

GULL LAKE WATER SYSTEM FEASIBILITY STUDY



GLSWA

Gull Lake Sewer & Water Authority



WIGHTMAN

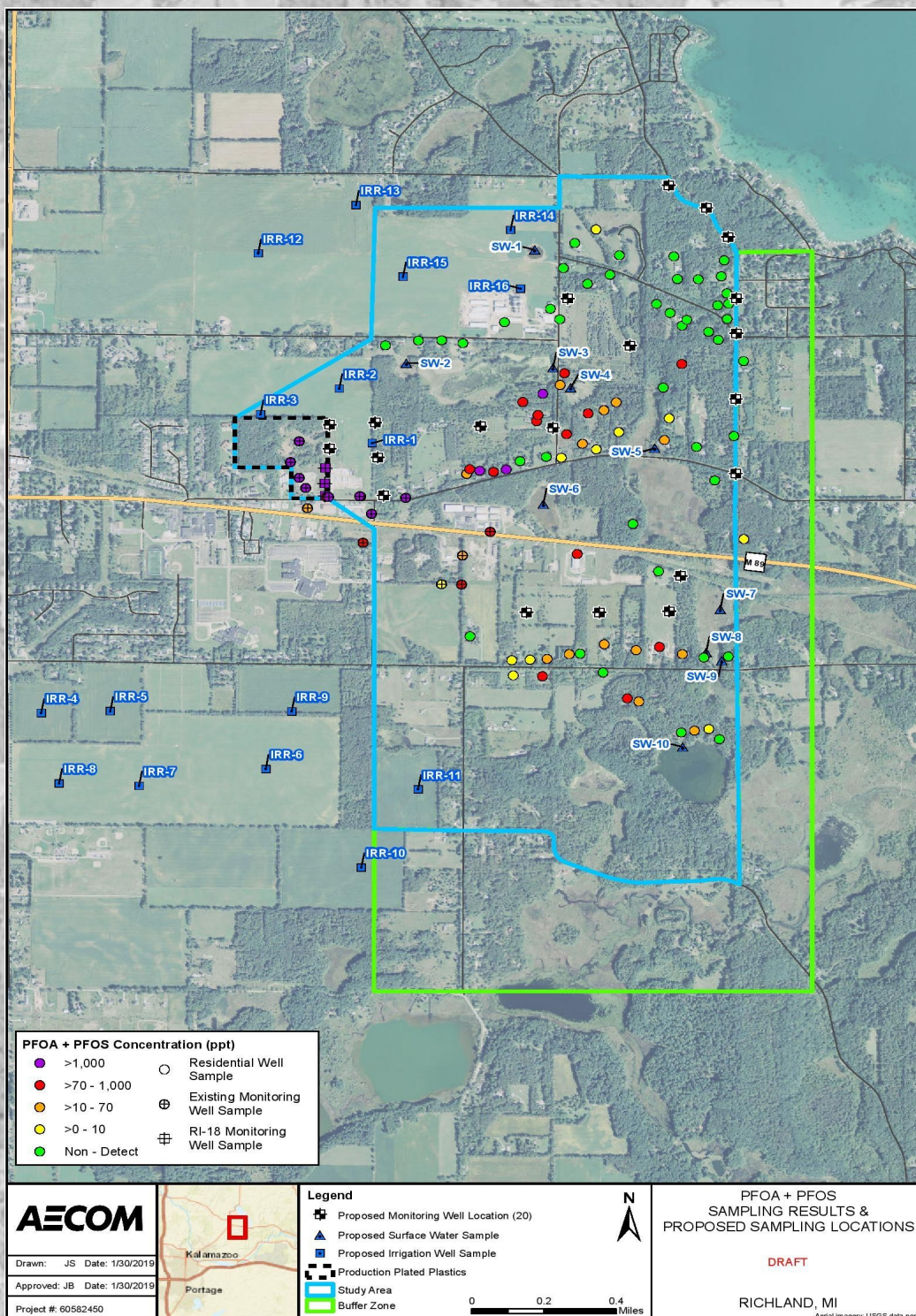
UNKNOWN:

PLUME DEPTH (WHAT AQUIFER?)

ARE THERE UNAFFECTED AQUIFER(S)?

RATE OF PLUME EXPANSION

IMPACT OF AGRICULTURAL IRRIGATION
ON PLUME BEHAVIOR



PRIMARY BENEFITS

PUBLIC HEALTH: ELIMINATES PFAS THREAT TO PRIVATE WELLS

FIRE FLOW: PROPOSED TOWER AND WELL FIELDS DELIVER MAXIMUM DAY DEMAND AND FIRE FLOW OF 3000 GALLONS PER MINUTE FOR 2 HOURS

WATER QUALITY: THE PROJECT ESTIMATE INCLUDES AN IRON FILTRATION PLANT. TREATMENT FOR MOST SECONDARY MCL'S. THIS WOULD ELIMINATE THE NEED FOR INDIVIDUAL TREATMENT SYSTEMS.

CONTAMINANTS IN A WATER SUPPLY WHICH ARE NOT HARMFUL BUT STILL UNDESIRABLE. TASTE, ODOR, COSMETIC, SCALE BUILDUP, ETC.

WATER SOFTENER COSTS: $2 \text{ BAGS/MONTH} * \$7/\text{BAG} = \$168/\text{YEAR} + \text{EQUIPMENT}$

ALTERNATIVES III AND IV RESOLVE STAGNATION ISSUES IN RURAL WATER EXTENSIONS FOR PFAS IMPACTED PROPERTIES IN RICHLAND

PRIMARY BENEFITS

DEVELOPMENT FRIENDLY: NEW POSSIBILITY FOR INTERNAL FIRE SUPPRESSION

INSURANCE SAVINGS: ESTIMATED INSURANCE PREMIUM SAVINGS FROM AVAILABLE FIRE PROTECTION EXCEED ESTIMATED COST FOR HOMES VALUED OVER \$_____

ISO RATING LOWERED FROM 9 TO 5

INCREASE IN PROPERTY VALUES

NOT IMMEDIATELY TAXABLE

TOWNSHIPS CAPTURE TAX INCREASES AS PROPERTIES SELL

An aerial photograph of a rural landscape, showing a patchwork of agricultural fields in various shades of brown and tan. A prominent, irregularly shaped body of water, likely a reservoir or lake, is situated in the upper right portion of the image. The overall scene is captured from a high altitude, providing a broad view of the terrain.

ANCILLARY BENEFITS

NO MORE UNSIGHTLY WELLHEADS

EXISTING WELLS MAY BE USED FOR IRRIGATION

ISOLATION DISTANCE

METERED SEWER BILLING

GLSWA LICENSED STAFF AND INFRASTRUCTURE ALREADY IN PLACE

SHARED FIXED BASE RADIO SYSTEM FOR FULL SCADA LIFT STATION
REPORTING AND REAL TIME SYSTEM STATUS

WATER PRESSURE DURING POWER OUTAGES

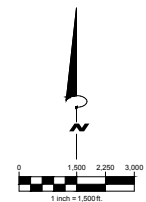
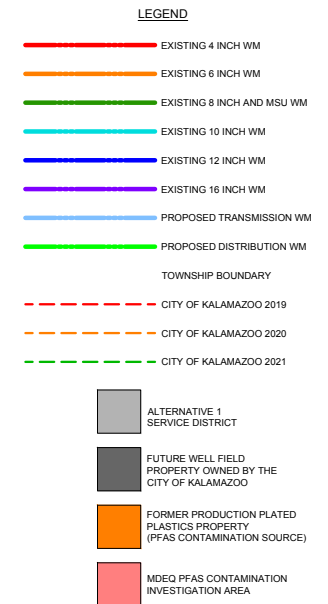
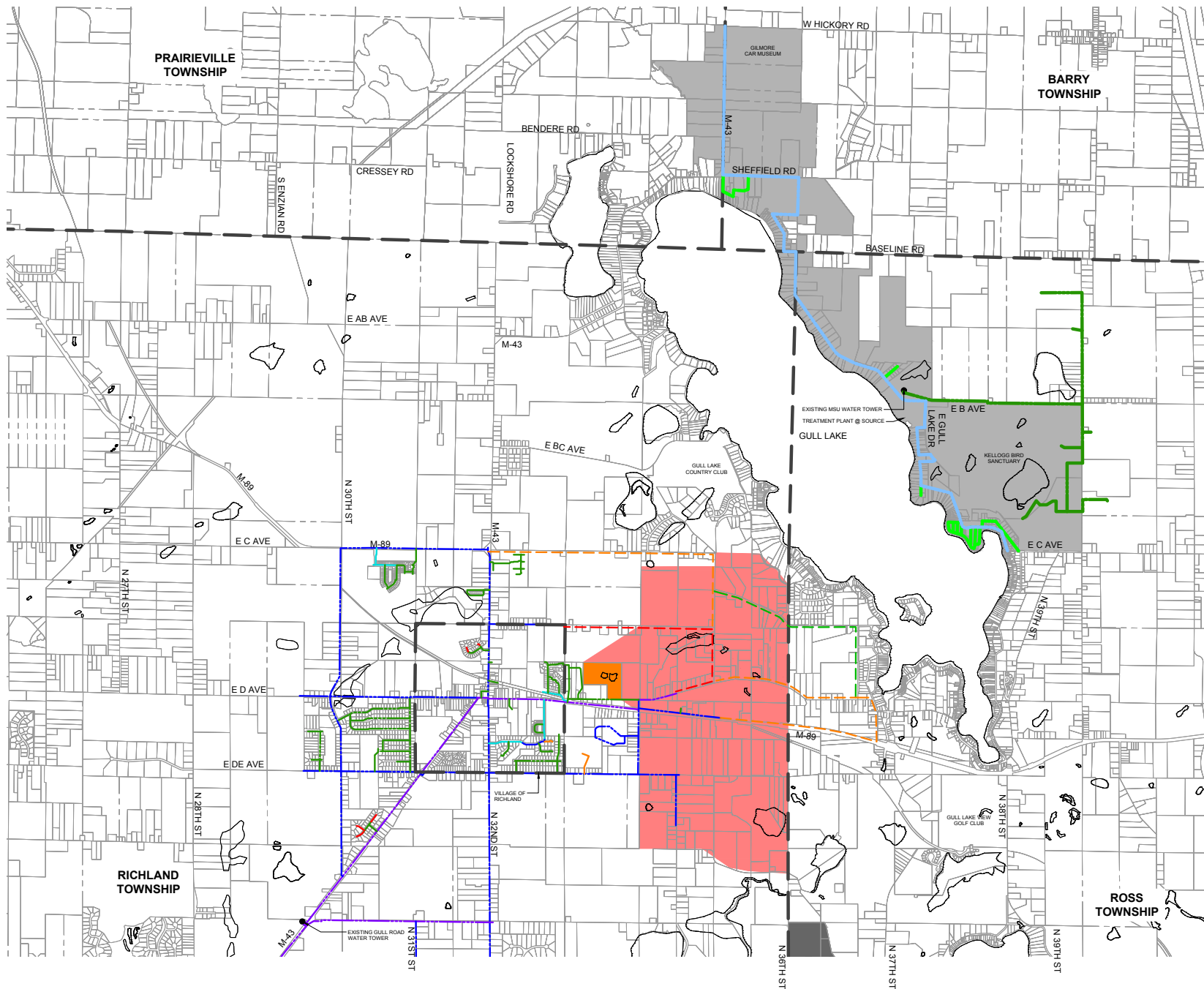
ALTERNATIVES

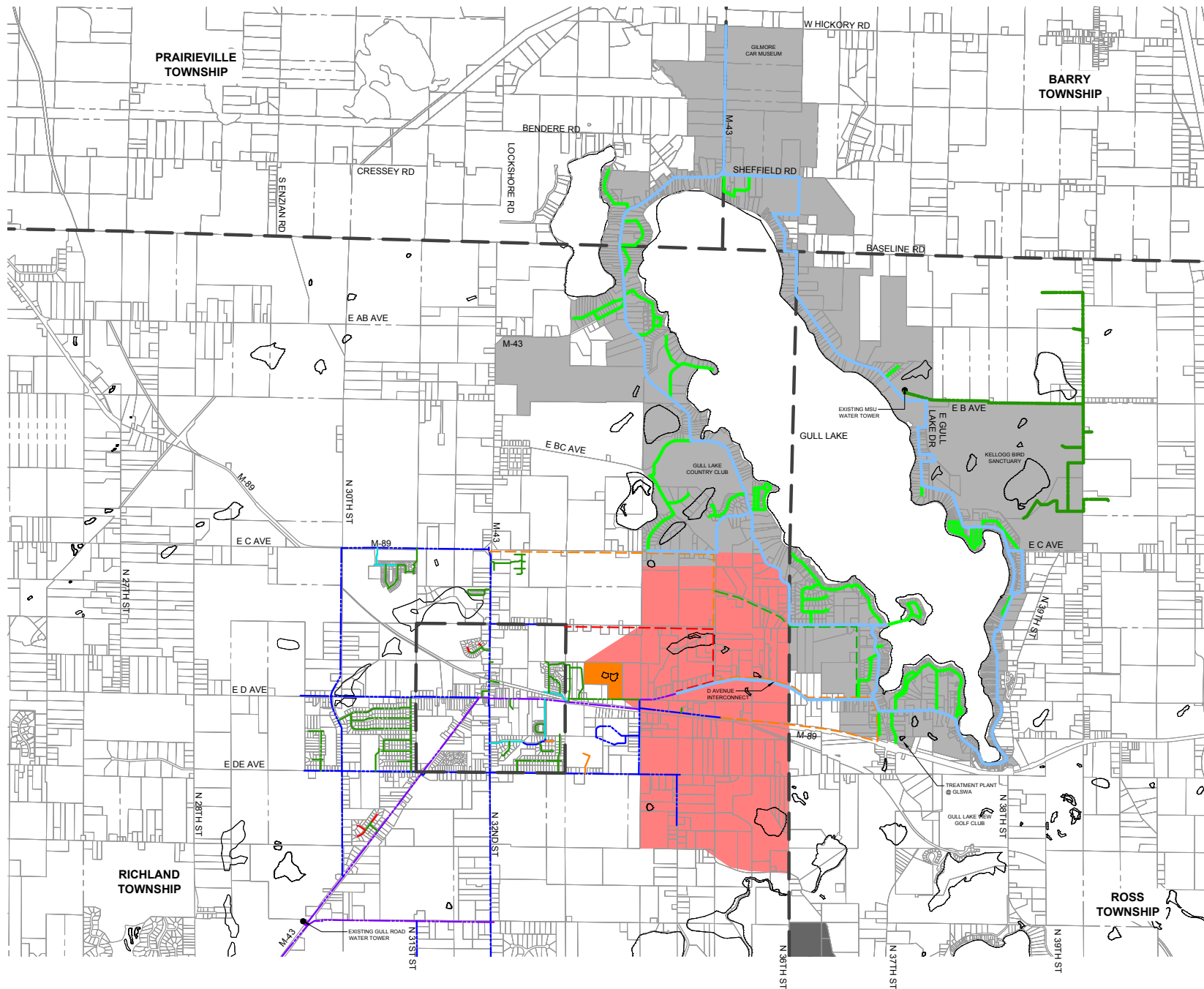
ALTERNATIVE I: GILMORE CAR MUSEUM TO GULL LAKE MINISTRIES (UTILIZE EXISTING MSU WELL FIELD)

ALTERNATIVE II: GULL LAKE LOOP - INDEPENDENT WATER SUPPLY

ALTERNATIVE III: GULL LAKE LOOP - BULK WATER FROM CITY OF KALAMAZOO

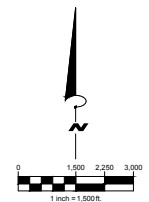
ALTERNATIVE IV: GULL LAKE + EXISTING RICHLAND SERVICE AREA - INDEPENDENT WATER SUPPLY

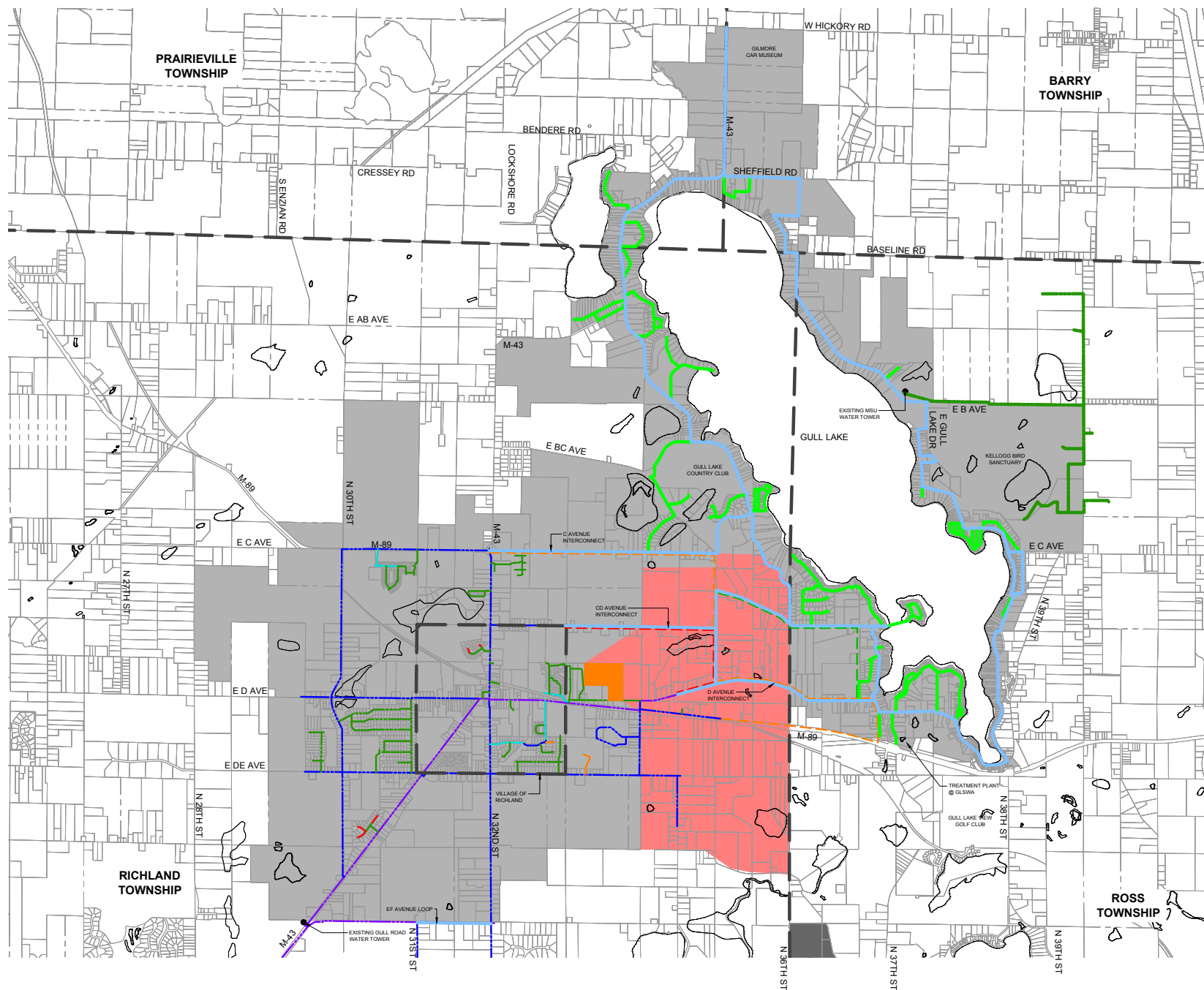




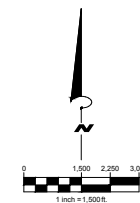
LEGEND

- EXISTING 4 INCH WM
- EXISTING 6 INCH WM
- EXISTING 8 INCH AND MSU WM
- EXISTING 10 INCH WM
- EXISTING 12 INCH WM
- EXISTING 16 INCH WM
- PROPOSED TRANSMISSION WM
- PROPOSED DISTRIBUTION WM
- TOWNSHIP BOUNDARY
- - - CITY OF KALAMAZOO 2019
- - - CITY OF KALAMAZOO 2020
- - - CITY OF KALAMAZOO 2021
- ALTERNATIVE 2 AND 3 SERVICE DISTRICT
- FUTURE WELL FIELD PROPERTY OWNED BY THE CITY OF KALAMAZOO
- FORMER PRODUCTION PLATED PLASTICS PROPERTY (PFAS CONTAMINATION SOURCE)
- MDEQ PFAS CONTAMINATION INVESTIGATION AREA





- LEGEND**
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 - FORMER PRODUCTION PLATED PLASTICS PROPERTY (PFAS CONTAMINATION SOURCE)
 - MDEQ PFAS CONTAMINATION INVESTIGATION AREA



	GLM to GCM	Gull Lake	Gull Lake + Richland
REUs	417	1,559	3,103
Estimated Population	1,085	4,053	8,068
Average Daily Flow (GPD)	83,484	311,782	620,582
Average Daily Flow (GPM)	58	217	431
Peaking Factor	3.777	3.328	3.047
Peak Flow (GPM)	219	721	1,313
Max Flow (GPM) 3.2.1.1	219	721	1,313
500 GPM wells	2	3	4
Firm Capacity (GPM)	500	1,000	1,500
Capacity-Demand (GPM)	281	279	187
Well Field Cost (\$ Million)	0.6	0.9	1.2
Fire Flow Demand (GPM)	3,000	3,000	3,000
Fire Flow * 2 hr (GAL)	360,000	360,000	360,000
Tower Volume to Satisfy Fire Flow (GAL)	407,844	408,091	421,949
Tower Volume Satisfying 7.01 A (GAL)	84,000	312,000	621,000
Minimum Tower Volume	407,844	408,091	621,000
Filter Area Satisfying Firm Capacity (SF) 4.3.2.2	125	250	375
Filter Area Satisfying Existing Peak Flow	60	190	330
Filters required	2	4	7
Future filters (firm capacity)	1	1	1
Average Filtration Rate (GPM/SF)	0.58	1.08	1.22
Peak Filtration Rate (GPM/SF)	2.18	3.58	3.73



COST ESTIMATES

CONSTRUCTION COST ESTIMATES

IRON FILTRATION PLANT CONSTRUCTION COST ESTIMATE

ALTERNATIVES COST SUMMARY

COST ESTIMATES INCLUDING WATER SERVICES AND METERS

COST ESTIMATES EXCLUDING WATER SERVICES AND METERS

Engineer's Estimate

Alternative I - Gilmore Car Museum to Gull Lake Ministries (Including MSU)

Quantity	Units	Item		Unit Price	Total
29,529	LFT	12" DIP Water Main	@	\$55.00	\$1,624,095.00
9,950	LFT	8" DIP Water Main	@	40.00	398,000.00
92	EA	6" Hydrant, Valve and Box	@	3,500.00	322,000.00
63	EA	12" Gate Valve and Box	@	2,750.00	173,250.00
40	EA	8" Gate Valve and Box	@	1,500.00	60,000.00
1	EA	Connect to Existing 12" Water Main	@	2,500.00	2,500.00
160	EA	1" Water Service	@	1,200.00	192,000.00
2	EA	2" Water Service	@	1,800.00	3,600.00
160	EA	1" Water Service, Long	@	1,500.00	240,000.00
3	EA	2" Water Service, Long	@	2,500.00	7,500.00
3,173	TON	HMA Pavement Restoration	@	75.00	237,952.00
1,351	SYD	Concrete Driveway Replacement	@	60.00	81,066.67
1,351	SYD	Asphalt Driveway Replacement	@	50.00	67,555.56
2,000	SFT	Concrete Sidewalk Replacement	@	5.00	10,000.00
320	EA	1" Meter	@	800.00	256,000.00
5	EA	2" Meter	@	1,250.00	6,250.00
0	LFT	8" Directional Drilled Water Main	@	150.00	0.00
Subtotal Alternative Infrastructure					\$2,976,419.22
Water Services					\$443,100.00
Meters					\$262,250.00
Grand Total					\$3,681,769.22

Engineer's Estimate

Alternative II and III - Gull Lake Loop

Quantity	Units	Item		Unit Price	Total
102,992	LFT	12" DIP Water Main	@	\$55.00	\$5,664,560.00
64,886	LFT	8" DIP Water Main	@	40.00	2,595,440.00
317	EA	6" Hydrant, Valve and Box	@	3,500.00	1,109,500.00
177	EA	12" Gate Valve and Box	@	2,750.00	486,750.00
161	EA	8" Gate Valve and Box	@	1,500.00	241,500.00
1	EA	Connect to Existing 12" Water Main	@	2,500.00	2,500.00
816	EA	1" Water Service	@	1,200.00	979,200.00
13	EA	2" Water Service	@	1,800.00	23,400.00
816	EA	1" Water Service, Long	@	1,500.00	1,224,000.00
14	EA	2" Water Service, Long	@	2,500.00	35,000.00
5,774	TON	HMA Pavement Restoration	@	75.00	433,022.83
7,182	SYD	Concrete Driveway Replacement	@	60.00	430,933.33
7,182	SYD	Asphalt Driveway Replacement	@	50.00	359,111.11
2,000	SFT	Concrete Sidewalk Replacement	@	5.00	10,000.00
1,632	EA	1" Meter	@	800.00	1,305,600.00
27	EA	2" Meter	@	1,250.00	33,750.00
850	LFT	8" Directional Drilled Water Main	@	150.00	127,500.00
Subtotal Alternative Infrastructure					\$11,460,817.28
Water Services					\$2,261,600.00
Meters					\$1,339,350.00
Grand Total					\$15,061,767.28

Engineer's Estimate

Alternative IV - Gull Lake, Richland Village, and Richland Township

Quantity	Units	Item		Unit Price	Total
138,969	LFT	12" DIP Water Main	@	\$55.00	\$7,643,295.00
64,886	LFT	8" DIP Water Main	@	40.00	2,595,440.00
373	EA	6" Hydrant, Valve and Box	@	3,500.00	1,305,500.00
221	EA	12" Gate Valve and Box	@	2,750.00	607,750.00
161	EA	8" Gate Valve and Box	@	1,500.00	241,500.00
6	EA	Connect to Existing 12" Water Main	@	2,500.00	15,000.00
869	EA	1" Water Service	@	1,200.00	1,042,800.00
15	EA	2" Water Service	@	1,800.00	27,000.00
857	EA	1" Water Service, Long	@	1,500.00	1,285,500.00
14	EA	2" Water Service, Long	@	2,500.00	35,000.00
5,780	TON	HMA Pavement Restoration	@	75.00	433,481.17
7,483	SYD	Concrete Driveway Replacement	@	60.00	449,000.00
7,343	SYD	Asphalt Driveway Replacement	@	50.00	367,166.67
2,000	SFT	Concrete Sidewalk Replacement	@	5.00	10,000.00
1,724	EA	1" Meter	@	800.00	1,379,200.00
29	EA	2" Meter	@	1,250.00	36,250.00
850	LFT	8" Directional Drilled Water Main	@	150.00	127,500.00
Subtotal Alternative Infrastructure					\$13,795,632.83
Water Services					\$2,390,300.00
Meters					\$1,415,450.00
Grand Total					\$17,601,382.83

IRON FILTRATION PLANT

LEGEND

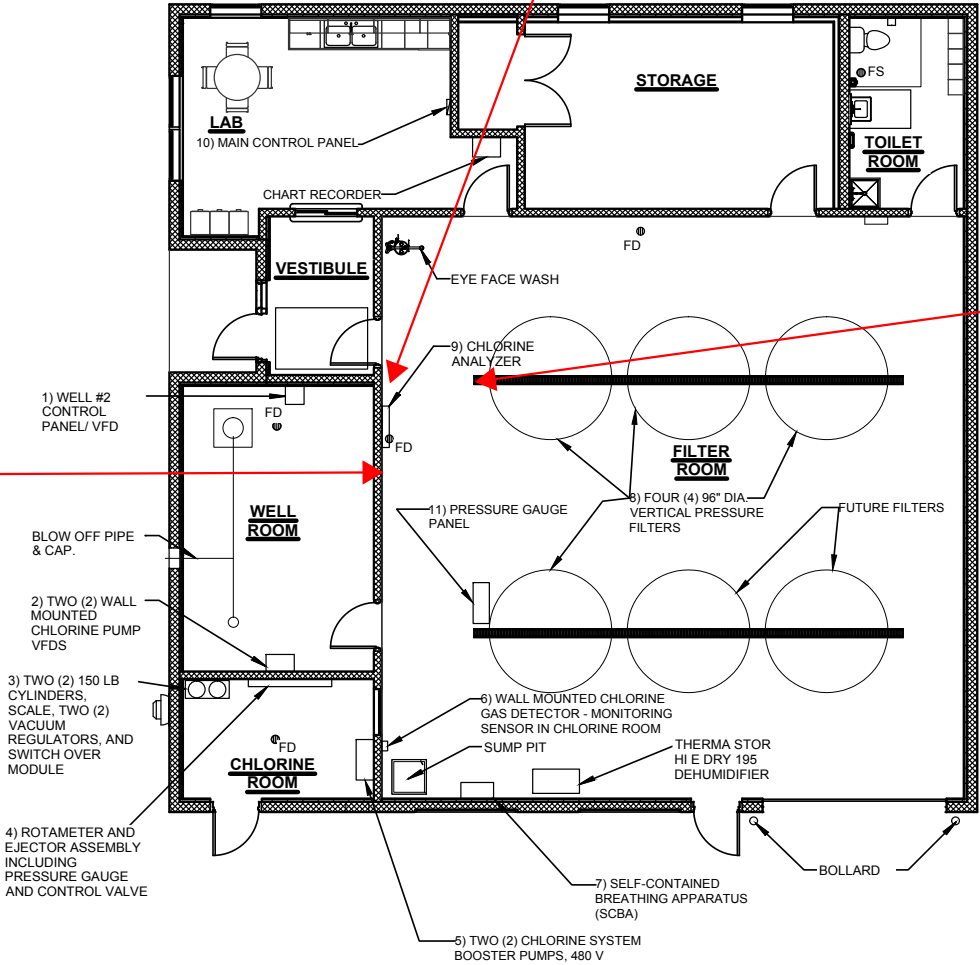
ID NUMBER	EQUIPMENT NAME	O/M MANUAL APPENDIX	PAGE/SECTION
1	WELL #2 CP AND VFD	C	PG. 384
2	CHLORINE PUMP VFDS	C	PG. 384
3	CHLORINE CYLINDERS, SCALE, VACUUM REGULATORS, AND SWITCHOVER MODULE	B	SECT. 2 (REGULATORS & MODULE), SECT. 4 (SCALE & CYLINDERS)
4	ROTAMETER AND EJECTOR ASSEMBLY	B	SECTION 2
5	CHLORINE SYSTEM BOOSTER PUMPS	B	SECTION 3
6	CHLORINE GAS DETECTOR	B	SECTION 6
7	SELF-CONTAINED BREATHING APPARATUS	B	SECTION 5
8	VERTICAL PRESSURE FILTERS	A	SECTION 2
9	CHLORINE ANALYZER	B	SECTION 6
10	MAIN CONTROL PANEL	C	PG. 763
11	PRESSURE GAUGE PANEL	A	SECTION 4



POST-FILTRATION
CHLORINE INJECTION
POINT



SAMPLE TAP LOCATION
CONTROL POINT



PRE-FILTRATION
CHLORINE INJECTION
POINT

Alternative I Gilmore Car Museum to Gull Lake Ministries
Alternative II Gull Lake Loop - Independent Supply
Alternative III Gull Lake Loop - Bulk Rate
Alternative IV Gull Lake + Existing Richland Service Area - Independent Supply

Iron Filtration Plant Construction Cost Estimate			Past Project Bid \$ (With 2% Inflation)	Alternative			
				I	II	III	IV
1.1	Site Piping and Valves	91,330.00	50,000.00	75,000.00	25,000.00	100,000.00	
1.2	Interior Piping and Valves	172,310.00	160,000.00	175,000.00	175,000.00	200,000.00	
2	Earthwork, Basin and Restoration	14,130.00	15,000.00	15,000.00	15,000.00	15,000.00	
3.2	Galley 1 - 96" Diameter Pressure Filtrters (I = 2, II = 4, III = 4, IV = 4)	149,330.00	75,000.00	150,000.00	150,000.00	150,000.00	
3.3	Galley 2 - 96" Diameter Pressure Filtrters (I = 0, II = 0, III = 0, IV = 3)	91,900.00	0.00	0.00	0.00	112,500.00	
3.5	Filter Media	37,910.00	20,000.00	40,000.00	40,000.00	70,000.00	
5	Flow Metering Equipment (3 meters, well meters in well construction cost)	7,330.00	12,500.00	12,500.00	12,500.00	12,500.00	
6	Well and Filter Building, Complete (52' x 64' \$185/SFT)	549,990.00	615,680.00	615,680.00	615,680.00	615,680.00	
7	Control System, Complete	66,430.00	50,000.00	60,000.00	30,000.00	80,000.00	
8	Site Electrical	136,700.00	125,000.00	150,000.00	60,000.00	200,000.00	
9	Site Roads, Parking and Sidewalks	15,740.00	15,000.00	15,000.00	15,000.00	15,000.00	
10	Site Fencing	16,440.00	15,000.00	15,000.00	15,000.00	15,000.00	
11.1	Field Painting and Signage	42,390.00	30,000.00	45,000.00	45,000.00	75,000.00	
12	Chlorination Equipment	31,020.00	35,000.00	35,000.00	350,003.00	35,000.00	
13	Analysis and Monitoring Equipment	5,750.00	7,500.00	7,500.00	7,500.00	7,500.00	
Total Construction Cost		1,428,700.00	1,225,680.00	1,410,680.00	1,555,683.00	1,703,180.00	
			1,226,000.00	1,411,000.00	1,556,000.00	1,704,000.00	

Cost Estimate Summary

Alternative I	Gilmore Car Museum to Gull Lake Ministries (Utilize MSU Well Field)
Alternative II	Gull Lake Loop - Independent Supply
Alternative III	Gull Lake Loop - Bulk Rate
Alternative IV	Gull Lake + Existing Richland Service Area - Independent Supply

		Project Alternatives			
		Alternative I	Alternative II	Alternative III	Alternative IV
Distribution	Distribution System/Restoration	2,976,419	11,460,817	11,460,817	11,460,817
	Looping Water Main				2,334,816
	Water services	443,100	2,261,600	2,261,600	2,390,300
	Meters	262,250	1,339,350	1,339,350	1,415,450
Supply	Independent Supply (new wells)		900,000.00		1,200,000
	Treatment Plant	1,226,000	1,411,000	1,556,000	1,704,000
	Booster from Gull Road Tower			150,000	
Storage	0.5 MG x 110' Tower	1,750,000	1,750,000	1,750,000	
	1.0 MG x 110' Tower				2,300,000

Cost Estimate Summary

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Project Alternatives				
	Alternative I	Alternative II	Alternative III	Alternative IV
Project Including Water Services and Meters				
Total New Distribution Costs				15,266,567
Total Supply, Storage and Looping Costs				7,538,816
Total Construction Cost	6,657,769	19,122,767	18,517,767	22,805,383
Project Related Costs (30%)	1,997,331	5,736,830	5,555,330	6,841,615
Total Project Cost	8,655,100	24,859,597	24,073,097	29,646,998
REU - New Customers	417	1,559	1,559	1,559
Parcels Abutting New Main	500	1,788	1,788	1,892
REU - Existing Customers	0	0	0	1,544
Total Cost per Unit - New	20,756	15,946	15,441	12,730
Total Cost per Parcel - New	17,310	13,904	13,464	10,490
Total Cost per Unit - Supply/Etc.				3,158

Cost Estimate Summary

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Project Alternatives				
	Alternative I	Alternative II	Alternative III	Alternative IV
Project Not Including Water Services and Meters				
Total New Distribution Costs				11,460,817
Total Supply, Storage and Looping Costs				7,538,816
Total Construction Cost	5,952,419	15,521,817	14,916,817	18,999,633
Project Related Costs (30%)	1,785,726	4,656,545	4,475,045	5,699,890
Total Project Cost	7,738,145	20,178,362	19,391,862	24,699,523
REU - New Customers	417	1,559	1,559	1,559
Parcels Abutting New Main	500	1,788	1,788	1,892
REU - Existing Customers	0	0	0	1,544
Total Cost per Unit - New	18,557	12,943	12,439	9,557
Total Cost per Parcel - New	15,476	11,285	10,846	7,875
Total Cost per Unit - Supply/Etc.				3,158

Annual Bulk Water Cost from Kalamazoo (\$0.385/m³) - Alt. III = 165,800

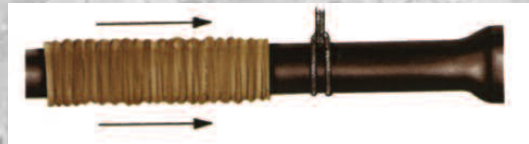
General Notes:

- 1 Construction costs for Alternatives II, III, and IV are inclusive of Alternative I
- 2 Assumes City of Kalamazoo will install currently planned water main loops on C/CD/D Avenues and M-43
- 3 Adds water main loops on C/CD/D/EF Avenues and M-43 into project as GLSWA cost
- 4 Project costs do not assume compensation for asset values of existing water main or Kzoo proposed main
- 5 Construction costs assume ductile iron water main and copper water services
- 6 Water supply and storage sized to meet maximum day demands plus 3,000 gpm fire flows
- 7 Treatment plant assumes installation of 96" diameter vertical pressure filters
- 8 Supply/treatment plant location for Alternative I would be adjacent to the associated service district
- 9 Supply/treatment plant location for Alternatives II, III, and IV assumed to be in the GLSWA office vicinity
- 10 Water tower type assumed to be composite concrete stem/steel tank
- 11 Water tower location assumed to be in the north east vicinity of the Gull Lake service area
- 12 Project related costs inclusive of contingency/engineering/legal/fiscal/etc. costs
- 13 Total Cost per XXX - New assumed to be spread only among customers/parcels in the new service areas
- 14 Total Cost per Unit - Supply/Etc. assumed to be spread among new and existing customers
- 15 Potable demands assumed at 200 gpd per REU

DUCTILE IRON PIPE CORROSION PROTECTION: POLYETHYLENE ENCASEMENT



This photograph shows 6-in. (150-mm) ductile-iron pipe specimens from the Everglades, Fla., that were exhumed after an exposure of 4.25 years. The specimen in the center is polyethylene-encased pipe whereas the other two specimens are unprotected pipe.



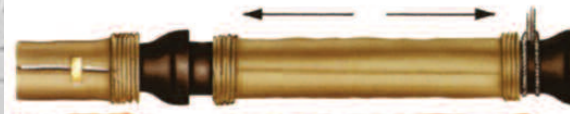
Step 1.

Cut a section of polyethylene tube approximately two feet longer than the pipe section. Remove all lumps of clay, mud, cinders, or other material that might have accumulated on the pipe surface during storage. Slip the polyethylene tube around the pipe, starting at the spigot end. Bunch the tube accordion-fashion on the end of the pipe. Pull back the overhanging end of the tube until it clears the pipe end.



Step 2.

Dig a shallow bell hole in the trench bottom at the joint location to facilitate installation of the polyethylene tube. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe.



Step 3.

Move the cable to the bell end of the pipe and lift the pipe slightly to provide enough clearance to easily slide the tube. Spread the tube over the entire barrel of the pipe. *Note: Make sure that no dirt or other bedding material becomes trapped between the wrap and the pipe.*



Step 4.

Make the overlap of the polyethylene tube by pulling back the bunched polyethylene from the preceding length of pipe and securing it in place. *Note: The polyethylene may be secured in place by using adhesive tape or plastic tie straps.*



Step 5.

Overlap the secured tube end with the tube end of the new pipe section. Secure the new tube end in place.



Step 6.

Take up slack in the tube along the barrel of the pipe to make a snug, but not tight, fit. Fold excess polyethylene back over the top of the pipe.



Step 7.

Secure the fold at several locations along the pipe barrel (approximately every three feet).



Step 8.

Repair all small rips, tears, or other tube damage with adhesive tape. If the polyethylene is badly damaged, repair the damaged area with a sheet of polyethylene and seal the edges of the repair with adhesive tape.



Step 9.

Carefully backfill the pipe according to the AWWA C600 standard for backfill procedure. To prevent damage during backfilling, allow adequate slack in the tube at the joint. Backfill should be free of cinders, rocks, boulders, nails, sticks, or other materials that might damage the polyethylene. Avoid damaging the polyethylene when using tamping devices.

COOPER WATER

IN FEBRUARY, THE COOPER TOWNSHIP BOARD VOTED TO JOIN THE KALAMAZOO WATER SYSTEM

COOPER DOES NOT HAVE A DPW

RECOGNIZE THE ADVANTAGE/SAFETY OF THE KALAMAZOO SYSTEM'S SOURCE REDUNDANCY

KALAMAZOO WORKING WITH COOPER TO EXPAND PUBLIC WATER TO ALL PFAS AFFECTED NEIGHBORHOODS

COOPER WORKING WITH KALAMAZOO TO RESOLVE INFRASTRUCTURE PURCHASE

PATH FORWARD

ESTABLISH PROJECT GOALS - BOARD LEVEL

ENGAGEMENT STRATEGY - PATIENT CONVERSATION AND EDUCATION

GULL LAKE AREA

RICHLAND VILLAGE

BEGINS WITH QUESTIONNAIRE/SURVEY - OPEN ENDED QUESTIONS - ELECTRONIC AND PAPER

WORK ON RESOLVING PROJECT VARIABLES

CONFIRM BULK RATE WITH CITY OF KALAMAZOO

INSURANCE SAVINGS CONFIRMATION

PFAS QUESTIONS

SELECT PROJECT ALTERNATIVE BEST ALIGNED WITH BOARD AND PUBLIC GOALS

IMPLEMENT PROJECT

SECURE FUNDING

ESTABLISH ORDINANCES

DESIGN

PERMITTING

CONSTRUCTION