Pump Capacity & Pumping Schedules

Introduction

The water supply system of our dairy park comprises of:

1. Pumps, facilitated by “Water Pump Stations”
2. Storage reservoirs, facilitated by “Overhead Tanks”, and
3. Pipe network to convey the water.

Methodology:

This report is completed in two segments:

1. Determination of Pump Capacity
2. Determination of Pumping Schedules

Pump type:

Pumps can be of different types, including but not limited to:

1. Submersible pump
2. Turbine pump
3. Centrifugal pump

For our dairy park, submersible pump is chosen. It will be installed in the housing pipe (below static water level but above the top of strainer).

Assumptions

- Pump efficiency: 75%
- Velocity for water supply: 3 fps
- Friction loss: 10% of maximum pipe length
- Tallest building: 6 storey = 60 ft
- Overhead tank height: 15 ft

Determination of Pump Capacity

Steps:

1. The dairy park is divided into two major zones:
    a. Zone 1 (Residential, Commercial, Administrative Zone): Comprises of facilities of the respective wings. The left side of the layout.
    b. Zone 2 (Industrial Zone): Comprises *mostly* of facilities of industrial wing. The right side of the layout.
2. Peak water demand for each zone is determined using the report "Estimate Water Demand". For each zone,
    $$WaterDemand = \Sigma(RelevantFacilitiesDemand) + FirefightingDemand$$
3. Total pump required for each zone is determined by dividing total water demand with design pump yields.
4. Capacity of each pump is determined.

Water Demand of Each Zone

Zone / Facilities	Peak Water Demand: Present (lpd)	Peak Water Demand: In 10 Years (lpd)	Peak Water Demand: In 20 Years (lpd)	Peak Water Demand: In 30 Years (lpd)
Industrial	**1,525,632**	**1,908,032**	**1,984,434**	**2,060,374**
Bottle Inventory	378	504	546	546
Chilling & Filtration Block	588	840	840	840
Cold Storage Warehouse	378	504	525	546
Cow Barn A	1,260	1,680	1,764	1,764
Cow Barn B	1,260	1,680	1,764	1,764
Effluent Treatment Plant	273	357	378	399
Industrial (Production)	1,512,000	1,890,000	1,965,600	2,041,200
Milking Center Utilities	84	126	126	126
Milking Rotary	1,117	1,452	1,564	1,564
Packaging Station	2,772	3,654	3,780	3,906
Processing Core	3,780	4,914	5,166	5,292
Raw Milk Silos	105	147	147	147
Sewage Treatment Plant	135	180	180	195
Shipping Docks	126	189	189	189
Solid Waste Dump	840	1,080	1,140	1,140
Truck Staging Yard	536	725	725	756
Residential, Commercial, Administrative	**954,880**	**1,175,442**	**1,255,584**	**1,342,120**
Automotive Department	1,080	1,440	1,440	1,512
Bank	16,875	21,600	22,613	23,288
Central Mosque	144,000	180,000	187,200	194,400
CMS	3,600	4,500	4,800	5,100
Communication Services	3,780	4,860	5,130	5,400
Corporate HQ	17,888	22,613	23,288	24,300

Zone / Facilities	Peak Water Demand: Present (lpd)	Peak Water Demand: In 10 Years (lpd)	Peak Water Demand: In 20 Years (lpd)	Peak Water Demand: In 30 Years (lpd)
Daycare & Gym	21,600	27,720	28,800	29,880
Education Department	168,070	215,130	223,533	231,937
Essential Services	1,960	2,520	2,660	2,800
Exhibition Center	20,250	25,380	26,325	27,405
Fire Station	2,240	2,800	2,940	3,080
Food Court	15,750	20,160	21,105	21,735
Health Department	75,000	96,000	99,750	103,500
Inspection Bay	240	300	360	360
Insurance	1,350	1,890	1,890	1,890
IT Center	525	735	735	735
Logistics & Customs Office	4,050	5,063	5,400	5,738
Park & Community Department	22,500	28,800	29,970	31,050
Park Op. Center	450	630	630	630
Parking Lot	900	1,125	1,181	1,238
Power Plant	540	720	720	780
QA Office	1,960	2,520	2,660	2,660
R&D Facility	3,360	4,200	4,620	4,620
Residential Estate Office	5,063	6,413	6,750	7,088
Retail & Café	10,800	14,040	14,580	15,120
Security Checkpoint	180	270	270	270
Shopping Complex & Super Market	18,000	23,175	24,075	24,975
Training Academy	36,000	45,000	46,800	48,600
Veterinary	5,040	6,720	6,720	7,056
Veterinary Office	5,040	6,300	6,720	7,140

Zone / Facilities	Peak Water Demand: Present (lpd)	Peak Water Demand: In 10 Years (lpd)	Peak Water Demand: In 20 Years (lpd)	Peak Water Demand: In 30 Years (lpd)
Water Pump Station	90	120	120	135
Building Type - Villa	36,400	40,300	44,850	49,400
Building Type - A	49,500	55,500	61,000	67,500
Building Type - B	58,500	67,500	75,150	83,700
Building Type - C	94,500	111,000	125,400	141,900
Building Type - D	107,800	128,400	145,400	165,200
Grand Total	**2,480,512**	**3,083,474**	**3,240,018**	**3,402,494**

Number of Pump Requirements

Zone	Peak Water Demand: Present (lpd)	Pump Count: Present	Peak Water Demand: In 10 Years (lpd)	Pump Count: In 10 Years	Peak Water Demand: In 20 Years (lpd)	Pump Count: In 20 Years	Peak Water Demand: In 30 Years (lpd)	Pump Count: In 30 Years
Residential, Commercial, Administrative	969,896	3	1,190,458	3	1,270,600	3	1,357,136	3
Industrial	1,540,648	4	1,923,048	5	1,999,450	5	2,075,390	5
Total	**2,510,544**	**7**	**3,113,506**	**8**	**3,270,050**	**8**	**3,432,526**	**8**

Note: Firefighting demand of 15016 L is considered independently for each zone.

Sample Calculation: Pump Capacity

Pump 1:

- Suction head: 0
- Delivery head: $30 + 60 = 90$ ft
- Velocity head: $\frac{3^2}{2*32.19} = 0.14$ ft
- Maximum horizontal distance: 888 ft
- Maximum pipe length: $888 + 60 + 15 = 963$ ft
- Friction head: $963 \times 0.1 = 96.3$ ft
- Therefore, total head: $0 + 90 + 0.14 + 96.3 = 186.44$ ft
- Yield of well: $29{,}563$ lph $= 130.16$ gpm
- Working horsepower, WHP: $\frac{186.44 \times 130.16}{3960} \approx 7$
- Breaking horsepower, BHP: $\frac{7}{0.75} \approx 10$

Pump Capacity

Pump	Pipe Length (ft)	Friction Head (ft)	Static Head (ft)	Velocity Head (ft)	Total Head (ft)	Yield of Well (gpm)	WHP (HP)	BHP (HP)
Pump 1	963	96.3	90	0.14	186.44	130.16	7	10
Pump 2	240	24	90	0.14	114.14	130.16	4	6
Pump 3	340	34	90	0.14	124.14	130.16	5	7
Pump 4	735	73.5	90	0.14	163.64	130.16	6	8
Pump 5	240	24	90	0.14	114.14	130.16	4	6
Pump 6	1430	143	90	0.14	233.14	130.16	8	11
Pump 7	1110	111	90	0.14	201.14	130.16	7	10
Pump 8	920	92	90	0.14	182.14	130.16	6	8

Determination of Pumping Schedule

Steps:

1. Water demand of each zone was used as aggregated earlier.
2. A 24-hour diurnal demand pattern was established using assigned or average peak factors for the zone and peak operational hours to determine hourly water demands.
3. Pumping chart was prepared:
    a. How many pumps need to be activated was determined as:
    $$\frac{Demand_t + Demand_{t+1} - Storage_t + Storage_{reserve}}{PumpYield}$$
    b. Pump was turned on by accounting for which pump was least used throughout the day to distribute the load evenly across the park.
4. Demand curve was prepared.

Method of supply:

In municipal and industrial water supply design, two primary methods of supply are generally considered:

1. Continuous Supply System
2. Intermittent Supply System

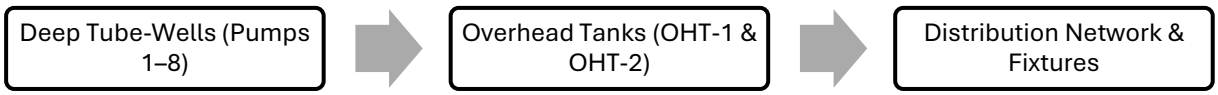
For the proposed 90-acre Dairy Farm Industrial Park, a Continuous Supply System has been selected.

Method of distribution:

The distribution of treated groundwater from production wells to fixtures across the park can be accomplished through two distinct configurations:

1. System with Direct Pumping
2. System with Pumping and Storage (Overhead Tanks)

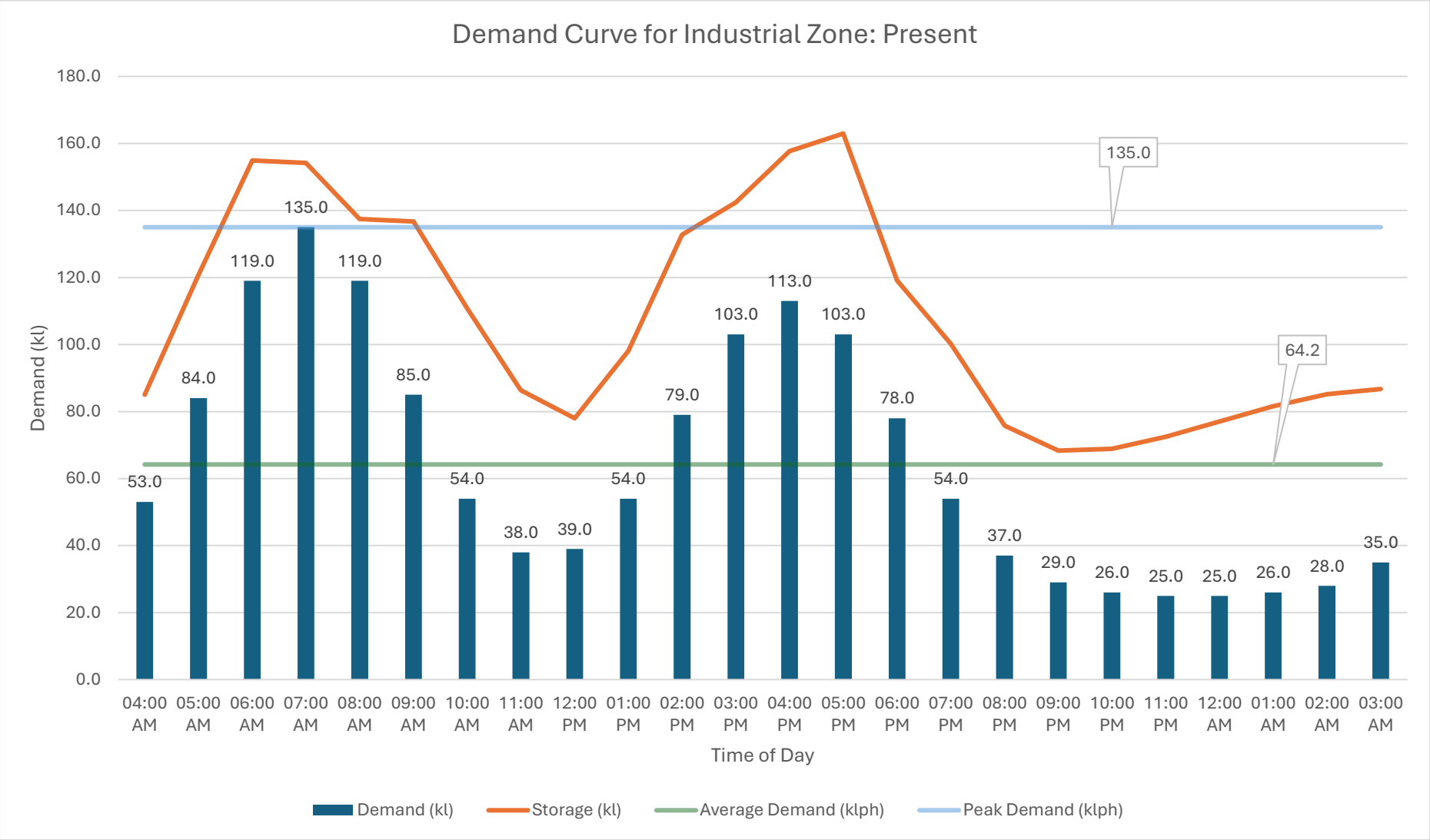
The water distribution network for this park is designed as a System with Pumping and Storage.



Schedule: Zone 2 - Industrial, Present

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
04:00 AM	05:00 AM	53.0	85.0	3	88.7	120.7	X	X	X		
05:00 AM	06:00 AM	84.0	120.7	4	118.3	154.9	X	X		X	X
06:00 AM	07:00 AM	119.0	154.9	4	118.3	154.2	X		X	X	X
07:00 AM	08:00 AM	135.0	154.2	4	118.3	137.4		X	X	X	X
08:00 AM	09:00 AM	119.0	137.4	4	118.3	136.7	X	X	X	X	
09:00 AM	10:00 AM	85.0	136.7	2	59.1	110.8	X				X
10:00 AM	11:00 AM	54.0	110.8	1	29.6	86.4		X			
11:00 AM	12:00 PM	38.0	86.4	1	29.6	77.9			X		
12:00 PM	01:00 PM	39.0	77.9	2	59.1	98.1				X	X
01:00 PM	02:00 PM	54.0	98.1	3	88.7	132.8	X	X	X		
02:00 PM	03:00 PM	79.0	132.8	3	88.7	142.5	X			X	X
03:00 PM	04:00 PM	103.0	142.5	4	118.3	157.7		X	X	X	X
04:00 PM	05:00 PM	113.0	157.7	4	118.3	163.0	X	X	X	X	
05:00 PM	06:00 PM	103.0	163.0	2	59.1	119.1	X				X
06:00 PM	07:00 PM	78.0	119.1	2	59.1	100.2		X	X		
07:00 PM	08:00 PM	54.0	100.2	1	29.6	75.8				X	
08:00 PM	09:00 PM	37.0	75.8	1	29.6	68.3					X
09:00 PM	10:00 PM	29.0	68.3	1	29.6	68.9	X				
10:00 PM	11:00 PM	26.0	68.9	1	29.6	72.5		X			
11:00 PM	12:00 AM	25.0	72.5	1	29.6	77.0			X		
12:00 AM	01:00 AM	25.0	77.0	1	29.6	81.6				X	
01:00 AM	02:00 AM	26.0	81.6	1	29.6	85.2					X
02:00 AM	03:00 AM	28.0	85.2	1	29.6	86.7	X				
03:00 AM	04:00 AM	35.0	86.7	1	29.6	81.3		X			
Total		**1,541.0**			**1,566.8**		**11**	**11**	**11**	**10**	**10**

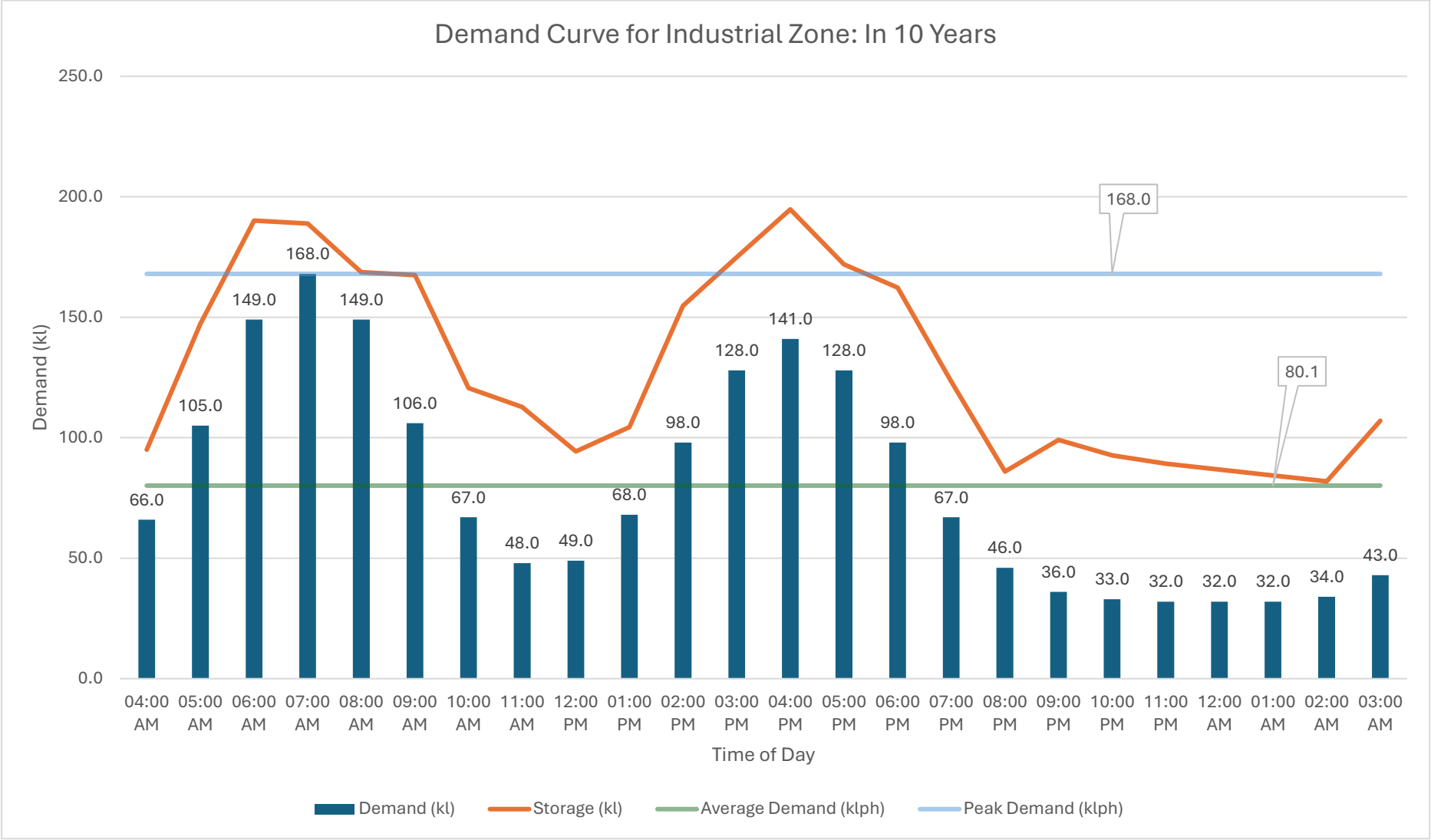
Demand Curve: Zone 2 – Industrial, Present



Schedule: Zone 2 - Industrial, In 10 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
04:00 AM	05:00 AM	66.0	95.0	4	118.3	147.3	X	X	X	X	
05:00 AM	06:00 AM	105.0	147.3	5	147.8	190.1	X	X	X	X	X
06:00 AM	07:00 AM	149.0	190.1	5	147.8	188.9	X	X	X	X	X
07:00 AM	08:00 AM	168.0	188.9	5	147.8	168.7	X	X	X	X	X
08:00 AM	09:00 AM	149.0	168.7	5	147.8	167.5	X	X	X	X	X
09:00 AM	10:00 AM	106.0	167.5	2	59.1	120.6	X				X
10:00 AM	11:00 AM	67.0	120.6	2	59.1	112.8		X	X		
11:00 AM	12:00 PM	48.0	112.8	1	29.6	94.3				X	
12:00 PM	01:00 PM	49.0	94.3	2	59.1	104.5	X				X
01:00 PM	02:00 PM	68.0	104.5	4	118.3	154.7		X	X	X	X
02:00 PM	03:00 PM	98.0	154.7	4	118.3	175.0	X	X	X	X	
03:00 PM	04:00 PM	128.0	175.0	5	147.8	194.8	X	X	X	X	X
04:00 PM	05:00 PM	141.0	194.8	4	118.3	172.0	X	X	X		X
05:00 PM	06:00 PM	128.0	172.0	4	118.3	162.3	X	X		X	X
06:00 PM	07:00 PM	98.0	162.3	2	59.1	123.4			X	X	
07:00 PM	08:00 PM	67.0	123.4	1	29.6	86.0					X
08:00 PM	09:00 PM	46.0	86.0	2	59.1	99.1	X	X			
09:00 PM	10:00 PM	36.0	99.1	1	29.6	92.7			X		
10:00 PM	11:00 PM	33.0	92.7	1	29.6	89.2				X	
11:00 PM	12:00 AM	32.0	89.2	1	29.6	86.8					X
12:00 AM	01:00 AM	32.0	86.8	1	29.6	84.3	X				
01:00 AM	02:00 AM	32.0	84.3	1	29.6	81.9		X			
02:00 AM	03:00 AM	34.0	81.9	2	59.1	107.0			X	X	
03:00 AM	04:00 AM	43.0	107.0	1	29.6	93.6					X
Total		**1,923.0**			**1,921.6**		**13**	**13**	**13**	**13**	**13**

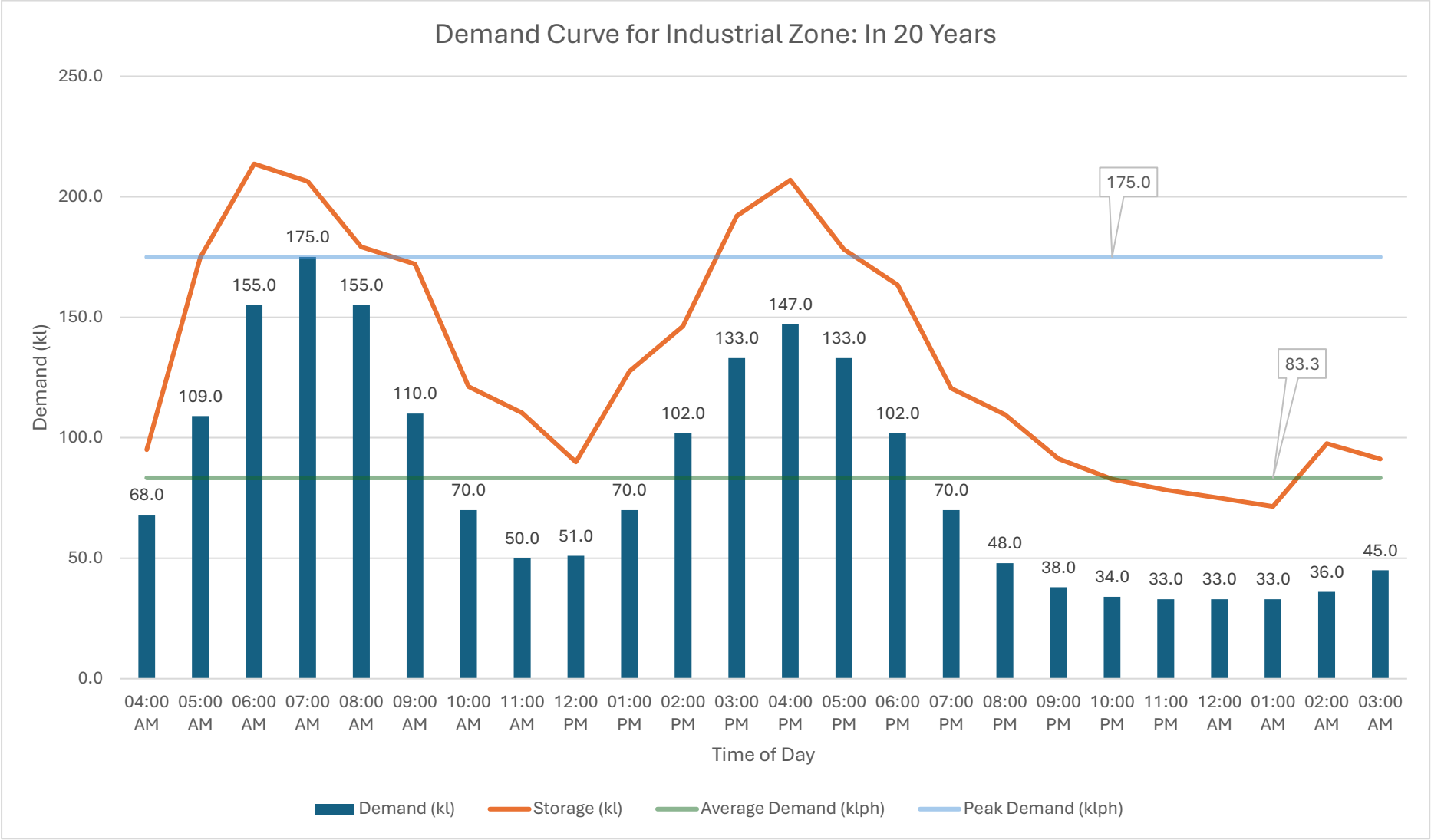
Demand Curve: Zone 2 – Industrial, In 10 Years



Schedule: Zone 2 - Industrial, In 20 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
04:00 AM	05:00 AM	68.0	95.0	5	147.8	174.8	X	X	X	X	X
05:00 AM	06:00 AM	109.0	174.8	5	147.8	213.6	X	X	X	X	X
06:00 AM	07:00 AM	155.0	213.6	5	147.8	206.4	X	X	X	X	X
07:00 AM	08:00 AM	175.0	206.4	5	147.8	179.3	X	X	X	X	X
08:00 AM	09:00 AM	155.0	179.3	5	147.8	172.1	X	X	X	X	X
09:00 AM	10:00 AM	110.0	172.1	2	59.1	121.2	X	X			
10:00 AM	11:00 AM	70.0	121.2	2	59.1	110.3			X	X	
11:00 AM	12:00 PM	50.0	110.3	1	29.6	89.9					X
12:00 PM	01:00 PM	51.0	89.9	3	88.7	127.6	X	X	X		
01:00 PM	02:00 PM	70.0	127.6	3	88.7	146.3	X			X	X
02:00 PM	03:00 PM	102.0	146.3	5	147.8	192.1	X	X	X	X	X
03:00 PM	04:00 PM	133.0	192.1	5	147.8	206.9	X	X	X	X	X
04:00 PM	05:00 PM	147.0	206.9	4	118.3	178.2		X	X	X	X
05:00 PM	06:00 PM	133.0	178.2	4	118.3	163.4	X	X	X	X	
06:00 PM	07:00 PM	102.0	163.4	2	59.1	120.5	X				X
07:00 PM	08:00 PM	70.0	120.5	2	59.1	109.7		X	X		
08:00 PM	09:00 PM	48.0	109.7	1	29.6	91.2				X	
09:00 PM	10:00 PM	38.0	91.2	1	29.6	82.8					X
10:00 PM	11:00 PM	34.0	82.8	1	29.6	78.3	X				
11:00 PM	12:00 AM	33.0	78.3	1	29.6	74.9		X			
12:00 AM	01:00 AM	33.0	74.9	1	29.6	71.5			X		
01:00 AM	02:00 AM	33.0	71.5	2	59.1	97.6				X	X
02:00 AM	03:00 AM	36.0	97.6	1	29.6	91.2	X				
03:00 AM	04:00 AM	45.0	91.2	2	59.1	105.3		X	X		
Total		**2,000.0**			**2,010.3**		**14**	**14**	**14**	**13**	**13**

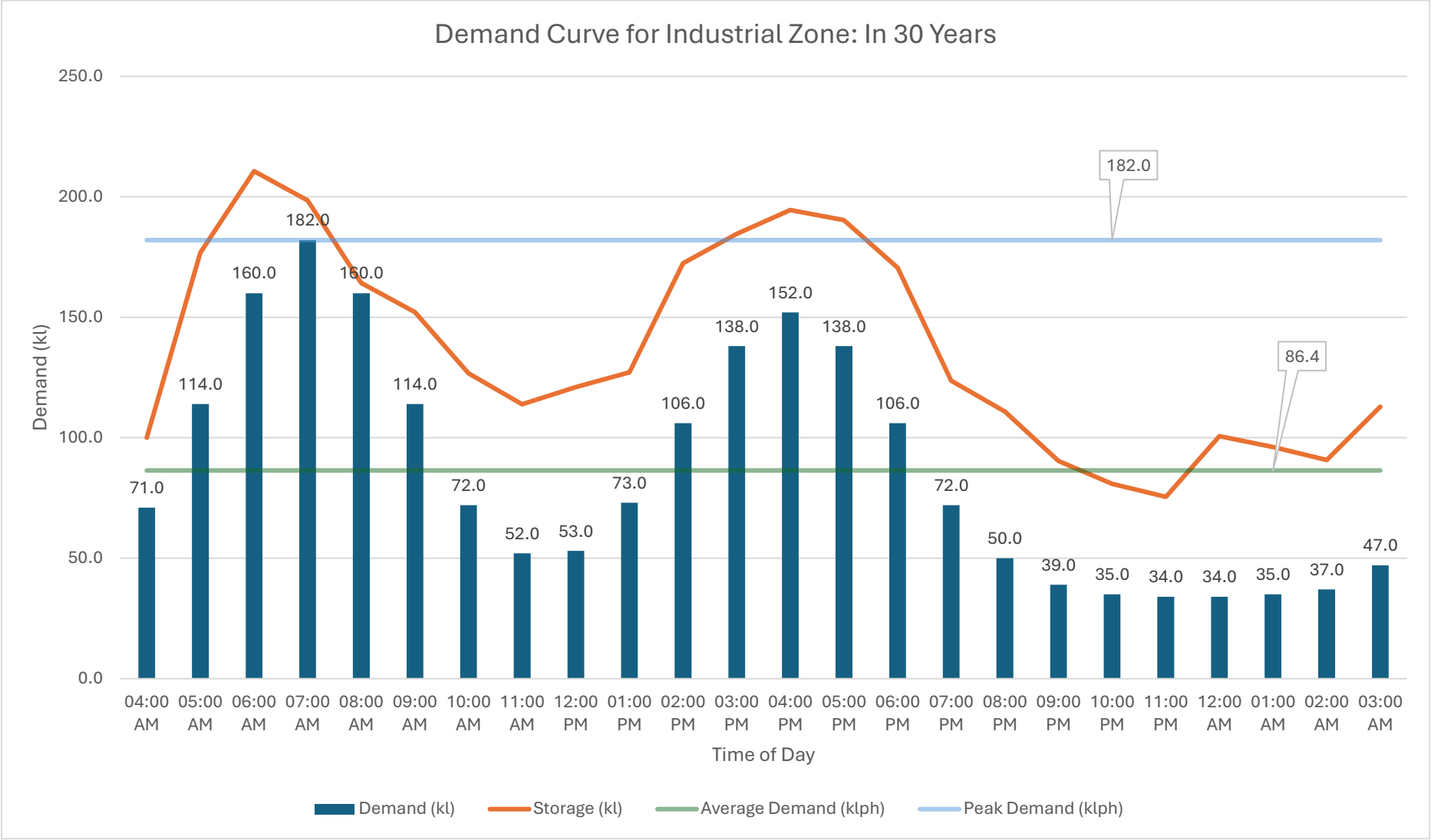
Demand Curve: Zone 2 – Industrial, In 20 Years



Schedule: Zone 2 - Industrial, In 30 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
04:00 AM	05:00 AM	71.0	100.0	5	147.8	176.8	X	X	X	X	X
05:00 AM	06:00 AM	114.0	176.8	5	147.8	210.6	X	X	X	X	X
06:00 AM	07:00 AM	160.0	210.6	5	147.8	198.4	X	X	X	X	X
07:00 AM	08:00 AM	182.0	198.4	5	147.8	164.3	X	X	X	X	X
08:00 AM	09:00 AM	160.0	164.3	5	147.8	152.1	X	X	X	X	X
09:00 AM	10:00 AM	114.0	152.1	3	88.7	126.8	X	X	X		
10:00 AM	11:00 AM	72.0	126.8	2	59.1	113.9				X	X
11:00 AM	12:00 PM	52.0	113.9	2	59.1	121.0	X	X			
12:00 PM	01:00 PM	53.0	121.0	2	59.1	127.1			X	X	
01:00 PM	02:00 PM	73.0	127.1	4	118.3	172.4	X	X	X		X
02:00 PM	03:00 PM	106.0	172.4	4	118.3	184.6	X	X		X	X
03:00 PM	04:00 PM	138.0	184.6	5	147.8	194.5	X	X	X	X	X
04:00 PM	05:00 PM	152.0	194.5	5	147.8	190.3	X	X	X	X	X
05:00 PM	06:00 PM	138.0	190.3	4	118.3	170.5	X		X	X	X
06:00 PM	07:00 PM	106.0	170.5	2	59.1	123.7		X	X		
07:00 PM	08:00 PM	72.0	123.7	2	59.1	110.8				X	X
08:00 PM	09:00 PM	50.0	110.8	1	29.6	90.3	X				
09:00 PM	10:00 PM	39.0	90.3	1	29.6	80.9		X			
10:00 PM	11:00 PM	35.0	80.9	1	29.6	75.5			X		
11:00 PM	12:00 AM	34.0	75.5	2	59.1	100.6				X	X
12:00 AM	01:00 AM	34.0	100.6	1	29.6	96.2	X				
01:00 AM	02:00 AM	35.0	96.2	1	29.6	90.7		X			
02:00 AM	03:00 AM	37.0	90.7	2	59.1	112.8			X	X	
03:00 AM	04:00 AM	47.0	112.8	1	29.6	95.4					X
Total		**2,074.0**			**2,069.4**		**14**	**14**	**14**	**14**	**14**

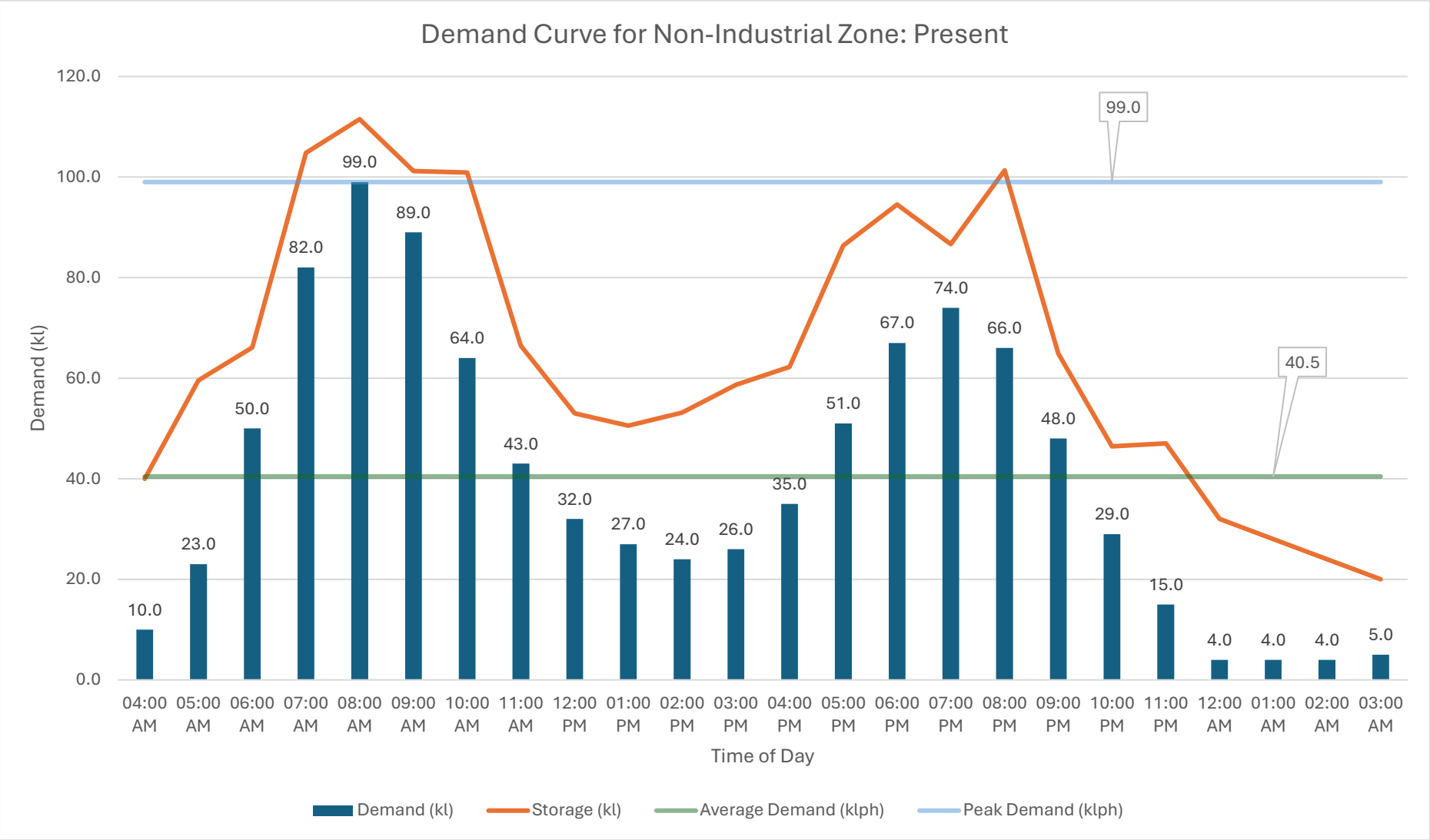
Demand Curve: Zone 2 – Industrial, In 30 Years



Schedule: Zone 1 – Residential, Commercial, Administrative, Present

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3
04:00 AM	05:00 AM	10.0	40.0	1	29.6	59.6	X		
05:00 AM	06:00 AM	23.0	59.6	1	29.6	66.1		X	
06:00 AM	07:00 AM	50.0	66.1	3	88.7	104.8	X	X	X
07:00 AM	08:00 AM	82.0	104.8	3	88.7	111.5	X	X	X
08:00 AM	09:00 AM	99.0	111.5	3	88.7	101.2	X	X	X
09:00 AM	10:00 AM	89.0	101.2	3	88.7	100.9	X	X	X
10:00 AM	11:00 AM	64.0	100.9	1	29.6	66.4			X
11:00 AM	12:00 PM	43.0	66.4	1	29.6	53.0	X		
12:00 PM	01:00 PM	32.0	53.0	1	29.6	50.6		X	
01:00 PM	02:00 PM	27.0	50.6	1	29.6	53.1			X
02:00 PM	03:00 PM	24.0	53.1	1	29.6	58.7	X		
03:00 PM	04:00 PM	26.0	58.7	1	29.6	62.3		X	
04:00 PM	05:00 PM	35.0	62.3	2	59.1	86.4	X		X
05:00 PM	06:00 PM	51.0	86.4	2	59.1	94.5		X	X
06:00 PM	07:00 PM	67.0	94.5	2	59.1	86.6	X	X	
07:00 PM	08:00 PM	74.0	86.6	3	88.7	101.3	X	X	X
08:00 PM	09:00 PM	66.0	101.3	1	29.6	64.9			X
09:00 PM	10:00 PM	48.0	64.9	1	29.6	46.5	X		
10:00 PM	11:00 PM	29.0	46.5	1	29.6	47.0		X	
11:00 PM	12:00 AM	15.0	47.0	0	0.0	32.0			
12:00 AM	01:00 AM	4.0	32.0	0	0.0	28.0			
01:00 AM	02:00 AM	4.0	28.0	0	0.0	24.0			
02:00 AM	03:00 AM	4.0	24.0	0	0.0	20.0			
03:00 AM	04:00 AM	5.0	20.0	1	29.6	44.6			X
Total		**971.0**			**975.6**		**11**	**11**	**11**

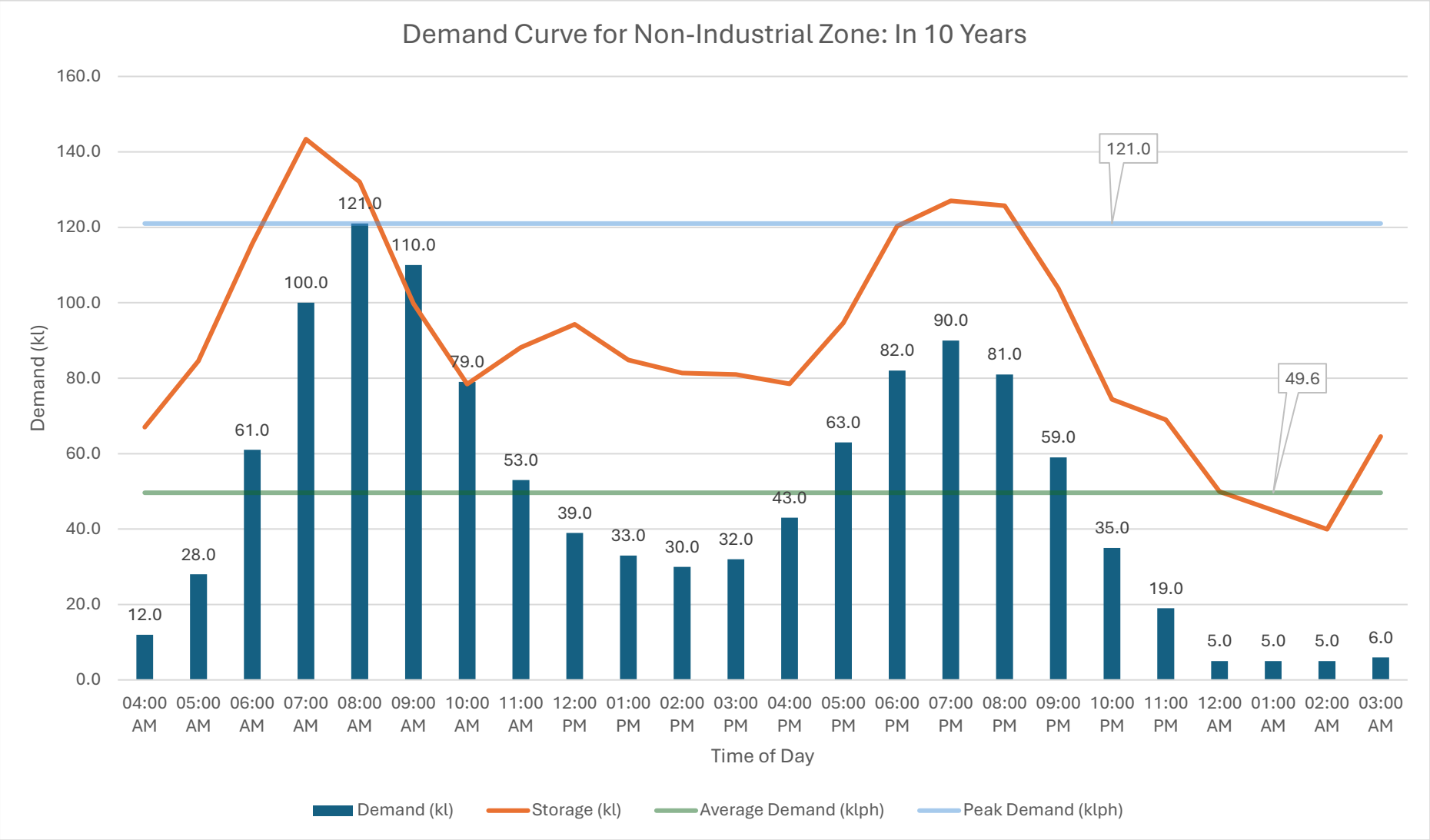
Demand Curve: Residential, Commercial, Administrative, Present



Schedule: Zone 1 – Residential, Commercial, Administrative, In 10 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3
04:00 AM	05:00 AM	12.0	67.0	1	29.6	84.6	X		
05:00 AM	06:00 AM	28.0	84.6	2	59.1	115.7		X	X
06:00 AM	07:00 AM	61.0	115.7	3	88.7	143.4	X	X	X
07:00 AM	08:00 AM	100.0	143.4	3	88.7	132.1	X	X	X
08:00 AM	09:00 AM	121.0	132.1	3	88.7	99.8	X	X	X
09:00 AM	10:00 AM	110.0	99.8	3	88.7	78.4	X	X	X
10:00 AM	11:00 AM	79.0	78.4	3	88.7	88.1	X	X	X
11:00 AM	12:00 PM	53.0	88.1	2	59.1	94.3	X	X	
12:00 PM	01:00 PM	39.0	94.3	1	29.6	84.8			X
01:00 PM	02:00 PM	33.0	84.8	1	29.6	81.4	X		
02:00 PM	03:00 PM	30.0	81.4	1	29.6	80.9		X	
03:00 PM	04:00 PM	32.0	80.9	1	29.6	78.5			X
04:00 PM	05:00 PM	43.0	78.5	2	59.1	94.6	X	X	
05:00 PM	06:00 PM	63.0	94.6	3	88.7	120.3	X	X	X
06:00 PM	07:00 PM	82.0	120.3	3	88.7	127.0	X	X	X
07:00 PM	08:00 PM	90.0	127.0	3	88.7	125.7	X	X	X
08:00 PM	09:00 PM	81.0	125.7	2	59.1	103.8	X		X
09:00 PM	10:00 PM	59.0	103.8	1	29.6	74.4		X	
10:00 PM	11:00 PM	35.0	74.4	1	29.6	69.0			X
11:00 PM	12:00 AM	19.0	69.0	0	0.0	50.0			
12:00 AM	01:00 AM	5.0	50.0	0	0.0	45.0			
01:00 AM	02:00 AM	5.0	45.0	0	0.0	40.0			
02:00 AM	03:00 AM	5.0	40.0	1	29.6	64.5	X		
03:00 AM	04:00 AM	6.0	64.5	0	0.0	58.5			
Total		**1,191.0**			**1,182.5**		**14**	**13**	**13**

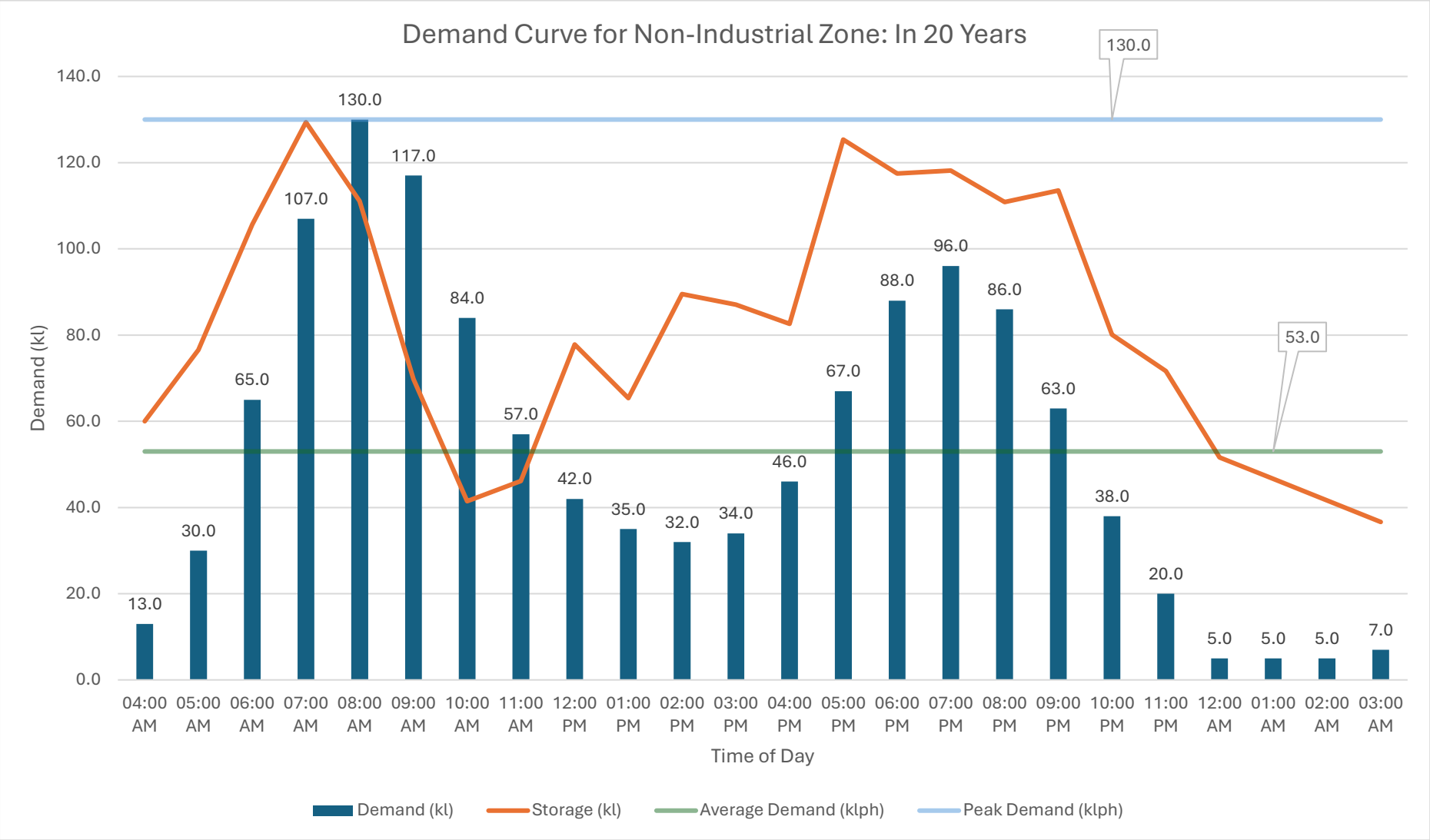
Demand Curve: Residential, Commercial, Administrative, In 10 Years



Schedule: Zone 1 – Residential, Commercial, Administrative, In 20 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3
04:00 AM	05:00 AM	13.0	60.0	1	29.6	76.6	X		
05:00 AM	06:00 AM	30.0	76.6	2	59.1	105.7		X	X
06:00 AM	07:00 AM	65.0	105.7	3	88.7	129.4	X	X	X
07:00 AM	08:00 AM	107.0	129.4	3	88.7	111.1	X	X	X
08:00 AM	09:00 AM	130.0	111.1	3	88.7	69.8	X	X	X
09:00 AM	10:00 AM	117.0	69.8	3	88.7	41.4	X	X	X
10:00 AM	11:00 AM	84.0	41.4	3	88.7	46.1	X	X	X
11:00 AM	12:00 PM	57.0	46.1	3	88.7	77.8	X	X	X
12:00 PM	01:00 PM	42.0	77.8	1	29.6	65.4	X		
01:00 PM	02:00 PM	35.0	65.4	2	59.1	89.5		X	X
02:00 PM	03:00 PM	32.0	89.5	1	29.6	87.1	X		
03:00 PM	04:00 PM	34.0	87.1	1	29.6	82.6		X	
04:00 PM	05:00 PM	46.0	82.6	3	88.7	125.3	X	X	X
05:00 PM	06:00 PM	67.0	125.3	2	59.1	117.5	X		X
06:00 PM	07:00 PM	88.0	117.5	3	88.7	118.1	X	X	X
07:00 PM	08:00 PM	96.0	118.1	3	88.7	110.8	X	X	X
08:00 PM	09:00 PM	86.0	110.8	3	88.7	113.5	X	X	X
09:00 PM	10:00 PM	63.0	113.5	1	29.6	80.1		X	
10:00 PM	11:00 PM	38.0	80.1	1	29.6	71.6			X
11:00 PM	12:00 AM	20.0	71.6	0	0.0	51.6			
12:00 AM	01:00 AM	5.0	51.6	0	0.0	46.6			
01:00 AM	02:00 AM	5.0	46.6	0	0.0	41.6			
02:00 AM	03:00 AM	5.0	41.6	0	0.0	36.6			
03:00 AM	04:00 AM	7.0	36.6	1	29.6	59.2	X		
Total		**1,272.0**			**1,271.2**		**15**	**14**	**14**

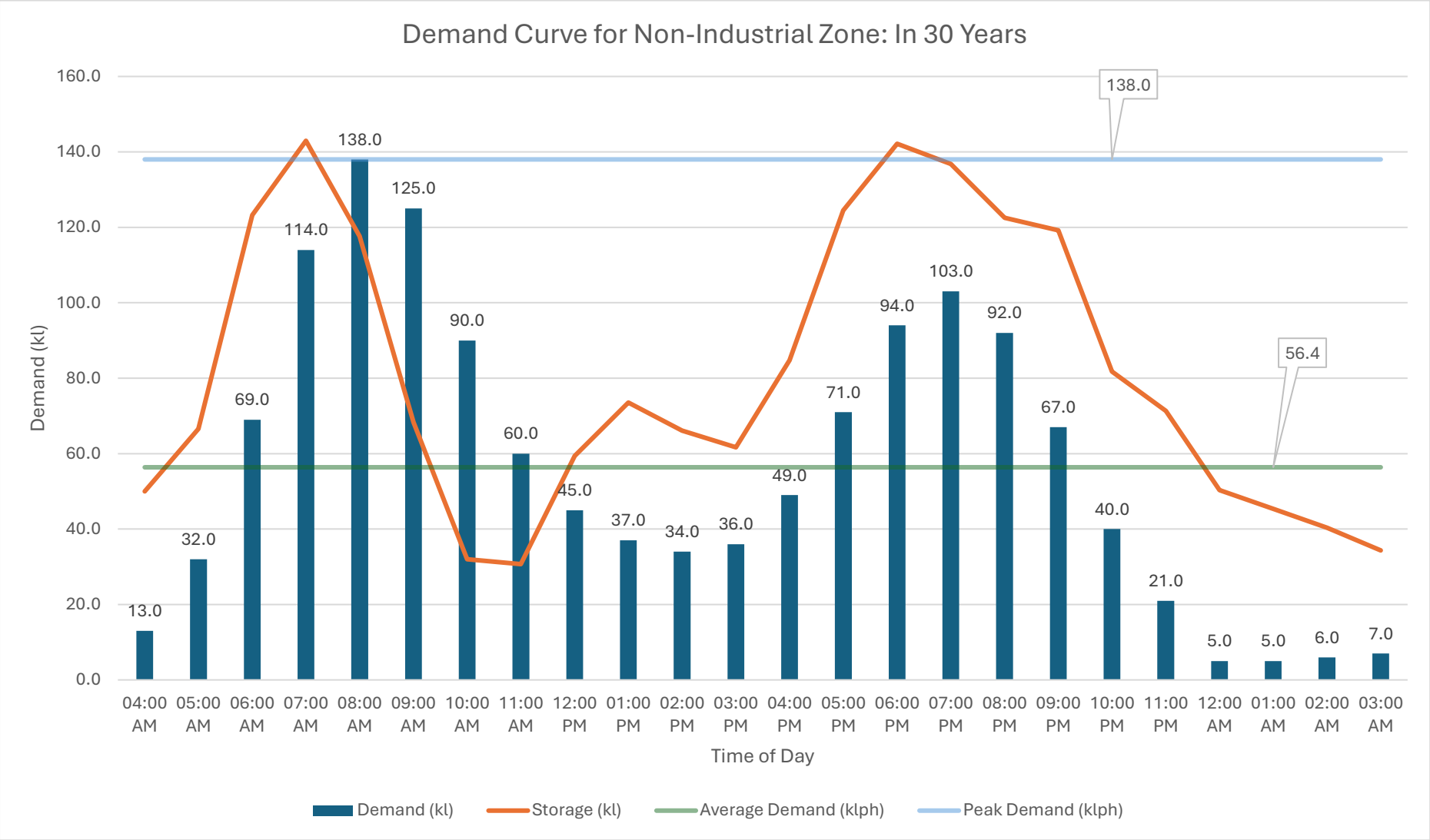
Demand Curve: Residential, Commercial, Administrative, In 20 Years



Schedule: Zone 1 – Residential, Commercial, Administrative, In 30 Years

Start Time	End Time	Demand (kl)	Current Storage (kl)	Required Pump	Supply (kl)	Net Storage (kl)	Pump 1	Pump 2	Pump 3
04:00 AM	05:00 AM	13.0	50.0	1	29.6	66.6	X		
05:00 AM	06:00 AM	32.0	66.6	3	88.7	123.3	X	X	X
06:00 AM	07:00 AM	69.0	123.3	3	88.7	142.9	X	X	X
07:00 AM	08:00 AM	114.0	142.9	3	88.7	117.6	X	X	X
08:00 AM	09:00 AM	138.0	117.6	3	88.7	68.3	X	X	X
09:00 AM	10:00 AM	125.0	68.3	3	88.7	32.0	X	X	X
10:00 AM	11:00 AM	90.0	32.0	3	88.7	30.7	X	X	X
11:00 AM	12:00 PM	60.0	30.7	3	88.7	59.4	X	X	X
12:00 PM	01:00 PM	45.0	59.4	2	59.1	73.5		X	X
01:00 PM	02:00 PM	37.0	73.5	1	29.6	66.1	X		
02:00 PM	03:00 PM	34.0	66.1	1	29.6	61.6		X	
03:00 PM	04:00 PM	36.0	61.6	2	59.1	84.8	X		X
04:00 PM	05:00 PM	49.0	84.8	3	88.7	124.5	X	X	X
05:00 PM	06:00 PM	71.0	124.5	3	88.7	142.1	X	X	X
06:00 PM	07:00 PM	94.0	142.1	3	88.7	136.8	X	X	X
07:00 PM	08:00 PM	103.0	136.8	3	88.7	122.5	X	X	X
08:00 PM	09:00 PM	92.0	122.5	3	88.7	119.2	X	X	X
09:00 PM	10:00 PM	67.0	119.2	1	29.6	81.8		X	
10:00 PM	11:00 PM	40.0	81.8	1	29.6	71.3			X
11:00 PM	12:00 AM	21.0	71.3	0	0.0	50.3			
12:00 AM	01:00 AM	5.0	50.3	0	0.0	45.3			
01:00 AM	02:00 AM	5.0	45.3	0	0.0	40.3			
02:00 AM	03:00 AM	6.0	40.3	0	0.0	34.3			
03:00 AM	04:00 AM	7.0	34.3	1	29.6	56.9	X		
Total		**1,353.0**			**1,359.9**		**16**	**15**	**15**

Demand Curve: Residential, Commercial, Administrative, In 30 Years



Summary of Pumping Schedule

Pump	Pumping Hours: Present	Pumping Hours: In 10 Years	Pumping Hours: In 20 Years	Pumping Hours: In 30 Years
Pump 1	11	14	15	16
Pump 2	11	13	14	15
Pump 3	11	13	14	15
Pump 4	11	13	14	14
Pump 5	11	13	14	14
Pump 6	10	13	14	14
Pump 7	10	13	13	14
Pump 8	10	13	13	14