Underwood Engineers

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

Technical Memorandum

To: Stephen Cronin, Director of Public Works and Steve Dalton, Assistant Water & Sewer Superintendent, Town of Exeter, NH

From: Thomas Page, PE, Senior Project Manager and Lance Olsen, EIT, Project Engineer

Date: 10/24/23 (Revised), 4/10/2026 (Rev 2)

Subject: **Existing Available Water Supply Options**

1. Introduction

1.1 Background

The Town of Exeter's water system is supplied by a combination of surface water and groundwater sources that are treated at the Lary Lane Groundwater Treatment Facility (GWTP) or the Surface Water Treatment Plant (SWTP). Underwood Engineers (UE) completed an evaluation of Exeter's supplies and recommended developing additional supplies due to growing demands and seasonal limitations. Improvements are also needed to existing facilities. Recommendations are described in more detail in the *Surface Water and Groundwater Assessment Interim Report (*2020) by Underwood Engineers (UE).

1.2 Goals

The Town desires to identify the current maximum capacity available to meet near-term needs while longer-term improvements are implemented. In accordance with Task 13 of our contract dated April 15, 2019, and last amended on April 14, 2023, UE prepared a memo in October 2023 to identify maximum existing capacity and excess capacity (if any). This information updates the information in the 2020 report.

Based on recent SWTP preliminary design work by others and design of groundwater improvements by UE, this memo has been updated to include:

- Average day demands and maximum day demands through 2025
- Combined firm yield of the Exeter River and Exeter Reservoir per 2025 AECOM Memorandum titled *Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station*.
- Existing groundwater supply capacity and proposed groundwater improvements based on the preliminary design memo dated 6/20/2025, by Underwood Engineers.

This memo includes a summary of:

- Existing water demands

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

- Groundwater supply and limitations
- Surface water supply and limitations
- Total supply versus demands

2. Water Production and Demands

Exeter's historical demands based on total finished water production from 2017 to 2025 are shown in **Table 1** and **Figure 1**. Total water production includes both surface water and groundwater sources, as metered at each treatment facility. The average daily production has been consistent at about **1.0 MGD**.

Table 1. Historical Water Demands

Year	Annual Average Day Demand (MGD)	Summer Average Day Demand (MGD)	Maximum Day Demand (MGD)	Date of Maximum Day Demand	Notes
2017	0.92	1.08	1.77	6/5/2017	Water main break
2018	1.01	1.14	1.55	10/18/2018	Flushing?
2019	0.95	1.02	1.46	9/25/2019	
2020	0.97	1.16	1.65	6/13/2020	The wells were off on 6/12/2020
2021	0.98	1.09	1.48	5/26/2021	Flushing?
2022	0.98	1.09	1.46	9/30/2022	Flushing?
2023	0.98	1.06	1.67	2/6/2023	
2024	1.01	1.15	1.60	9/25/2024	Flushing?
2025	1.03	1.17	1.69	9/14/2025	Flushing?

Maximum day demands have been recorded at up to 1.77 MGD, but these high demands occurred after a water main break, distribution system flushing or tank filling following maintenance (see **Table 1**). These peak events are assumed to be met by short-term increased production and storage. The current maximum day production is estimated at **1.60 MGD** per *Technical Memorandum No. 1 – Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station,* by AECOM (2025). Based on this highest daily production needed to meet demands, the maximum day peaking factor (ratio of maximum day demand to average day demand) is calculated at **PF = 1.6**.

Demands are higher in the summer season (June to August) as shown in **Figure 2**. The summer average demand is up to **1.17 MGD** compared to the annual average of 1.00 MGD.

The Town of Exeter placed drought restrictions on water use during the years 2020 to 2022 and in September of 2025 (see **Figure 2**). Level 4 restrictions appear to reduce demands by an

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

estimated 0.1 to 0.2 MGD. However, the operators noted that it is difficult to turn over water in the system and maintain water quality when demands are low, especially during a water ban. The Cross Road Tank had to be dumped and refilled twice in 2022.

Table 2 shows the annual raw water production (MGD) from each source. Surface water supplies 57% to 68% of total demands with groundwater providing the balance.

Table 2. Annual Average Water Production by Source

Source	2018	2019	2020	2021	2022	2023	2024	2025
	MGD	MGD	MGD	MGD	MGD	MGD	MGD	MGD
Larry Lane Well	0.17	0.16	0.15	0.16	0.15	0.14	0.10	0.16
Gilman Well	0.13	0.13	0.10	0.12	0.11	0.11	0.11	0.09
Stadium Well	0.12	0.09	0.07	0.07	0.08	0.10	0.11	0.12
SWTP (includes Skinner Springs)	0.58	0.57	0.65	0.63	0.64	0.62	0.69	0.64
Total	**1.01**	**0.95**	**0.98**	**0.98**	**0.98**	**0.97**	**1.01**	**1.02**

Note: SWTP production based on finished water

Table 3 summarizes existing demands for the purposes of this memo to compare to available supply. Evaluation of future demands was not part of the scope of this memo. A maximum day demand of 2.00 MGD is projected for 2045 per *Technical Memorandum No. 1 – Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station,* by AECOM (2025).

Table 3. Summary of Existing Demands (Finished Water)

Description	Demand	Notes
Annual Average Day (MGD)	1.00	2023-2025 Finished Production Data
Summer Average Day (MGD)	1.17	Highest Summer Demand was in 2025 (2017-2025)
Maximum Day (MGD)	1.60	Per *Technical Memorandum No. 1 – Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station,* by AECOM (2025)
Peaking Factor	1.60	Max/Average

3. Groundwater Supply Capacity

The firm yield of a well is defined as the quantity of water that can be withdrawn on a continuing basis while sustaining the groundwater aquifer. The reported firm yields for the groundwater supply based on pump tests conducted in 2020 by EGGI/GZA are summarized in **Table 4**. The existing total groundwater capacity based on firm yield is 1.00 MGD. This is lower than indicated in previous studies by others.

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

Table 4. Existing Sustainable Groundwater Source and Treatment Capacity

Source	Firm Yield (MGD)	Notes
Stadium & Gilman Wells	0.50	Per *Groundwater Resource Assessment Groundwater Investigations Report* by Emery and Garrett (2020). Pump replacement and well rehab work was done to both wells in 2025.
Lary Lane Well	0.50*	Per *Groundwater Resource Assessment Groundwater Investigations Report* by Emery and Garrett (2020). Lary Lane Well needs replacement.
Total	**1.00***	
GWTP Capacity	1.08	Per *Exeter Groundwater Supply Improvement Preliminary Design Memo* by Underwood Engineers (6/20/2025)
Proposed Drinkwater Well	0.576	400 gpm PPV, anticipated online in 2027. Limited to 288,000 gallons per day for initial 2 years of operation.
Total future Groundwater	1.576	

*Emergency repairs were done to the Lary Lane Well in August of 2024. The replacement submersible pump has limited capacity to about 200 gpm (0.29 MGD) A replacement well is recommended due to the age of the well and declining yields and concerns of future damage if well cleaning is attempted.

Typical GWTP operation is to run a combination of all 3 wells at about 450 gpm total, for about 15 hours a day.

UE reviewed meter data recorded at various locations as shown in **Figure 3**. Note that the raw water meter at the GWTP includes recycled flow which is also metered (supernatant). Subtracting the supernatant flow from the plant's raw meter data provides a raw flow similar to the total of the three well meters.

Treatment efficiency is the ratio between finished water sent to distribution and raw water supplied to the treatment plant. The plant is very efficient based on the small amount of residuals that is not recycled through the plant. The finished water production is essentially the same as the raw water demand within the accuracies of the meters. Therefore, for the purposes of this memo no adjustment was made for plant efficiency.

The effective finished water capacity from groundwater is 1.00 MGD (**Table 4**). The Drinkwater Road Well will add 400 gpm of supply to the GWTP in the future but capacity will be limited to plant treatment capacity of 1.08 MGD.

Distribution water quality, including maintaining a minimum residual, depends on using some ground water supply to meet a portion of demands each day. The wells cannot be shut down for an extended period without impacting distribution water quality according to the operators.

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

Groundwater is also less expensive to treat than surface water, based on chemical cost information provided by the Town.

4. Surface Water Supply Capacity

Surface water firm yield is defined as the capacity that a source can supply water under all conditions, including extended drought. The firm yield for the Town's surface water supply based on previous engineering reports is shown in **Table 5**.

Table 5. Existing Sustainable Surface Water Source and Treatment Capacity

Source	Firm Yield (MGD)	Notes
Exeter River & Reservoir System	1.57	Firm Yield with hydraulic pumping constraints Per *Technical Memorandum No. 1 – Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station,* by AECOM (2025)
Skinner Springs	0.1	Estimates range: 0.05 to 0.125 MGD Per *Water System Evaluation Study*, by CDM (2002)
Total Source Capacity	**1.67**	
Finished Water Treatment Capacity	**1.25**	Based on historical maximum day production (Table 7)

The Exeter River and Exeter Reservoir have historically been used separately on a seasonal basis. The Exeter River was typically used from May to November, and the Reservoir was used from November to May. The Reservoir water quality is very challenging to treat in the summer months due to rising temperatures and low flow. In the past couple years, the Town has demonstrated the ability to pump from the Exeter River Pump Station to the Exeter Reservoir in the winter to supplement the supply of the Reservoir. For the purpose of this memo the firm yield of the Exeter River and Exeter Reservoir are combined, consistent with *Technical Memorandum No. 1 – Evaluation of Exeter Surface Water Treatment Plant and Exeter River Pump Station,* by AECOM (2025).

Typical SWTP operation is to run the plant 24/7 (personnel on site during the day) and maintain a minimum raw water flow of 0.65 MGD for clarifier flushing. Recent improvements to controls now allow a lower plant operating flow. One clarifier is typically used but when additional water is needed two clarifiers are run. Skinner Springs is typically run at around 60,000 gallons per day and fed to the plant prior to filtration. Total raw water demand is calculated based on the sum of the SWTP inlet flow meter and the Skinner Springs flow meter (**Figure 4**).

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

The average plant efficiency as defined by the ratio of finished water flow to raw water flow is **82%** (**Table 6**). The low plant efficiency is due to the aging equipment, challenging water quality and inability to recycle backwash water without significant impact to the treatment process. A modern plant with about 95%+ efficiency would provide more capacity and reduce impacts to the WWTF.

Table 6. Average SWTP Efficiency

Year	Raw Water (MGD)	Finished Water (MGD)	Average Efficiency
2023	0.76	0.62	82%
2024	0.84	0.69	82%
2025	0.77	0.64	83%
3-Yr Average	**0.79**	**0.65**	**82%**

The historical maximum day production for the SWTP is **1.25 MGD** (**Table 7**). The existing SWTP can be run at up to 1.5 MGD but only for very short-term periods (less than 24 hours) before there are water quality and process impacts per discussion with the operators. This is not a sustainable production rate. The firm yield shown above (**Table 5**) is considered a long-term sustainable rate in drought conditions. Normally the yield of the surface water sources is higher in non-drought conditions, but it is important to plan supply needs based on the sustainable yields.

Table 7. Historical Maximum SWTP Production

Year	Raw Water (MGD)	Finished Water (MGD)	Date (Note 1)
2017	1.25	1.14	4/5/2017
2018	1.20	1.01	10/18/2018
2019	0.99	0.95	9/21/2019
2020	**1.39**	**1.25**	6/20/2020
2021	1.28	1.19	7/1/2021
2022	1.14	1.08	7/19/2022
2023	1.21	1.05	7/13/2023
2024	1.28	1.20	7/10/2024
2025	1.34	1.24	9/14/2025

Note: 1. Date based on maximum finished water production

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

5. Total Supply vs. Demands

5.1 Total Capacity

Exeter's total water supply capacity is summarized in **Table 8** based on the above review of the firm yield of the groundwater and surface water supplies. It is noted that this is the yield that a given source can sustainably supply even under conditions of extended drought. Supplies are often operated at withdrawal rates exceeding the firm yield during times of normal precipitation. The total source capacity is **2.25 MGD**. If Lary Lane well is out of service, the source capacity is reduced to **1.75 MGD**. Note that completion of the Drinkwater Road production well (400 gpm) is planned in 2026-2027. The Drinkwater Road Well will provide redundancy for the other wells (**Figure 5**).

Table 8. Existing Total Finished Water Capacity

Source	Finished Water Capacity (MGD)
SWTP	1.25
GWTP	1.00*
Total All Sources	2.25
Total largest well out of service (Lary Lane @ 0.5 MGD)	**1.75**

*The Lary Lane Well is currently limited to 200 gpm due to emergency repairs

5.2 Supply Criteria – Regulatory Recommendations

The following criteria establish water supply capacity requirements for large water systems in New Hampshire:

Recommended Standards for Water Works 2003 (Adopted by reference by Env-Dw 404):

- For groundwater sources, the total developed capacity shall equal or exceed the design maximum day demand with the largest well offline.
- For surface water sources, the sources shall be adequate to meet the maximum projected water demand based on a one in fifty-year drought or extreme drought of record and should include consideration of multiple year droughts.

NHDES Env-Dw 404.01(h) provides the following exception:

- The total developed groundwater source capacity shall equal or exceed the design maximum day demand and equal or exceed the design average day demand with the largest producing well out of service.

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

5.3 Supply Capacity vs. Demands

With consideration of the above supply criteria, **Tables 9A, 9B,** and **Figure 5** show total finished capacity versus existing demands. The excess capacity for summer average demands is **0.58 MGD** based on NHDES criteria with the Lary Lane well out of service (**Table 9A**).

Table 9A. Total Firm Capacity vs. Summer Average Day Demands

Parameter	Capacity (MGD)	Notes
Total Finished Water Capacity	2.25	Based on Table 8
Existing Summer Average Day Demand	1.17	Based on Table 3
Excess Capacity with all sources	1.08	Total Capacity minus existing demands
Excess Capacity (Largest Well Out of Service)	**0.58**	Lary Lane Well out of service. NHDES Criteria (required)

The excess capacity for max day demands based on NHDES criteria with all sources online is **0.65 MGD** (**Table 9B**). This is reduced to **0.15 MGD** when the largest well is out of service under the more stringent Recommended Standards for Water Works (RSWW) criteria (**Table 9B**).

Table 9B. Total Firm Capacity vs. Maximum Day Demands

Parameter	Capacity (MGD)	Notes
Total Finished Water Capacity	2.25	Based on Table 8
Existing Maximum Day Demand	1.60	Based on Table 3
Excess Capacity with all sources	**0.65**	NHDES Criteria (required)
Excess Capacity (Largest Well Out of Service)	0.15	RSWW Criteria (optional)

Maximum day events can be met by short-term increased production from surface water in excess of the firm yield when drought conditions are not limiting and storage is available. However the existing SWTP capacity is effectively limited to less than the safe yield.

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

6. Summary and Conclusions

- Existing average finished water demand is 1.0 MGD and Max Day Demand is 1.60 MGD (non-flushing).
- Groundwater Capacity is 1.00 MGD (finished) based on firm yield of existing supplies and GWTP.
- Surface Water Capacity has seasonal limitations. Surface Water Capacity is 1.25 MGD limited by SWTP treatment capacity which is less than the of firm yield of the Exeter River and Exeter Reservoir. 1.57 MGD is the most recent estimated firm yield of the Exeter River and Reservoir System per AECOM memo dated 2025.
- The SWTP efficiency is about 82% based on data from 2023-2025 (last 3 years).
- Total surface water and groundwater capacity is 2.25 MGD.
- There is 0.15 MGD excess available capacity for maximum day demands if the largest well is out of service per RSWW criteria.
- The operators report the Lary Lane Well is currently producing about 200 GPM (0.29 MGD) versus its estimated firm yield of 0.5 MGD. The well house also has structural issues.
- Water bans have been used in the past to reduce demands as needed during drought conditions by about 0.1 to 0.2 MGD, and are an option to manage high demands.
- However, reducing demands makes maintaining water quality more challenging in the distribution system.
- Water conservation measures are an option to manage high demands in the near term until additional supplies are available.
- The proposed Drinkwater Rd Well will provide redundancy to the other wells under typical operation or supplemental supply when capacity from all wells is needed.

7. Recommendations

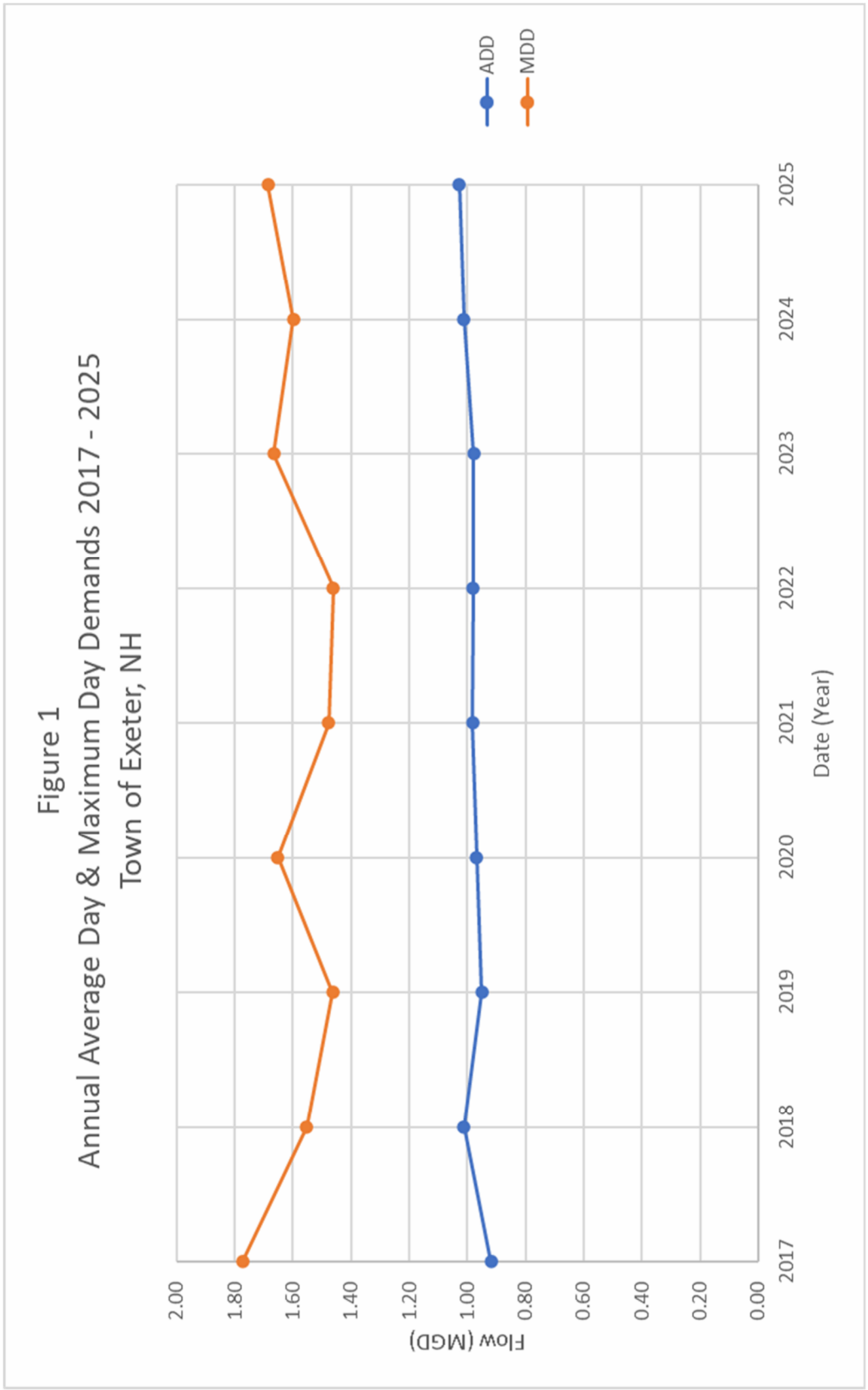
- Confirm the desired level of service; i.e. to meet maximum day demands with all wells in service (NHDES Standard -required) or with one well out of service (RSWW - optional but recommended).
- Continue to advance the proposed well at the PEA property off Drinkwater Road.
- Install Lary Lane Replacement Well to restore productivity and reliability.
- Review new connections to the system for impacts to supply.
- Advance planning for replacement of the Surface Water Treatment Plant to provide a more efficient and reliable facility.

Attachments

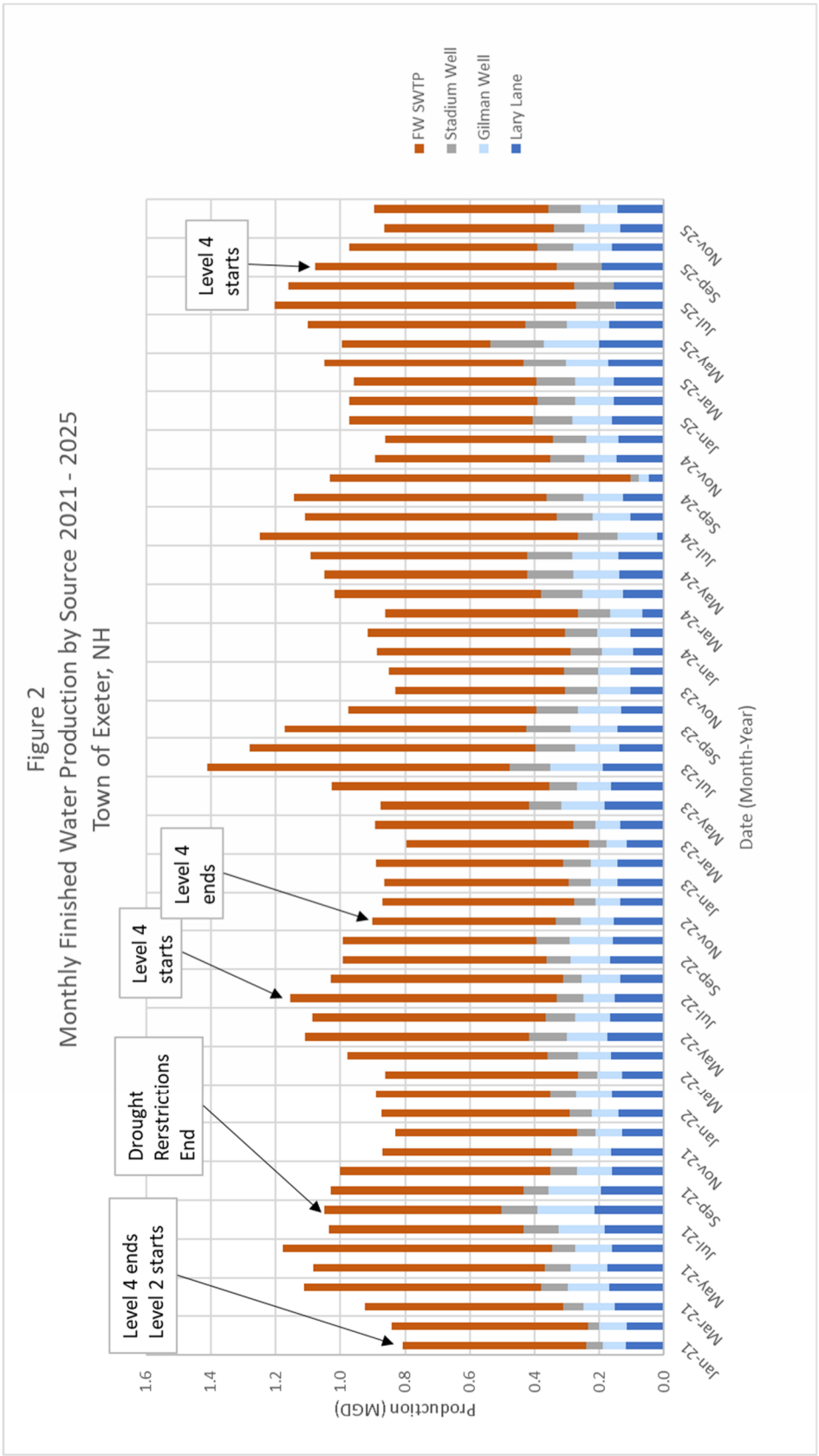
Figure 1 – Annual Average Daily Flows & Maximum Daily Flows 2017-2025

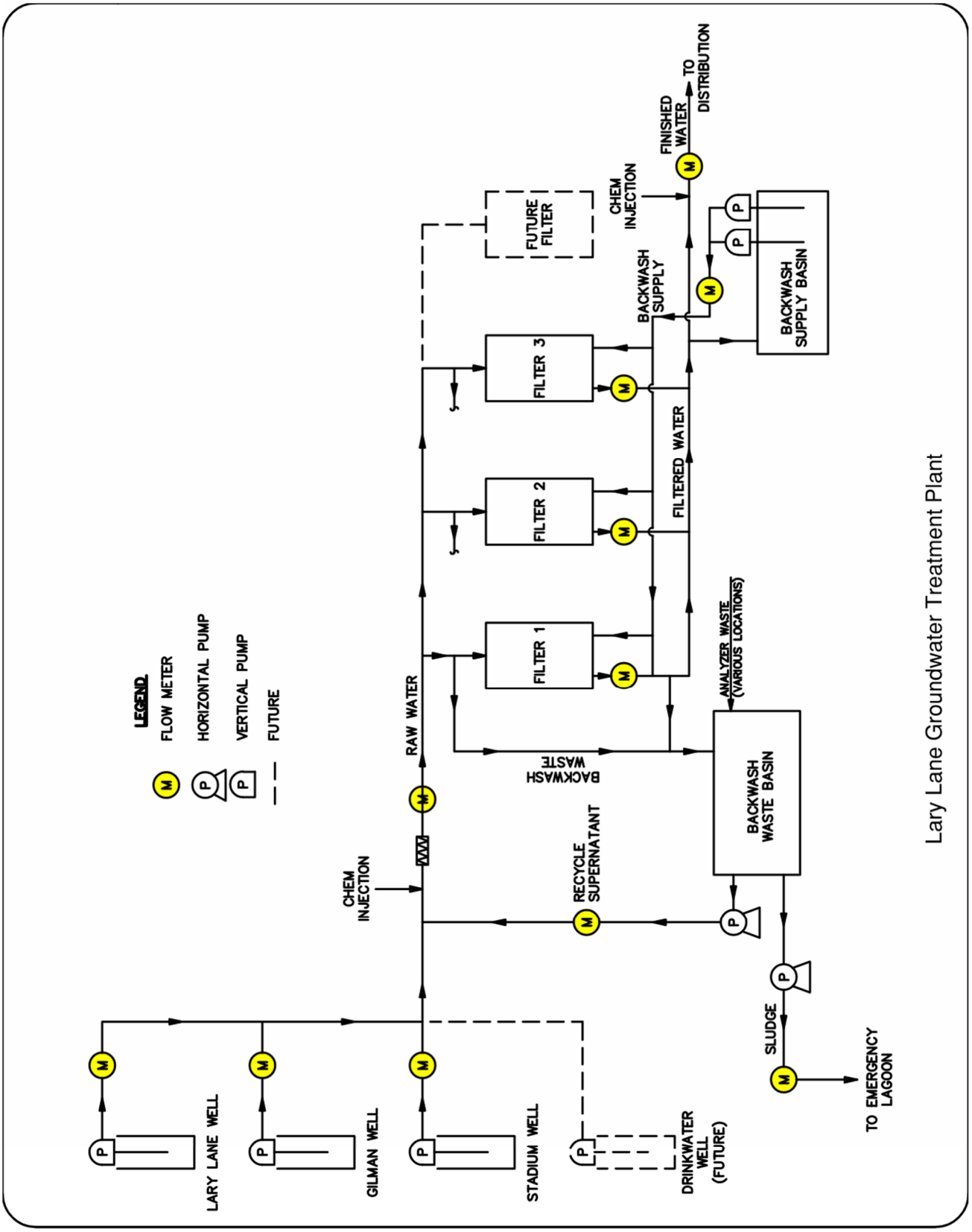
25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192

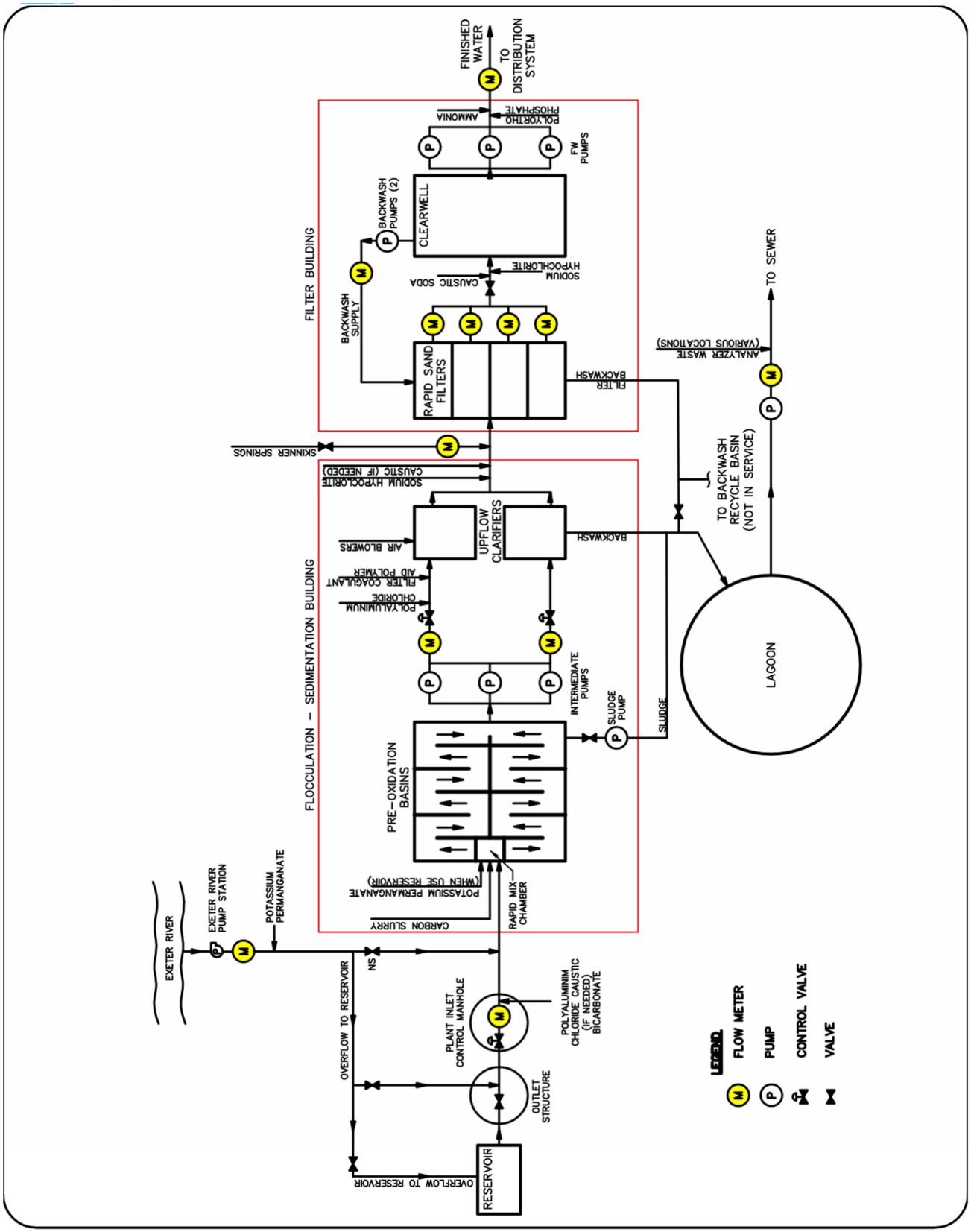


25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192





DATE		EXETER GROUNDWATER SUPPLY & WTP PROCESS FLOW DIAGRAM	FIG.
8/23	UNDERWOOD engineers	TOWN OF EXETER	3
PROJECT 2417	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	EXETER, N.H.	



DATE		FIG.
8/23	EXETER SURFACE WATER SUPPLY & WTP PROCESS FLOW DIAGRAM TOWN OF EXETER EXETER, N.H.	4
PROJECT 2417		

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603–436–6192 Fax. 603–431–4733

25 Vaughan Mall
Portsmouth, NH 03801
Tel: 603.436.6192