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OHM Advancing Communities℠

Northville Township – Peak Hour Evaluation
Technical Memorandum
October 23, 2015

BACKGROUND AND PURPOSE

Northville Township is a wholesale water customer of the Detroit Water & Sewerage Department (DWSD). As such, they can realize financial benefits if they can reduce their peak hour water draws from DWSD. Northville Township also has existing elevated storage in their system. Managing their storage to fill during the overnight hours and low demand times and to drain during high demand times is the most apparent method available to the Township to reduce their peak hour water draw from DWSD.

To this end, OHM was asked to evaluate the Township's demands and system operations to determine how their storage could be utilized more efficiently and what the potential cost savings would be.

DWSD RATE METHODOLOGY

Several factors go into the DWSD rate calculations including the location of the metered feeds and water use under various demand conditions. For the purposes of this evaluation, the Contract Maximum Day and Peak Hour water demands are the most important factors to consider. When performing rate calculations, a community's Contract Maximum Day demand is the amount of water that community can expect not to exceed on the highest use day of the year. A community's Contract Peak Hour demand is flow rate that they can expect not to exceed during the highest use hour of the year. An exception to the Contract Peak Hour is that the hours from midnight to 6:00 AM Eastern Daylight Time (EDT) are not considered when determining a community's Peak Hour. The period from midnight to 6:00 AM is referred to as the Exclusionary Period, while the 18 hours from 6:00 AM to midnight are referred to as the Non-Exclusionary Period.

A community's peak hour draw is typically the factor that they have the most control over through effective use of water storage systems and through ordinances that restrict lawn watering to the Exclusionary Period. The greatest financial savings can be realized if a community can lower their Contract Peak Hour to the same rate as their Contract Maximum Day.

SAVINGS FROM REDUCED PEAK HOUR

Currently the Township's contract with DWSD lists a maximum day flow rate of 10.4 MGD and a peak hour flow rate of 16.9 MGD for 2015. Along with a yearly volume of 133,000 mcf and the locations of the Township's meters, this translates into a calculated revenue requirement of $5,951,100 or $44.75/mcf.

The lowest that a community can reduce their contract peak hour rate is to be equal to their contract maximum day rate. For Northville Township, some calculated revenue requirements for various peak hour rates are shown in Table 1.

Table 1: Revenue Requirements for Different Peak Hour Rates

Peak Hour Contract Rate (MGD)	Yearly Revenue Requirement	Cost per mcf
10.40	$4,035,000	$30.34
12.00	$4,506,800	$33.89
13.00	$4,801,500	$36.10
14.00	$5,096,300	$38.32
16.00	$5,685,800	$42.75
16.90	$5,951,100	$44.75

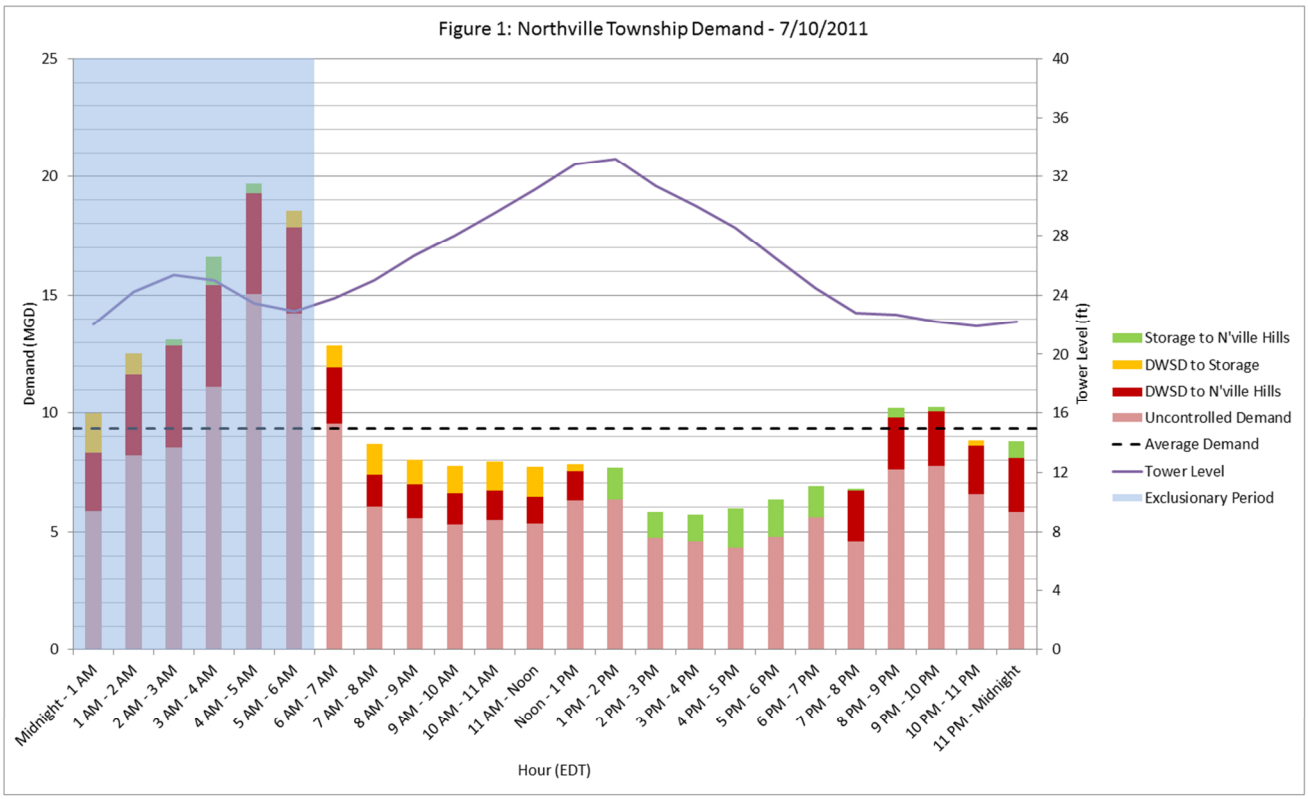
These calculations are included as an attachment to this memo.

EXISTING SYSTEM & OPERATIONS

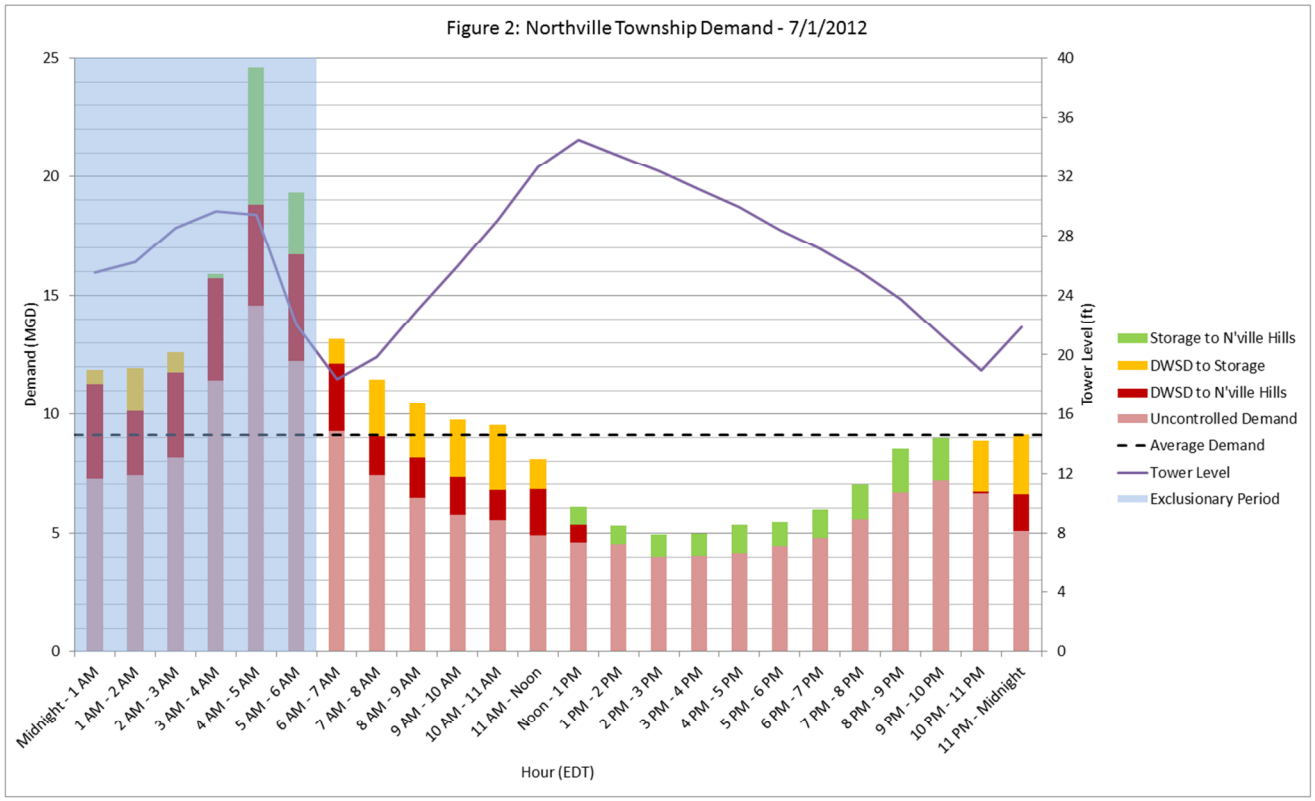
Northville Township receives water through five metered connections with DWSD. The connection known as NE-08 serves the Northville Hills Pressure District which is where the Township's elevated water storage tank is located. The Township operates a booster station known as the Five-Mile Road Booster Station (booster station) near NE-08 at the northeast corner of Five-Mile Road and Sheldon Road. The booster station has three identical pumps each with a design capacity of 1.3 MGD for a station firm capacity of 2.6 MGD and a total capacity of 3.9 MGD.

HISTORICAL WATER DEMAND AND ANALYSIS

The most recent high use days for most communities in the region occurred in the summers of 2011 and 2012. Hotter and dryer weather led to increased water demand for lawn irrigation. The Township's maximum demand day in 2011 occurred on 7/10/2011 when they used 9.3 MGD. The hourly usage for this day is shown in Figure 1.



The maximum demand day in 2012 occurred on 7/1/2012 when they used 9.1 MGD. The hourly usage for this day is shown in Figure 2. Both figures break down the Township's demand between the Northville Hills Pressure District, which can be managed through tower operations, and the remaining portions of the Township, where the demand cannot be controlled.

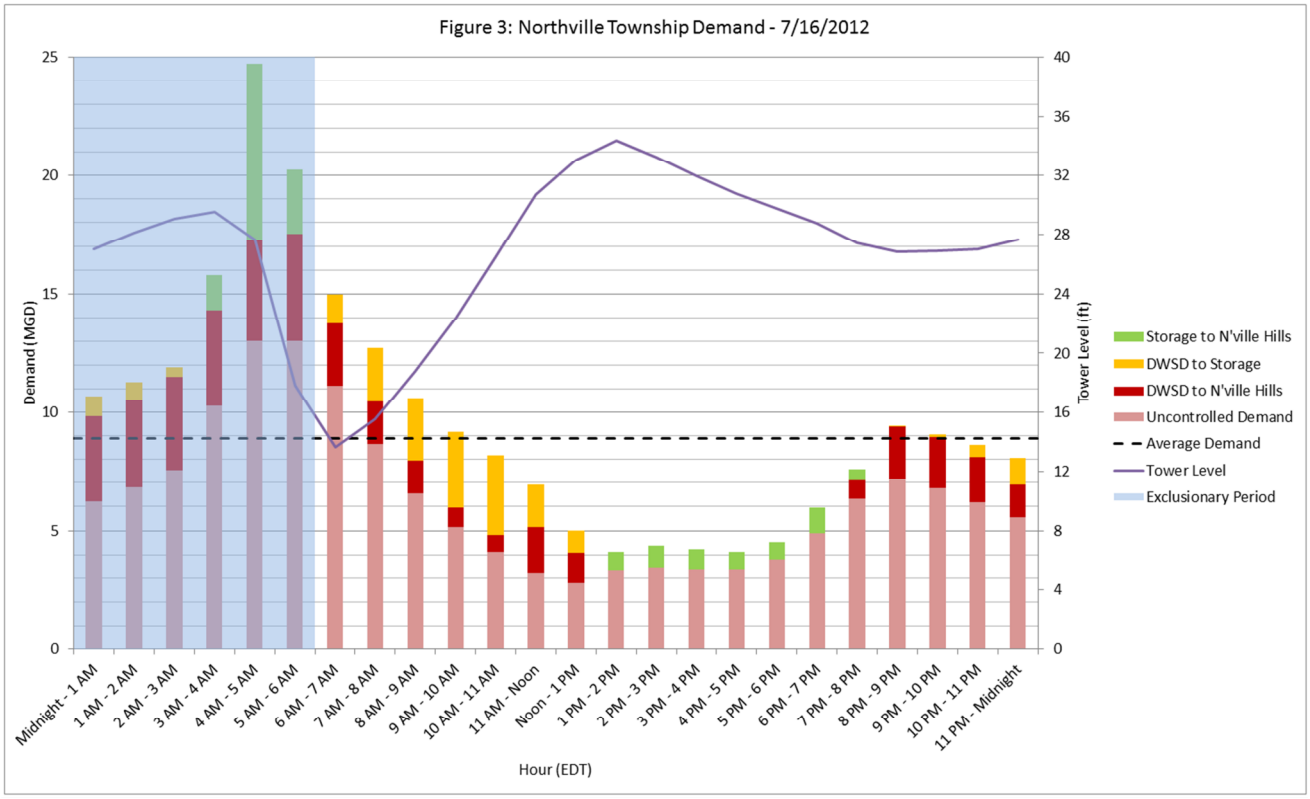


While the two days shown had similar average demands over the course of the day, the demand on 7/1/2012 had a much higher peak hour demand from 4:00 AM to 5:00 AM of 24.6 MGD. By comparison, the demand on 7/10/2011 peaked at 19.6 MGD during the same hour. These demand patterns were similar to other high use days during both years, respectively.

Another item to note in both figures is that the Non-Exclusionary peak hour occurred from 6:00 AM to 7:00 AM. In both cases the water tower is filling during this hour and adding to the peak draw from DWSD.

One reason that the tower may have been filling during the initial hours of the Non-Exclusionary Period is that the tower was already near its operational low water level of 18 feet, particularly on 7/1/2012. On this day, the water usage in the Northville Hills Pressure District from 4:00 AM to 6:00 AM was much higher than the total capacity of the booster station. The capacity limitations of the booster station resulted in much of the demand within the Northville Hills Pressure District to be met from the water tower from 4:00 AM to 6:00 AM. This led to the tower level being approximately 18.4 feet by the start of the Non-Exclusionary Period at 6:00 AM. With the tower level this low, there was little volume left available to help meet the demand within the Northville Hills Pressure District before the tower had to start filling.

It should also be noted that if the water tower had been draining during the initial hours of the Non-Exclusionary Period and meeting the entire demand of the Northville Hills Pressure District, then the peak hour draw from DWSD would be approximately equal to the average demand of both days shown in Figures 1 and 2. This is not the case for all high use days, though. Figure 3 shows flow rates on 7/16/2012, another high use day.



On 7/16/2012, if the tower had been draining at 6:00 AM and meeting the entire demand of the Northville Hills Pressure District, the demand in the uncontrolled areas of the Township would still have put the Non-Exclusionary peak hour draw of 11.1 MGD above the average demand of the day of 8.9 MGD. This is important to note, because it indicates that with the existing districting of the water system, the Township cannot reliably reduce their contract peak hour rate to be equal to their contract maximum day rate.

OPTIONS FOR PEAK HOUR REDUCTIONS

After analyzing historic usage, OHM considered different operational changes to reduce the Township's contract peak hour demand. The effect of operational changes was analyzed by examining how the system would perform on a contract maximum day demand of 10.4 MGD with a usage pattern taken from 7/16/2012. The usage pattern on 7/16/2012 was used because it represented a more conservative pattern than other high use days due to high morning peak usage

in both the Northville Hills Pressure District and in the uncontrolled portions of the Township. The usage pattern was ramped up to the contract maximum day demand rate in order to evaluate how the system would perform under a worst-case scenario. This represents demand that it is higher than the Township has seen in their recent past, but it is appropriate to consider the peak hour that could occur on a day with an average demand as high as their contract maximum day demand.

One exception to the 7/16/2012 demand pattern, though, was made for the hour from 4:00 AM – 5:00 AM, EDT. According to Township staff, they were regularly opening a valve between two districts during this time allowing the Northville Hills District to feed into a neighboring district in order alleviate low pressures that were occurring in the neighboring district. The exact timing of the valve opening and closing is not entirely known, but the ratio of the total demand occurring in the Northville Hills District showed a noticeable spike during the 4:00 AM hour before returning to previous levels. To account for this and to accurately reflect the demand breakdown by district, the ratio of demand in the Northville Hills District versus the rest of the Township was adjusted in the following analyses so the 4:00 AM hour ratio was approximately equal to the preceding and following hours at 35% of demand being in the Northville Hills District.

Option A – No Operational Changes

If the Township were to continue its current operations with no changes, it's still possible that current contract maximum day and peak hour rates may be too high. Currently, the Township's contract with DWSD lists a maximum day demand of 10.4 MGD and a peak hour demand of 16.9 MGD for the year 2015.

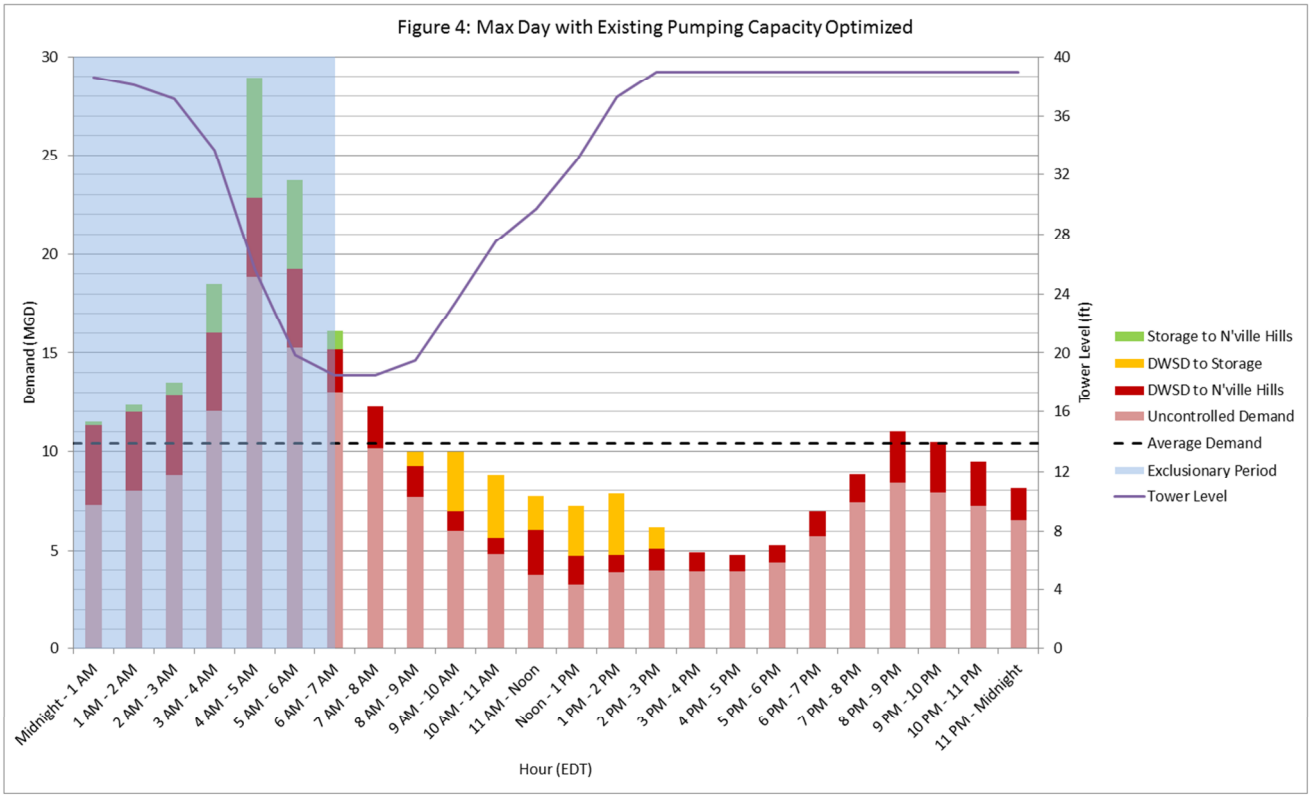
A starting point to determine the appropriateness of the Township's contract flow rates is to plot historic daily and peak hour usage versus DWSD total system pumpage. Trendlines can then be fitted to the plots and projected out to a high use day. These plots and projections were generated using Township usage data from the summer months (June – August) of 2011 – 2015 and are included as an attachment to this memo. The projections indicated that the current contract maximum day and peak hour rates are appropriate.

Option B – Optimization of Existing Facilities

Another option would be to keep the existing facilities as they are today, but make operational changes that would allow the Township to optimize the use of their storage volume. These changes would consist of ensuring that the water tower is full before the high usage that has occurred at 4:00 AM and also making sure that the tower is draining to meet all of the Northville Hills District's demand starting at 6:00 AM as long as there is enough volume in the tower to do so. Once the peak morning demands have passed, the tower could begin filling while keeping the Township's demands below the contract maximum day demand.

This level of optimization could require that the Township have meters reporting into their SCADA system at each DWSD feed.

Figure 4 displays demand rates and tower level on a day with an average demand of 10.4 MGD and the usage pattern from 7/16/2012. As can be seen, in this scenario the booster station is unable to meet the demands during the Exclusionary Period and the tower drains to its operational low water level of 18 feet even when starting out full. As such, there is not enough volume in the tower to effectively reduce the Non-Exclusionary peak hour at 6:00 AM, EDT.

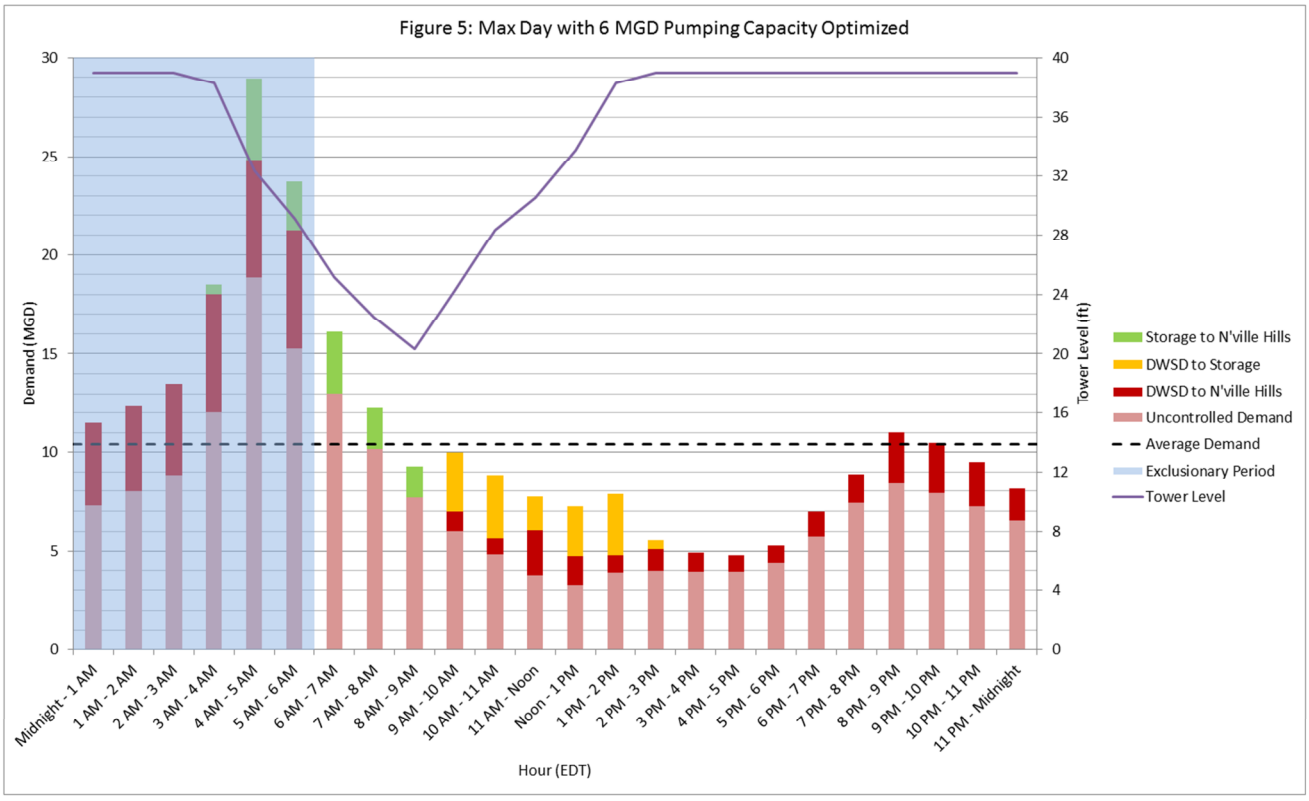


Option C – Increase Pumping Capacity of the Five-Mile Road Booster Station

One option to upgrade existing facilities would be to increase the pumping capacity of the booster station. This would help to maintain a high water level in the water tower during the Exclusionary Period by meeting a larger portion of demands through the booster station than from the tower when demands are peaking at 4:00 AM, EDT.

A new pumping capacity of 6 MGD was analyzed. This capacity was chosen because preliminary model analysis showed that a flow rate of between 5 – 7 MGD could be possible while maintaining a discharge pressure of 110 psi. Apart from new pumps, this could also require some piping upgrades in the booster station and in the system.

As shown in Figure 5, while the tower would start to drain during the 3:00 AM hour, the level in the tower would remain above 20 feet until the high demands had passed and the tower could begin filling again. Although it should be noted that the Non-Exclusionary peak hour draw from DWSD would still be above the maximum day rate of 10.4 MGD because the demand in the uncontrolled portion of the Township is approximately 13 MGD from 6:00 AM to 7:00 AM in this scenario.



CONCLUSIONS

Due to the high water usage that has been seen from 4:00 AM to 6:00 AM, the Township likely cannot reliably reduce its peak hour draw from DWSD by operational changes alone. However, facility upgrades to the booster station would allow operational changes that could result in the Township reducing their peak hour draw from DWSD. If the Township could lower their contract peak hour rate to 13 MGD, that would result in a financial savings of approximately $1,100,000 annually.

It's also important to note that while the high usage during the Exclusionary Period can make it difficult to control the Non-Exclusionary peak hour draw, it is ultimately beneficial to the Township to have this high usage occurring during the Exclusionary Period. Encouraging residents to water lawns during the Exclusionary Period is an effective method of managing Non-Exclusionary peak hour draw. The Township should continue to encourage residents to do so.

Revenue Requirement Calculations

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
2	Allocated Non-Revenue Water		55.1		*Allocated share @ 15.12 % of sales*
3	Commodity Units		419.5	419.5	*Ln 1 + Ln 2*
4	Max Day Units - *mgd*	10.40	1,390.3	1,445.4	*Contract or proxy + Ln 2*
5	**Peak Hour Units - *mgd***	**10.40**	1,390.3	1,445.4	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
	Cost Pool / Usage Category	NOCWA	System	SHARE	Rate Schedule
9	Commodity Units - Mcf	419.5	57,487	0.730%	Ln 3
10	Max Day Units - Mcf/Day	1,445.4	119,218	1.212%	Ln 4
11	Peak Hour **Increment** - Mcf/Day	0.0	30,446	0.000%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	44,083.9	3,775,561	1.168%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	77,617.6	5,088,187	1.525%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	0.0	1,035,378	0.000%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$3,758,100.00	$280,903,600.00	1.338%	Ln 31
	Budget Categories	Total Cost Pool ($)	% Share (a)	Allocation ($)	Rate Schedule
20	Commodity	$11,782,300.00	0.730%	$86,000.00	
21	Max Day Usage	$131,188,400.00	1.212%	$1,590,500.00	
22	Peak Hour Increment	$9,008,200.00	0.000%	$0.00	
23	Peak Hour Distance	$39,359,800.00	1.168%	$459,600.00	
24	Commodity Distance-Elevation	$26,054,300.00	1.230%	$320,500.00	
25	Max Day Distance-Elevation	$8,473,500.00	1.915%	$162,300.00	
26	Peak Hour Distance-Elevation	$72,402,500.00	1.525%	$1,104,500.00	
27	Peak Hour Increment Distance-Elevation	$13,027,200.00	0.000%	$0.00	
28	**Subtotal Common-To-All**	**$311,296,200.00**	**6.757%**	**$3,723,400.00**	
29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$3,758,100.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.338%	$276,900.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$4,035,000.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$2,421,000.00	
35	Fixed **Monthly** Charges @	60%		$201,750.00	
36	Commodity Charges @	40%		$1,614,000.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$12.14	**per MCF**
				$30.34	**per MCF**

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
2	Allocated Non-Revenue Water		55.1		*Allocated share @ 15.12 % of sales*
3	Commodity Units		419.5	419.5	*Ln 1 + Ln 2*
4	Max Day Units - *mgd*	10.40	1,390.3	1,445.4	*Contract or proxy + Ln 2*
5	**Peak Hour Units - *mgd***	**12.00**	1,604.2	1,659.3	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
	Cost Pool / Usage Category	NOCWA	System	SHARE	Rate Schedule
9	Commodity Units - Mcf	419.5	57,487	0.730%	Ln 3
10	Max Day Units - Mcf/Day	1,445.4	119,218	1.212%	Ln 4
11	Peak Hour **Increment** - Mcf/Day	213.9	30,446	0.703%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	50,607.5	3,775,561	1.340%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	89,103.6	5,088,187	1.751%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	11,486.0	1,035,378	1.109%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$4,197,500.00	$280,903,600.00	1.494%	Ln 31
	Budget Categories	Total Cost Pool ($)	% Share (a)	Allocation ($)	Rate Schedule
20	Commodity	$11,782,300.00	0.730%	$86,000.00	
21	Max Day Usage	$131,188,400.00	1.212%	$1,590,500.00	
22	Peak Hour Increment	$9,008,200.00	0.703%	$63,300.00	
23	Peak Hour Distance	$39,359,800.00	1.340%	$527,600.00	
24	Commodity Distance-Elevation	$26,054,300.00	1.230%	$320,500.00	
25	Max Day Distance-Elevation	$8,473,500.00	1.915%	$162,300.00	
26	Peak Hour Distance-Elevation	$72,402,500.00	1.751%	$1,268,000.00	
27	Peak Hour Increment Distance-Elevation	$13,027,200.00	1.109%	$144,600.00	
28	**Subtotal Common-To-All**	**$311,296,200.00**	**6.757%**	**$4,162,800.00**	
29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$4,197,500.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.494%	$309,300.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$4,506,800.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$2,704,080.00	
35	Fixed **Monthly** Charges @	60%		$225,340.00	
36	Commodity Charges @	40%		$1,802,720.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$13.55	**per MCF**
				$33.89	**per MCF**

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
2	Allocated Non-Revenue Water		55.1		*Allocated share @ 15.12 % of sales*
3	Commodity Units		419.5	419.5	*Ln 1 + Ln 2*
4	Max Day Units - *mgd*	10.40	1,390.3	1,445.4	*Contract or proxy + Ln 2*
5	**Peak Hour Units - *mgd***	**13.00**	1,737.8	1,792.9	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
	Cost Pool / Usage Category	NOCWA	System	SHARE	Rate Schedule
9	Commodity Units - Mcf	419.5	57,487	0.730%	Ln 3
10	Max Day Units - Mcf/Day	1,445.4	119,218	1.212%	Ln 4
11	Peak Hour **Increment** - Mcf/Day	347.6	30,446	1.142%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	54,684.7	3,775,561	1.448%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	96,282.3	5,088,187	1.892%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	18,664.7	1,035,378	1.803%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$4,472,000.00	$280,903,600.00	1.592%	Ln 31
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22	Peak Hour Increment	$9,008,200.00	1.142%	$102,900.00	
23	Peak Hour Distance	$39,359,800.00	1.448%	$570,100.00	
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29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$4,472,000.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.592%	$329,500.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$4,801,500.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$2,880,900.00	
35	Fixed **Monthly** Charges @	60%		$240,075.00	
36	Commodity Charges @	40%		$1,920,600.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$14.44	**per MCF**
				$36.10	**per MCF**

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
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5	**Peak Hour Units - *mgd***	**14.00**	1,871.5	1,926.6	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
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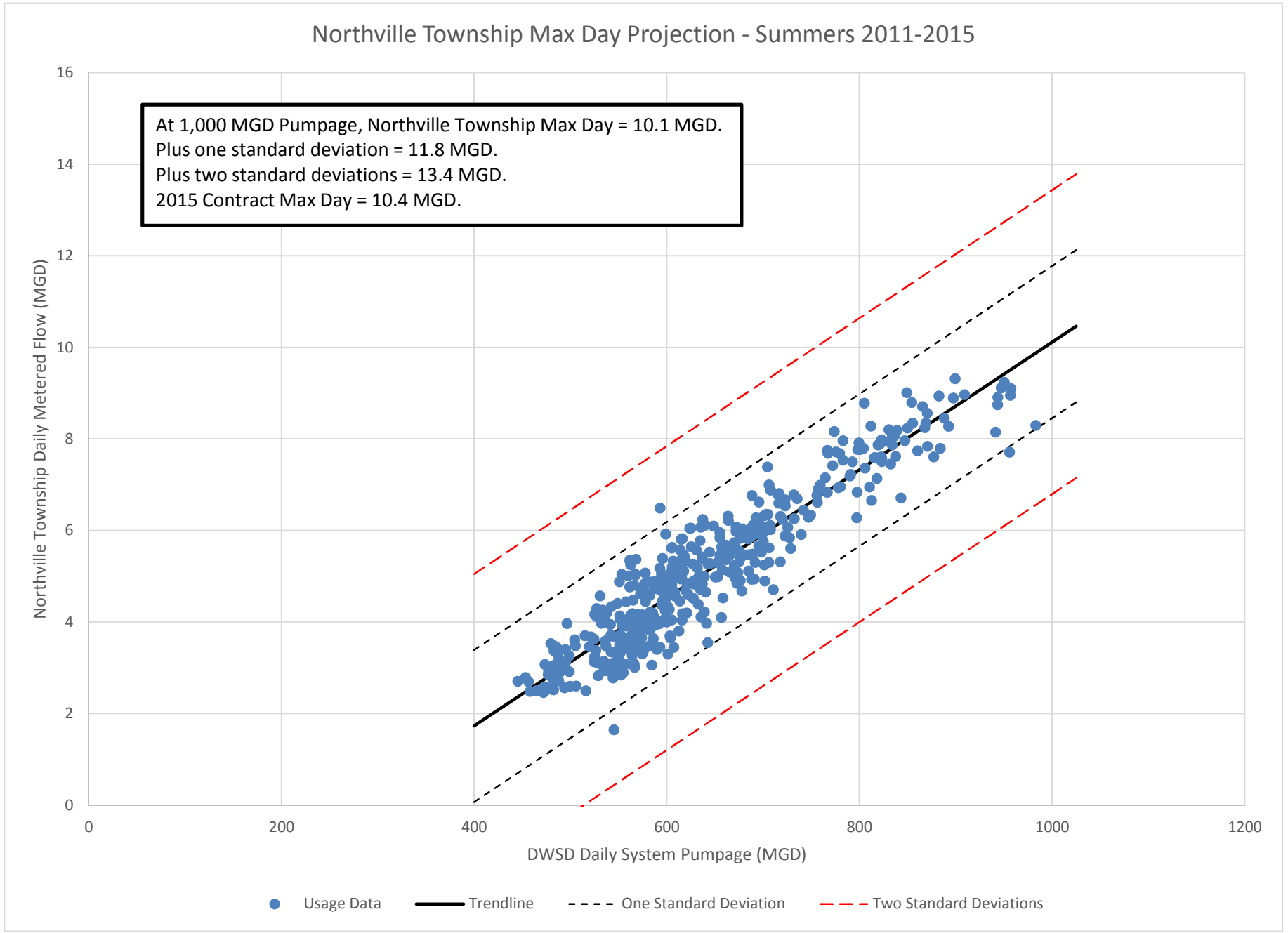
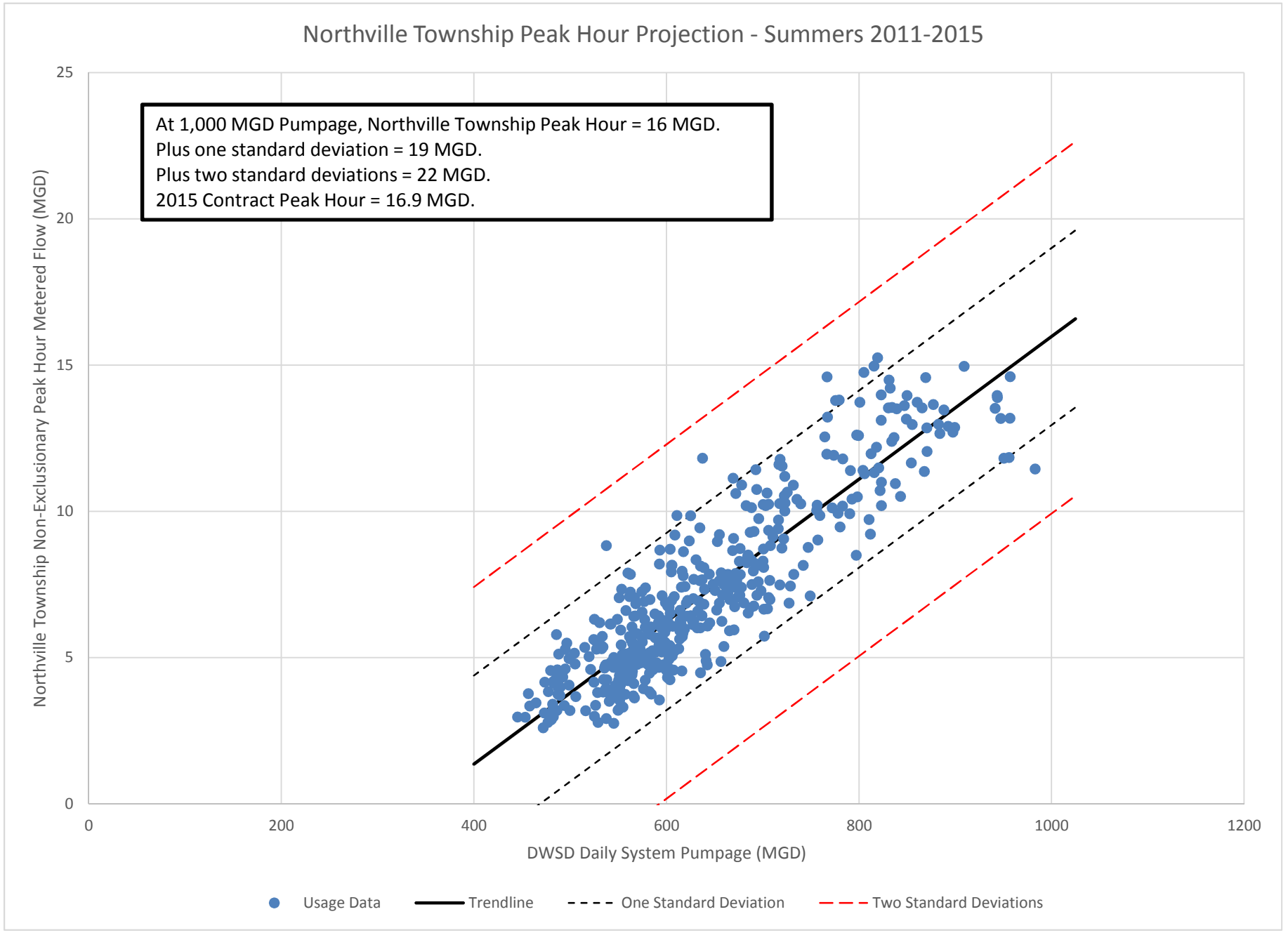
11	Peak Hour **Increment** - Mcf/Day	481.3	30,446	1.581%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	58,762.0	3,775,561	1.556%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	103,461.1	5,088,187	2.033%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	25,843.5	1,035,378	2.496%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$4,746,500.00	$280,903,600.00	1.690%	Ln 31
	Budget Categories	Total Cost Pool ($)	% Share (a)	Allocation ($)	Rate Schedule
20	Commodity	$11,782,300.00	0.730%	$86,000.00	
21	Max Day Usage	$131,188,400.00	1.212%	$1,590,500.00	
22	Peak Hour Increment	$9,008,200.00	1.581%	$142,400.00	
23	Peak Hour Distance	$39,359,800.00	1.556%	$612,600.00	
24	Commodity Distance-Elevation	$26,054,300.00	1.230%	$320,500.00	
25	Max Day Distance-Elevation	$8,473,500.00	1.915%	$162,300.00	
26	Peak Hour Distance-Elevation	$72,402,500.00	2.033%	$1,472,300.00	
27	Peak Hour Increment Distance-Elevation	$13,027,200.00	2.496%	$325,200.00	
28	**Subtotal Common-To-All**	**$311,296,200.00**	**6.757%**	**$4,711,800.00**	
29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$4,746,500.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.690%	$349,800.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$5,096,300.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$3,057,780.00	
35	Fixed **Monthly** Charges @	60%		$254,815.00	
36	Commodity Charges @	40%		$2,038,520.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$15.33	**per MCF**
				$38.32	**per MCF**

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
2	Allocated Non-Revenue Water		55.1		*Allocated share @ 15.12 % of sales*
3	Commodity Units		419.5	419.5	*Ln 1 + Ln 2*
4	Max Day Units - *mgd*	10.40	1,390.3	1,445.4	*Contract or proxy + Ln 2*
5	**Peak Hour Units - *mgd***	**16.00**	2,138.9	2,194.0	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
	Cost Pool / Usage Category	NOCWA	System	SHARE	Rate Schedule
9	Commodity Units - Mcf	419.5	57,487	0.730%	Ln 3
10	Max Day Units - Mcf/Day	1,445.4	119,218	1.212%	Ln 4
11	Peak Hour **Increment** - Mcf/Day	748.6	30,446	2.459%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	66,916.5	3,775,561	1.772%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	117,818.6	5,088,187	2.316%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	40,201.0	1,035,378	3.883%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$5,295,600.00	$280,903,600.00	1.885%	Ln 31
	Budget Categories	Total Cost Pool ($)	% Share (a)	Allocation ($)	Rate Schedule
20	Commodity	$11,782,300.00	0.730%	$86,000.00	
21	Max Day Usage	$131,188,400.00	1.212%	$1,590,500.00	
22	Peak Hour Increment	$9,008,200.00	2.459%	$221,500.00	
23	Peak Hour Distance	$39,359,800.00	1.772%	$697,600.00	
24	Commodity Distance-Elevation	$26,054,300.00	1.230%	$320,500.00	
25	Max Day Distance-Elevation	$8,473,500.00	1.915%	$162,300.00	
26	Peak Hour Distance-Elevation	$72,402,500.00	2.316%	$1,676,600.00	
27	Peak Hour Increment Distance-Elevation	$13,027,200.00	3.883%	$505,900.00	
28	**Subtotal Common-To-All**	**$311,296,200.00**	**6.757%**	**$5,260,900.00**	
29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$5,295,600.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.885%	$390,200.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$5,685,800.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$3,411,480.00	
35	Fixed **Monthly** Charges @	60%		$284,290.00	
36	Commodity Charges @	40%		$2,274,320.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$17.10	**per MCF**
				$42.75	**per MCF**

	(a) Units / SHARE Calculations	Basis	Units (*Mcf/day*)	Applied Units (*Mcf/day*)	Rate Schedule
1	Annual Sales - *Mcf*	133,000	364.4		*Avg annual for 24 mos. -> 9/2014*
2	Allocated Non-Revenue Water		55.1		*Allocated share @ 15.12 % of sales*
3	Commodity Units		419.5	419.5	*Ln 1 + Ln 2*
4	Max Day Units - *mgd*	10.40	1,390.3	1,445.4	*Contract or proxy + Ln 2*
5	**Peak Hour Units - *mgd***	**16.90**	2,259.2	2,314.3	*Contract or proxy + Ln 2*
6	Distance - *miles*	30.5			
7	Elevation - *feet*	855.0			
8	Dist-Elev Factor - *miles*	53.7			*[Ln 7-610]/10.56 + Ln 6*
	Cost Pool / Usage Category	NOCWA	System	SHARE	Rate Schedule
9	Commodity Units - Mcf	419.5	57,487	0.730%	Ln 3
10	Max Day Units - Mcf/Day	1,445.4	119,218	1.212%	Ln 4
11	Peak Hour **Increment** - Mcf/Day	868.9	30,446	2.854%	Ln 5 - Ln 4
12	Peak Hour Distance - Mcf-miles/Day	70,586.0	3,775,561	1.870%	Ln 5 x Ln 6
13	Commodity Distance-Elevation - Mcf-miles/Day	22,526.3	1,831,515	1.230%	Ln 3 x Ln 8
14	Max Day Distance-Elevation - Mcf-miles/Day	77,617.6	4,052,808	1.915%	Ln 4 x Ln 8
15	Peak Hour Distance-Elevation - Mcf-miles/Day	124,279.5	5,088,187	2.443%	Ln 5 x Ln 8
16	Peak Hour Increment Dist-Elev - Mcf-miles/Day	46,661.9	1,035,378	4.507%	[Ln 5 - Ln 4] x Ln 8
17	Suburuban Equivalent Meters	521	70,289	0.741%	Equivalent 5/8" meters
18	Suburban Outreach - Mcf/Day	419.5	43,379	0.967%	Ln 9
19	Suburban Wholesale BUDGET - $	$5,542,700.00	$280,903,600.00	1.973%	Ln 31
	Budget Categories	Total Cost Pool ($)	% Share (a)	Allocation ($)	Rate Schedule
20	Commodity	$11,782,300.00	0.730%	$86,000.00	
21	Max Day Usage	$131,188,400.00	1.212%	$1,590,500.00	
22	Peak Hour Increment	$9,008,200.00	2.854%	$257,100.00	
23	Peak Hour Distance	$39,359,800.00	1.870%	$735,900.00	
24	Commodity Distance-Elevation	$26,054,300.00	1.230%	$320,500.00	
25	Max Day Distance-Elevation	$8,473,500.00	1.915%	$162,300.00	
26	Peak Hour Distance-Elevation	$72,402,500.00	2.443%	$1,768,500.00	
27	Peak Hour Increment Distance-Elevation	$13,027,200.00	4.507%	$587,200.00	
28	**Subtotal Common-To-All**	**$311,296,200.00**	**6.757%**	**$5,508,000.00**	
29	Suburban Only - Meter Related	$3,336,100.00	0.741%	$24,700.00	
30	Suburban Only - Customer Outreach	$1,037,100.00	0.967%	$10,000.00	
31	**Subtotal**			**$5,542,700.00**	
32	Detroit / Suburban Ownership Adjustment	$20,700,000.00	1.973%	$408,400.00	
33	**Total FY 2015-16 BUDGET**	**$336,369,400.00**		**$5,951,100.00**	
	FY 2015-16 Rate Schedule				
34	Fixed **Annual** Charges @	60%		$3,570,660.00	
35	Fixed **Monthly** Charges @	60%		$297,555.00	
36	Commodity Charges @	40%		$2,380,440.00	
37	Commodity Rate (Commodity Charges / Projected Annual Volume)			$17.90	**per MCF**
				$44.75	**per MCF**

Maximum Day and Peak Hour Flow Rate Projections


Northville Township Max Day Projection - Summers 2011-2015
At 1,000 MGD Pumpage, Northville Township Max Day = 10.1 MGD.
Plus one standard deviation = 11.8 MGD.
Plus two standard deviations = 13.4 MGD.
2015 Contract Max Day = 10.4 MGD.
Northville Township Daily Metered Flow (MGD)
0
2
4
6
8
10
12
14
16
0
200
400
600
800
1000
1200
DWSD Daily System Pumpage (MGD)
Usage Data
Trendline
One Standard Deviation
Two Standard Deviations


Northville Township Peak Hour Projection - Summers 2011-2015
At 1,000 MGD Pumpage, Northville Township Peak Hour = 16 MGD.
Plus one standard deviation = 19 MGD.
Plus two standard deviations = 22 MGD.
2015 Contract Peak Hour = 16.9 MGD.
Northville Township Non-Exclusionary Peak Hour Metered Flow (MGD)
0
5
10
15
20
25
0
200
400
600
800
1000
1200
DWSD Daily System Pumpage (MGD)
Usage Data
Trendline
One Standard Deviation
Two Standard Deviations