conclusion or variant to guide Centre Wellington land use planning. If Tier 3 is going to speak to Water Supply Infrastructure Capacity then it needs to responsibly quote the alternative Water Supply Wellfield Infrastructure reference sources (Hunter or Draft WSMP). The Tier 3 specified 9,060 m^3/day Average Demand is similar to the Hunter 2041 Average Annual Demand Estimate.

The Tier 3 conclusion that the Centre Wellington Aquifers are sustainable under 2041 Average Annual Municipal Water Takings although concentrated at the Fergus / Elora existing Wellfield would appear to stand.

The Tier 3 earlier April 4, 2019 Simulated Yields letter conclusion may also stand:

"Overall the enhanced pumping is not estimated to result in significant or measurable effects on surface water features."

A simplified version of these statements should be included in Tier 3 Executive Summary and Conclusions rather than buried in the Report text.

8.3 Tier 3 Draft Risk Assessment Reports November 2019

The Tier 3 November 2019 'Draft' Risk Assessment Report (pg vii and pg 53) include the following sentences, which unexplained are removed from the March 2020 version marked as 'Final'.

"Although the water supply infrastructure cannot likely meet the future needs of the municipality, the results do not suggest that the municipal aquifer cannot meet future demands" **and** ***"The result suggests that the water supply infrastructure is inadequate to meet the future needs of the municipality and not the capacity or sustainability of the groundwater resource".***

This convoluted, double-negative sentence subsequently removed from the text appears to conclude that the municipal groundwater (aquifer) resources can sustain the future needs of the Municipality of Centre Wellington.

9.0 Tier 3 Water Budget Assessment CLG Meeting #5 May 20, 2020

The Slide Deck (pg 15) for this meeting provides confirmation that the Tier 3 Risk Assessment is assessing Average Day Demand as stated below:

- ***Current water supply system can meet future water demand until 2031 to 2036 period under average and drought climate conditions without impacts to the natural environment.***

- ***Current well infrastructure capacity (9,060 m^3/day) is insufficient to meet 2041 average day demand (11,104 m^3/day). Results in a significant risk level designation according to the Province's Technical Rules.***

- ***WHPA-Q assigned significant risk level. All groundwater takings and potential reductions to groundwater recharge within this area are classified as significant water quantity threats.***

In a public context, the reference that Average Day Demand is the determinant of Well Infrastructure Capacity is at best naive and at worst irresponsible.

The Average Day Demand as discussed elsewhere in this Letter Report does not directly determine Well Infrastructure Capacity. Furthermore, the stated 9,060 m^3/day Average Day Demand when mathematically converted to Maximum Day Demand significantly exceeds the Fergus / Elora Wellfield Infrastructure Capacity. Furthermore, the source and derivation of this 9,060 m^3/day Average Day Demand is unknown.

10. Tier 3 Purpose and Objectives

10.1 Community Liaison Group

Following the January 2018 meeting, a compiled Summary of the Community Liaison Group Feedback confirmed the study purpose:

"Similar to other Tier 3 Studies, this Scoped Tier 3 Study will develop and apply water budget tools that will be applied to support the Township in safeguarding the quantity of their long term municipal water supply aquifers." (pg 1)

The Tier 3 project has not yet demonstrated this purpose.

"The purpose of the Scoped Tier 3 Study is to evaluate the sustainability of Centre Wellington's municipal water supply system as it currently operates, and under various changes, such as land

development as the population increases, drought and increased municipal water takings that may occur into the future to year 2041." (pg 4)

Tier 3 has not yet demonstrated this purpose to the Year 2041.

10.2 Final Risk Assessment Report (March 2020)

The Tier 3 March 2020 Final Risk Assessment Report (pg vii last para):

"The Province designed the Tier Three Assessment to assess the ability of water supply wells to meet average water demand under existing and future conditions up to 2041."

Tier 3 has not yet accomplished this objective up to 2041.

and

"The Tier Three Assessment assesses the additional capacity of water supply wells as defined under the term 'Allocated' water demand."

and

"For this assessment, <u>Allocated</u> water demand is considered as the maximum amount of water that <u>existing wells</u> can meet on an average annual basis."(underlining added) and "According to the draft Water Supply Master Plan (WSMP; AECOM 2019), the water supply capacity of the existing municipal wells will exceed the projected water demand sometime between 2031 and 2036."

The Tier 3 statement that the Water Supply Capacity of the existing municipal wells will exceed the projected water demand sometime between 2031 and 2036 is only correct in the context of the Average Daily Demand, which has little direct relevance in Water Supply Infrastructure Planning and Design. The statement, however, is uninformed, misleading, reckless and utterly wrong in a public context.

The Draft WSMP appears to have been misquoted with respect to the inferred Infrastructure Capacity of the Fergus / Elora Wellfield. **Hunter estimates indicate that Fergus / Elora Water Supply Firm Infrastructure Capacity will be exceeded about 2026 and the July 2019 Draft WSMP in 2019 (Table 2, pg vi).**

10.3 Tier 3 Reverse Scope Creep / Usefulness for Purpose

The Centre Wellington Tier 3 modelling project has suffered severe reverse scope creep. The Tier 3 regulatory agencies and contractors late in the project have chosen to constrain the project to a strict interpretation of Technical Rules (2017) under the Clean Water Act (2006). This interpretation precluded the more useful analysis of the mandated Provincial and County Growth scenarios to 2041 and beyond to guide local land use planning decisions in Centre Wellington.

Instead, the Tier 3 project recommended that 2041 and beyond modelling scenarios be deferred until future more distant outer circle monitoring / production wells are established. In other words, the future hydro-geological investigations would inform the model, not vice versa.

Tier 3 modelling has required about four years to complete. For proper land use planning, Centre Wellington is mandated now, not sometime later, to conform to Provincial and County Growth Plan policies to 2041 and beyond. The Centre Wellington planning application pipeline for Fergus and Elora communities already extends beyond the Year 2030 approaching 2041 (Hunter, November 2018, s6.0).

The Tier 3 Study's usefulness is significantly compromised due to:

- **the utilization of incorrect steady state flows for the existing Wellfield Infrastructure**
- **the omission of longer-term Growth Plan Scenarios to 2041 and beyond, and**
- **the short-term Technical Rules (2017) constrained scenarios.**

11. Other Tier 3 Report Comments

11.1 Sanitary Sewer Infiltration

The Tier 3 Model does not include a component for sanitary sewer groundwater infiltration. Sanitary sewer infiltration is more significant in Fergus than in Elora.

11.2 Updated WHPA Fig 7

The updated 'smoothed' WHPA Map Figure 7 should also include the 10 m and perhaps the 15 m contour to demonstrate the selected hydraulic water level drawdown surfaces in more significant detail similar to the Golder (2013) version.

11.3 Long Term Drawdowns

The Permitted Quantity Capacities of the Fergus / Elora production wells are based on hydrogeological investigations, water levels, production history, operational drawdowns and adjacent well interference experience undertaken over a 20 to 85 year period. **Water levels (pump on/off) and available drawdowns have declined compared to the current non-pumping water level conditions utilized in Tier 3 modelling, as illustrated on the WHPA Fig 7 mapping.**

This long-term drawdown is demonstrated by the recent (November 26, 2019) Lotowater Technical Services Inc. Geophysical Logging of Fergus Well F4. The March 8, 1972 'as constructed' static water level was reported at 19.20 m depth versus the November 6, 2019 static water level with the well shutdown for maintenance at 28.24 m depth for a difference of 9.0 m**. Lotowater recommended setting the pump at the 70 m depth versus the current pump depth at about 77 m. An upward adjustment to the current low-level lockout (setpoint) would also be required reducing Total Well Capacity** (see s11.4 below).

The Tier 3 should also report on the total long-term historical drawdowns which have the effect of reducing production well yields since original well construction and development.

11.4 Tier 3 Existing Well Drawdown Assumptions

The Tier 3 conclusion that the existing municipal Wellfield may be operated at higher average annual daily rates without the related Maximum Demand Day drawdowns exceeding the existing setpoint elevations is not credible. The Tier 3 may be incorrectly assuming that average annual and maximum pumping volumes are independent unrelated variables.

A number of the existing wells including F1, F4, F5 and E3 in 2019 had minimum pumping water levels less than 4 m in 2019 (Appendix B Figures 2010.7 to 2019.7 incl).

Well F1 had a low level of 0.91 m and F4 2.4 m in 2019 indicating little remaining pumping capacity.

11.5 Municipal Wells - Geographic Separation

The Fergus / Elora wells have been operating for 20 to 85 years. During this period two production wells F3 and E2 were abandoned in part due to proximity and interference with F1 in Fergus and with E1 and E3 in Elora respectively. The Ministry did not permit the simultaneous operation of E1, E2 and E3. Operational history and experience over many years in Fergus and Elora indicate that municipal production wells should be separated by 2 km or more to avoid Maximum Day pumping interference and to provide for an appropriate recharge area consistent with the Tier 3 assumption that wells are mainly locally recharged. **Tier 3 does not get to re-write this operational history.**

The Tier 3 5-Year and 25-Year Time of Travel Particle Tracking Results (Matrix November 2018) support this conclusion (Appendix A, Fig A.5). Particle tracks for F1 overlay F2 at 5 years and F1 and F4 overlay F2 at 25 years.

11.6 Interference with Private Wells

During pre-construction production well hydrogeological investigations and after start-up, private well interference was observed near Wells F2, F7, E3 and E4 and perhaps others. This private well interference informed the original Ministry Permit to Take Water approval process. Many of these nearby private wells are still in use. **Increased Pumping Rates at existing Fergus / Elora Wells and new candidate well sites with proposed higher pumping rates may require private well interference mitigation or connection to municipal water services at additional cost to Centre Wellington.**

Considering the individual well hydrogeological investigation history, the Tier 3 conclusions that existing private wells will not be influenced by increased pumping is not credible. This conclusion may be the result of Tier 3 assuming all private 'well groups' have been bored to the top of the Goat Island formation and leaving out critical shallower wells in the analysis and averaging well groups. **Tier 3 does not get to re-write this operational history.**

11.7 Existing Well Modifications

The Draft WSMP and Tier 3 do not report on the modifications to existing wells required to increase maximum day pumping rates above those observed over the past decade by Centre Wellington in the Fergus / Elora Wellfield. Existing production wells will also have to be taken out of commission if modification is contemplated, temporarily reducing short-term Total and Firm Infrastructure Capacity. New wells are required in the short term.

11.8 TCE Contaminants

Tier 3 has ignored the TCE contaminant data and hydraulic information available for the Beatty / GSW / A.O. Smith site (Hunter November 2018, s2.0). The bedrock contaminant data demonstrate groundwater movement generally towards Well F1 (Appendix A, Fig A.6).

11.9 Fergus Well F5

The Tier 3 conclusion refers to deepening Well F5. This well is already bored to full depth to the base of the Gasport Formation. The F5 water (good quality) is mainly sourced from the top of the bedrock contact aquifer as confirmed by independent borehole geophysical surveys and water quality analysis. **Furthermore no deep aquifer production zone has been identified during geophysical testing of existing Well F5.**

Centre Wellington already occasionally operates Well F5 at rates up to 954 m^3/day under peaking conditions. A new well under the most optimistic circumstances would increase operational capacity by only about 500 m^3/day, notwithstanding the approved Permit to Take Water Quantity. Hunter has recommended a deep well at candidate New F5 site (Appendix A, Fig A.2 and A.3). The existing F5 well may continue to operate as it sources water from shallow bedrock aquifers. **The current F5 Well Time of Travel Particle Tracking Results appear to be based on a presumed deep aquifer source versus the actual shallow contact aquifer source** (Appendix A, Fig A.5).

11.10 Fergus Well F2

The Tier 3 conclusions refer to deepening Well F2 into the Gasport Formation. This well is located approximately 500 m from F1 and 1,200 m from F4. Fergus former Well F3 was abandoned, in part, due to proximity (470 m) to F1. **Historical operational experience in**

Fergus / Elora indicates Municipal Wells should be separated by a minimum of 2 km as demonstrated by Appendix A, Fig A.5.

Well F1 and F4 in 2019 had low water levels, potentially restricting operating capacity (Appendix B, Fig 2010.7 to 2019.7 incl). **Permitting restrictions may also be anticipated in the combined operation of future Well F2 and existing wells F1 and F4.** The operation of F2 may change the migration of the ambient TCE contaminant plume (Appendix A, Fig A.6). A full-depth F2 well may be considered as a replacement for F1.

11.11 Leakage Distortions

The calendar year 2018 average annual pumping and earlier rates utilized by the Tier 3 calibration still contain a significant leakage component in the Elora distribution system. In January 2018 the minimum water level at Elora Well E1 was less than 1 m but by 2019 after leakage repair the minimum water level recovered to about 10 m (Appendix B, Fig 2010.7 to 2019.7 incl). **These leakage effects are adversely embedded in the Draft WSMP (July 2019) per capita water demands, peak day multipliers and demand trend forecasts.**

11.12 WSMP and Hunter Candidate New Well Sites

The Draft WSMP July 2019 and the Hunter Candidate New Well Sites are illustrated in Appendix A, Fig A.3 and A.4.

WSMP Area A7 is discouraged as a candidate New Well site as this A7 site is too close to existing Fergus Well F7, and has extensive upgradient wetlands, similar to poor quality Fergus Well F6. The relocation of WSMP Area 7 would by default likely end up near the Hunter Candidate New Well 3, and the WSMP Area 5 to Hunter Candidate New Well 2 Area.

As a general statement the Hunter new wells are strategically located to more efficiently service the existing Fergus / Elora Water Pressure Zones (Appendix A, Fig A.2). **Despite the lower anticipated hydraulic conductivities east of Fergus, new candidate wells at higher elevations would provide more balanced and efficient water distribution input flows than locating all wells west of Elora in lower elevation areas**.

11.13 Middlebrook Well

The Tier 3 (March 2020) Bibliography indicates that the Middlebrook Well pump tests (two or more) and that all monitoring data history may not have been fully disclosed to the Tier 3 Project. Certainly Hunter was refused this information when requested from Nestle. **The justification is not clear why a new pump test is being recommended at the Middlebrook Artesian Well until there is full disclosure of at least two previous pump tests and related monitoring data.**

A Nestle Middlebrook well with realistic Average and Maximum Day Water Takings scenarios may also be analyzed for objectivity. **However, both the Draft WSMP and Hunter New scenarios include candidate New Well sites near this 50+ year-old Middelbrook well** (Appendix A, Fig A.3 and A.4). Because of the unfavourable watermain connection distance to the Elora settlement area, **the WSMP New Candidate Well Area 8 may be a more suitable location for a new 'Middlebrook Well' as the Nestle Well does not require municipal connection.**

12. Conclusions

- **The Tier 3 fundamental groundwater model is 'as good as it gets' in recognition of the available hydrogeological information and constraints.**

- Nevertheless, the fundamental groundwater model is limited by the sparse and absent high-quality deep aquifer data in the remote model domain beyond the Fergus/Elora wellfields.

- The Peer Reviews of Tier 3 fundamental hydrogeology and groundwater model have been comprehensive and thorough.

- **However, there has been little appropriate due diligence, or Peer Review applied to the water supply model scenario water taking assumptions.**

- **The Tier 3 conclusion that the water supply capacity of the existing municipal wells will exceed the projected water demand sometime between Years 2031 and 2036 is at best misleading and at worst irresponsible regardless of the implied agency source or context.**

- For comparison, the Hunter (2020) revised Demand Forecasts estimate that **the existing Fergus/ Elora Wellfield Infrastructure will reach Firm Capacity in about the Year 2026 with Average Annual Demand at 6,435 m^3/day and Maximum Day Demand at 10,135 m^3/day**

(Appendix A, Fig A.1 and Table A.2). **The Draft WSMP estimates that the Firm Capacity will be reached in 2019 (Table 2, pg vi).**

- **To satisfy the Hunter 2041 Demand Forecast, the Wellfield Infrastructure Firm Capacity must exceed 14,132 m^3/day based on an Average Daily Demand at 9,421 m^3/day.** This Average Daily Demand is similar to the Tier 3 Model incorrectly implied 'Average Annual Capacity' at 9,060 m^3/day for the existing Wellfield Infrastructure. **The term 'Average Annual Capacity' has not been defined in Tier 3 or the WSMP Reports and has little direct relevance to assessment of Wellfield Infrastructure Capacity.**

- **The Tier 3 Water Supply Modelling Scenario has the effect of forcing the equivalent of the Hunter Year 2041 Average Annual Demand Water Takings on the existing Year 2019 Fergus/ Elora Wellfield infrastructure. This modelling scenario is not factual and will produce compromised erroneous results.**

- The existing well Tier 3 WHPA assumptions do not conform to Tier 3's interpretation of the 2017 Technical Rules under the Clean Water Act (2006). **Tier 3 Modelling following the Technical Rules would correspond to about the Year 2026 under the Hunter Forecast Demand Scenarios or about the Year 2019 in the WSMP scenario.**

- **The Tier 3 steady state Average Annual Demand scenario of 9,060 m^3/day has the effect of creating deeper drawdown depression water level contours within the existing Fergus/ Elora wellfield area (Appendix A, Fig A.3 and A.4).**

- **The Tier 3 Average Annual Demand scenario of 9,060 m^3/day imposed on the existing 2019 Fergus / Elora Wellfield infrastructure will also produce exaggerated elongated ribbon-like Source Protection Areas compared to those from an expanded Wellfield with shallower drawdowns (Appendix A, Fig A.5).**

- **The Tier 3 Water Supply Scenario is not transparent. There is no clear articulation of how the steady state and transient Fergus / Elora Water Supply Demands have been determined or applied. The stated drawdown and interference conclusions are not credible for transient conditions.**

- **The current Tier 3 Wellhead Protection Area, Issue Contributing Area and Source Protection Area mapping are based on questioned steady state annual average flows (water takings) and will not support regulatory and land use planning judicial challenges.**

- However, the Tier 3 Model utilizing nearly equivalent Forecast Year 2041 Average Annual Demands (takings) does appear to confirm the sustainability of the Fergus / Elora Aquifers to support growth to 2041 and perhaps beyond.

13. Recommendations

- **Regardless of budget availability or deficits, this Tier 3 Risk Assessment Report should not be accepted as complete until factual water taking scenarios based on existing Wellfield Infrastructure constraints and 2041 Growth Plan scenarios with simulated candidate remote municipal wells are prepared.**

- **Similarly, the Tier 3 based Draft July 2019 Water Supply Master Plan should not be accepted by Centre Wellington until Peak Well Capacities are reassessed. Furthermore, the Forecast Water Demands are excessive. Alternatively, the Hunter updated Demand Forecast and Well Capacities may be accepted.**

- **The Tier 3 committed project objectives to guide future land use planning in Centre Wellington must be satisfied. The completion of interim 2041 Wellhead Protection Area, Issue Contributing Area and Source Protection Area designations cannot wait for the installation of a full circle of new outer perimeter monitoring and/or production wells simply to improve the predictive ability of the Tier 3 groundwater model. For practical and budget reasons Centre Wellington Wellfield expansion to 2041 will almost certainly be phased over a 15 year or longer period.**

- **The Tier 3 Modelling regardless of the Technical Rules, budget availability and constraints in conclusion should provide:**

    1) **Revised Wellhead Protection, Issue Contributing and Source Protection Area Maps based on the 2026 Wellfield Infrastructure (8 existing wells)**

    2) **Revised Wellhead Protection, Issue Contributing and Source Protection Area Maps based on geographically distributed simulated candidate municipal wellfield scenarios and 2041 Forecast Average and Maximum Demand Rates / Firm Infrastructure Capacity (11 or 12 Total Wells).**

- The Tier 3 should clearly state its conclusions on Aquifer Sustainability until 2041 and beyond.

- The Tier 3 should clearly state municipal pumping effects on local surface water features to 2041 and beyond.

- The Tier 3 Final Water Supply Model Conclusions require simplification, transparency and clear articulation of the underlying assumptions.

14. Clarifications

If I have not fully understood the Tier 3 Groundwater Model and Input Scenarios, I may be communicated with regarding issuing clarifications and/or revisions.

Yours truly,

Garry T. Hunter, M.A.Sc., P.Eng.
President
Hunter and Associates

Enclosure: Index to Appendix A and B

Separate Enclosures: Appendix A: Tables and Figures
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APPENDIX A

'Tier 3 Review Letter'
Centre Wellington Tier 3 Risk Assessment Review

'2019 Update Forecast Letter'
Fergus / Elora 2019 Municipal Water Production, Updated Demand Forecasts and New Infrastructure Requirements to Year 2041 and beyond

Tables

Figures

June 9, 2020

Table A.1: Revenue Water Quantities for Fergus / Elora (2019)

	Fergus			Elora			Total		
	Total Consump-tion (m^3/yr)	**Revenue Water (m^3/yr)**	**Known Non-Revenue Water (m^3/yr)**	**Total Consump-tion (m^3/yr)**	**Revenue Water (m^3/yr)**	**Known Non-Revenue Water (m^3/yr)**	**Total Consump-tion (m^3/yr)**	**Revenue Water (m^3/yr)**	**Known Non-Revenue Water (m^3/yr)**
	1,238,643	1,062,804	11,113	593,038	484,102	18,536	1,831,681	1,546,906	29,649
To Fergus	49,225			(49,225)					
To Elora	(7)			7					
Adjusted Total Consumption	1,287,861	1,062,804	11,113	543,820	484,102	18,536	1,831,681	1,546,906	29,649
Revenue Water (%)		**82.5**	**0.86**		**89.0**	**3.4**		**84.5**	**1.6**

Source: 1) Township of Centre Wellington (March 2020 FOI)

2) Revenue (Metered) Water % = $\frac{\text{Revenue Water}}{\text{Adjusted Total Consumption}}$ x 100

Notes: 1) The overall operational objective set for Fergus / Elora Metered Revenue Water is 85% and Non-Revenue Water 15% (Hunter, November 2018, Vol I, s7.0).

2) In 2019 Centre Wellington achieved this overall Fergus / Elora objective. However, there is still room for improvement in Fergus.

3) The dramatic improvement compared to years 2017 and earlier is the result of major leakage repair in Elora in March 2018 and likely greater attention to municipal use reduction, meter maintenance and attention to account billing by the municipality.

4) Centre Wellington needs to review the Revenue and Non-Revenue Water on an Annual basis with regard to non-metered water losses.

Table A.2: Existing Water Supply, Permitted, Total and Firm Capacity Fergus / Elora (2019)

	MECP Permit Taking (m^3/day) (1)	Demonstrated Maximum Infrastructure Capacity [7] (m^3/day) (2)	Most Recent Observed Date of Maximum Pumping (3)	Maximum Actual Operational Capacity (m^3/day) (4)	Permit Surplus (1) - (4) (m^3/day) (5)
F1 [8] [9] [10]	1,833	1,677	Apr 15/14	1,400	433
F2	409	0	-	0	409
F4	1,964	1,758	Oct 24/12	1,758	206
F5	1,963	954	Nov 4/12	954	1,009
F6	1,964	1,663	Oct 25/12	1,663	301
F7	1,964	1,703	Oct 24/12	1,703	261
Subtotal	**10,097**	**7,755**		**7,478**	**2,619**
E1	1,741	1,711	Sept 29/12	1,711	30
E3	1,964	1,765	Sept 29/12	1,765	199
E4 [1]	1,228	1,762	Sept 29/12	1,227	1
Subtotal	**4,933**	**5,238**		**4,703**	**230**
Grand Total	**15,030**	**12,993**		**12,181**	**2,849**
Permitting Taking Average at 60% [6]	**9,018**				
Firm Capacity [7] **at 85% Max Day Total**				**10,354**	

Notes:

1) Ministry of Environment, Conservation and Parks (MECP) Permit to Take Water.

2) Maximum TCW recorded daily pumping production for the period 2011 to 2019. E4 Approved Flow Rate 22.7 L/s for 15 hours maximum taking or unapproved 1,961 m^3/day on a 24 hour basis. F2 Not operational. The Demonstrated Maximum Infrastructure Pumping Capacities assume that under emergency peaking conditions water quality issues related to Well F5 (sand) and F6 (excessive Total Dissolved Solids) are acceptable. No allowance for subsequent loss of well performance or declining aquifer water levels due to well field pumping has been applied except at F1.

3) Date of maximum daily pumping as observed by TCW for Year 2011 to 2019.

4) Actual Observed Maximum Operational Infrastructure Capacity consistent with Permit to Take Water. F1 reduced to 1,400 m^3/day due to declining water levels.

5) Difference between Permit and Actual Operational Maximum Infrastructure Capacity.

6) Water Taking at 60% of Permitted Value to be reported to MOECC. However, for an existing Firm Infrastructure Capacity at 10,354 m^3/day and a Peak Day Multiplier of say 1.62, the average annual taking per day cannot exceed 6,391 m^3/day.

7) Firm Infrastructure Capacity assumed equal to 85% of Total Demonstrated Operational Infrastructure Capacity versus deletion of maximum producing well.

8) Major Water Main Break in Fergus on April 13, 14, 15 and16, 2014 resulted in Maximum Operational F1 pumping.

9) Aboyne Booster Pump transferred 305 m^3 from Elora to Fergus on April 14, 2014 and 135 m^3 on April 15, 2014.

10) Maximum Day Total Observed Combined Fergus / Elora pumping 8,645 m^3/day on April 15, 2014.

Table A.3: Demand Forecasts and Total Infrastructure Required to 2041, Fergus / Elora

		Total Serviced Population (1)	Equivalent Per Capita Demand (L/day) (2)	Annual Average Demand (m^3/day) (3)	Peak Day Multiplier (4)	Max Day Demand/ Firm Infrastructure Required (3)x(4) (m^3/day) (5)	Firm Capacity Reduction of Total (6)	Min Total Infrastructure Required (5) ÷ (6) (m^3/day) (7)
2011	Actual	17,260	285	4,927	1.70	8,376	0.85	9,854
2016	Actual	19,930	271	5,413	1.65	8,931	0.85	10,507
2019	**Actual**	**21,000**	**237**	**4,998**	**1.62**	**8,097**	**0.85**	**9,526**
2021	Forecast	23,790	235	5,591	1.60	8,946	0.85	10,525
2026	**Forecast**	**27,980**	**230**	**6,435**	**1.575**	**10,135**	**0.85**	**11,924**
2031	Forecast	33,790	225	7,603	1.55	11,785	0.85	13,865
2036	Forecast	39,720	220	8,738	1.525	13,325	0.85	15,676
2041	**Forecast**	**43,820**	**215**	**9,421**	**1.50**	**14,132**	**0.85**	**16,626**

Notes:

1) Total Serviced Population based on Watson (2015) plus future allowance for connection of unserviced properties in the Fergus/Elora settlement areas (Hunter, November 2018, Vol I, s6.0). 2019 Total Serviced Population is based on TCW (February 2020) estimates. These 2019 estimates are off trend (lower). If serviced population is higher, per capita water demand will be lower and resultant forecasts lower.

2) Per Capita Demand forecast to decline from 2019 actual values. Values for 2011 and 2016 back calculated from serviced populations and Actual Average Day Values. Future decline allowance based on current land use intensification and conservation trends.

3) Actual Average Annual Demand from TCW Production Well Records 2011 to 2019. Forecast values from 2021 to 2041 calculated from estimated declining Per Capita Demand beginning in 2019 to reflect conservation and continuing land use intensification. Actual 2016 average annual production includes a major leakage component in the Elora Water distributing system not repaired until March 2018.

4) Max Day Demand is based on a declining Annual Average Demand Day Multiplier as shown. Firm Infrastructure Capacity must equal or exceed Maximum Day Demand. This peak multiplier does not include allowance for the maximum day April 15, 2014 Major Watermain Break in Fergus.

5) For calculation simplicity, Firm Infrastructure Capacity is assumed to equal 85% of Total Infrastructure Capacity based on an integrated water supply system.

Surplus Maximum Day Capacity Fergus / Elora (2019)

Firm Infrastructure Capacity Available (Table A.2)	10,354 m^3/day
Maximum Day Demand	8,097 m^3/day
Surplus Firm Capacity	**2,257 m^3/day**

Hunter Forecast Year of Demand Capacity Exceedance:	2026
New Water Supply Capacity Required before	2025

Note: WMSP (July 2019) Table 1 Year of Demand/Capacity Exceedance occurs in 2020 (this year).

Table A.4: Aboyne Booster Pumping Station Volumes (2019)

	To Fergus (m^3)	To Elora (m^3)
January	4,054.48	
February	3,689.98	
March	3,359.92	
April	3,185.71	
May	3,651.70	
June	3,929.97	3.05
July	3,528.92	
August	5,029.78	
September	4,859.01	0.94
October	5,032.68	
November	4,392.12	
December	4,510.48	2.85
2019	49,224.75	6.84
2019 Daily	**134.86**	**0.02**

Table A.5: TCW Calculation of Uncommitted Reserve Capacity Water Year 2018

Fergus & Elora Combined
Calculation of the Uncommitted Reserve Capacity - Water

Summary of Units	
Description	Total Units
Remaining Vacant Single, Semi & Townhouse Lots and Apartment Units By Registered Plan Of Subdivision	515
Remaining Vacant Single, Semi & Townhouse Lots and Apartment Units By Draft Approved Plan Of Subdivision	1,615
Zoned Multiple Units Outside Draft Plans of Subdivisions & Registered Plans of Subdivisions	423
Zoned Institutional - Allocation for Future Groves Memorial Hospital	185
Allowance for Infill and Redevelopment - residential/non-residential	1,160
TOTAL COMMITTED FIRM CAPACITY - Uncommitted lots	3,998

URC Water Calculation		
3 Year Average Day	5,303	m^3/d
3 Year Peak Day	7,508	m^3/d
Peaking Factor	1.42	
3 Year Average Per Capita	236	litres/d /capita
3 Year Peak Day Per Capita	334	litres/d /capita

Typical Number of Building Units Constructed Annually	316

URC Firm Capacity - Available Actual Maximum Day Pumping Capacity					
F =	13,064	m^3/day			
PPU =	3.04	persons/unit			
Max. Day Flow /lot =	1.01	m^3/day			
1	F = Design Capacity (m^3/day)			13,064	m^3/day
	Maximum Day Flow (3 Yr Avg Peak)			7,508	m^3/day
2	Committed Firm Capacity			4,051	m^3/day
				3,998	units
3	Free Registered Dwelling Unit Capacity (Uncommitted Reserve Capacity)			1,505	m^3/day
				1,485	units
4	Capacity Commitment Under Consideration			320	m^3/day
				316	units
5	CAPACITY AVAILABLE			YES	
6	Remaining Capacity			1,184	m^3/day
				1,169	units

Table A6.1

Fergus and Elora Municipal Wells 2010-2019

Annual Five (5) Highest Days Pumping Volume (m^3/day)

Descending Order Sort

Date	F1 Pump	F4 Pump	F5 Pump	F6 Pump	F7 Pump	E1 Pump	E3 Pump	E4 Pump	Maximum Day Volume	
									10,354	IFC (2019) [1]
10/24/2012	1,630.12	1,758.33	917.24	1,632.68	1,703.44	492.64	375.09	785.12	**9,294.66**	Golder
04/15/2014	1,676.80	1,221.20	944.10	1,296.30	1,254.80	1,019.10	224.10	1,008.90	**8,645.30**	Highest
10/25/2012	1,628.40	1,758.33	915.65	1,663.40	1,691.18	466.15	489.04	0.00	**8,612.15**	Golder
10/19/2012	1,630.34	1,548.72	913.87	1,555.13	1,562.53	682.65	488.49	0.00	**8,381.73**	Golder
10/26/2012	1,626.94	1,695.35	914.43	1,600.77	1,355.78	1,097.38	77.08	0.00	**8,367.73**	Golder
10/18/2012	1,631.51	1,555.29	916.33	1,555.20	1,465.67	708.08	12.03	514.25	**8,358.36**	Golder
05/27/2014	1,586.90	925.70	940.50	189.40	1,449.30	1,335.30	1,088.20	687.90	**8,203.20**	
10/22/2015	0.00	1,230.80	925.80	1,175.60	1,512.40	1,418.30	742.60	871.30	**7,876.80**	
07/05/2010	1,133.12	1,510.15	663.88	723.00	0.00	1,476.59	1,428.85	864.05	**7,799.64**	
06/16/2015	1,313.40	521.40	621.20	487.10	1,400.10	1,341.00	1,296.40	687.50	**7,668.10**	
04/26/2017	1,003.70	1,303.10	926.00	955.20	727.20	1,003.40	686.00	1,016.30	**7,620.90**	
05/17/2017	0.00	1,355.00	596.70	1,023.90	1,417.00	1,419.50	735.80	933.10	**7,481.00**	
01/11/2018	418.99	1,398.26	225.48	1,360.67	807.18	1,519.17	897.72	852.16	**7,479.63**	
10/27/2015	617.40	1,319.90	637.50	1,119.10	1,438.50	1,215.60	397.90	637.30	**7,383.20**	
05/29/2013	867.56	1,237.81	497.87	407.11	1,530.43	1,474.76	820.90	522.78	**7,359.22**	
06/25/2016	1,136.34	834.89	585.25	692.78	1,320.97	1,124.48	628.78	978.47	**7,301.96**	
05/26/2015	1,100.50	1,452.30	664.40	92.90	1,010.70	1,426.60	453.90	1,019.90	**7,221.20**	
05/27/2015	1,555.80	382.10	925.90	259.60	1,428.20	896.00	799.30	931.80	**7,178.70**	
04/16/2014	1,337.50	557.50	492.30	1,286.20	1,004.10	980.20	588.60	931.40	**7,177.80**	
05/23/2017	0.00	1,334.60	157.80	1,041.00	1,448.00	1,469.90	686.20	1,010.30	**7,147.80**	
06/08/2017	1,676.70	1,116.90	253.80	841.80	598.90	1,185.50	1,441.40	0.00	**7,115.00**	
07/09/2018	897.71	883.56	925.92	1,420.40	706.64	590.37	937.15	721.05	**7,082.81**	
09/26/2017	1,342.40	1,142.20	899.90	979.00	277.40	1,475.70	0.00	929.50	**7,046.10**	
05/16/2013	957.18	989.55	55.49	793.81	1,142.18	1,423.30	658.12	1,010.00	**7,029.63**	
06/24/2016	1,174.24	902.76	237.24	887.10	1,320.03	1,214.47	1,177.21	91.36	**7,004.41**	
06/10/2014	234.40	1,445.10	640.70	1,343.30	217.20	1,401.40	920.90	798.70	**7,001.70**	
05/13/2013	1,444.89	1,225.95	0.00	964.42	693.14	1,473.93	170.16	1,011.91	**6,984.40**	
06/06/2011	955.95	1,600.87	924.53	1,192.97	0.00	952.18	362.44	986.97	**6,975.91**	
05/06/2013	1,676.74	1,136.85	27.14	141.75	1,353.39	1,073.12	820.81	659.58	**6,889.38**	
06/21/2016	1,189.01	816.21	344.53	722.73	1,312.46	1,216.56	744.92	542.20	**6,888.62**	
06/02/2014	584.30	1,395.00	0.00	1,302.20	760.90	1,506.60	318.30	1,010.20	**6,877.50**	
06/18/2016	988.28	794.68	542.74	635.76	1,319.95	960.31	778.04	848.24	**6,868.00**	
04/26/2013	325.71	1,398.15	0.00	1,280.28	790.33	1,339.65	747.48	972.09	**6,853.69**	
09/02/2016	1,350.23	637.61	265.23	550.97	1,058.56	1,065.49	1,008.24	869.48	**6,805.81**	
09/19/2018	775.50	1,138.69	738.72	1,025.11	1,221.87	986.08	595.74	319.38	**6,801.09**	
07/31/2011	1,626.23	1,507.78	0.00	1,005.84	0.00	1,411.83	569.11	657.76	**6,778.55**	
09/17/2018	1,187.48	1,228.87	374.92	550.84	1,266.16	708.26	889.81	537.34	**6,743.68**	
06/17/2018	1,234.25	878.27	677.59	677.51	862.81	976.43	1,209.10	217.53	**6,733.50**	
07/09/2019	1,062.89	989.25	485.79	990.36	1,008.74	342.74	1,019.37	782.47	**6,681.61**	2019 [2]
09/24/2019	1,115.90	1,359.55	703.33	312.12	787.53	725.28	546.56	1,019.44	**6,569.71**	2019 [2]
03/12/2011	1,618.87	1,514.04	923.92	0.00	0.00	1,474.03	935.25	0.00	**6,466.11**	
05/31/2011	1,494.74	1,572.61	664.06	917.08	0.00	900.16	91.67	814.98	**6,455.30**	
05/31/2010	1,621.95	1,590.86	718.00	771.00	0.00	1,268.53	466.09	5.07	**6,441.50**	
07/28/2019	1,561.04	1,561.51	522.51	0.00	709.64	1,050.22	1,000.82	0.00	**6,405.74**	2019 [2]
03/26/2011	1,618.45	1,392.31	3.29	912.54	0.00	868.83	1,580.52	0.00	**6,375.94**	
05/25/2010	1,347.11	1,592.24	464.84	973.00	0.00	1,419.26	560.82	8.83	**6,366.10**	
07/15/2019	825.76	1,572.40	687.18	150.12	747.12	1,011.49	1,061.08	286.78	**6,341.93**	2019 [2]
05/27/2010	1,627.13	1,410.53	498.33	959.00	0.00	844.56	540.77	451.04	**6,331.36**	
07/27/2019	1,374.47	1,573.30	652.45	0.00	471.66	1,142.36	1,069.75	0.00	**6,283.99**	2019 [2]
05/20/2010	1,380.83	1,496.01	569.08	593.00	0.00	665.29	1,235.33	178.93	**6,118.47**	

Note: 1) IFC: Integrated Firm Capacity
2) Pumping volumes after April 2018 are relatively leakage free.

Source: TCW Well Pumping Records.

Project: Elora (16-401)

File Date: May 22, 2020

Table A6.2

Fergus Municipal Wells 2010-2019

Annual Five (5) Highest Days Pumping Volume (m^3/day)

Descending Order Sort

Date	F1 Pump	F4 Pump	F5 Pump	F6 Pump	F7 Pump	Maximum Day Volume	
10/25/2012	1,628.40	1,758.33	915.65	1,663.40	1,691.18	**7,656.96**	Golder
10/24/2012	1,630.12	1,758.33	917.24	1,632.68	1,703.44	**7,641.81**	Golder
10/19/2012	1,630.34	1,548.72	913.87	1,555.13	1,562.53	**7,210.59**	Golder
10/20/2012	1,628.94	1,541.88	912.83	1,555.14	1,563.62	**7,202.41**	Golder
10/26/2012	1,626.94	1,695.35	914.43	1,600.77	1,355.78	**7,193.27**	Golder
04/15/2014	1,676.80	1,221.20	944.10	1,296.30	1,254.80	**6,393.20**	Highest
						6,132	NIFC (2019) [1]
10/27/2015	617.40	1,319.90	637.50	1,119.10	1,438.50	**5,132.40**	
05/27/2014	1,586.90	925.70	940.50	189.40	1,449.30	**5,091.80**	
04/26/2017	1,003.70	1,303.10	926.00	955.20	727.20	**4,915.20**	
09/19/2018	775.50	1,138.69	738.72	1,025.11	1,221.87	**4,899.90**	
10/22/2015	0.00	1,230.80	925.80	1,175.60	1,512.40	**4,844.60**	
07/09/2018	897.71	883.56	925.92	1,420.40	706.64	**4,834.23**	
05/25/2015	663.60	1,416.00	593.00	756.40	1,377.80	**4,806.80**	
12/23/2013	1,676.52	1,464.66	341.83	1,315.86	0.00	**4,798.87**	
10/12/2010	1,603.51	1,504.55	625.87	975.00	0.00	**4,708.93**	
05/31/2010	1,621.95	1,590.86	718.00	771.00	0.00	**4,701.81**	
04/14/2014	968.90	1,156.80	687.10	875.00	1,011.20	**4,699.00**	
04/16/2014	1,337.50	557.50	492.30	1,286.20	1,004.10	**4,677.60**	
06/06/2011	955.95	1,600.87	924.53	1,192.97	0.00	**4,674.32**	
05/31/2011	1,494.74	1,572.61	664.06	917.08	0.00	**4,648.49**	
09/26/2017	1,342.40	1,142.20	899.90	979.00	277.40	**4,640.90**	
08/08/2016	1,373.76	705.89	0.00	1,291.80	1,251.58	**4,623.03**	
07/12/2018	1,027.31	1,169.29	925.92	430.76	1,064.02	**4,617.29**	
10/10/2010	1,606.84	1,519.53	748.41	734.00	0.00	**4,608.78**	
09/17/2018	1,187.48	1,228.87	374.92	550.84	1,266.16	**4,608.27**	
06/25/2016	1,136.34	834.89	585.25	692.78	1,320.97	**4,570.23**	
07/04/2018	966.22	1,330.50	925.89	686.69	650.41	**4,559.72**	
05/27/2015	1,555.80	382.10	925.90	259.60	1,428.20	**4,551.60**	
05/29/2013	867.56	1,237.81	497.87	407.11	1,530.43	**4,540.78**	
07/09/2019	1,062.89	989.25	485.79	990.36	1,008.74	**4,537.03**	2019 [2]
05/24/2015	939.20	860.50	596.10	691.10	1,443.40	**4,530.30**	
06/24/2016	1,174.24	902.76	237.24	887.10	1,320.03	**4,521.37**	
05/27/2010	1,627.13	1,410.53	498.33	959.00	0.00	**4,494.99**	
06/08/2017	1,676.70	1,116.90	253.80	841.80	598.90	**4,488.10**	
06/17/2016	1,170.38	1,365.19	632.12	0.00	1,254.67	**4,422.36**	
08/09/2016	1,248.35	1,245.55	0.00	609.97	1,315.96	**4,419.83**	
05/17/2017	0.00	1,355.00	596.70	1,023.90	1,417.00	**4,392.60**	
05/25/2010	1,347.11	1,592.24	464.84	973.00	0.00	**4,377.19**	
06/23/2019	1,154.59	1,209.84	556.76	648.01	792.48	**4,361.68**	2019 [2]
07/29/2011	1,625.39	1,598.94	0.00	1,136.46	0.00	**4,360.79**	
07/28/2019	1,561.04	1,561.51	522.51	0.00	709.64	**4,354.70**	2019 [2]
05/21/2013	432.04	1,129.24	585.24	658.97	1,533.10	**4,338.59**	
05/06/2013	1,676.74	1,136.85	27.14	141.75	1,353.39	**4,335.87**	
05/13/2013	1,444.89	1,225.95	0.00	964.42	693.14	**4,328.40**	
07/30/2011	1,626.94	1,599.26	0.00	1,062.93	0.00	**4,289.13**	
09/24/2019	1,115.90	1,359.55	703.33	312.12	787.53	**4,278.43**	2019 [2]
03/18/2011	1,570.15	1,518.05	0.00	1,186.22	0.00	**4,274.42**	
05/29/2014	859.70	1,448.20	0.00	1,297.80	659.20	**4,264.90**	
05/29/2017	0.00	1,264.70	479.50	1,002.70	1,413.20	**4,160.10**	
06/07/2019	1,136.83	1,195.08	187.33	813.79	792.03	**4,125.06**	2019 [2]

Note: 1) NIFC: Non Integrated Firm Capacity

2) Pumping volumes after April 2018 are relatively leakage free.

Source: TCW Well Pumping Records.

Project: Elora (16-401)

File Date: May 22, 2020

Elora Municipal Wells 2010-2019 **Table A6.3**

Annual Five (5) Highest Days Pumping Volume (m^3/day)

Descending Order Sort

Date	E1 Pump	E3 Pump	E4 Pump	Maximum Day Volume	
29/09/2012	1,710.79	1,765.18	1,762.55	**5,238.52**	Golder
28/09/2012	1,710.57	1,764.94	1,600.10	**5,075.61**	Golder
22/09/2012	1,486.14	1,572.61	1,555.24	**4,613.99**	Golder
21/09/2012	1,486.14	1,572.53	1,555.25	**4,613.92**	Golder
30/09/2012	1,548.33	1,549.67	970.94	**4,068.94**	Golder
05/07/2010	1,476.59	1,428.85	864.05	**3,769.49**	Highest
02/11/2010	1,622.04	1,032.18	981.19	**3,635.41**	
26/10/2010	1,486.95	896.07	977.99	**3,361.01**	
06/16/2015	1,341.00	1,296.40	687.50	**3,324.90**	
01/11/2018	1,519.17	897.72	852.16	**3,269.05**	
05/23/2017	1,469.90	686.20	1,010.30	**3,166.40**	
03/28/2015	1,578.50	746.80	828.70	**3,154.00**	
06/10/2014	1,401.40	920.90	798.70	**3,121.00**	
05/27/2014	1,335.30	1,088.20	687.90	**3,111.40**	
10/25/2015	1,418.50	670.90	1,013.20	**3,102.60**	
05/18/2017	1,470.60	1,187.90	442.00	**3,100.50**	
05/16/2013	1,423.30	658.12	1,010.00	**3,091.42**	
05/17/2017	1,419.50	735.80	933.10	**3,088.40**	
01/01/2010	1,537.25	1,507.76	21.30	**3,066.31**	
03/30/2015	1,576.70	500.90	988.10	**3,065.70**	
10/26/2015	1,417.90	626.80	1,018.50	**3,063.20**	
04/26/2013	1,339.65	747.48	972.09	**3,059.22**	
10/15/2013	860.96	1,109.17	1,009.41	**2,979.54**	
05/31/2017	1,402.40	870.60	704.50	**2,977.50**	
10/02/2017	1,445.40	601.10	929.30	**2,975.80**	
09/02/2016	1,065.49	1,008.24	869.48	**2,943.21**	
31/10/2010	1,575.40	370.02	978.51	**2,923.93**	
09/01/2016	1,320.52	871.26	708.26	**2,900.04**	
07/17/2014	1,193.70	414.70	1,283.00	**2,891.40**	
02/25/2018	1,454.31	1,436.62	0.00	**2,890.94**	
02/24/2014	1,462.20	1,423.70	0.00	**2,885.90**	
02/17/2014	1,053.10	1,085.80	746.80	**2,885.70**	
02/03/2018	1,453.50	1,411.99	0.00	**2,865.49**	
05/22/2013	1,474.88	780.11	564.84	**2,819.83**	
05/29/2013	1,474.76	820.90	522.78	**2,818.44**	
03/03/2018	1,411.33	1,406.46	0.00	**2,817.79**	
				2,803	NIFC (2019) [1]
03/05/2018	1,454.52	1,131.83	204.64	**2,791.00**	
10/30/2016	1,350.63	1,415.09	0.00	**2,765.72**	
09/03/2016	1,018.89	917.55	806.94	**2,743.38**	
06/25/2016	1,124.48	628.78	978.47	**2,731.73**	
28/08/2011	1,111.52	1,602.40	0.00	**2,713.92**	
22/12/2011	1,353.11	422.13	933.00	**2,708.24**	
12/06/2019	1,470.09	656.31	569.34	**2,695.74**	2019 [2]
11/09/2011	1,527.43	1,113.44	0.00	**2,640.87**	
31/07/2011	1,411.83	569.11	657.76	**2,638.70**	
12/05/2019	1,359.98	590.21	681.65	**2,631.84**	2019 [2]
21/03/2011	0.00	1,629.00	985.70	**2,614.70**	
05/13/2019	1,180.79	802.97	491.15	**2,474.91**	2019 [2]
02/05/2019	565.75	858.24	973.68	**2,397.67**	2019 [2]
07/15/2019	1,011.49	1,061.08	286.78	**2,359.35**	2019 [2]

Note: 1) NIFC: Non Integrated Firm Capacity

2) Pumping volumes after April 2018 are relatively leakage free.

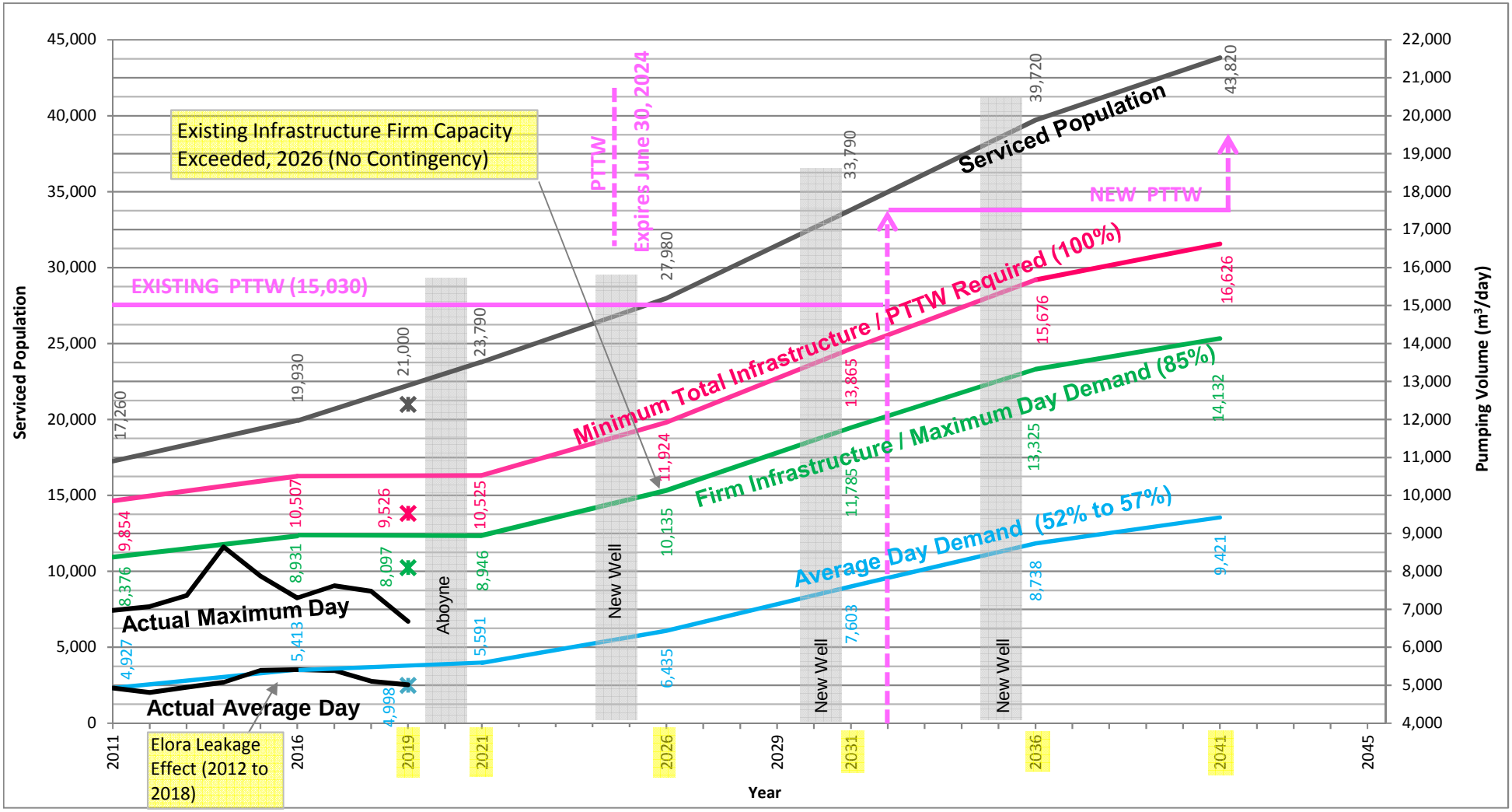
Source: TCW Well Pumping Records.

Project: Elora (16-401)

File Date: May 22, 2020

Fergus / Elora Conservation Water Demand Forecast (Revised)

Maximum Day Demand and Minimum Water Supply Infrastructure Required (m^3/day)



Notes: 1) See Hunter Table A.3 Demand Forecasts and Total Infrastructure Required to 2041, Fergus/ Elora (May 2020)

2) Assume Aboyne Booster Station functional bidirectional transfer 2,000 m3/day demonstrated in year 2020.

3) 2019 Serviced Population (suspect underestimated?)

4) Actual Day - Township of Centre Wellington Pumping Records (2011 to 2019)

Project: Elora (16-401)

File Date: May 20, 2020

Fig A.1

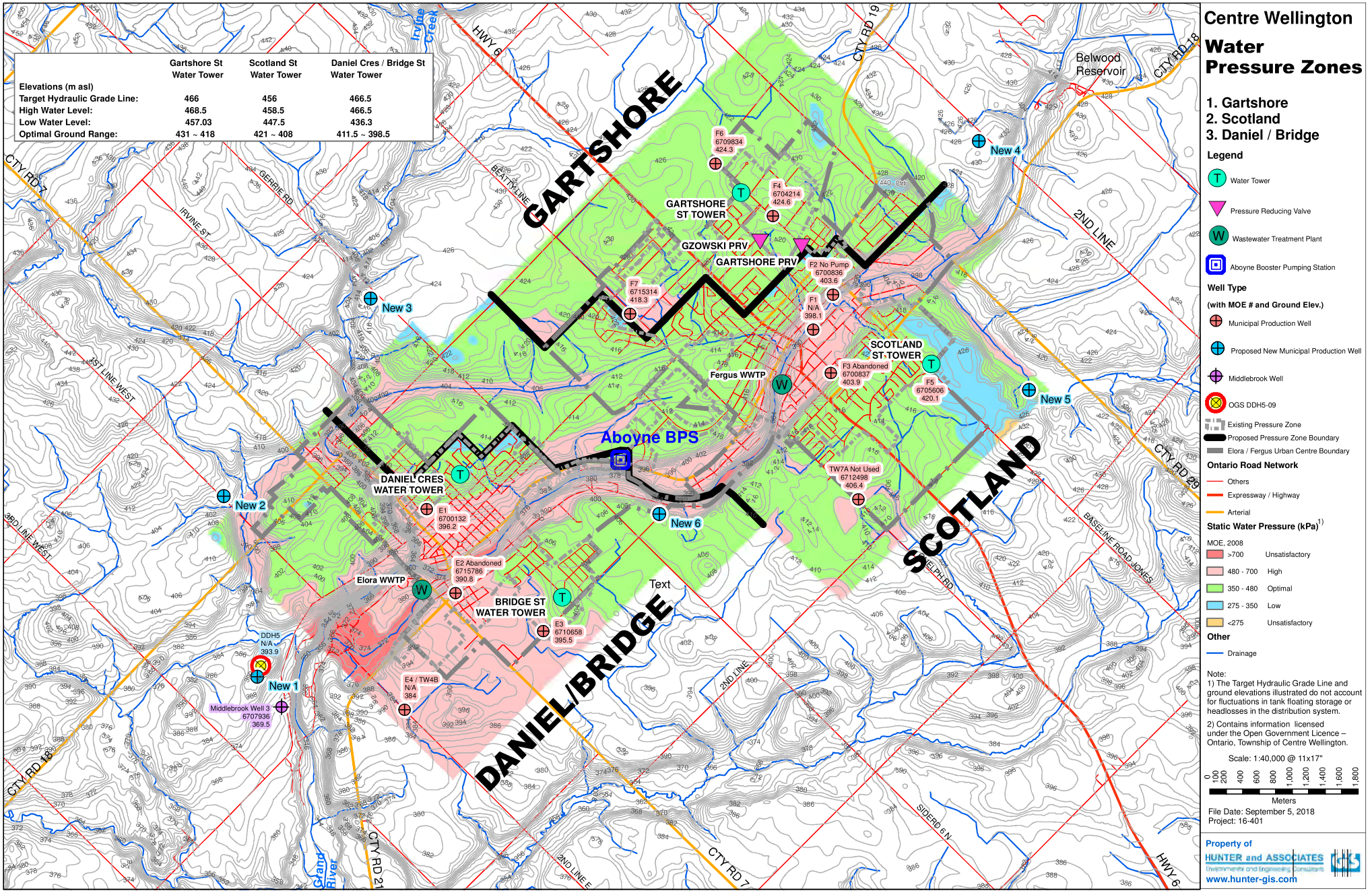

Gartshore St Water Tower
Scotland St Water Tower
Daniel Cres / Bridge St Water Tower
Elevations (m asl)
Target Hydraulic Grade Line: 466 456 466.5
High Water Level: 468.5 458.5 466.5
Low Water Level: 457.03 447.5 436.3
Optimal Ground Range: 431 ~ 418 421 ~ 408 411.5 ~ 398.5
GARTSHORE
SCOTLAND
DANIEL/BRIDGE
GARTSHORE ST TOWER
SCOTLAND ST TOWER
DANIEL CRES WATER TOWER
BRIDGE ST WATER TOWER
Aboyne BPS
Fergus WWTP
Elora WWTP
GZOWSKI PRV
GARTSHORE PRV
Belwood Reservoir
F6 6709834 424.3
F4 6704214 424.6
F2 No Pump 6700836 403.6
F7 6715314 418.3
F1 N/A 398.1
F3 Abandoned 6700837 403.9
F5 6705606 420.1
TW7A Not Used 6712498 406.4
E1 6700132 396.2
E2 Abandoned 6715786 390.8
E3 6710658 395.5
E4 / TW4B N/A 384
DDH5 N/A 393.9
Middlebrook Well 3 6707936 369.5
New 1
New 2
New 3
New 4
New 5
New 6
Text
Irvine Creek
Grand River
HWY 6
CTY RD 19
CTY RD 18
CTY RD 7
CTY RD 21
CTY RD 29
CTY RD 18
2ND LINE
2ND LINE E
IRVINE ST
GERRIE RD
BEATTY LINE
1ST LINE WEST
3RD LINE WEST
BASELINE ROAD JONES
ELPH RD
SIDERD 6 N
Centre Wellington
Water Pressure Zones
1. Gartshore
2. Scotland
3. Daniel / Bridge
Legend
Water Tower
Pressure Reducing Valve
Wastewater Treatment Plant
Aboyne Booster Pumping Station
Well Type
(with MOE # and Ground Elev.)
Municipal Production Well
Proposed New Municipal Production Well
Middlebrook Well
OGS DDH5-09
Existing Pressure Zone
Proposed Pressure Zone Boundary
Elora / Fergus Urban Centre Boundary
Ontario Road Network
Others
Expressway / Highway
Arterial
Static Water Pressure (kPa)1)
MOE, 2008
>700 Unsatisfactory
480 - 700 High
350 - 480 Optimal
275 - 350 Low
<275 Unsatisfactory
Other
Drainage
Note:
1) The Target Hydraulic Grade Line and ground elevations illustrated do not account for fluctuations in tank floating storage or headlosses in the distribution system.
2) Contains information licensed under the Open Government Licence – Ontario, Township of Centre Wellington.
Scale: 1:40,000 @ 11x17"
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800
Meters
File Date: September 5, 2018
Project: 16-401
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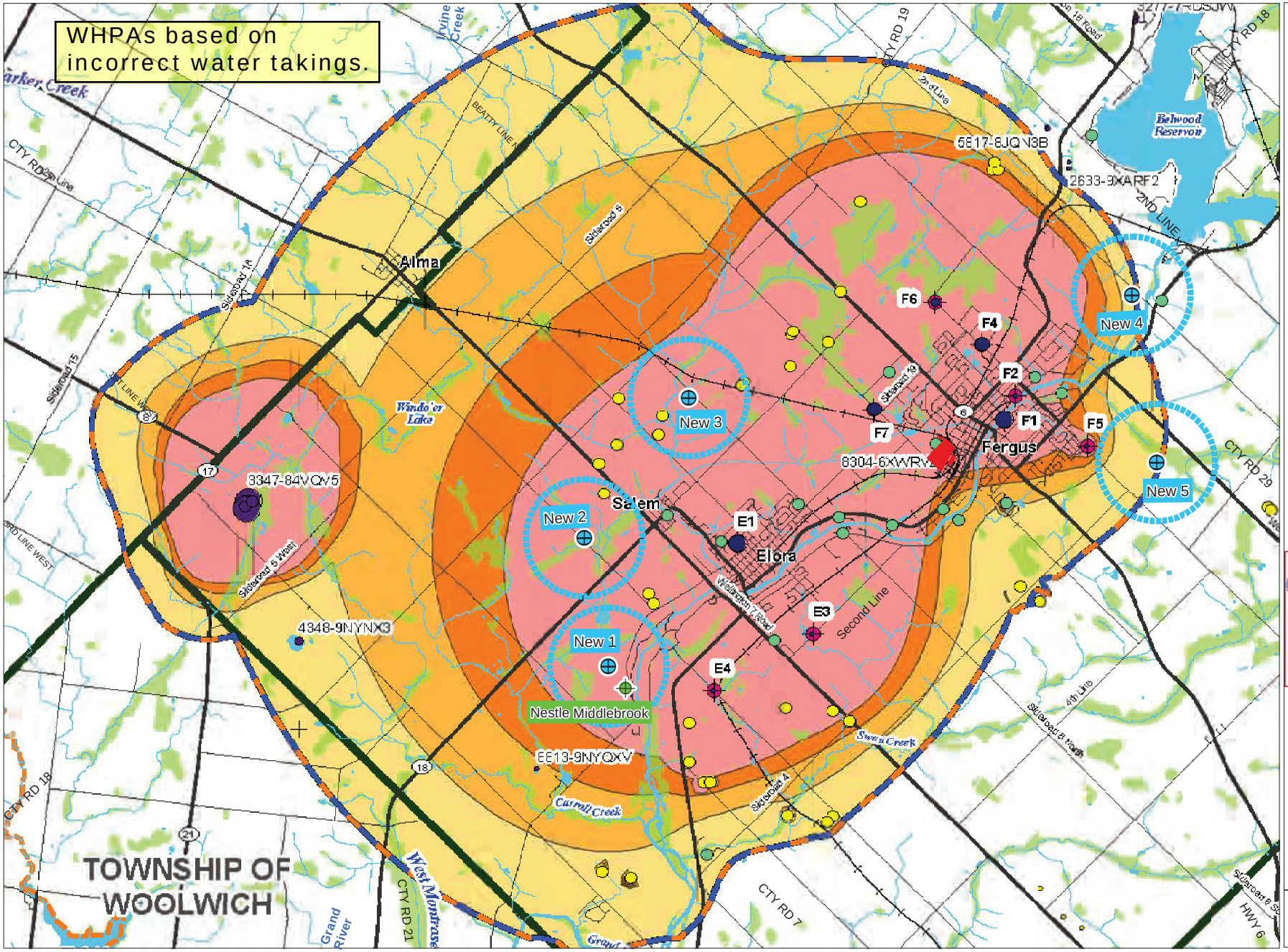
Fig A.2

Hunter Candidate New Well Sites



Centre Wellington
WHPA-Q1/ WHPA-Q2 /Groundwater Vulnerable Area

with Proposed New Well Sites (Hunter)

WHPA-Q1/WHPA-Q2/Groundwater Vulnerable Area
Municipal Boundary
Water Body
Watercourse
Highway
Road
Railroad Trail
Municipal Well

Drawdown (m)
2 - 3
3 - 4
4 - 5
> 5

Simulated Municipal and Non-municipal Demands
Type
Municipal PTTW
Non-Permitted Agriculture
Non-Municipal PTTW
Well Representing a Cluster of Domestic Wells

Average Annual Consumptive Rate (m³/day)
< 250
250 - 500
500 - 750
750 - 1000
1000 - 1250
1250 - 1500
1500 - 1750
> 1750

Legend

Hunter Proposed New Municipal Production Well (Candidate Sites)

Middlebrook Well (Nestle)

Other

Contaminant Site (TCE)
Added by Hunter on April 29, 2020

Background Source:
Fig 7, Centre Wellington Tier Three Water Budget Final Risk Assessment Report, Matrix (March 2020),

Scale: 1:60,000 @ 11x17"

0 250 500 1,000 1,500 2,000 2,500
Meters

File Date: May 5, 2020
Project: 16-401

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Fig A.3

WSMP Candidate New Well Sites

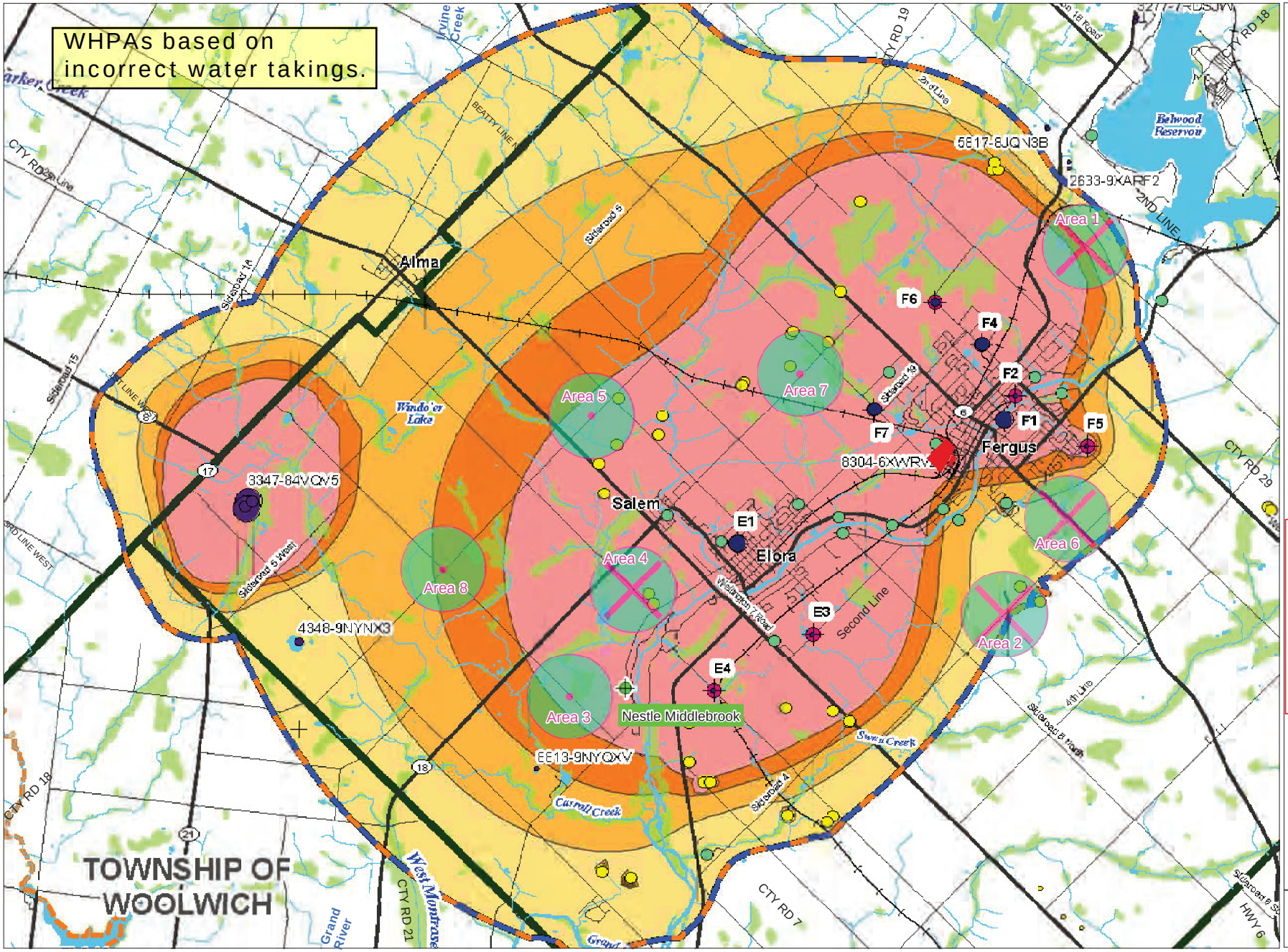


Fig A.4

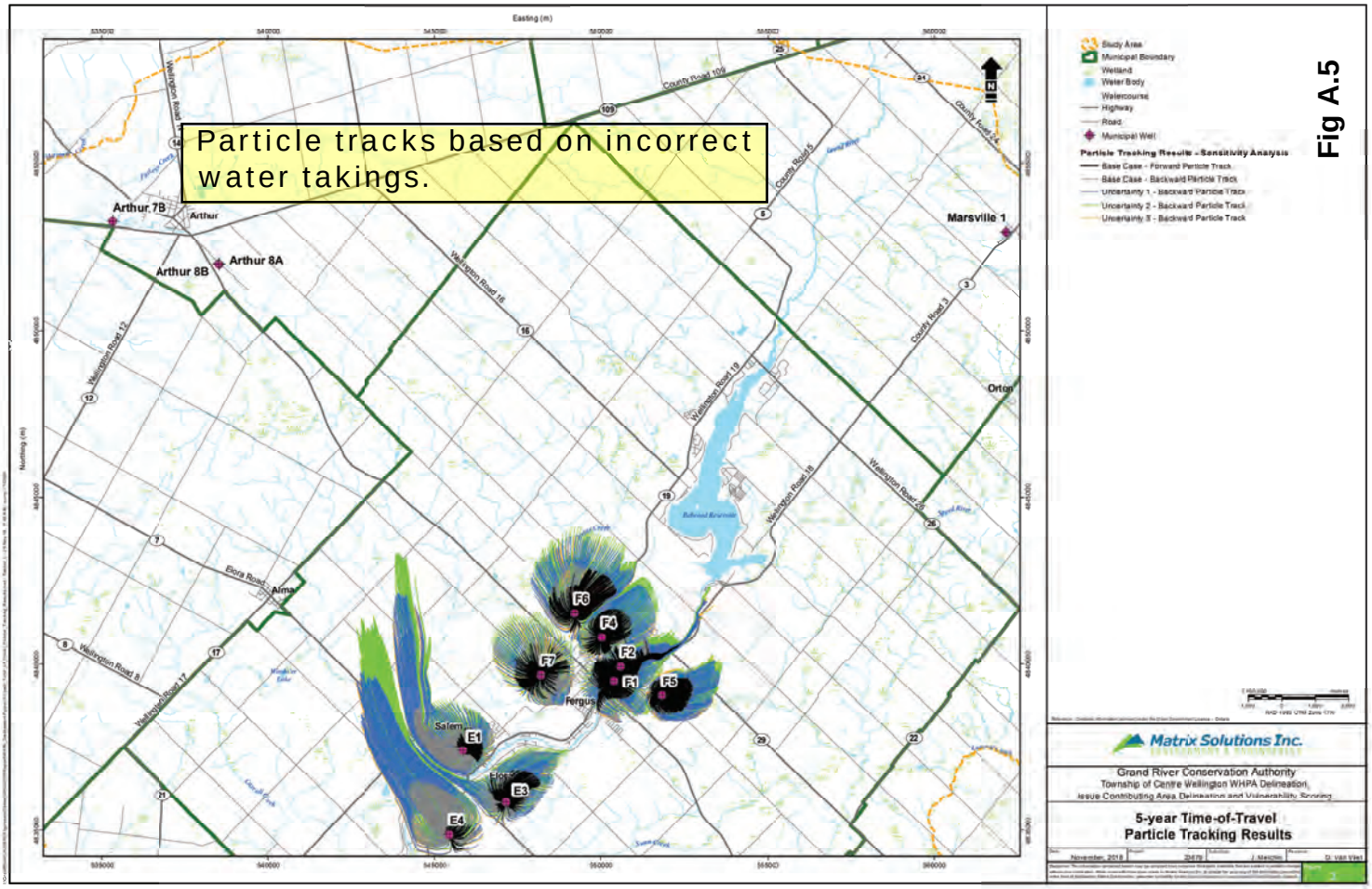
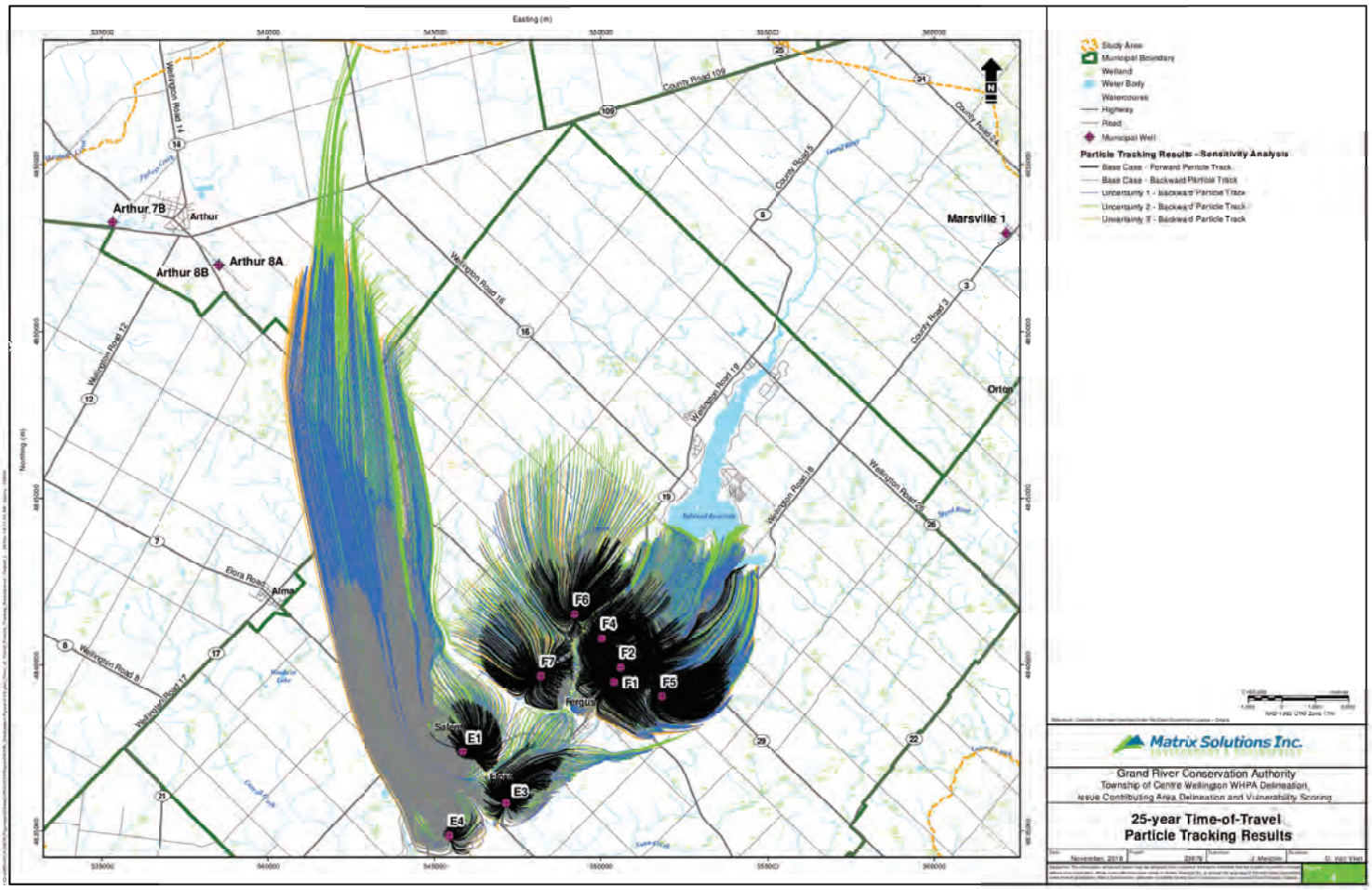
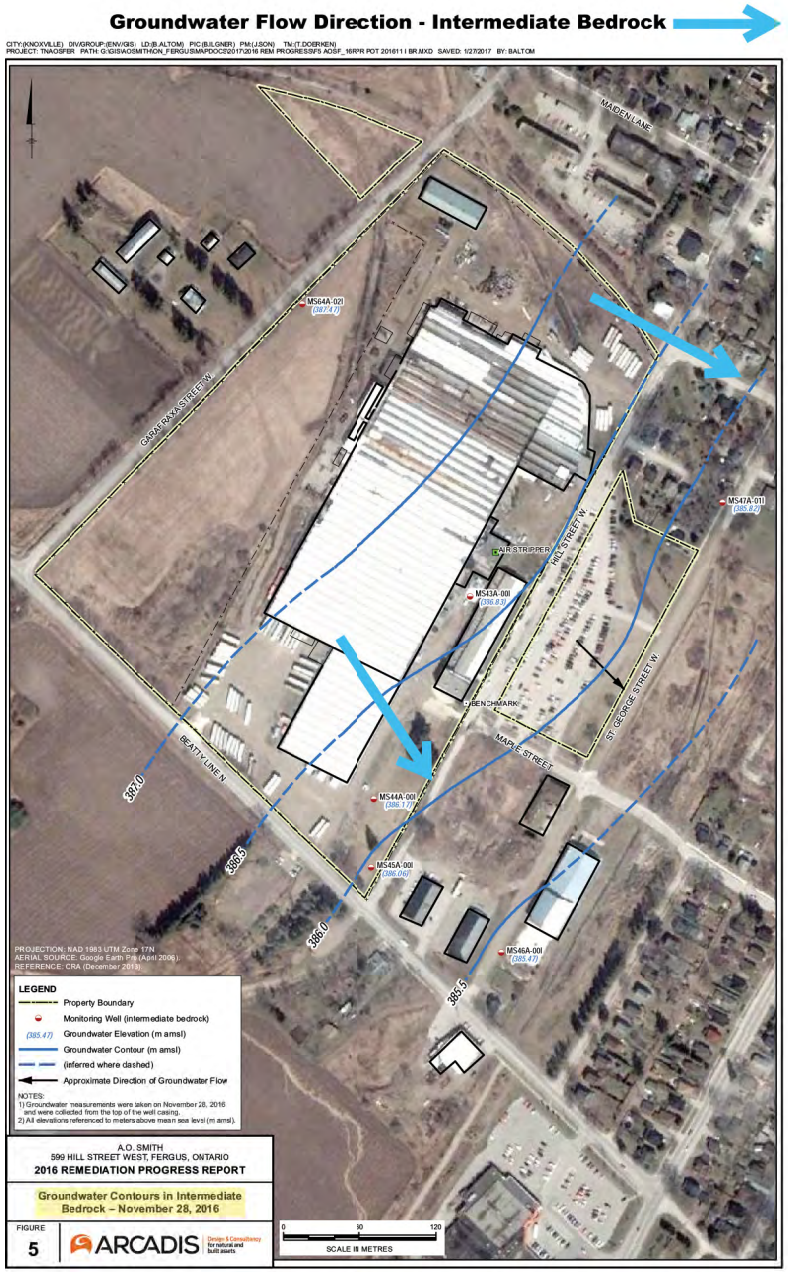


Fig A.5

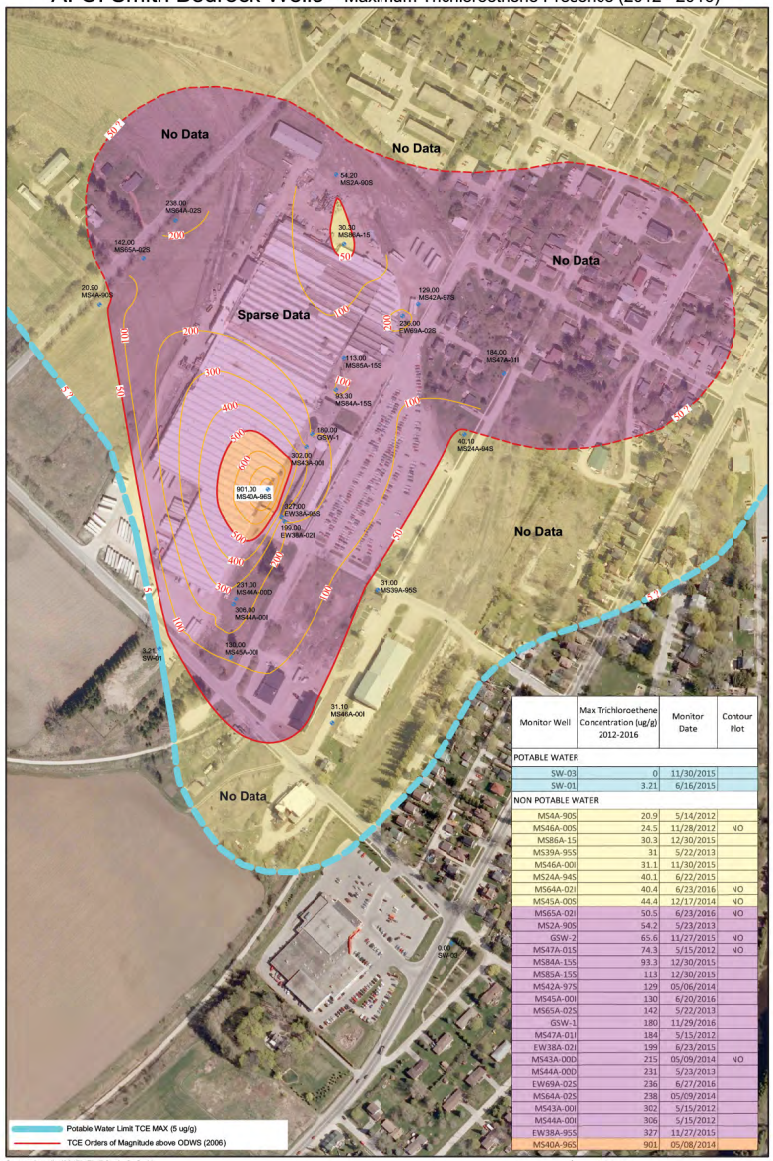
Source: Township Of Centre Wellington Wellhead Protection Area Delineation, Issue Contributing Area Delineation, and Vulnerability Scoring Report, Lake Erie Source Protection Region, Ver 1.0, by Matrix Solutions Inc., Nov 2018



Groundwater Flow Direction - Intermediate Bedrock



A. O. Smith Bedrock Wells - Maximum Trichloroethene Presence (2012 - 2016)



Monitor Well	Max Trichloroethene Concentration (ug/g) 2012-2016	Monitor Date	Contour Hot
POTABLE WATER			
SW-03	0	11/30/2015	
SW-01	3.21	6/16/2015	
NON POTABLE WATER			
MS4A-90S	20.9	5/14/2012	
MS46A-00S	24.5	11/28/2012	vO
MS86A-15	30.3	12/30/2015	
MS39A-95S	31	5/22/2013	
MS46A-00I	31.1	11/30/2015	
MS24A-94S	40.1	6/22/2015	
MS64A-02I	40.4	6/23/2016	vO
MS45A-00S	44.4	12/17/2014	vO
MS65A-02I	50.5	6/23/2016	vO
MS2A-90S	54.2	5/23/2013	
GSW-2	65.6	11/27/2015	vO
MS47A-01S	74.3	5/15/2012	vO
MS84A-15S	93.3	12/30/2015	
MS85A-15S	113	12/30/2015	
MS42A-97S	129	05/06/2014	
MS45A-00I	130	6/20/2016	
MS65A-02S	142	5/22/2013	
GSW-1	180	11/29/2016	
MS47A-01I	184	5/15/2012	
EW38A-02I	199	6/23/2015	
MS43A-00D	215	05/09/2014	vO
MS44A-00D	231	5/23/2013	
EW69A-02S	236	6/27/2016	
MS64A-02S	238	05/09/2014	
MS43A-00I	302	5/15/2012	
MS44A-00I	306	5/15/2012	
EW38A-95S	327	11/27/2015	
MS40A-96S	901	05/08/2014	

Source: Arcadis (2017), Fig 7 for A. O. Smith
Scale: 1:3000 @ 11x17"
File Date: July 10, 2018 (11:40 am)
Orthophoto: 2006

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Fig A.6

APPENDIX B

'Tier 3 Review Letter'
Centre Wellington Tier 3 Risk Assessment Review

'2019 Update Forecast Letter'
Fergus / Elora 2019 Municipal Water Production, Updated Demand Forecasts and New Infrastructure Requirements to Year 2041 and beyond

Figures

2019.1	Fergus / Elora Total Pumping Volume (m^3/day) 2019
2019.2	Fergus Total Pumping Volume by Well (m^3/day) 2019
2019.3	Elora Total Pumping Volume by Well (m^3/day) 2019
2019.4	Aboyne Booster Pumping Volume (m^3/day) 2019
2010.5 to 2019.5 incl.	Township of Centre Wellington 2010 to 2019 Daily Pumping Volumes (m^3/day) by Elora / Fergus in Descending Order Sort with Maximum Day, Minimum Day and Annual Average (m^3/day)
2010.6 to 2019.6 incl.	Township of Centre Wellington 2010 to 2019 Daily Pumping Volumes (m^3/day) by Well in Descending Order Sort including Maximum Day and Annual Average (m^3/day)
2010.7 to 2019.7 incl.	Township of Centre Wellington 2010 to 2019 Daily Minimum Water Level by Well in Descending Order including Minimum, Maximum and Average Days (m)

June 9, 2020

Fig 2019.1

Township of Centre Wellington

Total 2019 Pumping Volume (m^3/day)

with Elora and Fergus Subtotals

Source: Pumping Volume: TCW Well Pumping Records 2019.
Firm Capacity: Less Highest Pumping Well Less Other Operational Constraints.

Project: Elora (16-401)

File Date: May 12, 2020

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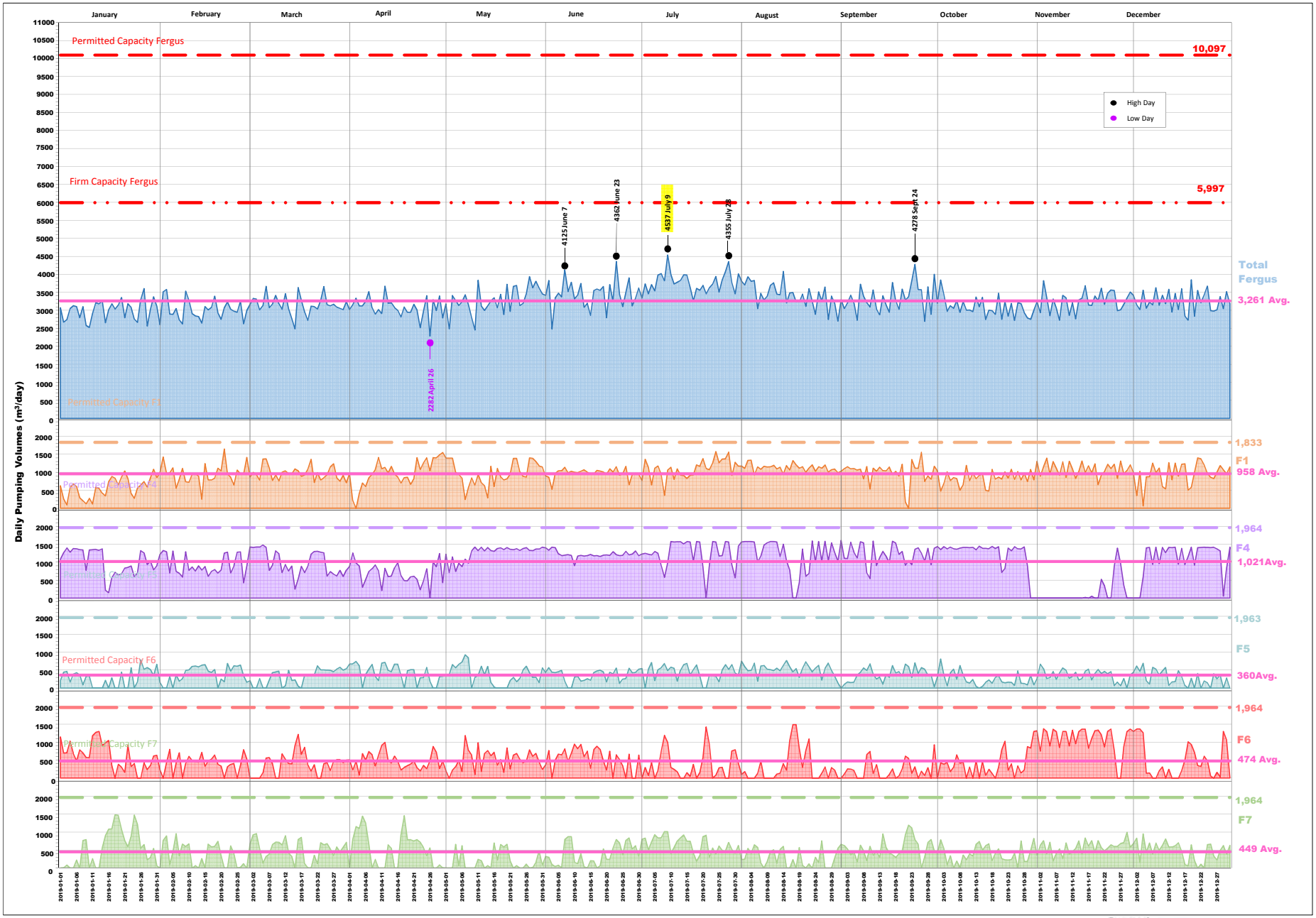
Fig 2019.2

Township of Centre Wellington

Fergus 2019 Pumping Volumes (m^3/day) by Well

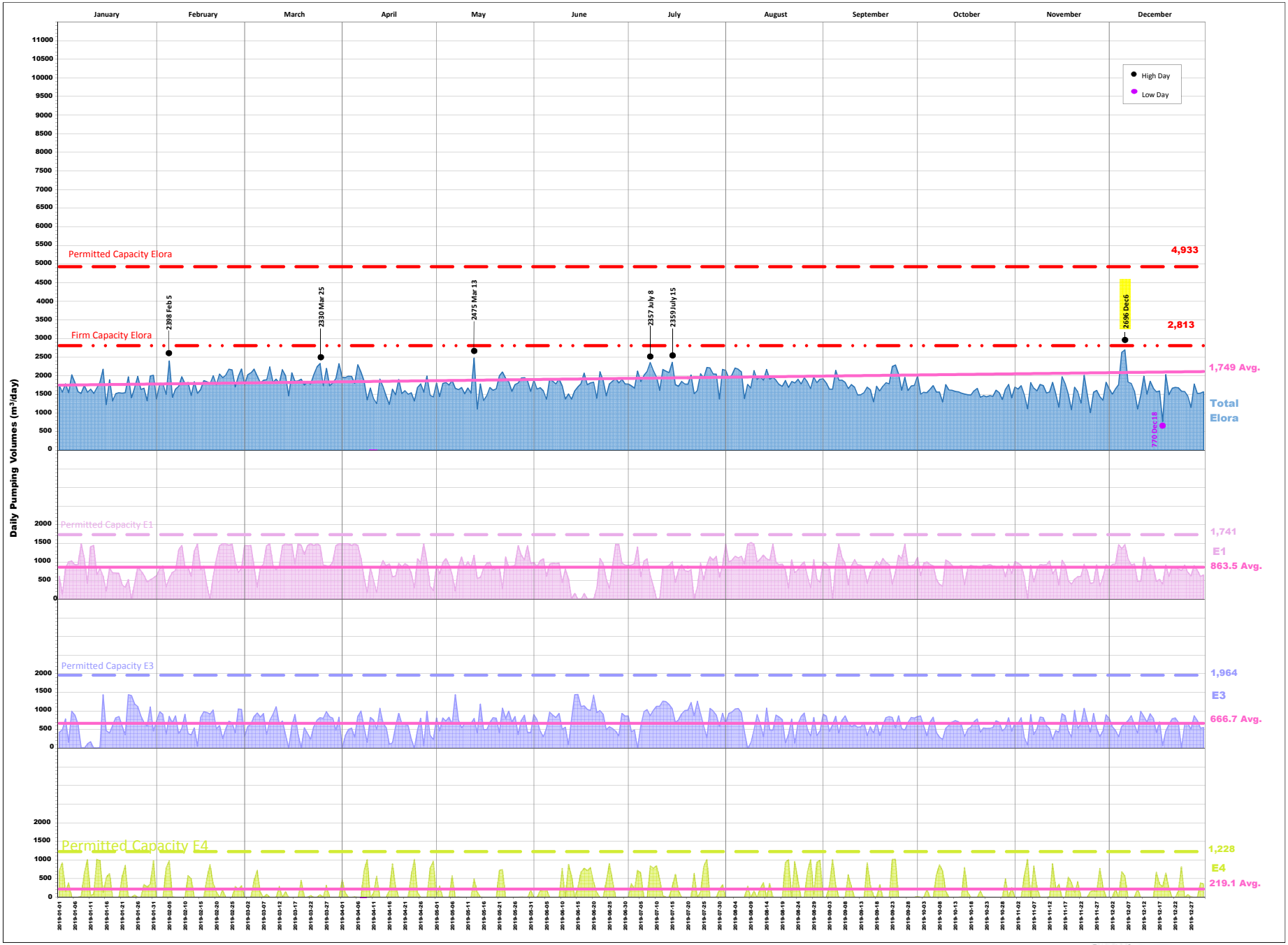


Source: Pumping Volume: TCW Well Pumping Records 2019.
Firm Capacity: Less Highest Pumping Well Less Other Operational Constraints.
Project: Elora (16-401)
File Date: May 12, 2020

Fig 2019.3

Township of Centre Wellington

Elora 2019 Pumping Volumes (m^3/day) by Well



Source: Pumping Volume: TCW Well Pumping Records 2019.
Firm Capacity: Less Highest Pumping Well Less Other Operational Constraints.
Project: Elora (16-401)
File Date: May 12, 2020

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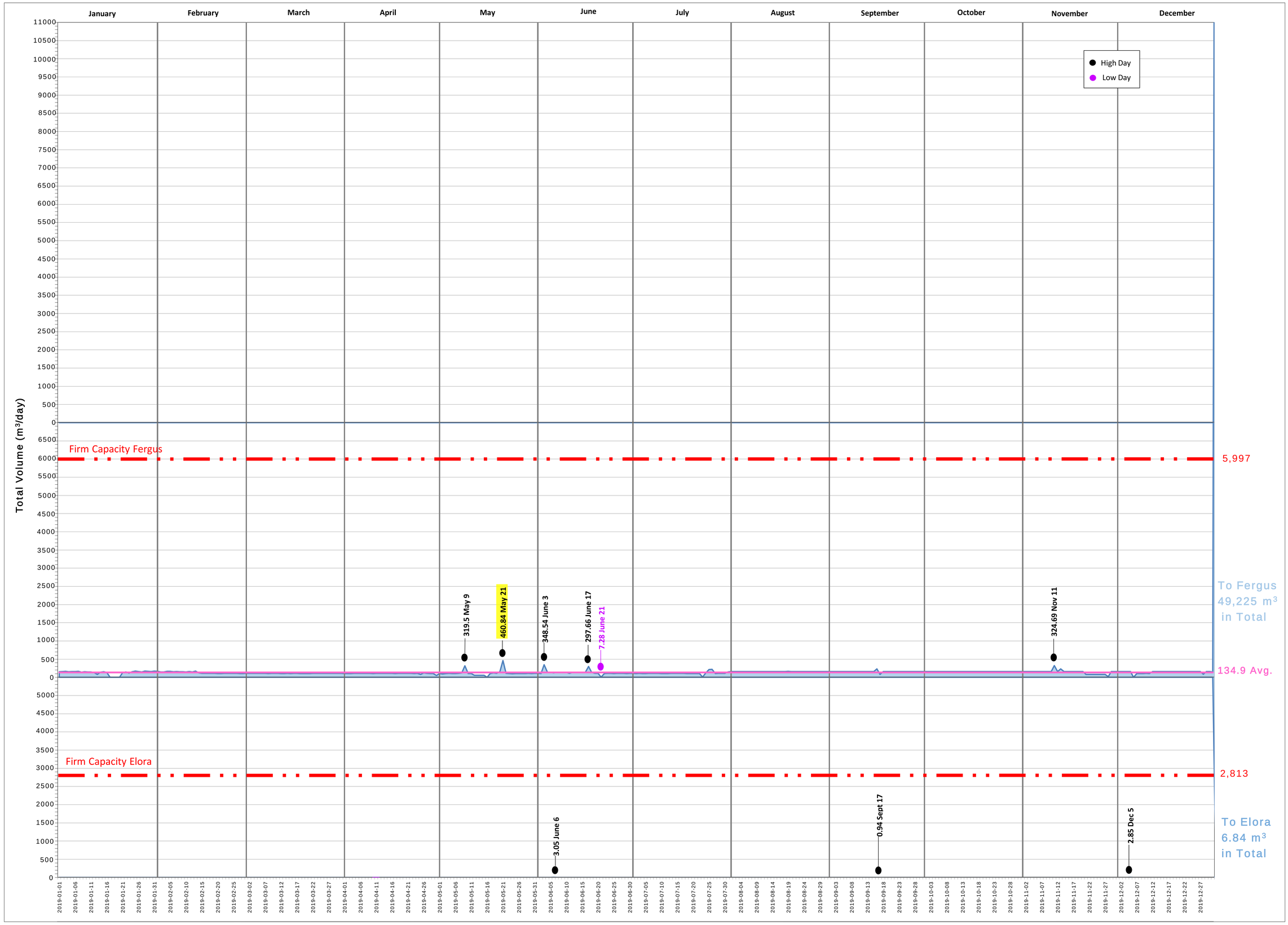
Fig 2019.4

Township of Centre Wellington

2019 Aboyne Booster Pumping Volume (m^3/day)

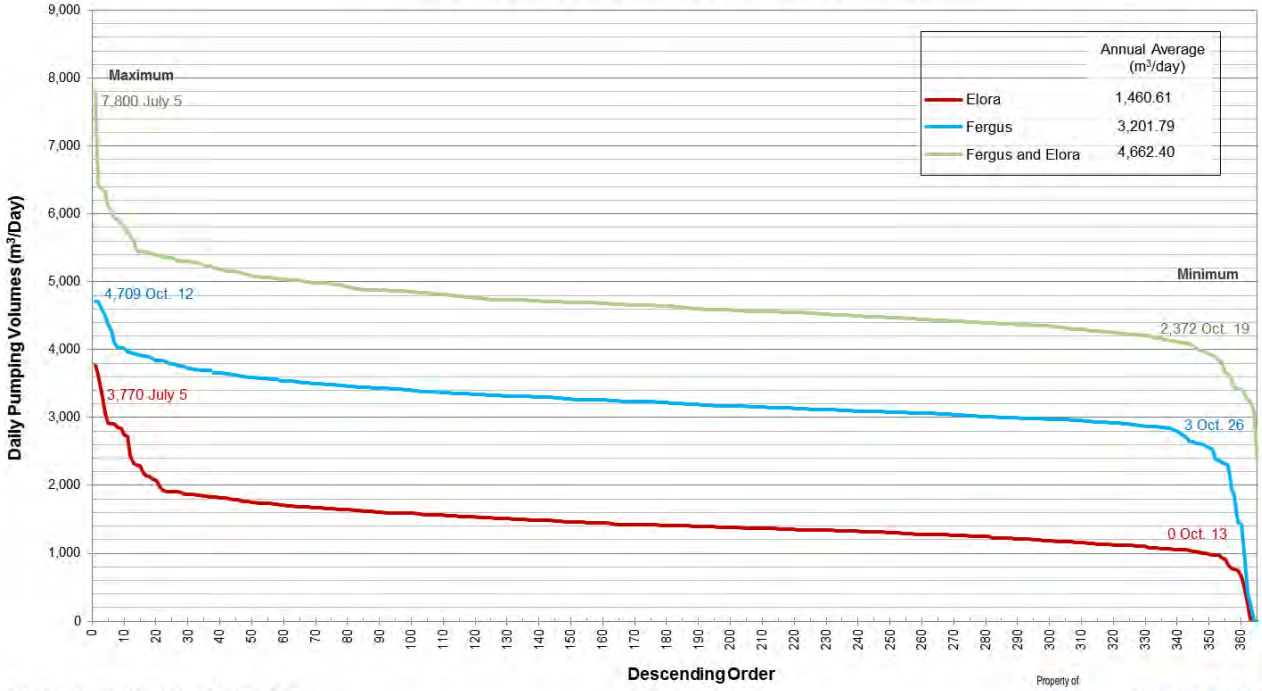


Source: Pumping Volume: TCW Well Pumping Records 2019.
Firm Capacity: Less Highest Pumping Well Less Other Operational Constraints.
Project: Elora (16-401)
File Date: May 12, 2020

Fig 2010.5

Township of Center Wellington

2010 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2010 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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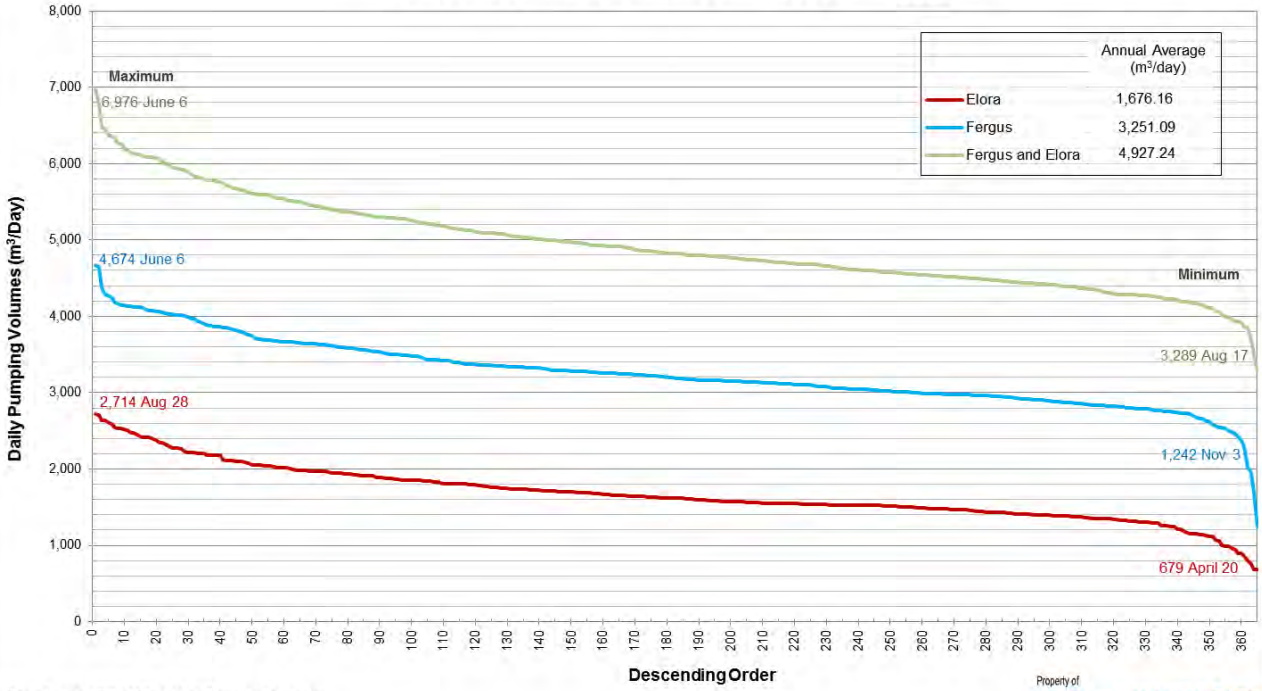
Fig 2011.5

Township of Center Wellington

2011 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2011 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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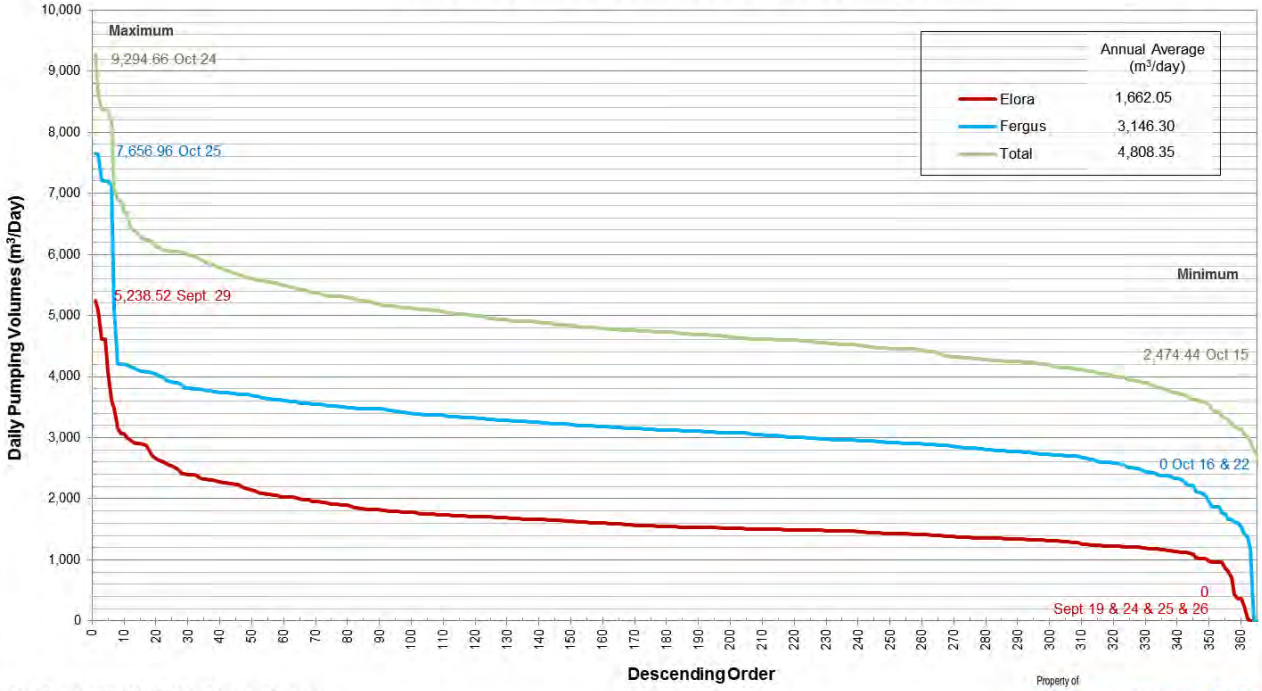
Fig 2012.5

Township of Center Wellington

2012 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2012 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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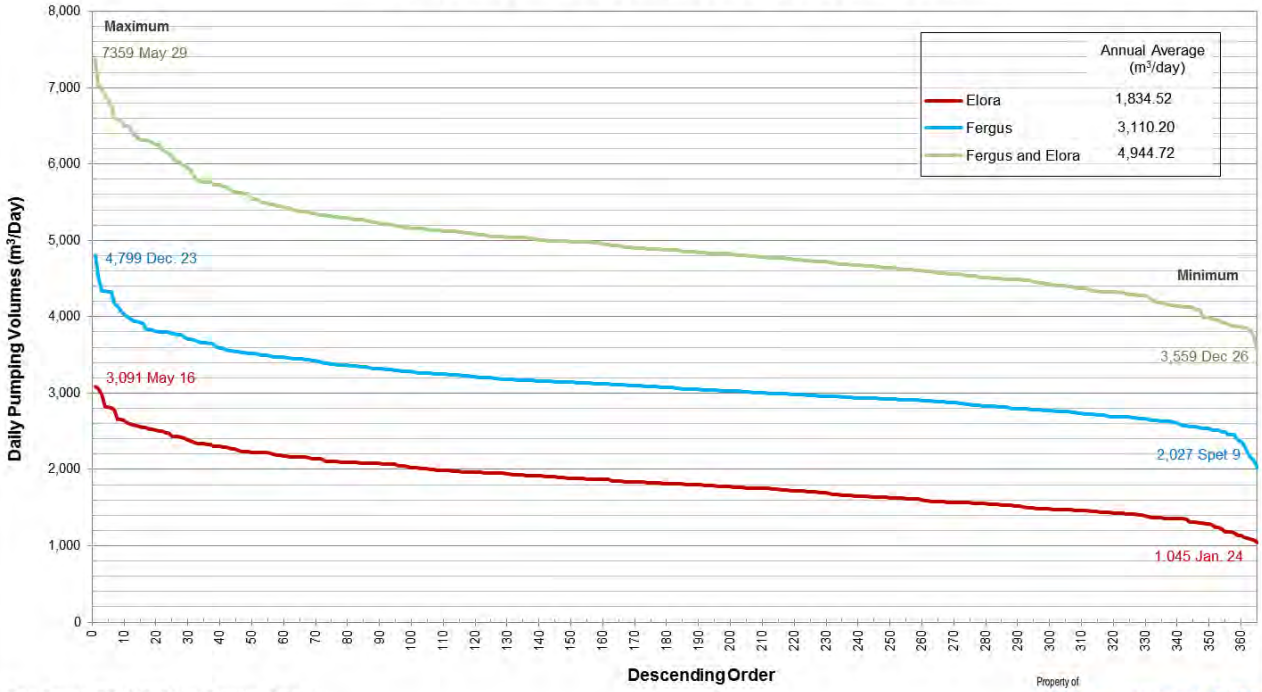
Fig 2013.5

Township of Center Wellington

2013 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2013 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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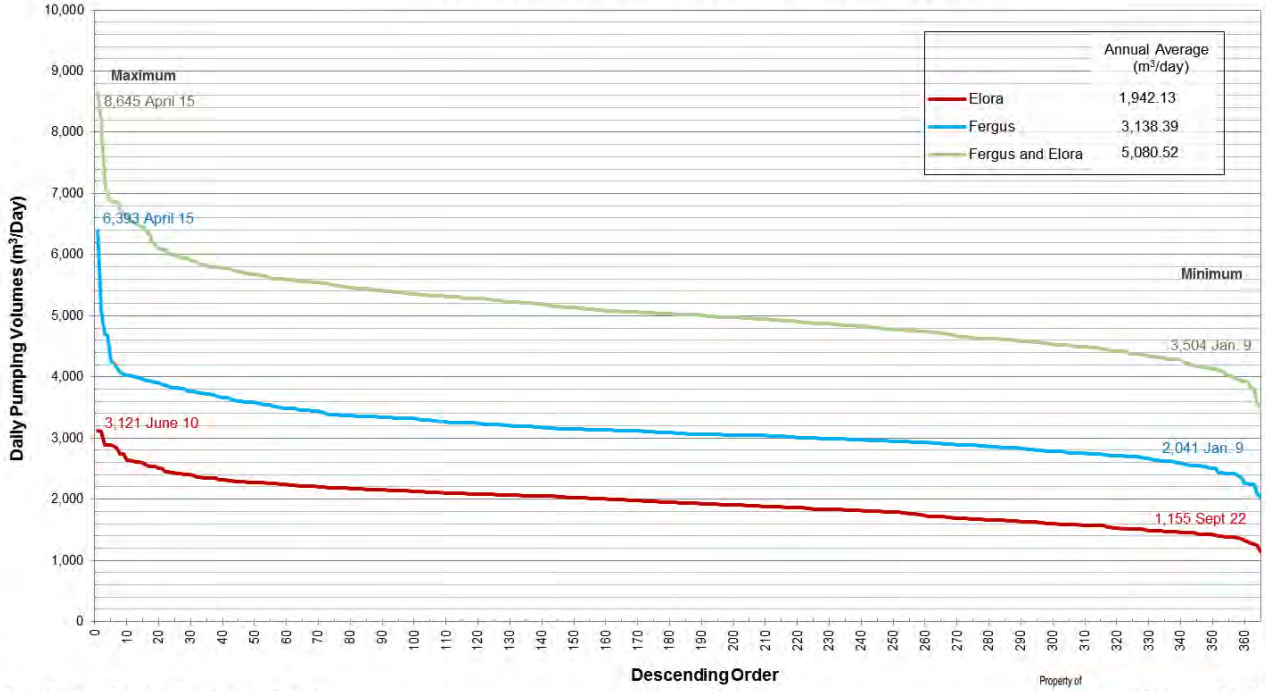
Fig 2014.5

Township of Center Wellington

2014 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2014 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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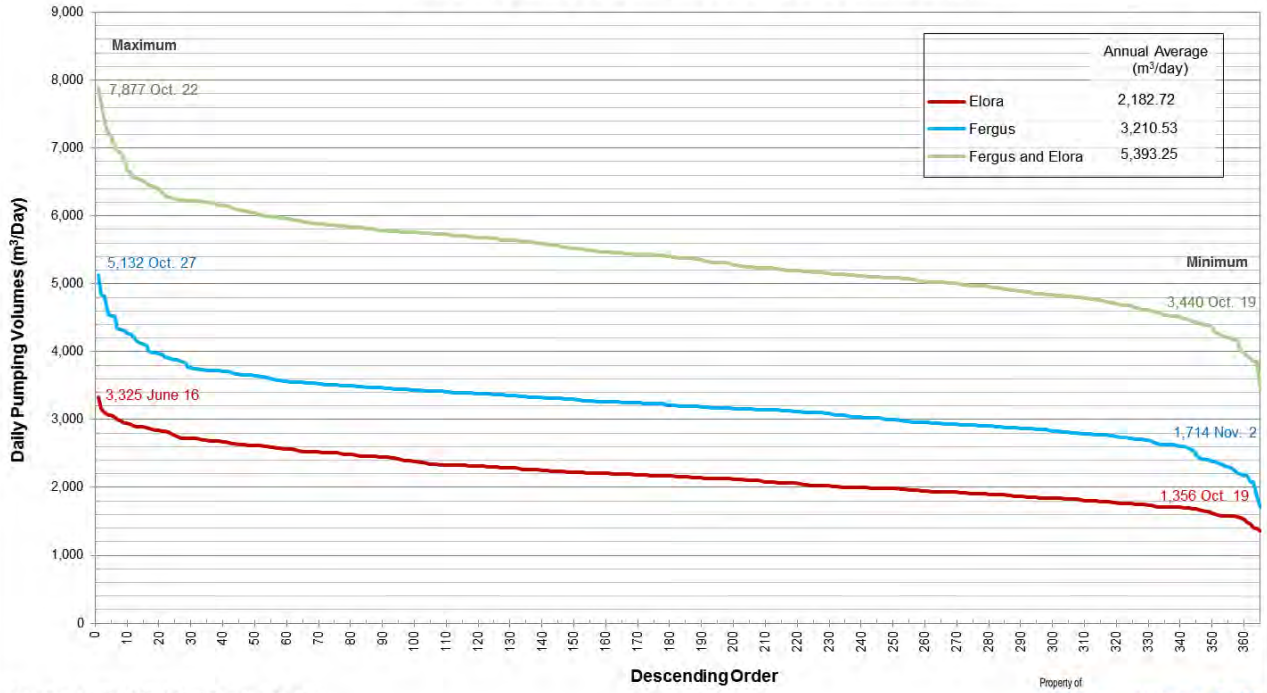
Fig 2015.5

Township of Center Wellington

2015 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2015 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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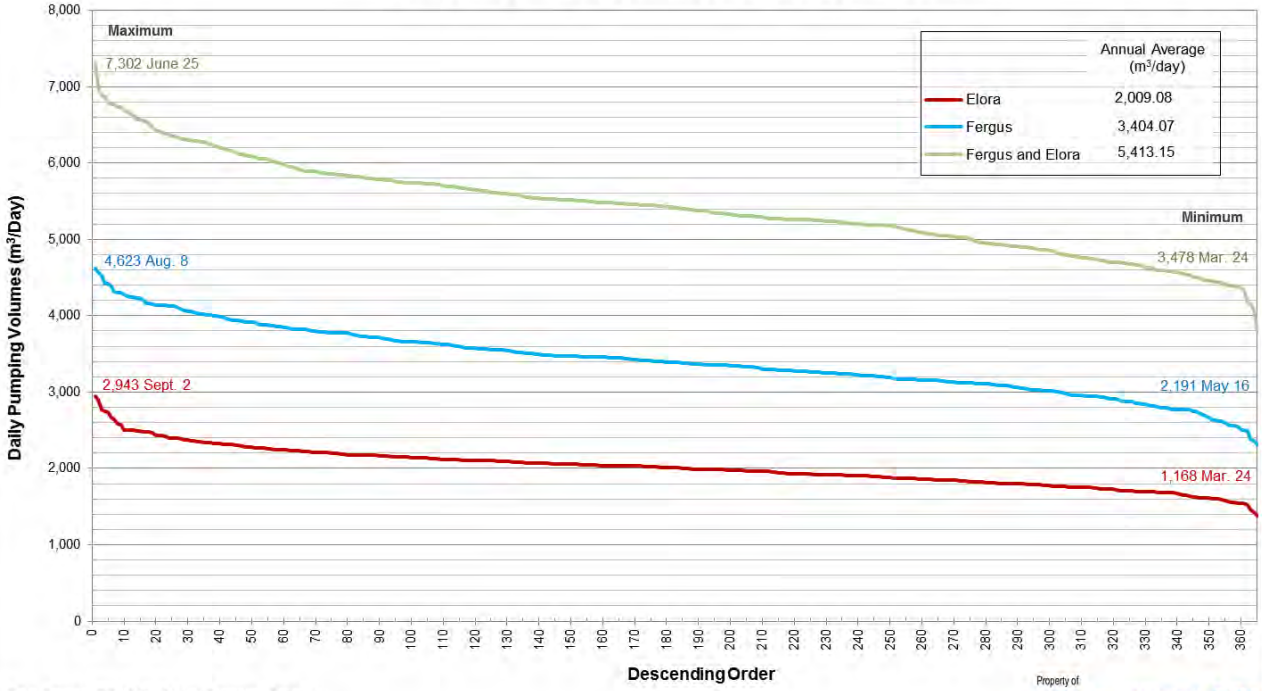
Fig 2016.5

Township of Center Wellington

2016 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2016 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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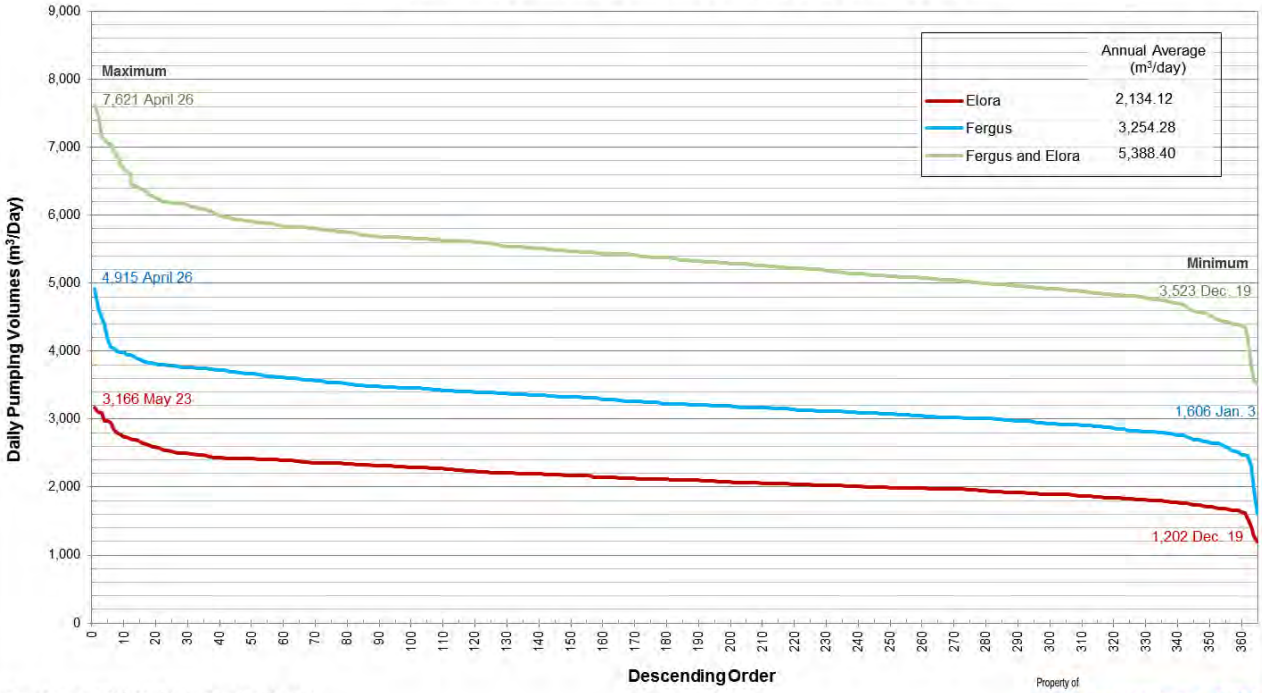
Fig 2017.5

Township of Center Wellington

2017 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2017 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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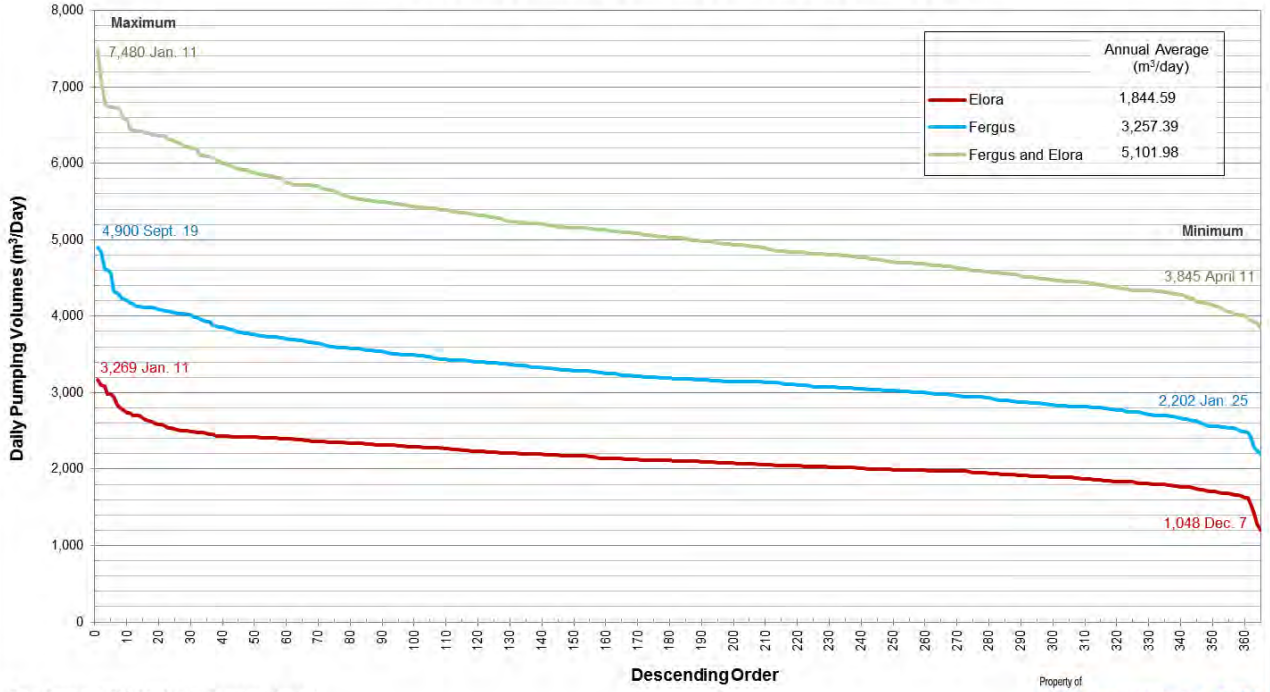
Fig 2018.5

Township of Center Wellington

2018 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2018 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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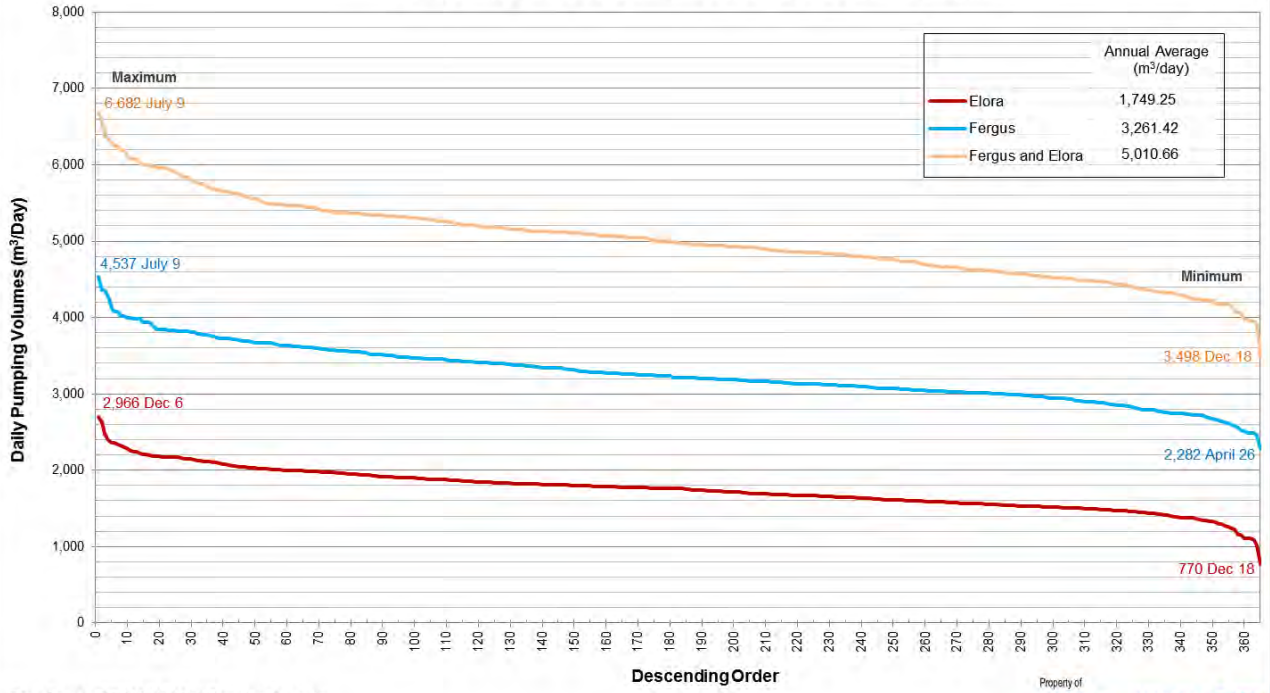
Fig 2019.5

Township of Center Wellington

2019 Daily Pumping Volumes (m^3/day) by Elora / Fergus



Data Source: TCW 2019 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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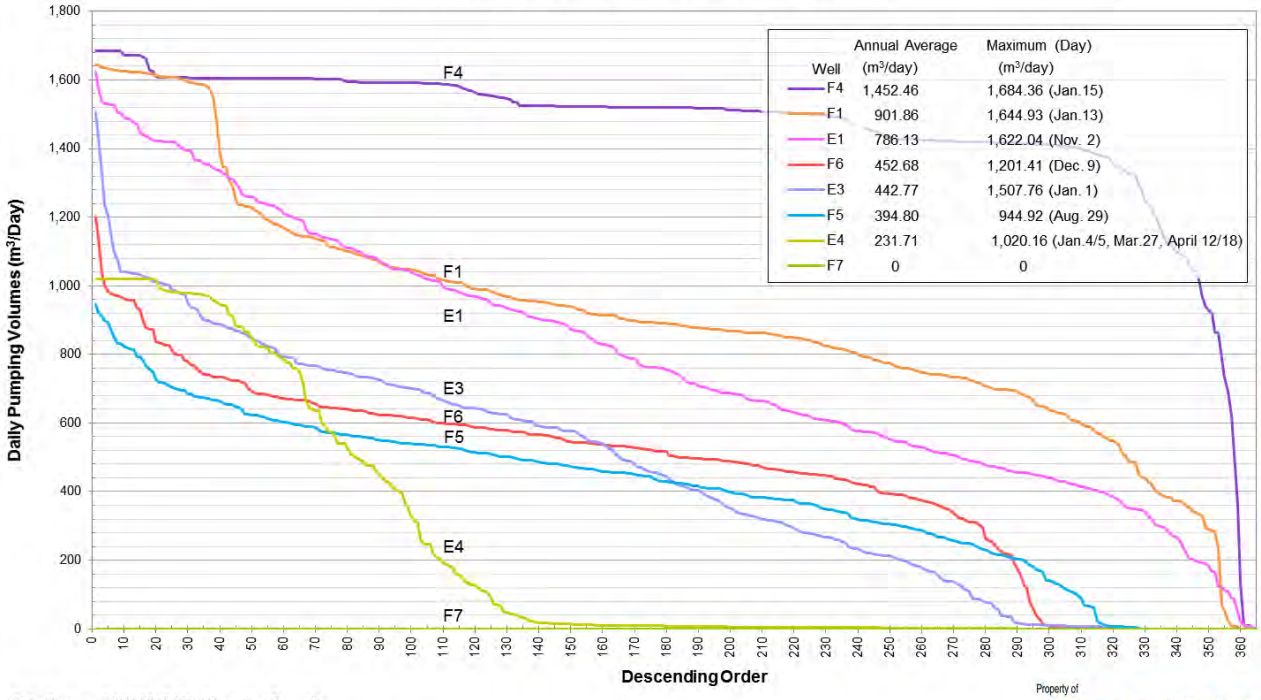
Fig 2010.6

Township of Center Wellington

2010 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
F4	1,452.46	1,684.36 (Jan.15)
F1	901.86	1,644.93 (Jan.13)
E1	786.13	1,622.04 (Nov. 2)
F6	452.68	1,201.41 (Dec. 9)
E3	442.77	1,507.76 (Jan. 1)
F5	394.80	944.92 (Aug. 29)
E4	231.71	1,020.16 (Jan.4/5, Mar.27, April 12/18)
F7	0	0

Data Source: TCW 2010 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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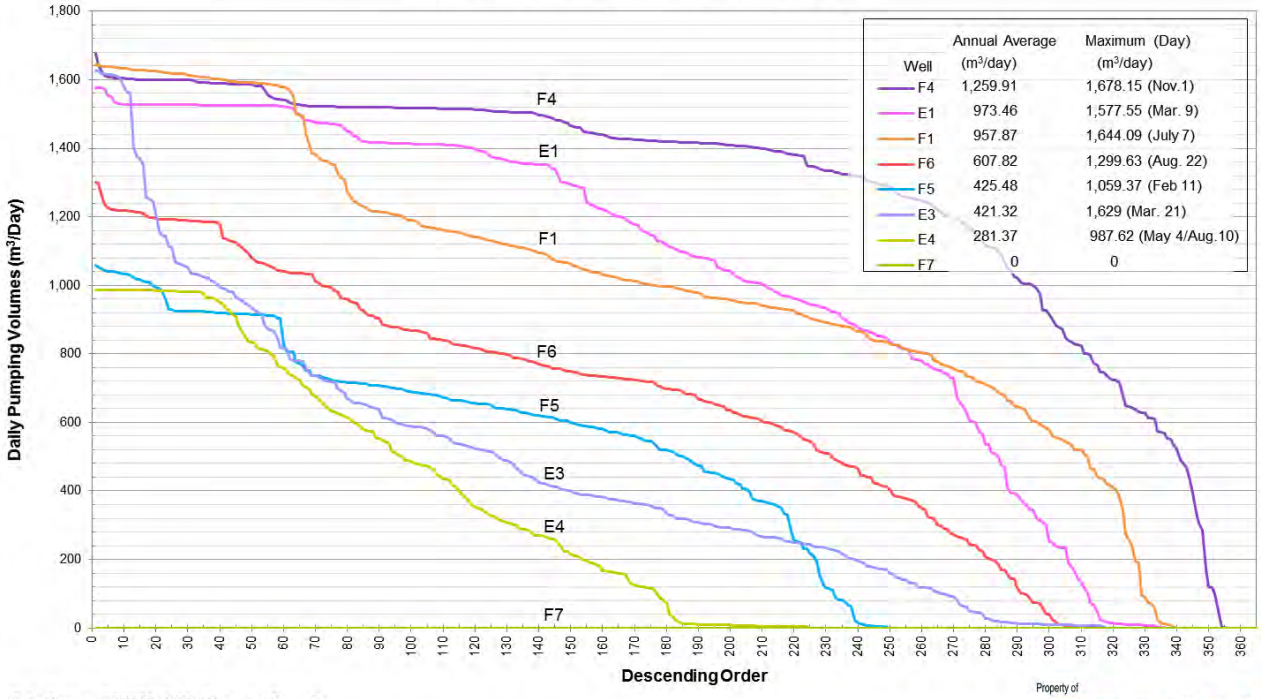
Fig 2011.6

Township of Center Wellington

2011 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
F4	1,259.91	1,678.15 (Nov.1)
E1	973.46	1,577.55 (Mar. 9)
F1	957.87	1,644.09 (July 7)
F6	607.82	1,299.63 (Aug. 22)
F5	425.48	1,059.37 (Feb 11)
E3	421.32	1,629 (Mar. 21)
E4	281.37	987.62 (May 4/Aug.10)
F7	0	0

Data Source: TCW 2011 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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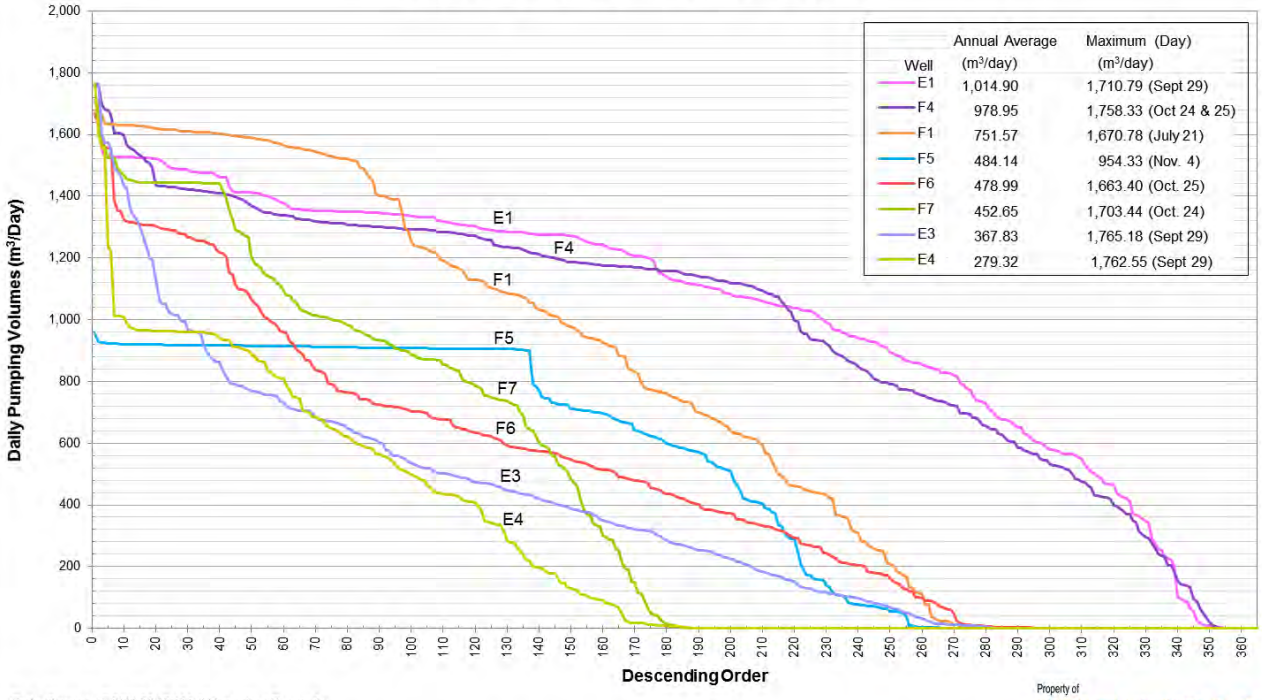
Fig 2012.6

Township of Center Wellington

2012 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,014.90	1,710.79 (Sept 29)
F4	978.95	1,758.33 (Oct 24 & 25)
F1	751.57	1,670.78 (July 21)
F5	484.14	954.33 (Nov. 4)
F6	478.99	1,663.40 (Oct. 25)
F7	452.65	1,703.44 (Oct. 24)
E3	367.83	1,765.18 (Sept 29)
E4	279.32	1,762.55 (Sept 29)

Data Source: TCW 2012 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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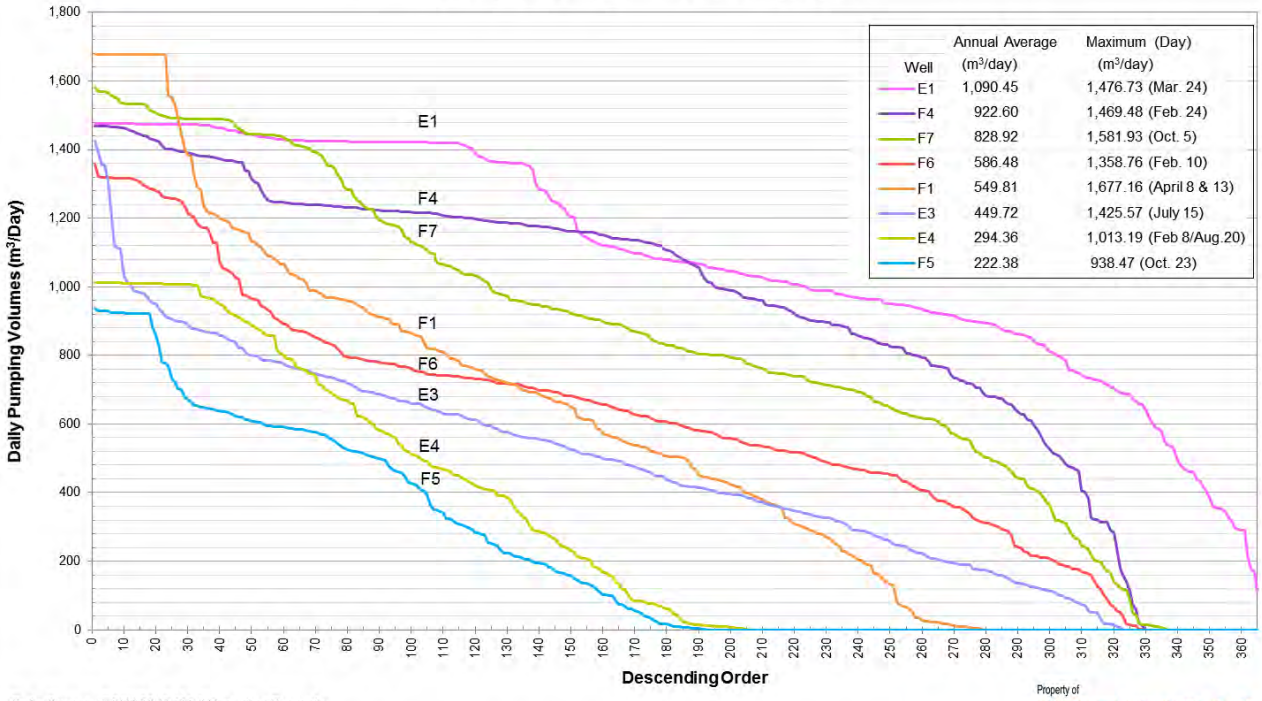
Fig 2013.6

Township of Center Wellington

2013 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,090.45	1,476.73 (Mar. 24)
F4	922.60	1,469.48 (Feb. 24)
F7	828.92	1,581.93 (Oct. 5)
F6	586.48	1,358.76 (Feb. 10)
F1	549.81	1,677.16 (April 8 & 13)
E3	449.72	1,425.57 (July 15)
E4	294.36	1,013.19 (Feb 8/Aug.20)
F5	222.38	938.47 (Oct. 23)

Data Source: TCW 2013 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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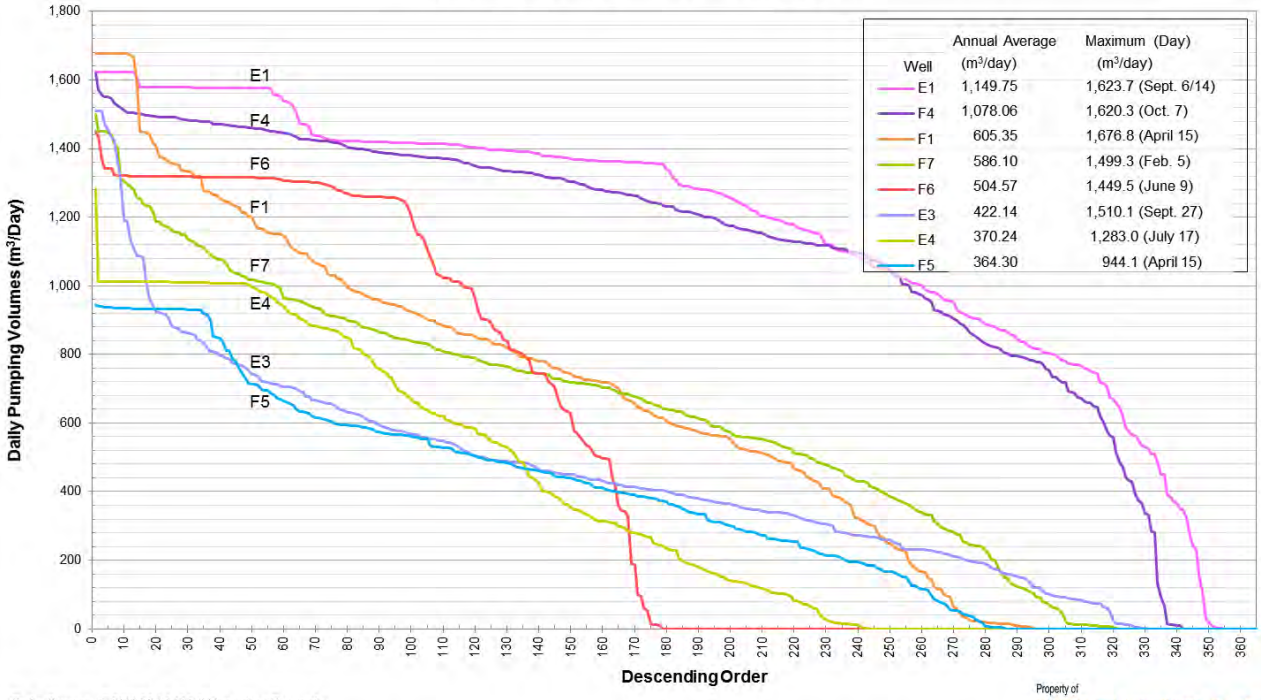
Fig 2014.6

Township of Center Wellington

2014 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,149.75	1,623.7 (Sept. 6/14)
F4	1,078.06	1,620.3 (Oct. 7)
F1	605.35	1,676.8 (April 15)
F7	586.10	1,499.3 (Feb. 5)
F6	504.57	1,449.5 (June 9)
E3	422.14	1,510.1 (Sept. 27)
E4	370.24	1,283.0 (July 17)
F5	364.30	944.1 (April 15)

Data Source: TCW 2014 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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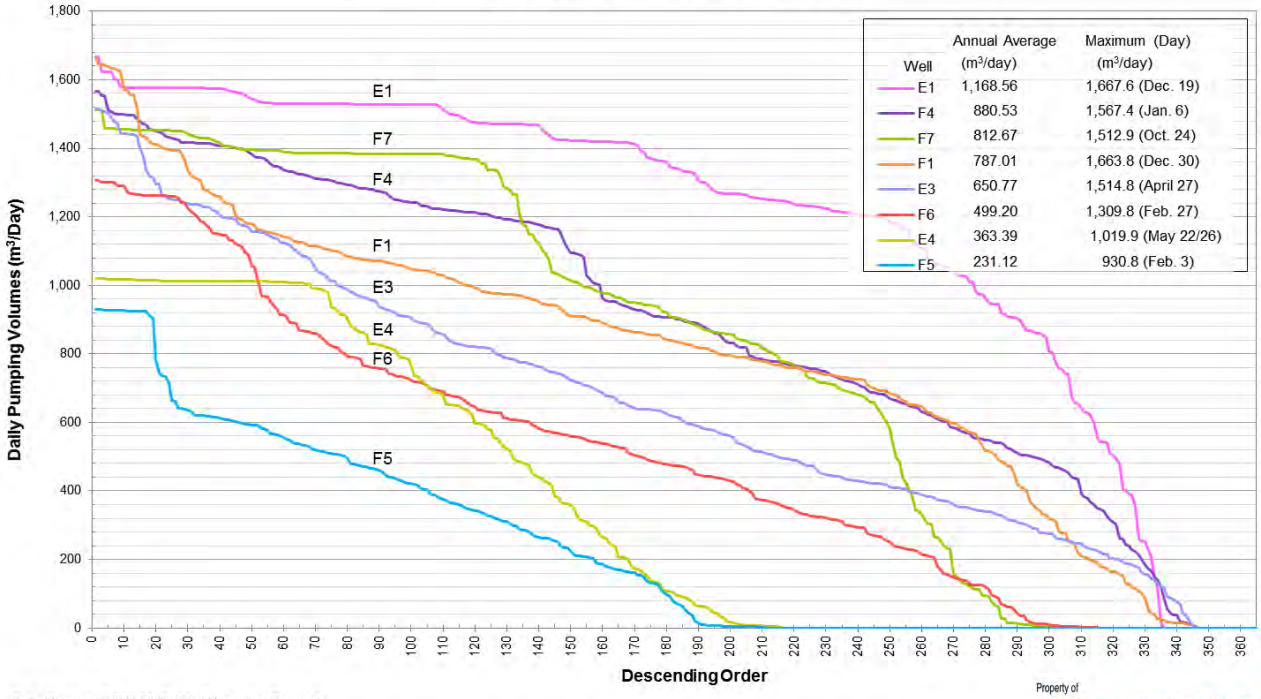
Fig 2015.6

Township of Center Wellington

2015 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,168.56	1,667.6 (Dec. 19)
F4	880.53	1,567.4 (Jan. 6)
F7	812.67	1,512.9 (Oct. 24)
F1	787.01	1,663.8 (Dec. 30)
E3	650.77	1,514.8 (April 27)
F6	499.20	1,309.8 (Feb. 27)
E4	363.39	1,019.9 (May 22/26)
F5	231.12	930.8 (Feb. 3)

Data Source: TCW 2015 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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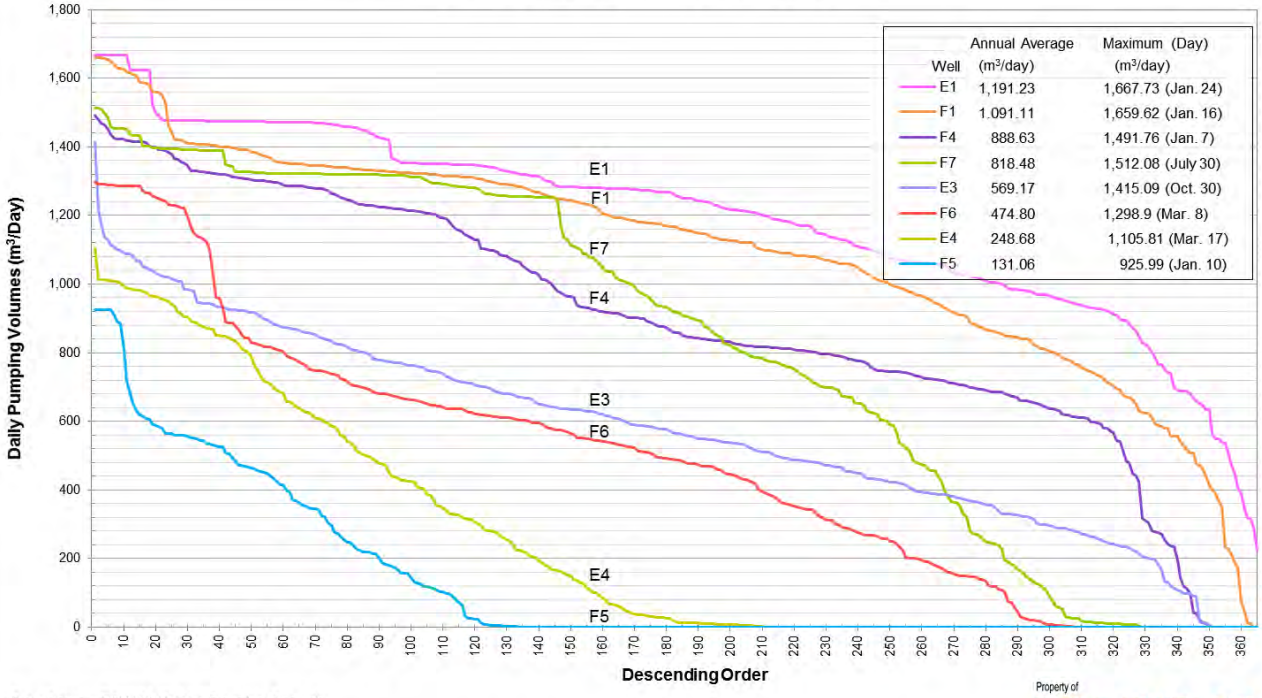
Fig 2016.6

Township of Center Wellington

2016 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,191.23	1,667.73 (Jan. 24)
F1	1.091.11	1,659.62 (Jan. 16)
F4	888.63	1,491.76 (Jan. 7)
F7	818.48	1,512.08 (July 30)
E3	569.17	1,415.09 (Oct. 30)
F6	474.80	1,298.9 (Mar. 8)
E4	248.68	1,105.81 (Mar. 17)
F5	131.06	925.99 (Jan. 10)

Data Source: TCW 2016 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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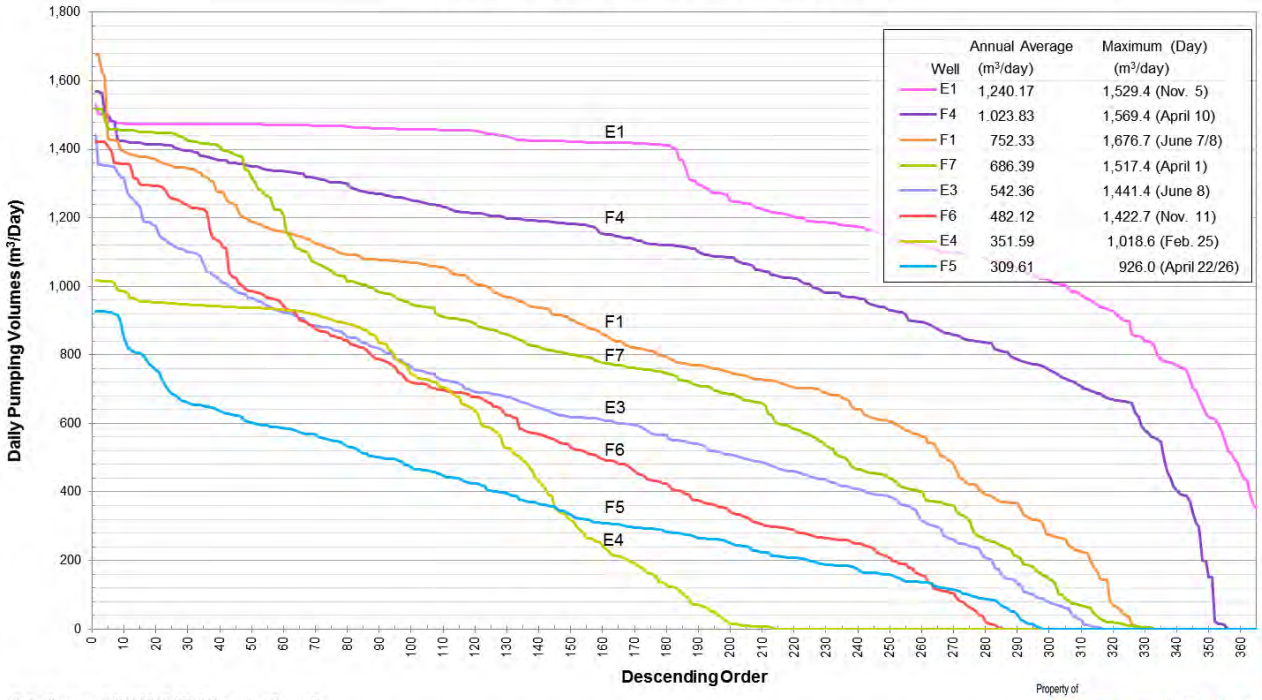
Fig 2017.6

Township of Center Wellington

2017 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
E1	1,240.17	1,529.4 (Nov. 5)
F4	1.023.83	1,569.4 (April 10)
F1	752.33	1,676.7 (June 7/8)
F7	686.39	1,517.4 (April 1)
E3	542.36	1,441.4 (June 8)
F6	482.12	1,422.7 (Nov. 11)
E4	351.59	1,018.6 (Feb. 25)
F5	309.61	926.0 (April 22/26)

Data Source: TCW 2017 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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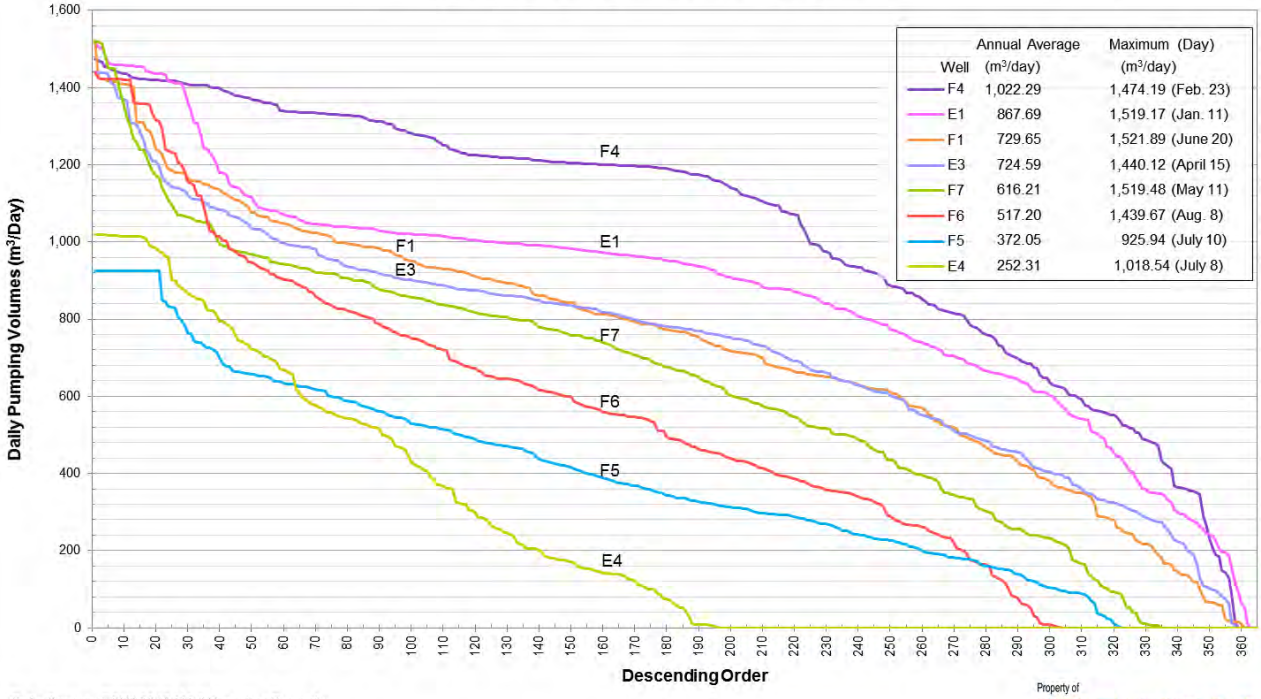
Fig 2018.6

Township of Center Wellington

2018 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
F4	1,022.29	1,474.19 (Feb. 23)
E1	867.69	1,519.17 (Jan. 11)
F1	729.65	1,521.89 (June 20)
E3	724.59	1,440.12 (April 15)
F7	616.21	1,519.48 (May 11)
F6	517.20	1,439.67 (Aug. 8)
F5	372.05	925.94 (July 10)
E4	252.31	1,018.54 (July 8)

Data Source: TCW 2018 Well Pumping Records
Project: Elora (16-401)
File Date: May 4, 2020

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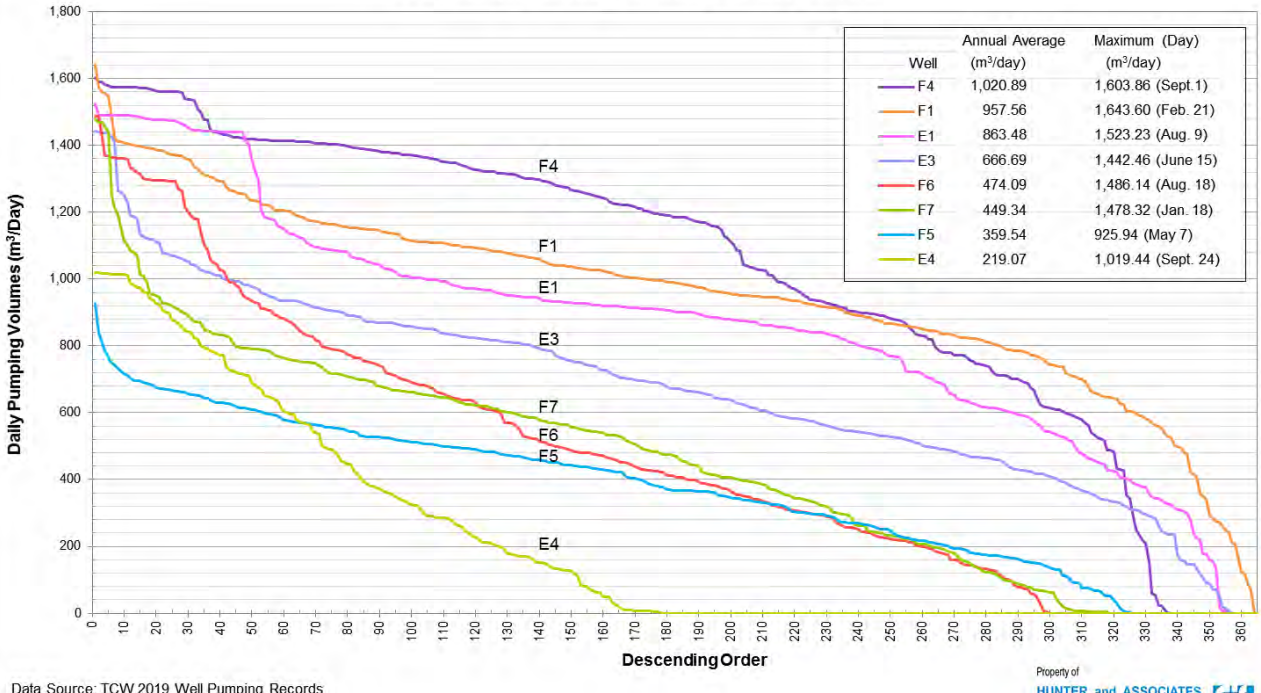
Fig 2019.6

Township of Center Wellington

2019 Daily Pumping Volumes (m^3/day) by Well



Well	Annual Average (m^3/day)	Maximum (Day) (m^3/day)
F4	1,020.89	1,603.86 (Sept.1)
F1	957.56	1,643.60 (Feb. 21)
E1	863.48	1,523.23 (Aug. 9)
E3	666.69	1,442.46 (June 15)
F6	474.09	1,486.14 (Aug. 18)
F7	449.34	1,478.32 (Jan. 18)
F5	359.54	925.94 (May 7)
E4	219.07	1,019.44 (Sept. 24)

Data Source: TCW 2019 Well Pumping Records
Project: Elora (16-401)
File Date: May 1, 2020

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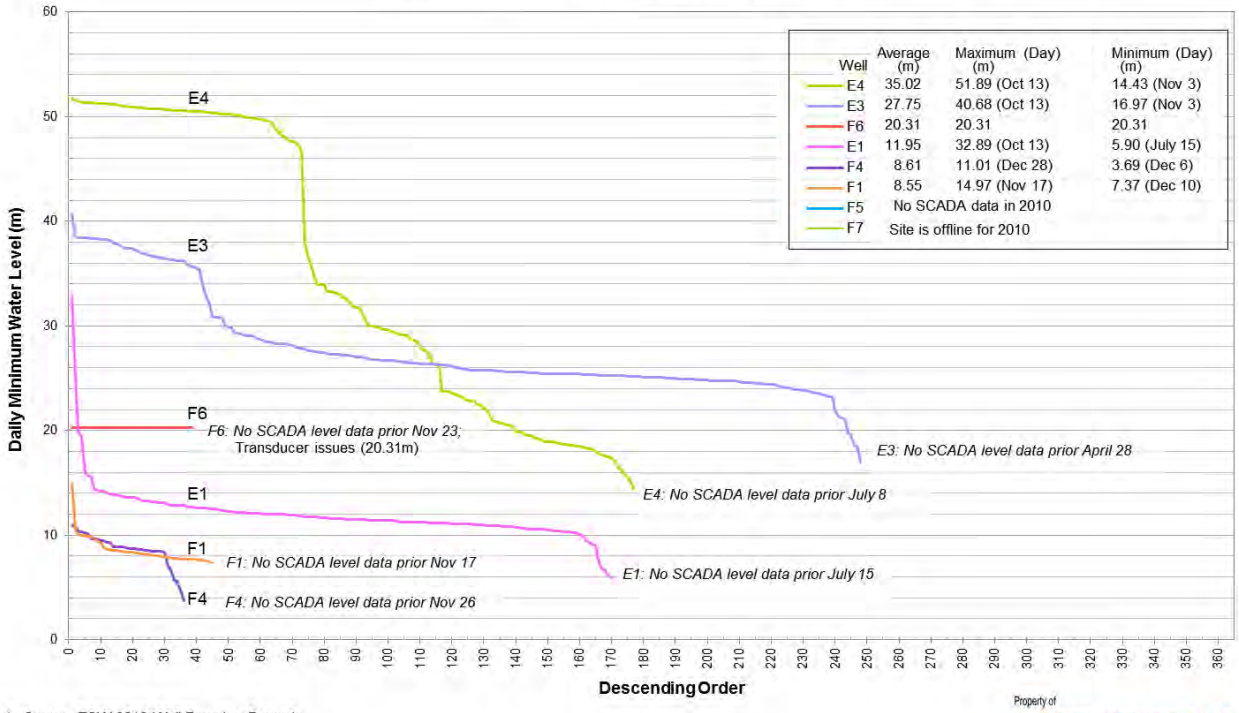
Fig 2010.7

Township of Center Wellington

2010 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	35.02	51.89 (Oct 13)	14.43 (Nov 3)
E3	27.75	40.68 (Oct 13)	16.97 (Nov 3)
F6	20.31	20.31	20.31
E1	11.95	32.89 (Oct 13)	5.90 (July 15)
F4	8.61	11.01 (Dec 28)	3.69 (Dec 6)
F1	8.55	14.97 (Nov 17)	7.37 (Dec 10)
F5	No SCADA data in 2010		
F7	Site is offline for 2010		

Data Source: TCW 2010 Well Pumping Records
Project: Elora (16-401)
File Date: May 15, 2020

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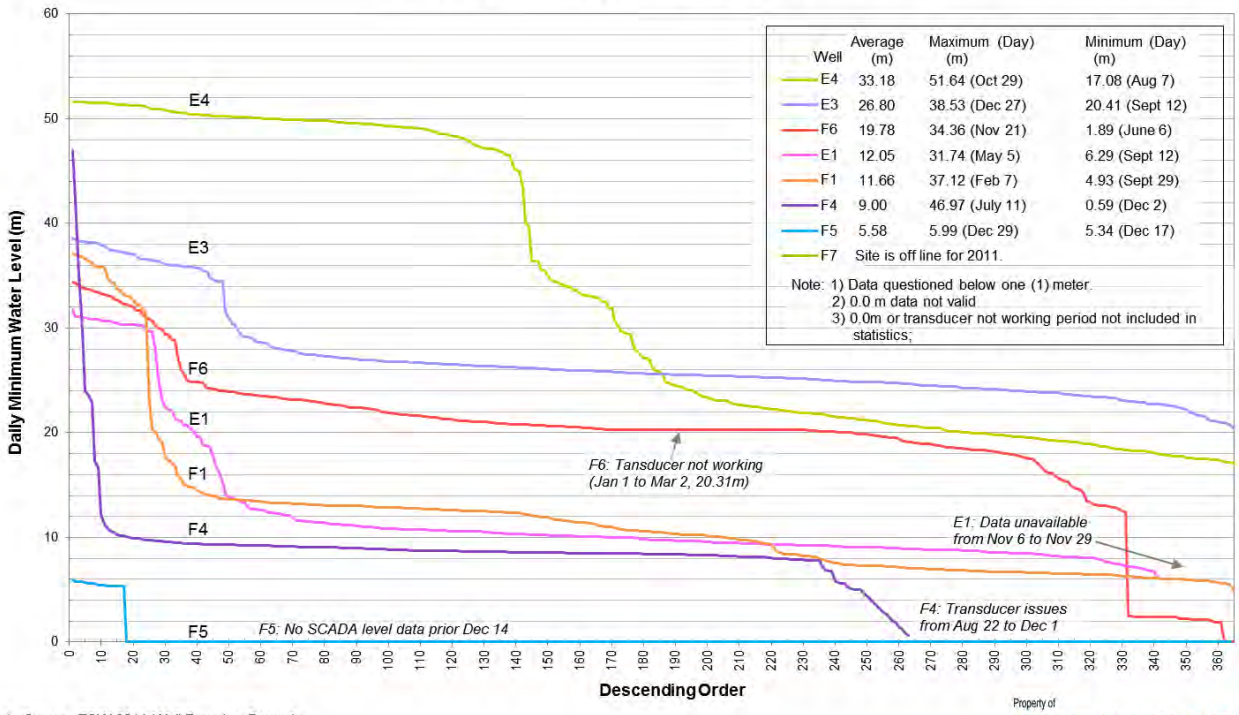
Fig 2011.7

Township of Center Wellington

2011 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	33.18	51.64 (Oct 29)	17.08 (Aug 7)
E3	26.80	38.53 (Dec 27)	20.41 (Sept 12)
F6	19.78	34.36 (Nov 21)	1.89 (June 6)
E1	12.05	31.74 (May 5)	6.29 (Sept 12)
F1	11.66	37.12 (Feb 7)	4.93 (Sept 29)
F4	9.00	46.97 (July 11)	0.59 (Dec 2)
F5	5.58	5.99 (Dec 29)	5.34 (Dec 17)
F7	Site is off line for 2011.		

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid
3) 0.0m or transducer not working period not included in statistics;

Data Source: TCW 2011 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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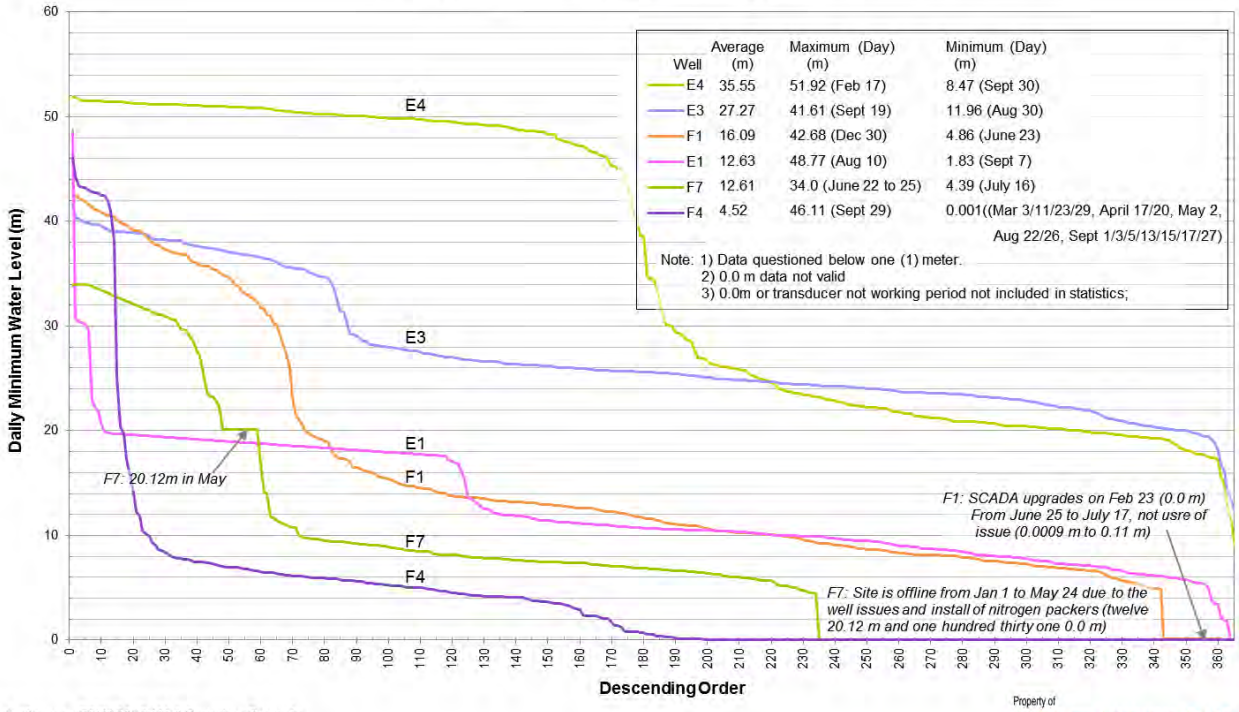
Fig 2012.7

Township of Center Wellington

2012 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	35.55	51.92 (Feb 17)	8.47 (Sept 30)
E3	27.27	41.61 (Sept 19)	11.96 (Aug 30)
F1	16.09	42.68 (Dec 30)	4.86 (June 23)
E1	12.63	48.77 (Aug 10)	1.83 (Sept 7)
F7	12.61	34.0 (June 22 to 25)	4.39 (July 16)
F4	4.52	46.11 (Sept 29)	0.001((Mar 3/11/23/29, April 17/20, May 2, Aug 22/26, Sept 1/3/5/13/15/17/27)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid
3) 0.0m or transducer not working period not included in statistics;

Data Source: TCW 2012 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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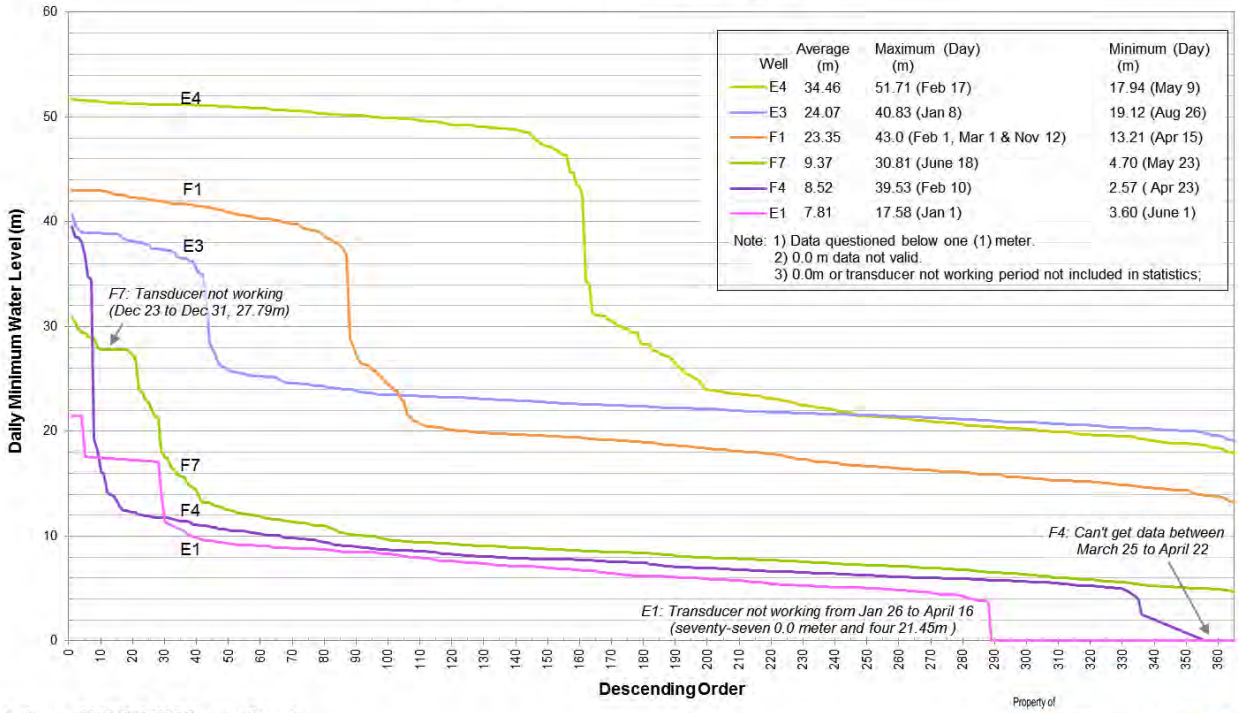
Fig 2013.7

Township of Center Wellington

2013 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	34.46	51.71 (Feb 17)	17.94 (May 9)
E3	24.07	40.83 (Jan 8)	19.12 (Aug 26)
F1	23.35	43.0 (Feb 1, Mar 1 & Nov 12)	13.21 (Apr 15)
F7	9.37	30.81 (June 18)	4.70 (May 23)
F4	8.52	39.53 (Feb 10)	2.57 (Apr 23)
E1	7.81	17.58 (Jan 1)	3.60 (June 1)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid.
3) 0.0m or transducer not working period not included in statistics;

Data Source: TCW 2013 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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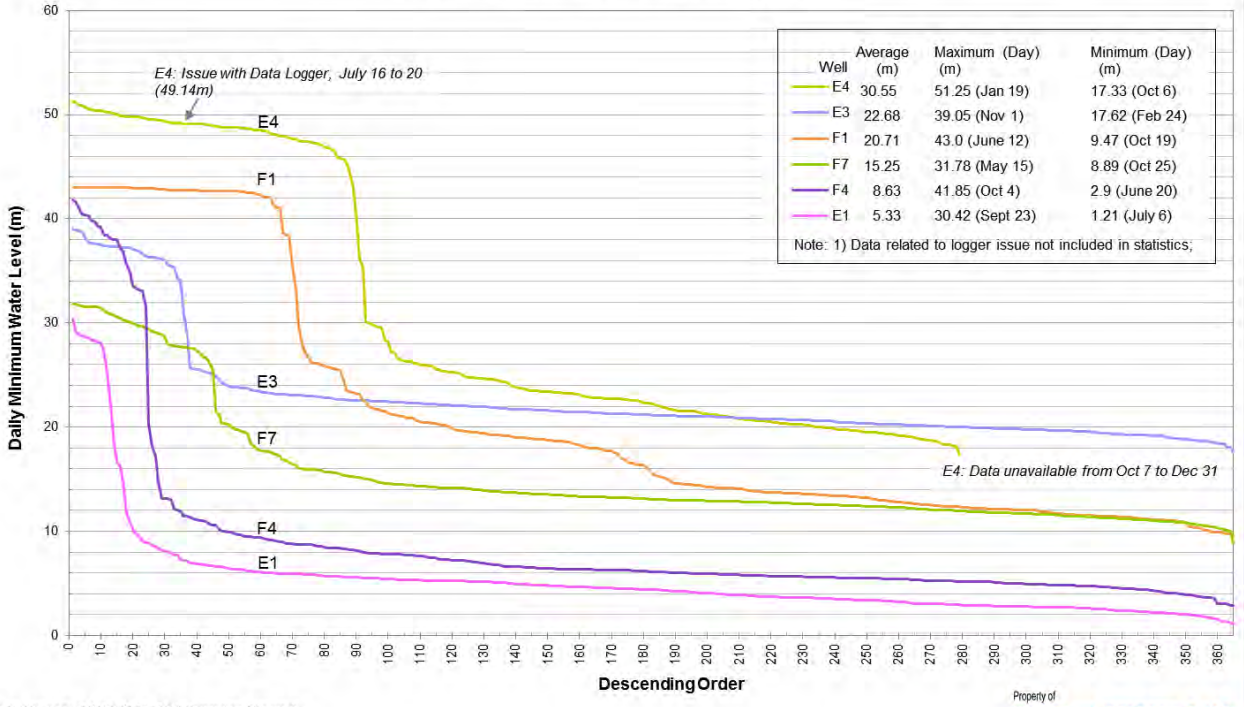
Fig 2014.7

Township of Center Wellington

2014 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	30.55	51.25 (Jan 19)	17.33 (Oct 6)
E3	22.68	39.05 (Nov 1)	17.62 (Feb 24)
F1	20.71	43.0 (June 12)	9.47 (Oct 19)
F7	15.25	31.78 (May 15)	8.89 (Oct 25)
F4	8.63	41.85 (Oct 4)	2.9 (June 20)
E1	5.33	30.42 (Sept 23)	1.21 (July 6)

Note: 1) Data related to logger issue not included in statistics;

Data Source: TCW 2014 Well Pumping Records
Project: Elora (16-401)
File Date: May 13, 2020

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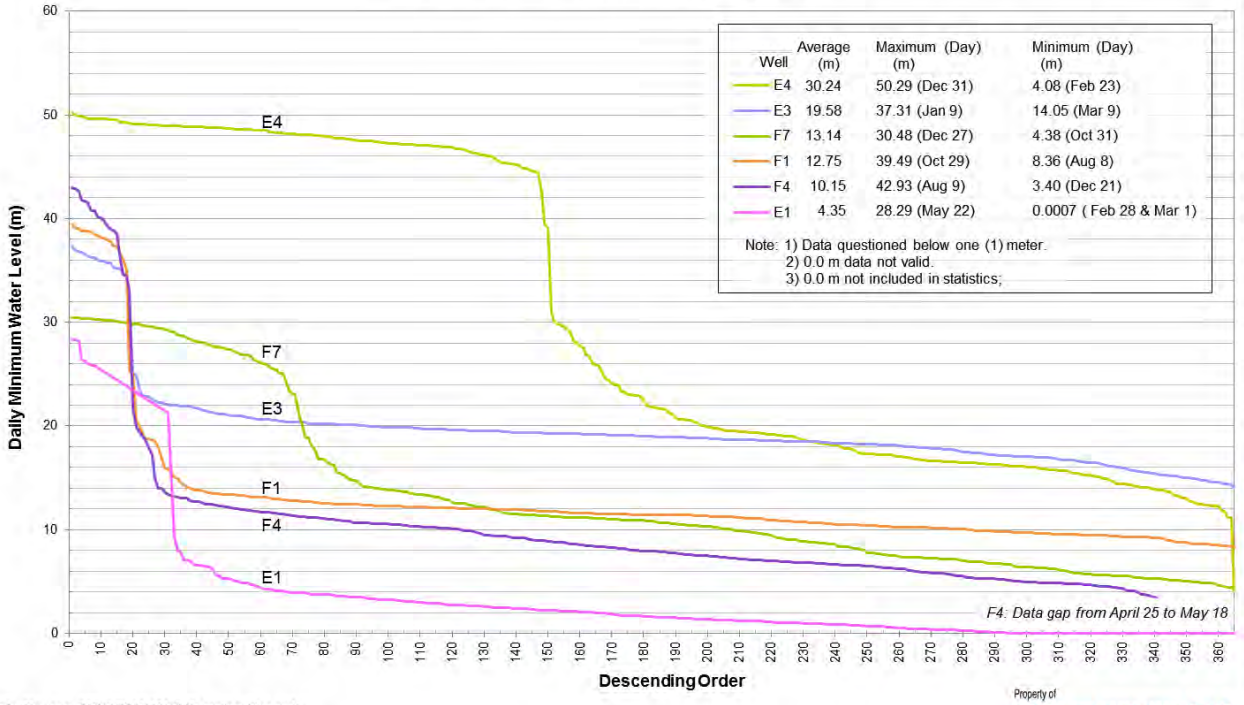
Fig 2015.7

Township of Center Wellington

2015 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	30.24	50.29 (Dec 31)	4.08 (Feb 23)
E3	19.58	37.31 (Jan 9)	14.05 (Mar 9)
F7	13.14	30.48 (Dec 27)	4.38 (Oct 31)
F1	12.75	39.49 (Oct 29)	8.36 (Aug 8)
F4	10.15	42.93 (Aug 9)	3.40 (Dec 21)
E1	4.35	28.29 (May 22)	0.0007 (Feb 28 & Mar 1)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid.
3) 0.0 m not included in statistics;

Data Source: TCW 2015 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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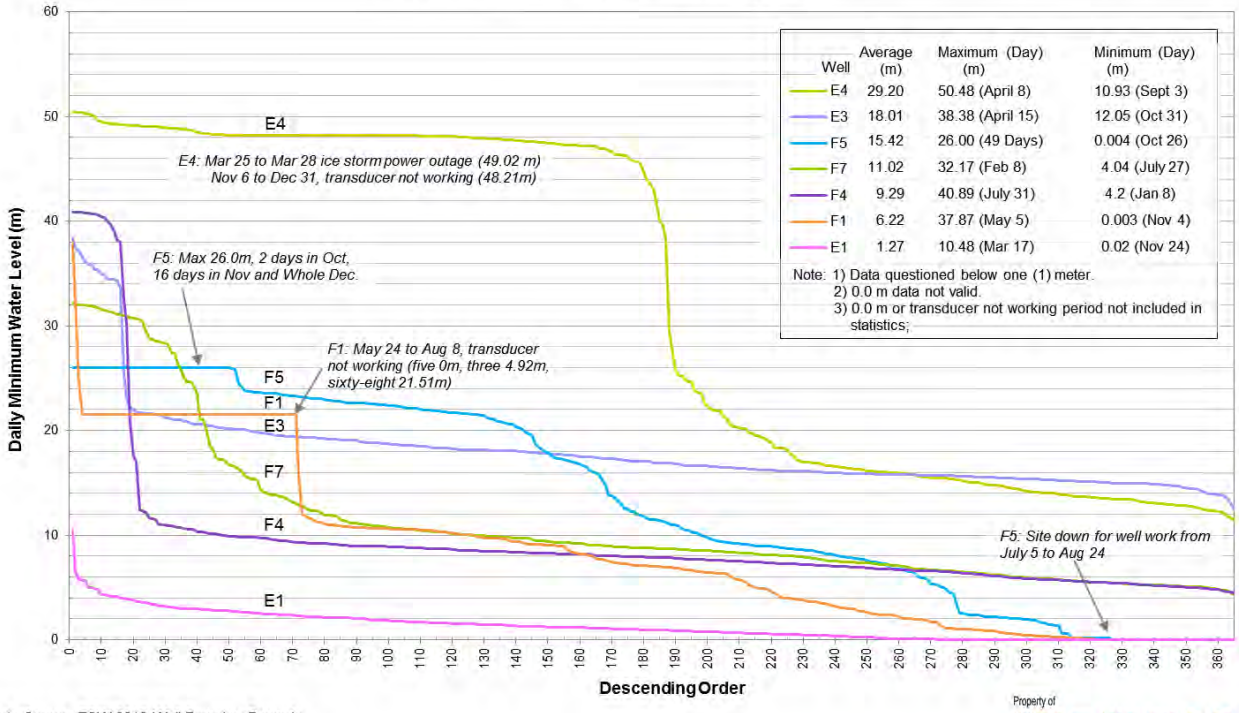
Fig 2016.7

Township of Center Wellington

2016 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	29.20	50.48 (April 8)	10.93 (Sept 3)
E3	18.01	38.38 (April 15)	12.05 (Oct 31)
F5	15.42	26.00 (49 Days)	0.004 (Oct 26)
F7	11.02	32.17 (Feb 8)	4.04 (July 27)
F4	9.29	40.89 (July 31)	4.2 (Jan 8)
F1	6.22	37.87 (May 5)	0.003 (Nov 4)
E1	1.27	10.48 (Mar 17)	0.02 (Nov 24)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid.
3) 0.0 m or transducer not working period not included in statistics;

Data Source: TCW 2016 Well Pumping Records
Project: Elora (16-401)
File Date: May 14 2020

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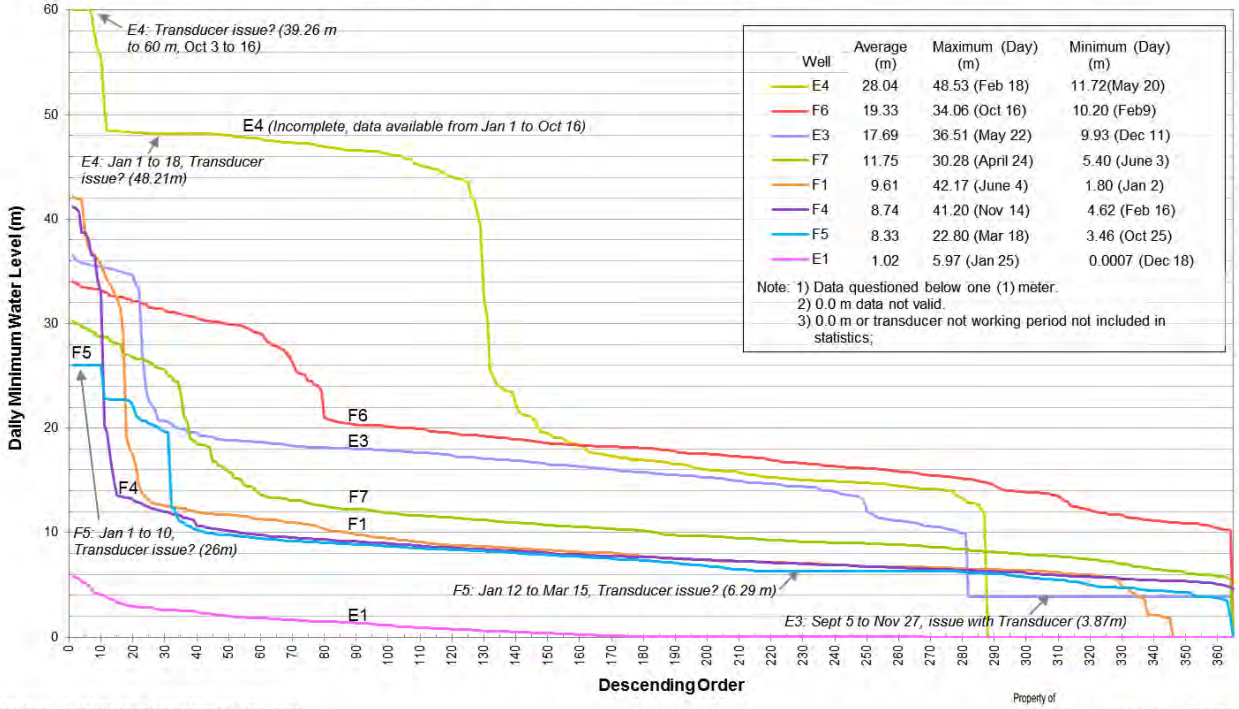
Fig 2017.7

Township of Center Wellington

2017 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	28.04	48.53 (Feb 18)	11.72(May 20)
F6	19.33	34.06 (Oct 16)	10.20 (Feb9)
E3	17.69	36.51 (May 22)	9.93 (Dec 11)
F7	11.75	30.28 (April 24)	5.40 (June 3)
F1	9.61	42.17 (June 4)	1.80 (Jan 2)
F4	8.74	41.20 (Nov 14)	4.62 (Feb 16)
F5	8.33	22.80 (Mar 18)	3.46 (Oct 25)
E1	1.02	5.97 (Jan 25)	0.0007 (Dec 18)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid.
3) 0.0 m or transducer not working period not included in statistics;

Data Source: TCW 2017 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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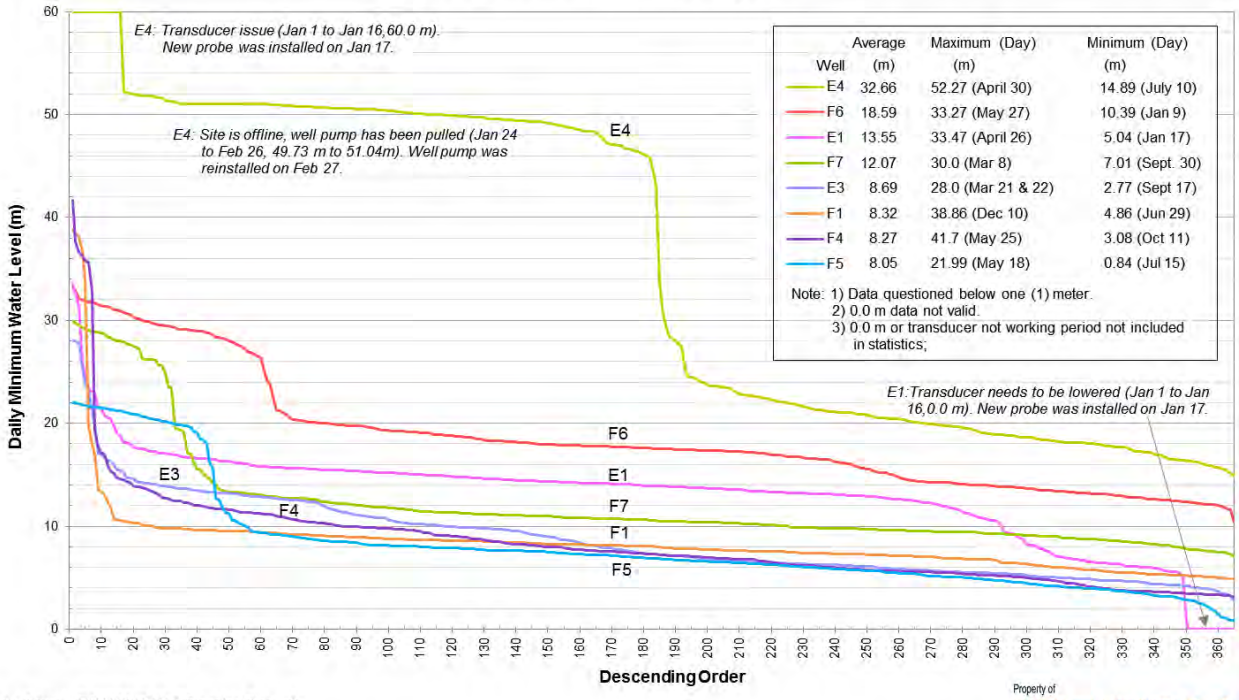
Fig 2018.7

Township of Center Wellington

2018 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	32.66	52.27 (April 30)	14.89 (July 10)
F6	18.59	33.27 (May 27)	10.39 (Jan 9)
E1	13.55	33.47 (April 26)	5.04 (Jan 17)
F7	12.07	30.0 (Mar 8)	7.01 (Sept. 30)
E3	8.69	28.0 (Mar 21 & 22)	2.77 (Sept 17)
F1	8.32	38.86 (Dec 10)	4.86 (Jun 29)
F4	8.27	41.7 (May 25)	3.08 (Oct 11)
F5	8.05	21.99 (May 18)	0.84 (Jul 15)

Note: 1) Data questioned below one (1) meter.
2) 0.0 m data not valid.
3) 0.0 m or transducer not working period not included in statistics;

Data Source: TCW 2018 Well Pumping Records
Project: Elora (16-401)
File Date: May 14, 2020

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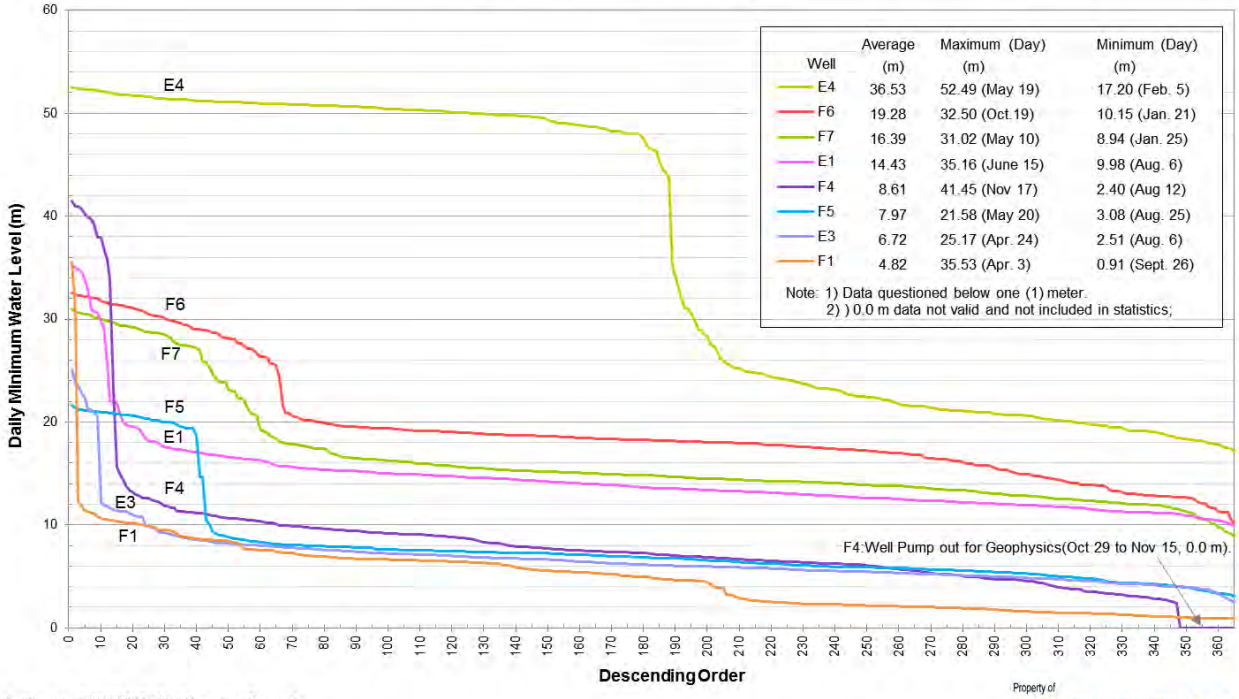
Fig 2019.7

Township of Center Wellington

2019 Daily Minimum Water Level by Well



Well	Average (m)	Maximum (Day) (m)	Minimum (Day) (m)
E4	36.53	52.49 (May 19)	17.20 (Feb. 5)
F6	19.28	32.50 (Oct.19)	10.15 (Jan. 21)
F7	16.39	31.02 (May 10)	8.94 (Jan. 25)
E1	14.43	35.16 (June 15)	9.98 (Aug. 6)
F4	8.61	41.45 (Nov 17)	2.40 (Aug 12)
F5	7.97	21.58 (May 20)	3.08 (Aug. 25)
E3	6.72	25.17 (Apr. 24)	2.51 (Aug. 6)
F1	4.82	35.53 (Apr. 3)	0.91 (Sept. 26)

Note: 1) Data questioned below one (1) meter.
2)) 0.0 m data not valid and not included in statistics;

Data Source: TCW 2019 Well Pumping Records
Project: Elora (16-401)
File Date: May 22, 2020

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