JOHN N. HUGHES
Attorney at Law
Professional Service Corporation
124 WEST TODD STREET
FRANKFORT, KENTUCKY 40601

Telephone:
(502) 227-7270

Telecopier:
(502) 875-7059

September 9, 2005

Beth O'Donnell
Executive Director
Public Service Commission
211 Sower Blvd.
Frankfort, KY 40601

Case No. 2005-00148

Dear Beth:

Northern Kentucky Water District files its responses to the Attorney General's Data Request of July 27, 2005. A copy of this Response has been delivered to the Attorney General's Office of Rate Intervention.

If there are any questions about this, please contact me.

Very truly yours,

John N. Hughes

Attorney for Northern Kentucky
Water District

Attachments

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

NORTHERN KENTUCKY WATER DISTRICT'S RESPONSE TO THE ATTORNEY GENERAL'S REQUEST FOR INFORMATION

Q1. Re: Petition, Numbered Paragraph 5. The District indicates that that a multi-year adjustment of rates is necessary. Please explain how the acceptance of the District's proposal will impact the need to issue short-term debt. Include in the response a narrative that demonstrates the projected issuance of short-term debt without the multi-year adjustment versus the projected issuance of short-term debt with the multi-year adjustment through the end of 2010. Include in the explanation how the acceptance of the proposal would impact the District's use of bond anticipation notes (BANs).

A1. Witness: Howe. The need for short term debt is driven by funding requirements of the capital plan. The funding requirements can be impacted by the underlying plan, cost over/under runs on existing projects, and counsel on accessing capital markets in an efficient manner. These factors will exist with or without the multi-year approach. As such, the multi-year plan in itself is not expected to significantly alter short-term debt financing. Bond Anticipation Notes (BAN) provides a flexible approach to accessing capital funding in between major bond issues, and their use is projected to continue in the 5 year plan.

Q2. Re: Petition, Numbered Paragraph 5. Please confirm that the District does not have any shareholders with an equity claim on the District.

A2. Witness: Barrow. The Northern Kentucky Water District became operational effective January 1, 1997 under the provisions of Kentucky Revised Statutes (Chapter 74). As a governmental entity, the District has no shareholders. Also, as stated in the petition, Numbered Paragraph 13(b), as part of the information required by 807KAR5:001 (11), no stock is to be issued.

Q3. Petition, Numbered Paragraph 5. Please indicate whether the District has approached any of its current debt holders or potential insurers of debt in order to garner feedback on its multi-year plan. If yes, please identify the lenders and summarize the feedback and assessments by the lenders. (For example, do the lenders believe that this will make the District's cost of debt increase, decrease, or that there will be no material impact. Provide any correspondence or presentation materials for the discussions.

A3. Witness: Barrow. Currently, the District has not approached any of its current debt holders or potential insurers of debt in order to garner feedback on its multi-year plan. However the District has contracted with the investment banking firm of Ross, Sinclair and Associates to determine the financial viability of this proposed rate structure as to the proposed bond issues and related debt service requirements. Please refer to Petition Exhibit A for the five year capital funding plan and Petition Exhibit Q for the pre-filed testimony of Terrell Ross from Ross, Sinclair and Associates. Also, the District has contracted with financial and management consulting firm of Black & Veatch to study the District's cost of water service and rate structure, including the proposed multi-year rate structure. Black & Veatch's study is provided in the Petition, Exhibit N. Peggy Howe's, a director in Black & Veatch, pre-filed testimony is included in Petition Exhibit Q.

Q4. Re: Petition, Numbered Paragraph 5. Is it fair to characterize the District's multi-year proposal as a cost reimbursement program? If not, please explain how adjustments in rates based upon actual amounts of capital costs plus pro-forma adjustments to operating and maintenance accounts does not constitute cost reimbursement rather than an opportunity to earn which the District currently has through the use of the rate-setting process that it has been using.

A4. Witness: Howe. The District's primary source of funds is revenue from rates. The rate case process, whether under the traditional approach or a multi-year approach, extends beyond a reimbursement program. Ultimately, the entire operation of NKWD is considered. In addition to expenses, operations, level of service achieved, and revenue are all part of the approach. A characterization of this proposal as a cost reimbursement program is not considered appropriate.

Q5. Re: Petition, Numbered Paragraph 5. During the 2005 Regular Session of the General Assembly, a bill was introduced (HB 427 -An Act relating to water utility rates) to amend KRS 278.192 to authorize the Public Service Commission to allow a water utility to implement a rate adjustment through a multi-year phase-in process using a capital improvement plan as a basis. HB 427 did not pass. In light of the fact that the General Assembly has not yet provided the Public Service Commission with the jurisdiction to implement such a rate adjustment as sought in this case, please explain the jurisdictional basis for the program sought under the Petition.

A5. Witness: Barrow. The PSC has broad powers to set rates that are fair, just and reasonable. There is no specific method of rate setting or rate methodology set forth in Chapter 278. The Commission has used its authority to allow various types of rate adjustment mechanisms, such as surcharges. It has also allowed periodic adjustments based on actual cost fluctuations, such as purchased gas adjustments. In a case involving Union, Light, Heat and Power, the Commission authorized a multi-year rate plan based on replacements of gas mains. Given the scope of the Commission's ratemaking authority and its history of allowing a variety of rate adjustment mechanisms, there is ample authority for the Commission to approve this proposal

Q6. Re: Petition, Numbered Paragraph 12(a). For the $25,334,500 of new projects, please indicate the amount attributable to repair and replacement and the amount attributable to improvements to the system.

A6. Witness: Harrison. The amount of the revised new project cost of $25,276,500 outlined in Exhibit O that is attributable to water line repair and replacement is $4,800,000. The amount that is attributable to improvements to the system is $20,476,500.

Q7. Re: Petition, Numbered Paragraph 12(a). Consider a scenario in which during the multi-year period the District must expend significant funds for an infrastructure project (such as a new treatment plant). How will the District handle the need to obtain a significant amount of additional funding above and beyond the funding in the multi-year capital plan?

A7. Witness: Howe. The purpose of the multi-year rate proposal is to incorporate significant and reasonable anticipated requirements, such as a new water treatment plant, into the planning process to minimize the impact on customers over time. As described on pages 8-9 of my initial testimony, an event or series of events that leads to a cumulative variance beyond 5 percent of total revenue requirements will trigger a new rate case. This rate case then supersedes the plan provided in the initial multi-year case.

Q8. Re: Petition, Exhibit C. Please explain the District's current policy regarding the use of sub-districts.

A8. Witness: Harrison. The District utilizes sub-districts for mainline extension projects serving unserved customers that include State and/or Federal grant/loan funding to help finance the extension.

Q9. Re: Petition, Exhibit C. Please explain the increase in Accounts and Notes Receivable, less accumulated provision for uncollectible accounts from $ 3,987,197 to $ 4,717,008 in the current year. Provide the balance for this account as of 30 June 2005.

A9(a). Witness: Barrow

1) Additional accounts from acquisition of Taylor Mill Plant. Rate increase effective 08/01/04 generating additional revenue and receivables.

2) Expected payment on construction grants/contributed capital $ 222,099.65

A9(b). Witness: Barrow.

Balance as of June 30, 2005 $ 3,633,060

Q10. Re: Petition, Exhibit C. Please explain the increase in accounts and Notes Payable from $ 100,000 in the previous year to $ 3,705,000. Provide the balance for this account as of 30 June 2005.

A10(a). Witness: Barrow.

1) The $ 3,705,000 is made up of the following items

Notes payable Campbell County Fiscal Court	$ 100,000
2004 A BAN payable	3,605,000
	3,705,000

A10(b.) Witness: Barrow.

2) Balance as of June 30, 2005

Notes payable Campbell County Fiscal Court	$ 100,000
* Series 2004 A BAN payable	3,605,000
** Series 2005 A BAN payable	17,980,000
	21,685,000

* Revenue Bond Anticipation Notes to Mature April 2006, purchase of central facilities NKWD

** Renovation of NKWD central facilities, Expansion of US 27 pumping station, replacement of major mainlines, contribute to debt service fund.

Q11. Re: Petition, Exhibit C. Please explain the decrease in Non-utility income from $ 314,577 in the previous year to $ 31,138 in the current year. Provide the balance for this account as of June 30, 2005. Please also describe what impact that non-utility has on the district in setting rates. (Is it the same as unregulated activity?)

A11. Witness: Barrow. Difference in Miscellaneous Income from 2003 to 2004 (283,439)

2004 includes loss on abandonment of Mains for	177,825
2003 includes miscellaneous cash received but unapplied to A/R	108,984
	$ 286,809

Balance as of June 30, 2005 $ 82,177

Q12. Petition, Exhibit C. Please explain the Extraordinary Income amount of $ 685,841 for the previous year.

A12. Witness: Barrow. In departure between the Boone County Water District and Florence Water with NKWD the agreement called for a cash settlement amount plus a penalty if they stop purchasing water from NKWD prior to January 1, 2004. Both systems stopped purchasing water prior to January 1, 2004, and per the agreement, the penalty they owed the District was $685,841.

Q13. Petition, Exhibit C. Please indicate the District's debt coverage ratio for each year through the end of year 2010 under the assumption that the multi-year proposal is in place and explain how it would differ in absence of the multi-year proposal.

A13. Witness: Barrow. See Tab 13 for projected debt ratio calculations.

Q14. Petition, Exhibit E, page 30, Statement of Comparison of Budget to Actual. For year 2004, please provide a summary that explains each variance between the "budget" amount and the "actual" amount greater than 5%. Please do not simply refer to the individual explanations in Exhibit I.

A14 : Witness: Barrow.

Statement of Comparison of Budget to Actual
Year Ended December 31, 2004

	Budget	Actual	Percentage Variance Fav (Unfav)	Response
OPERATING REVENUES				
Water Sales	$ 33,000,000	$ 30,931,919	-6.267%	(a)
Forfeited discounts	470,000	621,871	32.313%	(b)
Rents from property	349,500	452,661	29.517%	(c)
Other water revenues	475,000	178,801	-62.358%	(c)
TOTAL OPERATING REVENUES	34,294,500	32,185,252	-6.150%	
OPERATING EXPENSES				
Operation and maintenance expenses	19,862,700	19,949,361	0.436%	
Depreciation expense	0	5,329,289	100.000%	(d)
TOTAL OPERATING EXPENSES	19,862,700	25,278,650	27.267%	
NET OPERATING INCOME	14,431,800	6,906,602	-52.143%	
NONOPERATING INCOME (EXPENSES)				
Investment income	1,000,000	791,405	-20.860%	(e)
Miscellaneous non-operating income	200,000	31,136	-84.432%	(f)
Interest on long-term debt	(6,211,289)	(5,344,406)	-13.957%	(g)
Amortization of debt discount and expense	0	(524,696)	100.000%	(h)

NET NONOPERATING INCOME (EXPENSES)	(5,011,289)	(5,046,561)	0.704%	
INCOME BEFORE CONTRIBUTIONS	9,420,511	1,860,041	-80.255%	
CAPITAL CONTRIBUTIONS	0	4,368,357	100.000%	(i)
NET INCOME	$ 9,420,511	$ 6,228,398	-33.885%	

14(a). Witness: Barrow. Water sales for 2004 were below budget because of

1) The PSC Order 2003-00224 water rate increase was effective June 14, 2004, and the rates were not fully applied until September 14, 2004 because the District bills quarterly. The budget anticipated that the rate change would be effective in the first part of 2004.

2) The consumption of water was lower than projected due to abnormally high rainfall in 2004.

3) The conversion of the Taylor Mill water from a wholesale customer to a retail customer was delayed until April 2004. For budgeting purposes, it had been anticipated that this conversion would occur earlier during the year.

14(b). Witness: Barrow. Due to the economic conditions in Northern Kentucky, more customers chose to pay their water bills after the expiration of the discount period. The 2004 budgeted amount was based upon the actual 2003 forfeited discounts of $469,253.

14(c). Witness: Barrow. The 2004 budgeted amount of $349,500 was based upon the actual 2003 rents from property of $303,139 plus an anticipated 10%-15% increase. Actual 2004 exceeded the budget amount by 29.5% because of increased temporary meter rentals for temporary construction sites and swimming pool fills. Also, water tower antenna space rentals increased over the prior year. The District is renting space in the building purchased for the District's new central facility to an unrelated tenant.

14(d). Witness: Barrow. Depreciation expense is not budgeted.

14(e). Witness: Barrow. Investment income budgeted of $1,000,000 was based upon the actual 2003 investment income of $910,431. For 2004, it was anticipated that funds invested would approximately remain the same as 2003. Also, a small increase in the effective interest rates was projected. The 2004 actual investment income was lower than budgeted because effective interest rates remained somewhat stagnant around 2.5%.

14(f). Witness: Barrow. By its very nature miscellaneous non-operating income is difficult to estimate. The 2003 actual was $314,577, the 2004 budget was conservatively reduced to $200,000. Only $31,136 was recognized in 2004.

14(g). Witness: Barrow. The 2004A bond and the 2004A BAN that were issued during 2004 contained a lower interest rate than what was anticipated. Also, the 2004 debt instruments were projected to be issued earlier in the calendar year resulting in additional interest expense.

14(h). Witness: Barrow. Amortization of debt discount and expense is not budgeted.

14(i). Witness: Barrow. Capital contributions are not budgeted.

Q15. Please provide an overall summary of the assessment of the ability of the District to prepare a budget as compared to actual operating results for Year 2004 and include any modifications or changes to the budget process as a consequence of the assessment of the 2004 results.

A15. Witness: Barrow: The district's actual operating results varied from the total budget by only 3.4% for 2004. The district believes that its budget forecasts are as accurate as possible given the scope of its operations and the variables that must be dealt with each year, such as construction timing, weather and regulatory issues.

Q16. Petition, Exhibit E, page 30, Statement of Comparison of Budget to Actual. Please provide this statement for Years 2000, 2001, 2002, and 2003.

A16. Witness: Barrow. Please see Tab 16

Q17. Petition, Exhibit I, notwithstanding OAG 1-14, please explain how the record turbidities impacted the operating results for Year 2004 and please explain how the operating results differ from the corresponding budget projection as a consequence.

A17. Witness: Joslyn. The record turbidities for 2004 impacted the operating results in the following ways: higher chemical feed rates are required to deal with the higher turbidities which increases chemical costs. With higher chemical feed rates, the filter runs are shorter, due to quicker Loss of Head on filters. This increases costs with extra filter washes. Also, the increased chemical feed rates create extra sludge, which adds to the costs of pressing and hauling of the extracted solids.

Q18. Re: Petition, Exhibit M, Section XVII-A-Upgrading Inactive Service Connection. The language in the proposal indicates that a point of service is located; however, no meter is present. If the customer asks that a meter be set in an inactive service connection the District will activate the service at no cost to the customer. Please explain (a) whether the activation will require District personnel to visit the location and actually set a meter (and if not, what steps are necessary at the point of service to bring the service back on); (b) how the District selected the period of one year in order to classify this type of service; and (c) what goals of objectives that the District is attempting to meet by adopting this policy.

A18(a). Witness: Harrison. The activation of an Inactive Service Connection will require District personnel to visit the location and actually set a meter.

18(b). Witness: Harrison. The District selected the period of one year in order to classify this type of service because that is the time frame that a meter is normally left in place in the meter setting before being removed.

18(c). Witness: Harrison. The District is attempting to clarify that requesting a larger service will result in the customer paying a charge because that essentially results in the installation of a new service connection. However, simply activating an inactive service connection will not result in the customer having to pay an additional charge/fee.

Q19. Re: Prefiled Direct Testimony of Peggy L. Howe. What type of review did Ms. Howe conduct to assess the accuracy and reasonableness of the District's budgeting process? Please explain.

A19. Witness: Howe. The District uses a "zero-based" budgeting approach for operational expenses, which means District planners are required to assess funding needs to perform at the targeted level of service rather than trend incremental funding estimates from the prior year expense levels. The capital budget is based on the master planning document, which reflects the needs of the District as filed with the PSC. Based on my experience, both of these approaches are appropriate and reasonable.

Q20. Re: Prefiled Direct Testimony of Peggy L. Howe. For the utilities listed in the schedule appearing on page 5, please indicate which of the utilities, if any, are regulated by state regulatory agencies (as opposed to local agencies or governmental bodies) with regard to the process of approving their rate structures and charges for service.

A20. Witness: Howe. As noted on page 4 of my testimony, all the utilities surveyed for use on page 5 are drawn from the municipal community and are regulated through local agencies and other governmental boundaries. However, both Philadelphia and St. Louis MSD both use a quasi-public service commission approach, which mirrors the structure and purpose typical of state-sponsored public service commissions. For instance, Philadelphia provides for the filing of direct testimony, and allows for discovery and interveners in its process, which is managed by an appointed Hearing Officer. In St. Louis, a chartered commission oversees the rate case process.

Q21. Re: Prefiled Direct Testimony of Peggy L. Howe. For the utilities listed in the schedule appearing on page 5, please indicate which of the utilities, if any, have private shareholder equity interests as a source of capital.

A21. Witness: Howe. The utilities listed on page 5 are publicly owned entities and therefore do not have a private shareholder equity component.

Q22. Re: Prefiled Direct Testimony of Peggy L. Howe. Please provide a photocopy of the article mentioned on page 6 as well as a photocopy of any of the presentation materials available to Ms. Howe from the workshop mentioned on page 6.

A22. Witness: Howe. "Avoiding Rate Shock: Making the Case for Water Rates" is a 131 page book published by AWWA in 2004. An abstract is provided for additional context to the testimony. The book is available through AWWA's bookstore at www.awwa.org\bookstore. In addition, a copy of select presentations from the AWWA June 12 workshop is also included under tab 22

Q23. Re: Prefiled Direct Testimony of Peggy L. Howe. Does Ms. Howe assume that the District's multi-year proposal will terminate in 2010, continue indefinitely, or terminate at another time (for this last case, please, if applicable, provide the date of termination)?

A23. Witness: Howe. This multi-year rate case filing is assumed to terminate in 2010. Should events transpire that require a new rate case be filed, it would supersede the plan set forth in the current rate case, which could occur prior to 2010. This proposed multi-year filing is intended to establish a repeatable framework for future rate case filings.

Q24. Re: Prefiled Direct Testimony of Peggy L. Howe. If the Commission were to approve the District's proposal, what would be the role, if any, of the traditional rate case for the District's subsequent rate setting activities?

A24. Witness: Howe. The traditional rate case is the cornerstone of a multi-year plan. The first year of the multi-year plan establishes rates under the traditional rate case framework. In addition, to the extent a material modification to the multi-year plan is required; the rate case is the vehicle by which such modification will be administered.

Q25. Re: Prefiled Direct Testimony of Peggy L. Howe. Please provide a narrative of Ms. Howe's understanding of the District's growth through merger, consolidation, and acquisition as well as the increase in native customer base since 1 January 1995.

A25. Witness: Howe. The Kenton and Campbell County systems merged in January 1997 and created the NKWD. Since that time, the District has grown through additional acquisition and consolidation to include Newport and Taylor Mill, as well as the loss of service to Boone County. I have participated in rate cases where these events were represented. Proceedings from the last 2 rate cases itemize these activities in detail.

Q25(a). Additionally, what impact, if any, does the District's growth through merger, etc. have on a multi-year planning process?

A25(a). Witness: Howe. The 5 year plan, as submitted, does not anticipate additional merger or acquisition activity, which is reinforced by the limited availability of potential merger candidates. To the extent such activity would occur, the impact would depend on the scale of the initiative, as measured in the look-back process. If the variance to total revenue requirements exceeds a cumulative 5%, a new rate case would be filed.

Q25(b). Is there a base level of stability in the utility's growth pattern that must be present in order for an alternative approach, such as the District's, proposal to be more cost-effective than the traditional rate case mechanism for setting rates?

A25(b). Witness: Howe. Given the limited availability of potential merger candidates, the likelihood of additional merger and acquisition activity over the study period is considered to be low. As proposed, the multi-year framework will operate in both a stable or a growth/acquisition environment. If material changes in operations are encountered, the 5 percent cumulative variance threshold on total revenue requirements will provide the mechanism to address the change – a new rate case.

Q25(c). Is it the case that the process of modifying the plan may be more expensive than not having the plan and simply using traditional regulation in times of fluctuating growth?

A25(c). Witness: Howe. We anticipate the look-back process to be a simplified review of limited aspects of the District operations. However, the economic benefit is dependent on how the look-back process is ultimately defined, including the timing and depth of associated reviews.

Q26. Re: Prefiled Direct Testimony of Peggy L. Howe. Is there any difference between the use of a "look-back" adjustment process by a non-shareholder entity such as the District and a shareholder entity that has a "market-based" equity requirement? Please explain and include a discussion of any additional complexity that would be associated with adjusting an equity cost requirement in a "look-back" adjustment process.

A26. Witness: Howe. Yes. A shareholder entity must determine an appropriate sharing of earnings between the entity and the shareholders. The District's situation is less complex, as it is limited to O&M, debt service elements, and depreciation.

Q27. Re: Prefiled Direct Testimony of Peggy L. Howe. Is it fair to characterize the "look-back" and "true-up" mechanism described by Ms. Howe's testimony as a modified reimbursement system under which the reimbursement amount would not change within a certain band? If not, please explain how the mechanism differs from a reimbursement system.

A27. Witness: Howe. Please refer to the answer provided for Question 4.

Q28. Re: Prefiled Direct Testimony of Peggy L. Howe. Assuming for the moment that a multi-year mechanism was in place and functioning.

Q28(a). By what means and how often would the District reconsider cost allocation and rate design.

A28(a). Witness: Howe. As described on pages 8-9 of my initial testimony, calculations used to establish the rates would be updated to reflect actual results during the annual look-back process. This action will provide a means of updating the distribution of costs. However, the methodology used as the basis of the allocations will not be changed. Such changes would be accomplished in a full rate case filing, which would be required when the 5 percent cumulative threshold for variance in total revenue requirements was exceeded, or at the end of the multi-year period.

Q28(b). How would changes in cost allocation and rate design be implemented while the mechanism is in place and functioning?

A28(b). Witness: Howe. The look-back process will provide adjustments to true-up results for each customer class, as described on pages 8-9 of my initial testimony. These changes would result from variances in units and costs. However, the underlying basis for the allocation would not be changed as noted in A28a.

Q29. Re: PSC request of 26 April 2005, Item 5. Please explain the following:

Q29(a). What is the "Metropolitan Club" (Check #34319)?

A29(a). Witness: Barrow. This was a business meeting lunch and monthly membership fee.

Q29(b). Explain the Kiwanis Go expense (Check #36052).

A29(b). Witness: Barrow. The Kiwanis Club of Covington/Kenton County is a non–profit voluntary social service organization that is chartered by Kiwanis International. The $85.00 expenditure is the annual membership dues for Bari Joslyn, vice president responsible for the District's Fort Thomas treatment plant. The District encourages its management team to be involved with community and civic organizations to maintain and foster good community relations, provide a forum for District contributions to the community and opportunity for the public to interact with district employees to express concerns, needs and suggestions for improved service or community involvement.

Q29(c). Explain the fees associate with "governmental affairs" (Check #36301).

A29(c). Witness: Barrow. The term "governmental affairs" refers to the District's outside attorney's terminology (Graydon, Head & Ritchey, LLP) for their law firm's fee classification. The legal fee of $216.00 represents March and April 2004 communications between Richard L. Robinson, Attorney, and Jon Deuser concerning the state's budget appropriation process as it relates to the District.

Q29(d). Explain Rotary Dues and Expenses (Check #37961).

A29(d). Witness: Barrow. The Covington Rotary Club is a non-profit voluntary social service organization that is chartered by Rotary International. The $300.50 expenditure is the semi-annual costs for dues and meeting meals for Bill Wulfeck, operations manager of the District. The District encourages its management team to be involved with community and civic organizations to maintain and foster good community relations, provide a forum for District contributions to the community and opportunity for the public to interact with district employees to express concerns, needs and suggestions for improved service or community involvement.

Q29(e). For each of the above: (i) explain in detail how these expenses were removed from the base period; (ii) explain if and how the District will prevent these type of expenses from being included in the rate setting process through a multi-year mechanism such as the one proposed by the District.

A29(e). Witness: Barrow. These expenses have not been removed and are considered justifiable expenses in the operating the affairs of the District. Just as they have not been removed from prior cases, they have not been removed from the multi-year calculations.

Northern Kentucky Water District
Coverage Ratio 2005-2010

Description	Definitions	2005	2006		2007		2008		2009		2010	
		Current	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed
Revenues	Current Op Rev, All forecasted other rev, growth as defined in case. No explicit inclusion of svc apps	35,508,691	37,630,970	41,001,185	37,927,805	42,919,138	38,224,639	45,571,060	38,521,474	48,080,152	38,820,614	50,218,566
LESS: Operating expenses	per rate case	20,375,306	21,190,318	21,190,318	22,037,931	22,037,931	22,919,448	22,919,448	23,836,226	23,836,226	24,789,675	24,789,675
Net operating income before debt service	calc	15,133,385	16,440,652	19,810,867	15,889,874	20,881,207	15,305,191	22,651,612	14,685,248	24,243,926	14,030,939	25,428,891
Maximum Principal & Interest - T Ross Schedule	see debt svc tab - takes T Ross spreadsheet and adds proposed debt. Excludes Taylor Mill note	10,953,130	$13,343,577	$13,343,577	$14,310,840	$14,310,840	$15,281,203	$15,281,203	$16,248,978	$16,248,978	$17,217,928	$17,217,928
Coverage Ratio	calc	**1.38**	**1.23**	**1.48**	**1.11**	**1.46**	**1.00**	**1.48**	**0.90**	**1.49**	**0.81**	**1.48**

NORTHERN KENTUCKY WATER SERVICE DISTRICT

STATEMENT OF COMPARISON OF BUDGET TO ACTUAL

Year Ended December 31, 2000

	2000 Budget	2000 Actual
OPERATING REVENUES		
Water sales	$ 25,000,000	$ 23,913,227
Forfeited discounts	300,000	284,232
Rents from property-net	250,000	349,530
Other water revenues	90,000	176,347
TOTAL OPERATING REVENUES	25,640,000	24,723,336
OPERATING EXPENSES		
Operation and maintenance expense	16,452,520	14,265,253
Depreciation expense	3,200,000	3,293,681
TOTAL OPERATING EXPENSES	19,652,520	17,558,934
NET OPERATING INCOME	5,987,480	7,164,402
NONOPERATING INCOME (EXPENSE)		
Interest income	1,000,000	1,452,807
Miscellaneous non-operating income	145,000	110,225
Lawsuit settlement	-	3,549,267
Loss on disposition of assets	-	(171,459)
Interest on long-term debt	(4,881,506)	(4,281,110)
Amortization of debt disc. and expense	(200,000)	(189,435)
NET NONOPERATING INCOME (EXPENSE)	(3,936,506)	470,295
NET INCOME	$ 2,050,974	$ 7,634,697

NORTHERN KENTUCKY WATER DISTRICT
STATEMENT OF COMPARISON OF BUDGET TO ACTUAL
Year Ended December 31, 2001

	2001 Budget	2001 Actual
OPERATING REVENUES		
Water sales	$ 25,000,000	$ 23,992,767
Forfeited discounts	275,000	366,475
Rents from property-net	300,000	277,893
Other water revenues	130,000	223,529
TOTAL OPERATING REVENUES	25,705,000	24,860,664
OPERATING EXPENSES		
Operation and maintenance expense	16,529,000	15,665,700
Depreciation expense	3,300,000	3,636,840
TOTAL OPERATING EXPENSES	19,829,000	19,302,540
NET OPERATING INCOME	5,876,000	5,558,124
NONOPERATING INCOME (EXPENSES)		
Interest income	1,300,000	1,263,833
Miscellaneous non-operating income	(145,000)	53,969
Loss on disposition of assets	50,000	(88,157)
Interest on long-term debt	(5,300,000)	(5,072,313)
Amortization of debt disc. and expense	(240,000)	(241,323)
NET NONOPERATING INCOME (EXPENSES)	(4,335,000)	(4,083,991)
INCOME BEFORE CONTRIBUTIONS	1,541,000	1,474,133
CAPITAL CONTRIBUTIONS	-	2,817,320
NET INCOME	$ 1,541,000	$ 4,291,453

NORTHERN KENTUCKY WATER DISTRICT
STATEMENT OF COMPARISON OF BUDGET TO ACTUAL
Year Ended December 31, 2002

	2002 Budget	2002 Actual
OPERATING REVENUES		
Water sales	$ 25,000,000	$ 27,048,947
Forfeited discounts	350,000	371,144
Rents from property-net	315,000	351,320
Other water revenues	230,000	259,836
TOTAL OPERATING REVENUES	25,895,000	28,031,247
OPERATING EXPENSES		
Operation and maintenance expense	17,555,600	17,180,952
Depreciation expense	3,840,000	4,368,389
TOTAL OPERATING EXPENSES	21,395,600	21,549,341
NET OPERATING INCOME	4,499,400	6,481,906
NONOPERATING INCOME (EXPENSES)		
Interest income	1,400,000	1,148,898
Miscellaneous non-operating income	150,000	76,910
Loss on disposition of assets	-	(9,600)
Interest on long-term debt	(6,300,000)	(5,592,915)
Amortization of debt disc. and expense	-	(418,577)
NET NONOPERATING INCOME (EXPENSES)	(4,750,000)	(4,795,284)
INCOME BEFORE CONTRIBUTIONS	(250,600)	1,686,622
CAPITAL CONTRIBUTIONS	-	2,038,964
NET INCOME	$ (250,600)	$ 3,725,586

NORTHERN KENTUCKY WATER DISTRICT
STATEMENT OF COMPARISON OF BUDGET TO ACTUAL
Year Ended December 31, 2003

	2003 Budget	2003 Actual
OPERATING REVENUES		
Water sales	$ 28,700,000	$ 27,167,452
Forfeited discounts	400,000	469,253
Rents from property	325,000	303,139
Other water revenues	410,000	260,967
TOTAL OPERATING REVENUES	29,835,000	28,200,811
OPERATING EXPENSES		
Operation and maintenance expense	19,477,940	18,734,903
Depreciation expense	-	5,016,275
TOTAL OPERATING EXPENSES	19,477,940	23,751,178
NET OPERATING INCOME	10,357,060	4,449,633
NONOPERATING INCOME (EXPENSES)		
Investment income	1,000,000	910,431
Miscellaneous non-operating income	150,000	314,577
Settlement on cancellation of contract	-	685,842
Interest on long-term debt	(6,100,000)	(5,244,744)
Amortization of debt discount and expense	-	(392,248)
NET NONOPERATING INCOME (EXPENSES)	(4,950,000)	(3,726,142)
INCOME BEFORE CONTRIBUTIONS	5,407,060	723,491
CAPITAL CONTRIBUTIONS	-	1,875,382
NET INCOME	$ 5,407,060	$ 2,598,873

American Water Works Association
The Authoritative Resource on Safe Water

Bookstore | Membership
Login
Search Bookstore

Home | Advocacy | Communications | Conferences | Education & Training | Science & Technology | Sections

Bookstore

- Specials
- It's New!
- AWWA Standards
- CDs/Software/References
- Conservation Resources
- Consumer Education
- Distribution/Infrastructure
- Utility Management
- Manuals
- Operator/Employee Training
- Research Reports
- Security and Safety
- Videos
- Water Quality and Treatment
- Logo Merchandise

- Advanced Search
- Downloads
- Ordering Information
- Shopping Cart

Product	Qty
(empty cart)	

Checkout

VeriSign Secured

Order a free catalog

Can't find what you're looking for?

Be an AWWA author

AWWA Products
Avoiding Rate Shock: Making the Case for Water Rates

Save 33%

Communicating the true value of water can act as a shock absorber when utilities must raise rates, according to this study sponsored by the AWWA Water Utility Council.

This comprehensive study found that consumers get upset over rate increases because of a misunderstanding about the true value of a safe, adequate supply of water. The report, funded by the AWWA Water Industry Technical Action Fund, resulted from the need in many cities to replace aging infrastructure and the necessity of sharing the cost burden with water utility customers.

Drawing on extensive research, case studies, and in-depth interviews, the report lists four key findings:

- People undervalue water, making it more difficult for them to accept rate increases
- A consistent, structured communications strategy builds the credibility necessary to support the customer-utility relationship and rate increases
- It's never too late to start doing the right thing; think long-term and plan beyond the current crisis
- Billing practices and rate structure options can affect customer reactions and acceptance of rate increases

Each finding is followed by several recommendations to help utilities know their customers and deliver clear messages relating the benefits of water service, increased costs. It also includes tips on how, when, and where to communicate rate increases, plus a comprehensive plan to explain and implement rate increases, and outreach programs regarding billing and payment options.

Edition: 2004, Softbound, 131 pp.
ISBN 1-58321-334-1; Catalog Number 20570.
Your Price: $ 59.95

Member Price: $39.95
Join AWWA now
Login for Member Pricing

Buy now

SUN5

Navigating the Perfect Storm of Utility Finance: Strategies to Meet Unfunded Mandates, Fund Capital Renewal and Replacement, and Avoid Rate Shock

American Water Works Association
The Authoritative Resource on Safe Water

AWWA Annual Conference and Exposition 2005

American Water Works Association

Navigating the Perfect Storm of Utility Finance

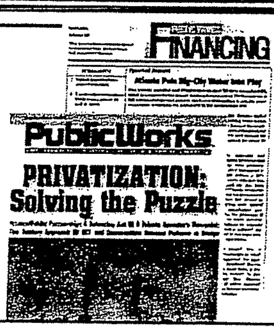
Forecasting the Perfect Storm

Presentation Outline

- The 'Perfect Storm'
- Battening down the hatches
- A view from inland: Ann Arbor, MI
- Conclusions

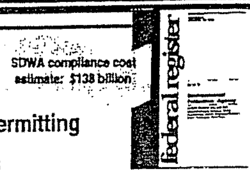
Privatization pressures fundamentally altered the water utility marketplace

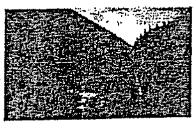
- Acute pressures to be competitive
- Heightened challenge of securing rate increases
- Enhanced focus on financial management

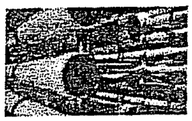


Increasingly stringent regulatory requirements

- water quality
- water supply
- environmental permitting
- utility operations

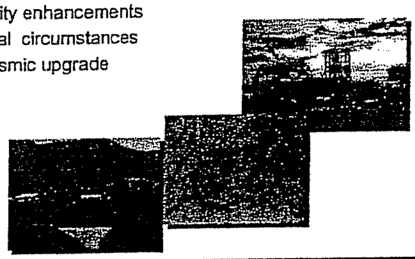






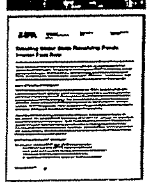
System development costs driven by a variety of factors

- Population growth / economic development
- Security enhancements
- Special circumstances
  - seismic upgrade

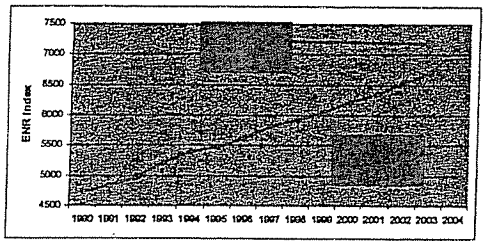


Withdrawal of federal and state funding support

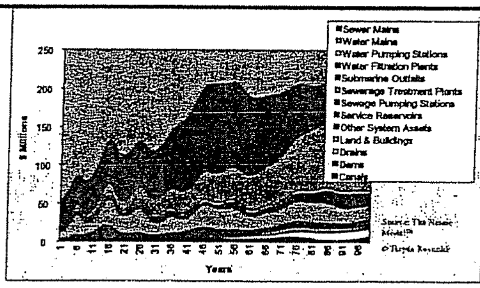
- Federal grant availability is now largely limited to 'special cases'
- State Revolving Fund loan rates and terms offer limited financial benefit
- Proposed 2005 federal budget reflects a reduction in funding



Capital costs continue to be driven by inflationary factors



Aging infrastructure and historic under-investment coming due



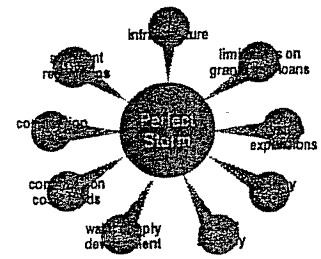
Addressing water supply limitations will be costly

- Raw Water Facilities

- Treatment Facilities

- Pump Stations
- Transmission System

Financial storm clouds have produced the 'Perfect Storm'



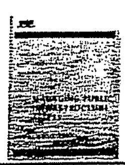
Presentation Outline

- The 'Perfect Storm'
- Battening down the hatches
- A view from inland: Ann Arbor, MI
- Conclusions

Asset management - a response to long-term under investment

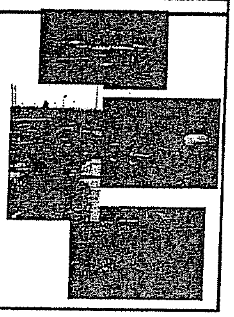
- *Managing infrastructure assets to minimize the total cost of owning and operating them, while continuously delivering the service levels customers desire, at an acceptable level of risk.*

Managing Public Infrastructure Assets, AMSA, AMWA, WEF, AWWA, 2001

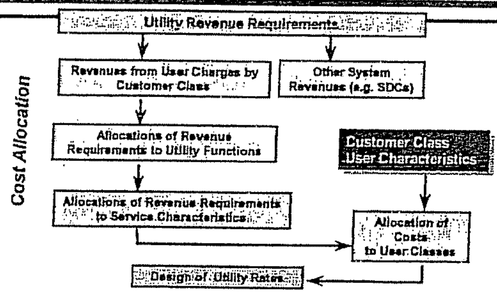


Alternative project delivery mechanisms yield important financial benefits

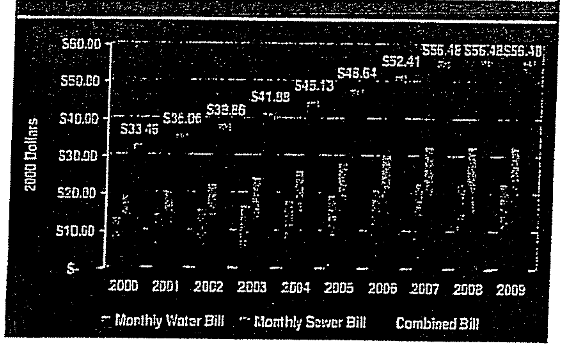
- Cost saving through project delivery and efficient operations
- Scheduling benefits
- Reduction in project delivery complexity
- Encouragement of innovation
- Transfer of risk
- Fixed price requirements
- Reduced potential for litigation



Cost-of-service rate development is ensures equity in cost distribution

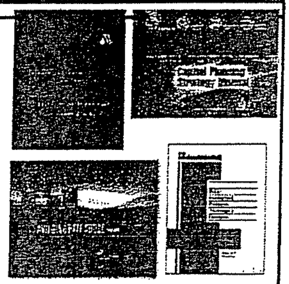


Augusta, GA's rate plan is one of many examples of local commitment



Industry has developed a wealth of guidance to help navigate the storm

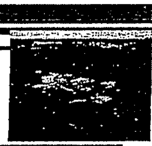
- Industry standard methods for rates, fees & charges
- Capital planning, prioritization & financing
- Public involvement & communications
- Alternative delivery methods



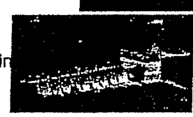
Presentation Outline

- The 'Perfect Storm'
- Battening down the hatches
- A view from inland: Ann Arbor, MI
- Conclusions

City of Ann Arbor Water Utilities



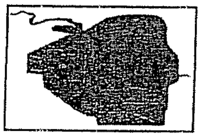
- Water Treatment Plant(s):
  - Plant1 (1938 and 1949): 22 MGD
  - Plant 2 (1966 and1975): 28 MGD
- Water distribution system:
  - Five pressure districts
  - 439.02 miles of water main
  - 3,646 fire hydrants,
  - 5,635 water main valves.



- Four dams located on the Huron River:
  - Two generate hydroelectric power.
  - All four dams are operated to maintain pond levels.

Financial challenges are reflected in utilities ongoing activities

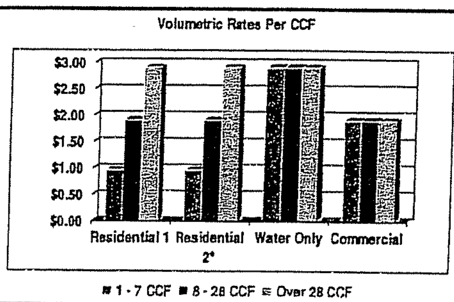
- The Vision of the Water Master Plan is to ensure a sustainable, high quality, and *cost-effective* drinking water system for the City of Ann Arbor."



Community input is important for defining rate study objectives

- 'Initial community input has proposed the following objectives:
  - Rates should be designed to assure stability of revenue to the Department.
  - Rate design should be understandable.
  - Rates established should be based on the costs to provide service.
  - Water and wastewater service should be affordable.'
    - *Source: City of Ann Arbor Water Utilities Web Site*

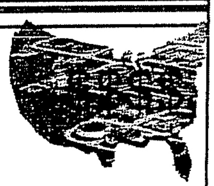
Ann Arbor's current rate structure reflects conservation objectives



Presentation Outline

- The 'Perfect Storm'
- Battening down the hatches
- A view from inland: Ann Arbor, MI
- Conclusions

Conclusions



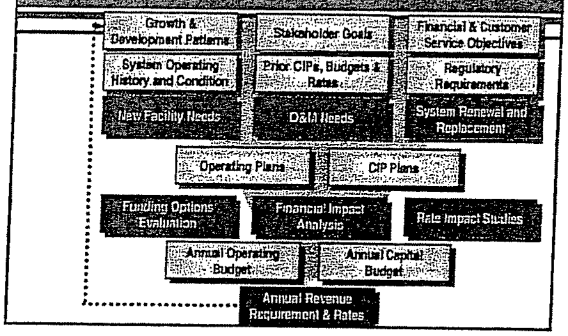
- The 'Perfect Storm' has hit
  - External factors include changing availability of federal funding and construction cost trends
  - Internal factors include historical under-pricing and limited asset mgmt
- The industry will 'weather the storm'
  - Adopting a broad range of techniques to manage long-term costs while enhancing customer services
  - Improving approaches to rate development and securing acceptance of rate increases

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Strategic Financial Planning

General financial planning process



Presentation Outline

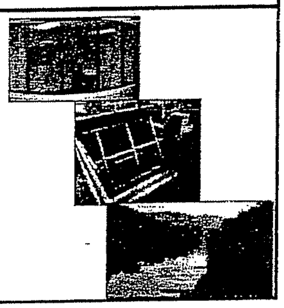
- Strategies to weather the 'Perfect Storm'
  - Revenue enhancement
  - O & M expense management
  - Capital financing
  - Reserve policies
- Financial planning
  - Annual planning cycle
  - Integrated model structures
  - Scenario analyses/ outputs
- Conclusions

Presentation Outline

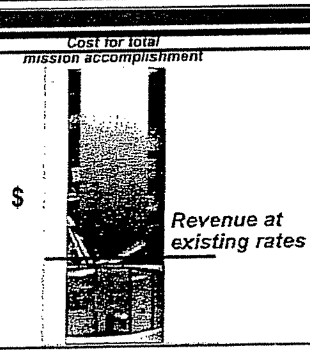
- Strategies to weather the 'Perfect Storm'
  - Revenue enhancement
  - O & M expense management
  - Capital financing
  - Reserve policies
- Financial planning
  - Annual planning cycle
  - Integrated model structures
  - Scenario analyses/ outputs
- Conclusions

Most municipal mission statements embrace three goals

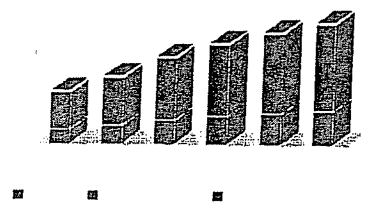
- Satisfied customers
  - Financial accountability
  - Uninterrupted service
- Regulatory compliance
  - Permits and laws
  - Enforcement actions
- Community stewardship
  - Watershed vision
  - Stakeholder outreach



Financial realities put cap on ability to accomplish mission



Atlanta's 5-year rate increase was required to establish revenue base



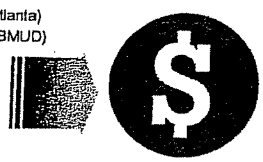
Atlanta will use sales tax to reduce adopted 2005 rate increase

- 1% Municipal Option Sales Tax (MOST) approved in July 20, 2004 referendum
- Projected to provide $70M per annum in proceeds for payment of water and sewer capital and operations
- MOST in place for 4-years with 2 renewals possible with voter approval

Council tweaks sewer rate breaks

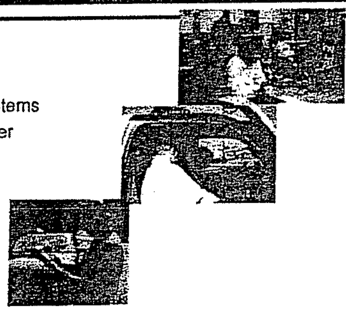
Non-rate revenue sources can

- Surcharges
  - Security improvements (Atlanta)
  - Seismic improvements (EBMUD)
- Capacity Expansion
  - Impact Fees
- Local Benefit Projects
  - Assessments
  - Connection charges
- External Sources
  - Grants
  - Developer contributions

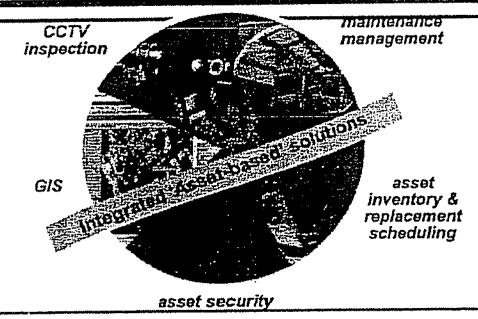


O&M expense containment is being sought through adoption of technology

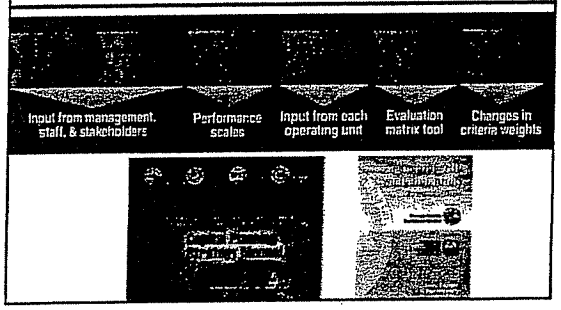
- Field service management
- Geographical Information Systems
- Automated Meter Reading

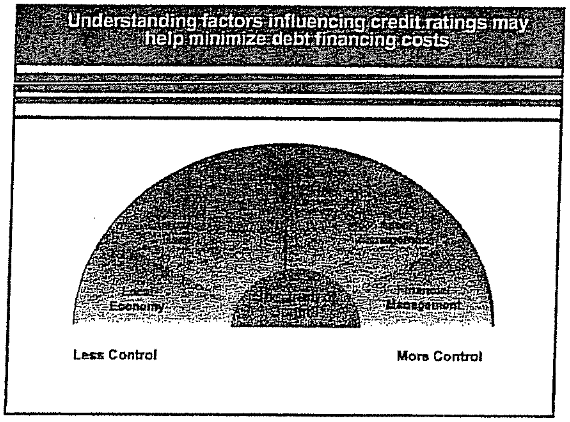


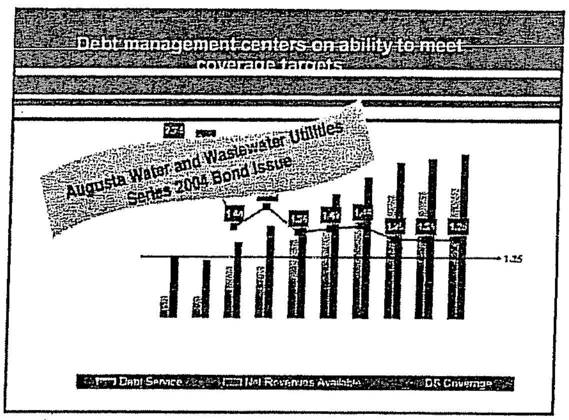
...and integrating solutions

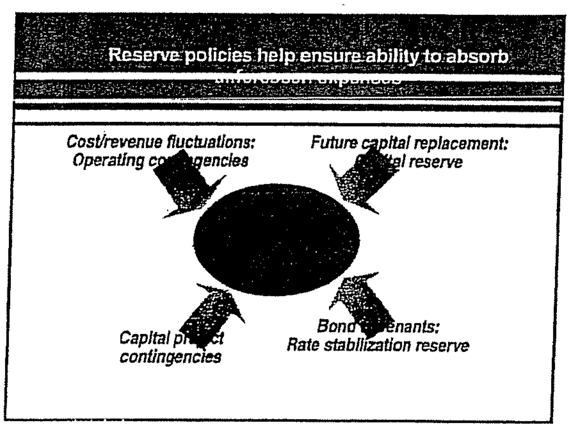


CIP prioritization helps justify capital spending & prospective financing




Understanding factors influencing credit ratings may help minimize debt financing costs
Economy
Management
Less Control
More Control

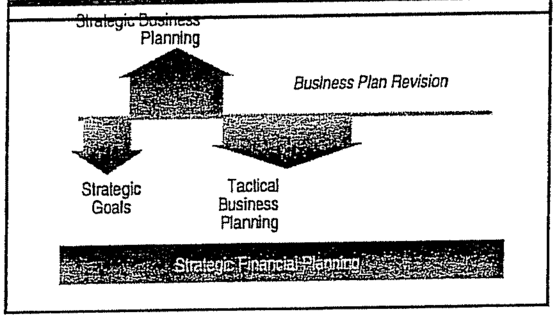

Debt management centers on ability to meet coverage targets
Augusta Water and Wastewater Utilities
Series 2004 Bond Issue
1.25
Debt Service
Net Revenues Available
DS Coverage


Reserve policies help ensure ability to absorb
Cost/revenue fluctuations:
Future capital replacement:
Rate stabilization reserve
contingencies

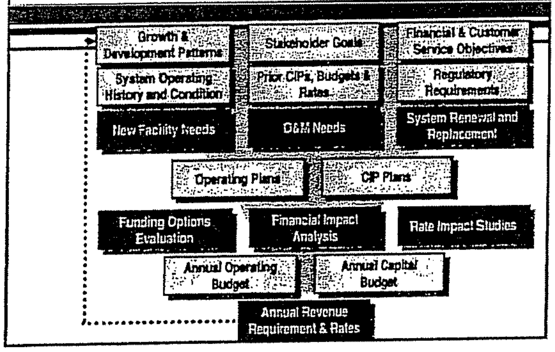
Presentation Outline

- Strategies to weather the 'Perfect Storm'
  - Revenue enhancement
  - O & M expense management
  - Capital financing
  - Reserve policies
- Financial planning
  - Annual planning cycle
  - Integrated model structures
  - Scenario analyses/ outputs
- Conclusions

Strategic financial planning underlies strategic & tactical business planning

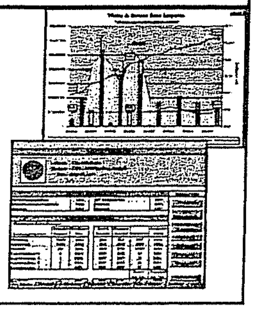


General financial planning process

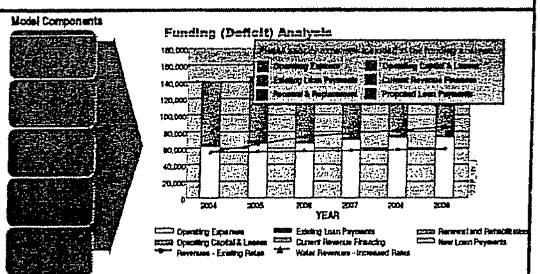


Strategic Financial Planning Example: City of Atlanta

- $3-5 billion program implementation
- SFP used by highest levels of administration to:
  - Project required rates & bill impacts
  - Affordability assessments
  - Assess impacts of alternative funding (e.g., grants, loans, taxes)



Customized financial modeling facilitates scenario analysis



Presentation Outline

- Strategies to weather the 'Perfect Storm'
  - Revenue enhancement
  - O & M expense management
  - Capital financing
  - Reserve policies
- Financial planning
  - Annual planning cycle
  - Integrated model structures
  - Scenario analyses/ outputs
- Conclusions

Conclusions

- Water industry's response to unprecedented financial pressures has been comprehensive
- As water rates continue to increase, rate payers will require demonstration of effective financial management
- Strategic financial planning is becoming increasingly necessary
  - Advanced tools offer ability to develop and evaluate impacts of strategic options

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

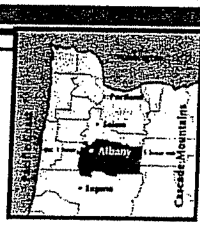
Case Study:
City of Albany, Oregon
From Skeptics to Advocates

[illegible]
City of Albany, OR
June 12, 2005

Presentation Outline

- Albany's story
- Steps we took
- Things that went well...
- Things we would do differently
- Summary

Albany, Oregon



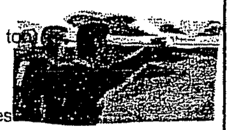
- Population: 45,000
- Serves two cities and a service district
- Private utility acquired in 1984
- Last facility plan completed in 1988
- History of annual rate increases

Albany's Objectives

- Update water facility plan
- Adopt 10-year financial plan
- Revise and update SDCs
- Review and update rate structure

Along the way....

- Appointed 18-member task force
  - Residential customers (seniors, t
  - Homebuilders and landlords
  - School district, hospital
  - Large water users, small busines
  - Financial institutions, budget committee
  - Councilor and Mayor
- Began with tours of facilities
- Ended by adopting facility plan and financial plan

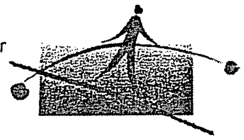


Along the way....

- Raised rates 9% January 2003 and 28% September 2003
- Largest revenue bond in City history
- Adopted 40% increase to SDCs
- Raised rates 2.5% January 2005
- Set formula for future rate increases
- Albany's rates near highest in Oregon

Along the way....

- Did not abandon declining block rate structure
- Chose not to implement cost-of-service rates now
- Agreed to re-structure rates for service district
- Agreed to minor changes in Albany rate structure



Process Options

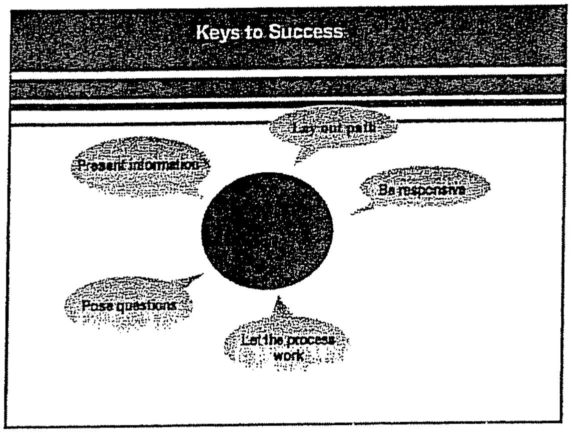
Option A
Elected officials receive info, make decisions

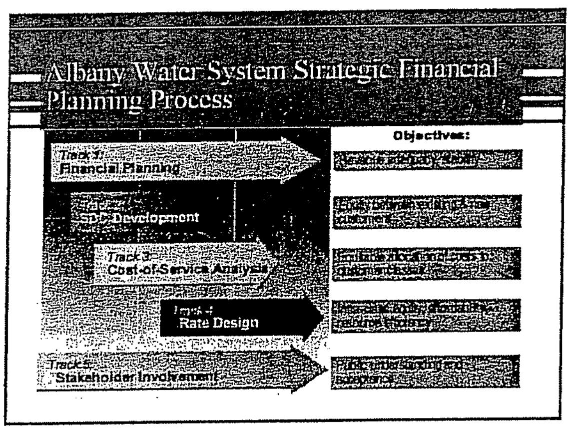
- Elected officials control process and information
- May be less likely to get into details
- Decisions made in context of other city priorities
- Lower trust level - general public acceptance less likely

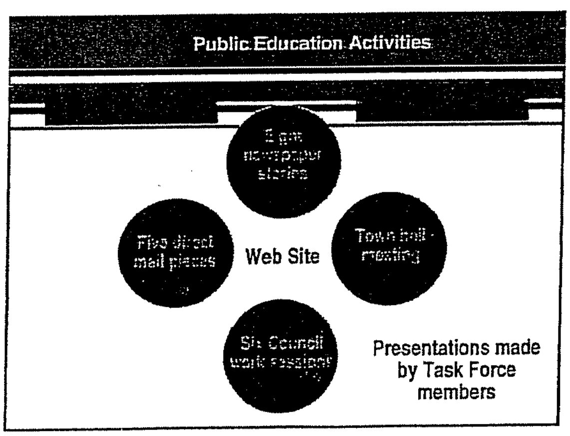
Process Options

Option B
Task Force appointed to make recommendations

- Task Force guides process and information
- Longer process - more likely to get into details
- Use of subcommittees
- Recommendations may not reflect other priorities
- General public may be more likely to accept recommendations
- Officials may not agree with recommendations


Keys to Success
Lay out path
Present information
Be responsive
Pose questions
Let the process work


Albany Water System Strategic Financial Planning Process
Objectives:
Track 1: Financial Planning
SDC Development
Track 3: Cost-of-Service Analysis
Rate Design
Track 5: Stakeholder Involvement


Public Education Activities
Web Site
Presentations made by Task Force members

Keys to Success

- Recognize that key decisions are policy choices
- Access to reliable billing and customer data
- Solid technical analysis

Keys to Success

- Help frame the discussion
  - Not just about rate increases
  - Improving system reliability and securing future water supply
  - Water availability as a community asset

Summary

- Choose a process that fits your community
- Get the best people and trust them with the information
- Keep changes manageable - prioritize

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Capital Financing

Edward J. Donahue III, CMC
Municipal & Financial Services Group
June 12, 2004

Basic Financial Assumptions

- Utility must be financially self-supporting
- Lowest rates over time consistent with chosen service levels

Capital Financing Considerations

- Legal Requirements
- Local Custom / Tradition / Policy
- Debt Affordability
- Comfort with Risk

Legal Requirements

- State / local laws
- Restrictions on types of debt that can be issued (GOs, Revenue Bonds, COPs, Lease-purchase, etc.)
- Permits, licenses, certificates, etc.
- Voter approval if needed
- Timeline / critical path
- Existing covenants

Local Custom / Tradition / Policy

- Cash vs. Debt
- GO Bonds vs. Revenue Bonds vs. Bank Financing
- Intergenerational Equity – who pays for infrastructure?
- Competitive vs. Negotiated Sales

Affordability Concerns

- Long-Range Plan
- Formal Debt Affordability Study
- Financial Feasibility Study
- Growth vs. Non-Growth
- Financing Period

Comfort With Risk

- Capacity added before customers arrive
- Carrying costs of idle capacity
- Sensitivity analysis
- Impact on user rates and customer bills

Existing Covenants / Indentures

- Additional bonds test
- Coverage ratios
- GASB 34's unintended consequences
- Annual provisions
- - interest rates vs. coverage ratios
- - revenue stability
- - reserves

Financing Plan

- Financial model for COS / rates / capacity fees / financial feasibility
  - capital budget vs. CIP vs. master plan
- Sensitivity analysis for changes in growth or consumption, inflation, etc.
- Funding sources
  - internal ("pay as you go," cost savings, cost avoidances, reserves)
  - external (grants, loans, bonds, developer contributions)

External Considerations

- Market conditions
- Economic outlook
- Federal deficit
- Elimination of CDBG & HOPE VI
- Reductions in SRF & USDA/RUS funding

Selecting the Financing Team

- Bond counsel
- Underwriter
- Financial advisor
- Consulting engineer
- Rate / feasibility consultant

Public support

- General public
- Development community
- Elected officials
- Regulators

Financing Alternatives Comparison

	General Obligation Bonds	Revenue Bonds
Key Factors	Full faith and credit	Enterprise earnings
Positives	Strong security	No voter approval
Negatives	Voter approval	Higher interest rates
When to use	Strong tax base	Enterprise healthier than municipality

Financing Variations

- Double-barreled bonds
- Reverse double-barreled bonds
- COPs
- Lease Purchases
- Credit enhancements

Summary

- Develop a long-term capital financing plan
- Review / update it frequently
- Invest in "up front" professional services
- Educate the public, elected officials and regulators

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

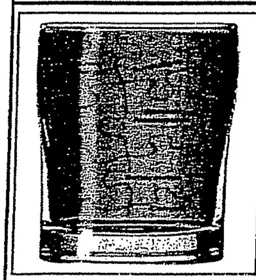
Capital Recovery Charges

Carol Malesky/Integrated Utilities Group, Inc.
Lex Warmath/Raftelis Financial Consultants, Inc
June 12, 2005

Now that I know how much I need to spend…

- How can I recover these capital costs from my customers?
  - Replacement, renewal, and other improvements for serving existing demand
  - Improvements needed to serve new demand/growth

Recovering the costs of serving existing demand



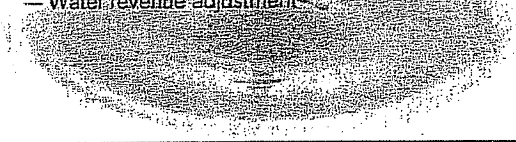
- User charges
- Surcharges
- Betterments
- Special Assessments
- Others?

Most common: User charges

- Part of annual user charge revenue requirements
- Cash-financed capital improvements
- Debt service payments
- Coverage requirements
- Capital reserves

LADWP: Surcharges galore

- Purchased water adjustment
- Demand-side management & water reclamation
- Water security adjustment
- Water quality improvement
- Water revenue adjustment



How are surcharges different?

- Assessed on a per unit-basis separately from user charges
- Specific capital program can be targeted
- Can include a sunset clause
- In LADWP, some O&M expenses also included

Massachusetts: Betterments

- — Similar to an impact fee
- — Recovers cost of replacement or "betterment" of existing facilities
- — Often one-time fee or payment
- — Example: funding of sewer and water lines in most of Massachusetts

Special assessments

- — Established to finance capital improvements within a defined area
- — Creation of special district is key
- — Who benefits from the project?
- — Assessing the fee:
  - – Front footage
  - – Square footage
- — Example:

What are development fees?

- — One-time capital recovery charges assessed against new development as a way to recover a proportional share of the costs of capital facilities constructed for its use
- — AKA – Development Impact Fees, Capital Recovery Charges ("CRC"), Facility Investment Fees ("FIF"), System Development Charges, Capital Investment Fees, etc.

Basis for cost justification: rational nexus test

- Fees must reflect:
  - Linkage between new customer demand and additional facilities
  - Linkage between fees and benefits received by new customers
  - Must not exceed proportionate share of cost for additional facilities

Accepted approaches for calculating development fees

- Marginal/Incremental cost method:
  - Looks at cost for the next increment of capacity based on an approved Capital Improvement Plan
  - Includes adjustments for facilities financed with debt – debt service credits
  - Excludes cost for system upgrades or asset replacement that benefit all customers (existing & new)

Accepted approaches for calculating development fees

- System Buy-In method:
  - Focuses on the proportional cost of existing system components with additional capacity available to serve new customers
  - Includes credits or adjustments for outstanding debt on assets, and for grant funded or developer contributed assets
- Hybrid – Combination of Marginal/ Incremental and System Buy-In methods:
  - Based on Weighted Average Cost of Capacity (per gallon per day)

Implementation issues

- Nomenclature
  - Connection Charges vs Development Impact Fees
- Different states – Different regulations
- Significant variation in the level of fees
- Methods of assessment

Nomenclature — Often confusing & potentially misleading

- Development Impact fees -- For trunk facilities
- Connection charges
  - Cost of Physical Connection – O&M
- Frontage fees and assessments
  - For Local Service Facilities and Extensions
- Contributions in Aid of Construction – CIAC
  - More of a Policy Driven Approach

Methods of assessing development fees

- Meter size approach –
  Charge varies based on ratio of potential demand for each meter size
- Equivalent Residential Unit (EQR) approach –
  Customers classified by common business or residential usage or loading characteristics
- Fixture unit approach –
  Specific fixture units and associated demand are determined for each new Customer connecting to system

CIAC

- "Any amount of money, service or property received by a water or sewer utility from any person or government agency that is provided at best cost to the utility."
- Is an addition or transfer of capital to the utility
- Excluded from Capital Cost Basis,
  - for developing Impact Fees (GOU)
  - for calculating Rate Base (IOU)

Policy issues related to CIAC

- Management of system growth and service area expansion
- Control and inspection of infrastructure construction
- Extensions policy
  - Concept of Payback
  - Oversizing to meet "planning" needs

Summary of Capital Recovery Charges

- What are capital recovery charges?
- Why are these charges important to financial planning strategies?
- Which mechanisms are most appropriate for my utility?
- How can these charges be implemented?

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Denver Water's Sliding Scale System Development Charge

Kerry Kuykendall,
Manager of Rate Administration
Denver Water
June 12, 2004

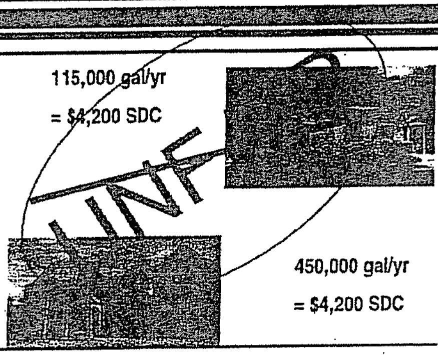
System Development Charge A Working Definition

- One time fee - new customer demand only
- Charges for new demand
  - customers desiring water service; and
  - existing customers requesting increased water service.
- Fee based on utility's capacity value & new capacity needed
- SDC payment finances part, or all utility capital improvements:
  - supply, treatment plant, & backbone facilities that are CTA.
- SDC capital improvement = capacity required to serve growth.

Background for designing the sliding scale SDC in 1998

- SDCs had not been reviewed since 1986
- Historically had maintained the SDC at a level below the full cost of serving new customers
- 40% differential between inside city and outside city SDCs
- SDCs were based on tap size
  - Standard water utility practice
  - Information readily available
  - Customers understood tap equivalencies
  - Easily explainable

Public Comment: Home Builder's Association



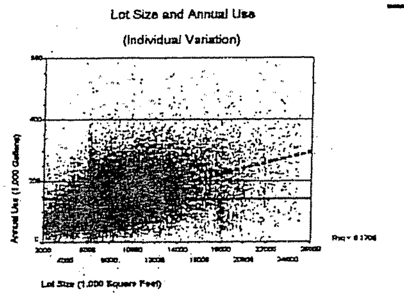
SDC Equity Issues

- Most popular method of assessing SDC's is by tap size
  - Inequity within meter size
  - Meter size governs maximum capacity not actual capacity.
- Analysis shows that within our ¾ in meter class there were various capacity needs
- Denver water decided to use average usage as measure of capacity needs

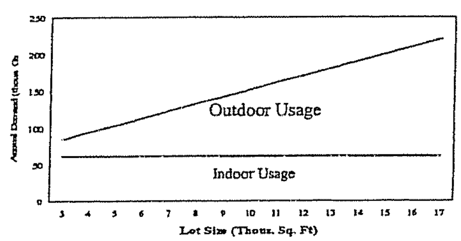
SDCs By Lot Size—Data Collection

- Usage information by lot size
- Unit Costs for all components of the system
  - Source of Supply
  - Treatment

SDCs By Lot Size – Results

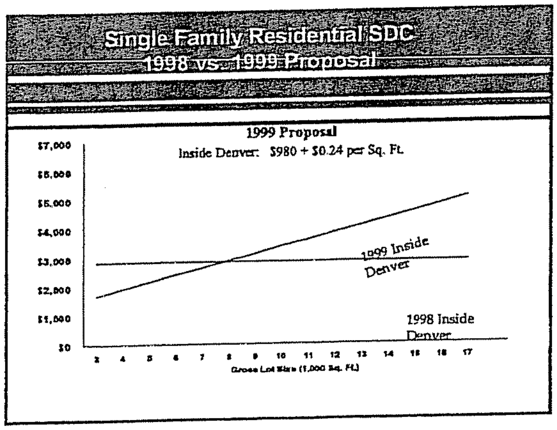


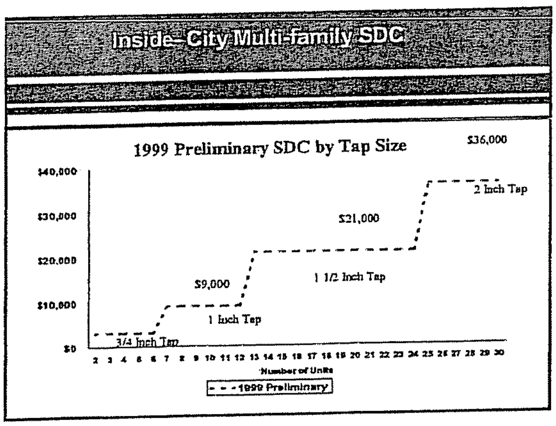
Residential Demand

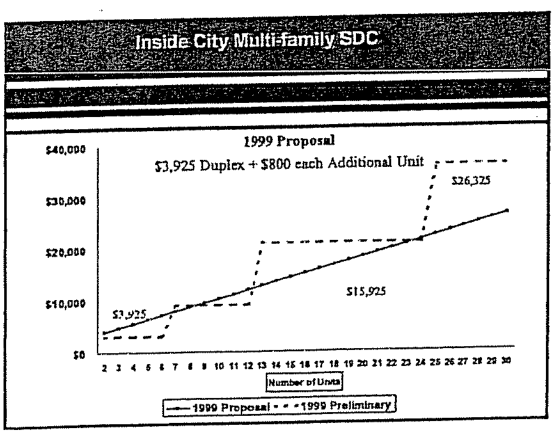


Basic SDC Calculation

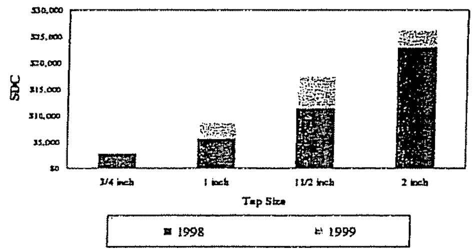
♦ Indoor	♦ Outdoor
Weighted Average Indoor Usage	Weighted Average Outdoor Usage
X	X
Unit Costs (SOS and Treatment)	Unit Cost (SOS)
-	-
Debt Service Credit	Debt Service Credit


Single Family Residential SDC
1998 vs. 1999 Proposal
1999 Proposal
Inside Denver: $980 + $0.24 per Sq. Ft.
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
1999 Inside Denver
1998 Inside Denver
Gross Lot Size (1,000 Sq. Ft.)


Inside City Multi-family SDC
1999 Preliminary SDC by Tap Size
$36,000
$40,000
$30,000
$20,000
$10,000
$0
2 Inch Tap
$21,000
$9,000
1 1/2 Inch Tap
1 Inch Tap
3/4 Inch Tap
Number of Units
1999 Preliminary


Inside City Multi-family SDC
1999 Proposal
$3,925 Duplex + $800 each Additional Unit
$40,000
$30,000
$20,000
$10,000
$0
$26,325
$15,925
$3,925
Number of Units
1999 Proposal
1999 Preliminary

All Other Inside City SDC (Commercial, Industrial, Government)



Summary and Conclusions

- Public involvement in the process proved helpful
- SDCs by tap size although common present certain types of inequities
- Traditional SDC approaches can be changed to improve equity issues
- Sliding scale SDC designs are not without their own equity issues

QUESTIONS

American Water Works Association

Navigating the Perfect Storm of Utility Finance: Fundamentals of Financial Benchmarking for Water and Wastewater Utilities

Introduction

- USEPA estimates a funding gap of $76 billion to $534 billion in water and wastewater systems over next 20 years
- Implications for Management
  - Utilities will need to issue significant debt to fund growing CIPs
    - How do I manage this?
    - How do I know if I'm over-leveraged?
    - What metrics are important?

Why are financial benchmarks important?

- Monitor financial performance
  - Operational Reserves & Balances
  - Debt Coverage
  - Rate Shock Mitigation Policies
- Provide an indication of health of the utility
- Used by Rating Agencies

Typical financial benchmarks

- Qual Serve
  - Debt Ratio
    - Total Liabilities/Total Assets
    - Quantifies level of indebtedness
  - Return on Assets
    - Net Income/Total Assets
    - Measures financial effectiveness
  - System Renewal/Replacement
    - Funds reserved or spent for renewal for specific asset categories in current year
    - Proportional annual expenditure required for such categorical replacements
    - GASB 34 impacts

Typical financial benchmarks

- Rating agencies and investment community
  - Debt Service Coverage
  - Operating Ratio
    - Operating Expense/Operating Revenue
    - Measure efficiency of management
  - Current (or Working Capital) Ratio
    - Current Assets/Current Liabilities
    - Measure of short-term liquidity

Sources of Information

- Qual Serve
- Moody's and S&P
- AMSA

Summary

- Financial benchmarking is a tool
  - Long term capital and financing planning
  - Operational management
  - Rate shock mitigation
  - Indicators for rating agencies

Summary

- You get what you measure

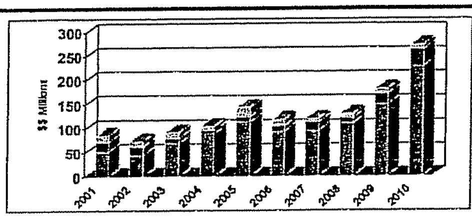
Examples of practical applications

- Large Pacific NW City and Tualatin Valley Water District, Oregon
- Los Angeles Department of Water and Power

Strategies to meet capital challenges

- Large Pacific NW City – Wastewater Bureau
  - Coping now with massive Combined Sewer Overflow project
- Tualatin Valley Water District
  - Planning ahead for new supply and renewal & replacement needs

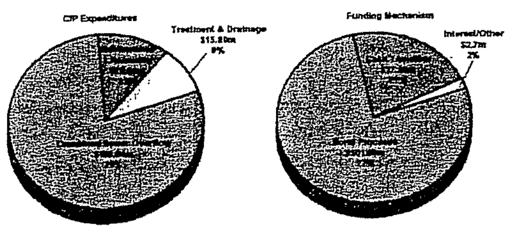
Large Pacific NW City – Wastewater CIP



Anticipate 75% of FYs 2005-10 CIP to be Funded with Borrowing

CIP Cost and Funding Comparison

(Average over 10 Years – Millions of Dollars)



Average over 10 years: $132.5 million

Average over 10 years: $132.5 million

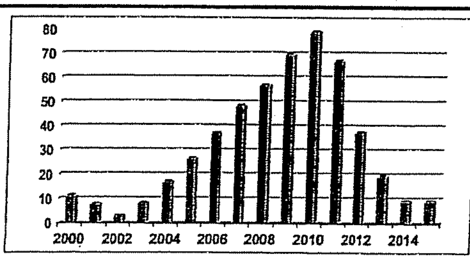
Implications of CIP & debt burden

- Operations constrained by capital
  - De facto cap on rates; "end-point" constraint
  - Operations costs must be cut to meet rate cap
  - Re-organize and re-prioritize to meet capital needs
  - No opportunity to do "extra" projects or asset management
- Technical default unthinkable
  - $1.023 billion in debt outstanding
  - Need to sell $0.853 billion more by 2011
  - Debt service averages $75-85 million/year
  - Operating revenues average $210 million/year

Financial Operations Policies

- Ending Fund Balances
  - Combined ending fund balances must be 10-15% of Operating Expenses
  - Separate Risk Reserve and Debt Redemption
- Rate Stabilization Fund
  - Used to smooth rate increases over the financial planning period
- Debt Service Coverage
  - Covenant is 1.20 for 1st lien; 1.10 for combined
  - Planning target is 1.50 for 1st lien; 1.30 for combined
  - Subordinate debt is no more than 20% of total

Rate Stabilization Fund Balance
(Millions of Dollars)



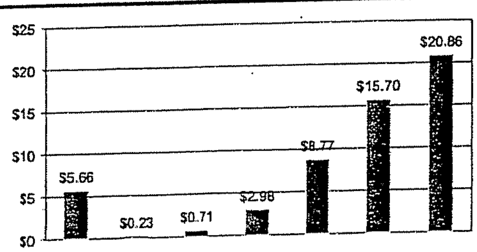
Strategies to Cope

- Rate stabilization fund management
- Debt Service Coverage
  - Higher planning target for coverage
    - Provides safety margin
    - Demonstrates sound fiscal management
    - Ensures ongoing equity contributions to capital program
  - Subordinate debt: no more than 20% of total
  - Variable rate debt has its own risk reserve
    - Forecast at 200 bp above current actuals
  - Utility franchise fees
    - 7.5% of Sales Revenues
    - Declared subordinate to payment of Debt service

Tualatin Valley Water District

- Planning Ahead – 50 Years
  - Growth forecasts show major new supply investments needed
  - Renewal & replacement study updated every 3 years
- Key planning ratios:
  - Debt service coverage
  - Combined fund balances
  - Affordability ratios
  - Operating ratio

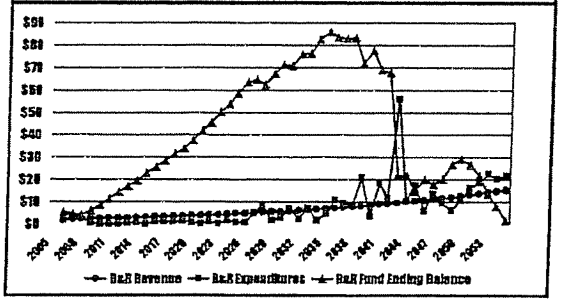
Annual Renewals & Replacements per Period (Millions of Dollars)



Renewal and replacement requirement

- Two scenarios
  - Rate revenue only
  - Rate revenue and debt
- Balances accumulate to fund future requirements
- End-point constraint
- Separate reserves
- Rate Stabilization fund

Renewal & Replacement Requirements
(Millions of Dollars)

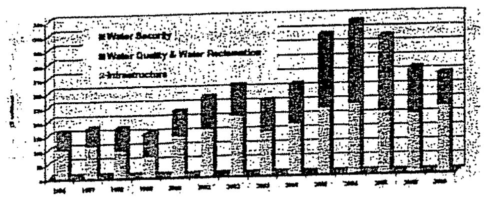


Lessons learned

- Plan and plan again
  - Extend forecast out as far as possible
  - Construct alternative scenarios
  - Test sensitivity of key assumptions
- Track the ratios that matter
  - Establish planning targets
  - Be consistent
  - Get Board buy-in
- Financial policies provide context

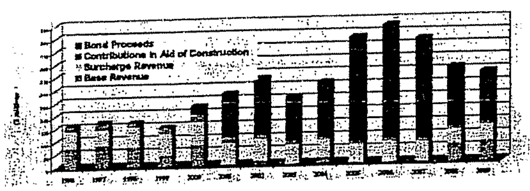
Los Angeles Department of Water and Power

CIP "Tsunami"



Los Angeles Department of Water and Power

CIP "Tsunami"



Los Angeles Department of Water and Power

Finance Plan Response

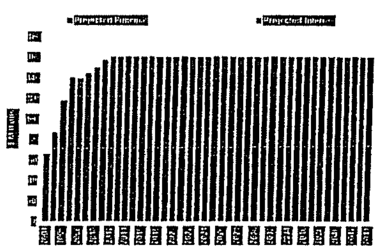
- Transition to New Master Resolution for Bonds
- Use a Combination of Debt & Internally Generated Cash to Fund the CIP
- Maintain Appropriate Debt Service Coverage
- Actively Manage Variable Rate Debt Portfolio
  - Target range of 25% to 30%

Los Angeles Department of Water and Power

- Summary of key Master Bond Resolution provisions
  - Creates a Master & Supplemental Resolution structure
  - Provides for an Expense Stabilization Fund
  - Modernizes the Additional Bonds Test
    - Maintains 1.25x minimum annual Debt Service test on a historical basis
    - Interest coverage ratio of 2x the max annual interest accrual eliminated
    - (Minimum 60 % equity to debt ratio was eliminated from City Charter)
  - Ability to issue Parity Debt Structured as Variable Rate, Balloon Maturities and/or Interest Rate Swaps
  - Permits use of subordinate debt

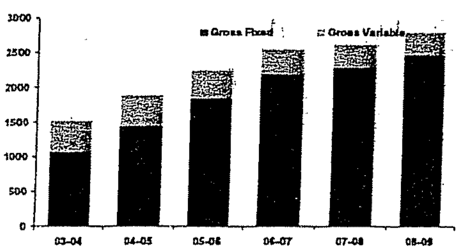
Los Angeles Department of Water and Power

Projected Debt Profile – Levelized



Los Angeles Department of Water and Power

Projected Fixed vs Variable Debt Profile



QUESTIONS?

Utility Formation Expansion

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Usefulness of Valuation Techniques in Dealing with the Perfect Storm

MSA issues.

CBA: Certified Business Appraiser.

Purpose of Topic

- Usefulness of Valuation in Dealing with the "Perfect Storm"
- Utility Valuation Techniques
- Valuation Exercise

Usefulness of Valuation

- Mergers and acquisitions to mitigate costs
  - Lower costs through economies of scale
  - Larger customer base to spread overhead costs
  - Larger customer base to spread capital costs to minimize rate shock
- Articulate to owners (citizens) value of utility

Types of Utility Transfers

- Regionalization of MUNIs
- Creation of Authority
- Purchase of IOU or MUNI by another MUNI
- Sale of MUNI to IOU (could result in higher rates)

Standards of Value

- Fair Market Value – Value to the general "marketplace"
- Investment Value – Value to specific buyer or seller

Fair Market Value

- Income Approach
- Market Approach
- Asset Approach

Income Approach

- A utility is worth the present value of its future earnings
  - Single Period Capitalization Method
  - Multiple Period Discounting Method

Single Period Capitalization Method

Normalized Earnings (Net Operating Income)
+Depreciation and Amortization +
– Capital Expenditures –
+ Increase in Net Working Capital
= Net Cash Flow

Capitalization Rate = Discount Rate (WACC) – Long-Term Sustainable Growth Rate
Net Cash Flow/Capitalization Rate
= Value of Utility

Market Approach

- A utility is worth the value implied by the active marketplace
  - Direct Market Data Method - Sales of utilities
  - Guideline Public Company Method - Publicly traded companies

XS Earnings Method: Takes into acct Goodwill, Intangible Assets

Direct Market Data Method

Transaction multiples developed based on indicators such as:
- Net utility plant
- Revenues
- Number of Customers

Transaction Price / Transaction Indicator
= Transaction Multiple
Transaction Multiple * Subject Indicator
= Value of Utility

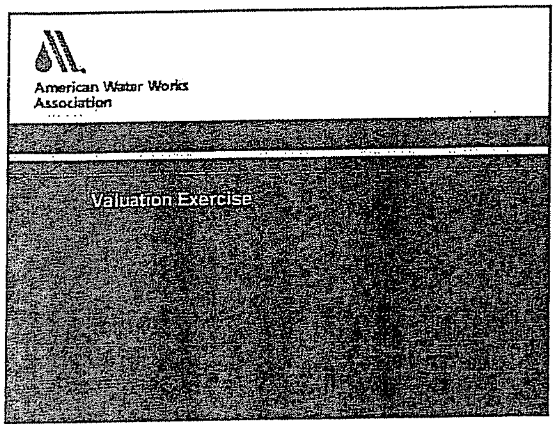
Asset Approach

- A utility is worth the sum of the values of its assets
  - Reproduction Cost New Less Depreciation ("RCNLD")
  - Adjustments made by using the Excess Earnings Method

RCNLD

Cost to replace each functional asset
X Percent condition of each asset
= RCNLD

- Adjustments for good will and/or economic obsolescence calculated using Excess Earnings Method


American Water Works
Association
Valuation Exercise

American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Avoiding Rate Shock: Making the Case for Raising Water Rates

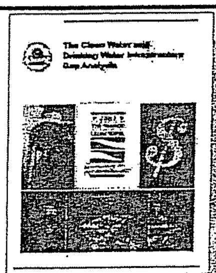
Gina Whitcock
Vice President, CH2M HILL
June 12, 2004

Agenda

- The need for increased utility spending
- About this project
- Findings and recommendations

Infrastructure challenges and investments dominate today's headlines

EPA has estimated extraordinary capital needs for drinking water utilities



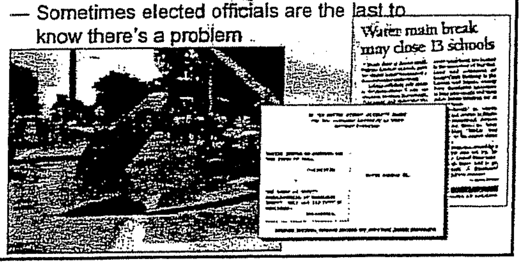
Spending needs for <u>*water systems:*</u>
$300 billion to $1 trillion over 20 years

How would answer these questions?

- — Have infrastructure failures led to negative media coverage?
- — Are you operating under a consent order to expand or improve your system?
- — Are you planning system upgrades to comply with new regulations or security requirements?
- — Have you reduced a rate increase below what you really needed for fear of rejection?
- — Have you only implemented rate increases when you <u>had</u> to?
- — Have your rate increases failed to keep up with inflation?
- — When's the last time you attended a ribbon-cutting for a new pipe?

Avoiding needed rate increases can have dire consequences

- — Can't just wait until the house is on fire
- — Sometimes elected officials are the last to know there's a problem ..



Agenda

- The need for increased utility spending
- About this project
- Findings and recommendations

What is the Water Utility Council?

- Chartered by the American Water Works Association to address governmental affairs
- 24 members from across the U.S.
- Develops action programs to address legislative & regulatory matters that affect water utilities
- Encourages provision of better water service to the consuming public

American Water Works Association

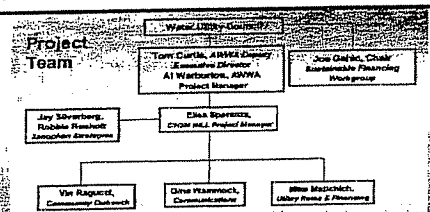
The Authoritative Resource for Safe Drinking Water

Goals of the "Rate Shock Absorbers" project:

- Analyze how community decision-makers set goals
- Explore how utilities can align rates with the best interests of the communities they serve
- Provide practical tools for building stakeholder support for necessary rate increases

Project scope and schedule

- Timeline: June-December 2003
- Tasks:
  - Ad Hoc Sustainable Financing Workshop
  - Research on "best practices" used to build support for financing long-term capital program
  - Stakeholder interviews & case study development
  - Final report and presentation templates
- Deliverable:
  - Report documenting methodology, findings, case studies, and recommendations

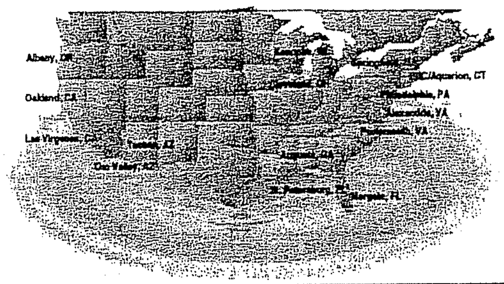


- Water Utility Council workgroup: guidance & review
- CH2M HILL: lead investigator
- Xenophon Strategies: research

Workgroup members represent a cross-section of water utilities

- Joe Gehin (Chair) Wausau, WI
- Bernie Brunwasser, Philadelphia Water Dept.
- Karen Lisowski, Cleveland Division of Water
- Ed Olson, Medford (OR) Water Commission
- Sue McCormick, Ann Arbor Water Utilities
- Barbara Buus, Tucson Water
- Frank Coulter, Ft. Lauderdale Utilities Department
- Larry Bingaman, BHC Company
- Gary Breaux, East Bay M.U.D.

Case studies targeted different geographies, sizes and circumstances



In-depth interviews covered various categories of stakeholders

- Council/Board members
- Mayor
- Watchdog
- Residential customer
- Industrial/institutional customer
- Consumer advocate
- Business community
- Bond rating agencies
- Employees

Sample question from case study survey: "Which of the following were used as part of this rate increase effort?"

- Public opinion polls
- Focus groups or stakeholder interviews
- Rate impact projection
- Multi-year financial models
- Comparisons with neighboring communities
- Showing connection between utility assets and other community goals
- Affordability analyses
- Analysis of historical utility rate increases
- Asset management studies
- Tuberculated pipes
- Maps showing pipe age
- Other (specify)

Agenda

- The need for increased utility spending
- About this project
- Findings and recommendations

Many influences shape public perceptions of water utility rates

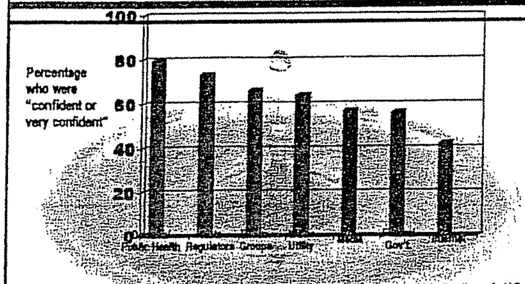
- Water utilities as monopolies
  - you can't fire each other
- Utility billing methodologies
  - combined bills can lead to misperceptions
- Perceived value of water vs. other utility services
- Attitudes toward public vs. investor-owned utilities
- Cultural factors, inside & outside utility organizations
- Credibility & trust of elected and appointed officials

–Top 5 reasons you now want to analyze your rates:

Show Me Ratemaker Workshop

- *If you raise rates for no good reason, the ratepayers will break your legs*
- You need grants and loans to keep your system from going broke
- Some big ticket item died and fixing it made your system go broke
- Your rates are very old and the system is going broke
- The State is forcing you to upgrade your system and it is going to break you

Who does the public trust for credible information about tap water?



Source: "Analysis and Findings of The Gallup Organization's Drinking Water Customer Satisfaction Survey", U.S. EPA Office of Groundwater and Drinking Water, August 2003.

... in public water supplies— for infrastructure improvements

"Meeting customer needs, exceeding customer expectations, and providing accurate and timely information on drinking water quality will help develop and maintain public confidence in tap water...

...(which) may result in increased public involvement in decision making, and stronger community support."

Source: "Analysis and Findings of The Gallup Organization's Drinking Water Customer Satisfaction Survey", U.S. EPA Office of Groundwater and Drinking Water, August 2003.

"Show-stoppers" can sink rate increase proposals

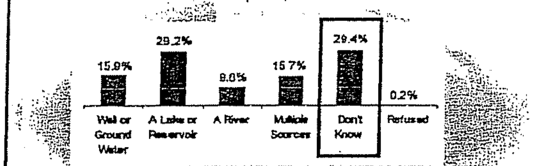
- Lack of proper documentation
- Public perceptions on unrelated issues
- Timing of other rate / tax increases and public expenditures
- Consent decree requirements
- Election timing
- Crisis

Findings fall into four general categories

- Water is undervalued, which increases the challenge in getting rate increases accepted
- Consistent communication promotes credibility and acceptance of rate increases
- It's never too late to start doing the right thing - thinking long-term and planning beyond the current crisis
- Billing practices and rate structure options can affect customer reactions and acceptance of rate increases

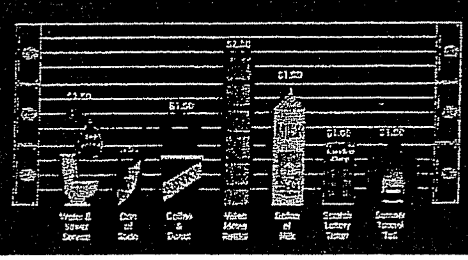
Water is undervalued, which increases challenges in getting rate increases accepted

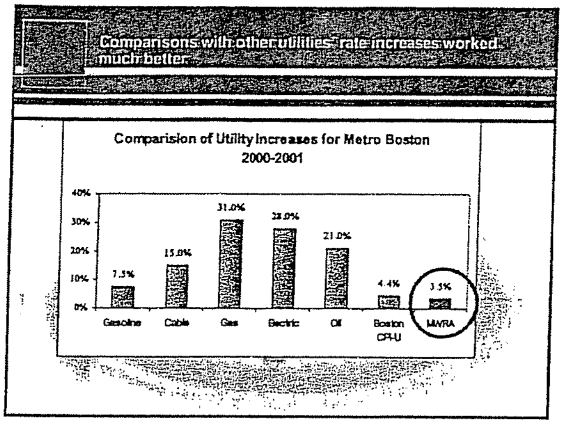
Americans Identify Where Their Water Comes From
Gallup Poll, 2003

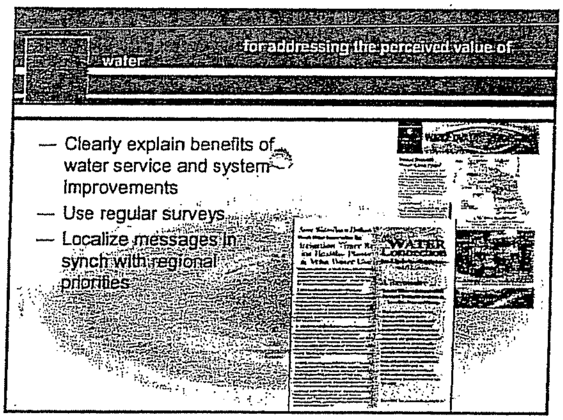


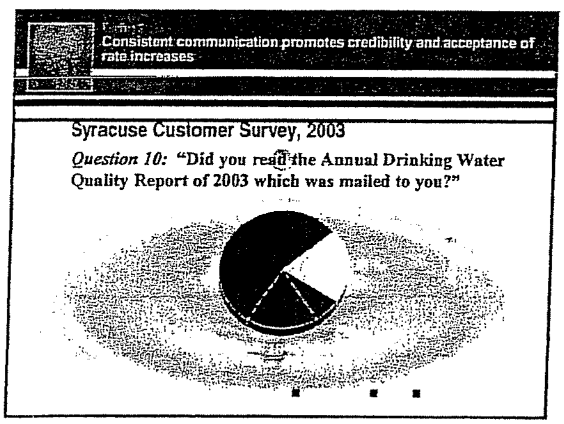
In illustrating value of water, comparisons with voluntary purchases backfired badly

The Average Daily Cost of Water & Sewer Service For a Family of Four vs. Other Common Expenses



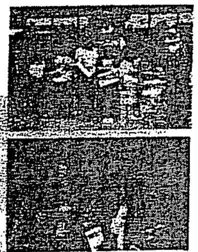

Comparisons with other utilities' rate increases worked much better
Comparision of Utility Increases for Metro Boston
2000-2001
40%
30%
20%
10%
0%
7.3%
15.0%
31.0%
28.0%
21.0%
4.4%
3.5%
Gasoline
Cable
Gas
Electric
Oil
Boston CPI-U
MWRA


for addressing the perceived value of water
— Clearly explain benefits of water service and system improvements
— Use regular surveys
— Localize messages in synch with regional priorities
WATER Connection


Consistent communication promotes credibility and acceptance of rate increases
Syracuse Customer Survey, 2003
Question 10: "Did you read the Annual Drinking Water Quality Report of 2003 which was mailed to you?"

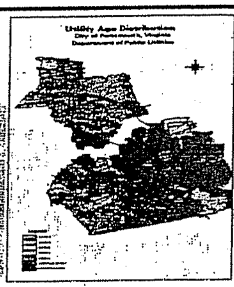
Recommendations for better communication and credibility-building

- Make employees and decision-makers "ambassadors" for the utility
- Strategic and ongoing communication plan
- Surveys for feedback and continuous improvement
- Educating the kids works better than mailing annual reports
- Take a neighborhood approach to educating the public
- Celebrate and publicize successes



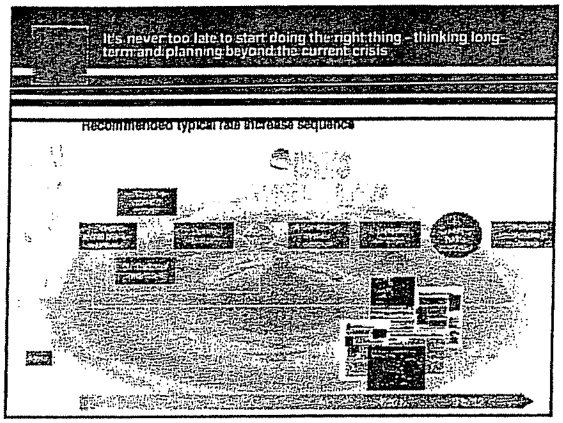
Take a neighborhood approach to educating the public

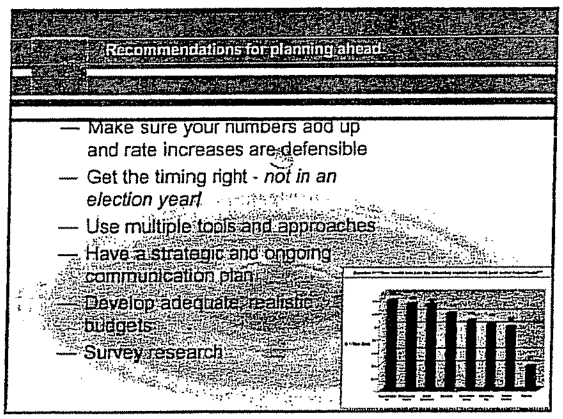
- Neighborhoods can be prioritized based on infrastructure age & problems
- Produces noticeable, affordable results
- Projects are sized to match local construction capabilities

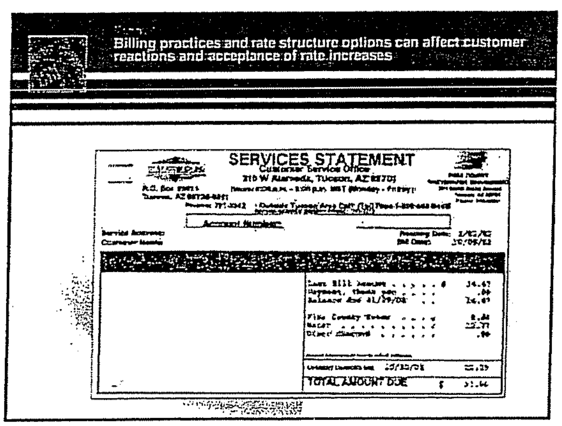


Celebrate and publicize success!

- Financial commitment was made despite tough economic times
- 77% voter support for bond referendum
- Construction started in priority areas while more detailed studies were conducted

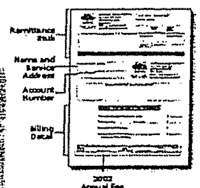

It's never too late to start doing the right thing – thinking long-term and planning beyond the current crisis
Recommended typical rate increase sequence


Recommendations for planning ahead
— Make sure your numbers add up and rate increases are defensible
— Get the timing right - *not in an election year!*
— Use multiple tools and approaches
— Have a strategic and ongoing communication plan
— Develop adequate, realistic budgets
— Survey research


Billing practices and rate structure options can affect customer reactions and acceptance of rate increases
SERVICES STATEMENT
Customer Service Office
310 W Alameda, Tucson, AZ 85701
Account Number
TOTAL AMOUNT DUE

Recommendations for billing practices & rate structure options

- Clearly explain billing information
- Use multiple tools and approaches to ensure rates are defensible, equitable, affordable
- For combined billing, create an inter-agency working group on finance and communication



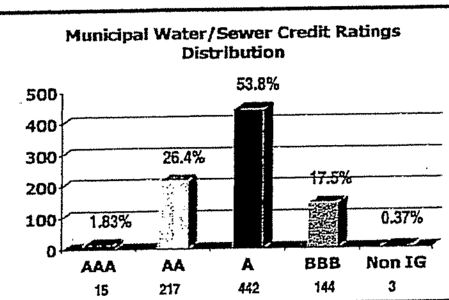
American Water Works Association

Navigating the Perfect Storm of Utility Finance:

Municipal Water Utility Credit Quality in the 21st Century

Jim Wiemken
Managing
Standard & Poors
June 12, 2005

Water/Sewer Credit Rating Distribution



Capital Requirements for Water Utilities Will Increase

- Regulatory Compliance
- Sprawling growth
- Aging infrastructure
- Heightened awareness of asset quality
  - GASB 34?
  - Asset Management?
- Likely that utilities will become increasingly leveraged
  - Especially if recognition is delayed

Deferred Costs are Likely a Significant Risk in Some Areas

- Pipes and plants are neither visible nor sexy
- Rate deferrals are commonplace—especially during elections
- Deferred maintenance can have a compounding effect over time
- Opportunities for outside detection are very limited until service disruptions occur.

What are the Implications for Water Utility Credit Ratings?

- Credit analysis has moved beyond a point-in-time analysis of current debt service coverage
- Credit analysis has moved beyond a simple current rate comparison between the utility' rates and its income levels or the utility's rates and those of its neighbors
- Ratings increasingly reflect the extent of a utility's ability to implement strategies and policies that address its unique characteristics and allow it to finance needed improvements
- Key question is whether rates will be set such that available revenues are consistently sufficient to meet all of the ongoing needs and obligations of the utility, both now and in the future.

"Whether rates will be set such that available revenues are consistently sufficient to meet all of the ongoing needs and obligations of the utility, both now and in the future."

- A variety of factors influence the analysis of this capability
  - Regulatory issues
  - Growth trends
  - Customer concentration
  - Operational capacity
  - Rate stability*
  - Rate transparency*
  - Long term planning*
    - Risk Management?

Rate stability means recognizing and addressing change

- The key statistic to be managed is the variance of the changes in rates rather than the variance in rates themselves
- Inflationary and other cost pressures should be addressed
- Lower rates should be pursued from a long term perspective and obtained through efficiencies—not through deferred recognition to benefit the short term.
- Over the long term bondholder, ratepayer, and other stakeholder interests are very aligned

Rate Stabilization Funds (RSFs): power to be used for good or evil

- S&P generally prefers that rates be regularly set to provide sufficient funds to meet all current obligations.
- RSFs can be a credit strength when used appropriately
  - Part of long-term rate strategy
  - Not a recurring reliance
  - Not used for political conveniance
- A long term revenue source should be identified to make up for the subsidization in any given year

Multi-year rate approvals: Forcing a long-term perspective

- May not be possible in some states
- Allows utility to lock in funding for entire project up front
- Prevents having to re-argue case for project annually
- Even internal policies or agreements can help if formal multi-year approvals are not possible

Rate Transparency

- Understanding the reasons for needed rate increases becomes more important when larger increases are necessary
- Transparency practices
  - Whole vs. retail costs—automatic pass-throughs
  - Expansion vs. maintenance costs
  - Variable vs. fixed costs
  - Public education of benefits
  - Publication of performance measures

Wholesale rate increases: To pass through or not?

- Pressure to absorb or dampen wholesale increases at retail level can be significant
- Creates ambiguity in true cost of service
- Pass-through policies should lead to increased popular support over the long run

Breaking Down Cost Structures

- New development often intended to pay its fair share
  - Cost of connection
  - Marginal operational and capital costs?
  - What about replacement costs?
  - Loss of economies of scale?
- Fixed vs. variable costs
- Base vs. consumption charges

Transparency largely means public education

- Water quality reporting
- Taste and odor issues
- Alternatives
- Performance measures
  - Rate increases vs. inflation
  - Cost increases vs. inflation
  - FTE measures: total, per customer, etc.
  - Other services delivered vs. cost measures

Long Range Planning

- True rate stability and transparency assumes that a system's current and likely future needs have been measured and are relatively known.
- Ratepayers cannot be educated about future rate needs without some understanding of future cost pressures
  - Are costs one time or ongoing
  - What pressures that don't exist today will exist tomorrow?

Other factors impacting future rates

- What is the revenue mix, and how might this be affected as development trends change?
- What about technology?
- Pipes may live for decades, but the average business does not—think amount customer concentration

A $2 crystal ball is worth more than you think

- Despite the multitude of questionable assumptions which support any forecast, several benefits justify at least a minimal effort toward long-term planning
- Planning forces managers to recognize long-term trends and encourages early investigation of possible solutions
- Planning can limit the opportunity for political interference
- Planning limits surprises, which almost always decrease efficiency and increase risk

Implications

- A refusal to consider the potential burden of cost pressures beyond the short to medium term is considered a credit risk
- Coverage projections should be encouraged not discouraged
- Even small utilities with limited resources can benefit from even basic forward projections; such attempts will make rate assumptions and capital plans more accepted by S&P

Can Risk Management Policies Affect Credit Quality?

- They must address risk in a measurable way
  - By adding clarity to forecasts,
  - By limiting potential volatility
- Policies must be such that they are clearly practiced, not pretended
- The cost/benefit tradeoffs and the likelihood of benefits of these policies are still unclear, thus difficult to measure
- Benefits are more likely for those practices that address multiple risks
  - Redundancies
  - System monitoring
  - Risk assessment

Northern Kentucky
Water District

ASSET MANAGEMENT PROGRAM

Volume 1 of 2

BLACK & VEATCH

May 2004

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Northern Kentucky Water District (NKWD) is a leading water utility in Kentucky and the Midwest. However, impending new drinking water regulations, an evolving customer base, aging infrastructure, an expanding distribution system, and increasing financial pressures present challenges to preserving the high level of service the District has provided in the past. Recognizing the need for a comprehensive strategic plan, NKWD has embarked on an Asset Management Program (AMP) for the 2004 – 2020 planning period. This report is the initial step in implementing the AMP.

This Executive Summary provides the principal findings and recommendations resulting directly from the AMP. Various studies and evaluations conducted prior to the AMP also identified certain areas in need of improvement. The Executive Summary generally does not list those improvements or recommendations resulting from previous evaluations; however, these improvements have been discussed in detail in subsequent chapters, and the studies from which they originated have been referenced appropriately.

This section lists only those findings and recommendations considered most pertinent or significant for the reader to develop an understanding of the general scope and results of the AMP. It is suggested this document be reviewed in its entirety, as there are numerous other findings and recommendations not included in this section for the sake of brevity.

A. EXISTING WATER SYSTEM INFRASTRUCTURE AND PROGRAMS

1. RAW WATER SUPPLY

The following summarizes the condition of the District's raw water supply facilities.

- The Ohio River Pumping Station #1, which supplies water to the Fort Thomas Treatment Plant, is in excellent condition, with the exception of the traveling screens and Pump No. 6, which are considered to be unsatisfactory.

- Ohio River Pumping Station #2, the source of raw water for the Memorial Parkway Treatment Plant, is in very poor condition. Several areas are seriously deteriorated, and substantial improvements would be required to make this a reliable facility.

- The raw water pumping station at the Memorial Parkway Treatment Plant is in poor condition. Structural, ventilation, and pumping equipment deficiencies are present.

- Most elements of the Licking River Pumping Station are generally in good condition, except structural and lighting aspects of the station are in need of improvement.

2. WATER TREATMENT PLANTS

- The Fort Thomas Treatment Plant is in generally good condition. Specific areas of notable need for the plant are as follows:

  - Tube settlers in the sedimentation basins will require replacement within the next few years. In particular, the tube settlers in Basin No. 4 are unsatisfactory.

  - Media in Filters 7 – 12 is more than 20 years old, and will likely require replacement soon.

  - The Backwash Supply Tank is in unsatisfactory condition, being in need of concrete repairs and general maintenance.

- The Memorial Parkway Treatment Plant is in poor to unsatisfactory condition, with several areas in serious need of improvement, as follows:

  - Due to the inability to dewater sludge, the North Reservoir (presedimentation basin) is being utilized for sludge and backwash holding, with decant water flowing from the North Reservoir to the South Reservoir over the earthen dam. Transfer piping between the reservoirs is hydraulically inadequate.

  - The Filter Building shows numerous locations of structural deterioration.

  - Filters 1, 2, and 3 are not operational, and will require correction to expand treatment capacity at the plant.

  - Isolation valves between the two finished water clearwell chambers are not operational and the clearwell has significant areas of structural deterioration.

  - Backwash pumps are in need of replacement or rehabilitation.

- The Chemical Building exhibits serious structural deficiencies and has numerous shortcomings with the chemical storage and feed systems.

- The residuals handling system does not properly function, and is not usable in its current condition. This significantly hampers plant operations.

- The Taylor Mill Treatment Plant was generally found to be in good condition. Specific areas of notable need for the plant are as follows:

  - Tube settlers in the sedimentation basins are in need of replacement.

  - The sedimentation basins exhibit noticeable leaks and the structural integrity of the basins is questionable.

3. DISTRIBUTION PUMPING STATIONS

With a few exceptions, the thirteen distribution pumping stations were in good to excellent condition. Listed below are significant areas of need identified for the stations.

- The District has experienced operational problems with the sodium hypochlorite feed pumps at the Bristow Road Pumping Station, but it appears the difficulties have recently been resolved

- The building used for bulk storage of sodium hypochlorite at the Dudley Pumping Station is too small to properly house the tank, and may constitute an unsafe situation in the event of an emergency.

- The District's current operations, minimizing water production at Memorial Parkway and making greater use of water from Fort Thomas for supply to Campbell County, has placed a substantial burden on the US 27 Pumping Station.

4. DISTRIBUTION SYSTEM STORAGE

The condition of NKWD's eighteen distribution storage tanks ranges between good and excellent, with the exception of the Old State Route 4 Tank, which is in critical need of attention.

5. TRANSMISSION AND DISTRIBUTION MAINS

With a few exceptions, the distribution system provides adequate capacity, pressure, and water quality to its customers. The following summarizes findings and recommendations specific to the transmission and distribution infrastructure and programs.

- NKWD currently has a total of approximately 1,000 miles of transmission, distribution, and service pipes (not including Taylor Mill), ranging in diameter from ¾ to 42 inches. The age of the piping ranges from new to as old as the 1870s.

- The current replacement cost of the transmission and distribution system is estimated to be approximately $560 million.

- The average number of main breaks per year in 1997 - 2002 was 349, a break rate of 34.9 per year per 100 miles, which exceeds the recommended AWWARF goal of 25 to 30 breaks per 100 miles. The number of breaks has increased at a rate of about 25 per year, which will double the current rate in about 14 years. It is recommended that the District take action to reduce its water main break rate by at least 20%.

- Discolored water problems are a significant cause of customer complaints and the frequency of such calls appears to be increasing.

- The District replaced approximately 25.6 miles of water mains from 1998 through 2002, at a total cost of $9.1 million ($72 per foot).

- The most pressing issue is unlined cast iron water mains, which cause most customer complaints. If it is assumed that 50% of the cast iron mains are unlined, the estimated length of unlined cast iron would be about 200 miles. To line this amount of pipe over 20 years would require approximately $2 million annually.

- The rate of replacing cast iron water mains (5 miles per year, for about $2.1 million) would require approximately 80 years (2083) to replace all the cast iron mains. At that time, the "youngest" cast iron water main in the system would be 111 years old (installed in 1965).

- The District's strategy for operation and maintenance of the piping system is generally adequate. The conventional flushing is not very effective in minimizing discolored water incidents. Unidirectional flushing will produce better results and the District's decision to execute a pilot unidirectional project is prudent.

- It is recommended to implement a comprehensive leak detection program to identify and prioritize areas with the most leaks with the objective to minimize water main breaks.

- The District should continue to clean and reline sound, unlined cast iron pipes. The relining program should be targeted for completion in 20 years. Water mains with a high frequency of breakage should be replaced and continue replacing all old steel transmission mains with ductile iron.

6. PREVENTATIVE MAINTENANCE PROGRAM

NKWD's current preventative maintenance program is very effective. The Operator 10 maintenance software is serving NKWD's needs, however the District could make additional use of that system's functions.

7. PUMP INSPECTION PROGRAM

The District does a very good job in collecting data on pumps and identifying potential equipment problems as early as possible. Data collection combined with the Pump Inspection Program has been very effective in increasing the reliability of pumping systems. This program is a success, and it is recommended that it be continued.

8. WATER QUALITY LABORATORY

The Water Quality Laboratory is currently operating very successfully, but updates to the equipment and facilities will be necessary to remain operable and in compliance in the future. More notable recommendations for the laboratory include the following:

- Should the District choose to perform in-house analysis for *Cryptosporidium*, the laboratory staff should be increased by one full-time position and additional equipment should be purchased. A cost evaluation is recommended before finalizing which approach is selected.

- NKWD does not have a laboratory information management system (LIMS) database or software. Future regulations will not mandate the use of a LIMS; however, a networked database would facilitate sample analysis and data retrieval.

- The following items are recommended to be acquired in the near future:

  - Atomic Adsorption (AA) graphite furnace, flame and autosampler
  - ICP-MS and an Autosampler
  - Gas Chromatographs and Mass Spectrophotometer
  - Additional bench space
  - Ion Chromatograph (IC)
  - Sample Refrigerators
  - Total Organic Carbon (TOC) Analyzer
  - Water Purification System

B. WATER SALES PROJECTIONS

For the AMP the water demand projections developed for the 2001 "Water System Master Plan" were utilized. For 2000 to 2020, the rate of population increase for Kenton and Campbell Counties is expected to average about 0.2% per year. However, the City of Newport is expected to experience a slight decline in population.

The District has experienced steadily rising average day demands over the last fifteen years, increasing by about 36%. Recent changes in the NKWD service area will affect these demand rates in the future; these being the acquisition of the Newport system and the loss of Boone County and Florence as wholesale customers. Table ES-1 presents the total projected water demands for the NKWD system, including Newport.

Table ES-1
Projected NKWD Water Demands

Year	Average Day (mgd)	Maximum Day (mgd)
2000	37.8	62.4
2005	32.7	54.1
2010	35.1	57.8
2020	39.7	65.5

Based on the demand projections, the District will have sufficient capacity from the three treatment plants (64 mgd combined) to meet maximum day demands for at least the next ten years, and possibly until 2020, depending upon the actual rate of growth. For planning purposes, it is assumed that additional treatment capacity will be needed about 2018.

C. WATER QUALITY AND REGULATORY ASSESSMENT

The District's ability to comply with current, impending, and potential future water quality and treatment regulations was assessed, the results of which are presented below.

- Settled and filtered water turbidity results for all three treatment plants are indicative of excellent performance with respect to the coagulation and filtration processes.

- Reported disinfection CT ratios typically exceed the minimum value of 1.00 at all three treatment facilities, which indicates disinfection conditions that significantly exceed the minimum KDOW-specified requirements. Review of the District's CT reporting practices revealed that the manner in which the "CT Required" is determined reported CT ratios considerably lower than that actually being provided. This conservative method of calculating the "CT Required" causes the District to show results which would be out of compliance, when this is not actually the case.

- The District's treatment facilities comply with all current state and federal water quality and treatment requirements.

- TOC removal performance for the Taylor Mill and Memorial Parkway plants consistently exceed the minimum TOC removal requirement. However, TOC removal ratios for the Fort Thomas plant are significantly lower than those for TMTP and MPTP, and exceed the minimum required 1.00 value by only a small margin.

- Recent quarterly running annual average TTHM and HAA5 concentrations from the District's 12 current distribution system compliance monitoring locations suggest that NKWD should easily comply with the Stage 2A Disinfection By-Product Rule TTHM and HAA5 MCLs of 0.120 mg/L and 0.100 mg/L, respectively.

- Review of DBP monitoring data suggests that compliance with the Stage 2B DBPR will be difficult to achieve using current treatment/disinfection practices. Reductions in DBP concentrations will be required to comply with the Stage 2B TTHM MCLs and to continue to provide high-quality water to the consecutive systems served by the District.

- NKWD should budget for construction of post-filtration GAC adsorption at the Fort Thomas plant, with operation by mid-2012. Construction of the GAC system would require removal of one flocculation/sedimentation basin and retrofitting another basin train with high-rate ballasted flocculation (ACTIFLO®) to maintain the rated plant capacity of 44 mgd. To provide additional flexibility and ensure the ability to operate at high production rates with one basin train out of service, it is recommended that the conversion be based on a 32 mgd ACTIFLO® system.

- Additional bench-scale testing should be conducted at the Fort Thomas plant to evaluate the potential for further reductions in system DBP concentrations through coagulation process improvements.

- The District should consider conducting informal surveys of other large utilities that have implemented chloramination. The information could be used to assist in determining if chloramines would be a viable treatment option for DBP control.

- NKWD should consider modifying the *Cryptosporidium* monitoring program to collect samples twice per month to average any potential high *Cryptosporidium* results over the 2-year monitoring period, rather than using the 12-month period with the highest results to determine bin placement under the LT2ESWTR.

D. AWWARF INFRASTRUCTRE ASSESSMENT MANAGER

For the AMP B&V created a facilities tree of NKWD water facilities using the AWWRF "Water Treatment Plant Infrastructure Assessment Manager" computer program. Problems with the program were recognized while using the Manager. There are shortcomings in the subjectivity that is applied when assigning equipment condition and interpretation of the scores. The Manager does accomplish one important goal of providing a data collection and storage system while performing a facilities assessment.

E. IDENTIFIED NEEDS AND IMPROVEMENTS

This section summarizes the more significant improvement projects which have been identified for the AMP.

1. RAW WATER SUPPLY

- The primary concern for adequate raw water supply is ORPS2. It is impractical to rehabilitate due to its age and deficiencies. Replacing ORPS2 with collector wells utilizing riverbank infiltration is cost prohibitive. Retiring ORPS2 and supplying

MPTP from a modified ORPS1 does not appear to be practical, and would require further evaluation for a definitive determination. The recommended method of supplying MPTP in the future is by a new intake facility, sized at 32 mgd capacity, to replace ORPS2. Also, new raw water mains should be constructed to MPTP.

- Pump No. 6 at ORPS1 should be replaced to bring the station up to full capacity. The new pump should be identical in capacity and rated head to the existing units.

- It is recommended that the District plan in the future to replace one of the existing 30 inch raw water mains from ORPS1 to FTTP.

- Make appropriate repairs to the ORPS1 traveling screens.

- It is recommended that the MPTP Raw Water Pumping Station be improved by replacing the three pumps as well as interior valves and associated piping.

- Recommended improvements at LRPS are to replace either Pump No. 1 or No. 2 with a new pump and VFD. However, it is questionable if the station has sufficient space to house two VFDs. It is recommended other solutions be examined.

- LRPS has severe structural cracking. The cracking in the load bearing masonry wall support system and bridge / support corbels should be repaired expeditiously to eliminate further deterioration and potential unsafe conditions.

2. WATER QUALITY AND PRODUCTION

Table ES-2 lists the projected maximum day demands for NKWD and the associated surplus or shortfall in treatment capacity, based on a total available capacity of 64 mgd.

Table ES-2
Projected Maximum Day Water Demands vs. NKWD Treatment Capacity

Year	Maximum Day Demand (mgd)	Treatment Capacity Surplus or Shortfall (mgd)
2000	62.4	+1.6
2005	54.1	+9.9
2010	57.8	+6.2
2020	65.5	-1.5

- The combined treatment capacity of the plants is anticipated to be inadequate to meet maximum day demands in about year 2018.

- NKWD currently has about 10 mgd in excess treatment capacity, which would theoretically allow operating without either the Taylor Mill or Memorial Parkway plants through approximately 2005. By the summer of 2006, it is expected all three of the plants would be needed to meet demands. However, the advantages presented by a plant shut-down are outweighed by the disadvantages.

- With the option of constructing a new treatment facility not considered, the best available alternative for increasing the supply to the system is expansion of the Memorial Parkway plant.

- Due to the age of the media in Filters No. 7 thru 12 at FTTP, the media in these filters should be replaced. While the filters are apparently functioning adequately at this time, the replacement of the media would ensure the filters continue to operate well.

- It is recommended that a second 36 inch raw water line be installed off one of the existing lines from ORPS1 to the FTTP South Reservoir.

- The existing transfer pipe between the MPTP North and South Reservoir is hydraulically restricted. The berm between the reservoirs should be reconstructed where it is damaged and a new pipe should be installed under the berm so water can flow from one reservoir to the other.

- The existing MPTP Chemical Building is in such deteriorated condition that a new Chemical Building should be constructed to replace the existing structure. (The District is currently considering a study to evaluate potential rehabilitation options for the existing building.)

- Filters No. 1, 2, and 3 at MPTP should be restored to working condition with new underdrains and media installed. Also, it is recommended that air scour backwash capabilities and automated controls be added to these filters.

- A project to improve the MPTP residual handling system is needed. It is recommended that a new gravity thickener with positive displacement pumps be installed to deliver thickened sludge to the belt filter press. ACTIFLO® residuals and sludge dredge discharge should be directed to the gravity thickener.

- Cleaning, inspection, and evaluation of the MPTP clearwell is long overdue, however, this cannot be done without taking the plant out of service. The clearwell control valves should be repaired or replaced. Structural repairs should be made as needed on various locations where exposed reinforcement is visible.

- It is expected that the MPTP will need to increase capacity to 20 mgd by 2018 to adequately serve the District's customers.

- Due to continuously increasing sanitary sewer rate charges, it has been determined that a new backwash treatment facility at TMTP is economically justifiable.

3. DISTRIBUTION PUMPING STATIONS

- It is recommended that a new Sodium Hypochlorite Building be constructed at the Dudley Pumping Station to house the complete feed and storage systems.

- Based on analyses conducted under the 2001 Master Plan, it was determined that the Ripple Creek Pumping Station will require expansion, along with related water main improvements, to address increasing water demands in southern Campbell County. As such, it is recommended that a third pump be installed at Ripple Creek.

- The Taylor Mill Pumping Station should have a new pump with a variable frequency drive installed to replace one existing pump.

- It is recommended a new second pumping station be constructed adjacent to the existing US 27 PS.

- The 2001 Master Plan identified a need for capacity expansion of the West Covington Pumping Station as a system hydraulic improvement. Due to restrictions with the existing facility, it is recommended that a new pumping station be constructed to replace the existing West Covington PS.

4. DISTRIBUTION SYSTEM STORAGE

NKWD has adequate system storage for all areas except southern Campbell County, to be addressed by the elevated tank already planned, and northern Campbell County, where a replacement for the existing Rossford and Lumley Tanks is proposed. Although the storage available in the Independence area is currently adequate, eventually this area will encounter conditions similar to that now experienced in southern Campbell County. Therefore, the District has identified the need for a second storage facility in the Independence area.

5. TRANSMISSION AND DISTRIBUTION MAINS

A series of water main improvements were identified through year 2020 as part of the 2001 Master Plan and subsequent 2003 Addendum to address current and anticipated hydraulic restrictions and provide redundancy to maintain service to customers. These improvements should be implemented as originally planned.

6. VULNERABILITY ISSUES

Items identified in the District's Vulnerability Assessment which should be included as recommended projects consist of the installation of back-up power generators at selected facilities. The generators would be added over a phased period to mitigate financial impacts. In addition to the generators, relocation of the exposed portion of the raw water main from the Licking River Pumping Station to the Taylor Mill Treatment Plant is recommended.

7. CENTRAL FACILITY

NKWD has recognized the need for consolidating its operations into fewer locations and facilities than are currently utilized, and is moving forward in pursuing a centralized facility.

8. RADIO READ METERS

The District is investigating a potential phased conversion of water meters to some type of "radio-read" technology. NKWD plans to perform a feasibility study to determine the benefits of such a conversion and evaluate its effectiveness against the costs involved. It is intended that such a conversion, if implemented, would begin with the District's older service areas that have known deficiencies, such as the Newport area. Preliminarily, it is thought that changing to automatic meter reading will be more efficient, provide a better source of data on water usage, and improve the accuracy of customer billings by replacing malfunctioning or faulty meters.

9. NKWD STAFF INTERVIEWS

As part of the AMP, B&V conducted interviews with key District staff members. The following summarizes the responses provided.

- The majority of staff envision the District continuing to evolve as a regional supplier of water and potentially expanding its service area beyond Kenton and Campbell Counties. Staff believes the District does a very good job in planning for the future.

- Opinions regarding the highest priorities for the District varied. Upper management consider public relations, improved distribution system water quality, and meeting future water quality regulations as high priority items. Supervisors and middle-level management view system redundancy and water main replacement (which is related to distribution system water quality) as priorities. Both groups placed a high value on proceeding with the Central Facility.

- There was consensus that NKWD compares very positively with other utilities, and that the District is one of the leading, if not <u>the</u> leading, utility in the state. Employees feel they have the resources to do their jobs. Management is proactive and forward-thinking, and provides staff with a sense of pride and accomplishment.

- District staff feels the facility most in need of attention is the Memorial Parkway Treatment Plant. Second in priority is ORPS2, which should be replaced by a new facility in staff's opinion. Other areas mentioned were the Central Facility, old distribution mains, the Old State Route 4 Tank, the planned South Campbell County Tank, back-up power, and improvements to FTTP and TMTP.

- Staff agree that replacement and rehabilitation of water mains justifies increased attention. The effectiveness of the current program is perceived as being everywhere between "very successful" to only "more reactive than proactive". Personnel agreed that the program would benefit from an expanded budget.

- The District's susceptibility to terrorists or other threats is regarded very seriously by staff. But it is believed that NKWD is not a high risk target, to no greater extent than other large utilities, and that realistic security issues are vandalism and theft. Personnel feel the District is taking reasonable steps to address the recommendations that resulted from the Vulnerability Assessment.

- Opinions regarding communications within the District varied, and were not dependant upon position. Most people felt communication inside their department was adequate, but exchange of information with other departments was lacking. It was believed that a Central Facility would reduce communication deficiencies.

- The consensus among upper management is that staffing is adequate, and that training opportunities are encouraged and available but under-utilized. Conversely, staff at subordinate levels felt personnel resources were inadequate in some areas.

- All of the persons interviewed had high regard for their co-workers. Staff considers themselves to demonstrate a high level of professionalism. They have a lot of pride in NKWD, and are very willing to pull together in times of need.

F. RECOMMENDED STRATEGY

1. DEVELOPMENT OF RECOMMENDED STRATEGY

The primary tool for planning the District's future is the Capital Improvement Program (CIP). The CIP is a strategy for addressing needs through year 2020. B&V initially developed two scenarios to represent "Aggressive" and "Minimal" approaches to implementing the projects. The Aggressive schedule was based on performing each project at its earliest opportunity or providing the most complete scope. The Minimal approach was prepared to defer projects as late as possible and limit the scale to its bare minimum. Once the two extreme strategies were created, a "Moderate" plan was developed as an approach that balanced needs with financial limitations. The Moderate schedule was identified as being the best combination of necessity, timing, cost, and prudent planning. The District refined the CIP, continuing with the Moderate, Minimal, and Aggressive versions. Although the Moderate plan is the selected CIP, the other versions have been retained to represent alternative methods of planning the projects.

Table ES-3 below presents the monetary differences between the three scenarios, listing the total estimated construction cost for all the projects identified over the 2004 – 2020 period.

Table ES-3
Alternative CIP Scenarios

	Minimal	Moderate	Aggressive
Total Estimated Cost	$146,775,000	$228,475,000	$282,540,000

The complete Minimal, Moderate, and Aggressive scenarios are presented in section H of this Executive Summary in Tables ES-6, ES-7, and ES-8, respectively.

2. 5-YEAR AND 20-YEAR CAPITAL IMPROVEMENT PROGRAM

Each of the key components of the CIP are discussed below. Together they constitute the approach planned for NKWD, using the Moderate scenario, to meet its needs through year 2020.

- The CIP includes approximately $64 million for improvements to water supply and delivery functions. This component has 73 projects to meet system service demands from growth and shifting population.

- The CIP commits about $129 million for infrastructure renewal and replacement projects, the largest expenditure area of the five CIP components. These are projects identified for existing system elements which will extend their service life or will need to be replaced.

- There is one project in the CIP to enable the District to meet future drinking water regulations, which is the addition of Post-Filtration GAC at the Fort Thomas Treatment Plant. This project has an estimated total cost of $21 million, and is needed to comply with anticipated limits on disinfection byproducts in the system.

- $3.85 million in treatment enhancements are included in the CIP, through four projects. These projects will improve finished water quality, provide additional treatment barriers, or enable more efficient operation of treatment facilities.

- The CIP contains approximately $12 million in projects to augment operations and management systems. These seven projects cover the Central Facility, information technology systems and improvements, and laboratory enhancements.

3. FINANCIAL AND RATE IMPACTS

a. Assumptions. The assumptions below summarize the basis for the financial analysis performed for the AMP. The assumptions were applied to each scenario.

- *Growth.* From 2005 through 2020, the Master Plan projects that average day demand will increase from 32.7 mgd to 39.7 mgd, or 21.4 percent. Under NKWD's existing rate structure, this corresponds to a cumulative revenue increase of 20.7 percent over 2003 levels, based solely on increase in customer accounts.

- *Inflation.* Summarized in Table ES-4 are annual inflation adjustment factors.

Table ES-4
Annual Inflation Assumptions

O&M		**CIP**
Labor & Benefits	4%	2.5%
Health Insurance	8%	
Other	2% - 5%	
Cumulative	3% - 4%	

- *Capital Financing.* NKWD uses a combination of debt, grants, and cash-on-hand to finance capital improvements. Debt instruments include open-market revenue bonds and bond anticipation notes (BANS). The PSC requires pre-approval of revenue bond issuances. Consequently, NKWD has elected to use BANS for temporary financing to allow projects to proceed in anticipation of permanent financing approval from the PSC. The following assumptions apply for projects requiring debt financing.

  - Interest Rate – Three percent for BANS and 5.5 percent for long-term debt.
  - Tenure – Two years for BANS and 25 years for revenue bonds.
  - Issuance Date – February (BANS) or August (revenue bonds) of the applicable year.
  - Issuance Costs – Two percent for BANS and 3 percent for long-term debt.

  Routine annual repairs and replacements (R&R) are typically cash financed. For the analysis, the level of R&R is equal to the system's annual depreciation. This level of re-investment provides reasonable assurance that NKWD is not gradually depleting the system's original assets. In addition to R&R, a small amount of the CIP is cash-financed. Over the planning period, the level of cash financing for capital projects starts at $500,000 and increases $250,000 per year thereafter.

- *Revenue Adjustments.* The minimum time between effective dates of revenue adjustments is 18 months. All revenue adjustments are effective for 6 months in the year implemented.

b. Operating and Capital Flow of Funds. There are three approaches to establishing utility revenue requirements. The first identifies the cash requirements of utilities – operation and maintenance expense, principal and interest to satisfy debt service requirements of bonds or loan programs, capital improvements which are funded from revenues, and deposits to reserve funds. The second method addresses the utilities' financial statements. Operation and maintenance expenses and bond or loan generated debt service interest are the same as in the cash approach. However, the financial statements recognize depreciation of assets instead of the actual cash spent on capital items. The third approach addresses the covenants that the utilities have made to their bond holders, financing agents, or District mandated policies in regards to minimum reserve balances.

Northern Kentucky Water District's 1985 General Bond Resolution as amended requires that the District maintain a cash operating reserve equivalent to 60 days of budgeted O&M expense.

Annual expenditures for each CIP scenario are anticipated to be met from a combination of available funds on hand, interest earnings, revenues, and debt financing. The financing plans developed allow for end-of-year fund balances equal to approximately 2 months of the following year's CIP expenditures. This approach allows for continued work prior to obtaining temporary financing monies.

The District has a policy of operating with a balanced budget. The levels of revenue adjustments which are proposed for each of the improvement scenarios reflect this policy as well as attempting to "levelize" adjustments so that customers do not experience large rate swings.

c. Summary of Results. Under the Minimal scenario, delaying significant capital projects causes rates to increase in the middle of the planning period (2011 through 2014). With the other two scenarios, the timing of projects allows for a smooth decline in revenue adjustments.

Table ES-5
Results of Financial Analyses

Year	Minimal CIP Scenario				Moderate CIP Scenario				Aggressive CIP Scenario			
	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust.	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust
	$1,000	$1,000			$1,000	$1,000			$1,000	$1,000		
2004	20,758	0	0.00%	0.00%	23,587	0	0.00%	0.00%	30,987	0	0.00%	0.00%
2005	4,932	23,249	10.00%	10.00%	14,275	26,417	11.50%	11.50%	22,799	34,705	15.50%	15.50%
2006	11,937	0	0.00%	10.00%	16,633	0	0.00%	11.50%	29,731	0	0.00%	15.50%
2007	3,254	18,893	7.75%	18.53%	11,130	34,617	11.50%	24.32%	20,872	58,834	14.50%	32.25%
2008	4,268	0	0.00%	18.53%	8,018	0	0.00%	24.32%	16,693	0	0.00%	32.25%
2009	15,441	8,425	7.75%	27.71%	23,826	21,446	9.75%	36.44%	25,404	42,073	11.50%	47.46%
2010	15,804	0	0.00%	27.71%	21,191	0	0.00%	36.44%	28,639	0	0.00%	47.46%
2011	16,781	34,994	9.00%	39.20%	23,123	50,419	9.75%	49.75%	25,086	60,528	11.50%	64.41%
2012	16,551	0	0.00%	39.20%	23,087	0	0.00%	49.75%	26,214	0	0.00%	64.41%
2013	3,131	37,332	8.00%	50.34%	12,780	51,755	9.75%	64.35%	7,925	57,456	8.00%	77.57%
2014	9,152	0	0.00%	50.34%	13,156	0	0.00%	64.35%	8,305	0	0.00%	77.57%
2015	1,047	13,757	5.00%	57.86%	8,313	29,048	5.75%	73.80%	5,321	18,178	4.75%	86.00%
2016	10,459	0	0.00%	57.86%	14,701	0	0.00%	73.80%	17,147	0	0.00%	86.00%
2017	0	12,887	5.00%	65.75%	3,567	25,776	5.75%	83.79%	6,911	25,164	4.75%	94.84%
2018	0	0	0.00%	65.75%	2,963	0	0.00%	83.79%	5,434	0	0.00%	94.84%
2019	0	0	3.00%	70.72%	4,186	7,314	2.50%	88.39%	5,082	13,826	3.00%	100.68%
2020	0	0	0.00%	70.72%	3,454	0	0.00%	88.39%	5,347	0	0.00%	100.68%
CUMULATIVI	**$133,515**	**$149,537**	**70.72%**	**70.72%**	**$227,990**	**$246,792**	**88.39%**	**88.39%**	**$287,897**	**$310,764**	**100.68%**	**100.68%**

It should be noted that two factors impact revenue adjustments: (1) the magnitude of the adjustment and (2) the timing of the adjustment. For example, under the Moderate Scenario, in 2009 the issuance of $21M in bonds results in a 9.75 percent revenue adjustment following the two 11.5 percent adjustments that had been previously implemented. The cumulative adjustment in revenues is 36.4 percent. Similarly, by 2011, $50M in bonds are financed with the previous cumulative increase in revenue plus an additional 9.75 percent. This illustrates that is no direct relationship between a bond issue and a rate increase in any single year.

d. Benchmarks. To assess the reasonableness of the proposed plans and identify areas of operational or financial improvement, benchmarking ratios were calculated. The District's operating ratios (defined as O&M expense/Total Operating Revenues) exceed the benchmarking peer group and improve over the planning period. With respect to the debt ratio (defined as [Net Utility Plant + Funds on Hand] / [Outstanding Long-Term Debt]), the District makes significant improvement over the planning period and reaches the benchmark ratio for all three scenarios.

G. RECOMMENDATIONS FOR ADDITIONAL STUDIES

For the AMP, B&V issued a series of memoranda that recommended additional studies, evaluations, or reviews. The significant suggestions contained in those memoranda are presented below.

1. WATER MAIN REHABILITATION AND REPLACEMENT PROGRAM

This memorandum provided recommendations for the water main rehabilitation and replacement (R&R) program. It was concluded that NKWD is proceeding in an appropriate manner with the R&R program, but some enhancements would be beneficial, as follows:

- At the time the AMP was prepared, the data base maintained by the District was incomplete, missing installation dates for about 70% of water mains. It is recommended the District attempt to estimate when each of the lines were installed. (Since the time the R&R program was reviewed for the AMP the District has assigned installation dates to all mains in the database.)

- The District should proceed with selection of professional services to implement a unidirectional flushing program.

- It is recommended that the District consider dedicating one full-time employee to leak detection.

- It is recommended the District consider modifying its existing model / database to aid in identifying candidate water mains for rehabilitation and replacement.

- The District should allocate funds for rehabilitation of unlined CIP. It is estimated that $2 million per year would enable the District to re-line an average of 10 miles of main per year, thus requiring about 20 years to eliminate unlined piping.

- The District is in the process of utilizing the AWWARF KANEW model for planning long-term R&R strategies. The District should supplement its system data as recommended herein before this model will yield valid results.

2. TAYLOR MILL TREATMENT PLANT – DISINFECTION CT COMPLIANCE

This memorandum presented a review of disinfection CT compliance for the TMTP. The spreadsheet utilized by the District in assessing CT compliance yields reported CT ratios considerably lower than are actually provided. The District may consider obtaining a commercial CT compliance program that calculates required CTs as a function of temperature, pH, and chlorine residual conditions.

Compliance with CT requirements under "worst case" conditions should be achieved if the clearwell level is maintained at a minimum of 9 feet. At lower levels chlorine residual requirements may be high enough to produce taste and odor complaints. As required chlorine residual concentrations increase with increasing pH, addition of sulfuric acid to maintain pH in the 7.3 to 7.5 range (or lower) would be beneficial, particularly when clearwell depths are less than 8 to 9 feet.

3. MEMORIAL PARKWAY TREATMENT PLANT – FUTURE DISINFECTION CT COMPLIANCE

This memorandum summarized review of the MPTP's ability to meet disinfection CT requirements using current disinfection practices at a future expanded flow rate of 20 mgd. Compliance with CT requirements under "worst case" temperature and pH conditions can be achieved if the clearwell level is maintained at a minimum of approximately 11 to 13 feet. At levels less than 10 feet, required chlorine residual requirements may be high enough to produce complaints of excessive chlorine taste and/or odors. Additional evaluation of clearwell inlet/outlet and operating conditions is required to confirm that the 0.3 baffle factor is appropriate. The District should evaluate actual flow and retention time characteristics.

4. RATE OF ACCEPTABLE MAIN BREAKAGE CRITERIA

This memorandum provided information to assist in establishing the acceptable number of water main breaks in the NKWD system. Utilities develop such criteria based on their system and level of service they strive to maintain. AWWARF recommends that on a system-wide basis 25 to 30 breaks per 100 main miles per year is a "reasonable" goal. The average break rate concept should not be used as criteria for replacing mains; a model should be developed which considers factors such as pipe material, age, diameter, soil type, etc.

5. RECOMMENDATIONS FOR ADDITIONAL ANALYTICAL TESTING

B&V reviewed the water quality monitoring conducted and concluded there are additional tests NKWD could perform to evaluate enhanced coagulation and granular activated carbon adsorption to help decide how to achieve compliance with the Stage 2 DBP requirements. It is recommended the District initiate bench-scale testing to evaluate reduced coagulation pH and increased ferric sulfate dosages on TOC removal at FTTP. Testing should be conducted as follows:

- For current coagulant dosages, evaluate reduced coagulation pH on TOC removal and finished water DBPs. This can be accomplished by adding sulfuric acid for pH in the 6.0 to 6.5 range.
- Evaluate TOC removal rates and finished water DBPs as a function of ferric sulfate dosage, with and without sulfuric acid addition for coagulation pH of 6.5 or lower.
- The testing described above should be repeated with addition of PAC at dosages of 10 mg/L and 20 mg/L to assess benefits of PAC addition on finished water TOC and DBP concentrations.

DBP analyses should be conducted using chlorinated sample holding times of 3 days and 7 days. Prior to this testing, a testing protocol delineating all testing procedures and analytical requirements should be prepared.

It is recommended the District test GAC adsorption to evaluate DBP precursor compound removal, using conventional GAC pilot filters or Rapid Small Scale Column Test (RSSCT) procedures. DBP precursor removal as a function of GAC contactor operating time should be assessed based on contactor influent and discharge TOC and DBP formation potentials for GAC-treated water at regular intervals throughout the run. It is recommended that testing to assess EBCTs of 10 and 20 minutes be conducted. Prior to initiating testing a protocol should be prepared.

6. INFORMATION TECHNOLOGY MASTER PLAN

This memorandum provided B&V's recommendations related to the District's computer software systems and suggested that NKWD develop a proposed Information Technology (IT) Master Plan. As more computer programs and functions are installed on the District's information system, and the need to manage "assets" more efficiently increases, it will become important that the various systems communicate and share information. It is recommended the District consider preparation of an IT Master Plan, either as a continuation of the AMP or as a stand-alone project. An IT Master Plan should address the interface between NKWD's existing software systems and identify any additional needs the District may have.

7. EVALUATION OF POTENTIAL SOUTHERN REGIONAL WATER TREATMENT PLANT

Future regulatory limits on disinfection byproducts are anticipated to have significant impact on some portions of the District system, primarily those that are located most remotely from the treatment plants. This would also affect wholesale customers. It is recommended within the next one to three years the District evaluate the possible construction of a new water treatment plant to serve southern Kenton and Campbell Counties, as well as potential adjacent water utilities. Such a plant could theoretically be a joint venture between the District and one or more nearby utilities. The study would involve modeling water quality to determine the appropriate service area for the plant.

H. MINIMAL, MODERATE, AND AGGRESSIVE CAPITAL IMPROVEMENT SCENARIOS

The complete Minimal, Moderate, and Aggressive capital improvement plan scenarios are presented on the following pages in Tables ES-6, ES-7, and ES-8, respectively.

Table ES-6
NKWD Minimal Capital Improvement Program

Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$820,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$1,700,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	Subtotal - 2004			**$19,960,000**
2005	05-01	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$2,000,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$2,100,000
	Subtotal - 2005			**$5,795,000**
2006	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000
	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000
	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation	$480,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$2,100,000
	Subtotal - 2006			**$12,285,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000

Table ES-6
NKWD Minimal Capital Improvement Program

Year	Designation	Item	Description	Cost
2007	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$2,100,000
	Subtotal - 2007			**$4,490,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$1,900,000
	08-04	New Tank	New Rossford 0.75 MG Tank; Retire Existing Lumley and Rossford Tanks	$1,000,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$2,100,000
	Subtotal - 2008			**$5,450,000**
2009	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$10,500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$2,100,000
	Subtotal - 2009			**$15,000,000**
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$10,500,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$2,100,000
	Subtotal - 2010			**$15,235,000**
2011	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$2,100,000
	Subtotal – 2011			**$15,900,000**
2012	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$2,100,000
	Subtotal - 2012			**$15,600,000**
2013	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$2,100,000
	Subtotal - 2013			**$5,080,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$2,100,000
	Subtotal - 2014			**$9,610,000**
2015	15-02	WTP Improvement	MPTP Residuals Handling	$1,500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$2,100,000
	Subtotal - 2015			**$3,600,000**

Table ES-6
NKWD Minimal Capital Improvement Program

Year	Designation	Item	Description	Cost
2016	16-01	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$2,100,000
	Subtotal - 2016			**$10,370,000**
2017	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$2,100,000
	Subtotal - 2017			**$2,100,000**
2018	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$2,100,000
	Subtotal - 2018			**$2,100,000**
2019	19-04	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$2,100,000
	Subtotal - 2019			**$2,100,000**
2020	20-03	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$2,100,000
	Subtotal - 2020			**$2,100,000**
2004 – 2020 TOTAL				**$146,775,000**

Table ES-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-02	12" Water Main	Bristow Rd. PS 12" to Bristow Rd.	$90,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-07	24" Water Main	Genn Ave., Covington (24" Redundancy)	$650,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$1,300,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-18	WM Rehab. & Repl.	Year 2004 Systematic WM Replacement	$1,000,000
	04-19	Unserved Expan.	Mains into Unserved Areas 2004 (Sub. H, Campbell)	$500,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$1,700,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	Subtotal - 2004			**$22,680,000**
2005	05-01	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-02	12" Water Main	Narrows Rd., Connect Existing 16" and 12"	$95,000
	05-03	36" Water Main	Licking River Crossing	$1,400,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-05	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	05-06	Inform. Tech. Impr.	Utility Information Management – CMMS / Inventory	$1,200,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$5,085,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-09	Back-Up Power	Standby Generator at ORPS1	$510,000
	05-10	WM Rehab. & Repl.	Year 2005 Systematic WM Replacement	$1,000,000
	05-11	Unserved Expan.	Mains into Unserved Areas 2005	$500,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$2,100,000
	Subtotal - 2005			**$14,585,000**
2006	06-01	36" Water Main	KY 9, 36" Moock Rd. to Newport Steel Entrance	$1,500,000
	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000

Table ES-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2006	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000
	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-12	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation	$480,000
	06-16	WM Rehab. & Repl.	Year 2006 Systematic WM Replacement	$1,000,000
	06-17	Unserved Expan.	Mains into Unserved Areas 2006	$500,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$2,500,000
	Subtotal - 2006			**$16,685,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-03	30", 24", 12" WM	Dudley PS Discharge, 12", 24", and 30" WMs	$2,800,000
	07-04	30" Water Main	Newport Low Service interconnect	$750,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000
	07-06	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-08	Back-Up Power	Standby Generator at Dudley PS	$275,000
	07-09	WM Rehab. & Repl.	Year 2007 Systematic WM Replacement	$1,000,000
	07-10	Unserved Expan.	Mains into Unserved Areas 2007	$500,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$2,900,000
	Subtotal - 2007			**$11,615,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$1,900,000
	08-03	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	08-04	New Tank	New Rossford; Retire Ex. Lumley & Rossford	$1,000,000
	08-05	WM Rehab. & Repl.	Year 2008 Systematic WM Replacement	$1,000,000
	08-06	Unserved Expan.	Mains into Unserved Areas 2008	$500,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$3,000,000
	Subtotal - 2008			**$8,850,000**
2009	09-01	12" Water Main	KY536, US 27 to Pond Creek Rd.	$1,990,000
	09-02	12" Water Main	Interconnect 1010 / 1017	$500,000
	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	09-04	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$10,500,000
	09-06	Back-Up Power	Standby Generator at TMTP PS	$235,000
	09-07	WM Rehab. & Repl.	Year 2009 Systematic WM Replacement	$1,000,000
	09-08	Unserved Expan.	Mains into Unserved Areas 2009	$500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$3,100,000
	Subtotal - 2009			**$22,225,000**

Table ES-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-04	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$10,500,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	10-07	WM Rehab. & Repl.	Year 2010 Systematic WM Replacement	$1,000,000
	10-08	Unserved Expan.	Mains into Unserved Areas 2010	$500,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$3,200,000
	Subtotal - 2010			**$19,835,000**
2011	11-01	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-04	Back-Up Power	Standby Generator at Ripple Creek PS	$90,000
	11-05	WM Rehab. & Repl.	Year 2011 Systematic WM Replacement	$1,000,000
	11-06	Unserved Expan.	Mains into Unserved Areas 2011	$500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$3,750,000
	Subtotal – 2011			**$21,140,000**
2012	12-01	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,130,000
	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-03	WM Rehab. & Repl.	Year 2012 Systematic WM Replacement	$1,000,000
	12-04	Unserved Expan.	Mains into Unserved Areas 2012	$500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$3,750,000
	Subtotal - 2012			**$20,880,000**
2013	13-01	42" Water Main	42" Transmission Main, FTTP to Moock Rd.	$4,290,000
	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-04	Back-Up Power	Standby Generator at Carothers Rd. PS	$100,000
	13-05	WM Rehab. & Repl.	Year 2013 Systematic WM Replacement	$1,000,000
	13-06	Unserved Expan.	Mains into Unserved Areas 2013	$500,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$3,750,000
	Subtotal - 2013			**$12,620,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	14-06	WM Rehab. & Repl.	Year 2014 Systematic WM Replacement	$1,000,000
	14-07	Unserved Expan.	Mains into Unserved Areas 2014	$500,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$3,750,000
	Subtotal - 2014			**$12,760,000**

Table ES-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2015	15-01	36" Water Main	36" Along Moock Rd.	$2,175,000
	15-02	WTP Improvement	MPTP Residuals Handling	$1,500,000
	15-03	Back-Up Power	Standby Generator at LRPS	$100,000
	15-04	WM Rehab. & Repl.	Year 2015 Systematic WM Replacement	$1,000,000
	15-05	Unserved Expan.	Mains into Unserved Areas 2015	$500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$3,750,000
	Subtotal - 2015			**$9,025,000**
2016	16-01	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-03	WM Rehab. & Repl.	Year 2016 Systematic WM Replacement	$1,000,000
	16-04	Unserved Expan.	Mains into Unserved Areas 2016	$500,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$3,750,000
	Subtotal - 2016			**$13,520,000**
2017	17-01	Back-Up Power	Standby Generator at US 27 PS	$425,000
	17-02	WM Rehab. & Repl.	Year 2017 Systematic WM Replacement	$1,000,000
	17-03	Unserved Expan.	Mains into Unserved Areas 2017	$500,000
	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$3,750,000
	Subtotal - 2017			**$5,675,000**
2018	18-01	WM Rehab. & Repl.	Year 2018 Systematic WM Replacement	$1,000,000
	18-02	Unserved Expan.	Mains into Unserved Areas 2018	$500,000
	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$3,750,000
	Subtotal - 2018			**$5,250,000**
2019	19-01	Back-Up Power	Standby Power at MPTP	$630,000
	19-02	WM Rehab. & Repl.	Year 2019 Systematic WM Replacement	$1,000,000
	19-03	Unserved Expan.	Mains into Unserved Areas 2019	$500,000
	19-04	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$3,750,000
	Subtotal - 2019			**$5,880,000**
2020	20-01	WM Rehab. & Repl.	Year 2020 Systematic WM Replacement	$1,000,000
	20-02	Unserved Expan.	Mains into Unserved Areas 2020	$500,000
	20-03	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$3,750,000
	Subtotal - 2020			**$5,250,000**
2004 – 2020 TOTAL				**$228,475,000**

Table ES-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-02	12" Water Main	Bristow Rd. PS 12" to Bristow Rd.	$90,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-07	24" Water Main	Genn Ave., Covington (24" Redundancy)	$650,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$1,100,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-18	WM Rehab. & Repl.	Year 2004 Systematic WM Replacement	$1,000,000
	04-19	Unserved Expan.	Mains into Unserved Areas 2004 (Sub. H, Campbell)	$1,500,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$4,000,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$5,085,000
	Subtotal - 2004			**$29,795,000**
2005	**05-01**	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-02	12" Water Main	Narrows Rd., Connect Existing 16" and 12"	$95,000
	05-03	36" Water Main	Licking River Crossing	$1,400,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-05	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	05-06	Inform. Tech. Impr.	Utility Information Management – CMMS / Inventory	$1,500,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-09	Back-Up Power	Standby Generator at ORPS1	$3,060,000
	05-10	WM Rehab. & Repl.	Year 2005 Systematic WM Replacement	$1,000,000
	05-11	Unserved Expan.	Mains into Unserved Areas 2005	$1,500,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$4,000,000
	13-01	42" Water Main	42" Transmission Main, FTTP to Moock Rd.	$4,290,000
	Subtotal - 2005			**$22,650,000**
2006	**06-01**	36" Water Main	KY 9, 36" Moock Rd. to Newport Steel Entrance	$1,500,000
	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000
	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000

Table ES-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2006	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-12	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation & Residuals Handling	$1,980,000
	06-16	WM Rehab. & Repl.	Year 2006 Systematic WM Replacement	$1,000,000
	06-17	Unserved Expan.	Mains into Unserved Areas 2006	$1,500,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$4,000,000
	06-19	Inform. Tech. Impr.	Utility Information Management – Phase 3, CIS Interface, Asset Depreciation	$750,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	07-08	Back-Up Power	Standby Generator at Dudley PS	$2,200,000
	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	Subtotal - 2006			**$28,795,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-03	30", 24", 12" WM	Dudley PS Discharge, 12", 24", and 30" WMs	$2,800,000
	07-04	30" Water Main	Newport Low Service interconnect	$750,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000
	07-06	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-09	WM Rehab. & Repl.	Year 2007 Systematic WM Replacement	$1,000,000
	07-10	Unserved Expan.	Mains into Unserved Areas 2007	$1,500,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$4,000,000
	07-12	Inform. Tech. Impr.	Utility Information Management – Phase 4, Dispatch / Tracking with CIS	$1,000,000
	09-06	Back-Up Power	Standby Generator at TMTP PS	$2,940,000
	Subtotal - 2007			**$20,490,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$2,100,000
	08-04	New Tank	New Rossford 0.75 MG Tank; Retire Existing Lumley and Rossford Tanks	$1,000,000
	08-05	WM Rehab. & Repl.	Year 2008 Systematic WM Replacement	$1,000,000
	08-06	Unserved Expan.	Mains into Unserved Areas 2008	$1,500,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$4,000,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	11-04	Back-Up Power	Standby Generator at Ripple Creek PS	$270,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	Subtotal - 2008			**$16,610,000**

Table ES-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2009	09-01	12" Water Main	KY536, US 27 to Pond Creek Rd.	$1,990,000
	09-02	12" Water Main	Interconnect 1010 / 1017	$500,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$14,550,000
	09-07	WM Rehab. & Repl.	Year 2009 Systematic WM Replacement	$1,000,000
	09-08	Unserved Expan.	Mains into Unserved Areas 2009	$1,500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$4,000,000
	13-04	Back-Up Power	Standby Generator at Carothers Rd. PS	$200,000
	Subtotal - 2009			**$23,740,000**
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$14,550,000
	10-07	WM Rehab. & Repl.	Year 2010 Systematic WM Replacement	$1,000,000
	10-08	Unserved Expan.	Mains into Unserved Areas 2010	$1,500,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$4,000,000
	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	15-03	Back-Up Power	Standby Generator at LRPS	$1,000,000
	Subtotal - 2010			**$26,135,000**
2011	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-05	WM Rehab. & Repl.	Year 2011 Systematic WM Replacement	$1,000,000
	11-06	Unserved Expan.	Mains into Unserved Areas 2011	$1,500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$4,000,000
	17-01	Back-Up Power	Standby Generator at US 27 PS	$2,550,000
	Subtotal – 2011			**$22,850,000**
2012	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-03	WM Rehab. & Repl.	Year 2012 Systematic WM Replacement	$1,000,000
	12-04	Unserved Expan.	Mains into Unserved Areas 2012	$1,500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$4,000,000
	15-01	36" Water Main	36" Along Moock Rd.	$2,175,000
	19-01	Back-Up Power	Standby Power at MPTP	$1,260,000
	Subtotal - 2012			**$23,435,000**
2013	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-05	WM Rehab. & Repl.	Year 2013 Systematic WM Replacement	$1,000,000
	13-06	Unserved Expan.	Mains into Unserved Areas 2013	$1,500,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$4,000,000
	13-08	Back-Up Power	Standby Power at Latonia PS	$450,000
	Subtotal - 2013			**$8,950,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000

Table ES-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2014	14-06	WM Rehab. & Repl.	Year 2014 Systematic WM Replacement	$1,000,000
	14-07	Unserved Expan.	Mains into Unserved Areas 2014	$1,500,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$4,000,000
	14-09	Back-Up Power	Standby Generator at Bristow Rd. PS	$450,000
	Subtotal - 2014			**$9,120,000**
2015	15-04	WM Rehab. & Repl.	Year 2015 Systematic WM Replacement	$1,000,000
	15-05	Unserved Expan.	Mains into Unserved Areas 2015	$1,500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$4,000,000
	15-07	Back-Up Power	Standby Generator at Bromley PS	$300,000
	Subtotal - 2015			**$6,800,000**
2016	16-01	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-03	WM Rehab. & Repl.	Year 2016 Systematic WM Replacement	$1,000,000
	16-04	Unserved Expan.	Mains into Unserved Areas 2016	$1,500,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$4,000,000
	16-06	Back-Up Power	Standby Generator at Richardson Rd. PS	$450,000
	Subtotal - 2016			**$15,220,000**
2017	17-02	WM Rehab. & Repl.	Year 2017 Systematic WM Replacement	$1,000,000
	17-03	Unserved Expan.	Mains into Unserved Areas 2017	$1,500,000
	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$4,000,000
	17-05	Back-Up Power	Standby Generator at ORPS2	$1,500,000
	Subtotal - 2017			**$8,000,000**
2018	18-01	WM Rehab. & Repl.	Year 2018 Systematic WM Replacement	$1,000,000
	18-02	Unserved Expan.	Mains into Unserved Areas 2018	$1,500,000
	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$4,000,000
	18-04	Back-Up Power	Standby Generator at Waterworks Rd. PS	$450,000
	Subtotal - 2018			**$6,950,000**
2019	19-02	WM Rehab. & Repl.	Year 2019 Systematic WM Replacement	$1,000,000
	19-03	Unserved Expan.	Mains into Unserved Areas 2019	$1,500,000
	19-04	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$4,000,000
	Subtotal - 2019			**$6,500,000**
2020	20-01	WM Rehab. & Repl.	Year 2020 Systematic WM Replacement	$1,000,000
	20-02	Unserved Expan.	Mains into Unserved Areas 2020	$1,500,000
	20-03	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$4,000,000
	Subtotal – 2020			**$6,500,000**
2004 – 2020 TOTAL				**$282,540,000**

GLOSSARY

The following are definitions and abbreviations for terminology used in this report.

Phrase	Abbreviation	Definition
atomic adsorption	AA	Method used for trace metals/inorganic analyses
acrylonitrile butadiene styrene	ABS	Material of construction that is a type of plastic
average day demand	AD	Annual water consumption divided by 365 days in a year
Asset Management Program	AMP	Systematic care, disposal, maintenance, or replacement of the total resources of a business
bond anticipation notes	BANS	Short-term interest-bearing note issued by a governmental agency in anticipation of bonds to be issued at a later date
best available technology	BAT	Under Section 1412(b)(4)(D) of the Safe Drinking Water Act, the best technology, treatment techniques, or other means that the US EPA administrator finds available to water systems
capital improvement program; cast iron pipe	CIP	A plan, updated or compiled annually by most utilities, that identifies facility requirements over an extended period, often 20 years or more; Water pressure pipe made from pig iron
Customer Information System	CIS	A system that manages, processes, and controls information for each utility customer
disinfection residual concentration contact time	CT	Product of disinfectant residual concentration, C in mg/l, and the contact time, T, in minutes
disinfection by-products	DBP	A group of disinfectants and the chemical by-products resulting from the application of those disinfectants that have been selected by the US EPA for regulation
Disinfection By-Products Rule	DBPR	A national primary drinking water regulation promulgated by the US EPA to regulate drinking water disinfectants and by-products of disinfection
diameter	diam	The length of a straight line measured through the center of a circle from one side to the other
ductile iron pipe	DIP	Water pressure pipe made from low-sulfur base iron, resulting in a less brittle product than cast iron
empty bed contact time	EBCT	A standard convention or measure of the time during which a water to be treated is in contact with the treatment medium
Filter Backwash Recycling Rule	FBRR	A process in which retained particles on a filter are removed by reversing the flow direction
fiberglass reinforced plastic	FRP	A generic term for a plastic material containing glass fibers for reinforcement

Phrase	Abbreviation	Definition
granular activated carbon	GAC	Form of particulate carbon manufactured with increased surface area per unit mass to enhance the adsorption of soluble contaminants
gas chromatograph	GC	A laboratory instrument commonly used to separate and identify organic compounds at trace concentrations
Geographic Data Technology	GDT	Information that can be related to a physical location, such as a building, land parcel, or natural feature
Geographical Information System	GIS	Computer system that stores and links non-graphic attributes and geographically referenced data with graphic map features to allow a wide range of information processing and display operations
Global Positioning Satellite System	GPS	A constellation of satellites originally developed by the US Department of Defense as a navigational aid that in 1993 became available for geodetic control surveying
haloacetic acids	HAA5	A class of disinfection by-products formed primarily during the chlorination of water containing natural organic matter
horizontal directional drilling	HDD	Controlled method for installing pipe lines underneath existing structures without disturbing their environment
high service	HS	Refers to an area with a higher water gradient asset by tank overflow elevations
Hertz	Hz	Unit of measure of the frequency of a periodic phenomenon in which the period is on second
Infrastructure Assessment Manager	IAM	Software program developed by AWWARF to manage asset information
ion chromatograph	IC	Technique for separating substances based on ion exchange
Inductively Coupled Plasma Optical Mass Spectrophotometer	ICP-MS	One of the "hyphenated techniques" in which two powerful instruments are linked
Information Collection Rule	ICR	Rule issued by US EPA in 1996 that requires water utilities serving 10,000 people or more to conduct monitoring in order to gather data for use in developing the Stage 2 Disinfectants-Disinfection By-Products Rule and the Enhanced Surface Water Treatment Rule
Initial Distribution System Evaluation	IDSE	Monitoring to be conducted for 1 year at 60-day intervals at 8 locations per plant in accordance with proposed Disinfection By-Products Rule
Interim Enhanced Surface Water Treatment Rule	IESWTR	Current regulation for monitoring and meeting turbidity requirements and removal of *Cryptosporidium*
Integral Media Support	IMS	Support system with integral underdrains for filter media that eliminates need for large diameter gravel

Phrase	Abbreviation	Definition
inorganic chemicals	IOC	Broad category of naturally occurring mineral–based elements, such as metals, radionuclides and nitrates that can be found in drinking water
Laboratory Information Management System	LIMS	A compilation of computer software and hardware designed to aid in the storage and retrieval of laboratory data
locational running annual average	LRAA	A running annual average concentration at each monitoring location
low service	LS	Refers to an area with a lower water gradient asset by tank overflow elevations
Long Term 2 Enhanced Surface Water Treatment Rule	LT2ESWTR	Proposed rule (expected promulgation 2005) that will apply to all public water systems that use surface water or groundwater under the direct influence of surface water that will improve control of microbial pathogens, specifically *Cryptosporidium*
motor control center	MCC	An enclosure housing multiple equipment motor starters for a single facility or area
maximum contaminant level	MCL	A value defined under the Safe Drinking Water Act as the maximum permissible level of a contaminant in water delivered to any user of a public water system
maximum contaminant level goal	MCLG	A federally non-enforceable, health-based goal established by the US EPA under the Safe Drinking Water Act for each contaminant regulated by a national primary drinking water regulation
maximum day demand	MD	Maximum volume of water used on any one day of the year
microfiltration	MF	A pressure-driven membrane process that separates micrometer-diameter and submicrometer-diameter particles from a feed stream by using a sieving mechanism
maximum hour demand	MH	Peak rate at which water is required during one hour
magnetized ion exchange	MIEX	Proprietary treatment process using resins to remove naturally occurring organic matter
Maintenance Management System	MMS	Software system for scheduling and recording information on maintenance of equipment
Maximum Residual Disinfectant Level	MRDL	A level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an acceptable possibility of adverse health effects
Main Replacement and Rehabilitation Program	MRRP	Program for evaluating pipes for rehabilitation or replacement
nanofiltration	NF	A pressure-driven membrane separation process that generally removes substances in the nanometer size range
Nephelometric Turbidity Units	NTU	A unit for expressing the cloudiness (turbidity) of a sample as measured by a nephelometric turbidimeter

Phrase	Abbreviation	Definition
National Pollutant Discharge Elimination System	NPDES	The regulatory agency document issued by either a federal or state agency that is designed to control all discharges of pollutants from point sources into US waterways
operations & maintenance	O&M	The ongoing process of carrying out activities necessary to fulfill the mission of an organization and to keep a system in such condition as to be able to achieve those objectives
Occupational Safety and Health Administration	OSHA	A federal agency in the Department of Labor that administers safety and health regulations and their enforcement
powdered activated carbon; poly aluminum chloride	PAC	Activated carbon composed of fine particles and providing a large surface area for adsorption
prestressed concrete cylinder pipe	PCCP	A type of reinforced concrete pipe placed in compression by a highly stressed, closely spaced helical wire winding
Programmable Logic Controller	PLC	A control device used for sequential control of processes or functions
polyvinyl chloride	PVC	An artificial polymer made from vinyl chloride monomer and frequently used in pipes, sheets, and vessels for transport, containment, and treatment in water facilities
riverbank infiltration	RBI	A process of collecting water in an infiltration gallery located within a bank along a river to allow the river water to pass through the soil in the riverbank
reverse osmosis	RO	A pressure-driven membrane separation process that removes ions, salts, and other dissolved solids and nonvolatile organics
Rapid Small Scale Column Test	RSSCT	A procedure used to predict the removal of contaminants by granular activated carbon adsorption at operating times much shorter than for pilot or full-scale facilities
Supervisory Control and Data Acquisition	SCADA	A computer-monitored alarm, response, control, and data acquisition system used by drinking water facilities to monitor their operations
Safe Drinking Water Act	SDWA	Enacted Dec. 16, 1974. It required the US EPA to set national primary (health-related) drinking water regulations that were the first to apply to all public water systems, as defined by the act, in the USA
synthetic organic chemicals	SOC	An organic compound that is commercially made; some are contaminants in drinking water and are regulated by the US EPA.
Surface Water Treatment Rule	SWTR	The common name for the US EPA regulation promulgated June 29, 1989, that set maximum contaminant level goals for viruses
Total Coliform Rule	TCR	A rulemaking of the US EPA that sets National Primary Drinking Water Regulations for total coliforms

Phrase	Abbreviation	Definition
total organic carbon	TOC	A measure of the concentration of organic carbon in water, determined by oxidation of the organic matter into carbon dioxide
treatment plant	TP	The central portion of water facilities that contains various treatment processes exclusive of collection or distribution of water
total suspended solids	TSS	A measure of all suspended solids in a liquid
total trihalomethanes	TTHM	The sum of the four chlorine-and bromine-containing trihalomethanes; the US EPA regulates the sum of these four species on a weight concentration basis
ultrafiltration	UF	A pressure-driven membrane process that separates submicron particles and dissolved solutes from a feed stream by using a sieving mechanism that is dependent on the pore size rating of the membrane
ultraviolet	UV	Radiation in the region of the electromagnetic spectrum that includes wavelengths from 10 to 390 nanometers
Vulnerability Assessment	VA	An evaluation of the likelihood that a water system could be contaminated by a particular chemical that is covered by the National Primary Drinking Water Regulations
variable frequency drive	VFD	A motor speed controller that uses adjustment of the applied power frequency to affect motor speed control
volatile organic compounds	VOC	A class of organic compounds that includes gases and volatile liquids
water main	WM	The water pipe, located beneath the ground, from which domestic water supply is delivered to the service pipe leading to specific premises
water treatment plant	WTP	The central facility for the production of potable water, containing all treatment processes and appurtenances exclusive of the distribution system

I. INTRODUCTION

A. BACKGROUND

Over the last several years, the Northern Kentucky Water District (NKWD) has evolved into a large, well-respected utility in the Midwest. The District currently serves about 218,800 people in Campbell and Kenton Counties through retail accounts, and additional areas and citizens under wholesale arrangements. Created in December 1996 by the merger of the Campbell County, Kentucky Water District and Kenton County Water District No. 1, NKWD is now the third largest water utility in Kentucky. In addition to the development occurring in this fast-growing region, the District was further expanded in 2002 with the acquisition of the water system previously owned and operated by the City of Newport. At the time of preparing this report the District had recently completed the purchase the City of Taylor Mill's water system.

B. OBJECTIVES

With the significant expansion and growth the District has recently experienced, it has become apparent that a new level of strategic planning is required to properly address and prepare for both near-term and long range needs. Although the District has had several planning studies and related projects performed over the last few years, none of these efforts was made using a global or all-inclusive examination of the overall situation to develop a complete synopsis of recommended improvements. As a result, NKWD has commissioned Black & Veatch (B&V) to prepare an Asset Management Program (AMP) to meet this goal. The AMP, as envisioned by the District, is intended to accomplish three primary objectives, as follows:

- Assess the current condition of the District's facilities
- Prioritize the recommended improvements by developing 5-year and 20-year Capital Improvement Programs
- Create the basis of an on-going Asset Management Program

This report summarizes the methodologies and results of beginning the AMP, through a series of evaluations, reviews, and analyses. These are presented herein, providing a comprehensive examination of the existing NKWD water system, a compilation of recommendations from previous studies and those resulting from the AMP, and establishing precedence for those recommendations. This will be the guidance document setting the course for the District's future. With periodic updates and re-assessments, the AMP can continue functioning as NKWD's "road map" well beyond the conclusion of this project.

It should be noted that B&V was provided with specific guidelines as part of the Scope of Services for this project regarding items to be considered in developing the AMP and how the project was to be conducted. Some of these guidelines, which are particularly relevant in the reading and understanding of this report, are as follows:

- Cost and planning information for the District's proposed Central Facility utilized in the AMP shall be as furnished by the District; further investigation as part of this project was not planned.
- Population and water use characteristics developed in the Distribution System Master Plan shall be utilized for the AMP.
- Expansion of the existing treatment facilities may be considered if the need for additional treated water supply is indicated; new treatment plants or other suppliers will not be considered.

C. ABBREVIATIONS

The following are the abbreviations used in this report:

AA	atomic adsorption
ABS	acrylonitrile butadiene styrene
AC	air conditioning
AD	average day demand
AMP	Asset Management Program
Avg.	average
AWWARF	American Water Works Association Research Foundation
BANS	bond anticipation notes
BAT	best available technology
B&V	Black & Veatch
CIP	capital improvement program; cast iron pipe
CIS	Customer Information System
CMU	concrete masonry units
CT	disinfection residual concentration contact time

DBP	disinfection by-products
DBPR	Disinfection By-Products Rule
diam	diameter
DIP	ductile iron pipe
EBCT	empty bed contact time
El	elevation
EPA	United States Environmental Protection Agency
F	Fahrenheit, Fluoride
FBRR	Filter Backwash Recycling Rule
FRP	fiberglass reinforced plastic
ft	feet
FTTP	Fort Thomas Treatment Plant
GAC	granular activated carbon
gal	gallons
gals/sq ft	gallons per square foot
GC	gas chromatograph
GCWW	Greater Cincinnati Water Works
GDT	Geographic Data Technology
GIS	Geographical Information System
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
GPS	Global Positioning Satellite System
HAA5	haloacetic acids
HDD	horizontal directional drilling
hp	horsepower
hr	hour
HS	high service
HVAC	heating, ventilation and air conditioning
Hz	hertz
IAM	Infrastructure Assessment Manager
IC	ion chromatograph
ICP-MS	Inductively Coupled Plasma Optical Mass Spectrophotometer
ICR	Information Collection Rule
IDSE	Initial Distribution System Evaluation
IESWTR	Interim Enhanced Surface Water Treatment Rule
IMS	Integral Media Support
in	inch
IOC	inorganic chemicals
IT	information technology

KDOW	Kentucky Division of Water
kW	kilowatts
kW/hp	kilowatts per horsepower
L	liters
lbs	pounds
LIMS	Laboratory Information Management System
LRAA	locational running annual average
LRPS	Licking River Pump Station
LS	low service
LT2ESWTR	Long-Term 2 Enhanced Surface Water Treatment Rule
LWC	Louisville Water Company
max	maximum
MCC	motor control center
MCL	maximum contaminate level
MCLG	maximum contaminant level goal
MD	maximum day demand
MF	microfiltration
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
mg-min/L	milligrams per minute per liter
MH	maximum hour demand
MIEX	magnetized ion exchange
min	minutes; minimum
mL/min	milliliters per minute
MMS	Maintenance Management System
MOR	Monthly Operating Report
MPTP	Memorial Parkway Treatment Plant
MRDL	Maximum Residual Disinfectant Level
MRRP	Main Replacement and Rehabilitation Program
mrem/yr	millirems per year
NF	nanofiltration
No.	number
NTU	Nephelometric Turbidity Units
NKWD	Northern Kentucky Water District
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
ORPS1	Ohio River Pump Station #1
ORPS2	Ohio River Pump Station #2
OSHA	Occupational Safety and Health Administration

PAC	powdered activated carbon; poly aluminum chloride
PCCP	pre-stressed concrete cylinder pipe
pCi/L	picocuries per liter
PDA	personal digital assistant
PEM	Pipe Evaluation Model
PIP	Pump Inspection Program
PLC	Programmable Logic Controller
PS	pumping station
PSC	Public Service Commission
psig	pounds per square inch
PVC	polyvinyl chloride
RBI	riverbank infiltration
RFQ	Request for Qualifications
RO	reverse osmosis
rpm	revolutions per minute
R/R	rehabilitation and replacement
RSSCT	Rapid Small Scale Column Test
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SOC	synthetic organic chemicals
sq ft	square feet
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TMTP	Taylor Mill Treatment Plant
TOC	total organic carbon
TP	treatment plant
TSS	total suspended solids
TTHM	total trihalomethanes
UF	ultrafiltration
ug/L	micrograms per liter
USDA	United States Department of Agriculture
UV	ultraviolet
VA	Vulnerability Assessment
VFD	variable frequency drive
VOC	volatile organic compounds
W&T	Wallace & Tiernan
WDMS	Water Distribution Management System
WM	water main
WTP	water treatment plant

D. ACKNOWLEDGEMENTS

Development of the District's Asset Management Program represents an important planning step for NKWD's future, and that of its customers. The work towards that goal which is documented in this report was carried out mutually by both Black & Veatch and the Northern Kentucky Water District. Several members of the District's staff were involved the extensive effort represented here, without whom this project would not have been successful. The B&V project team would like to acknowledge and thank the following NKWD personnel for their cooperation and assistance in making the Asset Management Program a reality:

Mary Alexander	Ron Barrow	Steve Broering
Bob Buhrlage	Mike Casebolt	Glenda Carmack
Rusty Collinsworth	Jim Dierig	Steve Findley
Don Gibson	Richard Harrison	Jim Johnson
Bari Joslyn	Amy Kramer	Ryan Kramer
Mark Lofland	Amy Matracia	Kevin Owen
Phil Perry	Ed Prather	Andy Remlinger
Scott Rymarquis	John Scheben	Joan Verax
Mary Carol Wagner	Chris Wetherell	Bill Wulfeck

II. EXISTING WATER SYSTEM INFRASTRUCTURE AND PROGRAMS

This chapter presents a summary of the District's existing facilities and related programs. The focus of this portion of the report is to provide a description of the Northern Kentucky Water District's (NKWD's) present infrastructure, including condition assessments, and a review of some key practices followed by the District for water main replacement and rehabilitation, preventative maintenance for equipment, and pump inspections. Black & Veatch (B&V) conducted inspections of the District's major facilities in June, July, and August 2003, for the purpose of compiling condition information. Comments and observations developed from those inspections are included in the facility descriptions. In addition to the information contained in this chapter, detailed inspection summaries for each facility are included in Appendix A.

Condition assessment criteria were assigned using a standard convention as defined in the American Water Works Association Research Foundation (AWWARF) Infrastructure Assessment Manager (IAM) software and as expanded on herein, rating each unit as excellent, good, satisfactory, unsatisfactory, or inoperable/unknown. It should be noted that the majority of the units evaluated were not taken out of service during the investigations. The following are the definitions used for the condition assessments:

> Excellent – Unit is in new or superior condition. No maintenance is required other than routine procedures. No reliability questions. Has full or almost full life span. Unit does not require any immediate attention. No noticeable defects.
>
> Good – Unit is in good condition with minimal to no noticeable defects. Unit does not require immediate attention, but should receive routine maintenance. No reliability questions.
>
> Satisfactory – Unit works as intended and is in satisfactory condition with minor defects and/or wear. Unit requires maintenance attention beyond routine procedures. Reliability is an issue; however, if the unit is maintained as needed, it will function properly.
>
> Unsatisfactory – Unit is in unsatisfactory condition and has significant defects and/or wear. Unit requires immediate attention with reliability unknown. Unit is nearing the end of useful life, is a major maintenance problem, and has to be serviced more than normal. Unit may not function all the time.

Inoperable / Unknown - Inoperable or severely deteriorated condition or unit does not work at all.

A. RAW WATER INTAKES AND PUMPING STATIONS

The District owns and operates three river intake and pumping facilities, each providing a dedicated supply source to one of the treatment plants. Two intakes are located on the Ohio River; the Ohio River Pumping Stations #1 and #2 (ORPS1 & ORPS2), supplying the Fort Thomas Treatment Plant (FTTP) and the Memorial Parkway Treatment Plant (MPTP) respectively. There is also a raw water pumping station at MPTP, which takes water from the presedimentation lagoons and transfers it into the treatment process. The Licking River Pumping Station (LRPS) serves the Taylor Mill Treatment Plant (TMTP), and as indicated by its name, takes suction from the Licking River.

1. OHIO RIVER PUMPING STATION #1

The Ohio River Pumping Station #1 (ORPS1) was placed into service in 1997, replacing two aged structures which had previously provided raw water to the Fort Thomas Treatment Plant (FTTP). (The two older raw water pumping stations have subsequently been demolished in 2000.) The station is located along Kentucky Route 8 (Mary Inglis Highway) about ¾ miles north of I-275, in the Brent area.

The pumping station has positions for six raw water pumps. All six positions are currently filled, however one of the units (Pump No. 6) is not operational. Each of the pumps is rated at 8,400 gallons per minute (gpm) (12 million gallons per day (mgd)) at 430 feet (ft) of head. With five pumps operating, capacity of the station is 60 mgd (42,000 gpm). All of the pumps are equipped with 1,250 horsepower (hp) motors. Pumps No. 1, 2, 3, 4, and 6 are Ingersoll Dresser "16QL21" units. Pumps No. 1 – 4 were installed with the original construction of ORPS1. Pump No. 6 was originally installed in 1994 in one of the older pumping stations that has been demolished, and relocated to ORPS 1 in 2000. Pump No. 5 is a Byron Jackson "23HQO" unit, and was installed in 1999.

Raw water from ORPS1 is conveyed to FTTP via three mains; one 42 inch diameter and two 30 inch diameter.

As originally constructed, ORPS1 included chemical storage and feed systems for adding both sodium hypochlorite and potassium permanganate to the river water as it enters the wetwell areas through the inlet ports. However, the sodium hypochlorite system has not been used for that chemical, and instead has served for additional potassium permanganate capability. The potassium permanganate is added for both zebra mussel control and as a pre-oxidant.

ORPS1 has two primary floor levels, the main pump floor and the chemical / piping level. The pumps, traveling screens, hydraulic power unit, and other major operations equipment are located at the pump level. The electrical equipment room, a storage room, and a lavatory are also located on the pump floor. Below the pump floor is the chemical / piping level, where the potassium permanganate and sodium hypochlorite systems are housed. In addition to the two primary floors, the station also has an upper mezzanine above the pump floor where ventilation equipment is located, interior wetwells extending below river level, and a loading dock.

In addition to the pumps, the pumping station consists of the following major equipment, housed in a cast-in-place concrete building:

- Pump discharge valves: 18" Rodney Hunt pump control valves and 18" Apco cushioned swing check valves
- Three FMC raw water traveling screens
- Two 2-ton monorails with hoists
- One 10-ton bridge crane with electric wire rope hoist
- One hydraulic power unit
- Four vane-axial fans in main pump room, three vane-axial fans in the electrical equipment room
- Five electric unit heaters (main pump room), and one-electric duct heater for chemical storage and feed area
- Electrical Motor Control Center (MCC) panels
- Lighting (combination of high bay metal halide and florescent)
- Chemical feed systems: potassium permanganate and sodium hypochlorite

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in excellent shape. Interior walls are a combination of un-painted and painted concrete masonry units (CMU) and painted and un-painted cast-in-place concrete. The lower portions of the walls in the main pump room are covered with metal sound-adsorbing panels, all of which were noted to be in good condition. The roof of the building is constructed of steel framing members with standing seam metal roofing, which are in good condition. Minor debris from birds, etc. was noted on the interior of the building rafters, but it was not heavy enough to warrant any action at this time. There are no signs of differential settlement or cracking of the pumping station walls or the wetwells. The electrical equipment is housed in a separate room, adjacent to the pump room.

There is a single 2-ton monorail located outside the pump room on the river side of the building for removing the bar racks. A second monorail is located just inside the building, intended to facilitate moving bar racks to the station interior. The outdoor unit is equipped with a chain pull hoist, and the indoor unit is equipped with an electric wire rope hoist. Both units are in good working order. A 10-ton bridge crane is located in the main pump room for servicing the pumps, motors, discharge piping, and valves. It is in good working order, and no problems were noted.

Three FMC Link-Belt traveling water screens are installed at the pumping station, one for each wetwell. District staff indicated that the screens were previously inspected by equipment manufacturer's representatives due to problems experienced with the head shaft excessively wearing the bearings. As a result the traveling water screens are considered to be in unsatisfactory condition and the District is currently investigating a solution to the problems with the screens.

b. Heating and Cooling. The pumping station is cooled by natural ventilation when the pumping units are not in operation, and by forced air ventilation through the use of four vane-axial fans mounted on a mezzanine level located above the main pump floor. Air is drawn into the pumping station through side louvers with motor operated dampers. The fans were not operating during the site investigation; however, District staff noted that they operate satisfactorily and that the airflow through the room is significant enough to limit the temperature rise to acceptable levels. The main pump room is heated by five electric unit heaters located around the perimeter of the room. Each of the units is in good working order, and staff indicated no problems with their operation.

The chemical area is cooled by forced air ventilation through a duct fan drawing air from the exterior of the building. Heating is provided by the same system with an in-line duct heater. Both the fan system and the heating system are in good working order.

The electrical equipment room is cooled by three vane-axial fans drawing air in through louvers in the side of the building. All three units were in good working order.

c. Lighting. Lighting within the pumping station main pump room is provided by high bay metal halide fixtures. Additional light is provided through glass block side lights on three sides of the pumping station. Artificial lighting levels in the main pump room could not be verified due to the amount of sunlight present at the time, but based on the number of fixtures it appears that the lighting levels would be adequate at night. Lighting fixtures in the electrical equipment room and the chemical storage and feed area are both florescent, and the illumination levels are excellent. In addition, the lighting fixtures in all three areas are in good condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, in a separate room adjacent to the pump room. Electrical control and power equipment were noted to be in excellent condition, with no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. Pumping Units No. 1, 2, 3, and 4 were installed when the building was constructed. Each of the four units is in excellent working condition, and only minor maintenance related problems were noted. Pumping Unit No. 5 was installed in 1999, is of the same capacity as units 1 through 4, and is also in excellent working order. District staff indicated no problems with the operation of Pumps 1 through 5. Pumping Unit No. 6 was relocated from one of the older, demolished pumping stations and installed at ORPS1. The pump is currently inoperable, and the District has forgone repairs to the unit in lieu of replacement at some time in the future.

The lower shaft area and wetwells for the pumps were examined during the site investigation. Pump column supports were observed to be in good condition, and no abnormal corrosion or other forms of wear were observed.

f. Chemical Feed Systems. Potassium permanganate is the only chemical that is currently fed at the pumping station. Originally designed with one storage / mixing tank and four metering pumps, the system now uses what was originally designed as the sodium hypochlorite feed system as well. An additional storage tank and four additional metering pumps are all now used as part of the potassium permanganate feed system. The system was expanded for increased capacity so that the storage tank would not have to be filled twice on long weekends. Also, since sodium hypochlorite has never been fed at the intake, the sodium hypochlorite system presented a convenient solution to increase capacity of the potassium permanganate system.

The potassium permanganate system is overall in satisfactory condition. Evidence of leaks and / or spills was apparent on the metering pumps, piping, and valves. Heavy corrosion was noted around the metering pumps and piping in the pump area, most likely due to minor leaks in the piping and pump connections. The connection pipe from the original storage / mixing tank to the old sodium hypochlorite storage tank is located in the middle of a walkway creating a tripping potential and safety hazard.

g. Miscellaneous Equipment. Other support equipment located at ORPS1 includes a service air compressor system, a traveling screen washwater strainer system, and a hydraulic power unit. The service air compressor is located on the main pump room floor and provides pressurized air supply for service tools, and other miscellaneous uses throughout the pumping station. The unit is in good working order, and no visible problems were noted.

A series of strainers are used for removing large particles out of the raw water supply used for washing the traveling screens. These strainers are located on the main pump room floor. Each of the strainers, and their associated piping and valves, appear to be in good working order. No visible leaks or other problems were noted by District staff or observed during the site investigation.

A single hydraulic power unit is located on the main pump room floor to provide power to the pump discharge cone valves and a number of hydraulically actuated gates. The unit is equipped with redundant hydraulic pumps, with a common accumulator and control panel. The unit is in excellent condition, with only minor accumulation of hydraulic fluid in the pump area. Operations staff indicated that they stock spare relays and control modules for the unit as it is the only power system on site for the hydraulically powered equipment.

2. OHIO RIVER PUMPING STATION #2

The Memorial Parkway Treatment Plant (MPTP) is supplied from the Ohio River Pumping Station #2 (ORPS2), which is about ½ mile downstream (north) from ORPS1 on the Ohio River, also along Kentucky Route 8. ORPS2 is located within the city limits of Fort Thomas, and was originally constructed in 1876.

The station is equipped with three vertical turbine pumps. Maximum capacity of ORPS2 (all pumps running) is about 23.1 mgd (16,000 gpm), and firm capacity (largest unit out of service) is about 14.4 mgd (10,000 gpm). However, as is noted below, Pump No. 1 is currently inoperable. Additional information for the ORPS2 pumping units is provided in Table II-1. The performance characteristics for the pumping units were obtained from NKWD staff, no documentation or nameplate data was available for the pumps.

Table II-1
Ohio River Pumping Station No. 2

Pump ID	Installation Date	Manufacturer	Discharge		Head (feet)	Motor hp
			gpm	mgd		
ORPS2-PUMP-1	2001	Unknown	6,000	8.6	430	800
ORPS2-PUMP-2	2001	Unknown	6,000	8.6	430	800
ORPS2-PUMP-3	1999	Fairbanks Morse	4,000	5.8	430	600

Two 20 inch raw water mains convey raw water from ORPS2 to MPTP.

In addition to the pumps, the pumping station consists of the following major equipment, housed in a brick building with cast-in-place concrete pump pit:

- Pump discharge valves: 18" Rodney Hunt pump control valves and 18" Apco cushioned swing check valves
- One raw water traveling screen
- One 5-ton bridge crane with electric hoist (Yale)
- One 5-ton monorail with chain pull hoist (Yale)
- Hydraulic power unit (Henry Pratt)
- One propeller ceiling mounted ventilation fan with manual inlet damper.
- Two natural gas unit heaters (main pump room)
- Electrical MCC panels
- Lighting (combination of side wall mounted metal halide and incandescent)
- Potassium permanganate feed system

a. Condition. The overall condition of the pumping station is unsatisfactory.

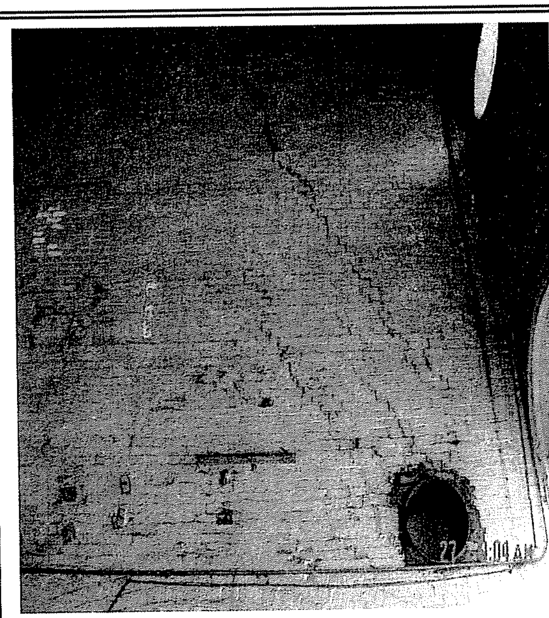


Figure II-1

The interior of the building is unsatisfactory. The brickwork and concrete floor are extremely deteriorated and show signs of age after numerous modifications over the years. The upper portion of the pumping station is brick and shows signs of differential settlement, as shown in Figure II-1. There are a number of places where radial cracks as wide as ½ inch are evident. The lower portion of the pumping station is constructed of cast-in-place concrete and there are a number of places where the deterioration is excessive. The concrete in the lower pump pit is in very bad shape, and the structural integrity of the pumping station is questionable.

The roof of the building is constructed of wood framing members with wooden plank roofing and composite shingles. Figure II-2 shows the interior of the roof. There are a number of locations where daylight could be seen through the roof, indicating significant holes.

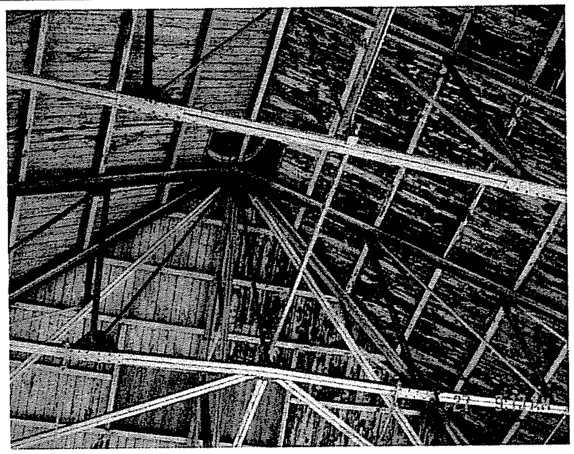


Figure II-2

A 5-ton bridge crane with electric hoist is provided in the main pump room. A 5-ton monorail with chain pull hoist is provided above the lower pump pit. Both units are in good working order.

Pump inlet piping is located in the bottom of the lower pump pit. A sump pump system is used to pump water out of the lower pump pit. During the site investigation the lower pump pit was observed to be partially flooded, and efforts to de-water it only reduced the level of the water to approximately the top of the pump inlet piping. Figure II-3 shows the lower pump pit area and the water remaining in the pit.

Figure II-3

b. Heating and Cooling. The pumping station is cooled by forced air ventilation through the use of a single ceiling mounted propeller fan above the pump heads. Air is drawn in through open windows around the perimeter of the pumping station. Heat for the pumping station is provided by two natural gas unit heaters located in the main pump room. The fan was observed to operate during the site investigation, and the heaters appear to be in good working order.

c. Lighting. Lighting within the pumping station main pump room is a combination of incandescent and wall mounted metal halide fixtures. Lighting levels are adequate, with the exception of the lower pump pit. Metal halide fixtures are mounted on the wall at the top of the pit; however, light does not reach the lower pipe area, making the area essentially dark. Fixtures are in satisfactory condition.

d. <u>Electrical Equipment</u>. The electrical MCCs and breaker panels are located within the interior of the main pump room on the upper mezzanine. Electrical control and power equipment were noted to be in satisfactory condition; however, it was apparent that they have been moved from one location to another by the minor damage evident to the exterior of the cabinets. The equipment is old and availability of spare parts may be limited.

e. <u>Pumping Equipment</u>. Pumping Unit No. 1 is not currently used as it has experienced bearing and seal failure and the District has elected not to repair it. Pumps No. 2 and 3 appear to be in satisfactory operating condition, although their reliability is a major concern. Limited data was available regarding the design characteristics, performance, and repair histories of the pumping units.

Access to the upper pump head area is limited. Access to the lower pump area is adequate, but problems with the lighting and excessive corrosion and deterioration of the building make it unsafe.

f. <u>Miscellaneous Equipment</u>. The pump station is equipped with one traveling screen, which appears to be in good working order. There is a 5 ton bridge crane and a 5 ton monorail for pump, piping, and valve maintenance. Each of the units is in good working order. There is other support equipment located at the pumping station including a service air compressor system, a traveling screen washwater strainer system, a potassium permanganate feed system, and a hydraulic power unit. The service air compressor is located on the main pump room floor and provides air for service tools, and other miscellaneous uses throughout the pumping station. The unit was observed to be in good working order, and no visible problems were noted.

A single strainer used for removing large particles out of the traveling screen washwater is located on the main pump room floor. The strainer and its associated piping and valves are in good working order. No visible leaks or other problems were noted during the site investigation.

A single hydraulic unit is located on the upper mezzanine to provide hydraulic power to the pump discharge valves. The unit is old but appears to be in good working order.

A potassium permanganate storage and feed system is located on the main pump room floor and is in overall good condition. The system consists of one bulk storage / mixing tank, one metering pump, and associated piping and valves, with containment provided by an approximately 3 foot high wall.

3. MEMORIAL PARKWAY TREATMENT PLANT RAW WATER PUMPING STATION

Water from ORPS2 is conveyed to one of two presedimentation basins at the Memorial Parkway Treatment Plant. A raw water pumping station adjacent to the North Reservoir is then used to transfer the raw water to the plant processes for treatment. The station houses three horizontal split case pumps, all of which are Worthington model "12LN17" units. The pumps are original to the construction of the station, circa 1961. One unit (Pump No. 1) is rated at 5,300 gpm (7.6 mgd), and the other two pumps (Pumps No. 2 and 3) are each rated 3,675 gpm (5.3 mgd). All of the pump capacity ratings are based on a head of 64 feet. Therefore, the combined capacity of the three pumps is 12,650 gpm (18.2 mgd), and the station has a firm pumping capacity of 7,350 gpm (10.6 mgd).

In addition to the pumps, the pumping station consists of the following major equipment, housed in a CMU block building with a concrete floor:

- Pump suction valves: 16" M&H gate valve (Pumps 1 & 2), 16" Mueller butterfly valve (Pump 3)
- Pump discharge valves: 14" Pratt butterfly valve, 14" M&H check valve (Pumps 1 & 2), 14" GA Industries check valve (Pump 3)
- Electrical MCC panels
- Two natural gas unit heaters (Janitrol and Sterling)
- 3-Ton monorail (Robbins / Meyers)
- Lighting (incandescent)

a. Condition. The overall condition of the pumping station is unsatisfactory.

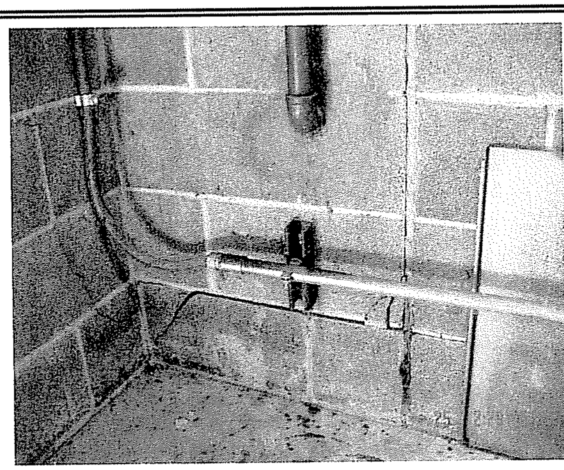


Figure II-4

The interior of the building is in unsatisfactory shape, based on observed interior wall cracks. Walls are un-painted CMU. It was noted during the site investigation that there is strong evidence that the building is experiencing differential settlement due to the cracking apparent in the CMU walls at three corners of the building. Figure II-4 shows cracking in the southwest corner of the building. The exterior of the pumping station is brick which is in satisfactory condition; however, in the areas where the CMU cracking was noted in the interior of the building, similar cracking and missing mortar was visible on the exterior.

The interior of the pumping station consists of a single story pump room which houses the pumps, inlet and discharge piping and valves, and electrical MCC and control panels. A 3-ton monorail with hoist is provided for pump, piping, and valve maintenance. The exterior doors and wall mounted louvers are painted and moderate corrosion was noted.

b. Heating and Cooling. The pumping station is cooled by natural ventilation through side windows and two roof gravity vents with manual dampers, resulting in unsatisfactory ventilation. During the site investigation, movement of air through the room was minimal, and the temperature inside the pump room was high. Heating is provided by two natural gas fired unit heaters controlled through separate wall-mounted thermostats. One unit appeared to be part of the original construction, and did not appear to be operable. The second unit was recently installed and appeared to be in excellent working order.

c. Lighting. Lighting fixtures in the pumping station interior are incandescent type. Lighting levels in the pump room are satisfactory; however, during daylight hours the majority of the lighting is provided from the side windows. Lighting levels on the opposite side of the room are low and may pose a safety concern.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, adjacent to the pumps. Electrical control and power equipment were noted to be in new, excellent condition, with no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed when the building was constructed in 1961. The overall condition of the pumps is unsatisfactory. A number of excessive water leaks were noted from pump and valve seals throughout the pumping station. Heavy corrosion was noted along the pump bases, bearing housings, and pipe trench grating covers. Figure II-5 shows an example of typical degree of corrosion that was noted due to excessive water leaks. No vibration or maintenance history data was available for the pumping systems from the records provided by the District.

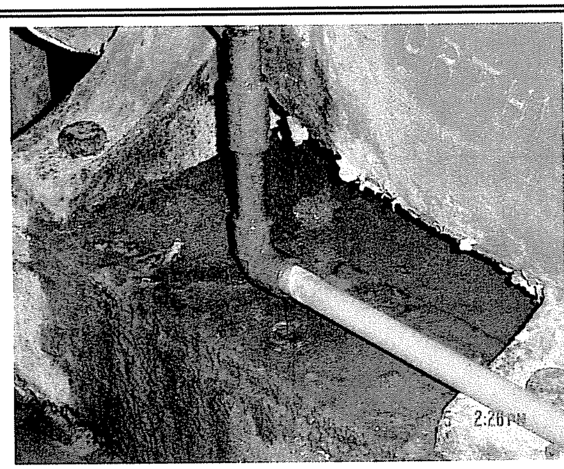


Figure II-5

4. LICKING RIVER PUMPING STATION

The Licking River Pumping Station (LRPS) supplies raw water to the Taylor Mill Treatment Plant (TMTP). The station is located in Taylor Mill, just off Kentucky Route 177 (DeCoursey Pike), adjacent to a CSX Railroad switching yard. The station has three vertical turbine pumping units installed, with a combined rated capacity of 25.1 mgd (17,400 gpm) and a firm capacity of 16.1 mgd (11,150 gpm). Details regarding the Licking River pumps are listed in Table II-2.

Table II-2
Licking River Pumping Station

Pump ID	Installation Date	Manufacturer and Model	Discharge		Head (feet)	Motor hp
			gpm	mgd		
LRPS-PUMP-1	1990	Fairbanks Morse "28HC"	6,250	9.0	126	350
LRPS-PUMP-2	1971	Peerless "24MA-2"	4,900	7.1	133	250
LRPS-PUMP-3*	1993	Fairbanks Morse "28HC"	6,250	9.0	126	150

* = LRPS-PUMP-3 is equipped with a variable frequency drive

In addition to the pumps, the pumping station consists of the following major equipment, housed in a brick building with concrete floor, and a concrete mezzanine:

- Pump discharge valves: 16" Dezurik butterfly valve (Pump 3)
- Pump discharge check valves: 16" Apco
- Electrical MCC panels
- Two ventilation fans (one wall and one roof mounted)
- One electric unit heater
- 2 -Ton monorail
- Lighting (incandescent)
- Inlet fine screen

A steel access bridge and deck extends from the pumping station to the nearby river bank. At the "shore" end of the bridge is a metal building which houses potassium permanganate storage and feed equipment. District staff indicated that the support columns for the bridge are cracking as shown in Figure II-6.

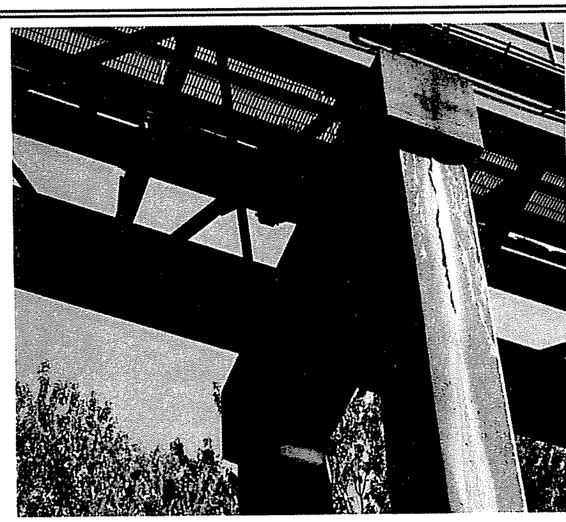


Figure II-6

a. Condition. Overall condition of the pumping station is unsatisfactory. The interior of the building is in satisfactory shape. Interior walls are painted brick. It was noted during the site investigation that the building may have structural problems due to cracking that is apparent in the walls and lower concrete foundation. Figures II-7 and II-8 show example of the cracking that was observed. The exterior of the pumping station is brick, in satisfactory condition; however, as mentioned above, some cracking was evident.

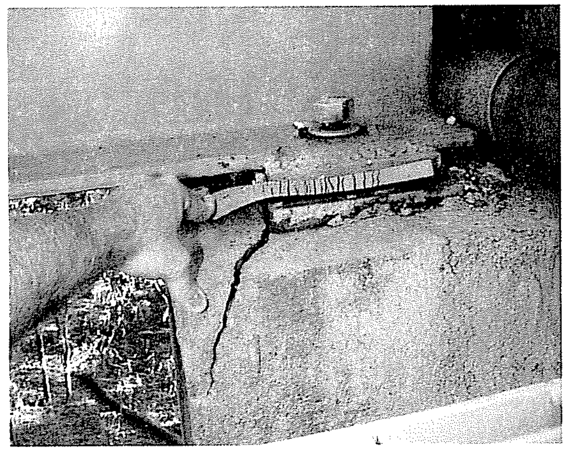


Figure II-7

The interior of the pumping station consists of a single story pump room which houses the pumps, discharge piping, valves, and electrical MCC and control panels. A 2-ton monorail with hoist is provided for piping and valve maintenance. Roof hatches are provided for pulling the pumps, which must be done from a boom barge located on the river or a large crane on shore. The exterior doors and wall mounted louvers are painted and moderate corrosion was noted.

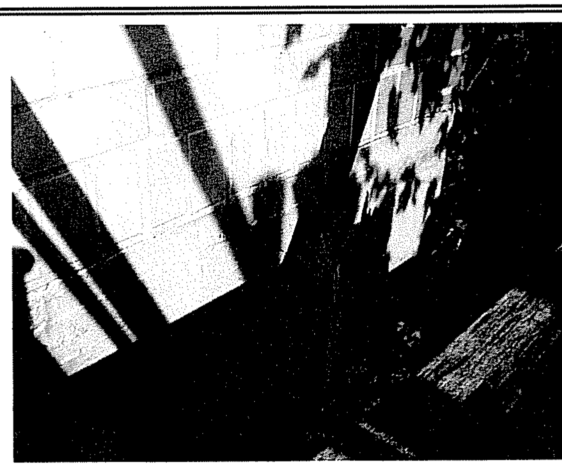


Figure II-8

b. Heating and Cooling. The pumping station is cooled by two ventilation fans, one wall- mounted unit and one roof-mounted unit, which draw air from wall louvers on the river side of the facility. Movement of air through the room is satisfactory, and temperatures within the room were acceptable at the time of the inspection. Heating is provided by a small electric unit heater located in the pump room, controlled by a wall-mounted thermostat. Both ventilation fans are operational and they exhibited no excessive vibration or noise. The unit heater appears to be in good working order, and District operations staff indicated that there are no known problems with the unit.

c. Lighting. Lighting within the pumping station interior is provided by incandescent fixtures. Lighting levels in the pump room are unsatisfactory, and may be low enough to potentially pose a safety concern.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, adjacent to the pumps. Electrical control and power equipment were noted to be in satisfactory condition, and no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed at the station in stages between 1971 and 1993. Overall condition of the pumping units is satisfactory, and only minor corrosion was noted on the pump bases and piping. Maintenance space around the pumps and piping is satisfactory. Pump vibration data collected by District staff for the period of November 2002 through April 2003 show acceptable levels of vibration for each pump, indicating there are no major problems with the bearings within the pumps and motors.

f. Inlet Screen. Water drawn from the river is screened prior to entering the pump wetwell. A single FMC "A5A" traveling screen mounted on an exterior platform is used for screening debris from the water. The unit was not in operation during the site investigation; however, it appeared to be in good working order. District staff indicated that they have not experienced any major problems the unit.

g. Potassium Permanganate Storage and Feed. Potassium permanganate is fed to the LRPS wetwell. The feed system consists of one storage / mixing tank, two transfer pumps, and two metering pumps. The system is located in a separate potassium permanganate building located west of the LRPS. The potassium permanganate feed system is overall in good condition. District staff noted no concerns about the operation of the system.

B. WATER TREATMENT PLANTS

The District's three water treatment plants (WTPs) in many ways represent the heart of NKWD's system. They play a crucial role in providing clean, safe water for the people of Northern Kentucky. The following portion of Chapter II provides a description of each plant and the results of the field inspections and condition assessments.

1. FORT THOMAS TREATMENT PLANT

The Fort Thomas Treatment Plant (FTTP) is the largest of NKWD's treatment facilities, with a rated production capacity of 44 mgd, and it represents the primary source of finished water for the District. FTTP is a conventional coagulation / settling / filtration plant. Raw water from the Ohio River is pumped to two presedimentation basins at the plant, having a combined total capacity of 72 million gallons (MG). Following the presedimentation basins, the water is treated by four flocculation / sedimentation basins, and then filtered through twelve mixed-media filters.

After filtration, finished water flows to one of two clearwells. The original plant clearwell, beneath the filters, has a capacity of 3 MG. In 1988 a second clearwell was constructed at the plant, which is a partially-buried prestressed concrete reservoir with a capacity of 3.5 MG.

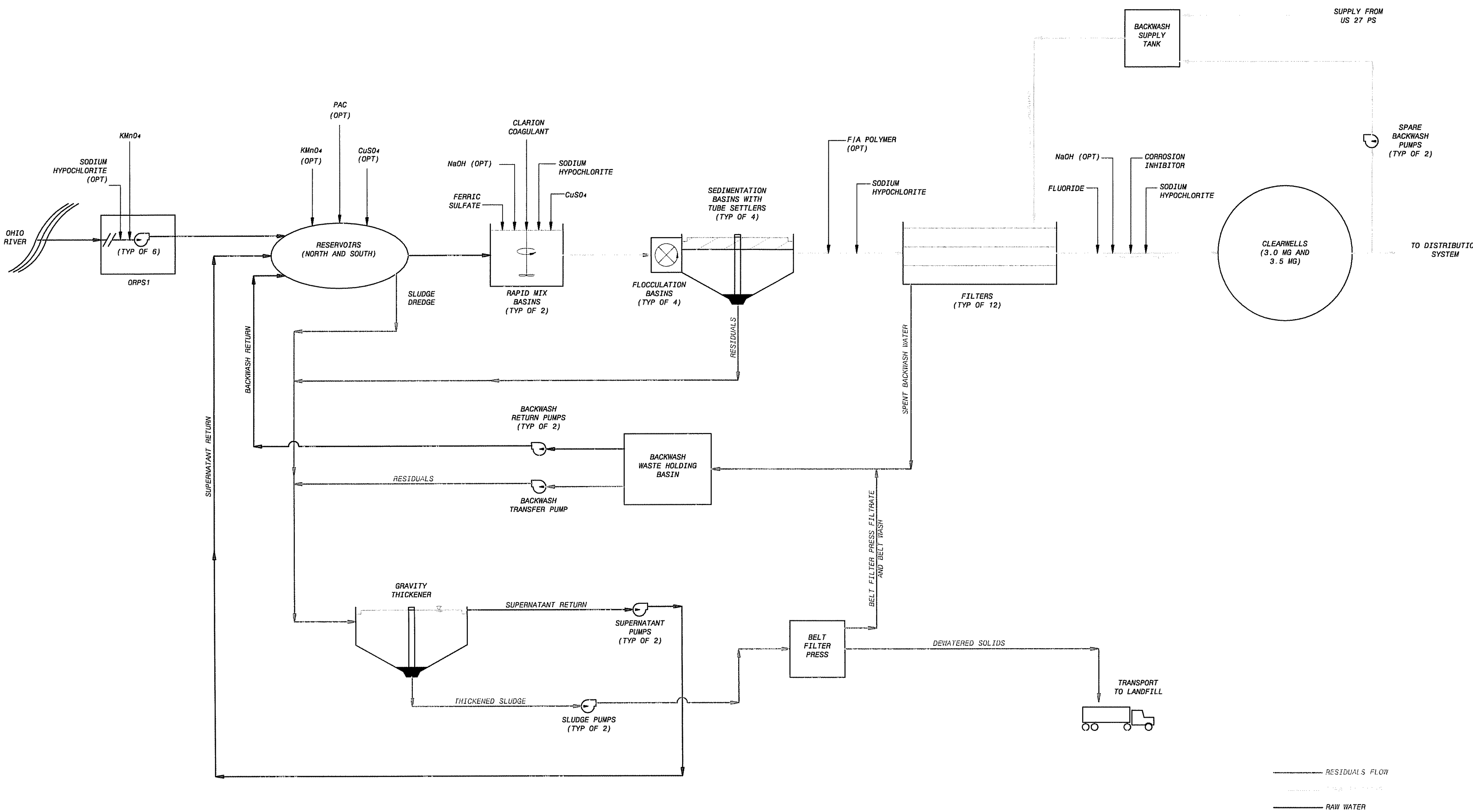
FTTP has the capability to feed a variety of chemicals including polymer, coagulant, ferric sulfate, caustic soda, sodium hypochlorite, fluoride, copper sulfate, corrosion inhibitor, powdered activated carbon, and potassium permanganate.

The original Fort Thomas Treatment Plant was constructed in 1891. However, the facility's treatment processes initially consisted only of settling of large solids. Disinfection with chlorine was incorporated into the plant in 1927. In 1936 the Filter House was constructed with twelve filter beds. In 1994 the fourth flocculation / sedimentation basin was completed, bringing the plant's treatment capacity to its current 44 mgd. Since then, major additions at the plant have included the Water Quality Laboratory, a sodium hypochlorite storage/feed facility, and expansion of the Chemical Building. With completion of these projects, most of the available land area at the Fort Thomas site is now occupied.

The FTTP is located on Alexandria Pike (US 27) in the City of Fort Thomas. The surrounding area is predominately residential, with a few commercial businesses. Figure II-9 on the following page provides a schematic of the FTTP treatment process.

a. Presedimentation Basins and Rapid Mix. As described above, the FTTP has two presedimentation basins; the North and South Reservoirs where raw water enters the plant. Water flows by gravity from either of the two reservoirs to one of two rapid mix basins located in the Chemical Building. Each rapid mix basin is equipped with a vertical turbine type rapid mixer. Rapid Mixer No. 1 was constructed in 1936 with the original flocculation / sedimentation basins, but most recently the mixer was replaced in 1990 according to District records. Rapid Mixer No. 2 was constructed in 1987 when Basin No. 1 was constructed and the equipment was also replaced in 1990.

The rapid mix basins have the following characteristics:



FORT THOMAS TREATMENT PLANT SCHEMATIC

NO SCALE

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

FORT THOMAS TREATMENT PLANT SCHEMATIC

BLACK & VEATCH Corporation
Cincinnati, Ohio

DESIGNED:	APW
DETAILED:	DAD
CHECKED:	
APPROVED:	
DATE:	

PROJECT NO.
135208

FIGURE II-9

FD5000
D5009

Rapid Mixer No. 1

Basin Dimensions, ft	14'-0" x 14'-0" x 14'-0" (depth)
Mixer	Lightnin "82 Q 7.5 LHR"
Distributes Flow to:	Basins No. 2 and 3
Mixer Output, rpm	125
Ratio	14.4:1
Motor Manufacturer	Siemens
Motor, hp	7.5
Motor, rpm	1745
Volts	460

Rapid Mixer No. 2

Basin Dimensions, ft	7'-0" x 10'-0" x 11'-6" (depth)
Mixer	Lightnin "82 Q 7.5 LHR"
Distributes Flow to:	Basins No. 1 and 4
Mixer Output, rpm	155
Ratio	11.5:1
Motor Manufacturer	Siemens
Motor, hp	7.5
Motor, rpm	1745
Volts	460

The raw water reservoirs are in good condition, however, District staff stated that the North Reservoir fills prior to the South Reservoir, which is a symptom of a hydraulic restriction in the raw water piping. There is also some concern that accumulated solids in the reservoirs has reached a point where the actual storage capacity is now limited to an undesirable degree.

Both Rapid Mixers No. 1 and No. 2 are in good condition. Rapid Mixer No. 1 was observed to have some very minor corrosion evident, and Rapid Mixer No. 2 had no noticeable defects. District staff indicated no problems with either of the mixers.

b. Sedimentation Basins.

i. Sedimentation Basin No. 1. Sedimentation Basin No. 1 was constructed in 1987 and is a conventional treatment type basin with three flocculation zones separated by vertical wooden baffles walls supported by the basin slab, walls, and intermediate concrete columns. Each cell is equipped with horizontal paddle type flocculation equipment, installed in 1987. The paddle shafts are supported by concrete piers. The flocculator drive assemblies are located above grade to allow for convenient maintenance. Following the third flocculation cell is a clarification zone separated from the flocculation zone by a vertical wooden baffle wall. In the middle of the clarification zone is a center driven sludge collector rake with corner sweeps. The sedimentation zone has a sloped bottom to a center hopper to facilitate collection and removal of solids. A walkway leads to a platform in the center of the basin where the rake drive assembly is located. The rake assembly was installed during the original construction of the basin in 1987. According to District records tube settlers were installed in 1987, although the construction drawings do not indicate tubes were installed at this time.

Basin No. 1 has the following characteristics:

Basin No. 1 Flocculation Cell No. 1	
Basin Cell Dimensions, ft	78'-0" x 14'-0" x 16'-6" (depth)
Equipment	Amwell "R13370DV132H4"
Ratio	194:1
Motor Manufacturer	SEW
Motor, hp	7.5
Motor, rpm	1740
Volts	360

Basin No. 1 Flocculation Cell No. 2	
Basin Cell Dimensions, ft	78'-0" x 14'-0" x 16'-9" (depth)
Equipment	Amwell "R10370DT100L4"
Ratio	203:1
Motor Manufacturer	SEW
Motor, hp	N/A
Motor, rpm	N/A
Volts	N/A

Basin No. 1 Flocculation Cell No. 3	
Basin Cell Dimensions, ft	78'-0" x 14'-8" x 17'-0" (depth)
Equipment	Amwell "R10370DT100L4"
Ratio	203:1
Motor Manufacturer	SEW
Motor, hp	N/A
Motor, rpm	N/A
Volts	N/A

Clarifier No. 1 Rake	
Basin Cell Dimensions, ft	90'-0" x 90'-0" x 18'0" (depth)
Equipment	Amwell "R63DLR"
Ratio	66.02:1
Motor Manufacturer	Underwriter Labs
Motor, hp	1
Motor, rpm	1725
Volts	460

Basin No. 1 Tube Settlers	
Equipment Manufacturer	N/A
Material of Construction	N/A
Surface Area, sq ft	3,820
Depth, ft	2

All three flocculators and the clarifier rake are in good condition. A minor oil spill was noted around the drive mechanism for Cell No. 1 Flocculator. However, it was not clear if this was due to a leak or just a spill during a maintenance procedure. District staff did not mention any problems with equipment in Basin No. 1. The tube settlers are in unsatisfactory condition; District staff indicated that pieces of the tubes are found when the basin is taken down for regularly scheduled maintenance, and deterioration of the tubes has become more apparent recently. Structurally, the basin is in excellent condition with no noticeable defects.

ii. Sedimentation Basins No. 2 and No. 3. Basins No. 2 and No. 3 were constructed in 1936 as part of the expansion of FTTP to include filtration. Basins No. 2 and 3 are parallel conventional treatment type basins with two flocculation zones or cells each that are separated by horizontal wooden baffles walls supported by the basin slab, walls, and intermediate concrete columns. Each cell is equipped with horizontal paddle type flocculation equipment which was last replaced in 1991. The paddle shafts are supported by concrete piers. The flocculator drive assemblies are located above grade to allow for convenient maintenance.

Following the second flocculation cells are clarification zones separated from the flocculation zones by vertical wooden baffle walls. In the middle of the clarification zones are center driven sludge collector rakes with corner sweeps, one for each basin. The sedimentation zones have sloped bottoms to center hoppers to facilitate collection and removal of solids. A walkway leads to a platform in the center of each basin where the rake drive assemblies are located. The rake assemblies were replaced in 1991. Tube settlers were also installed in 1991. Basins No. 2 and 3 have the same equipment installed.

Basins No. 2 and No. 3 have the following characteristics:

Basin No. 2 and No. 3 Flocculation Cells No. 1	
Basin Cell Dimensions, ft	84'-6" x 13'-0" x 16'-0" (depth)
Equipment	SEW-Eurodrive "R107HM213"
Ratio	115.63:1
Motor Manufacturer	Inverter
Motor, hp	5
Motor, rpm	1760
Volts	460
Basin No. 2 and No. 3 Flocculation Cells No. 2	
Basin Cell Dimensions, ft	84'-6" x 17'-0" x 16'-0" (depth)
Equipment Manufacturer	Amwell "R83LP"
Ratio	107.42:1
Motor Manufacturer	Inverter
Motor, hp	3
Motor, rpm	1750
Volts	460
Clarifier No. 2 and No. 3 Rakes	
Basin Cell Dimensions, ft	89'-7" x 89'-7" x 16'0" (depth)
Equipment Manufacturer	Amwell "R63DT80N4"
Ratio	48.65:1
Motor Manufacturer	Eurodrive
Motor, hp	1
Motor, rpm	1700
Volts	460
Basin No. 2 and No. 3 Tube Settlers	
Equipment Manufacturer	Enviropax
Material of Construction	ABS
Surface Area each basin, sq ft	3,820
Depth, ft	2

All four flocculators are in satisfactory condition. Minor corrosion was noted on all equipment in Basins No. 2 and No. 3. The clarifier rakes are in good condition. District staff stated that performance of these inner sedimentation basins is noticeably less than the two outer basins, most likely because the floc formation is not as good. This is attributed to the fact there are only two flocculators per basin compared to three flocculators in the outer basins. Typical operating practice is therefore to use Basins 2 and 3 to treat approximately 40 percent of the total plant flow, with the remaining 60 percent of the total plant flow directed to Basins 1 and 4.

The tube settlers are in unsatisfactory condition; District staff indicated that pieces of the tubes are found when the basin is taken down for regularly scheduled maintenance. There are several places where the tubes are damaged from cleaning and maintenance and replacement of the tubes will likely be needed within the next few years. Structurally, the basin is in satisfactory condition with a few locations where concrete is cracked and reinforcement is exposed.

iii. Sedimentation Basin No. 4. Basin No. 4 was constructed in 1993 and is a conventional treatment type basin with three flocculation zones that are separated by vertical wooden baffles walls supported by the basin slab, walls, and intermediate concrete columns. Each cell is equipped with horizontal paddle type flocculation equipment, originally installed in 1993 with the basin construction. The paddle shafts are supported by concrete piers. The flocculator drive assemblies are located below grade in line with the paddle shafts in a separate drywell accessible from above through removable metal grating.

Following the third flocculation cell is a clarification zone separated from the flocculation zone by a vertical wooden baffle wall. In the middle of the clarification zone is a center driven sludge collector rake with corner sweeps. The sedimentation zone has a sloped bottom to a center hopper to facilitate collection and removal of solids. A walkway leads to a platform in the center of the basin where the rake drive assembly is located. The rake assembly was installed during the original construction of the basin in 1993. Tube settlers were also installed during the original construction of the basin in 1993.

Basin No. 4 has the following characteristics:

Basin No. 4 Flocculation Cell No. 1

Basin Cell Dimensions, ft	90'-0" x 14'-0" x 16'-6" (depth)
Equipment Manufacturer	DBS "154-2000-095"
Ratio	N/A
Motor Manufacturer	Baldor
Motor, hp	N/A
Motor, rpm	N/A
Volts	N/A

Basin No. 4 Flocculation Cell No. 2	
Basin Cell Dimensions, ft	90'-0" x 14'-0" x 16'-9" (depth)
Equipment Manufacturer	DBS "154-2000-095"
Ratio	N/A
Motor Manufacturer	Baldor
Motor, hp	N/A
Motor, rpm	N/A
Volts	N/A
Basin No. 4 Flocculation Cell No. 3	
Basin Cell Dimensions, ft	90-0" x 14'-8" x 17'-0" (depth)
Equipment Manufacturer	DBS "154-2000-095"
Ratio	N/A
Motor Manufacturer	Baldor
Motor, hp	N/A
Motor, rpm	N/A
Volts	N/A
Clarifier No. 4 Rake	
Basin Cell Dimensions, ft	90'-0" x 90'-0" x 18'0" (depth)
Equipment Manufacturer	DBS "DF-42-7"
Ratio	N/A
Design Torque, ft-lbs	35,000
Output rpm	0.035
Motor Manufacturer	Baldor
Motor, hp	1
Motor, rpm	1725
Volts	460
Basin No. 4 Tube Settlers	
Equipment Manufacturer	MRI
Material of Construction	Polyvinyl Chloride (PVC)
Surface Area, sq ft	3,820
Depth, ft	2

The three flocculator drive assemblies were visually inspected from above and were noted to have some minor corrosion on the metal surfaces. The packing around the drives was leaking slightly in the pit and causing water from the basin to leak into the drywell. The clarifier rake was also noted to have light corrosion on the exposed metal with some of the paint pealing from the assembly. However, both the flocculators and the rake assembly are overall in good condition. District staff did not mention any problems with equipment in Basin No. 4.

The tube settlers in Basin No. 4 are in unsatisfactory condition with more severe deterioration than the other three basins and several places where the tubes are damaged from cleaning and maintenance. The tube settler material appears to have deteriorated from ultraviolet radiation due to long-term sunlight exposure. District staff indicated that pieces of the tubes are found when the basin is taken down for regularly scheduled maintenance. The tube settlers will require replacement in the near future. Figure II-10 shows an example of the extent of the damage to the tube settlers. Structurally, the basin is in good condition with only a few places where minor cracking of the concrete was observed.

Figure II-10

c. Filter Building. The Filter Building was constructed in 1936 when the FTTP was expanded to include filtration. The Filter Building is a block and brick, two story building with a basement and Clearwell No. 1 located under the building. The interior of the building is in good shape. Walls are painted or glazed CMU, and locations with offices are covered in drywall. There are some isolated locations where minor cracking, chipping, or chalking was observed in portions of the walls. However, no major cracking or differential settlement was noted in the walls. The exterior of the building is painted brick, and is in good condition structurally. The brick work was observed to have no noticeable defects, with no major cracks or missing mortar being noted.

The first floor of the building consists of offices, an operator laboratory, restrooms, and the filter wings. The filter wings extend from both the North and South side of the first floor. The wings are constructed of block and brick with glass block windows to allow for natural light to enter the filter gallery. Weather louvers and ventilation fans are located throughout the filter wings to allow airflow into the filter gallery which appeared to be in good condition. The offices, laboratory, and restrooms appeared to be in good condition with no noted problems. The offices on the first floor are air conditioned with individual units which had no noted concerns.

The second floor has undergone many renovations since the original construction and currently is the location of various offices for NKWD personnel. The offices appeared to be in good shape with no structural problems or other deficiencies noted. The second floor temperature is controlled by central heating and air conditioning which seems to be in good condition.

d. Filters. The Fort Thomas plant has twelve mixed-media gravity filters located in the Filter Building, which was constructed in 1936. The filters consist of approximately 30 inches of mixed media (anthracite / sand / garnet) with 10 inches of graded support gravel and vitrified clay tile block underdrains. The filters are equipped with hydraulic surface wash capability, and are capable of operating in a filter-to-waste mode following backwashing.

Filters 1-6 were rehabilitated during 1992, with new media installed at that time. Media in filters 7-12 has been in place since 1981/1982. A filter inspection conducted by Roberts Services Inc. in January 2000 indicated that essentially all of the garnet media had migrated out of filters 7-12, and that total media depths for these filters varied significantly. The report also concluded that additional anthracite should be added to filters 1-6 to increase total media depths to specified levels, and that there was evidence of mudball formation/accumulation in many of the filters.

The filters have the following characteristics:

Filters	
Number of Units	12
Cell Dimensions, ft x ft	20 x 28
Surface Area each filter, sf	560
Filter Box Depth, ft	10.0
Filters Loading Rate, gpm/sf (44 mgd, 12 filters in service)	4.55
Filters Loading Rate, gpm/sf (44 mgd, 11 filters in service)	4.96

Filters No. 1-6 are in good condition. Review of Monthly Operating Reports from 2000 to the present indicated that each of the filters is performing well with regard to filtered water turbidity levels. District staff noted that there are no significant differences in media effective sizes or overall condition of the media in these six filters. It was noted from review of operating data that run times for both Filter No. 5 and Filter No. 6 were less than for the remaining filters. The reason for these differences could not be determined, however, from the data that is included in the Monthly Operating Reports. Filters No. 7-12 are in satisfactory condition, as they are performing well treatment wise with regard to filtered water turbidity levels. However, due to the age of the media in these filters and the physical condition being unknown, their reliability is unknown.

e. Clearwells. Filtered water flows to one of two clearwells, either the 3.0 MG Clearwell No. 1 underneath the Filter Building, or the 3.5 MG Clearwell No. 2 located outside the plant. Clearwell No. 1 was constructed in 1936, and Clearwell No. 2 was constructed in 1988. Baffle walls have been added to each clearwell to meet regulations for contact time. Clearwell No. 1 had baffles added in 1995 and Clearwell No. 2 had baffles installed in 1998. During the site investigation, the clearwells were not taken out of service for inspection; however, expected overall condition and comments from District staff indicate that they are in excellent condition.

f. Backwash Equipment. The filters are backwashed using finished water stored in the Backwash Supply Tank that is located to the west of the South Reservoir. The Backwash Supply Tank was constructed in 1936 and is a rectangular concrete basin that is mostly buried with a capacity of approximately 240,000 gallons. Based upon comments from District staff, the condition of the Backwash Supply Tank is unsatisfactory. Very little maintenance has been done on the tank over the years, and it is starting to show its age. Several locations are in need of concrete repair.

Water is pumped to the Backwash Supply Tank from the US 27 Pumping Station and then flows by gravity to backwash the filters. Previously, the Backwash Supply Tank was filled using two backwash supply pumps that are located in the basement of the Filter Building.

The Backwash Pumps have the following characteristics:

Backwash Pumps	
No. of Units	2
Manufacturer	Gorman-Rupp Co. "T10A61-B"
Capacity, gpm	2500
Head, ft	N/A
Motor Manufacturer	Marathon Electric
Motor, hp	75
Motor, rpm	1780
Volts	208

These two pumps, both installed in 1987, drew water from the 3.0 MG Clearwell No. 1 located under the Filter Building. Currently these pumps are not in use and are in place solely for backup purposes.

Spent backwash water is sent to Backwash Holding Basin located to the west of the 3.5 MG Clearwell No. 2. The Backwash Holding Basin was constructed in 1987 and is a square concrete basin with the top slab sitting just above grade. The Backwash Holding Basin also receives flow from the belt filter press wash. The approximate capacity of this basin is 680,000 gallons. It is in good condition with no noticeable structural defects.

Water in the Backwash Holding Basin is returned to the head of the plant at the North Reservoir by two backwash return pumps. The pumps are located in the Sludge Pump Room directly west of the Backwash Holding Basin between it and the Gravity Thickener. Both Backwash Return Pumps were installed in 1987. The residuals that settle out in the Backwash Holding Basin are transferred to the Gravity Thickener by a separate Backwash Transfer Pump. The Backwash Transfer Pump was also installed in 1987.

The Backwash Return Pumps and Backwash Transfer Pump have the following characteristics:

Backwash Return Pumps	
No. of Units	2
Manufacturer	ITT Industries "NSW 5 x 5 x 12"
Capacity, gpm	1,200
Head, ft	N/A
Motor Manufacturer	Baldor
Motor, hp	50
Motor, rpm	1770
Volts	460
Backwash Transfer Pump	
No. of Units	1
Manufacturer	Allis - Chambers "NSW 6x4x12 LC"
Capacity, gpm	200
Head, ft	25
Motor Manufacturer	US Motor
Motor, hp	5
Motor, rpm	N/A
Volts	200

The Backwash Return Pumps and Backwash Transfer Pump are all in satisfactory condition. A small number of water leaks were noted from pump and valve seals on all three pumps. Moderate corrosion was noted along the pumps, pump bases, and bearing housings. Drive shaft guards were inadequate for personnel protection as they were made from thin gage wire and 2 inch by 4 inch boards. District staff did not indicate any operational problems with these pumps. Inlet valves on the return pumps are 10 inch DeZurik manual butterfly valves. Discharge valves on the return pumps are 5 inch Red Valve Company, Series 33 check valves. The inlet valve on the transfer pump is a 6 inch DeZurik manual butterfly valve. Discharge valves on the transfer pump are 6 inch DeZurik manual butterfly valve and a 6 inch Kennedy check valve.

g. Chemical Feed Systems. The chemical feed systems at FTTP consist of coagulant, ferric sulfate, caustic soda, sodium hypochlorite, fluoride, copper sulfate, corrosion inhibitor, polymer, powdered activated carbon, and potassium permanganate. The following section presents equipment characteristics, capacities, and condition assessments of the chemical feed systems.

i. Chemical Building. The Chemical Building was expanded in 2001 to create a central location for most chemical feed systems at FTTP. Prior to 2001, chemical feed systems were located throughout the plant in various locations. The Chemical Building currently houses the clarion coagulant feed system as well as caustic soda, fluoride, ferric sulfate, corrosion inhibitor, and copper sulfate. Also located in the Chemical Building are the two rapid mix basins, a maintenance storage area, offices, and restrooms.

The Chemical Building is a block and brick, single story building. The interior is in excellent shape. Walls are painted CMU. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No cracking or differential settlement was noted in the walls. The exterior of the building is brick, and is in excellent shape structurally. The brick work is excellent, with no cracks or missing mortar being noted.

The electrical equipment is located in a separate room inside the building and is in excellent condition with no observable corrosion, accumulation of debris, or other damage. Heating, air handling units, ductwork, and air conditioning units in the building appeared to be in excellent condition. Chemical unloading stations for each chemical are located outside the building with connections for each storage tank that are in excellent condition. Each unloading station has its own key and is kept locked at all times. A fire protection sprinkler system is inside the building which appeared to be in excellent condition.

ii. Sodium Hypochlorite Building. The Sodium Hypochlorite Building is a block and brick, single story building. The interior of the building is in excellent shape. Walls are painted

CMU. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No cracking or differential settlement was noted in the walls. The exterior of the building is brick and is in excellent shape structurally. The brick work is excellent with no cracks or missing mortar being noted. The six bulk storage tanks and transfer pumps are in a recessed lower level for containment while the metering pumps and day tanks are in a separate area contained by an approximately 2 foot high wall.

Building temperature is controlled by central heating and air conditioning which, at the time of the site investigation, kept the room very cool although the outside ambient temperature was approximately 90°F +. It therefore is considered to be in excellent condition.

The electrical equipment is located in a separate room inside the building and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. A chemical unloading station is located outside the building with connections for each storage tank that are locked and is in excellent condition. A fire protection sprinkler system is inside the building which appeared to be in excellent condition.

iii. Copper Building. The Copper Building was the original location of the plant prior to 1936. Currently, it houses the potassium permanganate feed system and the copper sulfate feed system that can be fed at the reservoirs. It also appeared that various items and records are stored on the second floor of the building. The Copper Building is a two story brick building that was constructed in 1891.

The interior of the building is in unsatisfactory shape. Walls are painted brick. It was noted during the site investigation that there is strong evidence that the building is experiencing differential settlement due to the cracking apparent in the brick walls. Figure II-11 shows cracking observed in the northeast corner of the building. The exterior of the building is brick which is in satisfactory condition; however where cracking was noted in the interior of the building, similar cracking and missing mortar was visible on the exterior. Glass block windows are located on three sides of the building with ventilation louvers and fans in the center of the window. The glass block was in good condition; however, ventilation in the building was unsatisfactory. At the time of the site investigation temperatures in

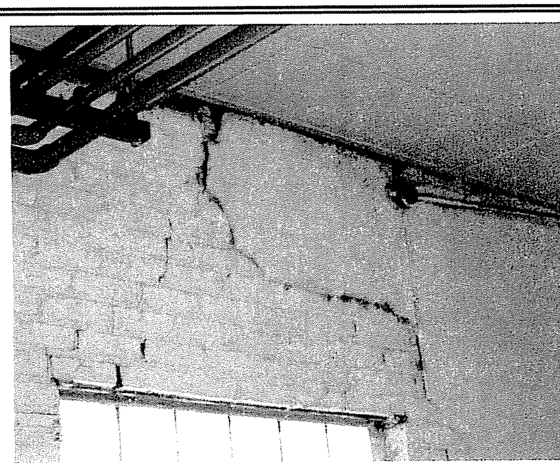


Figure II-11

the building were above 90°F. Lighting levels in the building, notably on the second floor, were unsatisfactory and it was very difficult to see, potentially causing a safety hazard.

iv. Sodium Hypochlorite Feed and Storage. Sodium hypochlorite is used as the primary disinfectant and can be fed to both rapid mix basins, the filter influents from all four basins, and at the inlet to both clearwells. The sodium hypochlorite feed system was put into operation in 1999. Sodium hypochlorite is stored in the Sodium Hypochlorite Building which contains six bulk storage tanks, two day tanks, two transfer pumps, and six metering pumps.

The sodium hypochlorite system has the following characteristics:

Storage Tanks	
No. of units	6
Capacity (each), gal	8,670
Day Tanks	
No. of units	2
Capacity (each), gal	1,850
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag “KM1515-CA”
Capacity	N/A
Motor, hp	1.5
Metering Pumps	
No. of units	8
Manufacturer	W&T “Encore 700 44 Series”
Capacity, gph	77
Motor, hp	1.0

The overall condition of the sodium hypochlorite system is good. The storage and day tanks are in excellent condition. During the site investigation, only three of the six storage tanks were in use. Transfer Pump No. 1 was removed and not in service at the time of the site investigation. Transfer Pump No. 2 appeared to be recently installed or replaced and is in satisfactory condition, although records did not indicate when it was installed. The metering pumps are in satisfactory condition. Moderate corrosion was noted on the pumps and associated piping from past leaks and / or spills. District staff stated that a common problem with the sodium hypochlorite system is that it continues to air bind and needs frequent maintenance procedures performed. The District staff indicated they have tried a few different venting remedies but none have effectively resolved the problem.

v. Coagulant. The primary coagulant used is an alum-polymer blend (currently General Chemical "Clar+Ion 5055"). It is fed to both rapid mix basins. The coagulant feed system was installed in 2001 with the construction of the Chemical Building expansion. The coagulant feed system is located in the main room of the Chemical Building in the coagulant storage area. The area is a recessed area which contains three bulk storage tanks, one day tank, two transfer pumps, and five metering pumps.

The coagulant system has the following characteristics:

Storage Tanks	
No. of units	3
Capacity (each), gal	9,056
Day Tank	
No. of units	1
Capacity, gal	1,132 gal
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag "KP326CA"
Capacity, psig	285
Motor, hp	2.0
Metering Pumps	
No. of units	5
Manufacturer	Milton Roy "231732-18"
Capacity, gph	35.9
Motor, hp	0.75

Overall condition of the coagulant system is good. The storage and day tanks and transfer pumps are all in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping from past leaks and / or spills. At the time of the site investigation there was a slight coating of residue on the floor from a past leak or spill. District staff did not indicate any problems with the coagulant system.

The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the clarion coagulant area and appeared to be in excellent condition with no observable corrosion or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tanks and is in excellent condition.

vi. Caustic Soda. Caustic soda (sodium hydroxide) is used for pH adjustments and can be fed to both rapid mix basins and to both clearwell inlets. The caustic feed system was put into operation in 2001 with the construction of the Chemical Building expansion. The caustic soda system is located in a separate room of the Chemical Building. The area is a recessed area which contains two bulk storage tanks, one day tank, two transfer pumps, and five metering pumps.

The caustic soda system has the following characteristics:

Storage Tanks	
No. of units	2
Capacity (each), gal	8,810
Day Tank	
No. of units	1
Capacity, gal	735 gal
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag "KP326CA"
Capacity, psig	285
Motor, hp	2.0
Metering Pumps	
No. of units	5
Manufacturer	Milton Roy "PPRW212RMH"
Capacity, gph	35.9
Motor, hp	0.75

The overall condition of the caustic soda system is excellent. All of the equipment associated with caustic soda had no noticeable defects and appeared to be in new condition. The only item of note was the storage tanks do not have nameplates on them to indicate capacities. District staff did not indicate any problems with the caustic soda system.

The electrical equipment and controls are located in the separate room for caustic soda on the wall nearest the door and appeared to be in excellent condition with no observable corrosion or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tanks and is in excellent condition.

vii. Fluoride. Fluoride (hydrofluorosilicic acid) is fed to both clearwell inlets. The fluoride system was put into operation in 2001 with the construction of the Chemical Building expansion. The fluoride system is located in a separate room of the Chemical Building. The area is a recessed area which contains one bulk storage tank, one day tank, two transfer pumps, and three metering pumps.

The fluoride system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	6,391
Day Tank	
No. of units	1
Capacity, gal	255 gal
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag "KP326CA"
Capacity, psig	285
Motor, hp	2.0
Metering Pumps	
No. of units	3
Manufacturer	Milton Roy
Capacity, gph	5.0
Motor, hp	N/A

Overall condition of the fluoride system is good. The storage and day tanks and transfer pumps are in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping from past leaks and / or spills. The nameplates affixed to the metering pumps are on in a manner such that they are impossible to read because of the side of the metering pumps they are attached. The nameplates are on the wall side and there is no access space between the wall and the pumps. District staff did not indicate any problems with the fluoride system.

The electrical equipment and controls are located in the separate room for fluoride on the wall nearest the door and appeared to be in excellent condition with no observable corrosion or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tanks and is in excellent condition.

viii. Ferric Sulfate. Ferric sulfate is fed to both rapid mix basins as a coagulant. The ferric sulfate feed system was put into operation in 2001 with the construction of the Chemical Building expansion. The ferric sulfate system is located in the main room of the Chemical Building in the ferric sulfate storage area. The area is a recessed area which contains two bulk storage tanks, one day tank, two transfer pumps, and three metering pumps.

The ferric sulfate system has the following characteristics:

Storage Tanks	
No. of units	2
Capacity (each), gal	6,391
Day Tank	
No. of units	1
Capacity, gal	285 gal
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag "KP326CA"
Capacity, psig	285
Motor, hp	2.0
Metering Pumps	
No. of units	3
Manufacturer	Milton Roy
Capacity, gph	11.0
Motor, hp	N/A

The overall condition of the ferric sulfate system is good. The storage and day tanks are in excellent condition. Both transfer pumps are in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping and valves from past leaks. The nameplates affixed to the metering pumps are on in a manner such that they are impossible to read because of the side of the metering pumps they are attached. The nameplates are on the wall side and there is no access space between the wall and the pumps. At the time of the site investigation there was a slight coating of residue on the floor from a past leak or spill. District staff did not indicate any problems with the ferric sulfate system.

The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the ferric sulfate area and appeared to be in excellent condition with no observable corrosion or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tanks and is in excellent condition.

ix. Corrosion Inhibitor. Carus Chemical Company "K-5" is currently used as the corrosion inhibitor and is fed to both clearwells. The corrosion inhibitor feed system was put into operation in 2001 with the construction of the Chemical Building expansion. The corrosion inhibitor system is located in the main room of the Chemical Building in the corrosion inhibitor storage area. The area is a recessed area which contains one bulk storage tank, one day tank, two transfer pumps, and three metering pumps.

The corrosion inhibitor system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	6,391
Day Tank	
No. of units	1
Capacity, gal	105 gal
Transfer Pumps	
No. of units	2
Manufacturer	Pump Pro Anst Mag "KP326CA"
Capacity, psig	285
Motor, hp	2.0
Metering Pumps	
No. of units	3
Manufacturer	Milton Roy "231732-8"
Capacity, gph	1.6
Motor, hp	0.5

The overall condition of the corrosion inhibitor system is good. The storage and day tanks are in excellent condition. Both transfer pumps are in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping and valves from past leaks and /or spills. The nameplates affixed to the metering pumps are on in a manner such that they are difficult to read because of the side of the metering pumps they are attached. The nameplates are on the containment wall side and there is no access space between the containment wall and the pumps. District staff did not indicate any problems with the corrosion inhibitor system.

The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the corrosion inhibitor area and appeared to be in excellent condition with no observable corrosion or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tanks and is in excellent condition.

x. Copper Sulfate. There are two copper sulfate feed systems at FTTP. Typical practice is to feed copper sulfate at both rapid mix basins; this system was put into operation in 2001 with the construction of the Chemical Building expansion. The copper sulfate system is located in the main room of the Chemical Building in the copper sulfate storage area. The area contains one batch mixing tank and three metering pumps. Copper sulfate is delivered and stored in 50 lbs. bags and dumped into the mixing tank.

The other copper sulfate system is used periodically to feed at the reservoirs. This copper sulfate feed system is located on the second floor of the Copper Building north of the North Reservoir. It consists of a feeder and mixer, which the District constructed, and a mixing tank. Copper sulfate is then fed to the reservoirs by gravity. No capacity or size information was gathered from this system as all components were inaccessible and no data about this copper sulfate system is available. This system is not flow paced.

The copper sulfate system in the Chemical Building has the following characteristics:

Batch Mixing Tank	
No. of units	1
Capacity, gal	211
Metering Pumps	
No. of units	3
Manufacturer	Milton Roy "321732-22"
Capacity, gph	17.4
Motor, hp	0.5

The overall condition of the copper sulfate system in the Chemical Building is excellent. The mixing tank is in excellent condition. The metering pumps are in excellent condition with no noticeable signs of corrosion or leaks. The only item of note is that the metering pumps sit on top of the containment wall. If there were to be a leak in the pumps or associated piping this leakage would not be contained. District staff did not indicate any problems with the corrosion inhibitor system.

The electrical equipment and controls are located in the hallway of the main room in the Chemical Building adjacent to the copper sulfate area and appeared to be in excellent condition with no observable corrosion or other damage.

xi. Potassium Permanganate. The potassium permanganate feed system at the Fort Thomas plant is located on the ground floor of the Copper Building. Potassium permanganate is fed to both reservoirs when the river pumps are operating. The system was put into operation in 1992. The area is a contained area which includes one batch mixing tank and two metering pumps. Potassium permanganate is delivered and stored in storage drums and transported to the mixing tank by eduction. This system is not flow paced. Potassium permanganate is normally only fed at the Ohio River Pumping Station No. 1, but can also be fed at the reservoirs by this system.

The potassium permanganate system has the following characteristics:

Batch Mixing Tank	
No. of units	1
Capacity, gal	1,750
Metering Pumps	
No. of units	2
Manufacturer	Milton Roy "YB1M60ALIDD"
Capacity, gph	195
Motor, hp	0.75

The overall condition of the potassium permanganate system is good. All the associated equipment is in good condition. A residue was noted around the pumps and piping, but it was difficult to determine if it was potassium permanganate or if was from the copper sulfate feed system located on the second floor of the building. District staff indicated no problems with the potassium permanganate system as it is not used that often.

xii. Powdered Activated Carbon. The powdered activated carbon (PAC) feed system at Fort Thomas is located in the Carbon Silo adjacent to the Copper Building. It is periodically fed to both reservoirs. The system was put into operation in 1993. PAC is delivered and stored in the carbon silo and fed by two metering pumps. This system is not flow paced.

The only information obtainable about the PAC feed system equipment is that there are two Warman centrifugal metering pumps, model "B005-MM10", which were installed in 1993. Capacity data was not readily available due to heavy PAC coating of all surfaces within the feed area.

xiii. Filter Aid Polymer. The filter aid polymer feed system at the Fort Thomas plant is located in the basement of the Filter Building. Records indicate that the current polymer used is Cyanamide "990 N" nonionic. District staff indicated that the filter aid polymer currently is seldom used. The system was put into operation in 1992. The transfer pump was replaced in 1996. The area consists of one batch mixing tank, three feed tanks, one transfer pump, and three metering pumps. Filter aid polymer is delivered and stored in 50 pound bags and manually dumped into the batch mixing tank. This system is not flow paced.

The filter aid polymer system has the following characteristics:

Batch Mixing Tank	
No. of units	1
Capacity, gal	180
Feed Tanks	
No. of units	3
Capacity (each), gal	180
Transfer Pump	
No. of units	1
Manufacturer	Robbins Myers "34T51-5593"
Metering Pumps	
No. of units	3
Manufacturer	W&T "Series 44-114 M9P"
Capacity, gph	20.8
Motor, hp	0.25

The overall condition of the filter aid polymer system is satisfactory. The storage tanks and feed tanks are in good condition. The covers for the feed tanks do not fit securely on top of the tanks. The transfer pump and feed pumps are in satisfactory condition. Light corrosion was noted on the pumps and associated piping from past leakage. No containment provisions were present for the system. District staff indicated no problems with the filter aid polymer system as it is not used that often.

xiv. Sludge Polymer. The sludge polymer feed system at Fort Thomas is located on the operating floor of the Sludge Building and is used to feed polymer to the belt filter presses. The system consists of one batch mixing tank and two metering pumps. The original system was put in operation in 1991, although the tank was replaced in 1999. Sludge polymer is delivered and stored in 50 pound bags and manually dumped into the mixing tank.

The sludge polymer system has the following characteristics:

Batch Mixing Tank	
No. of units	1
Capacity, gal	200
Metering Pumps	
No. of units	2
Manufacturer	W&T "Series 44 125 M2P"
Capacity, gph	208

The overall condition of the sludge polymer system is satisfactory. The mixing tank is in good condition. The metering pumps are in satisfactory condition. Light corrosion was noted on the pumps and associated piping from past leak events. Evidence of spills and / or leaks was observed on the floor. No containment was present for the system. District staff indicated no problems with the sludge polymer system.

h. Residuals Handling Systems. The residuals handling system at FTTP consists of a gravity thickener, sludge pumps, supernatant pumps, a dredge for the reservoirs, and belt filter presses. The following section presents equipment characteristics, capacities, and condition assessments of the residuals handling system.

i. Sludge Press Building. The Sludge Building is a block and brick, bi-level building. The upper level consists of the process area where the sludge belt presses are located, a restroom, janitors closest, assembly / storage area, and a separate enclosed office room. The lower level consists of the loading area where two dumpsters are located for dried sludge loading. The interior of the building is in excellent shape. Walls are painted CMU. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No structural cracking or differential settlement was noted in the walls. The exterior of the building is brick, and is in excellent shape structurally. The brick work is in excellent condition, with no cracks or missing mortar being noted. The restroom and janitors closet were in good condition.

The temperature in the building is controlled by a heating and ventilation unit which moves air from the outside through various exhaust fans throughout the building. The unit is controlled by a wall mounted thermostat with a heating or ventilation selector switch. There are also electric unit heaters and wall mounted space heaters located in the building. They appeared in good condition, although, the site investigation was in the middle of the summer so their functionality was not evaluated. The office temperature is controlled by a separate wall mounted heating and air conditioning unit which is in good condition.

ii. Sludge Pump Room. The Sludge Pump Room is a cast-in-place concrete below grade room accessible by a staircase on the southeast side of the facility or an access hatch on the top slab of the room. The interior of the room is in excellent shape. Walls are cast-in-place concrete. No cracking, chipping, or chalking was noted for those portions of the walls that are visible. No structural cracking or differential settlement was noted in the walls. The exterior of the building is mostly buried, with the top slab being the only visible section.

The temperature in the building is controlled by a heating and ventilation unit which moves air drawn from a ventilation louver above the doorway at the bottom of the stairs through two exhaust fans on the other side of the room. The exhaust fans are controlled by separate wall mounted thermostats. The exhaust and ventilation system in the room is in unsatisfactory condition. It is very difficult to open the door to get into the room when the system is operating because of the draft that is created by the exhaust fans and the single louver above the door. It appears that there is not sufficient air movement to adequately ventilate the room. The fans were operating during the site investigation; however the room temperature was greater than 90° F.

There is also an electric unit heater in the room. It appeared to be in good condition, although the site investigation was conducted in the middle of the summer so the functionality was not evaluated.

iii. Gravity Thickener. The gravity thickener basin was constructed in 1987 with the drive and equipment installed in 1991. It is a square basin with a circular drive and sloped bottom to facilitate sludge recovery. The gravity thickener receives flow from the backwash waste holding basin, the four clarifier basins, sludge dredged from the reservoirs, and belt filter press filtrate. The thickener is equipped with a fiberglass weir around the perimeter for supernatant flow. The supernatant is pumped back to the head of the plant at the reservoirs by two supernatant pumps. Thickened sludge from the gravity thickener is pumped to the two belt filter presses by two progressing cavity sludge pumps.

The gravity thickener has the following characteristics:

Gravity Thickener	
Basin Cell Dimensions, ft	30'-0" x 30'-0" x 16'-3" (depth)
Equipment Manufacturer	Amwell "W28M"
Motor Manufacturer	Baldor
Motor, hp	1
Motor, rpm	1725
Volts	460

The gravity thickener is in good condition. Minor corrosion was noted on exposed metal surfaces but not to a degree that will affect performance. Structurally, the basin appears to be in excellent condition with no noted deficiencies.

The reservoir dredge currently operating at FTTP was originally installed at MPTP. However, due to MPTP's problems in handling sludge, and the fact that the FTTP dredge was not functioning correctly, the MPTP dredge was moved to FTTP. The dredge currently installed at FTTP is in satisfactory condition according to District staff. It does have to monitored fairly closely though, and it is a maintenance issue.

iv. Sludge Pumping Equipment. The Sludge Pump Room at FTTP houses the two progressing cavity sludge pumps, two vertical centrifugal supernatant pumps, two backwash return pumps, and one backwash transfer pump. The two sludge pumps pump thickened sludge from the Gravity Thickener to the belt filter presses. The two supernatant pumps pump water from the Gravity Thickener back to the head of the plant. The two backwash return pumps, as described above under the filter backwash equipment section, return backwash decant water to the head of the plant. The Backwash Transfer Pump, also described above in the filter backwash equipment section, pumps settled solids in the Backwash Waste Holding Basin to the Gravity Thickener.

The sludge pumps and supernatant pumps have the following characteristics:

Sludge Pumps	
No. of Units	2
Manufacturer	Moyno "1H115G1CDQ"
Capacity, gpm	N/A, Variable Speed
Motor Manufacturer	Super E Motor
Motor, hp	20
Motor, rpm	1760
Volts	208
Supernatant Pumps	
No. of Units	2
Manufacturer	Fairbanks Morse "K3X1-071793"
Capacity, gpm	750
Head, ft	N/A
Motor Manufacturer	US Motors
Motor, hp	40
Motor, rpm	1775
Volts	206

The sludge pumps are in satisfactory condition. Moderate corrosion was noted along the pumps and pump bases, in some places somewhat severe. District staff did not indicate any operational problems with the sludge pumps. Inlet valves on the sludge pumps are 6 inch DeZurik manual plug valves. Discharge valves on the sludge pumps are 6 inch check valves and 6 inch plug valves. They are at a higher elevation and inaccessible to gather nameplate data.

The supernatant pumps are in good condition. Light corrosion was noted along the pumps. District staff did not indicate any operational problems with the supernatant pumps. Inlet valves on the pumps are 6 inch DeZurik manual butterfly valves. Discharge valves on the pumps are 6 inch Red Valve Company electric ball valves.

All residuals process piping and associated valves appeared to be in good condition. Some locations, as noted above, were observed to have some minor leaks, but nothing constant or that would cause a major concern.

v. Belt Filter Presses. The two belt filter presses at FTTP are located in the Sludge Building that was constructed in 1991. The presses take the thickened sludge from the Gravity Thickener, press out the liquid, and then convey the dewatered sludge cake to dumpsters via two conveyor belts; the dewatered sludge is then periodically hauled to landfills.

The belt filter presses have the following characteristics:

Sludge Belt Filter Presses

No. of Units	2
Manufacturer	Enviroquip "Series 4 (1.2 meter)"
Hydraulic Loading rate (each), gpm	40 – 180
Capacity (each), lbs/hr	1700
Inlet Consistency, percent TSS	2.0 - 8.0
Min. Cake Solids, percent	28.5
Min. Solids Capture, percent	92
Motor Manufacturer	SEW Eurodrive
Motor, hp	3
Motor, rpm	1200
Volts	208

The belt filter presses are in excellent condition. No defects of any kind were observed. District staff indicated that the presses are working extremely well. The two conveyor belts were observed to be in good condition. At the time of the site investigation the presses and conveyors were in operation and all equipment seemed to be working as intended.

i. Engine Generator. The Fort Thomas plant also has an engine generator, although, no information was obtained on the generator. District staff did not mention any operational or reliability problems with the engine generator and it was assumed to be in good overall condition.

2. MEMORIAL PARKWAY TREATMENT PLANT

Previously known as the Newport Water Treatment Plant, the Memorial Parkway Treatment Plant was acquired by the District with the other Newport water system facilities in 2002. Originally constructed in 1961 as a conventional coagulation / flocculation / sedimentation facility, MPTP now uses a high-rate ballasted flocculation (ACTIFLO®) process, which was installed in 1999. Raw water from the on-site presedimentation basins is pumped to two parallel 7.5 mgd ACTIFLO® process trains and the clarified water then flows to six granular media filters. The filtered water flows to a 3 million gallon circular clearwell. Finished water flows from the plant by gravity to the Newport distribution system. Water can also be pumped from the plant by the Waterworks Road Pumping Station to feed areas in Fort Thomas.

The current rated capacity of MPTP is about 10 mgd. However, some components, most notably the filters and the ACTIFLO® process, have higher capacities. Combined, the six existing filters have a flow capacity of 22 mgd (assuming that five of the six filters are operable and in service at a maximum hydraulic loading rate of 5.0 gpm/sq ft).

As its name implies, the Memorial Parkway Treatment Plant is located on Memorial Parkway in the City of Fort Thomas. The area around the plant is residential. See Figure II-12 on the following page for a schematic of the treatment process.

a. Presedimentation Basins. As described above, the MPTP has two presedimentation basins, the North and South Reservoirs, where raw water enters the plant. Piping was constructed in 1961 to allow raw water to flow directly from the Ohio River Pumping Station No. 2 to the original rapid mix basin, bypassing the reservoirs. However, normal operation is for raw water to be pumped to the reservoirs. The settled water flows by gravity from the two reservoirs to the Raw Water Pumping Station described in the previous section. From the Raw Water Pumping Station, water is conveyed to the one of two ACTIFLO® trains. Coagulant is introduced into the pipeline just upstream of the ACTIFLO® trains using a pumped diffusion-type flash mixing system.

The South Reservoir is currently being used as the only presedimentation basin and is in good condition. The North Reservoir is currently being used as a sludge and backwash holding basin. Due to the inability of the Sludge Handling Facility at MPTP to function correctly, no mechanical dewatering of sludge is currently taking place. The condition of the North Reservoir is unsatisfactory due to the fact that no sludge is being removed from the reservoir, which is estimated to be at approximately 75 to 80% of capacity, based on comments from District staff. District staff indicated that the transfer piping between the two reservoirs is insufficient and should be replaced. Currently water flows from the North Reservoir to the South Reservoir over the dam between the two when the water level in the North Reservoir is high enough. There is a concern that this will erode the dam over time. Figure II-13 shows where water typically overflows the dam between the reservoirs.

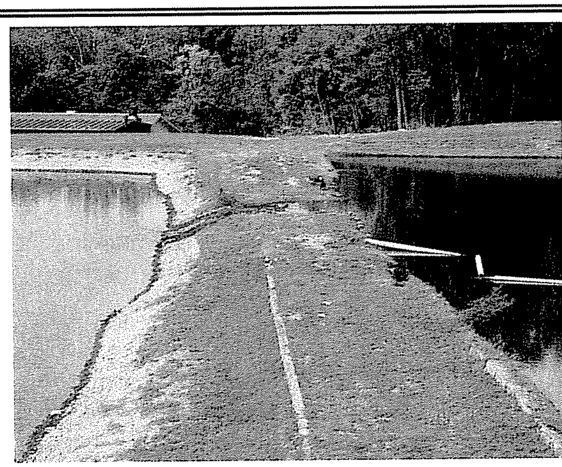
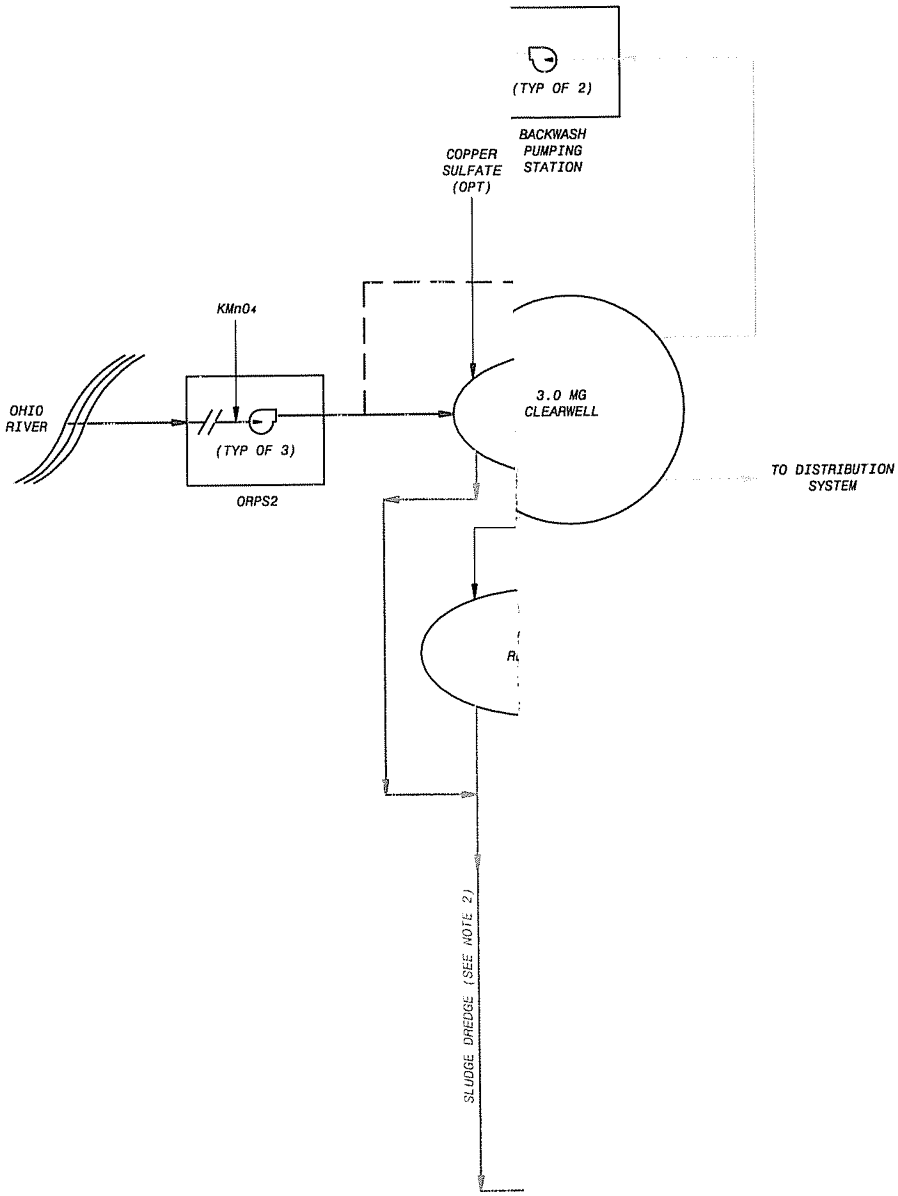


Figure II-13



NOTES:

1. CURRENTLY, DUE TO THE INOPERATION OF THE SLUDGE HANDLING BUILDING, ALL SLUDGE AND RESIDUALS FROM THE TREATMENT PROCESS ARE DISCHARGED TO THE NORTH RESERVOIR.

2. THE SLUDGE DREDGE FOR THE RESERVOIRS AT THE MEMORIAL PARKWAY TREATMENT PLANT IS CURRENTLY NOT IN OPERATION.

3. RAW WATER MAY BE PUMPED DIRECTLY FROM ORPS2 TO THE SOUTH RESERVOIR, OR STRAIGHT TO THE ACTIFLO® PROCESS. TYPICAL OPERATION IS TO PUMP TO THE SOUTH RESERVOIR.

RESIDUALS FLOW

RAW WATER

NO.	BY	CK	APP

REVISIONS AND RECORD OF ISSUE

DATE

CYGNET ID: XREF1 ID:
SAVED: DUN38005, 11/20/2003 9:26:55 AM XREF2 ID:
DWG VER #: XREF3 ID:
PLOTTED: FAU37423, 11/5/2002 10:35:12 AM XREF4 ID:
USER: DUN38005 SW: ACAD-2000i XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

MEMORIAL PARKWAY TREATMENT PLANT
SCHEMATIC

DESIGNED: APW
DETAILED: DAD
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

FIGURE II-12

FD5000
D5009

b. ACTIFLO® System. The ACTIFLO® system was installed in 1999 and consists of coagulation basins with mixers; injection basins with mixers; maturation basins with mixers; settling basins with sludge scrappers and lamellar tube modules; sand pumps; and hydrocyclones. There are two trains each rated 7.5 mgd at a hydraulic loading rate of 30 gpm per square foot in the sedimentation zone. The basins are cleaned out once every 30 to 45 days. District staff indicated that the system is operated to maintain a microsand inventory of about 100 pounds per million gallons at a 3.5% to 5% concentration. When the concentration drops below about 4%, makeup microsand is added.

Overall, the Actiflo system is in excellent condition. The system has performed very well with regard to removal of turbidity. The process can operate at an effluent turbidity of 0.3 NTU if desired; however, typically it is maintained around 1.0 NTU to obtain good filter performance. The galvanized electrical conduits near the Actiflo discharge were noted to be degrading. The only other concern is the metal grating above some of the basins and effluent channels is loose and a potential safety hazard. District staff also noted that the grating is covered in places with mats to block the cold and wind into the building during winter months as the effluent channels are open to the outside environment.

i. Coagulation. The coagulation basins are rapid mixing type tanks equipped with vertical turbine mixers. Coagulant is injected directly into the raw water supply prior to entering the basins. The chemically-coagulated water enters through pipes located at the base of each basin. There is also a 6 inch drain at the bottom of each basin for drainage purposes.

The coagulation basins have the following characteristics:

Coagulation Mixers A and B	
Basin Dimensions (each), ft	9'-11" x 9'-11" x 14'-0" (depth)
Detention Time @ 7.5 mgd, min	2
Mixer Manufacturer	Lightnin "Series 10"
Motor Manufacturer	Siemens
Motor, hp	5, with helical gear reducers
Volts	460

The coagulation basins and mixers are in excellent condition. When the coagulation mixers were taken out of service for routine maintenance in 2003, no problems were observed and District staff did not indicate any concerns with the basins or mixers.

ii. Injection. Coagulated water flows from the coagulation basins to the injection basins, where flocculation is initiated through the addition of polymer and microsand from the hydrocyclone underflow collection boxes. The injection basins also have a 6 inch drain that can be used to drain the injection and maturation basins.

The injection basins have the following characteristics:

Injection Mixers A and B	
Basin Dimensions (each), ft	9'-11" x 9'-11" x 14'-0" (depth)
Detention Time @ 7.5 mgd, min	2
Mixer Manufacturer	Lightnin "Series 10"
Motor Manufacturer	Siemens
Motor, hp	5, with helical gear reducers and variable frequency drives
Volts	460

The injection basins and mixers are in excellent condition. Early in 2003 the injection mixers were taken out of service for routine maintenance, no problems were observed. District staff did not indicate any concerns with the coagulation basins or mixers.

iii. Maturation. Water from the injection basins includes a suspension of microsand ballasted floc particles. This water enters the maturation basins through an opening at the bottom of the common wall between the injection and maturation basins. In the maturation basins, high density flocs form which will settle quickly in the settling basins. The mixers are vertically mounted and their rotating speed can vary between 45 Hz. and 60 Hz. adjusted with variable frequency drives for optimum floc formation.

The maturation basins have the following characteristics:

Maturation Mixers A and B	
Basin Dimensions (each), ft	18'-9" x 15'-0" x 14'-0" (depth)
Detention Time @ 7.5 mgd, min	5.7
Mixer Manufacturer	Lightnin "50607.50"
Ratio	38.10:1
Motor Manufacturer	Siemens
Motor, hp	7.5, with helical gear reducers and variable frequency drives
Output rpm	22.8
Volts	460

The maturation basins and mixers are in excellent condition. No problems were observed and District staff did not indicate any concerns with the maturation basins or mixers.

iv. Settling. The high-density microsand ballasted flocs from the maturation basins flow into the settling basins where the ballasted flocs settle to the bottom. The scrapers continuously rake the sand / sludge slurry towards the collection pits located in the center of the setting basins. The scrapers transport the slurry to the suction piping for the sand pumps. The scrapers rotating speed can vary between 30 Hz. and 90 Hz. adjusted with variable frequency drives for additional operational flexibility. Clarified water flows upward through lamellar tubes to a series of effluent collection troughs located above the lamellar tube modules. The collection troughs are provided with adjustable V-notch weirs. The settling basins also have a 6 inch drain that can be used to drain the basins for inspection and cleaning of the lamellar tube modules.

The scrapers are equipped with an overload device to protect them from damage due to excessive torque. The overload devices were originally set to shut off the drive at a torque of 24,000 ft-lbs, also known as the cutout torque. An alarm is sounded when the drive unit reaches 100% of the continuous operating torque or 18,500 ft-lbs. However, these setting are adjustable, and it was not clear if they had been modified.

The settling basins have the following characteristics:

Settling Scrapers A and B	
Basin Dimensions (each), ft	15'-0" x 15'-0" x 14'-0" (depth)
Rise Rate @ 7.5 mgd, gpm/sf	30
Scraper Manufacturer	DBS "SF-34-12"
Torque Rating, ft-lbs	18,500
Motor Manufacturer	Inverter Motor
Motor, hp	2.0, with variable frequency drives
Output rpm	22.8
Volts	460

The settling basins and scrapers are in excellent condition. No problems were observed and District staff did not indicate any concerns with the settling basins or scrapers.

v. Sand Pumps. There are six sand pumps installed at the end of the ACTIFLO® system, three in each train, which pump the settled sand / sludge slurry from the settling tank to the hydrocyclones at the beginning of the ACTIFLO® trains. The intake and discharge piping is 304 stainless steel. The sand pumps are centrifugal rubber lined slurry pumps with V-belt drives. The impellers and inside pump housings are rubber lined for resistance to the microsand abrasion. The pumps operate at a constant discharge pressure and are monitored with a low / high pressure switch at the pump discharge. If the measured pressure becomes too high or too low, the PLC stops the pumps and alarms the plant operator. The pumps require a minimum seal water flow of ½ to 1 gpm at 45 to 50 psi.

The sand pumps have the following characteristics:

Sand Pumps	
No. of Units	6
Manufacturer	Ingersoll-Dresser (5 units) Flowserve (1 unit, replaced in 2003)
Model Type	R 2 ½ RO 90
Capacity, gpm	120
Discharge pressure, psi	30
Motor Manufacturer	Sieman
Motor, hp	7.5
Motor, rpm	1750
Volts	460

The sand pumps are good condition. As noted above, Pump No. 3 in Train A was replaced in 2003 with a new pump; the other five pumps were rehabilitated in 2001. Some minor corrosion and leakage was noted on the pump seals and piping. No major problems were observed and District staff did not indicate any concerns with the units.

vi. Hydrocyclones. Flow is received from the six sand pumps at the twelve hydrocyclones, six for each train. The hydrocyclones separate the sand / sludge slurry by utilizing the force of the feed stream generated by the sand pumps. The hydrocyclone feed creates a vortex effect that exerts a centrifugal force on the mixture of particles. The microsand grains are forced to the outer walls of the hydrocyclone. The sludge particles are discharged out of the hydrocyclone overflow while the microsand is discharged by gravity out of the underflow. The underflow from each hydrocyclone is collected in a common collection box and returned to the injection tank.

The hydrocyclones have the following characteristics:

Hydrocyclones	
No. of Units	12
Manufacturer	Krebs "U4B-10"
Inlet Orifice size, in	1.25
Vortex finder size, in	1.0
Apex size, in	0.75

The hydrocyclones are in good condition. Some very minor corrosion and leakage was noted on piping entering the hydrocyclones. No major problems were observed; however, District staff indicated that pieces of the tubes sometimes clog the hydrocyclones. Kruger is currently investigating the situation and looking into retrofitting the sedimentation basins with tubes modules constructed of a different material.

c. Filter Building. The Filter Building was constructed in 1961. The Filter Building is a block and brick, single story building with a basement. The interior of the building is in poor shape. Walls are glazed and painted CMU. There are numerous locations where cracking, chipping, or chalking was observed in portions of the walls and support columns. Figure II-14 shows an example of this cracking that was observed in the southwest corner of the building. It was noted during the site investigation that there is strong evidence that the building is experiencing differential settlement due to the cracking apparent in the CMU walls at different location of the building.

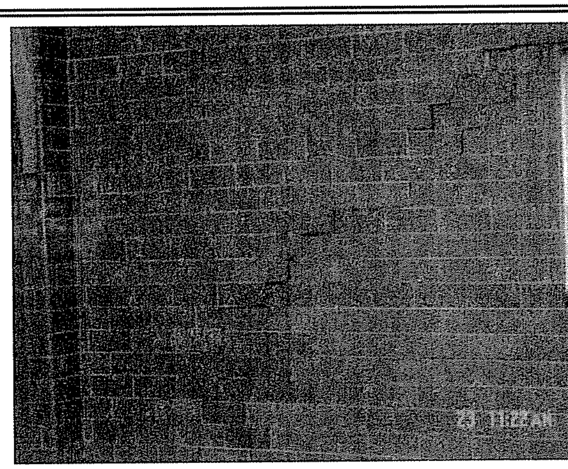


Figure II-14

The exterior of the building is brick, which is in unsatisfactory condition. In the areas where the CMU cracking was noted in the interior of the building, similar cracking and missing mortar was visible on the exterior of the building. At the southwest wall of the Filter Building, major cracking was observed. The interior block wall at this location is a load bearing member. The cracking and slipping of the brick was also noticed on the exterior brick facing of the Filter Building, as shown in Figure II-15. The brick wall is not load bearing; however, the cracking/slipping of the brick will only get worse over time, potentially leading to collapse of the brick wall in the future. The possible cause is continuous freeze/thaws that are pushing the brick facing away from the block wall.

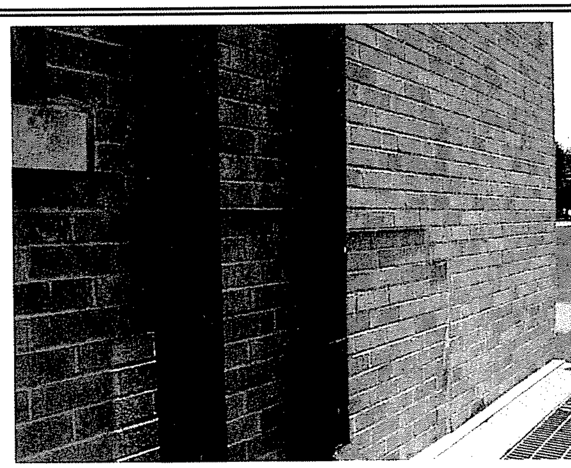


Figure II-15

The first floor of the building consists of offices, an operator laboratory, restrooms, and the filter wing. Windows on the east side of the building are in unsatisfactory condition as some do not open or are broken and others will fall out if they are opened. The offices, laboratory, and restrooms appeared to be in satisfactory condition, although all are showing their age. Temperature control on the first floor is through a central heating / ventilation system along with portable fans.

The basement of the Filter Building houses the filter piping, two chemical feed systems, the filter backwash blower, air compressors, and hot water boiler. No structural problems were noted in the basement. The paint on the filter piping and walls is chipping and peeling. Staff indicated that the hot water boiler is a constant maintenance problem as it was originally installed in 1961 and needs replacement.

d. Filters. MPTP has six gravity filters located in the Filter Building, constructed in 1961. The filters originally consisted of dual media (anthracite/sand), Wheeler monolithic underdrains with porcelain spheres, and graded media support gravel. The media and underdrain system were removed from Filter No. 1. Filters No. 2 and No. 3 still contain the original media system. Three filters (Nos. 4, 5, and 6) were rehabilitated in 1996 with new dual media and Leopold plastic underdrains, with integral media support (IMS) caps and air scour capabilities. The filters are capable of operating in a filter-to-waste mode after backwashing.

The filters have the following characteristics:

Filters	
Cell Dimensions, ft x ft	25.5 x 24
Surface Area each filter, sf	612
Filter Box Depth, ft	11.33
Filters Loading Rate, gpm/sf (22 mgd, 5 filters in service)	5.00
Filters Loading Rate, gpm/sf (10.5 mgd, 3 filters in service)	3.97
Filters Loading Rate, gpm/sf (8.8 mgd, 2 filters in service)	5.00

Currently only three of the six filters at MPTP are operational, Filters No. 4, 5, and 6. These three filters were recently restored and are in good condition. Review of Monthly Operating Reports from 2001 to the present showed that the three operational filters are performing well with regard to filtered water turbidity levels. Filter No. 1 is completely inoperable at this time. Filters No. 2 and 3 are not in use right now and would require a substantial amount of work to make operational. The pneumatic influent valve on Filter No. 2 is stuck in the closed position and the pneumatic influent valve on Filter No. 3 is stuck in the open position. All filter influent valves are the 1961 original valves, and replacement parts are reportedly no longer available.

e. Clearwell. Filtered water flows to the 3.0 MG clearwell located outside the plant. The 3.0 MG Clearwell was constructed in 1961. The clearwell was constructed with two zones, an inner and outer. No baffle walls are installed in the clearwell. Two 20 inch lines run out the west side of the clearwell to the Newport distribution system. They were constructed in 1961 and are controlled by two effluent valves which District staff report have never been exercised, and therefore functionality of these valves is unknown. Two additional pipelines exit the south side of the clearwell and convey finished water to the Waterworks Road Pumping Station.

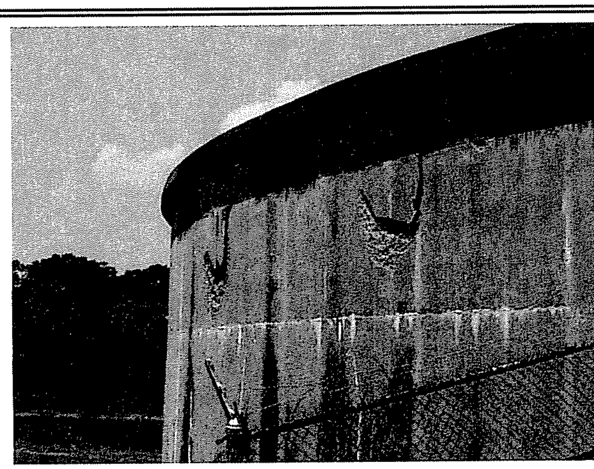


Figure II-16

Currently the isolation valve that directs flow to either the inner or outer zone is broken and the zones cannot be isolated. The clearwell cannot be taken out of service for investigation, as no provisions are in place to bypass it and direct flow directly to the distribution system.

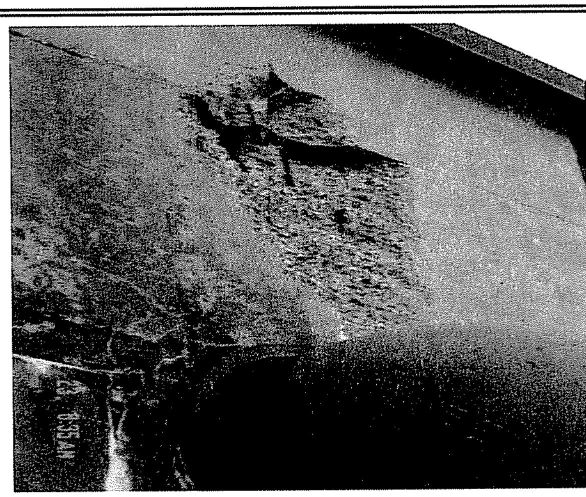


Figure II-17

During the site investigation, numerous locations were noted where concrete was severely cracking with places where the wall is chipping and falling off exposing reinforcement in the wall as shown in Figures II-16 and II-17. The top slab of the clearwell was noted to have similar structural deficiencies. Also of note is the clearwell does not have handrails on the access stairs and guardrails around the top perimeter. This is a potential fall hazard and safety concern. The expected condition of the inside of the clearwell, visual inspection of the outside, and comments from District staff indicate that the clearwell is in unsatisfactory condition.

f. Backwash Equipment. The filters are backwashed using finished water pumped from the clearwell by two backwash pumps. The pumps are located in the Backwash Pumping Station that is located to the east of the Clearwell. The Backwash Pumping Station was constructed in 1961. Pump No. 1 was installed in 1998, while Pump No. 2 is the original pump installed in 1961, although it was rehabilitated in 2000.

The Backwash Pumps have the following characteristics:

Backwash Pumps

	Pump No.1	Pump No. 2
Manufacturer	Ingersoll-Dresser	Worthington
Model	N/A	16LA1
Capacity, gpm	9000	9000
Head, ft	45	45
Motor Manufacturer	US Motor	Ideal Electric
Motor, hp	150	125
Motor, rpm	890	878
Volts	460	440

According to District staff, even though each backwash pump is rated 9000 gpm, together they can only pump approximately 12,000 gpm. Each pump needs to operate to adequately backwash a filter. An excessive number of water leaks were noted from pump and valve seals throughout the pumping station.

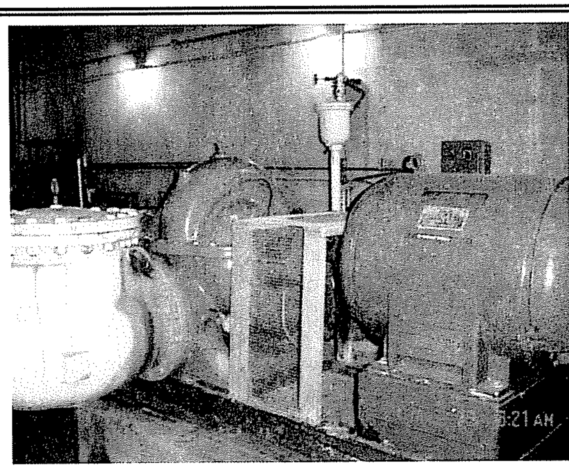


Figure II-18

Pump No. 1 is in good condition. Moderate corrosion was noted on the pump, pump base, and piping and valves. The inlet valve for the pump is a 24 inch Keystone manual butterfly valve. The discharge valves are a 16 inch check valve and a 16 inch Pratt manual butterfly valve.

Pump No. 2 is in unsatisfactory condition. Heavy to moderate corrosion was noted on the pump, pump base, bearing housings, and piping and valves as shown in Figure II-18. The inlet valve for the pump is a 24 inch Keystone manual butterfly valve. The discharge valves are a 16 inch check valve and a 16 inch Pratt manual butterfly valve. Drive shaft guards were inadequate for personnel protection as they were made from thin gage wire and 2 inch by 4 inch boards causing a potential safety concern.

g. Backwash Pumping Station. The Backwash Pumping Station was constructed in 1961. The pumping station is a block and brick, single story building with a concrete basement. The exterior of the upper portion of the building is brick and is in satisfactory condition. The basement of the building is concrete and is in satisfactory condition with locations where minor cracking is evident. However, no evidence was noted of differential settlement of the building.

A 5-ton Robbins & Myers monorail with hoist is provided for pump, piping, and valve maintenance. The exterior doors and wall mounted louvers are painted and moderate corrosion was noted. Lighting in the building was adequate with overhead lighting as well as wall mounted lights in the basement of the building. Ventilation of the pumping station is provided by natural ventilation through three windows, two roof gravity vents with manual dampers, and a single weather louver. During the site investigation, movement of air through the room was minimal. Heating is provided by a single Sterling electric heater controlled by a wall-mounted thermostat.

The electrical equipment and switchgear in the pumping station are original equipment installed in 1961. District staff stated that they need to be replaced with new equipment.

h. Air Wash Blower. The filter blower was installed in 1996 to provide air wash scour capabilities for the three renovated filters, Filters No. 4, 5, and 6. The blower is located in the basement of the Filter Building in a separate room in the Northeast corner of the building.

The blower has the following characteristics:

Filter Blower	
No. of Units	1
Manufacturer	Hoffman "74105A7"
Capacity, psig	25
Motor Manufacturer	Reliance Electric
Motor, hp	100
Motor, rpm	3565
Volts	460

The filter blower is in excellent condition. No deficiencies were noted during the site investigation. District staff did not have any concerns about the operation or reliability of the blower.

i. Chemical Feed Systems. At the time of the site evaluation, the chemical feed systems employed at MPTP consisted of coagulant, ferric sulfate, caustic soda, gaseous chlorine, fluoride, copper sulfate, corrosion inhibitor, polymer, and powdered activated carbon. Subsequently, the District has abandoned the gaseous chlorine storage and feed systems and replaced them with a "temporary" sodium hypochlorite facility. The following section presents the equipment characteristics, capacities, and condition assessments of the chemical feed systems at the time of the site evaluation, and does not include the sodium hypochlorite equipment.

i. Chemical Building. The Chemical Building was constructed in 1961. The Chemical Building Chlorine Rooms are block and brick, single story rooms. The interior of the rooms are in satisfactory shape. Walls are painted CMU. The exterior of the building is brick which is in unsatisfactory condition. It was noted during the site investigation that there is strong evidence that the building is experiencing differential settlement due to the cracking apparent in the CMU walls and exterior brick walls at different location of the building. Figure II-19 shows an example of the cracking on the west side of the Chemical Building.

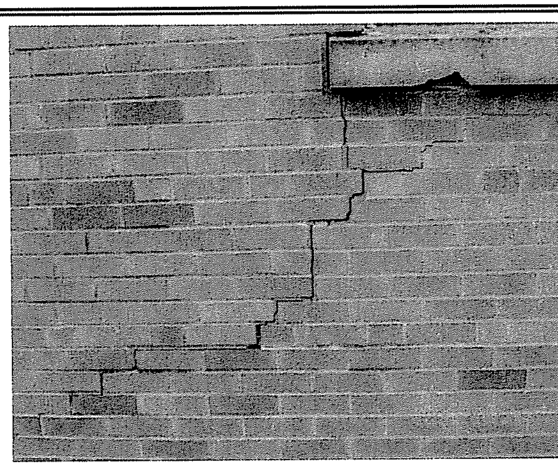


Figure II-19

The Chemical Building is a block and brick structure that is in unsatisfactory condition. The interior is in unsatisfactory condition; most walls are painted CMU while some are unpainted CMU. It was noted during the site investigation that there is strong evidence that the building is experiencing differential settlement due to the cracking apparent are various locations in the CMU. The exterior of the building is brick which is in unsatisfactory condition as well. In the areas where the CMU cracking was noted in the interior of the building, similar cracking and missing mortar was visible on the exterior.

Located in the upper level of the Chemical Building is a non-functioning bathroom, an office area that is not in use, and a carbon storage and feed system that is no longer used. There are also elevated lime bulk storage tanks that are no longer in use. District staff informed B&V of safety issues for the upper level platform including broken doors and unstable support of the platform. It should also be noted that the plant does not have sufficient area for a 30 day storage supply for most chemicals, as required by Ten States Standards.

The bottom floor of the Chemical Building houses raw water piping and analyzing equipment. Portions of the raw water piping to the Actiflo system were observed to be in unsatisfactory condition. Figure II-20 displays an example of moderate corrosion present on the raw water piping. It was noted that condensation and humidity levels can become very high in this area, and pose a threat to the electronic analyzing equipment and displays. District staff noted that the floor drains in this area are clogged and are inoperable.

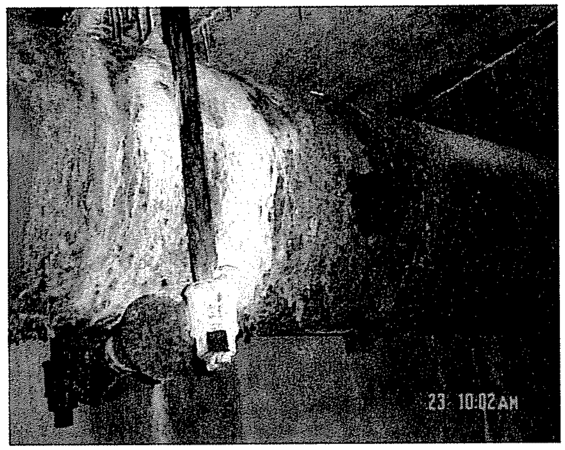


Figure II-20

A new boiler was installed in the lower level of the Chemical Building earlier in 2003 to replace an older unit from 1961 that was inoperable.

The operating level of the Chemical Building contains a truck access area for chemical delivery. District staff noted that the roadway to this area is difficult for large trucks to maneuver due to its configuration. The fill piping connections are located in the chemical delivery area. This piping is not labeled, making it difficult to for delivery personnel to determine the proper pipe connection the chemical supplier should attach to. There are several chemical storage and feed systems that are located on the ground floor level which are no longer in use, some of which still contain residual chemicals. It is noted that the floor and metal columns show significant deterioration by chemical contact and structural integrity of the building may be questionable. Several locations were noted where past chemical spills have dripped into holes in the floor of the operating level and down to the lower level of the building.

ii. Chlorine. Chlorine was used as the primary disinfectant at the Memorial Parkway Treatment Plant at the time of the site evaluation. This section describes the gaseous chlorine equipment and systems as they existed at that time. As described below, the

District has subsequently installed a sodium hypochlorite system for disinfection, and the chlorine system is no longer used.

Chlorine was fed to the filter influent following the ACTIFLO® system and to the finished water clearwell inlet. The gaseous chorine system was put into operation in 1992. The chlorine storage cylinder tanks were stored in a separate room of the Chemical Building from the chlorine feeders. The chlorine feed system consists of scales for the storage tanks, two chlorine feeders, and associated piping.

The chlorine system has the following characteristics:

Storage Cylinders on scales	
No. of units	4
Feeders	
No. of units	2
Manufacturer	Wallace & Tiernan "V-notch"
Capacity (each), lb/day	300 (feeder No. 1)
	400 (feeder No. 2)

The chlorine feed system as it existed at the time of the site investigation was overall in satisfactory condition. While the two feeders were rebuilt in 2001 and are equipped with 500 pound per day rotometers, plant staff report that neither feeder could operate at full 500 pounds per day capacity. The storage area has room for three additional tanks to be stored off of the scales along with the two tanks on each scale. The chlorine system was not flow paced, the feeders are manually set.

The District has replaced the gaseous chlorine system with a sodium hypochlorite feed system housed in the basement of the Chemical Building. At the time of the site investigation, the sodium hypochlorite system only consisted of five empty 1,100 gallon storage tanks. Once the sodium hypochlorite system is on-line, it will be able to feed to the injection basins, filter influents, and combined filter effluent to the clearwell.

iii. Ferric Sulfate. Ferric sulfate is fed to the ACTIFLO® system influent as the primary coagulant. The ferric sulfate feed system was put into operation in 1961 although various pieces of equipment have been replaced since. Most recently, the day tank and metering pump were installed in 2003. The ferric sulfate system is located in the main room of the Chemical Building in the ferric sulfate storage area. The area is a contained area which contains one day tank and one metering pump. An elevated bulk storage tank is located above the main room in the Chemical Building, and is not contained. Ferric sulfate is transferred from the bulk tank to the day tank by gravity.

The ferric sulfate system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	6,000 (approximately)
Day Tank	
No. of units	1
Capacity, gal	1,000 (approximately)
Metering Pump	
No. of units	1
Manufacturer	Wallace & Tiernan "Series 44"
Capacity, mL/min	2,000 (approximately)
Motor Manufacturer	Reliance Electric
Motor, hp	0.5
Volts	90

The overall condition of the ferric sulfate system is satisfactory. The day tank is in excellent condition. The bulk storage tank is in unsatisfactory condition based upon the fact that the tank is elevated with no containment, and B&V and District staff noticed evidence of rusting at the bottom of this tank. The metering pump is in satisfactory condition. The metering pump appeared to be a refurbished unit from another application. No redundant metering pump is in place at this time. Moderate corrosion was noted on the pumps and associated piping and valves from past leaks and or spills. There was also evidence of spills and / or leaks on the floor in the area. The ferric sulfate system is not flow paced.

Four old LMI Milton Roy metering pumps are still installed in the area from the old ferric sulfate feed system as well as the old day tank. Capacity of these old metering pumps is 25 gpd at 30 psig. However, District staff noted that these units would most likely not work if they were placed in service and should be removed from the area.

iv. Polyaluminum Chloride Coagulant. Polyaluminum chloride coagulant is used as the secondary coagulant at MPTP. The polyaluminum chloride system was placed into operation in 1994, although the metering pump was replaced in 2003. The coagulant system is located in the main room of the Chemical Building in the polyaluminum chloride coagulant storage area. The area is a contained area which contains one storage tank and one metering pump.

The polyaluminum chloride system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	2,000 (approximately)
Metering Pump	
No. of units	1
Manufacturer	W&T "Series 44 – 125 M9P"
Capacity, mL/min	2,000 (approximately)
Motor Manufacturer	Reliance Electric

The overall condition of the polyaluminum chloride coagulant system is satisfactory. The storage tank is in unsatisfactory condition based because it is not adequately sized to handle a full chemical delivery. Currently, the District is paying for full shipments of polyaluminum chloride, even though the tank can only hold about half of a full shipment volume. The metering pump is in satisfactory condition and appeared to be a refurbished unit from another application. No redundant unit is in place for the metering pump at this time. Moderate corrosion was noted on the pump and associated piping and valves from past leaks and or spills. There was also evidence of spills and / or leaks on the floor in the area. The polyaluminum chloride coagulant system is not flow paced.

Four old LMI Milton Roy metering pumps are still in the area from the old coagulant feed system. Capacity of these metering pumps is 108 gpd, at 50 psig. However, District staff noted that these units would most likely not work if they were placed in service and should be removed from the area.

v. Copper Sulfate. Copper sulfate is fed to the reservoir inlet on an as-needed basis for algae control. The copper sulfate system was placed into operation in 1999, although the metering pump was rebuilt in 2003. The copper sulfate system is located in the main room of the Chemical Building adjacent to the polyaluminum chloride coagulant storage area. The area is not contained and consists of one storage / mixing tank and one metering pump. District staff indicated that copper sulfate is typically batched at 50 gallons of water per 50 pounds of copper sulfate.

The copper sulfate system has the following characteristics:

Storage / Mixing Tank	
No. of units	1
Capacity, gal	200 (approximately)
Metering Pump	
No. of units	1
Manufacturer	Wallace & Tiernan "Series 44 – 118"
Capacity, mL/min	500 (approximately)
Motor Manufacturer	Dayton Electric
Motor, hp	0.25
Volts	N/A

The overall condition of the copper sulfate system is satisfactory. The storage tank is in good condition although no containment is present for the tank. The metering pump is in satisfactory condition. The metering pump appeared to be a refurbished unit from another application as the nameplate had a date of 1987. However, District records indicated that it was placed in service in for this application in 1999. No redundant unit is in place for the metering pump at this time. Moderate corrosion was noted on the pumps and associated piping and valves from past leaks and / or spills. The metering pump sits on top of plastic grating that is used as a shelf. The copper sulfate system is not flow paced.

vi. Caustic Soda. The caustic soda (sodium hydroxide) system was placed into operation in 1999, although the metering pumps were rebuilt in 2003. Caustic soda can be fed both prefiltration and postfiltration. The caustic soda system is located in the main room of the Chemical Building in the caustic soda storage area. The area is a contained area which contains three storage tanks and four metering pumps. However, the metering pumps are not located inside the containment area.

The caustic soda system has the following characteristics:

Storage Tanks	
No. of units	3
Capacity (each), gal	2,000 (approximately)
Metering Pumps	
No. of units	4
Manufacturer	LMI Milton Roy "C731-26"
Capacity, gph	8.0 (Pumps No. 2-4) 9.0 (Pump No. 1)
Motor Manufacturer	N/A

The overall condition of the caustic soda system is good. The storage tanks are in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping and valves from past leaks and or spills. There was also evidence of spills and / or leaks on the floor in the area. No containment was present for the metering pumps. The caustic soda system is not flow paced.

vii. Powdered Activated Carbon. The powdered activated carbon system was placed into operation in 2003 and had not been used yet at the time of the site investigation. The PAC system is located in the main room of the Chemical Building in the PAC storage area. The area is a contained area which contains the storage / mixing tank and one metering pump.

The powdered activated carbon system has the following characteristics:

Storage / Mixing Tank	
No. of units	1
Capacity, gal	500 (approximately)
Metering Pump	
No. of units	1
Manufacturer	Wallace & Tiernan "214-M1P"
Capacity, mL/min	1200 (approximately)
Motor Manufacturer	Magmetek Electric
Motor, hp	0.25
Volts	90

The overall condition of the powdered activated carbon system is excellent. The storage tanks are in excellent condition. The metering pump is in excellent condition, although there is no back-up metering pump in place for redundancy. As stated above, at the time of the site investigation, the PAC system had not been operated. The PAC system is not flow paced.

It should be noted that although the PAC system components are collectively considered to be in excellent condition, the environment in the PAC area does represent a potential explosion hazard, due to the nature of PAC dust particles.

viii. Corrosion Inhibitor. Carus Chemical Company "K-5" is currently used as the corrosion inhibitor. The system was placed into operation in 1994, although the metering pump was recently rebuilt in 2003. The corrosion inhibitor system is located in the basement of the

Filter Building near the South staircase. The system is not contained and consists of the storage / mixing tank and one metering pump.

The corrosion inhibitor system has the following characteristics:

Storage / Mixing Tank	
No. of units	1
Capacity, gal	100 (approximately)
Metering Pump	
No. of units	1
Manufacturer	LMI Milton Roy "B911-91FS"
Capacity, gph	1.60

The overall condition of the corrosion inhibitor system is good. All equipment associated with the system is in good condition. Light corrosion was noted on the associated piping and valves. There is no containment for this system and no back-up metering pump in place for redundancy. The corrosion inhibitor system is not flow paced.

ix. Fluoride. The fluoride system was placed into operation in 1961, although pieces of equipment have been replaced since. The fluoride system is located in the basement of the Filter Building near the North staircase. The system is not contained and consists of a storage tank located outside, a day tank, one transfer pump, and one metering pump. The storage tank located outside was installed in 1989. The day tank and metering pump were replaced in 2003, and the transfer pump was last replaced in 1998.

The fluoride system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	6,457
Day Tank	
No. of units	1
Capacity, gal	100 (approximately)
Transfer Pump	
No. of units	1
Manufacturer	ARO

Metering Pump	
No. of units	1
Manufacturer	LMI Milton Roy "B911-91FS"
Capacity, gph	1.60

The overall condition of the fluoride system is satisfactory. The storage tank is in unsatisfactory condition due to the location of it outside with no protection from the environment and the light corrosion noted on some of the connections. The day tank is in good condition, although there is evidence of past spills around the tank and deteriorate of the concrete floor is evident. The transfer pump is in satisfactory condition, although very little information was available about it. District staff did not mention any operational concerns about the transfer pump. The metering pump is in good condition. There is no containment for this system and no back-up metering pump in place for redundancy. The fluoride system is not flow paced.

x. ACTIFLO® Polymer. The ACTIFLO® polymer system was installed with the ACTIFLO® system in 1999. Currently the District is feeding dry polymer (LT22S) but is in the process of changing to a liquid polymer. Preliminary testing performed by the District indicates that the currently 0.40 mg/L dry polymer dosage can be reduced to about 0.25 to 0.30 mg/L with liquid polymer. Currently, the ACTIFLO® dry polymer system consists of a mixing tank and mixers, three metering pumps, two of which are in service and one standby, and associated valves and piping.

The ACTIFLO® polymer system has the following characteristics:

Mixing / Feeder Tank	
No. of units	1
Manufacturer	Pro Minent "AT-400/96-SANSI"
Capacity, gph	100
Metering Pumps	
No. of units	3 (2 service, 1 standby)
Manufacturer	SEW-Eurodrive-Moyno "RX611P56"
Capacity, gph	190
Motor Manufacturer	Warner Electric
Motor, hp	0.75
Volts	90

The overall condition of the ACTIFLO® polymer system is good. The mixing / feeder tank is in excellent condition. The three metering pumps are all in good condition. Minor corrosion was noted on the pumps and pipe connections. District staff indicated that when the conversion is made to liquid polymer, one of the three metering pumps will be taken out of service. The ACTIFLO® polymer system is flow paced.

xi. Sludge Polymer. The sludge polymer system was installed when the Sludge Handling Building was constructed in 1997. Currently, the District does not use the Sludge Handling Building at all, and therefore is not using the sludge polymer system. The sludge polymer system consists of one metering pump, storage drums, and associated valves and piping.

The sludge polymer system has the following characteristics:

Metering Pump	
No. of units	1
Manufacturer	LMI Milton Roy "CP31-20PB"
Capacity, gph	9
Motor Manufacturer	Baldor
Motor, hp	0.33
Volts	115-208/230

The overall condition of the sludge polymer system is excellent due to the fact that is has hardly been used. The metering pump is in excellent condition. The metering pumps draw polymer directly from 50 gallons drums located next to the wall mounted metering pump. Also in the area at the time of the site investigation were two spare polymer metering pumps. District staff was not aware of the purpose of these spare units.

j. Residuals Handling Systems. The residuals handling system at MPTP is currently inoperable due to problems in the Sludge Handling Building. The Sludge Handling Building was constructed in 1997. During initial startup, the influent sludge had a relatively low solids concentration with a high viscosity and the facility operated as intended. However, after a few weeks as sludge solids percentages increased and viscosity decreased, problems began to occur with the processing of the sludge, and dewatering was therefore discontinued. All treatment process residual flows, including filter backwash water and ACTIFLO® residuals, are therefore currently being discharged into the North Reservoir.

The Sludge Handling Building consists of one 2 meter belt filter press located above a below-grade 200,000 gallon sludge holding tank. As designed, residuals from the ACTIFLO® process flow by gravity to the holding tank. The tank is rectangular with a moderately sloped floor designed to facilitate movement of settled solids to a single collection point from which the sludge is intended to be pumped by two vertical turbine pumps up to the belt filter press on the operating floor.

When the facility was initially operated, District staff noticed that as the higher percentage solids (i.e., thicker) sludge collected in the holding tank it would not flow properly to the collection point. The sludge "mounded" in areas surrounding the tank influent pipe and did not flow to the press feed pumps. The slope of the floor is apparently not adequate to allow the thicker sludge to flow to the collection point. In addition, the sludge is of such low viscosity that the press feed pumps have difficulty pumping it to the belt filter press. Currently, the holding tank is full of unprocessed sludge, which will require removal by other means before operation of the facility may be resumed, due to this material having dried and solidified.

The residuals handling system has the following characteristics:

Belt Filter Press	
No. of Units	1
Manufacturer	Ashbrook "Klampress 2 meter"
Sludge Pumps	
No. of Units	2
Manufacturer	Seepex "Size 70"
Capacity, gpm	40-250
Motor Manufacturer	SEW-Eurodrive
Motor, hp	10.7
Motor, rpm	1740
Volts	460

The belt filter press is in excellent condition. No defects of any kind were observed. The press has less than approximately 100 hours of operation time due to the other problems that exist with the facility. The press is a "top of the line" make and model and should perform well if the other problems in the facility are remedied. No Operations & Maintenance manuals were available for the press at the time of the site investigation, so the only information obtainable was that which was on the nameplate.

The conveyor belt was observed to be in excellent condition. However, District staff stated that there is a problem in the truck loading station where the conveyor discharges the pressed sludge into the dumpster. The roof is apparently too low for a dumpster loading truck to back into the loading station and raise its boom to lift a dumpster. Therefore, to either remove a full dumpster or place an empty dumpster under the conveyor, an alternative means is necessary.

The sludge transfer pumps are inoperable due to the fact that they are vertical turbine type pumping units and are not appropriate for the intended application. This is a major contributing factor to the sludge processing facility not being operable. As stated above, the pumps simply can not pump sludge to the belt press from the Sludge Holding Basin located below the building.

The reservoir dredge on site was originally installed at the Fort Thomas plant, but it was moved to MPTP when the Memorial Parkway dredge was moved to FTTP. The dredge is not currently in service and District staff indicated that it is inoperable at this time. The dredge has been partially disassembled.

The Sludge Handling Building is a block, bi-level building above-grade, with the Sludge Holding Basin underneath the building. The upper level consists of a storage area that was locked at the time of the site investigation. The lower level consists of the sludge belt filter press, an electrical room, a laboratory area, a restroom, and janitors closest. The interior of the building is in excellent shape. Walls are painted CMU. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No cracking or differential settlement was noted in the walls. The exterior of the building is concrete block, and is in excellent shape structurally. The block work is in excellent condition, with no cracks or missing mortar being noted. The restroom and janitors closest were in good condition. The laboratory area was locked at the time of the inspection. District staff stated that the electrical system is inadequate to serve both the lab and the sludge facility at the same time.

k. <u>Engine Generator</u>. The engine generator at MPTP was installed in 1986 and serves as backup electric supply to the Filter Building, Chemical Building, Backwash Pumping Station, and the Raw Water Pumping Station. However, it does not supply the ACTIFLO® system. The generator is a Caterpillar, 3013 KVA, 250 kW generator. It is in satisfactory physical condition, but because it cannot power the ACTIFLO® system, the overall condition is unsatisfactory because the plant can not treat water without the ACTIFLO® system.

l. <u>Compressed Air System</u>. The compressed air system is used to power pneumatically actuated valves in the Filter Building. The compressed air system consists of two air compressors, two air tanks, and the associated valves and piping in the building. The air compressors are manufactured by Ingersoll-Rand and each has a tank attached to it. However, one of the tanks is cracked and is inoperable, but both compressors still function. Therefore the air compressors themselves are in satisfactory condition; however one air tank is in need of repair or replacement.

3. TAYLOR MILL TREATMENT PLANT

Although smaller in capacity than the FTTP (10 mgd), the Taylor Mill Treatment Plant (TMTP) nonetheless plays an important roll in the District's operations. The plant is similar to FTTP, being a conventional coagulation / settling / filtration plant. Source water for TMTP is the Licking River. Raw water is pumped to a single rapid mix chamber and then flows to one of two parallel flocculation / sedimentation basin trains. Following sedimentation, water is filtered by eight granular activated carbon media filters, and then flows to a below-grade concrete clearwell. Chemicals fed at TMTP include ferric sulfate, sodium hypochlorite, coagulant, corrosion inhibitor, fluoride, sodium bisulfite, caustic soda, polymer, copper sulfate, and powdered activated carbon.

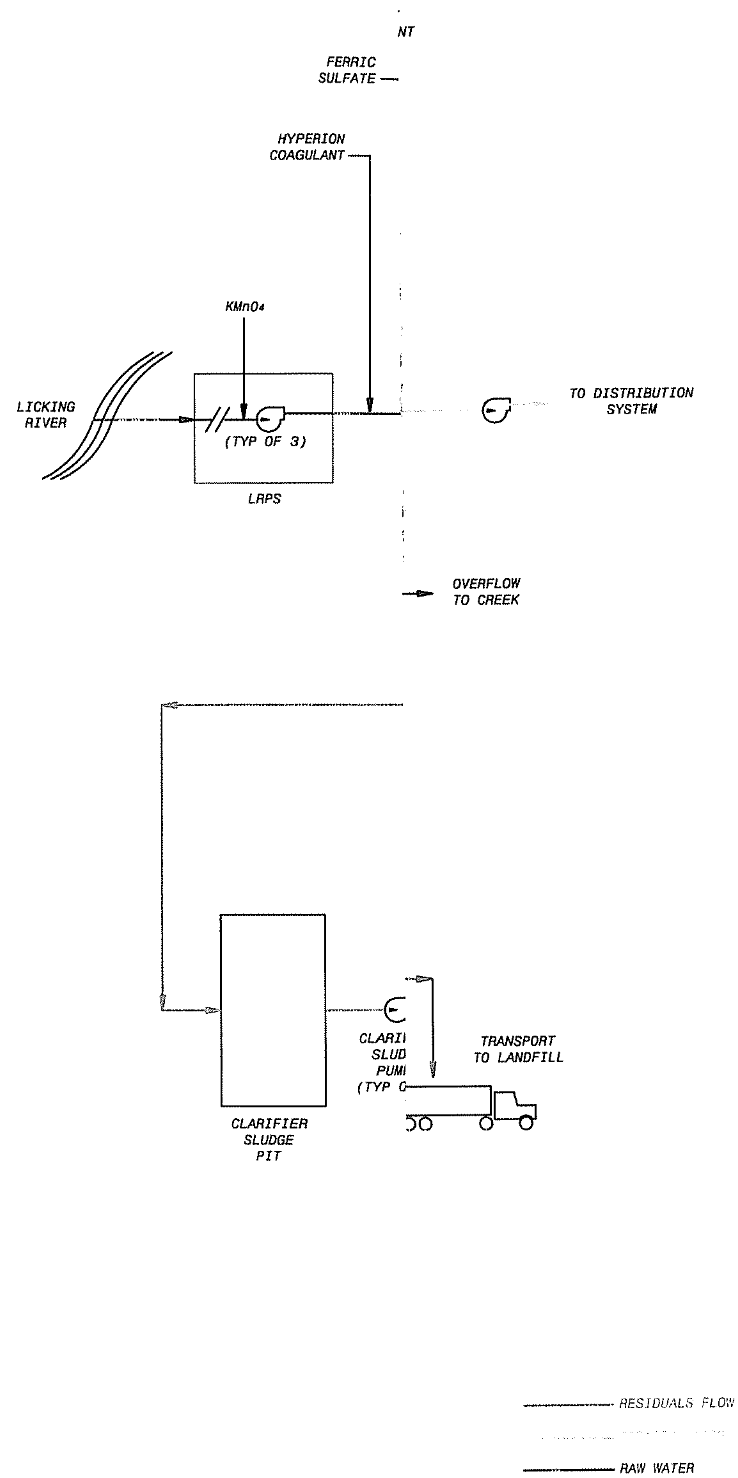
In addition to the treatment processes, TMTP serves as a critical pumping facility for NKWD, taking water produced at both Taylor Mill and Fort Thomas (which flows by gravity to TMTP) and transferring it to the distribution system. Further discussion of the Taylor Mill pumping facilities is provided in the following section of this chapter.

Similar to FTTP, the Taylor Mill plant is located in a residential area and is adjacent to an elementary school. There is very little unoccupied land area at the plant site. The facility is located on Grand Avenue in the City of Taylor Mill. See Figure II-21 on the following page for a schematic of the TMTP treatment process.

a. Rapid Mix Basin. The Taylor Mill plant receives raw water pumped directly from the Licking River Pumping Station to the rapid mix basin located between the two flocculation / sedimentation basins. The rapid mix basin is equipped with a vertical turbine type mixer. The rapid mix basin was originally constructed in 1953 with the original North flocculation / sedimentation basin. According to District records, the mixer was last replaced in 1989.

The rapid mix basin has the following characteristics:

Rapid Mixer	
Basin Dimensions, ft	4'-6" x 4'-6" x 6'-0" (depth)
Mixer Manufacturer	Lightnin
Motor Manufacturer	Siemens
Motor, hp	3.0
Motor, rpm	1730



DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

CYGNET ID: | XREF1 ID:
SAVED: DUN38005, 11/20/2003 8:27:55 AM | XREF2 ID:
DWG VER #: | XREF3 ID:
PLOTTED: FAU37423, 11/5/2002 10:35:12 AM | XREF4 ID:
USER: DUN38005 | SW: ACAD-2000i | XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

TAYLOR MILL TREATMENT PLANT
SCHEMATIC

DESIGNED: APW
DETAILED: DAD
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

FIGURE II-21

FD5000
D5009

The rapid mix basin is in satisfactory condition. Moderate corrosion was noted on the base plates, supports, and bolts around the mixer. This is most likely due to the rapid mix basin being located outside and unprotected from the environment. District staff reported no problems with the operation of the rapid mixer.

b. <u>North and South Sedimentation Basins</u>. The North Sedimentation Basin was constructed in 1953 and the South Sedimentation Basin in 1960. They are conventional treatment type basins with four flocculation zones or cells each that are separated by concrete divider walls. Each cell is equipped with a vertical turbine type flocculator that was replaced in 2003. Following the fourth flocculation cells water flows to the center of the sedimentation zones and then upward through tube settlers. In the middle of the clarification zones are center driven sludge collector rakes with corner sweeps. The sedimentation zones have sloped bottoms to center hoppers to facilitate collection and removal of solids. Walkways lead to platforms in the center of the basins where the rake drive assemblies are located. Rake assemblies and tube settlers were replaced in 1997.

The North and South Sedimentation Basins have the following characteristics:

North and South Basins Flocculators	
Cell No. 1 Dimensions, ft	14'-0" x 18'-7" x 17'-2" (depth)
Cell No. 2 Dimensions, ft	14'-0" x 11'-9" x 16'10" (depth)
Cell No. 3 Dimensions, ft	14'-0" x 13'-9" x 16'-6" (depth)
Cell No. 4 Dimensions, ft	14'-0" x 16'-7" x 16'-2" (depth)
Equipment Manufacturer	Lightnin "Series 10, LFD4501CMX"
Ratio	87.5:1
Motor Manufacturer	Baldor
Motor, hp	1.0
Motor, rpm	1725
Volts	460
North and South Clarifiers Rakes	
Basins Cell Dimensions (each), ft	65'-0" x 65'-0" x 17'-2" (depth)
Equipment Manufacturer	Eimco "C30HT"
Ratio	57.0:1
Motor Manufacturer	US Electric Motor
Motor, hp	5.0
Motor, rpm	1745
Volts	460

North and South Basins Tube Settlers	
Surface Area (per basin), sq ft	1,750 (approximately)
Depth, ft	2

All the flocculators are in excellent condition, as they were replaced recently or were in the process of being replaced at the time of the site investigation. Minor corrosion was noted on the flocculator base plates in all cells. The clarifier rakes are in good condition. Light corrosion was noted on exposed metal surfaces and the bolts. Paint was peeling from the drive assemblies. The tube settlers are in good condition, although District staff indicated that pieces of the tubes are found when the basins are taken down for regularly scheduled maintenance. There are several places where the tubes are damaged from cleaning and maintenance. Figure II-22 shows the submerged tubes and examples of locations which are damaged.

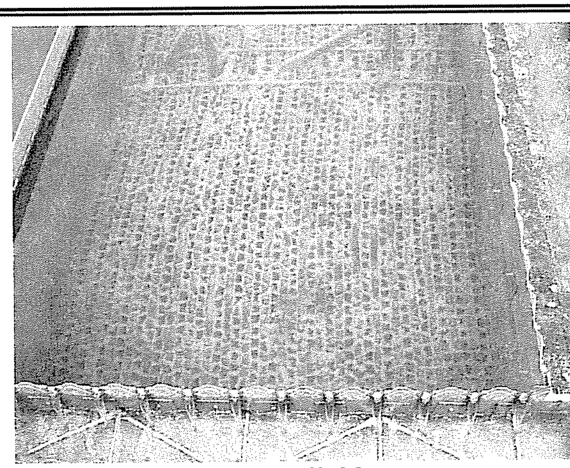


Figure II-22

Structurally, the basins are in unsatisfactory condition. Numerous locations were noted, as shown in Figure II-23, where water was leaking through the walls of the basins. District staff indicated that they are currently evaluating the structural integrity of the basins in a separate investigation.

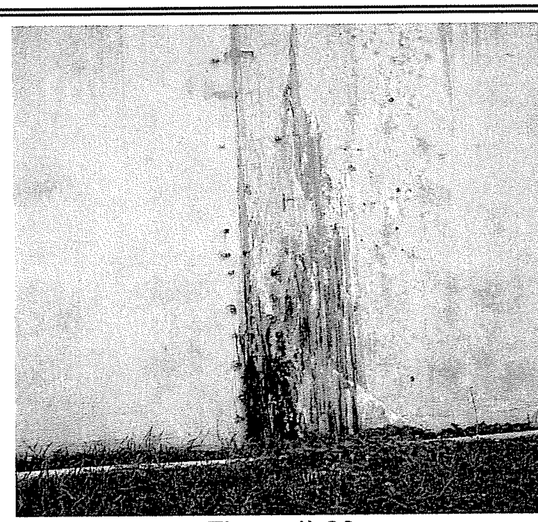


Figure II-23

c. Filter Building. The Filter Building was constructed in 1953, when the TMTP was constructed. The Filter Building is a block and brick, three story building with a basement and clearwell located under the building. The interior of the building is in good shape. Most walls are glazed CMU. There are some isolated locations where minor cracking, chipping, or chalking was observed in portions of the walls. However, no major cracking or differential settlement was noted in the walls. The exterior of the building is brick, and is in good shape structurally. The brick work was observed to have no noticeable defects, with no major cracks or missing mortar being noted.

The first and second floors of the building consist of offices, an operator laboratory, restrooms, and the filter wings. The filter wings are constructed of block and brick with skylights to allow for natural light to enter the filter gallery. Weather louvers and ventilation fans are located throughout the filter wings to allow airflow into the filter gallery which appeared to be in good condition. The offices, laboratory, and restrooms appeared to be in good condition with no noted problems.

The third floor has undergone many renovations since the original construction and currently serves as a storage area. Prior to the construction of the Chemical Building in 1998, the third floor stored most of the chemical feed systems. Some evidence was noted of past chemical spills by minor deterioration of the concrete floor.

The basement of the building houses the majority of piping within the plant. The filter gallery was visually inspected and appeared to be in good condition. The raw water main to the rapid mix basin, filter to waste piping, and the line from FTTP to the clearwell are were all determined to be in good condition.

d. Filters. TMTP has eight gravity filters located in the Filter Building. Four filters were constructed with the original plant in 1953 and four more were added when the plant was expanded in 1960. The filters were rehabilitated in 2001 when granular activated carbon media was installed. Each filter is equipped with GAC and fine sand media with a Leopold plastic underdrain system with IMS caps and provisions for air scouring. Backwash collection troughs have been retrofitted with baffles to permit simultaneous air/water backwashing and minimize loss of GAC media during backwashing. The filters are capable of operating in a filter to waste mode after backwashing.

The filters have the following characteristics:

Filters	
Number of Units	8
Cell Dimensions, ft x ft	18 x 15
Surface Area each filter, sf	270
Filter Box Depth, ft	5.75
Filters Loading Rate, gpm/sf (10 mgd, 8 filters in service)	3.21
Filters Loading Rate, gpm/sf (10 mgd, 7 filters in service)	3.67

Each of the eight filters is in good condition. Review of Monthly Operating Reports from 2000 to the present showed that each of the eight filters is performing well with regard to filtered water turbidity levels. District staff noted that there are no significant differences in media effective sizes or overall condition of the media in the eight filters. District records indicate that typically only five of the eight filters are used at a time, based upon demand.

e. Clearwell. Filtered water flows to the 1.0 MG clearwell located underneath the Filter Building. The Clearwell was constructed in 4 different zones. Two of the zones were constructed with the original construction of the plant in 1953. When the plant was expanded in 1960, two additional zones were added. In 1997, baffle walls were constructed to facilitate compliance with requirements for disinfectant contact time. Treated water from FTTP flows by gravity to the Taylor Mill plant and is mixed in one of the four zones in the Clearwell with treated water from TMTP and then pumped to the distribution system. The clearwell was not taken out of service for investigation; however, expected overall condition and comments from District staff indicate that it is in good condition.

f. Backwash Equipment. The filters are backwashed using finished water from the Clearwell using a backwash pump or more typically, directly from the distribution system. The Backwash Pump was replaced in 2003.

The Backwash Pump has the following characteristics:

Backwash Pump	
No. of Units	1
Manufacturer	Cascade "12MFCA"
Capacity, gpm	4500
Motor Manufacturer	Fairbanks Morse Motor
Motor, hp	75
Motor, rpm	1755
Volts	416

The backwash pump was in excellent condition (new 2003). Light corrosion was noted on the discharge Chapman 16 inch check valve. A manual 16 inch gate valve is also located on the discharge side of the pump. At the time of the site investigation, District staff did not have any specific comments or concerns about the new backwash pump.

Spent backwash water discharges to the Backwash Holding Basin located underneath the Sludge Handling Building. The Backwash Holding Basin was constructed in 1989 and is a below grade cast-in-place concrete basin. The basin also receives decant flows from the two adjacent sludge storage tanks. The Backwash Holding Basin is in good condition with no noticeable structural defects and no noted concerns.

g. Air Wash Blower. The filter blower was installed in 2000 to provide air wash scour capabilities for the filters. The blower is located in the basement of the Filter Building enclosed with heavy plastic covering for noise reduction.

The blower has the following characteristics:

Filter Blower	
No. of Units	1
Manufacturer	United Blower Inc. "4513-DVOF/W"
Load	6.0

The blower is in excellent condition; no deficiencies were noted during the site investigation and District staff did not have any concerns about the operation or reliability of the blower.

h. Chemical Feed Systems. Chemical feed systems at TMTP consist of ferric sulfate, sodium hypochlorite, coagulant, corrosion inhibitor, fluoride, sodium bisulfite, caustic soda, polymer, copper sulfate, and powdered activated carbon. This section presents equipment characteristics and condition assessments of the chemical feed systems.

i. Chemical Building. The Chemical Building was constructed in 1998 to create a central location for the chemical feed systems at TMTP. Prior to 1998, chemical feed systems were located throughout the plant in various locations, including areas on the second floor above the building's electrical systems. The Chemical Building is a block and brick, single story building. The interior of the building is in excellent shape. Walls are painted CMU. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No cracking or differential settlement was noted in the walls. The exterior of the building is brick, and is in excellent shape structurally. The brick work is excellent, with no cracks or missing mortar being noted.

The electrical equipment is located in a separate electrical room inside the building and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. Heating, air handling units, ductwork, and exhaust fans in the building appeared to be in excellent condition. The sodium hypochlorite room is the only room with air conditioning and it appeared to be in excellent condition. Chemical unloading stations for each liquid chemical are located outside the building with connections for each storage tank that are in excellent condition. Each unloading station has its own key and is kept locked at all times. A fire protection sprinkler system is inside the building which appeared to be in excellent condition.

ii. Sodium Hypochlorite. Sodium hypochlorite is the primary disinfectant and can be fed to the raw water line, both sedimentation basin effluents, and the clearwell influent. The sodium hypochlorite feed system was put into operation in 1998 with construction of the Chemical Building. Sodium hypochlorite is stored in a separate room containing one bulk storage tank, one day tank, one transfer pump, and five metering pumps. Originally, there were two transfer pumps, but due to air binding problems and their location, only one replacement pump was installed at a lower elevation in 2001.

The sodium hypochlorite system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	15,535
Day Tank	
No. of units	1
Capacity, gal	658
Transfer Pump	
No. of units	1
Manufacturer	Goulds “3298”
Capacity, gpm	40
Metering Pumps	
No. of units	5
Manufacturer	W&T “Encore 700 44 Series”
Capacity, gph	22.5 (Pumps No. 1, 4, and 5) 5 (Pumps No. 2 and 3)
Motor, hp	0.75

Overall condition of the sodium hypochlorite system is satisfactory. The storage and day tanks are in excellent condition. Transfer Pump No. 1 was installed 2001 and is in satisfactory condition. Moderate corrosion was noted on the transfer pump and associated piping and connections. Transfer Pump No. 2 was removed and not in service at the time of the site investigation. According to District staff, there are no plans to replace Transfer Pump No. 2 unless Transfer Pump No. 1 fails; therefore, there is no redundant transfer pump. The metering pumps are in satisfactory condition. Moderate corrosion was noted on the pumps, associated piping, and exposed metal from past leaks or spills. District staff stated that a problem with the sodium hypochlorite system is that it continues to air bind and needs frequent maintenance. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building outside the sodium hypochlorite room and are in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections and is in excellent condition.

iii. Coagulant. General Chemical Hyper+Ion 1090 is currently used as the primary coagulant for flocculation. It is fed at the rapid mix basin. The coagulant feed system was put into operation in 1998 with the construction of the Chemical Building. The coagulant system is located in the main room of the Chemical Building in the shared coagulant and ferric sulfate recessed storage area. The coagulant system consists of one bulk storage tank, one day tank, two transfer pumps, and three metering pumps.

The coagulant system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	13,535
Day Tank	
No. of units	1
Capacity, gal	658
Transfer Pumps	
No. of units	2
Manufacturer	Goulds "3200 Size 2-3-6"
Capacity, gpm	50
Motor, hp	2.0
Metering Pumps	
No. of units	3
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	90
Motor, hp	1.0

The overall condition of the coagulant system is good. The storage and day tanks are in excellent condition. Both transfer pumps are in excellent condition. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping from past leaks and / or spills. District staff did not indicate any problems with the coagulant system. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the clarion coagulant area and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tank and is in excellent condition.

iv. Ferric Sulfate. Ferric sulfate can also be used as a coagulant for flocculation. It is fed at the rapid mix basin. The ferric sulfate feed system was put into operation in 1998 with the construction of the Chemical Building. The ferric sulfate system is located in the main room of the Chemical Building in the shared coagulant and ferric sulfate recessed storage area. The ferric sulfate system consists of one bulk storage tank, one day tank, one transfer pump, and two metering pumps. Originally, there were two transfer pumps but due to air binding problems and their location, only one replacement pump was installed at a lower elevation location in 1998.

The ferric sulfate system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	13,535
Day Tank	
No. of units	1
Capacity, gal	658 gal
Transfer Pump	
No. of units	1
Manufacturer	Goulds "Size 1 x 1.60-S"
Capacity, gpm	45
Motor, hp	1.5
Metering Pumps	
No. of units	2
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	22.5
Motor, hp	0.75

The overall condition of the ferric sulfate system is good. The storage and day tanks are in excellent condition. Transfer Pump No. 1 was replaced in 1998 according to District records and is in satisfactory condition. Moderate corrosion was noted on the transfer pump and associated piping and connections with evidence of past leaks or spills. Transfer Pump No. 2 was removed and not in service at the time of the site investigation. According to District staff, there are no plans to replace Transfer Pump No. 2 unless Transfer Pump No. 1 fails. Therefore, there is no redundant transfer pump in the system. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping from past leaks and / or spills. District staff did not indicate any problems with the ferric sulfate system.

The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the ferric sulfate area and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tank and is in excellent condition.

v. Caustic Soda. Caustic soda (sodium hydroxide) is used to adjust pH and can be fed to the raw water line and the clearwell inlet. The caustic soda feed system was put into operation in 1998 with the construction of the Chemical Building. Caustic soda is stored in a separate caustic soda room in the Chemical Building and contains one bulk storage tank, one day tank, two transfer pumps, and three metering pumps. Currently, the District is in the process of converting the caustic soda feed system to a sulfuric acid feed system to permit adjustment of coagulation pH.

The caustic soda system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	13,500 (approximately)
Day Tank	
No. of units	1
Capacity, gal	500 (approximately)
Transfer Pumps	
No. of units	2
Manufacturer	Goulds “3200 Size 2-3-6”
Capacity, gpm	50
Motor, hp	1.5

Metering Pumps	
No. of units	3
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	22.5
Motor, hp	0.75

The overall condition of the caustic soda system at TMTP is good. The storage and day tanks are in excellent condition. Both transfer pumps are in good condition. There was evidence on the pumps and floor around the pumps from leaks and / or spills. The metering pumps are in satisfactory condition. Moderate corrosion was noted on the pumps and associated piping from past leaks and / or spills. District staff did not indicate any problems with the caustic soda system. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building outside the caustic soda room and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tank and is in excellent condition.

vi. Fluoride. Fluoride is fed to the clearwell inlet. The system was put into operation in 1998 with the construction of the Chemical Building. Fluoride is stored in a separate fluoride room in the Chemical Building and contains one bulk storage tank, one day tank, two transfer pumps, and two metering pumps.

The fluoride system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	7,049
Day Tank	
No. of units	1
Capacity, gal	90
Transfer Pumps	
No. of units	2
Manufacturer	Goulds "3200"
Capacity, gpm	12
Motor, hp	1.5

Metering Pumps	
No. of units	2
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	6
Motor, hp	0.5

The overall condition of the fluoride system is good. The storage and day tanks are in excellent condition. Both transfer pumps are in good condition with minor corrosion on the pumps and pump bases. There were visible places where spill and / or leaks have occurred. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping. District staff did not indicate any problems with the fluoride system. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building outside the fluoride room and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tank and is in excellent condition.

vii. Corrosion Inhibitor. Carus Chemical Company "K-5" is currently used as the corrosion inhibitor and is fed at the clearwell inlet. The system was put into operation in 1998 with the construction of the Chemical Building. The corrosion inhibitor system is located in the main room of the Chemical Building in the shared corrosion inhibitor and sodium bisulfate recessed storage area. The corrosion inhibitor system consists of one bulk storage tank, one day tank, two transfer pumps, and two metering pumps.

The corrosion inhibitor system has the following characteristics:

Storage Tank	
No. of units	1
Capacity, gal	7,049
Day Tank	
No. of units	1
Capacity, gal	70
Transfer Pumps	
No. of units	2
Manufacturer	Goulds "3200"
Capacity, gpm	6
Motor, hp	1.5

Metering Pumps	
No. of units	2
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	2.5
Motor, hp	0.5

The overall condition of the corrosion inhibitor system is good. The storage and day tanks are in excellent condition. Transfer Pump No. 1 is considered to be in satisfactory condition, as there was some minor leakage around the pipe connection for this pump. Transfer Pump No. 2 is in good condition. There was evidence of areas where past spills and / or leaks have occurred. The metering pumps are in good condition. Light corrosion was noted on the pumps and associated piping from past leaks and / or spills. At the time of the site investigation there was some standing chemical on the floor around the concrete pump support from a past leak or spill. District staff did not indicate any problems with the corrosion inhibitor system. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building overlooking the corrosion inhibitor area and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage. The chemical unloading station is located outside the building with labeled connections for the storage tank and is in excellent condition.

viii. Sodium Bisulfite. Sodium bisulfite is used to dechlorinate overflow water from the Filter to Waste Basin prior to discharge to the creek. The system was put into operation in 2003 with the construction of the Filter to Waste Basin. The sodium bisulfite system is located in the main room of the Chemical Building in the shared corrosion inhibitor and sodium bisulfite recessed storage area. The sodium bisulfite system consists of one storage / feed tank and two metering pumps.

The sodium bisulfite system has the following characteristics:

Storage / Feed Tank	
No. of units	1
Capacity, gal	250
Metering Pumps	
No. of units	2
Manufacturer	Milton Roy "B731-468S1"
Capacity, gph	4.5
Type	Solenoid Pulse

The overall condition of the sodium bisulfite system is excellent. All of the equipment associated with the sodium bisulfite system is in excellent condition as it has not been used as of yet at the time of the site investigation. District staff did not indicate any problems with this system. The sodium bisulfite system chemical unloading station consists of a drum pump that pumps sodium bisulfite from storage drums to the storage tank.

ix. Filter Aid Polymer. Filter aid polymer is fed to the filter influent channels. Currently, Cytec "Superfloc N-300" polymer is used. The system was placed into operation in 1998 with the construction of the Chemical Building. The system is located in the main room of the Chemical Building in the filter aid polymer recessed storage area. The filter aid polymer system consists of one storage / mixing tank, one day tank, and three metering pumps.

The filter aid polymer system has the following characteristics:

Storage / Mixing Tank	
No. of units	1
Capacity, gal	863
Day Tank	
No. of units	1
Capacity, gal	863
Metering Pumps	
No. of units	3
Manufacturer	Wallace & Tiernan "Encore 700"
Capacity, gph	12
Motor, hp	0.5

The overall condition of the filter aid polymer system at the Taylor Mill plant is considered to be excellent. The storage and day tanks are in excellent condition. There are no transfer pumps present in this system, as the chemical flows from the storage / mixing tank to the day tank by gravity. The metering pumps are in excellent condition. District staff did not indicate that any problems exist with the filter aid polymer system, as it is not used very often. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building, overlooking the filter aid polymer area, and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage present. The chemical unloading station consists of a mixer and feeder for mixing

50 pound bags of dry polymer in the mixing / storage tank and also appeared to be in good condition.

x. Copper Sulfate and Powdered Activated Carbon. Copper sulfate and powdered activated carbon (PAC) are fed at the rapid mix basin, and both chemicals utilize the same feed system. The copper sulfate and PAC sulfate feed systems were placed into operation in 1998 with the construction of the Chemical Building. The feed systems are located in a separate Copper Sulfate / PAC room of the Chemical Building. The copper sulfate system consists of a hopper / feeder tank and two metering pumps. The PAC system uses the same hopper / feeder tank as well as a transfer pump, and the same two metering pumps.

The copper sulfate and powdered activated carbon systems have the following characteristics:

Hopper / Feeder Tank	
No. of units	1
Manufacturer	Wallace & Tiernan
Capacity, gal	N/A
Transfer Pump	
No. of units	1
Manufacturer	Netzsch “Type NM038SY”
Capacity	N/A
Motor, hp	3.0
Metering Pumps	
No. of units	2
Manufacturer	Wallace & Tiernan “Encore 700”
Capacity, gph	6
Motor, hp	0.5

The overall condition of the copper sulfate and powdered activated carbon system is excellent. The feeder / storage tank is in excellent condition. The PAC transfer pump is in excellent condition. The metering pumps are in excellent condition. Minor evidence was noted on the piping from a past leaks and / or spills. District staff indicated that the system is not often used. The electrical equipment and controls are located in the hallway of the main room in the Chemical Building outside the copper sulfate / PAC room and appeared to be in excellent condition with no observable corrosion, accumulation of debris, or other damage.

xi. Sludge Polymer. The sludge polymer feed system at the Taylor Mill Treatment Plant is located on the upper floor of the Sludge Handling Building and is used to feed polymer to the belt filter press. The system consists of one batch mixing tank, one day tank, and two metering pumps. The system was placed into operation in 1989. The sludge polymer is delivered and stored dry form in 50 pound bags and manually dumped into the mixing tank.

The sludge polymer system has the following characteristics:

Batch Mixing Tank	
No. of units	1
Capacity, gal	200
Day Tank	
No. of units	1
Capacity, gal	200
Metering Pumps	
No. of units	2
Manufacturer	Wallace & Tiernan "Series 44-125"
Capacity, gph	208
Motor, hp	0.5

The overall condition of the sludge polymer system is satisfactory. The mixing tanks are in good condition. The metering pumps are in satisfactory condition. Minor corrosion was noted on the pumps and associated piping from past leakage events. There is evidence of spills and / or leaks apparent on the adjacent floor area. No containment provisions were present for the system. District staff indicated no problems with the sludge polymer system.

i. Sludge Handling Facility. The Sludge Press Building at the Taylor Mill plant houses the Belt Filter Press, two progressing cavity sludge pumps, the Backwash Holding Basin (as described above in the Backwash Equipment section), two submersible backwash pumps that pump to the sanitary sewer, and two sludge holding basins. Also associated with the residuals handling system are two submersible sludge pumps in the clarifier sludge pit adjacent to the clarifiers that pump settled sludge from the clarifiers to the two sludge holding basins.

The two progressing cavity pumps transfer sludge from the two sludge holding basins to the Sludge Belt Filter Press. Press filtrate and screen wash water flows by gravity back to the sludge holding basins. The decant from the sludge holding basins overflows into the adjacent Backwash Holding Basin where it combines with spent backwash from the filters and is pumped by the two submersible backwash pumps to the sanitary sewer for disposal. All of the equipment associated with the sludge handling facility was installed in 1989 with the exception of the two submersible backwash pumps, which were replaced in 2001.

The residuals handling system equipment has the following characteristics:

Sludge Clarifier Pumps	
No. of Units	2
Manufacturer	ABS
Capacity, gpm	400
Sludge Progressing Cavity Pumps	
No. of Units	2
Manufacturer	Netzsch "Type NE 80A"
Capacity, gpm	N/A, Variable Speed
Motor Manufacturer	GE Motor
Motor, hp	10
Motor, rpm	1165
Volts	416
Sludge Backwash Pumps to Sewer	
No. of Units	2
Manufacturer	ABS
Capacity, gpm	700
Belt Filter Press	
No. of Units	1
Manufacturer	Andritz "CPF 2.0 SMK (S8P)"
Capacity, lbs/hr	2000 (at 3% feed of TSS)
Inlet Consistency, percent TSS	2.0 - 8.0
Min. Cake Solids, percent	35
Min. Solids Capture, percent	95

The residuals handling system is in overall good condition. The two sludge holding basins appeared to be in good condition. No structural problems were noted, and District staff did not mention any problems with operation of the tanks. The two submersible backwash pumps that convey backwash water to the sanitary sewer were not taken out of service during the site investigation. However, comments by District staff indicated that they are in good condition. The two submersible sludge clarifier pumps located in the clarifier sludge pit were also not taken out of service, and condition assessments were not available for these pumps.

The sludge belt filter press and conveyor were observed to be in good condition. District staff stated that the press at the Taylor Mill plant does not perform as well as the two sludge presses at Fort Thomas in regard to solids production. During the site investigation the press was in operation and appeared to be functioning well. The two progressing cavity pumps that pump sludge to the sludge belt filter press are regarded to be in satisfactory condition. Moderate corrosion was noted on the pumps, pump bases, valves, and associated piping.

The Sludge Handling Building is a two story block and brick building, with the Backwash Holding Basin located underneath it. The upper level of the facility consists of the process area where the sludge belt press is located and a separate office room. The lower level of the building consists of the loading area where the dumpster is located for dried sludge loading and removal, and the progressing cavity sludge pumps. The interior of the building is in good shape. Walls are of painted CMU construction. Minor cracking was noted in the interior CMU walls, most notably on the second floor. The cause of this, as determined by an earlier B&V evaluation, is most likely due to shrinkage in the concrete block. The cracking was assumed to be cosmetic and does not pose a concern for the structural integrity of the building. The exterior of the building is brick, and is in good shape structurally. The brick work is in excellent condition, with no cracks or missing mortar being noted.

The ambient air temperatures in the Sludge Handling Building are controlled by a heating and ventilation unit which moves air from the outside through the windows on the second floor and doors on the first floor. The unit is controlled by a wall mounted thermostat. There are also electric unit heaters and wall mounted space heaters located within the building. The heating units appeared to be in good condition, although, the site investigation was conducted in the middle of the summer so their functionality was not able to be evaluated.

j. Filter to Waste System. The filter to waste system at TMTP was constructed in 2003 and allows the plant operators to send filtered water to the Filter to Waste Basin after the filters are backwashed. This is intended to avoid sending filtered water with high initial turbidity to the distribution system. Filter to waste flows may also be surface discharged to a nearby creek under an NPDES permit following dechlorination with sodium bisulfite; however, surface discharge of these flows is not currently practiced based on information from NKWD staff. Four submersible pumps installed in the below grade, concrete basin pump the filter to waste water back to the head of the plant for treatment.

The filter to waste pumps have the following characteristics:

Filter to waste pumps	
No. of units	4
Manufacturer	Pumpex "K 103 F-CF3250"
Capacity, gpm	375
Head, ft	64
Motor Manufacturer	Pumpex
Motor, hp	15
Motor, rpm	1724
Volts	208

The filter to waste system is in overall excellent condition. The pumps were not inspected during the site investigation since they are submersible pumps and were not taken out of service, but given the fact that the system has only been in operation only a few months, they should be in excellent condition. District staff did not report any problems or concerns with any equipment associated with the filter to waste system.

C. DISTRIBUTION PUMPING STATIONS

The District operates thirteen transmission and distribution pumping stations, including the Taylor Mill Pumping Station, located in TMTP. This section describes each of the pumping stations and includes the results of their condition assessments.

1. BRISTOW ROAD PUMPING STATION

Completed in 2002, the Bristow Road Pumping Station replaced another pumping station of the same name. It is in Independence and serves the 1080 pressure zone, acting as an in-line booster station. The PS is equipped with three vertical turbine can pumps. Each pump is rated at 2,900 gpm (4.2 mgd) at 65 feet of head, giving the station a combined rated capacity of about 12.5 mgd (8,700 gpm) and a firm capacity of 8.4 mgd (5,800 gpm). (Firm capacity is the flow rate available with the largest pumping unit out of service.) The three units are identical Floway model "MKL" pumps with 75 hp motors.

In addition to the pumps, the pumping station consists of the following major equipment, housed in a brick building with concrete floor:

- Pump suction valves: 12" Dezurik butterfly valve
- Pump discharge valves: 12" Dezurik butterfly valve and 12" Cla-Val pump control valve
- Electrical MCC and Control Panels
- One in-line duct fan
- Two electric unit heaters
- 2 -Ton monorail with electric hoist (Wright)
- Lighting (florescent)
- Sodium hypochlorite storage and feed system (in separate room)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - HACH – EC 310 pH monitor
  - HACH - CL17 Chlorine Residual Analyzer

a. Condition. The overall condition of the pumping station is excellent, being essentially new. The interior of the building is in excellent shape, walls are painted CMU with metal acoustic panels. No cracking, chipping, or chalking was noted for those portions of the walls that were visible. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick, and is in excellent shape structurally. The brick work is excellent, with no cracks or missing mortar being noted.

The interior of the pumping station consists of a single story pump room which houses the pumps, inlet and discharge piping and valves, and MCC and control equipment. The sodium hypochlorite system, including its control panel, is located in an adjacent room that is entered from the pump room. A separate lavatory is adjacent to the main pump room and is in excellent condition. A 2-ton monorail system with electric hoist is provided for pump, piping and valve maintenance. Exterior doors and wall mounted louvers are painted and no corrosion was noted.

b. Heating and Cooling. The pumping station is cooled by an in-line duct fan, controlled by a wall mounted thermostat. Heating is provided by two electric unit heaters controlled through a separate wall mounted thermostat. The ventilation fan was operating during the site investigation, and no problems were noted.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures. Lighting levels in the pump room are excellent, and the fixtures are in excellent condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, adjacent to the pumps. Electrical control and power equipment were noted to be in excellent condition, and no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed in 2002 and is in excellent condition. According to District records, no major overhauls, or maintenance problems were noted for the pumping equipment since their installation. Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration for the pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 12 inch Dezurik butterfly valves. The discharge of each pump is provided with a 12 inch Cla-Val pump control valve.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and the associated sample water piping were noted to be in good condition.

g. Sodium Hypochlorite Storage and Feed System. A complete sodium hypochlorite storage and feed system is located in a separate room adjacent to the pump room. The system consists of an 825 gallon vertical storage tank, two Watson-Marlow peristaltic metering pumps, and associated piping and valves to feed chemical into the pumping station discharge line. In addition, the sodium hypochlorite room is equipped with a separate ventilation fan and ducting to draw air from floor level. A separate make-up air unit providing tempered air is located on the roof of the facility. A single emergency eyewash and deluge shower is provided within the room. Access to line mounted piping components, instruments, and the metering pumps is difficult due to the arrangement of the piping on the feed skid.

h. Valve Vault. A below grade valve vault, located in front of the Bristow Road PS facility, houses inlet and discharge piping, bypass piping, and an inline strainer. The vault is constructed of cast-in-place concrete, and was noted to be in excellent condition. A number of access hatches are provided in the top slab of the vault. Covers for the hatches are Bilco, aluminum units rated for truck loading.

2. BROMLEY PUMPING STATION

The Bromley Pumping Station, located in the City of Bromley, takes suction from the 763 service level, through the adjacent Bromley Tank, and discharges to the 1040 service level. It houses three vertical turbine can pumps with a combined rated capacity of 2.7 mgd (1,900 gpm) and a firm capacity of 1.7 mgd (1,200 gpm). Details regarding the three pumps are provided in Table II-3.

Table II-3
Bromley Pumping Station

Pump ID	Installation Date	Manufacturer and Model	Discharge		Head (feet)	Motor Hp
			gpm	mgd		
BROM-PUMP-1	1968	Johnston	500	0.7	340	60
BROM-PUMP-2	1986	Goulds VIC-T	700	1.0	315	75
BROM-PUMP-3	1986	Goulds VIC-T	700	1.0	315	75

In addition to the pumps, the station consists of the following major equipment, housed in a brick one-story building with cast-in-place concrete basement:

- Pump suction valves: 8" Darling gate valve
- Pump discharge valves: 8" Darling gate valve with 8" Ross pump control valve
- Electrical MCC panels
- Single roof-mounted ventilation fan
- Single electric unit heater (Dayton)
- Lighting (incandescent/florescent)
- Sodium hypochlorite storage and feed equipment
- Flowmeter (Sparling FT555-231)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Capitol Controls – 9410 pH monitor
  - Capitol Controls - 1770 Chlorine Residual Analyzer

a. Condition. The overall condition of the pumping station is satisfactory. The main floor houses the MCC and control panels, and the basement houses the pumps and piping. Walls within the interior of the pumping station are un-painted concrete and no visible cracking or signs of differential settlement were noted. The exterior of the MCC room is concrete masonry units with a painted exterior. The exterior paint is in satisfactory condition. Structurally, the concrete masonry units of the MCC room are in excellent shape. The basement area is tight with no signs of leakage.

Maintenance space around the pumps, valves, and piping is poor. Movement from one side to the other of the pump room requires traversing over multiple pipes. No permanent hoist is provided; a removable hatch is located above each pump to permit removal from grade level with a boom truck.

b. Heating and Cooling. The pumping station is cooled by a single roof-mounted fan in the MCC area controlled by a line voltage thermostat. Air is drawn through the pump room via a ceiling mounted vent with motor operated damper. Heat is provided by a single gas fired unit heater controlled through a separate wall mounted thermostat. The ventilation fan was not operating during the site investigation, and the temperature within the pump room was excessive. Ambient temperature outside the pump room during the site investigation was approximately 78° F; however, the temperature within the pump room was 85°+ F.

c. Lighting. Lighting within the pumping station interior is incandescent in the basement pump room, and florescent within the MCC room. Lighting levels in the pump room are unsatisfactory, and portable lighting was required to collect data during the site investigation. Lighting within the MCC area is satisfactory.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the pumping station on the ground floor and are in excellent condition, and no observable corrosion, accumulation of debris, or other damage noted.

e. Pumping Equipment. The pumping equipment is located in the basement of the station, accessible by a ladder from the MCC room. The pumps were installed in 1968 (Pump No. 1) and 1986 (Pump Nos. 2 & 3), and are in unsatisfactory condition. Each pump and associated piping and valves has extensive corrosion present due to multiple seal leaks. Figure II-24 shows corrosion on Pump No. 2 and associated piping. Pipe supports are inadequate, and the level of actual support provided is questionable.

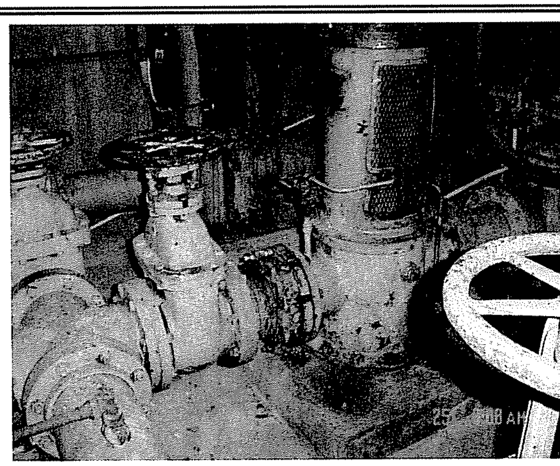


Figure II-24

Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration for each of the three pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 8 inch Darling gate valves, with 8 inch Ross pump control valves on the pump discharge.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and associated sample water piping were noted to be in good condition.

g. Sodium Hypochlorite Storage and Feed. The sodium hypochlorite storage and feed room was added to the structure sometime after completion of the pumping station. The room houses a single 400 gallon storage tank, metering pumps, instrumentation, and heating and cooling equipment. The originally installed Jesco metering pumps were disconnected and replaced with two new units (no tag available). District operations staff indicated numerous problems with the Jesco pumps requiring their replacement. Secondary containment for the storage and feed equipment is provided by a single pre-fabricated FRP container with grating cover. Capacity of the secondary containment is adequate; however the sides of the tank and some piping hang outside the limits of the containment. Cooling within the room is provided by a single wall mounted AC unit which appeared to be in good working order. Heating is provided by a single electric unit heater. A single emergency eye wash and shower is provided within the interior of the room. Lighting is florescent, lighting levels are good, and the fixtures were in good condition.

The Sodium Hypochlorite room shows signs of differential settlement from the original pumping station. As shown in Figure II-25, this was evident by the cracking and movement of the CMU blockwork that comprises the walls of the building.

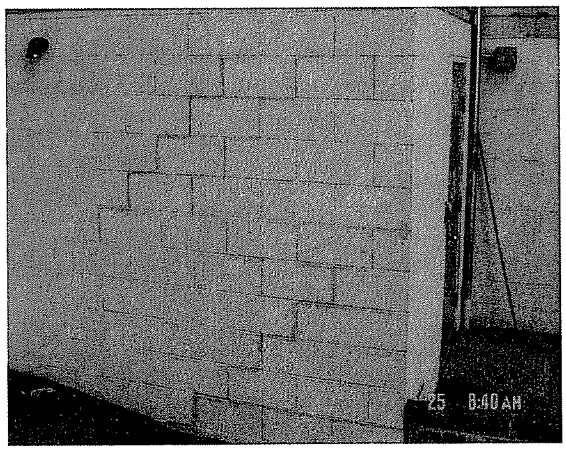


Figure II-25

3. CAROTHERS ROAD (16th STREET) PUMPING STATION

The Carothers Road Pumping Station (also known as the 16th Street Pumping Station) became a part of the NKWD system with the Newport acquisition in 2002. It is an in-line booster facility which raises system pressure for flows to the Newport 965 service area. The station is equipped with two Ingersoll-Dresser "12 NKH" vertical turbine pumping units, each rated at 1600 gpm (2.3 mgd) at 263 feet of head. The pumps have 150 hp motors. Both pumping units were installed in 1996. The 2003 Master Plan Addendum determined that the Carothers Road Pumping Station has sufficient capacity to provide adequate service through the study period and no hydraulic improvements are anticipated or recommended.

In addition to the pumps, the station includes the following major equipment, housed in a brick building with concrete floor:

- Pump suction valves: 12" Clow butterfly
- Pump discharge valves: 8" Dezurik butterfly with 8" GA Industries pump control valve
- Electrical MCC panels
- Single roof-mounted ventilation fan
- Single natural gas fired unit heater (Sterling)
- 2 -Ton monorail with chain pull hoist
- Lighting (incandescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Capitol Controls – 9410 pH monitor
  - HACH - CL17 Chlorine Residual Analyzer

a. <u>Condition</u>. The overall condition of the Carothers Road Pumping Station is satisfactory. The interior of the pumping station consists of an upper floor which houses the electrical MCC and control panels, a storage room, and a restroom. The condition of the interior paint was satisfactory, however there were a number of locations where the paint was chipped, and/or worn through. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick and in excellent shape structurally; no cracks or missing mortar was noted. Exterior doors at the location of the monorail were noted to have moderate to heavy corrosion. The restroom is in disrepair and no longer used. The upper floor is elevated approximately 4-1/2 feet above the pump operating floor elevation. Maintenance space around the pumps and piping is satisfactory; however, to get to the far side of the pumps requires crawling under or over the pump suction and discharge piping. A 2-ton monorail with manual chain pull hoist is provided for pump maintenance.

b. <u>Heating and Cooling</u>. The pumping station is cooled by a single roof-mounted fan, controlled by a line voltage thermostat. Heating is provided by a single gas fired unit heater controlled through a separate wall mounted thermostat. The ventilation fan was not operating during the site investigation; however no problems were noted by District Operations staff.

c. Lighting. Lighting within the pumping station interior is provided by incandescent fixtures. The lighting levels in the pump room are considered satisfactory; however replacement of the fixtures with higher output florescent fixtures would greatly increase the effectiveness.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on an elevated (approximately 4 1/2 ft.) floor area. The electrical control and power equipment are old and obtaining replacement parts may be difficult, however District staff indicated there have been no problems experienced with their operation. No observable corrosion, accumulation of debris, or other damage was noted.

e. Pumping Equipment. The pumping equipment was installed in 1996 and was noted to be in satisfactory condition. Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration for each of the two pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 12 inch Clow butterfly and 8 inch Dezurik butterfly valves. In addition, the discharge of each pump is provided with an 8 inch GA Industries pump control valve. Moderate corrosion was noted on the pump suction and discharge piping, and on the pump bases.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation, and the connecting sample water piping, was noted to be in good condition. Drain piping from the equipment is routed to a floor drain in the middle of the pump room. The flow rate from the sampling equipment creates a large puddle adjacent to the floor drain which has resulted in heavy corrosion around the stair base and pipe supports as shown in Figure II-26.

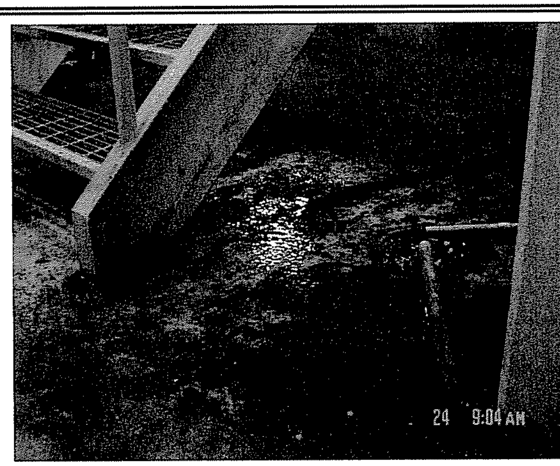


Figure II-26

4. DUDLEY 1040 PUMPING STATION

The Dudley 1040 and 1080 Pumping Stations, the associated sodium hypochlorite storage and feed building, and the two Dudley Tanks are all located at the same site, within the City of Edgewood. The facility descriptions and condition summaries of the Dudley 1080 PS and the storage tanks are included elsewhere in this chapter; the Sodium Hypochlorite System is addressed in this section.

The two pumping stations take suction from the storage tanks and transfer water to different pressure zones in the NKWD system, as referenced by their respective hydraulic elevation (I.e., the 1040 PS discharges to the 1040 pressure zone, the 1080 PS discharges to the 1080 pressure zone). The 1040 PS is equipped with four vertical can pumps, with a combined rated capacity of 15.4 mgd (10,697 gpm) and a firm rated capacity of 11.3 mgd (7,872 gpm). Additional information regarding the pumping units is provided in Table II-4.

Table II-4
Dudley 1040 Pumping Station

Pump ID	Installation Date	Manufacturer	Discharge		Head (feet)	Motor Hp
			gpm	mgd		
DUD-PUMP-1[1]	1965	Layne & Bowler	2,825	4.1	270	250
DUD-PUMP-2[2]	1965	Layne & Bowler	2,825	3.4	270	250
DUD-PUMP-3[1]	1965	Layne & Bowler	2,825	4.1	270	250
DUD-PUMP-4[2]	1979	Goulds "12x14 HMC"	2,222	3.2	375	250

[1]Five stage pump.
[2]Four stage pump.

In addition to the pumps, the pumping station consists of the following major equipment, housed in a brick building:

- Pump suction valves: 14" Darling and Dezurik valves
- Pump discharge valves: 14" Darling and Dezurik valves with 12" Cla-Val pump control valve
- Electrical MCC panels
- Two roof mounted ventilation fans
- Two electric unit heaters (Electromode)
- Lighting (florescent)

a. Condition. The overall condition of the Dudley 1040 Pumping Station is good. The interior of the building is in good condition. The building is a single story structure with pump suction and discharge piping trenches located below the floor level. The walls are constructed of painted CMU and appear to be in good condition. No visible cracking or signs of differential settlement were noted. The exterior of the building is a brick veneer and was noted to be in excellent condition. Maintenance space available around the MCC and control panels is excellent. However, space around the pumps and piping is considered to be unsatisfactory, allowing limited access to spaces in-between the pumps and piping. A single chain pull bridge crane is provided for pump, valve, and piping removal. A single roll-up door is provided to permit equipment to be directly loaded onto a truck with the bridge crane.

b. Heating and Cooling. The pumping station is cooled by two roof mounted ventilation fans located immediately above the pumps. The fans are controlled by a single thermostat located adjacent to the pumps. Air is drawn through a single side wall mounted louver on the wall adjacent to the MCC gear. Both fans were observed to be operating during the inspection, and the temperature within the pump room was satisfactory. Heating is provided by two electric unit heaters controlled through a separate wall mounted thermostat.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures, in addition to four clear glass skylights which provide good lighting levels during daylight hours. Lighting levels in the pump room may possibly be inadequate during nighttime periods; however the actual lighting levels provided by the fixtures could not be verified due to the illumination from the skylights.

d. Electrical Equipment. The 1040 PS electrical MCCs and breaker panels are located within the pumping station on the same level as the pumping units. Electrical control and power equipment are old, but are in excellent condition, and only minor corrosion was noted on the exterior of the panels. No accumulation of debris, or other damage was noted.

e. Pumping Equipment. The pumping equipment was installed in 1965 (Pump Nos. 1, 2 and 3) and 1979 (Pump No. 4) and were all noted to be in good condition. Each of the pumps and their associated piping and valves were noted to have large areas of minor corrosion due to leaks in seals and piping connections. Heavy moss buildup was noted on the top of the pump control valve of one pump, which indicates an area that is consistently damp from leakage or condensation.

District records indicate the following significant repair histories for the four pumps:

- Pump No. 1 – Motor repair, and replacement of pump bowl and impeller assembly in 1994.
- Pump No. 2 – Motor repair, and replacement of bowl bearings, and new casing wear rings in 1995.
- Pump No. 3 – New pump bowl and impeller assembly, and motor rewound in 1994.
- Pump No. 4 – Replacement of pump bearings and wear rings in 1997.

Pump vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration levels for each of the four pumps and no trend was noted indicating any deterioration of the bearings, etc. Pump suction and discharge valves are 14 inch Darling, and Cla-Val pump control valves on the pump discharge.

f. Water Quality Instrumentation. Water quality monitoring instrumentation for the Dudley 1040 Pumping Station is located in the 1080 PS building. See section IIC-5 for discussion on the water quality instrumentation.

g. Sodium Hypochlorite System. The sodium hypochlorite system is housed in two separate buildings on the site. The two 100 gallon day tanks and three metering pumps are located in the old chlorine feed building. The tanks, which are in good condition, and metering pumps, which are in satisfactory condition, are mounted on a pre-fabricated FRP secondary containment system. The secondary containment has adequate capacity, however the tanks and much of the piping hangs over the edges of the containment tank which could lead to accidental spills. The building is in satisfactory condition, although items of note include: a potentially leaking roof drain leader, CMU block wall damage due to the installation of a wall mounted AC unit, shown in Figure II-27, and old conduit and wiring from previous equipment that has since been removed. Structurally, the building is in good condition. There are no signs of differential settlement or other signs of structural damage. Lighting is incandescent and is in good condition. Ventilation is provided by a single wall mounted vent fan.

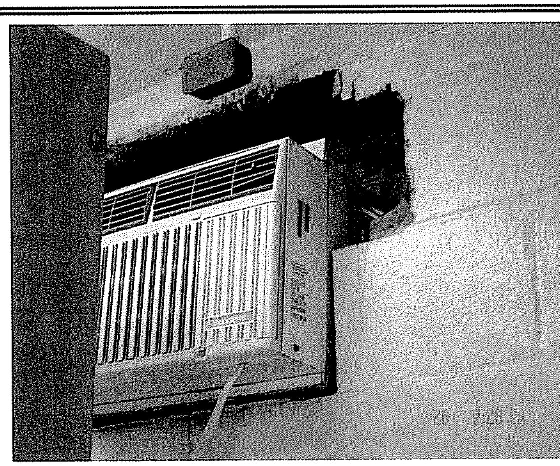


Figure II-27

The bulk storage tank and three transfer pumps are located in the old chlorine cylinder storage building. The 5,000 gallon double wall storage tank in good condition, although, the building itself is too small to properly house the tank. The size of the storage tank leaves approximately 1-1/2 feet on the sides and the ends of tank, making personnel movement within the building difficult, and unsafe in the event of an emergency. Figures II-28 and II-29 display the tight conditions inside the building.

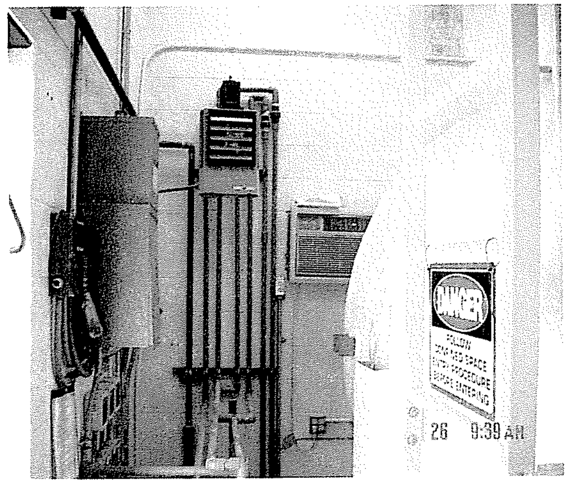


Figure II-28

The three transfer pumps are considered to be in satisfactory condition. Moderate corrosion was noted on the pumps, bases, and pipe connections. Lighting in the building is florescent with the fixtures in good shape and the lighting level is good. Ventilation for the room is provided by a single ventilation fan. Heating is provided by a single electric unit heater. A single eye wash shower is located in the building and appeared to be in good condition. District operations staff indicated that the system has operated well since the facility was converted from gaseous chlorine to sodium hypochlorite.

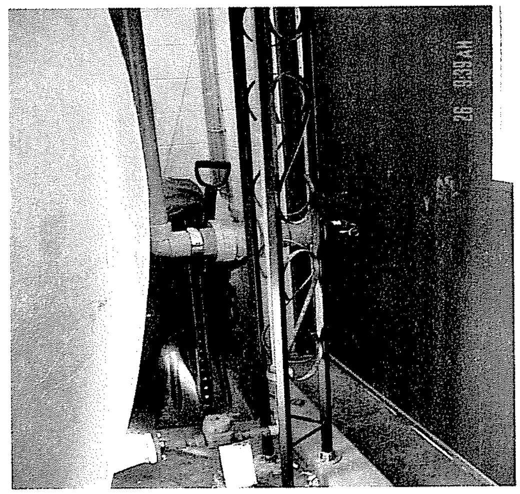


Figure II-29

5. DUDLEY 1080 PUMPING STATION

The Dudley 1080 Pumping Station houses four vertical turbine can pumping units. These pumps have a combined rated capacity of 33.4 mgd (23,200 gpm) and a firm capacity of 24.8 mgd (17,200 gpm). Details on the Dudley 1080 pumping units are listed in Table II-5.

Table II-5
Dudley 1080 Pumping Station

Pump No.	Installation Date	Manufacturer	Discharge		Head (feet)	Motor Hp
			gpm	mgd		
5	1990	Goulds	6,000	8.6	282	600
6	1990	Goulds	6,000	8.6	282	600
7	1990	Goulds	6,000	8.6	282	600
8*	1994	Goulds	5,200	7.5	282	600
* = Pump No. 8 was modified in 1995, changing the rated capacity from 6,000 gpm to 5,200 gpm.						

In addition to the pumps themselves, the pumping station consists of the following major equipment, housed in a brick building with cast-in-place concrete floor:

- Pump suction valves: 20” Pratt butterfly valves
- Pump discharge valves: 18” Pratt butterfly valves
- Electrical MCC panels
- 3-ton bridge crane (Sheperd Niles)
- Three roof- mounted ventilation fans
- Two electric unit heaters (CRT Manufacturing)
- Lighting (florescent)
- Water Quality Instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Capitol Controls – 9410 pH Analyzer
  - Capitol Controls – 1770 Chlorine Residual Analyzer

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in good condition. The building is a single story structure with below-floor pump suction and discharge pipe trenches. The walls are CMU and appear to be in good condition. No visible cracking or signs of differential settlement were noted. The exterior of the building is brick veneer and was noted to be in excellent condition. Maintenance space around the MCC and control panels is good. Space around the pumps and piping is good and adequate space is provided on all sides to facilitate maintenance activities. A single 3-ton electric bridge crane is provided for pump, valve, and piping removal. A single roll-up door is provided to permit equipment to be directly loaded onto a truck with the bridge crane.

b. Heating and Cooling. The pumping station is cooled by three roof-mounted fans located immediately above the pumps. The fans are controlled by a single thermostat located adjacent to the pumps. Air is drawn through side wall mounted louvers on the wall adjacent to the MCC gear. All three fans were observed to be operating during the inspection, and the temperature within the pump room was appropriate. The fans provide ample air movement through the pump room. Heating is provided by two electric unit heaters controlled through a separate wall mounted thermostat.

c. Lighting. Lighting fixtures within the pumping station interior are florescent type. Lighting levels in the pump room are acceptable, and the fixtures are in good shape.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on the same level as the pumping units. Electrical control and power equipment are in excellent condition, and no accumulation of debris or other damage was noted.

e. Pumping Equipment. The pumping equipment was installed in 1990 (Pump Nos. 1, 2 and 3) and 1994 (Pump No. 4) and were noted to be in good condition. Each of the pumps and their associated piping and valves were noted to have only minor corrosion. District records indicate the following repairs for the four pumps:

- Pump No. 4 – modified in 1995 due to excessive cavitation. A new bowl and impeller were supplied to produce approximately 5,200 gpm at 282 ft.

Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration levels for each of the four pumps and no trend was noted indicating deterioration of the bearings or other wear. The pump suction and discharge valves are 14 inch Darling and Cla-Val pump control valves located on the pump discharge piping.

f. Water Quality Instrumentation. Water quality monitoring instrumentation for both the 1040 and 1080 Pumping Stations is located in the corner of the 1080 Pumping Station, adjacent to the MCC panels. All of the instrumentation was noted to be in good working order and the sample supply and discharge piping was noted to be in good condition with no apparent leaks.

6. HANDS PIKE PUMPING STATION

The Hands Pike Pumping Station is in Covington, and takes suction from the 876 pressure zone and discharges to the 1080 service level. It has two vertical turbine can pumping units, with a combined rated capacity of 1.4 mgd (1,000 gpm) at 426 feet of head and a firm capacity of 0.7 mgd (500 gpm). The two pumps are identical. They are both Goulds model “6x10 GLC-14” units, and were installed in 1983. They are equipped with 75 hp motors.

Besides the pumps, the station consists of the following major equipment, housed in a cast-in-place concrete building with a stucco finish:

- Pump suction and discharge valves: 8” Dezurik butterfly
- Electrical MCC panels
- Single wall mounted ventilation fan (Dayton)
- Single electric unit heater (Federal Pacific)
- Lighting (florescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Capitol Controls - 9410 pH monitor
  - Capitol Controls – 1770 Chlorine Residual Analyzer

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in good shape. No visible cracking of the walls were noted, and the paint is in good condition with no visible blistering, cracking, or chalking noted. The exterior of the pumping station shows some signs of discoloration and minor rust around the door and ventilation opening frames, but is otherwise in excellent condition. The building includes a small room set up for chlorine storage and feed. District staff indicated that the room has never been outfitted with a chlorine system or any other chemical storage and feed equipment.

b. Heating and Cooling. The pumping station is cooled by a single wall-mounted propeller fan, controlled by a line voltage thermostat. Heating is provided by a single electric unit heater controlled through a separate wall mounted thermostat. The ventilation fan was observed to operate during the site investigation, and there were no signs of adverse wear or excessive noise or vibration.

c. Lighting. Lighting fixtures within the pumping station interior are florescent type. The lighting fixtures are in excellent condition, and lighting levels were observed to be good.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on an elevated concrete floor. Electrical control and power equipment were observed to be in excellent condition, and there was no observable corrosion, accumulation of debris, or other damage noted.

e. Pumping Equipment. The pumping equipment is generally in good condition. Vibration data for the period of November 2002 through April 2003, as measured by District staff, were within normal levels, with no indication that vibration of either pumping unit is increasing noticeably. Light corrosion was noted along the pump sub-bases. Figure II-30 shows corrosion around the sub-base of Pump No. 2 (HAND-PUMP2).

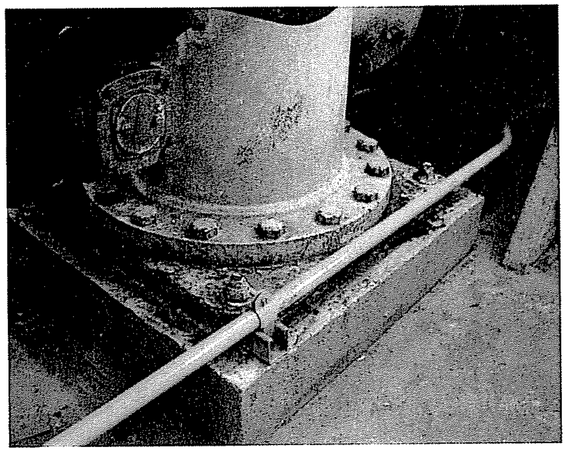


Figure II-30

One pipe support on Pump No. 1 consists of a chunk of concrete and CMU block, which should be replaced with a permanent installation. The pump suction and discharge valves are 8 inch butterfly valves, and appear to be in good working order. Access hatches are provided in the roof of the structure to facilitate pump removal; no fixed lifting equipment is provided within the pumping station.

7. LATONIA PUMPING STATION

The Latonia Pumping Station is located in Covington at Latonia Avenue and 35th Street. The facility is equipped with two pumps which take suction from the 763 service level and discharge to the 1003 service level. (The 1003 service area is a relatively small pressure zone served only by this station.) Combined, the two units have a rated capacity of 2.1 mgd (1,440 gpm) at 255 feet of head, and a firm capacity of 1.0 mgd (720 gpm). The two pumps are identical Goulds "4x6-10L, Type 3408" horizontal centrifugal units. They were installed in 2003, and have 75 hp motors.

In addition to the pumps, the station consists of the following major equipment, housed in a concrete masonry unit building with cast-in-place concrete basement:

- Pump suction and discharge valves: 8" Pratt butterfly
- Electrical MCC panels
- Single wall-mounted ventilation fan
- Single electric unit heater (Reznor)
- Lighting (incandescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM

   - HACH – EC 310 pH monitor
   - HACH - C117 Chlorine Residual Analyzer
- Marsh McBirney Multi-Mag, "Model 284" flow meter

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in good shape. The walls are glazed block and no visible cracking or differential settlement was noted. Three walls of the pump room include an approximate 3 ft. tall glass block section providing ample lighting within the pump room. Condition of the glass block is excellent, with the exception of a couple of blocks that are cracked. The exterior of the pumping station is in good shape and the site is secured with a 6+ foot tall chain link fence with locking gates, all of which are in good condition. The building includes a basement level which houses pump suction and discharge piping, valves, and the pumping station discharge flow meter. Access to the lower level is via a single opening in the upper pump room and a ladder. The basement level includes an old restroom area, which is in disrepair and no longer used.

b. Heating and Cooling. The pumping station is cooled by a single wall-mounted propeller fan, controlled by a line voltage thermostat. Heating is provided by a single natural gas fired unit heater controlled through a separate wall mounted thermostat. The ventilation fan was observed to operate during the site investigation, and there were no signs of adverse wear, excessive noise or vibration. NKWD staff has indicated that makeup air to the heating unit in insufficient and should be addressed.

c. Lighting. Lighting within the pumping station interior is provided with incandescent fixtures. Lighting levels in the pump room appear to be satisfactory, however light from the glass block sidelights was more than adequate and the lighting levels provided by the lamps could not be verified during the inspection. Lighting in the basement is unsatisfactory making it difficult to see.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on the same level as the pumps. Electrical control and power equipment are in excellent condition, and there was no observable corrosion, accumulation of debris, or other damage noted.

e. Pumping Equipment. The pumping equipment was installed in 2003, and is therefore in excellent condition. At the time of the inspection, no vibration data was available from the District for these units. Portions of the pumping suction and discharge piping was replaced as a part of the pump replacement project. The new piping has the factory primer coating, but no finish protective coating. Pump suction and discharge valves are 8 inch Pratt butterfly valves which were included as a part of the pump replacement. The discharge check valves are 8 inch GA Industries which are original to the station. A small portable hoist, located in the pump room, is used for pump removal.

8. RICHARDSON ROAD PUMPING STATION

The Richardson Road Pumping Station is located in Independence. The facility has three pumps with a combined rated capacity of 9.1 mgd (6,300 gpm), and a firm capacity of 6.0 mgd (4,200 gpm). The station takes suction from the 876 service level and discharges to the 1080 service level. Table II-6 presents a summary of the pump data for the three pumps.

Table II-6
Richardson Road Pumping Station

Pump ID	Installation Date	Manufacturer and Model	Discharge		Head (feet)	Motor Hp
			gpm	mgd		
RICH-PUMP-1	1981	Goulds 10x16 BHC-4	2100	3.0	515	400
RICH-PUMP-2	2001	Goulds 10x16 BHC-4	2100	3.0	515	400
RICH-PUMP-3	1998	Goulds 10x16 BHC-4	2100	3.0	515	400

In addition to the pumps, the station includes the following major equipment, housed in a cast-in-place concrete building with stucco finish:

- Pump suction and discharge valves: 10" Dezurik butterfly with Auma electric motor actuators
- Electrical MCC panels
- Two wall mounted ventilation fans (Coolair)
- Single electric unit heater
- Lighting (florescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - HACH – EC 310 pH monitor
  - HACH - C117 Chlorine Residual Analyzer

a. Condition. The overall condition of the pumping station is good. The interior of the building is in good shape. The walls are cast-in-place concrete with a concrete floor and elevated mezzanine. No cracking or differential settlement was noted, and the interior paint is in excellent condition. The exterior of the pumping station is in good shape structurally; however there are signs of rust stains from the door frames and other metal components along the exterior of the building. Discoloration of the exterior was also noted. The building is equipped with a small chlorine storage room which is no longer in use. The site is secured with a 6+ foot tall chain link fence with locking gate, which is in good condition.

b. Heating and Cooling. The pumping station is cooled by two wall-mounted propeller fans, controlled by a line voltage thermostat. Each fan is equipped with safety guard, and gravity backdraft dampers. Heating is provided by a single electric unit heater controlled through a separate wall-mounted thermostat. The ventilation fans were observed to be operating during the site investigation. The fans are very noisy, not due to wear or damage, but simply due to the amount of air being moved through the room to maintain temperature.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures. Lighting levels in the pump room are excellent, and all of the fixtures are in excellent shape.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on an elevated (approximately 3 ft.) mezzanine. Electrical control and power equipment were noted to have been refurbished approximately three years ago, and are in excellent condition. There is no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed in stages from 1981 to 2001, and is all in good condition. According to District records, Pump No. 1 (RICH-PUMP-1) had the motor bearings replaced in 1995, and the wear rings replaced in 1996. Vibration data, as measured by District staff for November 2002 through April 2003 indicated normal vibration for each of the three pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 10 inch Dezurik butterfly valves. Automatic motor actuators were added to the pump suction valves after flooding of the pumping station occurred due to leaks in the suction piping to the pumping units. No permanent hoist is installed at the station; a removable roof hatch is provided above each of the pumps to facilitate removal of the pumps with a boom truck.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and the sample water piping were noted to be in good condition.

g. Miscellaneous Instrumentation. After a flooding incident at the pumping station, the District installed flood switches to monitor interior water levels, activate an alarm, and shut down the pump suction valves in the event of a flood within the pumping station. Staff indicated that these systems all operated satisfactorily.

9. RIPPLE CREEK PUMPING STATION

The Ripple Creek Pumping Station, in Cold Spring, serves the 1017 service level, operating as a booster facility for southern Campbell County. The station has two vertical split case pumps with a combined rated capacity of 6.0 mgd (4,100 gpm) at 100 feet of head, and a firm capacity of 3.0 mgd (2,050 gpm). The pumps were installed in 1992 and have 75 hp motors.

In addition to the pumps themselves, the station houses the following major equipment, in a brick building with concrete floor:

- Pump suction valves: 12" Mueller gate
- Pump discharge valves: 12" Mueller gate with 12" Pratt ball valve
- Electrical MCC panels
- Single wall mounted ventilation fan
- Single electric unit heater (Chromalox)
- 1 -Ton monorail with chain pull hoist
- Lighting (florescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Royce – 5000 pH monitor
  - Capitol Controls - 1770 Chlorine Residual Analyzer
  - Marsh McBirney "Model 284" flow meter

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in excellent shape, walls are painted and no cracking, chipping, or chalking was noted. No structural cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick and in excellent shape structurally; no cracks or missing mortar was noted. The interior of the pumping station consists of an upper mezzanine which houses the electrical MCC and control panels. The mezzanine is elevated approximately 3 feet above the pump operating floor elevation. Space is provided within the pumping station for a third pump, and the suction and discharge piping are designed to permit connection. A 1-ton monorail with electric hoist is provided for pump maintenance. The site was secured with a 6+ foot tall chain link fence with locking gate, which is in good condition.

b. Heating and Cooling. The pumping station is cooled by a single wall-mounted fan, controlled by a line voltage thermostat. Heating is provided by a single electric unit heater controlled through a separate wall-mounted thermostat. The ventilation fan was operating during the site investigation, and no problems were noted.

c. Lighting. Lighting fixtures within the pumping station interior are florescent type. Lighting levels in the pump room are excellent, and the fixtures are in excellent condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on an elevated (approximately 3 ft.) mezzanine. Electrical control and power equipment were noted to be in excellent condition, and no observable corrosion, accumulation of debris, or other damage was noted.

e. Pumping Equipment. The pumping equipment was installed in 1992 and is in good condition. According to District records, no major overhauls, or maintenance problems were noted for the pumping equipment. Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration for each of the two pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 12 inch Mueller gate valves. In addition, the discharge of each pump is provided with a 12 inch motor actuated ball valve.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and sample water piping were noted to be in good condition.

10. TAYLOR MILL PUMPING STATION

Located within the Taylor Mill Treatment Plant, the Taylor Mill Pumping Station houses a total of six vertical turbine pumping units. The pumps all discharge to the 876 service level. Three of the pumps are considered booster units and the other three are lift pumps. The three booster pumps take suction from the 763 service level and have a combined rated capacity of 32.3 mgd (22,390 gpm). Water from the Taylor Mill TP clearwell, with water produced at both TMTP and FTTP, provide supply for the lift pumps. The combined rated capacity of the lift pumps is 28.1 mgd (19,490 gpm). The pumps are located in two separate areas of the treatment plant, which will be referred to as Building No. 1, main Filter Building, and Building No. 2, auxiliary room accessible from a separate door in the back of the Plant, for the purposes of this report. Specific information regarding the Taylor Mill pumps is provided in Table II-7.

Table II-7 Taylor Mill Pumping Station						
Pump ID	Installation Date	Manufacturer and Model	Discharge		Head (feet)	Motor hp
			gpm	mgd		
TMTP-PUMP-1 (Booster)	1982	Byron Jackson 20HQ-4	6,945	10.0	250	600
TMTP-PUMP-2 (Booster)	1994	Peerless 27MA-2	8,500	12.2	145	450
TMTP-PUMP-3 (Lift)	1996	Goulds 20ELC-3	5,600	8.1	375	700
TMTP-PUMP-4 (Lift)	1974	Layne Bowler 24EXHX	6,945	10.0	490	1,250
TMTP-PUMP-5 (Lift)	1987	Layne Bowler	6,945	10.0	365	1,250
TMTP-PUMP-6 (Booster)	1982	Byron Jackson 20HQ-4	6,945	10.0	250	600

In addition to the pumping equipment, the following major equipment items are included in the two pumping station buildings:

Building No. 1 (Part of the Operations Building)

- Pump suction valves: 20" American Darling butterfly valves
- Pump discharge valves: 20" American Darling butterfly valves
- Electrical MCC panels
- Side windows and portable fans
- Two wall mounted electric heaters
- 5-ton bridge crane with electric hoist
- Lighting (incandescent and florescent) supplemented by two wall mounted metal halide lights

Building No. 2 (Exterior Facility)

- Pump suction valves: 20" Dezurik butterfly valves
- Pump discharge valves: 20" Dezurik butterfly valves
- Electrical MCC panels
- Three roof mounted fans
- 3-ton monorail with chain hoist
- Lighting (metal halide) side wall mounted

a. Condition. The condition assessments are provided separately for each of the two buildings that comprise the Taylor Mill Pumping Station.

i. Building No. 1. The overall condition of Building No. 1 is satisfactory. The interior is in excellent shape; walls are painted and no excessive cracking, chipping, or chalking was noted. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick and in excellent shape. The side windows are in satisfactory condition with minor corrosion on the metal frames, etc. The interior of the pumping station consists of an upper mezzanine housing the MCC and control panels. The lower level houses the pumps and discharge piping and valves. Pump suction valves are located in the basement of the building. (Refer to the Taylor Mill Treatment Plant review for further discussion on the condition of the treatment plant piping, valves, and general condition.) A single bridge crane with electric hoist is provided for pump, piping and valve maintenance. The bridge crane is in excellent condition and no problems were noted.

ii. Building No. 2. The overall condition of the pumping station is satisfactory. The building is constructed as a combination of steel framing with block and brick veneer. The structural block work and the steel roof framing are in good condition. The exterior of the pumping station is brick, and the brickwork is in excellent shape. The pump discharge valves are located within the building and are in good condition. A single 3-ton monorail is provided within the building; however its location only permits it to be used for piping and valves, pumps are removed through fan openings above the pumps using a boom truck.

b. <u>Heating and Cooling</u>.

i. Building No. 1. The pumping station is cooled by a series of portable fans and natural ventilation through side windows. The temperature within the pumping station was satisfactory at the time of the site inspection; however no pumps were operating. Heating is provided by two electric wall heaters. No controls were noted and the operation of the heaters could not be verified.

ii. Building No. 2. The pumping station is cooled by three roof-mounted ventilation fans, drawing air through wall louvers. The fans were operating during the site investigation; however the room temperature was greater than 90° F. Heating is provided by a number of portable electric heaters plugged into a number of convenience outlets throughout the pump room.

c. <u>Lighting</u>.

i. Building No. 1. Lighting within the pumping station interior is provided by a combination of incandescent and florescent fixtures, with supplemental lighting also provided by two metal halide fixtures located on the walls. Lighting levels within the pump room appear to be satisfactory; however the side windows provide ample lighting during daylight hours.

ii. Building No. 2. Lighting within the pumping station interior is provided by wall mounted metal halide lights. Lighting levels within the pump room are unsatisfactory, such that observation of equipment tags during the inspection was difficult with the lighting levels provided by the permanent fixtures.

d. Electrical Equipment.

The electrical MCCs and breaker panels are located within the interior of the pumping station on the upper mezzanine (approximately 15 feet above the pump floor). Electrical control and power equipment are noted to be in good condition, and no observable corrosion, accumulation of debris, or other damage was noted. District staff indicated no problems with the MCC or the pumping station control system.

e. Pumping Equipment.

i. Building No. 1. The pumping equipment was installed over a number of years as water demands and capacity needs increased. The pumps and piping are in satisfactory condition, and no excessive corrosion was noted. According to District records, Pump No. 1 received new bearings and wear rings in 1997. No major overhauls or maintenance problems were noted for Pumping Units No. 2 and 3 since their installation. Vibration data, as measured by District staff for November 2002 through April 2003, indicated normal vibration for each of the pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 20 inch American Darling butterfly valves.

ii. Building No. 2. Similar to the pumps located in Building No. 1, the pumping equipment was installed over a number of years. The pumps and piping are in satisfactory condition. Minor corrosion was noted along the bases of the pumps; however the extent of the corrosion is not excessive. The shaft safety guard for Pump No. 6 was noted to be missing. Notable repair record items for the pumps included the following:

- Pump No. 4 motor bearings were replaced and the motor was re-wound in 1995, and the pump received new bearings and wear rings in 1997.
- Pump No. 5 was pulled and one impeller was removed to reduce cavitation in 1992. The pump also received new bearings and wear rings in 1997.

Vibration data, as measured by District staff for the period November 2002 through April 2003, indicated normal vibration for each pump and no trend was noted indicating deterioration of the bearings, etc. Pump discharge valves are 20 inch Dezurik butterfly valves.

11. US 27 (FORT THOMAS) PUMPING STATION

The US 27 Pumping Station, sometimes referred to as the Fort Thomas Pumping Station, is located immediately south of the Fort Thomas Treatment Plant, on the same grounds, adjacent to Alexandria Pike (US 27). The PS takes water from the FTTP clearwells and discharges to the 1017 service level. The station houses three vertical turbine can pumps with a combined rated capacity of 15.1 mgd (10,500 gpm) at 300 feet of head, and a firm capacity of 10.1 mgd (7,000 gpm). The pumps were all installed in 1992 and have 350 hp motors. The pumping units are identical Peerless "16HXB" models.

In addition to the pumps themselves, the station consists of the following major equipment items, housed in a brick building with concrete floor:

- Pump suction valves: 16" Pratt butterfly valve
- Pump discharge valves: 14" Pratt butterfly valve
- Electrical MCC panels
- Single wall mounted ventilation fan
- Single electric unit heater (Chromalox)
- 3-Ton bridge crane with electric hoist
- Lighting (florescent)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Royce – 5000 pH monitor
  - Capitol Controls - 1770 Chlorine Residual Analyzer

As part of the Master Plan Addendum, it was recommended that one of the US 27 pumps be replaced with a larger capacity unit to provide adequate service under maximum day conditions, if the Newport 741 and 965 service levels are interconnected with the 763 and 1017 service levels. Since the time the Addendum was finalized, overall system water demands have decreased due to Boone County and Florence ending their purchase of water from NKWD. Instrumentation limitations at FTTP hinder the plant's ability to properly feed chemicals at low production rates. The District has therefore been attempting to reduce production from the Memorial Parkway plant to match the reduced demands. As a result, utilization of the US 27 PS has increased in order to supply water from the Fort Thomas plant to areas of the northern Campbell County service area that previously had been served with water from MPTP, through the Waterworks Road PS. This change in operations has pushed the capabilities of the US 27 PS to its functional limits.

a. Condition. The overall condition of the pumping station is excellent. The interior of the building is in excellent shape, walls are painted and no cracking, chipping, or chalking was noted. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick, which is in excellent shape structurally. No cracks or missing mortar was noted. The interior of the pumping station consists of a single floor which houses the pumps, discharge piping and valves, and electrical MCC and control panels. The mezzanine is elevated approximately 3 feet above the pump operating floor elevation. A 3-ton bridge crane with electric hoist is provided for pump maintenance.

b. Heating and Cooling. The pumping station is cooled by a single wall-mounted fan, controlled by a line voltage thermostat. Air is drawn through louvers in the opposite wall of the pumping station. The louvers have automatic dampers, however they have been disconnected. Heating is provided by a single electric unit heater controlled through a separate wall-mounted thermostat. The ventilation fan was operating satisfactorily during the site investigation, with no apparent problems noted.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures. Lighting levels in the pump room are excellent, and the fixtures are in excellent condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, adjacent to the pumps. Electrical control and power equipment were noted to be in excellent condition, with no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed in 1992 and was noted to be in excellent condition. According to District records, no major overhauls, or maintenance problems were noted for the pumping equipment. Vibration data, as measured by District staff for the period November 2002 through April 2003, indicated normal vibration for each of the two pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 16 inch and 14 inch Pratt butterfly valves.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and the sample water piping were noted to be in good condition.

12. WATERWORKS ROAD (NEWPORT) PUMPING STATION

The Waterworks Road Pumping Station is relatively new, being placed into operation in 2000. It is located on the Memorial Parkway Treatment Plant site, in the City of Fort Thomas, and functions to convey flow from the MPTP clearwell to the 1017 service level in northern Campbell County. This pumping station is sometimes referred to as the Newport Pumping Station, due to its location on the site of the former Newport Treatment Plant. The station has three identical vertical turbine pumping units; each rated 4,200 gpm (6.1 mgd) at 372 feet of head. This provides a combined maximum rated capacity of about 18.2 mgd (12,600 gpm), and firm capacity of 12.1 mgd (8,400 gpm). The pumps have 500 hp motors and are equipped with variable frequency drives. Each of the pumps are Byron Jackson "17HQH" model units.

In addition to the pumps, the station consists of the following major equipment, housed in a brick building with concrete floor:

- Pump suction valves: 12" Dezurik butterfly valves
- Pump discharge valves: 12" Cla-Val pump control valves and 12" Dezurik butterfly valves
- Electrical MCC panels
- Three in-line centrifugal fans
- Two natural gas unit heaters (Reznor)
- 4-Ton monorail with electric hoist (Wright Way)
- Lighting (florescent)
- Sodium hypochlorite storage and feed system
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Royce – 5000 pH monitor
  - Capitol Controls - 1770 Chlorine Residual Analyzer

a. <u>Condition</u>. The overall condition of the pumping station is excellent. The interior of the building is in excellent shape. The walls are painted and no cracking, chipping, or chalking was noted. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is brick and is in excellent shape structurally. There are no cracks or missing mortar. The interior of the pumping station consists of a single story pump room which houses the pumps, inlet and discharge piping and valves, sodium hypochlorite system, electrical MCC and control panels. A 4-ton monorail with electric hoist is provided for pump, piping and valve maintenance. Exterior doors and wall mounted louvers are painted and no corrosion was noted.

b. Heating and Cooling. The pumping station is cooled by a three in-line centrifugal fans, controlled by a wall-mounted thermostat. Heating is provided by two natural gas fired unit heaters controlled through a separate wall-mounted thermostat. The ventilation fans were operating during the site investigation, and no problems were noted.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures. Lighting levels in the pump room were considered to be excellent, and the fixtures are in excellent condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station, adjacent to the pumps. Electrical control and power equipment were noted to be in excellent condition, with no observable corrosion, accumulation of debris, or other damage.

e. Pumping Equipment. The pumping equipment was installed in 2000 and is in excellent condition. According to District records, no major overhauls or maintenance problems were noted for the pumping equipment since their installation. Vibration data, as measured by District staff for the period of November 2002 through April 2003, indicated normal vibration for each of the three pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 12 inch Dezurik butterfly valves. In addition, the discharge of each pump is provided with a 12 inch Cla-Val pump control valve.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and the sample water piping were noted to be in good condition.

g. Sodium Hypochlorite Storage and Feed System. A small sodium hypochlorite storage and feed system is located in the interior of the pumping station. The system consists of 55 gallon drum storage tanks, one Wallace & Tiernan "AAA1289" metering pump, and associated piping and valves to feed chemical into the pumping station discharge line. In addition, the system is equipped with a separate ventilation fan drawing air from the top of the metering pump area, and a single emergency eyewash and deluge shower. According to District staff, the system has never been utilized and therefore no operational data was available.

13. WEST COVINGTON PUMPING STATION

The West Covington Pumping Station, located in the City of Covington, is an in-line booster station, equipped with two vertical centrifugal pumping units, having a total installed capacity of 5.8 mgd (4,000 gpm) and a firm capacity of 2.9 mgd (2,000 gpm). The pumps have 40 hp motors, and are rated at 60 feet of discharge head. Both pumps were installed in 1987 and are Paco "16-80951X" units. The station discharges to the 763 service level, primarily serving the Ludlow and Bromley areas.

In addition to the pumps, the station includes the following major equipment, housed in a CMU block building with concrete floor and concrete mezzanine:

- Pump suction valves: 12" Kennedy gate valves
- Pump discharge valves: 12" Kennedy gate valves with 12" check valves
- Electrical MCC panels
- Single wall mounted fan (Coolair)
- Single electric unit heater (Carolina Production)
- Monorail with removable hoist
- Lighting (florescent)
- Sodium hypochlorite storage and feed system (in separate adjacent building)
- Water quality instrumentation:
  - HACH – 1720D Turbidimeter with SOM
  - Capitol Controls – 9410 pH monitor
  - HACH - CL17 Chlorine Residual Analyzer

a. Condition. Overall condition of the pumping station is satisfactory. The interior of the building is in excellent shape, walls are painted and no excessive cracking, chipping, or chalking was noted. No cracking or differential settlement was noted in the walls. The exterior of the pumping station is painted, and some chipping of the paint was noted. In addition, moderate corrosion was noted around the air inlet louvers, door frames, and fan housing. The interior of the pumping station consists of an upper mezzanine housing the MCC and control panels, and water quality control instrumentation. The lower level houses the pumps, inlet and discharge piping and valves. A single monorail with removable hoist is provided for pump, piping and valve maintenance. The monorail is in good condition and no problems were noted. The hoist was not mounted on the monorail, and therefore condition of the hoist could not be verified. Exterior doors and wall mounted louvers are painted to match the building exterior and were noted to have moderate corrosion present.

b. Heating and Cooling. The pumping station is cooled by a single wall-mounted propeller fan, controlled by a wall-mounted thermostat. The fan controls are noisy during fan operation, possibly indicating dirty contacts. Heating is provided by a single electric unit heater controlled through a separate wall-mounted thermostat.

c. Lighting. Lighting within the pumping station interior is provided by florescent fixtures. Lighting levels in the pump room are excellent, and the fixtures are in good condition.

d. Electrical Equipment. The electrical MCCs and breaker panels are located within the interior of the pumping station on the upper mezzanine. Electrical control and power equipment are in good condition, and no observable corrosion, accumulation of debris, or other damage was noted. District staff indicated no problems with the MCC or the pumping station control system.

e. Pumping Equipment. The pumping equipment was installed in 1987 and was noted to be in satisfactory condition. According to District records, no major overhauls, or maintenance problems were noted for the pumping equipment since their installation in 1987. Vibration data, as measured by District staff for the period November 2002 through April 2003, indicated normal vibration for each of the two pumps and no trend was noted indicating deterioration of the bearings, etc. Pump suction and discharge valves are 12 inch Kennedy gate valves. In addition, the discharge of each pump is provided with a 12 inch Kennedy check valve.

f. Water Quality Instrumentation. Water quality monitoring instrumentation is provided to monitor pH, turbidity, and chlorine residual. All instrumentation and the sample water piping were noted to be in good condition.

g. Sodium Hypochlorite Storage and Feed System. A small sodium hypochlorite storage and feed system is located in a separate fiberglass building located adjacent to the pumping station building. The fiberglass building houses all of the storage and feed equipment, and provides for secondary containment for the stored chemical. The system consists of a single 100 gallon storage tank, one Hydroflo "CJ4T5658-0X014" metering pump, and associated piping and valves to feed chemical into the pumping station discharge line. In addition to the storage tank, two 55 gallon shipping drums were present at the time of the inspection.

The building is equipped with a single ventilation fan, wall-mounted unitary air conditioner, and electric unit heater. Each of the systems is in good working order and no abnormalities were noted. The floor of the building is depressed to provide secondary containment for the chemical storage with grating at grade level. Secondary containment provisions are excellent, and the coverage for the storage tank and shipping containers is also in excellent condition. A single emergency eyewash and deluge shower is provided within the interior of the building. Minor corrosion around the metering pumps and piping was noted, due to leakage at piping and valve connections. District staff indicated that operation of the system has been very good since its installation.

D. DISTRIBUTION SYSTEM STORAGE

There are a total of eighteen storage tanks on the NKWD distribution system, located at seventeen sites. For the AMP, Black & Veatch conducted site visits to each of the tanks and prepared condition assessments. This section describes each tank and provides a summary of the conditions observed. Review forms for the site inspections are included in Appendix A. Inspection of the tanks included visual assessments of the structural condition of the tank, the coating systems on the exterior of the tank, and the tank site.

The structural condition of each tank was visually inspected from ground level for signs of structural failure, including: corrosion, structural cracking of welds, and leaking or damage to structural steel members which may compromise the structural integrity of the tank. The foundation was inspected for cracks, spalling, and any signs of damage. The mastic and / or grout between the concrete foundation and the steel tank were also inspected for damage or deterioration.

The exterior coating systems on the steel tanks were visually inspected for corrosion, coating failure, delamination and general condition.

The tank sites were inspected for general site grading, adequate drainage, lighting and the condition of perimeter fences if applicable.

Access ladders, fall protection devices, and climb prevention devices were also visually inspected for effectiveness and condition. Access hatches, roof vents, overflow weirs, piping, and any additional accessories such as aircraft obstruction lighting and antennae were visually inspected where possible. Cathodic protection systems were visually inspected at the control panel.

1. AQUA DRIVE TANK

The Aqua Drive tank was constructed in 1990. It is a steel hydropillar, 2.0 million gallon facility, with a sidewater depth of about 40 feet. The tank overflow is at El. 1017.0. A cathodic protection system is installed in the tank. The tank is located on the same property as the District's headquarters.

The Aqua Drive Tank is in excellent condition. The tank was last painted in the spring of 2003 and the coating systems are in new (excellent) condition. The tank accessories are in excellent condition and safety items (ladders, handrails, etc.) meet OSHA requirements.

2. BARRINGTON ROAD TANK

The Barrington Road Tank is an elevated steel tank of hydropillar design, having a capacity of 1.0 MG. It has a sidewater depth of about 40 feet and is 65.2 feet in diameter. The tank was constructed in 1972. The tank base is set at El. 916.5 and the overflow is at El. 1046.7. A condition inspection has not been performed for this tank since it was painted in 1997.

The Barrington Road Tank is generally in good condition. The coating systems and tank accessories are in good condition and safety items (ladders, handrails, etc.) meet OSHA requirements. The fence is in satisfactory condition and overgrown by brush in many areas. Site security is unsatisfactory and requires improvements as graffiti has been painted on the tank. The tank is used as an antenna platform by several tenants who have antenna systems control facilities on the site.

3. BELLEVUE TANK

The Bellevue Tank is a riveted steel standpipe tank, constructed in 1930. (Note this tank is also referred to as the Harrison Road Tank.) It has a capacity of 600,000 gallons, sidewater depth of 60 feet, and is 41.25 feet in diameter. The tank base is at El. 769.0 and the overflow is set at elevation 829.0 feet. The tank was re-painted in 1999, and inspected the following year.

The Bellevue Tank is in excellent condition. The tank was last renovated in 1999 and the coating systems are in new (excellent) condition. An inspection was done in 2000. The structural support system for the tank roof was completely replaced as part of the renovation and the tank accessories and safety items (ladders, handrails, etc.) replaced with OSHA compliant systems. The instrumentation is located in a structure of light construction on the site.

4. BROMLEY TANK

The Bromley Tank is a steel standpipe, constructed in 1967. It provides supply to the adjacent Bromley Pumping Station, has a capacity of 3 million gallons and is 73.7 feet in diameter. The base of the tank is at approximately elevation 670.0, and the overflow is at El. 764.0.

The Bromley Tank is generally in good condition. The tank was last painted in 1993 and the last detailed inspection was conducted in 2001. The coating systems are observed to be in good condition and the tank accessories are similarly in good condition. The fence is in satisfactory condition and overgrown by brush in many areas. There are surveillance cameras and lights located around the site; however, the tank site was broken into in the spring of 2003.

5. DAYTON TANK

Matching the Bellevue Tank, the Dayton Tank is a riveted steel standpipe tank, constructed in 1930. It has a capacity of 500,000 gallons, with a 60.0 foot sidewater depth and diameter of 41.25 feet. The tank base is at El. 769.0 and the overflow is at El. 829.0. The Dayton Tank is identical in design and construction to the Bellevue (Harrison Road) Tank, which are the oldest tanks in the NKWD system. This tank has a cathodic protection system.

The Dayton Tank is in excellent condition. The tank was last renovated in 2001 and the coating systems are in relatively new (excellent) condition. No condition inspections have been performed since then. The structural support system for the tank roof was completely replaced as part of the renovation and the tank accessories and safety items (ladders, handrails, etc.) replaced with OSHA compliant systems. The instrumentation is located in a structure of light construction on the site.

6. DEVON TANK

The Devon Tank was constructed in 1990. It is a 2.0 million gallon steel hydropillar structure, 92.2 feet in diameter, with a sidewater depth of about 42 feet. The overflow elevation is 1082.0 feet, and the tank base is at El. 939.5. The tank has a cathodic protection system.

The Devon Tank is in excellent condition. The tank was last renovated in 2001 and the coating systems are essentially in new (excellent) condition. A complete condition assessment has not been performed since the 2001 painting project. The tank accessories are in excellent condition and safety items (ladders, handrails, etc.) meet OSHA requirements.

7. DUDLEY TANKS

There are two steel above-ground storage reservoirs located at the Dudley complex, each 5 million gallons in capacity. The tanks are identical in configuration, both 194.5 feet in diameter, with base elevations at 831.0 ft. and overflows at El. 876.0. However, the tanks were constructed separately, one in 1964 (east tank, service level 1040) and the second in 1990 (west tank, service level 1080). The west tank is equipped with a cathodic protection system. The tanks provide supply to both of the Dudley pumping stations on site.

The Old Dudley Tank, service level 1040, is in excellent condition. The tank was last renovated in 2000 and the coating systems are in new (excellent) condition. The tank has not been inspected since the painting project. The tank accessories are in excellent condition and safety items (ladders, handrails, etc.) meet OSHA requirements.

The New Dudley Tank, service level 1080, is in excellent condition. The tank was last renovated in 2000, with additional repairs to the exterior coating system completed in 2003. The coating systems are in good to excellent condition. The tank accessories are in excellent condition and safety items (ladders, handrails, etc.) meet OSHA requirements.

8. IDA SPENCE TANK

The Ida Spence Tank, constructed in 1953, is a 500,000 gallon elevated steel tank, of double ellipsoidal style. It has a sidewater depth of about 40 feet and a diameter of 47.3 feet. The tank's base is at El. 840.0, and has an overflow elevation of 1005.0 ft.

The Ida Spence Tank is generally in good condition. The tank was last painted in 1995 and the coating systems are in good condition. No subsequent condition inspections have been performed since that time. The tank accessories are in good condition and safety items (ladders, handrails, etc.) meet OSHA requirements. The fence is in satisfactory condition and overgrown by brush in some areas. There are no security cameras or lights at the site. The tank is used as an antenna platform by several tenants.

9. INDEPENDENCE TANK

The Independence Tank was constructed in 1982. It is a 1.0 MG steel hydropillar facility. The tank diameter is 65.2 feet and it has a sidewater depth of about 40 feet. The tank base is set at El. 943.5 and the overflow elevation is 1080.0 feet.

The Independence Tank was generally in satisfactory condition when examined for the AMP in June 2003. The tank was last painted in 2003 and a detailed inspection was conducted in 2002. At the time of the inspection, the coating systems were in satisfactory condition and the tank accessories were in good condition. Interior lights need to be replaced and fall protection cables should be installed on access ladders. The fence is in satisfactory condition and overgrown by brush at one corner.

10. INDUSTRIAL PARK TANK

Constructed in 1962, the Industrial Park tank is a 500,000 gallon steel hydropillar facility. The tank is 47.3 feet in diameter and it has a sidewater depth of about 40.5 feet. The tank base is located at El. 945.5 and the overflow elevation is 1083.5 feet.

The Industrial Park Tank is generally in satisfactory condition. The tank was last painted in 1996 and a detailed inspection conducted in 2002. The coating systems are in satisfactory condition and the tank accessories are in good condition. Interior lights need to be replaced and access ladders replaced with OSHA compliant systems, including fall protection devices. The fence is in good condition and is insulated from an adjacent electrical facility fence with a section of wood fence. The site does not have a paved access drive, site lighting or security cameras.

11. JOHN'S HILL ROAD TANK

The John's Hill Road elevated steel tank was constructed in 1959. It has a 500,000 gallon capacity, with a sidewater depth of about 39.1 feet. The tank overflow is located at El. 1017.0. It is a double ellipsoidal style tank, and is equipped with a cathodic protection system.

The John's Hill Tank is generally in good condition. The tank was last painted in 1997, and a condition inspection was performed in May, 1998. The coating systems are in good condition. The tank accessories are in good condition and safety items (ladders, handrails, etc.) meet OSHA requirements. The fence is in satisfactory condition and overgrown by brush along approximately 20% of site perimeter. The tank is used as an antenna platform by several tenants.

12. KENTON LANDS TANK

The Kenton Lands Tank is located adjacent to the District's maintenance and warehouse center on Kenton Lands Road. This steel elevated tank was constructed in 1954, and has a capacity of 500,000 gallons. It is a double ellipsoidal style tank. The tank is 47.3 feet in diameter and has a sidewater depth of about 40 feet. The overflow is set at El. 1045.0 and the tank base elevation is 896.0 feet.

The Kenton Lands Tank is generally in good condition. The tank was last painted in 1996 and the coating systems are in good condition. It has not been inspected since the repainting project. The tank accessories are in good condition and safety items (ladders, handrails, etc.) meet OSHA requirements. The tank site is located within a District maintenance facility. Site lighting is present, but limited. The tank is used as an antenna platform by several tenants.

13. LUMLEY TANK

Constructed in 1934, the Lumley Tank has a capacity of 275,000 gallons, and is of riveted steel construction. It is a double ellipsoidal style tank, 39.5 feet in diameter, with a sidewater depth of about 30.9 feet. The overflow is at El. 1017.0, and the base is at El. 986.1. The tank has obstruction lighting installed.

The Lumley Tank is generally in good condition. The tank was last renovated in 1999 and the coating systems are in good condition. No inspections having been performed in the intervening period. The tank accessories and safety items are also in good condition. There is minor leaking present on the riser. The issue of leaking on the riser was addressed several times during the renovation project; however, the riveted construction of the tank contributed to the difficulties encountered in sealing all the leaks. The tank is used as an antenna platform by several tenants.

14. MAIN STREET TANK

The Main Street Tank is a 300,000 gallon elevated double ellipsoidal steel structure. Built in 1962, the tank has a sidewater depth of about 28.8 feet and is 40.6 feet in diameter. The tank overflow is at El. 1017.0 and the base elevation is 988.2 feet. It is equipped with a cathodic protection system.

The Main Street Tank is generally in excellent condition. The tank was last renovated in 1998 and has not been inspected since that time. The coating systems are in excellent condition. The tank accessories are in good condition and the safety items (ladders, handrails, etc.) meet OSHA requirements. Instrumentation is located within a covered panel on the site. Security is only provided by a perimeter fence and intrusion alarm switch on the access ladder. The tank is used as a radio antenna platform by several tenants.

15. OLD STATE ROUTE 4 TANK

Also known as the South County Tank, the Old State Route 4 Tank was constructed in 1976. The torosphere style elevated tank has a capacity of 1.0 million gallons and has a sidewater depth of about 30 feet. The overflow elevation is 1017.0 feet.

The Old State Route 4 Tank is in unsatisfactory condition. This tank has not been re-painted since it was originally constructed and is critical need of attention. The District does not have any records of a condition inspection having been conducted for the tank. The coating systems applied during construction of the tank in 1976 are thin, chalking and faded. The coatings are minimally protecting the steel and corrosion is not extensive; however, the tank is in need of a detailed inspection to determine the condition of the accessories, fall protection devices and interior coatings. The cathodic protection system has been abandoned.

16. ROSSFORD TANK

The Rossford Tank was constructed in 1958. It is an elevated double ellipsoidal steel tank, having a capacity of 300,000 gallons. The overflow is at El. 1017.0. The tank is equipped with obstruction lighting at the top.

The Rossford Tank is generally in good condition. The tank was last renovated in 1997 and the coating systems are in good condition. No condition inspections have been performed in the interim. The tank accessories are in good condition and safety items (ladders, handrails, etc.) meet OSHA requirements. The fence is in satisfactory condition and overgrown by brush in many areas and property owners adjacent to the site have stacked wood and other debris against the perimeter fence. The tank is used as an antenna platform by several tenants.

17. SOUTH NEWPORT TANK

The South Newport Tank is a 1 MG elevated steel tank, serving the 965 service level in Newport. Records indicated the tank was constructed approximately 1972. The South Newport Tank was acquired by the District in 2002, with the City of Newport water system, and appears to be in satisfactory condition. However it is unknown when the tank was last painted, and a condition inspection has not been performed. The coating system is chalking and faded; however, corrosion is light and overall the exterior coating system appears to be in satisfactory condition. The condition of the interior coating system is unknown. The tank appears to be structurally sound; however, the condition of accessories on the tank roof and interior are unknown. The cathodic protection system is not activated and the overall condition is unknown. The tank is used as an antenna platform by several tenants

E. TRANSMISSION AND DISTRIBUTION MAINS

With few exceptions, the NKWD distribution system provides adequate capacity, pressure, and water quality to its customers. The District has been extremely proactive and conscientious in addressing any area of concern which threatened to disrupt or impair service in any way. Part of this effort has been the preparation of the Water Distribution System Master Plan and subsequent Addendum, through which extensive hydraulic analyses were conducted and a comprehensive program of water main improvements developed.

The District's water distribution network is exhibiting symptoms of an aging system. The system experiences approximately 350 breaks per year and the discolored water incidents are very frequent. These incidents impact the quality of service provided to the customer. The District has recognized the need to take action to reduce the frequency of these undesirable incidents. It is, however, clear that these problems cannot be solved in a short period of time, and may take one or two decades to rectify.

For this report the results and recommendations that emerged from the Master Planning efforts will not be repeated, and those documents should be consulted for particular aspects of the hydraulic analyses conducted and the improvements recommended therein. This portion of the report will focus on other areas of the NKWD transmission and distribution system which were specifically a part of the reviews and evaluations performed under the AMP project.

For the preparation of this portion of the AMP, the following information was collected and reviewed:

- NKWD Water Distribution System Master Plan, July 2001
- NKWD Report to the Board of Commissioners on Replacement of Customer Information System Capability & Utility Information Management Needs Assessment, February 2003
- NKWD Specifications for 2003 Water Main Cleaning & Epoxy Lining Projects, February 2003
- United States Department of Agriculture (USDA) Soil Survey of Boone, Campbell, and Kenton Counties, Kentucky, August 1973
- Standard Operating Guidelines for Discolored Water Complaints & Blow-Off Installations, January 2001
- Kentucky Attorney General's Post-Hearing Memorandum regarding NKWD Application for an Adjustment in Rates, February 2003
- Draft Request for Qualifications for Professional Services – Unidirectional Flushing Program, February 2003
- Water Main Inventory
- Water Main Break History

In addition to performing a review of the relevant documents and information, on-site interviews with several of the District's managerial, technical, operational and maintenance staff personnel were conducted. The interviews were conducted by Ahmad Habibian, Paul Hsiung and Sid Sengupta of B&V on June 25 and 26, 2003. The following staff was interviewed specifically for evaluating the transmission and distribution system:

Amy Kramer – Design Engineering Manager
Ryan Kramer – Staff Engineer
Steve Broering – Engineering Technician
Mary Alexander – Database Administrator
Chris Wetherell – Customer Service Field Representatives Supervisor
Glenda Carmack – Customer Service Administrative Assistant
Richard Harrison – Vice President of Engineering and Distribution
Don Gibson – Construction Manager
John Scheben - Design Supervisor
Phil Perry – Distribution Supervisor
Ed Prather – Distribution Supervisor
Rusty Collinsworth – Field Service Supervisor

1. SYSTEM INVENTORY

NKWD maintains information regarding the water mains and related appurtenances in a computerized Geographical Information System (GIS) database. The GIS data includes the diameters and lengths of all mains in the system. Currently, the District has a total of approximately 1,000 miles of transmission, distribution, and service pipes, ranging in diameter from ¾ to 42 inches. (This does not include the assets of the Taylor Mill water system, which was acquired by NKWD following the review of the system inventory conducted for the AMP.)

The District's water mains are constructed of a variety of materials, including: lined and unlined cast iron pipe (CIP), both pit cast and centrifugally cast; ductile iron pipe (DIP), installed with and without poly-wrapping; steel; transite (asbestos cement); pre-stressed concrete cylinder pipe (PCCP); and polyvinyl chloride (PVC). Service connection materials consist of copper, lead and galvanized steel. The age of the District's piping ranges from new to some as old as the 1870s. The current replacement cost of the complete transmission and distribution system is estimated to be approximately $560 million.

Table II-8 lists the total length, in miles, of the water mains in the NKWD system by material and diameter.

Table II-8
NKWD Water Mains by Diameter and Material

Pipe Material	Diameter (inches)													Total
	<4	**4**	**6**	**8**	**10**	**12**	**16**	**18**	**20**	**24**	**30**	**36**	**42**	
Ductile & Cast Iron	0.01	75.9	352.2	175.9	17.0	107.3	52.9	0.64	24.2	16.3	5.4	4.3	3.4	**835.4**
PCCP									1.1	4.1		6.6		**11.8**
PVC	35.0	5.6	21.2	58.8		0.4								**121.0**
Transite		9.5	18.3											**27.8**
Steel	0.17	0.02	0.002	0.006	0.003	0.32	0.11			1.0				**1.6**
Copper	3.91													**3.9**
Galvanized Steel	0.07													**0.07**
Total	**39.2**	**91.0**	**391.7**	**234.7**	**17.0**	**108.0**	**53.0**	**0.6**	**25.3**	**21.4**	**5.4**	**10.9**	**3.4**	**1001.6**

The 6 and 8 inch diameter water mains together constitute about 62% of the NKWD system. Approximately 120 miles of water mains (about 12% of the total) are transmission mains ranging from 16 inches to 42 inches in diameter. The most common materials in the District's water system are cast and ductile iron, which constitute approximately 83% of the total. PVC pipe constitutes approximately 10% of the system. Steel and copper pipe materials are relatively small portions of the distribution system.

In classifying the materials installed, it is important to note cast and ductile iron piping have distinct differences in the failure mechanisms typically exhibited by the two types. Therefore, it would be beneficial for the District to distinguish between these materials in the inventory and associated records. It is estimated that the District switched from installing primarily cast iron to ductile iron piping around 1965. As a result, it is recommended that all iron pipes installed after 1965 be classified as ductile iron pipe. If possible, an attempt should also be made to determine the number of miles of unlined cast iron mains in the system, as the rates of breakage and water quality complaints would be expected to be different than that for lined iron piping. Similarly, the miles of unwrapped ductile iron mains should be quantified, due to anticipated differences in breakage rates as compared to poly-wrapped DIP. It is understood Kenton County Water District No. 1 started poly-wrapping ductile iron pipe as a regular practice in 1992, and the Campbell County, Kentucky Water District began installing poly-wrap in 1994.

At the time B&V reviewed NKWD's pipe data, the installation date information for mains in the District's database was incomplete. It was estimated that the installation dates for only approximately 30% of the water mains were available in the District's database. Because pipe age is a significant factor in determining whether a given line segment should be considered for rehabilitation or replacement, B&V recommended that the District make an attempt to estimate the approximate installation years of its water mains. This may be achieved by reviewing existing as-built drawings, valve or fire hydrant cards, service line records, and tax records. In the interim period, NKWD has updated its information to now include installation dates for 100% of the database.

2. WATER MAIN BREAKS

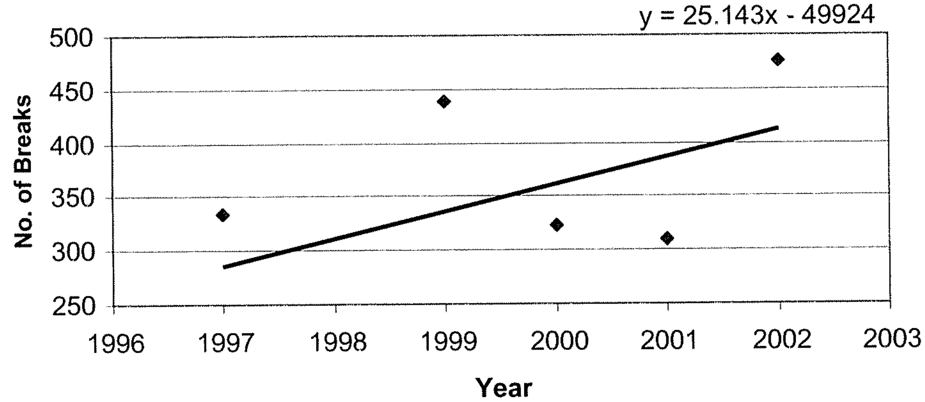
Similar to other major water utilities, repair of main breaks is a significant maintenance function for NKWD. Table II-9 provides a summary of main breaks for the District for the period of 1997 through 2002. The average number of main breaks per year over this period is 349, resulting in an overall break rate of 34.9 breaks per year per 100 miles.

Table II-9
NKWD Water Main Breaks

Year / Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2002	49	19	19	15	24	26	40	64	63	45	42	69	**475**
2001	47	14	23	23	24	31	21	23	24	33	21	26	**310**
2000	58	36	8	17	17	14	29	28	16	21	29	50	**323**
1999	36	10	16	10	21	20	35	48	70	59	32	82	**439**
1998	15	15	11	16	16	12	16	21	28	24	22	17	**213**
1997	33	14	14	21	22	22	30	32	45	44	31	26	**334**
Average	**40**	**18**	**15**	**17**	**21**	**21**	**29**	**36**	**41**	**38**	**30**	**45**	**349**

On average, the number of main breaks per year has increased over time, as indicated by Figure II-31. While there is some variance in the data, it appears the annual number of breaks is increasing at a rate of about 25 breaks per year. At this rate, the average number of breaks per year will double from the current 349 in approximately 14 years.

Figure II-31
NKWD Annual No. of Water Main Breaks



Based on the analysis of national water main break data, an AWWARF study ("Distribution System Performance Evaluation", 1995) recommended that utilities set a goal to keep the rate of their main breaks no more than 25 to 30 breaks per 100 miles per year. The District's current break rate of 34.9 per 100 miles per year exceeds these target values and is also expected to increase over time as discussed above. It therefore seems prudent for the District to take actions to reduce its break rate by at least 20%.

Table II-10 summarizes the historic average annual number of water main breaks on the NKWD system for 1997 through 2002, sorted by the pipe material and type of break encountered. The major failure types which occurred are: circular (36%), longitudinal and splits (28%), blowouts (23%), and joint failures (4%). (Other or unknown failure types were 7% of the total). The most frequent mode of failure for cast iron piping is circular. Ductile iron and steel pipe failed mostly by blow outs, which are typically corrosion related. The PVC and transite pipes failed mostly longitudinally or by splitting near corporation cocks.

Table II-10
NKWD Average Annual Number of Main Breaks
By Pipe Material and Type of Break (1997-2002)

Break Type	Material						TOTAL
	Cast Iron	Ductile Iron	PVC	Steel	PCCP	Transite	
Circular	114.7	1.0	1.1	0	0.2	2.2	**119.2**
Longitudinal / Split	73.3	1.5	15.0	0	0	3.5	**93.3**
Blowout	61.7	7.8	1.7	3.5	0.2	1.7	**76.6**
Joint Failure	8.8	1.8	1.0	0.3	0.3	1.0	**13.2**
Other	16.5	1.6	4.2	0.2	0.1	1.8	**24.4**
TOTAL	**275.0**	**13.7**	**26.0**	**4.0**	**0.8**	**10.2**	**329.7**

As expected, based on the amount of each pipe material that exists in the system, cast iron pipe is responsible for about 83% of the main breaks, followed by PVC pipe for 8%, ductile iron pipe for 4%, and transite pipe for 3%. To be able to make a meaningful comparison between these values, the number of breaks should be normalized relative to number of installed miles of water main for each pipe material. This information is provided in Table II-11.

Table II-11
NKWD Normalized Water Main Break Rates

	Material					TOTAL
	CIP / DIP	PVC	Steel	PCCP	Transite	
Avg. Annual No. of Breaks	288.7	26.0	4.0	0.8	10.2	**329.7**
Miles of Main	835.4	121.0	1.6	11.8	27.8	**997.6**
Break Rate Per 100 Miles	34.6	21.5	250.0	6.8	36.7	**33.0**

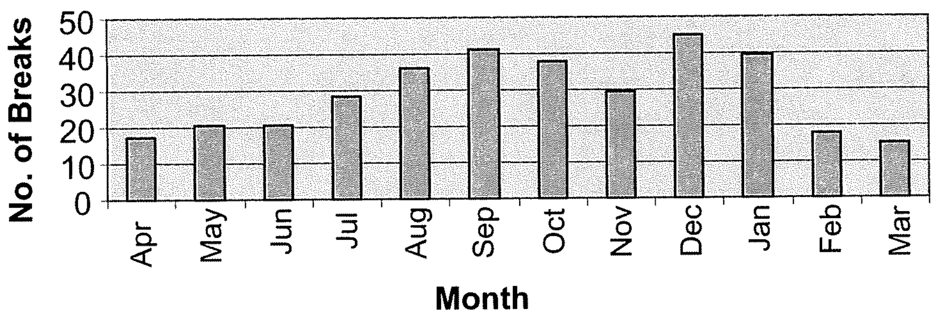
The breakage rate for NKWD's steel piping is an order of magnitude higher than other types of pipe. It is understood that the District has already made the decision to replace most of the steel pipe in its distribution system. While the next highest break rate belongs to transite pipe, discussions with the District indicate that most of those such breaks are due to corrosion of the service connections and not the failure of the pipe itself.

The combined break rate of 34.6 for cast and ductile iron pipe is the third highest of the pipe materials. To get a better understanding of the iron main break rate, it is necessary to have an accurate estimate of the miles of cast and ductile iron mains in the system. In the absence of such estimate, the calculated iron main break rate can be misleading. For example, if we assume that the length of ductile and cast iron mains are the same (i.e., 835.4 / 2 = 417.7 miles), then the break rate for cast iron would be 65.8 (275 / 417.7 x 100) and only 3.2 (13.3 / 417.7 x 100) for ductile iron mains. Regardless of the actual miles of cast and ductile iron mains, it is clear that the cast iron break rates are much higher than desirable.

While the PCCP break rates are the lowest of the piping materials, their impact on disrupting reliable water to the customers is very significant due to their large size and the critical locations of the PCCP piping in the transmission system.

Figure II-32 shows the monthly average number of breaks over the six year (1997-2002) period. There is an increasing trend in the number of breaks during the summer months (June, July, August & September). This trend is most likely associated with the stresses imposed on the mains due to shifting ground which occurs due to drying of the soil. This type of failure is most likely to be of circular (circumferential) type and occurs mostly on smaller diameter mains.

Figure II-32
NKWD Monthly No. of Water Main Breaks



The main break activity also typically increases when the temperature drops in the fall and early winter (November, December and January). During these three months, most of the weak spots that develop in the system are broken and repaired. As a result, the number of breaks in February and March decreases substantially and remains relatively low during spring.

The District does not have a full understanding of the causes of water main breaks in its system. Water main breaks can be caused by a number of factors such as corrosion (both internal and external), stray currents, inadequate bedding, leaks, shifting grounds, frost loads, thermal stresses, traffic loading, excessive earth loads, transient pressure (water hammer) and third party damage. A good understanding of the cause or causes of water main breaks helps the District understand the failure mechanisms and develop solutions appropriate for those mechanisms.

It is recommended that the District initiate a program to collect and analyze pipe samples (ring and coupon samples) as well as soil samples. These samples can be taken at locations where a main breaks and access to the pipe becomes available during repair of the break. It is understood that due to emergency nature of water main break repairs, it may not be convenient to take such samples for each incident. However, even if such samples are taken on 1/3 of the main breaks, there would be approximately 300 samples over a two year period. The analysis of such samples will allow the District to identify the primary causes of its main breaks.

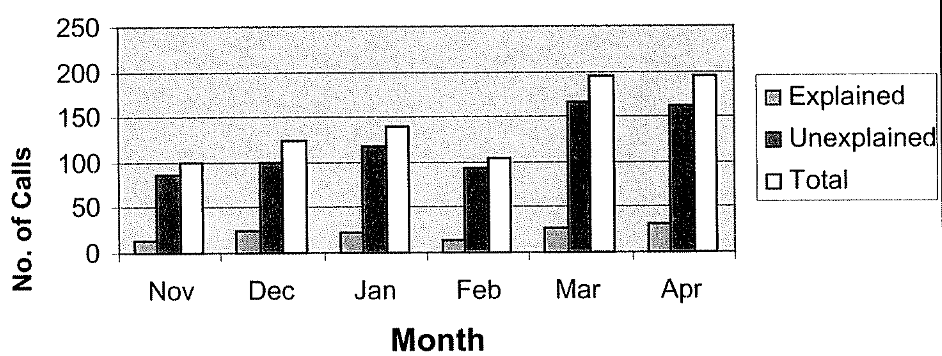
The District should also consider developing a soil corrosivity map for the service area. The USDA Soil Survey report maps can be used as a basis for such a map. The soil samples collected can be used to verify the accuracy of the map and make adjustments as necessary.

3. DISTRIBUTION SYSTEM WATER QUALITY

Discolored water problems appear to be a significant cause of the District's customer complaints and, based on discussions with NKWD staff, the frequency of such calls appears to be increasing. The District received a total of 857 calls over a six-month period (from November 2002 through April 2003).

NKWD tracks customer complaints in a database. The calls are divided into two categories; explained and unexplained. If the cause of the discolored water is determined in the field, it is noted as explained; otherwise, it is noted as unexplained. Over the six-month reporting period, there were 133 explained incidents and 724 unexplained incidents, as illustrated by Figure II-33. In order to get a better understanding of the causes of water quality problems, it is recommended that a new field be added to the database to capture the cause of explained incidents. Presently, this information is not recorded.

Figure II-33
Discolored Water Customer Calls From November 2002 through April 2003



The major source of discolored water in the system is the tuberculation of unlined cast iron pipes. These products get disturbed due to incidents such as water main breaks, pressure surges in the system when pumps are turned on or off, operation of nearby fire hydrants, or at high demand periods when the velocity of flow in the pipes increases. The number of discolored water incidents increases as temperature increases. As shown in Figure II-4, the number of complaint calls doubled from February to March and

April. Most discolored water incidents occur during summer months. A combination of a high number of water main breaks, increased water demands, and high temperature lead to the greater number of discolored water incidents. Most discolored water incidents occur in the Covington portion of the system, which has a high concentration of unlined cast iron water mains.

4. CUSTOMER SERVICE

The District has a customer service unit which responds to customers concerns. The service area is divided into four zones and each zone is handled by a field representative. Customer calls are documented in a database. After-hours calls are handled by an answering service system which notifies the duty foreman in case of an emergency. Most customer complaints are related to discolored water and low pressure problems. An internal Discolored Water Committee has been formed for coordination and consultation.

The District has developed and follows Standard Operating Guidelines for responding to customer complaints. All customer complaints are followed through by a field inspection. For discolored water complaints, the service line just before the meter is disconnected and opened to observe the quality of water. When frequent calls from one address or a street are received, an investigation is performed by the Field Services Supervisor to develop remedies, such as the installation of blow-offs.

The District also uses Crystal Reporting Software to generate reports of customer calls on a biweekly, monthly, and quarterly basis. The monthly report is sent to the Vice President of Engineering and Distribution. The quarterly reports are distributed to field supervisors.

5. INFORMATION MANAGEMENT SYSTEM

The District uses the GBA "Master Series" software package for maintenance management of its system. The District uses the GBA system extensively for issuing and tracking work orders, data storage and tracking of water main breaks and leaks, and inventory management. The system is linked with the District's GIS system. A full time database administrator manages the day-to-day needs of the system, develops tailored forms and generates a variety of reports.

Address matching (geocoding) is used to identify the location of main breaks. However, address matching does not always produce accurate results. It is recommended that parcel information be used for this purpose. The GDT system used by most phone companies and the 911 service may have better data for address matching.

The District has also a Customer Information System (CIS) to store and track customer information. The provider of this system, Convergys, has indicated that it will no longer offer such service to NKWD as of July 2004. As a result, the District is in the process of implementing a new CIS. It is anticipated that the new system will be linked with the GBA Master Series and District's GIS system.

6. DISTRIBUTION SYSTEM OPERATION AND MAINTENANCE

The District's distribution O&M program consists of several elements, including the following:

- Flushing Program
- Blow-offs
- Valve Exercising
- Leak Detection
- Repair of Main Breaks & Leaks

Each of these aspects of the O&M program is discussed below.

a. Flushing Program. The District routinely flushes its entire system twice a year. Every fire hydrant on water mains smaller than 16 inches is opened once in the spring and once in the fall, and the water is allowed to run until it becomes clear. The dead end fire hydrants are opened twice in the spring and twice in the fall. The District has four persons assigned for flushing operations. The daily production rate per person is about 20 fire hydrants. The flow and residual pressure are also measured when the flushing operations are performed.

While conventional flushing removes some of the loose deposits from the piping, the rest are simply transported to other parts of the system. In additional, if the main is badly tuberculated (i.e., encrusted with deposits), the clear cross sectional area of the main may not be large enough to generate adequate flow velocities to flush out the debris. These shortcomings can be addressed by utilizing unidirectional flushing methods combined with air scouring. Unidirectional flushing systematically cleans the system from the source to the peripheries of the system. When high velocities can be achieved, air scouring may be used to clean the pipe. The District has developed a Request for Qualifications (RFQ) to secure professional services for a pilot unidirectional flushing project, but to date it has been issued. The RFQ also contains a provision for including air scouring in areas where high velocities cannot be achieved. It is the District's intent to move forward with this project when the budget allows.

b. Meter Reading and Testing. The District has five meter reader staff positions. The meter reading is done manually. Large water meters are tested annually, and other meters are tested on average once every 10 years. The Kentucky Public Service Commission (PSC) has guidelines for meter testing which requires testing every ten years for meters 1 inch or smaller. Meters larger than 1 inch are required by the PSC to be tested at more frequent intervals, ranging down to once per year for meters 4 inches and larger.

c. Blow-Off Installations. The District has installed approximately 35 blow-offs to improve water circulation in the system and prevent incidents of discolored water. These blow-offs range in size from ¾ inch to 1 inch. The cost to install a blow-off is approximately $2,000. In 2003 the District paid a total of $181,966 to Sanitation District No. 1 for discharging the water from the blow-offs into the sewer system, based on being charged for about 80 percent of the total volume disposed into the sewers. It is estimated that approximately 11 million gallons of water per month (or 365,000 gallons per day) is discharged through blow-offs. This is about 1% of the average day demand for NKWD.

The District has found the blow-offs to be effective in reducing the number of discolored water incidents. Recently NKWD has begun actively monitoring the discharge from the blow-offs in an attempt to reduce the amount of water lost and the associated disposal costs, while still improving water quality by enhancing turnover in the system. In order to further minimize costs, it is recommended that the District investigate the costs and benefits of installing automated blow-off systems. Such systems can be programmed to turn on at frequent, preset intervals, and possibly reduce the amount of water that is wasted.

d. Valve Exercising. The District has a valve exercising program for 16-inch and larger valves. The valves are exercised once every two years. This frequency appears to be adequate to keep the valves operational, and it should provide the flexibility to isolate an area for repair purposes if needed. The District has also bought two GPS units which are used to locate all valves.

e. Leak Detection. The District has a set of leak detection equipment, including a noise correlator, which is used on an as-needed basis. The District has four operators who are trained to use the leak detection equipment, but leak detection is not performed on a regular, scheduled basis. Since leaks are often precursors of main breaks (by slowly washing out the pipe bedding material), it is recommended that the District dedicate one full time employee for leak detection. Such a practice should help reduce the number of main breaks, and it is believed the additional staffing costs will be more than offset by the reduction in repair activities.

f. Water Main Break and Leak Repairs. Two supervisors oversee the general maintenance work in the District's service area through nine field crews. One crew is dedicated for concrete pouring to repair sidewalks following main repairs. The District also has outside contractors on retainer for asphalt overlays, top soil, and service installations.

The maintenance staff has adequate equipment to handle the day to day and emergency conditions with which they are faced. The equipment includes dump trucks, backhoes, demolition hammers, and one Vac truck unit. The District also maintains an adequate supply of spare parts, fire hydrants, valves, etc. The GBA Master Series software system is used for inventory management. Items taken out of the warehouse are documented on a form which is later entered into the GBA system. The District may wish to consider establishing a bar code system to make the inventory management system more efficient.

From discussions with District staff, it appears that the O&M staff serving Kenton and Campbell counties and the newly acquired City of Newport is not well integrated. Certain staff members have more in-depth knowledge of the system in Kenton County than Campbell County, and vice-versa. It also appears that the same set of standard operating procedures may not be followed for the entire system. In addition, like many other water utilities, a significant number of the District's maintenance staff may be close to retirement age. The District should consider implementing a knowledge management project through which all the residual knowledge and information related to the system is captured, organized and put to effective use throughout the District's service area. This would help ease the transition to new staff members and provide a more uniform set of procedures for operations and maintenance.

7. WATER MAIN REHABILITATION / REPLACEMENT PROGRAM

The District has an ongoing water main rehabilitation and replacement (R/R) program. The program is designed to respond to distribution system water quality concerns and excessive water main breaks, and extending the service life of water mains. The District has extensively used epoxy lining techniques to line unlined cast iron water mains. Cement mortar lining has also been used on a limited basis, but the District's experience has not been positive.

Cleaning of water mains is performed by either drag scraping or power boring. District staff prefers the power boring system as it exerts less stress to the pipe, thereby reducing the potential for resulting damage. One epoxy lining system used is "GEOPOX GX014", manufactured by Mercol Products Ltd. This two-component product, which is applied by spraying to a finished film thickness of 40 mils, takes approximately 16 hours to cure. Following the curing of the liner and reinstatement of service lines, the line is disinfected and tested for water quality. Because the water main may be out of service for several days, above-surface temporary service lines are established to serve customers.

Because epoxy lining is a specialized technique, there are presently few qualified contractors to perform this type of work. This can have an impact on the availability and pricing of projects in the future. It is suggested that the District may wish to consider including cement mortar lining as an alternative in its lining specifications to improve bid pricing competitiveness and ensure there are adequate responses to its project bids. It should be noted that cement mortar lining has been used extensively in the US over the past 30 years and there is a larger pool of qualified contractors to perform this type of work.

The design of NKWD's epoxy-lining projects is performed in-house. The District has developed technical specifications for epoxy lining. Drawings are developed which indicate the location of the main to be cleaned and lined with notes added to replace, add or remove valves or fire hydrants. Valves and hydrants are also replaced; service connections are not replaced as a standard practice.

The District contracts out cleaning and epoxy lining of mains at a cost of approximately $650,000 per year. In addition, the District spends approximately $45,000 for in-house design and inspection services plus another $20,000 in materials supplied to the contractor. The average cost of epoxy lining is approximately $40 per foot. In 2003, the District is cleaning and lining 710 feet of 4 inch cast iron mains, 12,595 feet of 6 inch cast iron water main, and 615 feet of 8 inch cast iron water main, for a total of 13,920 feet (2.6 miles).

Water mains with excessive breakage rates are scheduled for replacement. All replacements are currently accomplished by open cut method. The District has explored, but not utilized any trenchless installation methods because it has not yet been proven to be cost effective. Many utilities nationwide have started using directional drilling for the installation of water lines, and pipe bursting has also become popular. Lining methods (such as subline, rolldown, and duraliner systems) have also been used by water utilities. It is recommended that the District consider using such techniques when it is found to be cost effective. Some installations, such as railroad, highway and environmentally sensitive area crossings, may be good candidates for trenchless installations.

The current water main replacement rate for NKWD is approximately five miles per year. The District replaced approximately 25.6 miles of main from 1998 through 2002, at a total cost of $9.1 million ($72 per foot). The Distribution System Master Plan recommended an annual expenditure of $2.1 million be budgeted for the water main replacement program. At an assumed unit cost of $72 per foot, this translates to approximately 5.5 miles of annual water main replacement (approximately 0.5% of the system).

The District has recently hired a Staff Engineer to manage and further develop the R/R program. Standard operating guidelines for the program are in the process of being established in an internal report by the District. This report will serve the purpose of formalizing a systematic approach to main replacement and rehabilitation. By following a known, defined, procedure, NKWD can be more efficient and consistent in prioritizing mains for replacement and also provide documentation to other interested parties as may be appropriate.

Currently, NKWD is working to develop an application to combine all factors (diameter, age, material, breaks/mile, quality complaints, etc) into one database. Based on discussions with the District, this database will then be manipulated, sorted, filtered and displayed in an ArcView or Excel computer program. The database will place a rank on each main in the system in order to visualize the highest priority for replacement. Essentially, this database will help prioritize the main replacement schedule just as NKWD has done manually for the five-year list. Also, the database will be converted to a shape file for geographic interpretation. Although this is a large task that may take some time to implement, once the database is complete it will provide an up-to-date evaluation of the system. When established, the District will maintain and update the database on a monthly basis.

At the District's request, selected tables and figures from the R/R program are included as Appendix E of this report for information purposes. Please note that these tables and figures are in the process of constant revision as the District continues to refine its program.

a. Decision Criteria for Main Rehabilitation and Replacement. The decision to clean and epoxy line specific water mains is primarily based on an analysis of discolored water problems. When an area is selected for cleaning and epoxy lining, the lines with a previous break history are replaced. Only those pipes that do not have an established break history are cleaned and lined. The District has developed a point-rating system decision model for identifying water main replacement candidates, which is summarized in Table II-12.

Table II-12
NKWD Decision Criteria for Water Main Replacement

Factor	Condition/ Quantity	Points
Discolored Water	If Present	100
Blow-offs	If Present	100
No. of Breaks	1	100
	2	200
	3	250
	4	300
	5	350
	6	400
	= or >7	450
Diameter	= or >16 inches	100
	12 inches	50
	10 inches	25
	8 inches	0
	6 inches	25
	= or < 4 inches and >1 inches	50
	= or < 1 inches	0
Age	> 60 years	100
	= < 60 years	50
Material	Copper	0
	DI	0
	CI	25
	Transite	50
	Steel	75
	PVC	100
	Concrete	125
	Galvanized	150
Street Replacement	If planned	200

The primary source of the District's discolored water problems are old, unlined cast iron mains in the system. Unfortunately, an accurate account of the miles of unlined cast iron pipe is not available to quantify the magnitude of the problem. Combined, the unlined and lined cast iron mains are responsible for 83% of the District's main breaks. Thus, cast iron piping is the cause of most problems experienced by the NKWD distribution system.

Ductile iron piping, which constitutes a major portion of the NKWD system, is a superior product to cast iron pipe and its performance history for the District has been good. However, ductile iron pipe, similar to cast iron pipe, is prone to failure when it is installed in corrosive soil environments. Furthermore, the wall thickness of ductile iron pipe is less than that for cast iron, and as a result less time is required for its walls to be penetrated due to corrosion. While not presently a problem, it is likely that the ductile iron piping will experience more frequent corrosion related failures in future years. The first known installation of ductile iron pipe in the District's system was around 1965, so the earliest ductile iron piping present in the system is approaching 40 years old. Depending on the corrosivity level of the surrounding soils, these pipes could start failing at a higher rate by approximately 2025. The District therefore has a window of opportunity to address its cast iron mains by 2025, before the ductile iron piping begins to become a problem.

b. Water Main Rehabilitation and Replacement Planning. The District is facing two major questions regarding its R/R program:

1. How much funding should NKWD allocate for the R/R Program?

2. How should NKWD prioritize its system for R/R?

Many utilities are faced with these very same issues. The American Water Works Association Research Foundation (AWWARF) has developed a computer model (KANEW) which utilities are using to develop long range pipe R/R plans. Based on the water main inventory and estimated life-span data, KANEW predicts the length of different pipe categories to be rehabilitated or replaced on an annual basis. KANEW is a macro model and does not provide specific locations for R/R. The District has a copy of this model and intends to use it as a planning tool to budget funds for R/R. This model will respond to the question of how much funding is necessary for main rehabilitation and replacement.

A prerequisite to using the KANEW model is to have a complete and accurate inventory of the system components in place. The District's system inventory at this time is incomplete, which would preclude effective use of KANEW. The inventory should be supplemented to include data on material type (lined cast iron, unlined cast iron, poly-wrapped ductile iron, and un-wrapped ductile iron) and age of the system.

On the issue of identifying candidate mains for R/R, NKWD has two options. One option is to revise the current model to include additional parameters; however this would require some programming effort. The second option would be to obtain an available software package designed for water mains, but these models are often inflexible and may not be able to accommodate special needs of the District. However, the in-house model can be as simple as an Excel spreadsheet or Access database.

It is recommended the District consider revising its in-house water main evaluation model. Good examples to consider are those models developed by the Louisville (Kentucky) Water Company (LWC) or Black & Veatch. A description of these two models follows.

i. LWC Pipe Evaluation Model. The Louisville Water Company developed an internal Pipe Evaluation Model (PEM) in 1993 to aid in development of their Main Replacement and Rehabilitation Program (MRRP). It consists of a distributed network of GIS applications that utilize various hardware and software systems. The facilities data incorporated into the model are managed by LWC's Oracle relational database management system. The PEM evaluates the service area on a street segment or block level.

In the PEM, twenty-three different criteria or parameters are used to evaluate the condition of water mains. These parameters are derived from integrating LWC's information systems and data that is obtained from other sources. The PEM integrates facility, hydraulic, and maintenance data from LWC's Facilities Management System, Automated Mapping System, Work Order System, and the City of Louisville Department of Public Works paving data to formulate the database for assessment of the distribution system.

The parameters used by the Louisville Water Company's PEM to rate water mains are listed in Table II-13, along with the associated category type and point value assigned for each.

Table II-13
LWC Pipe Evaluation Model Criteria

No.	Parameters	Category	Rating Range
1	Central Business District	Geographical	Yes = 10 No = 0
2	Redevelopment Zones	Geographical	Yes = 10 No = 0
3	LOJIC Roadway Classification	Geographical	Major Arterial = 10 Minor Arterial = 5 Primary and Secondary Collector = 2 Residential = 0
4	Water Main Size	Hydraulic, Maintenance, Service Quality	<6" diam. = 10 = 6" diam. = 5 >6" diam. = 0
5	Water Main Type	Hydraulic, Maintenance, Service Quality	Asbestos Cement, Delavaud Cast Iron, Steel = 10 All other = 0
6	Joint Type	Hydraulic, Maintenance, Service Quality	Lead, Leadite, Bondo = 10 Unknown = 5 All other = 0
7	Water Main Vintage	Hydraulic, Maintenance, Service Quality	1862-1865 = 10 1926-1931 = 8 1866-1925 = 5 All other = 0
8	Main Break Frequency (# per 100 miles per year)	Hydraulic, Maintenance, Service Quality	>150 = 10 100 - 150 = 8 50 - 100 = 5 25 - 50 = 2 <50 = 0
9	Joint Leak Frequency (# per 100 miles per year)	Hydraulic, Maintenance, Service Quality	>100 = 10 50 - 100 = 5 < 50 = 0
10	Emergency Maintenance	Maintenance	10 points if a special maintenance issue
11	Field Pipe Samples	Hydraulic, Maintenance, Service Quality	Not currently implemented
12	Corrosive Soil Zones	Geographic	10 points if located in corrosive soil area
13	Discolored Water Frequency (# per 100 miles per year)	Service Quality	>50 = 10 10-50 = 5 <10 = 0
14	Taste and Odor Frequency (# per 100 miles per year)	Service Quality	>50 = 10 10-50 = 5 <10 = 0
15	Documented Water Quality Data	Service Quality	Not currently implemented
16	Domestic/Fire Service Density	Maintenance, Service Quality	>2 services per 100 feet = 10 2 services per 100 feet = 5 <2 services per 100 feet = 0
17	Parallel Water Mains	Hydraulic, Maintenance, Service Quality	10 points if segment contains parallel water mains
18	High Pressure Frequency (# per 100 miles per year)	Hydraulic, Service Quality	>100 = 10 50 - 100 = 5 < 50 = 0
19	Low Pressure Frequency (# per 100 miles per year)	Hydraulic, Service Quality	>100 = 10 50 - 100 = 5 < 50 = 0
20	Fire Flow Availability	Hydraulic, Service Quality	<500 gpm = 10 500-750 gpm = 8 750-1500 gpm = 3 >1500 gpm = 0
21	Dead End Water Mains	Hydraulic, Service Quality	Yes = 10 No = 0
22	Lead Service Density	Maintenance, Service Quality	>2 lead services per 100 feet = 10 2 lead services per 100 feet = 5 <2 lead services per 100 feet = 0
23	Paving Data (Pavement Age)	Maintenance, Geographic	>=10 years = 10 5-9 years = 5 <5 years = 0

Each parameter is given a rating as indicated in the fourth column of Table II-13. For example, any water main located in the Central Business District (CBD) is given a rating of 10. In addition to the ratings listed in Table II-13, each parameter can also be assigned a weighting factor. The total score for each segment of water main is then obtained from the following equation:

$$\text{Total Score} = \sum Wi \times Ri \qquad i = 1,2,3,\ldots 23 \qquad \text{Eq. 1}$$

Where Wi is the weighting factor, and Ri is the rating factor for the parameter i.

The total score given to each pipe segment is the basis for prioritizing and developing the rehabilitation plan. The weighting factor provides a simple mechanism to emphasize one or more parameters at different stages of the program. For example, initially, the water quality parameters may be of great concern and given a high weighting factor; however, as water quality problems are resolved, the focus of the program can be shifted to eliminating another factor, such as high incidents of water main breaks.

ii. Black & Veatch Model. The approach used in the B&V Water Distribution Management System (WDMS) is very similar to the approach used in LWC model. The B&V model uses weighted strategic criteria (parameters) to come up with a total strategic score, using an equation similar to Eq.1 above. WDMS also has a cost module which compares the cost of rehabilitation / replacement with the cost of repair of future breaks over the remaining life of the main. The remaining life of the main is estimated from a formula developed by Tom Walski in 1982. This aspect is very important in that it responds to the question of whether replacement is a cost-effective approach as compared with continuing to repair the breaks.

c. Long-Term Rehabilitation and Replacement Program. The most pressing need of the District at this time is to address the issues related to cast iron water mains. This will be a significant undertaking which may take several years. An accurate accounting of the total length of unlined and lined cast iron water mains is not available to make an estimate of the magnitude of this task. However, it is estimated that to bring the situation under full control may take 15 to 20 years. The KANEW model results can provide a basis to determine an appropriate time table for cast iron main R/R.

For discussion purposes, it may be assumed that 50% of the water mains designated as iron pipe are cast iron and 50% of the cast iron is unlined. The estimated length of unlined cast iron under these assumptions would be approximately 200 miles. Lining of 200 miles over a 20 year period would require approximately $2.0 million annually. This is almost three times the amount the District is currently spending on relining of its water mains. While the assumptions need to be validated, it appears that the District should allocate more funds for the lining program.

The current rate of replacement for cast iron water mains (5 miles per year at a cost of approximately $2.1 million) would require approximately 80 years (2083) to replace all of the cast iron mains (assuming 400 miles of cast iron mains). At that time, the "youngest" cast iron water main in the system would be 111 years old (installed in 1965).

8. SYSTEM STRATEGY AND RECOMMENDATIONS

The District's overall strategy for operation and maintenance of the piping system consists of short-term solutions in conjunction with a long-term program. This strategy has the following elements:

- Ongoing maintenance activities such as flushing and installation of blow-offs to control the occurrence of discolored water incidents.
- Cleaning and lining of structurally sound unlined cast iron water mains to eliminate discolored water problems and protect interior of pipe from continued corrosion.
- Replacement of cast iron mains with a high frequency of breaks.

This strategy seems prudent and should minimize the number of water main breaks and discolored water problems in the long run.

At the same time, the reliability of the water service in the District service area depends to a large extent on the performance of its large transmission mains (16-inches and larger). The District has addressed this issue by deciding to replace all steel transmission mains in its system, and constructing a new line parallel to the existing PCCP line which has exhibited several joint problems.

The current O&M practices are generally adequate, although there are several areas where improvements can be made. The ongoing conventional flushing is not very effective in minimizing the discolored water incidents. Unidirectional flushing will produce better results. B&V concurs with the District's decision to execute a pilot unidirectional project with the objective of extending it to the entire system. Inclusion of air scouring technique as necessary will further enhance the results.

B&V also recommends that the District implement a formal leak detection program which would include metering to identify and prioritize the areas with most leaks. Assuming a production rate of 2,000 feet per day with a crew of one person, it would take approximately 10 years to survey the entire system. While the leak detection program will reduce the unaccounted-for-water loss, its primary objective would be to minimize water main breaks. The District's current unaccounted-for water rate of 10% is typical of most utilities and is below the 15% national average.

As discussed earlier, the District has a sizable length of cement lined ductile iron pipe which is not poly-wrapped. These pipes are subject to external corrosion and can lead to pinholes and eventual failure of the ductile iron pipe. Although ductile iron is more robust than cast iron, the ductile iron pipe wall thickness is significantly smaller than cast iron pipe. This means that the pipe wall can be penetrated by the external corrosion process in a much shorter timeframe. While interviews with District staff indicate that the poly-wrapped ductile iron pipes in the system have performed well, some utilities have experienced external corrosion even when poly-wrapping has been used. It appears that groundwater fluctuation may lead to corrosion of ductile iron pipe even with poly-wrapping. While not urgent, it is logical to initiate a program for the protection of ductile iron pipe. The District may want to postpone the initiation of this program to a time in the future when a substantial length of unlined cast iron mains has been rehabilitated.

Based on our review and assessment of the District's distribution system O&M and R/R programs, we concur with the multi-faceted approach adopted by the District and offer the following recommendations to enhance the existing programs:

- Establish a District-wide task force with representatives from engineering, operations and maintenance, water quality and production, information systems, and customer service with the objective to facilitate coordination and ensure that proper and thorough input is provided into the R/R program.

- Develop an understanding of the causes of water main breaks in the distribution system by collecting and analyzing pipe and soil samples from main break repair sites. The suggested time table for completing this task by the end of 2005.

- Continue tracking main breaks, leaks, and water quality complaints. Develop quarterly reports of data. Include a field in the CIS to document the causes of discolored water problems. Use parcel information and GDT for geocoding of incidents.

- Continue routine O&M practices to minimize the impact of discolored water problems. Utilize unidirectional flushing and air scouring as necessary to improve flushing results. It is recommended that the unidirectional pilot be implemented in 2004 and system-wide application be implemented in 2005.

- Establish a formal leak detection program. It is recommended that this program be initiated in 2005 or earlier if possible.

- Consider implementing a knowledge management project through which all the staff knowledge related to the system is captured, organized and put to effective use throughout the service area. A suggested start date for this project is 2005.

- Consider implementing a bar code system for inventory management.

- Develop long term R/R planning strategies. This task involves utilizing the AWWARF KANEW model. The District should first supplement its inventory data with pipe material and age data before this model can be run. The results of this model can be used to develop funding needs over the next 50 years. The funding needs will form the supporting basis for rate adjustment applications to the Public Service Commission (PSC). The suggested time table for completion of this task is 2004 or as soon as practical.

- Revise existing decision model for identifying R/R candidates by incorporating additional relevant parameters. Aspects of the LWC and B&V models can be incorporated as appropriate. In particular, the B&V cost module concept should be incorporated so that a cost benefit analysis of replacement versus continuing to repair breaks can be made. The suggested time table for completion of this task is June 2004.

- Continue with the implementation of the long term R/R.

- Clean and reline structurally sound unlined cast iron pipes. Replace cast iron lines with high frequency of breaks. The relining program should be targeted for completion in 20 years.

- Establish a post-rehabilitation evaluation to determine how effective the rehabilitation practices have been. A suggested frequency is to inspect the line one year and three years after rehabilitation, and every five years thereafter.

- Consider allowing cement mortar lining to improve bid pricing competitiveness and assure adequate number of bid responses.

- Replace water mains with high frequency of main breaks. The replacement program for cast iron will be completed in 80 years.

- Consider using trenchless technologies for pipe replacement.

- Establish a ductile iron pipe protection program. A suggested start date for this initiative is 2015. At that time, the oldest ductile iron main in the system would be 50 years old.

- Continue replacing all old steel transmission mains with ductile iron.

F. PREVENTATIVE MAINTENANCE PROGRAM

This section presents the findings of the evaluation and recommended improvements to NKWD's Preventative Maintenance Program. The section also discusses the role of the Operator 10 (Allmax) software program in the Preventative Maintenance Program, and its flexibility and viability for use by the District in the future.

The field assessment of the Preventative Maintenance Program and Operator 10 software was conducted on July 1 and 2, 2003. As part of the evaluation process, the following staff members who are involved with the Preventative Maintenance Program were interviewed:

- Jim Dierig - Maintenance Manager
- Bill Wulfeck - Operations Manager
- Scott Rymarquis - Maintenance Foreman
- Amy Matracia – SCADA Administrator
- Steve Findley - Mechanic
- Joan Verax - Receptionist

Each person explained their involvement in the Preventative Maintenance Program and their exposure to the Operator 10 software. It was determined that the NKWD staff directly involved in Preventative Maintenance include the Maintenance Manager, the Maintenance Supervisor, the Maintenance Foreman, six Equipment Servicemen, three Mechanics, the Facilities Foreman, and three Facilities Technicians. In addition, instrumentation staff is involved in the Preventative Maintenance Program. The instrumentation staff includes the SCADA Administrator, an Instrumentation Specialist, and an Instrumentation Technician. In addition, insight on the type of data entered and utilized in the Operator 10 software was obtained through these discussions.

NKWD is aware of the importance preventative maintenance has on the overall productivity of the utility. The maintenance philosophy is reflected among personnel at all levels and is demonstrated through regularly scheduled routine maintenance. The staff interviewed at each level exhibited dedication and commitment to quality workmanship and thoroughness. In general, the condition of the facilities reflects this philosophy.

NKWD has programs and regularly scheduled preventative maintenance in place for the following areas:

- Pump vibration, voltage, and amperage tests are conducted each month on units rated over 2100 gpm (3 mgd).
- Each pump rated over 2100 gpm is rehabilitated each year. The electrical components of the pumps are checked at an electrical shop, and the three NKWD pump mechanics perform the mechanical rehabilitation. It was noted that the NKWD pump mechanics do not work on submersible pumps.
- A mowing contract for the facilities is overseen by the Facilities Foreman and the Maintenance Manager.
- Contracts are awarded for tank painting and facilities painting, as needed.
- NKWD awards an electrical contract to perform work twice per year on equipment at various sites. The work consists of cleaning the contacts, meggaring, cleaning switch gears, making any adjustments as required, and greasing equipment as appropriate.
- A contract is awarded for diving inspections at the three raw water intakes. The inspections are done twice per year.

1. OPERATOR 10 PREVENTATIVE MAINTENANCE SOFTWARE

The Operator 10 software program forms a crucial component of the NKWD preventative maintenance program. The evaluation of the Operator 10 software program was performed by navigating through the brief cursory tour of the program as well as talking with users of the software. The program was evaluated for present use in regards to daily procedures, the expandability of the program, and whether it has the capability and upgradeability for future use by NKWD.

The Operator 10 program is currently used to prepare work orders for preventative maintenance procedures on various pieces of equipment. Preventative maintenance is scheduled on a prescribed time interval (i.e. daily, weekly, monthly, quarterly, etc.) which is either suggested by the equipment vendor or through the experience of NKWD maintenance personnel. The Operator 10 work orders also have a priority code; however, a definition of how these codes are assigned is not apparent and their effect on work order generation is minimal.

At the beginning of each week, work orders are generated by the software for equipment due for service that week. When the work is completed, the work order is returned by the maintenance personnel to the supervisor, who forwards it to the administrative assistant for entry into the Operator 10 program. Presently, the administrative assistant enters any comments noted on the work order and/or repairs performed into the system. When a regularly scheduled activity is completed, the Operator 10 program restarts its time schedule sequence at zero. It was noted that any corrective or non-scheduled maintenance work that is performed on equipment is first written by hand on a blank work order by the maintenance personnel, and turned in to the supervisor. The supervisor then reviews the work order, and forwards it on to the administrative assistant, who subsequently sets up a work order for that activity, and enters the information and work performed into the Operator 10 program.

B&V reviewed work orders from November, 2002 as examples of how the work orders are utilized by the maintenance group. As stated above, when a work order is completed, it is returned and the data is entered into the Operator 10 system. While reviewing completed work orders in the system, it was noted most work orders did not have any additional comments. The majority of the work orders had a note on them, but the notes did not explain or give specific information on how the work was completed. Work order documentation varies, and details are not always provided on the cause of the problem and the procedure followed to repair the problem. As a result, there is no history recorded for equipment in the Operator 10 program.

It was noted that additional SCADA capabilities are currently being added to the NKWD pumping stations as part of an ongoing project. Each pumping station will have a "Multi-Lens" system that will transmit information to the plant SCADA system. This information is currently collected by maintenance personnel during site visits to each pumping station, but is not recorded in the Operator 10 system. It is recorded in a spreadsheet not within the Operator 10 system. When the upgrade to the SCADA system is complete, it will be linked to the Operator 10 system.

Presently, the maintenance group uses the Operator 10 software system as a scheduler. The instrumentation group uses the system as a scheduler, and also as a tool for calibration protocols, work orders through PDAs, and basic recordkeeping.

To continue to use the Operator 10 package in the future, it would need to be upgraded periodically to keep the program current. Discussion with the Allmax – Operator 10 Software Company revealed that the product will be well supported in the future. Upgrades along with full use of the features of the program will make the Operator 10 software program viable for years to come.

2. PREVENTATIVE MAINTENANCE PROGRAM RECOMMENDATIONS

The following are B&V's recommendations to enhance the Preventative Maintenance Program:

- Assign a priority numeric code for order of repair to each piece of equipment. A definition should be assigned to each numeric code; e.g., Priority code 1 would be to repair the equipment as soon as possible, Priority code 5 would be repair within one week.

- Add or assign one person to administrate the Operator 10 program for the maintenance department and work in coordination with the SCADA Administrator to utilize the Operator 10 software program more effectively.

- Link the distribution pumping station information from the plant SCADA system into the Operator 10 system. The distribution pumping station information will be provided to the plant SCADA system via the new "Multi-Lens" system. This linkage will eliminate the need for maintenance personnel to collect information from the distribution pumping stations during their visits.

- Currently, the maintenance information resides in the Operator 10 software. This information is not readily available to the maintenance, operations and engineering managers. It is recommended that the maintenance information stored within the Operator 10 software should be made available via the computer network for the use of the above managers.

- Continue to use the Operator 10 software program to produce work orders on timed intervals, but develop priority codes for work orders.

- Document specific details of repairs on work orders, so that future maintenance personnel can use the information.

- Develop a maintenance history timeline that is stored in the Operator 10 program for each piece of equipment.

- Continue to record the hours spent on the job, including the amount of travel time. This will help management plan and schedule future work appropriately.

- Populate all aspects of the Operator 10 program. It is capable of providing:

    - Updated inventory and location of the inventory.
    - Vendor information such as address, phone number, contact name, etc.
    - Where parts may be purchased, part number, and costs.
    - Budget information to reflect hours on the repair or maintenance time, as well as the cost per job when base salaries are included.

- Use the Operator 10 program to automatically generate purchase orders. If the format is not satisfactory, then the information necessary to create a purchase order could be obtained from the Operator 10 software and formatted as desired, or the purchase order generated from the software could be attached to the current NKWD purchase order form to minimize writing purchase orders multiple times. The final order could then be initiated through the Operator 10 administrator or Maintenance Manager by reviewing the inventory.

- Equipment history should be stored in the Operator 10 program. Forecasting potential problem with equipment may be accomplished by reviewing equipment history. For example, in the past, the Richardson Road Pumping Station and TMTP pump seals needed replacement every two years. Maintenance personnel worked with the pump and seal vendors to find a remedy to this problem and the repeated repair was eliminated. With the Operator 10 program, such equipment history is readily available for review. In addition, if similar problems arise at other facilities, then the maintenance personnel can use Operator 10 to review what was done to fix a similar problem, rather than having to "re-invent the wheel" and increase efficiency.

- The maintenance and instrumentation groups should develop consistent priority codes to be entered into the Operator 10 program for determining the priority of equipment maintenance.

- Training of all maintenance staff on the equipment and the Operator 10 program would be beneficial. It is suggested maintenance management use their training budget each year to familiarize all maintenance personnel with the equipment they are repairing and present recommendations from vendors on repairs or maintenance that would make equipment more reliable. If an administrative assistant is hired to oversee and work with the Operator 10 program, that person could train maintenance personnel the hands-on use of the program.

- Knowledge transfer from some of the senior maintenance staff to new staff is imperative. Two of the pump mechanics have 20 plus years of experience, and are planning retirement in the near future. The knowledge and expertise of these staff members is very valuable and will be hard to replace.

3. ALTERNATIVE PM SOFTWARE SYSTEMS

The Operator 10 software is serving NKWD's needs, and the opportunity exists for the District to make additional use of that system's functions. As the District expands its use of PM software into the future, it may wish to examine alternative maintenance systems with other capabilities. One example is a Maintenance Management System (MMS). The MMS focuses on individual tasks that are related to maintaining a treatment facility. A recent innovation complementing MMS has been the development of a tool which places maintenance activities in a "process perspective". The goal of the treatment facility is to produce excellent quality water. MMS allows operations staff to track equipment status, and from a process perspective evaluate whether or not the plant has adequate available capacity. Evaluating the process capacity lets the maintenance staff know immediately what tasks are priorities. The application also tracks daily values on how much capacity the plant is capable of producing.

The Plant Capacity application contains a user-set list of all the equipment that personnel want to monitor. Operations staff input equipment status (In Service, Out of Service, or Stand-by) as needed on every shift, keeping the system updated. Users can view the current status of any piece of equipment, the person who made the changes, the date the status changed, and any comments on the equipment. The user also has the ability to sort the list by area, by status type, or by treatment capacity. The report allows the user to define a treatment "Process", then define treatment "Trains" that make up the process, and then set an "At Risk Value".

An example of this would be a plant that has 10 clarifiers with a sludge pump dedicated to each clarifier and a redundant pump provided for every 2 clarifiers. If the plant requires 8 clarifiers to be in operation at any given time, the logic would be as follows:

- Process: Clarification

- Trains: 10 Trains would be defined with each train made up of one clarifier, the sludge pump dedicated to it, and the redundant pump associated with it.

- The "At Risk Value": The process could be based on firm capacity or average daily flows. In this case it would use 8 clarifiers. That means if there are only 8 trains operating, the plant is at risk of not being able to meet treatment plant objectives for capacity and acceptable water quality.

- Report: When a report is run, it uses the defined logic above to determine whether there is adequate or inadequate capacity available. If there is insufficient capacity, the report indicates where the deficiency lies. The deficient area then becomes the priority for maintenance activities to increase the plant capacity.

G. PUMP INSPECTION PROGRAM

NKWD implemented an on-going Pump Inspection Program (PIP) several years ago to provide an additional element to the overall preventative maintenance efforts. The PIP is conducted on an annual basis, through a bid package with qualified pump repair companies. Each year the District determines which of its pumping units should be included in the PIP. This selection is based on a combination of factors, which include the following:

- Type of service (i.e., raw water, backwash, filter effluent, etc.)
- Run time
- Vibration measurements
- Collected field data (alignment readings, winding temperature, amp readings, etc.)
- Criticality to operations

The District does a very thorough job of collecting data on the pumping units for the purposes of assessing wear and identifying potential repair problems as early as possible. The combination of data collection by NKWD along with the PIP has been very effective at improving the reliability of the District's pumps. By one internal estimate, the PIP has contributed to a decrease of approximately 40% in the overall amount of pump down-time being experienced.

Typically, between five and ten pumps are identified each year for inspection. Once a company is selected for the annual PIP, they physically examine the critical pump components and provide a written inspection report documenting the condition of the unit and any recommended repairs. Depending upon the nature of any recommended repairs, the District may elect to have the PIP contractor to perform the repairs or have them conducted separately, outside the PIP work.

Since the PIP was first implemented in 1998, the District has experienced considerably better operation and reliability of its pumping units. This program is considered a success, and it is recommended that it be continued. Although NKWD has refined the PIP somewhat since its inception, and such enhancements are anticipated to continue as additional experience is gained, no significant modifications to the PIP are recommended.

H. WATER QUALITY LABORATORY

The District's Water Quality Laboratory was reviewed as part of the AMP for space and equipment needs related to current and future analytical testing requirements. NKWD operates a well established laboratory, focusing on compliance monitoring for trihalomethanes (TTHM) and haloacetic acids (HAA), volatile organic compounds (VOCs), total organic carbon (TOC), metals and inorganic compounds. The laboratory also participates in additional and unregulated testing. The analyses that are currently contracted out to other laboratories are for synthetic organic compounds (SOCs), radionuclides, cyanide, mercury, dioxin, and *Cryptosporidium*. The NKWD laboratory is contracted to perform various analyses for surrounding water utilities and private entities, which makes up approximately 20 percent of the entire analytical volume.

The laboratory facility, constructed in 1999, is located at the Fort Thomas Treatment Plant and includes the following rooms.

- Wet Chemistry
- Organics
- Microbiology

- Pathogen
- Balance/Dry Chemical Storage
- Water Purification/Glassware
- Inorganics/Trace Metals
- Gas Storage
- Shipping and Receiving

In addition, the laboratory facility has administrative and clerical areas for support functions related to the lab and areas for future expansion.

1. WET CHEMISTRY ROOM

The Wet Chemistry laboratory is used for general chemical analyses, including but not limited to alkalinity, pH, turbidity, fluoride, and total suspended solids (TSS). It is furnished with the following major equipment items:

- Fume hood
- Sample sink
- Two ovens
- Sample refrigerator (Fisher "Isotemp")

The laboratory staff indicated that spectrophotometric mercury analyses could be performed in this room; however, the instrumentation and equipment would need to be purchased if mercury is considered for in-house compliance monitoring. Future increases in in-house or contracted sample volumes will require an additional refrigerator.

The Wet Chemistry Room is an important part of the laboratory because it houses the most basic and essential equipment needed to operate a compliance laboratory. As regulations become stricter and more testing is required, more bench space will be needed. One option to meet this need is to move the wet chemistry laboratory to the first floor of the building and install cabinets and bench casings. Figure II-34 shows a space on the first floor in the southeast corner that could be modified

Figure II-34

to laboratory space. This would create space for another laboratory room, depending on District plans for future expansion.

2. ORGANICS ROOM

The Organics Room is used for testing organic compounds, such as TTHM / HAA5 and TOCs. Other analyses conducted include a three-year cycle of regulated and unregulated VOCs, which is performed by the laboratory staff. The major equipment in this laboratory includes the following:

- Tekmar Dohrman "Phoenix 8000" TOC Analyzer, with a "Aqua Tek 70" Autosampler
- Hewlett Packard "5972 Mass Spectrometer" with an Hewlett Packard "5890 Gas Chromatograph Series II Plus", a Hewlett Packard purge and trap apparatus, and a Tekmar Dohrman "Aqua Tek 70 Autosampler"
- Hewlett Packard "5890 Series II Gas Chromatograph" with a Hewlett Packard "6890 Series" Injector and Autosampler

The TOC analyzer has been in operation for approximately three years. The Hewlett Packard "5972 Mass Spectrometer" with an HP "5890 Gas Chromatograph Series II Plus" is used for TTHM and VOC analyses. The Hewlett Packard "5890 Series II Gas Chromatograph" with a HP "6890 Series" injector and autosampler is used for HAA analyses. These instruments are currently able to reach detection limits. The laboratory is also equipped with a refrigerator for analytical standards and a fume hood.

The following list includes suggested modifications to this laboratory to accommodate future needs:

- Both Hewlett-Packard "GC 5890" models should be replaced in the near future.
- The TOC analyzer will need to be replaced before 2020.
- The two GC instruments share a helium tank. As the number and total volume of samples increase, a separate helium tank may have to be provided for each instrument.

3. MICROBIOLOGY ROOM

Several equipment items in the Microbiology Laboratory, although currently operational, will need replacement. The equipment in this laboratory room includes the following:

- Two Marketforge "Sterilmatic" autoclaves
- Fisher Scientific "CO_2 Incubator 605"
- Blue M HPC Incubator

The following are suggested modifications to this laboratory to accommodate future needs:

- The Blue M incubator lacks a humidity monitor and controls, which are likely to be required to meet future regulations.
- Future regulations may dictate that the coliform monitoring procedure be changed. The Colilert-Quanti-Tray coliform test, or other EPA approved method, is a reliable and more sensitive method, specifically for *E.coli.* The use of membrane filtration as a backup method may be necessary.

4. PATHOGEN ROOM

The Pathogen Room is currently not used for pathogen testing. The room contains a centrifuge, a refrigerator, and a magnet separation apparatus. There is also a closed-off darkroom for the Zeiss microscope.

According to the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), monthly monitoring of source water for *Cryptosporidium* will be required for two years. In-house analysis could be an alterative to contracting a certified laboratory for these analyses; however, the monitoring is mandated for only a two year period. Previously collected data must be approved to deduct any time from the two-year monitoring period. Should the District choose to pursue performing in-house analysis for *Cryptosporidium*, the laboratory staff should be increased by one full-time position and additional equipment should be purchased. A cost evaluation is recommended before finalizing which approach is selected.

5. BALANCE / DRY CHEMICAL STORAGE ROOM

The Balance / Storage Room is used for weighing dry chemicals. It is equipped with several analytical scales and balances and is considered adequate for the foreseeable future.

6. WATER PURIFICATION / GLASSWARE ROOM

The Water Purification Room is crucial to all laboratory functions. It currently contains two water purification trains: (1) outdated Barnstead "ROpure ST" unit and NANOpureII system (Type One water), and (2) an updated Barnstead "ROpure Infinity" and NANOpure Infinity system (Type Two water) and two glass washers, one of which is dedicated to metals glassware.

The following are suggested alterations to this room to accommodate future needs:

- The older water purification system should be replaced. It would be useful to have a backup of Type One system available in the event one system is inoperable. The metals glass washer relies on Type One water.

Additional equipment items that are located in this room because of space and electric power availability are a medium capacity drying oven and a muffle furnace.

7. INORGANICS / TRACE METALS ROOM

The Inorganics / Trace Metals Room is used for analyses for inorganics and trace metals, and contains the following:

- Perkin Elmer "Atomic Adsorption Spectrophotometer 1100B Flame" and a Perkin Elmer "HGA 700 Furnace" and Perkin Elmer "AS-70 Autosampler"

- Varian "Atomic Adsorption Spectrophotometer Spectra 880" and a Varian "GTA 100 Furnace" and autosampler

- Dionex "DX-120 Ion Chromatograph" and Dionex "AS40 Autosampler"

The Perkin Elmer "HGA 700" furnace unit is out of service because of gas leaks. It is not equipped to interface with a computer and is about to become obsolete because its parts will no longer be manufactured.

The Varian AA is used for the furnace and the Perkin Elmer is used for the flame analyses.

Another important instrument is the ion chromatograph. Dionex has phased out this model and in the next two years spare parts will no longer be available. The IC unit was designed to run only one column for analyses of certain ions.

The following list includes suggested equipment additions to this laboratory room to meet future needs:

- Inductively Coupled Plasma Optical Mass Spectrophotometer (ICP-MS) and autosampler
- Ion Chromatograph (IC) and autosampler

Replacing the Hewlett-Packard AA with an ICP-MS would eliminate the optimization procedures and time lost in superfluous analyses when alternating between flame and furnace on the Varian instrument.

Inductively coupled plasma with mass spectrophotometry is a technique, like atomic adsorption, for determining the concentration of elements in solution. The chief advantage of ICP-MS over atomic adsorption spectrophotometry is the ability to analyze many elements simultaneously. The AA needs different lamps for different elements, requiring additional time commitment and labor for changing lamps.

There are several benefits to adding an ICP instrument to this laboratory room. An ICP-MS can achieve detection limits better than those achieved using an AA, and with higher rate of productivity. The ICP-MS also provides linearity when establishing a calibration curve and can provide a large working range when calibrated. As the regulated maximum contaminant levels continue to decrease, an ICP-MS will be the best means of meeting future detection limits.

An ICP-MS is a very complicated instrument and requires intensive training and skilled operation. In addition, the ICP-MS methods can be complicated by one metal interfering with another and require inter-elemental corrections, which makes them time consuming and intensive.

The space to accommodate an ICP-MS in this laboratory is available or can be made available. There is 90 inches of bench space where the Perkin Elmer "1100B" unit is set up with a vent system. There is also space near the entrance to the laboratory room that could accommodate an ICP-MS and ancillary equipment, but additional venting and gas service would have to be installed.

In the event perchlorate is added to the compliance list, a specific column and method will be required for IC use. Manually changing the columns within the IC can be both time consuming and damaging to the instrument, and may not be possible with the currently used IC model currently in use. The acquisition of a new IC would enable the laboratory staff to monitor for perchlorate, as well as for chloride, bromide, sulfates, nitrates, and fluoride.

8. GAS STORAGE ROOMS

There are two Gas Storage Rooms at the laboratory. One room is used to store nitrous oxide, argon, nitrogen, and oxygen, and the other to store helium and nitrogen gas. An increase in the total volume of samples, especially for TTHM and HAA analyses could increase the consumption of helium. An increase in the volume of samples for inorganic compounds or trace metals could increase the consumption of argon and hydrogen gases.

9. SHIPPING AND RECEIVING

The shipping and receiving area is located near the east entrance. Another sample refrigerator will be needed to accommodate the influx of samples from the surrounding areas and also the increase the in-house samples. There are several locations in the laboratory building that could accommodate a sample refrigerator.

10. LABORATORY INFORMATION MANAGEMENT SYSTEM

Currently, NKWD does not have a dedicated laboratory information management system (LIMS) database or software. Some of the laboratory instruments are connected to the utility network; others are not networked. Future regulations will not mandate the use of a LIMS; however, a networked database would facilitate sample analysis, data retrieval, report generation, and compliance notification.

The District does perform analytical work under contract to some smaller utilities in the surrounding area and a central database system would make the QA/QC record and data retrieval easier. The central database system would make it possible to log samples as soon as they are received in the laboratory, making it easier to track the analyses and results, and could produce results reports which could be accessed by plant staff. The system could also track water quality trends, which would be another useful tool for plant staff. A central database system license can be purchased from a laboratory software company. Depending upon the options selected, the LIMS system could also encompass report generation and compliance notification functions. These would substantially enhance the capabilities of NKWD's laboratory.

One option for evaluating laboratory needs and instrument needs is to develop a detailed database of all the analytical equipment. The database, which can be developed in-house or coordinated with state regulators, should include information such as date of purchase, service requirements, additional components, manufacturer information, and life expectancy. The purpose would be to create a standardized method of surveying and documenting equipment to prepare the laboratory and NKWD for any future instrument purchases.

11. RECOMMENDATIONS

The Water Quality Laboratory is a well-operated facility. The laboratory can operate successfully for the next few years, but updates will be necessary to remain fully operable and in compliance by the year 2020. The following items are recommended to be acquired for the laboratory in the near future:

- Atomic Adsorption (AA) graphite furnace, flame and autosampler
- ICP-MS Autosampler
- Gas Chromatographs and Mass Spectrophotometer
- Additional bench space
- Ion Chromatograph (IC)
- Network instruments and central database system (LIMS)
- Sample Refrigerators
- Total Organic Carbon (TOC) Analyzer
- Water Purification System

III. WATER SALES PROJECTIONS

In July 2001 Black & Veatch completed the "Water System Master Plan" for NKWD. The Master Plan was prepared to provide NKWD with a long-range strategy of hydraulic improvements for the transmission and distribution system in order to meet the District's anticipated needs through year 2020. For that study, future water demands were determined based on various factors, including population growth.

NKWD acquired the water system formerly owned and operated by the City of Newport in 2002. Following that acquisition, the District engaged B&V to prepare an "addendum" to the Master Plan for the purposes of incorporating the Newport system into the planning process and to assess specific reliability aspects of the water transmission network. The Addendum was completed in July 2003, and included merging the computerized hydraulic models of the Newport and NKWD systems.

For the purposes of the AMP the water demand projections developed for the Master Plan, and supplemented by the Addendum, will be utilized. This section of the report summarizes the sales projections for the purpose of anticipating specific planning needs as part of the AMP.

A. POPULATION DATA AND FORECASTS

Historical (1990 and 2000) and projected (2020) population data was obtained from the Ohio-Kentucky-Indiana Regional Council of Governments for Campbell and Kenton Counties, as presented in Table III-1. The estimates listed for years 2005 and 2010 were based on interpolations between the population numbers provided for years 2000 and 2020.

Table III-1
Historical and Projected Population

Year	Kenton County	Campbell County	Total
1990	142,031	83,866	225,897
2000	147,230	88,580	235,810
2005	149,008	90,171	239,179
2010	151,026	91,280	242,306
2020	153,221	92,513	245,734

As indicated above, the population of Kenton and Campbell Counties is anticipated to continue growing at a relatively constant rate into the foreseeable future. For the 2000 to 2020 timeframe, the rate of population increase is expected to average about 0.2% per year for both Kenton County and Campbell County. The region, as part of the Cincinnati metropolitan area, is considered to be an attractive place to live, work, and raise a family. Due to the high quality of life and business-friendly attitude in Northern Kentucky, the District's service area should experience a steady increase in water demands through the study period.

It is noted that although the population of Northern Kentucky and the NKWD service area as a whole is generally increasing at a moderate rate, the City of Newport is expected to experience a slight decline in population for the foreseeable future. In the City of Newport's 2000 "Comprehensive Plan" this population decrease was described as "the result of urban flight to the surrounding suburban areas".

With the incorporation of the Newport water system into NKWD in 2002, the District serves nearly the entire populace of the two counties. In 2000, NKWD provided water service to 97% of Kenton County, and about 95% of Campbell County outside the City of Newport. It is anticipated that by 2020 the District will serve virtually 100% of both counties. Therefore, for the purposes of creating projections of water demands, the Master Plan assumed the service area population would be the same as the total population for the counties.

B. HISTORICAL WATER DEMANDS

Water utilities are expected to meet varying rates of consumer demand based on a variety of conditions. Water consumption can range widely depending upon the time of day, weather conditions, industrial usage, and many other factors. For most utilities, water demand trends will closely match population changes for their service area. The primary exceptions to this pattern are water systems which have a high percentage of their sales to industrial and/or commercial customers.

In preparing the District's 2001 Master Plan and the 2003 Addendum, three particular characteristics of NKWD's water demands were examined:

- *Average Day Demand.* The average day (AD) rate is determined by the total annual water use divided by the number of days in the year. This value is used to estimate revenues and operating costs, and to estimate corresponding maximum day and maximum hour demands.

- *Maximum Day Demand.* Maximum day (MD) use is the maximum quantity of water used on any one day of the year. This value is significant for sizing water supply and treatment facilities, which are typically designed to meet maximum day usage rates. It should be understood that although the MD rate is based on the single greatest demand day, water utilities typically experience multiple days in the year with demands that approach or are nearly as great as the Maximum Day.

- *Maximum Hour Demand.* The maximum hour (MH) rate is the peak rate at which water is required during any one hour of the year. The sizing and location of distribution system facilities (water mains, booster pumping stations, and storage tanks) are typically determined based on this value. Minimum distribution system pressures are normally experienced during maximum hour conditions.

The District's average day, maximum day, and maximum hour water use for 1988 though 2002 is summarized in Table III-2, based on information provided by NKWD.

Table III-2
NKWD Historical Water Use

Year	Average Day (mgd)	Maximum Day (mgd)	Maximum Hour (mgd)
1988	24.4	36.3	46.4
1989	23.2	34.1	44.9
1990	22.6	36.9	43.6
1991	23.7	38.5	57.3
1992	24.1	32.0	50.9
1993	27.1	43.3	59.4
1994	27.5	46.8	63.1
1995	26.7	48.2	68.4
1996	28.3	44.3	NA
1997	30.2	48.6	NA
1998	29.5	46.6	NA
1999	32.6	51.2	68.3
2000	31.0	47.7	68.2
2001	33.3	47.1	NA
2002	36.4*	57.3*	NA

* = The AD and MD values listed include the Newport system effective June 13, 2002.

(Maximum hour information for 1996, 1997, 1998, 2001, and 2002 was not available.)

C. WATER DEMAND FORECASTS

As evidenced by the information in Table III-2, the District has experienced steadily rising average day demands over the last fifteen years, with the average day demands having increased by about 36% in that period, not including the Newport area. However, recent changes in the NKWD service area will affect these demand rates into the future. Key among these changes is the acquisition of the Newport water system and the loss of Boone County and Florence as wholesale customers. In March 2003, Boone County and Florence began purchasing water from the Greater Cincinnati Water Works through a connection under the Ohio River near Constance, Kentucky, thus ending their wholesale purchases from the District. These two users represented a combined average day sales volume of about 6.7 mgd in 2000.

For the Master Plan, a review was conducted of historical water use and metered sales data from the NKWD system, and criteria developed for making sales projections in each service level. Traffic area zone maps created by the Ohio-Kentucky-Indiana Regional Council of Governments were used along with census data to prepare population projections for the service levels, and corresponding industrial, commercial, and institutional demands were allocated proportionately to the population and land use maps. As part of the 2003 Addendum, revised projected system demands were prepared to reflect anticipated population increases, expansion of the NKWD service area, ceasing sales to Boone County and Florence in 2003, and the acquisition of the Newport water system and associated facilities.

Table III-3 presents the total projected water demands for the entire NKWD system, including Newport.

Table III-3
Projected NKWD Water Demands

Year	Average Day (mgd)	Maximum Day (mgd)
2000	37.8	62.4
2005	32.7	54.1
2010	35.1	57.8
2020	39.7	65.5

Although the overall water demands for NKWD will continue increasing, the Newport system does not follow that trend. As previously noted, it is anticipated that the City of Newport's population will decrease at a rate of about 0.8% per year through the study period. The associated water demands in Newport will decline at a comparable rate, as illustrated by the projections shown in Table III-4.

Table III-4
Projected Newport Water Demands

Year	Average Day (mgd)	Maximum Day (mgd)
2000	3.24	5.34
2005	3.21	5.29
2010	3.18	5.24
2020	3.14	5.17

Based on the demand projections for the complete NKWD distribution system, the District will have sufficient capacity from the three water treatment plants (64 mgd combined capacity) to meet maximum day demands for at least the next ten years, and possibly until 2020, depending upon the actual rate of growth experienced. For planning purposes, it is assumed that additional treatment capacity will be needed about 2018.

IV. WATER QUALITY AND REGULATORY ASSESSMENT

This section presents an assessment of the District's ability to comply with current, impending, and potential future water quality and treatment regulations. A detailed discussion of current and impending regulations under the 1986 and 1996 Amendments to the Safe Drinking Water Act (SDWA) is presented in Appendix B. Aspects of these regulations that may affect current treatment practices at the District's three treatment facilities are discussed below.

It is emphasized that the United States Environmental Protection Agency (EPA) is continuously modifying and revising many of these regulations in response to public and water industry comments and results of new research regarding the potential adverse impacts of the compounds to be regulated. The discussion that follows reflects the present position of EPA on various water quality and treatment issues at the time of this writing, and on the proposed and promulgated regulations as currently published. Major changes to this position prior to final promulgation of the regulations may require revision of the conclusions and opinions presented in this report.

As the District currently owns and operates three treatment facilities that utilize two different source waters, the following discussion identifies and evaluates specific compliance requirements for each facility on an individual basis where appropriate. (Unless specified otherwise, regulations discussed herein apply to all of the District's treatment facilities.)

A. TREATMENT PLANT OPERATING DATA REVIEW

Plant operating records for June 2000 through May 2003 for the District's Fort Thomas and Taylor Mill plants, and for August 2001 through May 2003 for the Memorial Parkway plant, were reviewed to evaluate plant performance characteristics and typical operating practices. Information reviewed included daily water quality data (raw, intermediate, and finished water), chemical feed dosages, filter operating data from the District's Monthly Operating Reports (MORs), and plant performance data collected to assess compliance with various regulatory requirements.

A summary of the data compiled during review of the MORs is presented in Tables IV-1 through IV-6.

Table IV-1
Water Quality Data
Fort Thomas WTP (June 2000 – May 2003)

Constituent	Average	Range
Turbidity, NTU		
Raw Water	24.9	2 - 198
Settled	2.3	0.8 – 8.4
Finished Water*	0.07	0.01 – 0.24
pH, units		
Raw Water	7.8	6.5 – 8.5
Top of Filters	7.3	6.9 – 7.5
Finished Water	7.3	6.9 – 7.7
Total Alkalinity, mg/L as $CaCO_3$		
Raw Water	53	17 - 91
Finished Water	49	16 – 94
Total Hardness, mg/L as $CaCO_3$		
Raw Water	131	11 - 263
Finished Water	131	80 – 233
Free Chlorine Residual, mg/L		
Filter Inlet	0.9	0.2 – 2.2
Finished Water	2.0	1.2 – 3.6
Fluoride Residual, mg/L as F		
Raw Water	0.19	0.02 – 0.7
Finished Water	1.11	0.11 – 2.00
Total Organic Carbon, mg/L		
Raw Water	3.08	2.10 – 8.20
Finished Water	2.50	1.50 – 7.34

*Based on combined filter discharge values at 4 hour intervals

Table IV-2
Operating Parameters
Fort Thomas WTP (June 2000 – May 2003)

Parameter	Average	Range
Raw Water Treated, mgd	27.051	16.792 – 40.607
Chemicals Fed, mg/L		
Ferric Sulfate (as 100% $Fe_2(SO_4)_3 \cdot 4.5H_2O$)	7.8	0.2 – 26.7
Coagulant (Clar+Ion)[1]	32.6	12.2 – 73.6
Coagulant (AS3062)[2]	29.7	16.0 – 42.8
Polymer (filter aid)[3]	0.012	0.002 – 0.025
Predisinfectant (at rapid mix)[4]	1.7	0.6 – 2.2
Chlorine		
Pre	1.8	0.9 – 2.0
Post	2.3	0.4 – 4.1
Sodium Hypochlorite (as chlorine)[5]		
Pre	1.6	1.1 – 2.6
Post	1.9	0.8 – 3.4
Powdered Activated Carbon (at reservoir)[3]	10.8	1.0 – 18.4
Copper Sulfate (at rapid mix)[3]	0.50	0.11 – 0.92
Potassium Permanganate (at river)	0.94	0.17 – 2.10
Corrosion Inhibitor	2.38	1.75 – 3.00
Hydrofluosilicic Acid (as fluoride ion)	0.86	0.44 – 1.18
Sodium Hydroxide (as 100% NaOH)[3]		
Pre	3.3	0.8 – 5.7
Post	5.4	0.1 – 10.7
Filter Operating Data		
Filter Run Time, hours	64.7	5.0 – 104.2
Washwater Volume, gallons per backwash	84,500	34,000 – 219,000
Filter Productivity, gals/sq ft per run[6]	13,970	8,010 – 19,050
Unit Filter Backwash Volume, gals/sq ft	151	61 – 391
Disinfection CT Ratio[7]	6.92	1.12 – 24.97

[1]Clar+Ion fed June 2000 – September 2002
[2]AS3036 fed October 2002 – May 2003
[3]Intermittent usage; dosages shown based on days fed only
[4]Predisinfectant fed August 1, 2002 through December 5, 2002
[5]Hypochlorite feed initiated December 2000
[6]Monthly average unit filter run volume values
[7]Ratio of CT provided to minimum CT required

Table IV-3
Water Quality Data
Taylor Mill WTP (June 2000 – May 2003)

Constituent	Average	Range
Turbidity, NTU		
Raw Water	64	3.7 - 1437
Settled	1.4	0.6 - 15
Finished Water*	0.08	0.03 – 0.90
pH, units		
Raw Water	8.0	7.1 – 9.0
Top of Filters	7.4	6.9 – 8.5
Finished Water	7.3	6.8 – 7.9
Total Alkalinity, mg/L as $CaCO_3$		
Raw Water	78	19 - 164
Finished Water	74	27 – 170
Total Hardness, mg/L as $CaCO_3$		
Raw Water	146	82 - 250
Finished Water	145	72 – 271
Free Chlorine Residual, mg/L		
Filters Discharge	0.19	0.02 – 0.90
Finished Water	2.35	1.00 – 3.90
Fluoride Residual, mg/L as F		
Raw Water	0.18	0.04 – 0.60
Finished Water	1.11	0.09 – 1.60
Total Organic Carbon, mg/L		
Raw Water	4.9	2.5 – 12.04
Finished Water	2.5	1.4 – 9.88

*Based on combined filter discharge values at 4 hour intervals

Table IV-4
Operating Parameters
Taylor Mill WTP (June 2000 – May 2003)

Parameter	Average	Range
Raw Water Treated, mgd	5.811	0.273 – 12.667
Chemicals Fed, mg/L		
Ferric Sulfate (as 100% $Fe_2(SO_4)_3 \cdot 4.5H_20$)[1]	15.5	0.5 – 43.2
Coagulant (Hyper+Ion)	25.1	0.16 – 59.9
Polymer (filter aid)[1]	0.047	0.002 – 0.056
Chlorine		
Pre	1.96	0.26 – 4.29
Post	2.66	1.20 – 5.70
Sodium Hypochlorite (as chlorine)[2]		
Pre	1.9	0.6 – 3.7
Post	2.7	2.1 – 4.3
Copper Sulfate[1]	0.50	0.10 – 0.63
Potassium Permanganate	1.0	0.2 – 2.9
Corrosion Inhibitor	1.89	1.00 – 2.25
Hydrofluosilicic Acid (as fluoride ion)	0.8	0.4 – 1.3
Sodium Hydroxide (as 100% NaOH)[1]	1.72	0.32 – 4.03
Filter Operating Data		
Filter Run Time, hours	76.1	5.0 – 159.8
Washwater Volume, gallons per backwash	35,000	18,000 – 107,000
Filter Productivity, gals/sq ft per run[3]	13,600	5,220 – 24,350
Unit Filter Backwash Volume, gals/sq ft	130	67 – 396
Disinfection CT Ratio[4]	5.86	0.95 – 23.81[5]

[1]Intermittent usage; dosages shown based on days fed only
[2]Hypochlorite feed initiated May 1998
[3]Monthly average unit filter run volume values
[4]Ratio of CT provided to minimum CT required
[5]CT ratio less than 1.0 on 01/03/2002

Constituent	Average	Range
Table IV-5 Water Quality Data Memorial Parkway WTP (August 2001 – May 2003)		
Turbidity, NTU		
Raw Water	18.1	1.9 – 120.5
Settled	1.2	0.4 – 6.5
Finished Water*	0.09	0.04 – 0.18
pH, units		
Raw Water	7.7	7.2 – 8.5
Top of Filters	7.3	7.0 – 7.8
Finished Water	7.5	7.2 – 8.0
Total Alkalinity, mg/L as $CaCO_3$		
Raw Water	63	32 - 100
Finished Water	59	32 – 98
Total Hardness, mg/L as $CaCO_3$		
Raw Water	133	76 - 204
Finished Water	135	56 – 206
Free Chlorine Residual, mg/L		
Filter Inlet	2.09	1.60 – 3.20
Finished Water	2.20	1.50 – 3.90
Fluoride Residual, mg/L as F		
Raw Water	0.2	0.1 – 1.0
Finished Water	1.0	0.8 – 1.4
Total Organic Carbon, mg/L		
Raw Water	2.5	2.1 – 3.2
Finished Water	1.6	1.4 – 2.0
Iron, mg/L		
Raw Water	0.57	0.17 – 1.83
Finished Water	0.02	0.00 – 0.11
Manganese, mg/L		
Raw Water	0.18	0.02 – 0.34
Finished Water	0.01	0.00 – 0.02
*Based on combined filter discharge values at 4 hour intervals		

Table IV-6
Operating Parameters
Memorial Parkway WTP (August 2001 – May 2003)

Parameter	Average	Range
Raw Water Treated, mgd	4.887	1.842 – 7.710
Chemicals Fed, mg/L		
Ferric Sulfate (as 100% $Fe_2(SO_4)_3 \cdot 4.5H_20$)	35.3	2.7 – 69.5
Coagulant (polyaluminum chloride)	4.7	0.6 – 16.3
Polymer (LT22S)	0.4	0.2 – 0.8
Chlorine		
Pre	3.1	1.2 – 6.2
Post	1.1	0.3 – 3.1
Copper Sulfate[1]	1.9	0.3 – 6.4
Potassium Permanganate	1.0	0.2 – 2.2
Corrosion Inhibitor	0.7	0.3 – 1.9
Hydrofluosilicic Acid (as fluoride ion)	1.7	0.3 – 4.4
Sodium Hydroxide (as 100% NaOH)		
Pre	8.9	1.0 – 22.2
Post	8.2	1.7 – 20.2
Filter Operating Data		
Filter Run Time, hours	67.2	7 - 136
Washwater Volume, gallons per backwash	100,800	38,400 – 264,000
Filter Productivity, gals/sq ft per run[2]	9,110	5,390 – 15,520
Unit Filter Backwash Volume, gals/sq ft	165	63 – 431
Disinfection CT Ratio[3]	12.78	2.77 – 38.13

[1]Intermittent usage; dosages shown based on days fed only
[2]Monthly average unit filter run volume values
[3]Ratio of CT provided to minimum CT required; data for 07/2002 – 05/2003 only

Settled and filtered water turbidity results for all three of the treatment plants are indicative of excellent performance with respect to the coagulation and filtration processes. The District's average filter productivities (expressed as the amount of filtered water produced per filter operating cycle per square foot of filter area) of approximately 9,000 to 14,000 gallons/sf were very good, exceeding the typically-recommended minimum of 5,000 to 7,000 gallons/sf by a significant margin.

Filter productivities for the Memorial Parkway Treatment Plant are lower than those for the Fort Thomas and Taylor Mill plants. However, this can be attributed primarily to the relatively large surface area per filter at MPTP and the practice of limiting filter run times at 65 to 75 hours. The average unit filter backwash water requirements (expressed as gallons of washwater used per square foot of filter area) for the District's plants are also within the 100-200 gallons/sf range typically observed for well-operated granular media filters equipped with provisions for air scouring.

Reported disinfection CT ratios (expressed as the ratio of the disinfection CT value provided to the minimum CT value required) typically exceed the minimum value of 1.00 by a substantial margin at all three treatment facilities, which indicates that the District typically maintains disinfection conditions which significantly exceed the minimum KDOW-specified requirements. (Refer to section IV-B.2.b for an explanation of disinfection CT.)

B. CURRENT REGULATIONS

1. GENERAL

As discussed in the paragraphs that follow, the District's treatment facilities consistently comply with all current state and federal water quality and treatment requirements. Filtered water turbidity consistently complies with the maximum 0.5 NTU for more than 95% of monthly samples requirement under the current Surface Water Treatment Rule (SWTR), and the recently-enacted 0.3 NTU limit for more than 95% of monthly samples requirement under the Interim Enhanced Surface Water Treatment Rule (IESWTR). The District also complies with the SWTR requirement that a detectable chlorine residual be maintained in at least 95 percent of the monthly distribution system monitoring samples collected. Samples collected from within the distribution system for bacteriological analysis are, with very few exceptions, consistently negative with respect to the presence of coliform organisms. Treated water fluoride concentrations are well below the current Maximum Contaminant Limit (MCL) of 4.0 mg/L and the secondary MCL of 2.0 mg/L.

The District is in compliance with all aspects of the Lead and Copper Rule. The 90th percentile lead and copper concentrations detected at consumer taps in the system have consistently been lower than the EPA-specified Action Levels (0.015 mg/L for lead, 1.3 mg/L for copper), and based on this performance, the District has been placed on reduced (triennial) monitoring status. The treated water also complies with the Phase II and Phase V Synthetic Organic Contaminant / Inorganic Contaminant regulations.

2. SURFACE WATER TREATMENT RULE

The Surface Water Treatment Rule (SWTR) was promulgated during June 1989, and applies to all public water systems treating surface water supplies or groundwater that is determined to be under the direct influence of surface water. This regulation established treatment technique requirements for turbidity and several microbial contaminants.

a. Turbidity. Turbidity data for the combined filter effluent at 4-hour intervals were reviewed for each of the District's treatment facilities. For the Fort Thomas and Taylor Mill plants data for the period from June 2000 through May 2003 (36 months) were reviewed. Similar data for the Memorial Parkway plant was provided only for August 2001 through May 2003 (22 months). In all cases, the turbidity levels of the combined filter effluent was less than or equal to 0.5 NTU for more than 95 percent of the samples analyzed, which indicates that the District was in full compliance with the turbidity requirements of the SWTR. (Note that as discussed in Section IV-A.5 below, the 0.5 NTU filtered water turbidity requirement of the SWTR was superceded in January 2002 by a more stringent 0.3 NTU requirement under the Interim Enhanced Surface Water Treatment Rule.)

b. Disinfection. Under current SWTR regulations, utilities must provide disinfection conditions which will ensure that KDOW-specified levels of inactivation of both *Giardia* cysts and enteric viruses are continuously achieved. KDOW currently requires that utilities maintain disinfection conditions that will provide a minimum 1-log (90 percent) inactivation of *Giardia* cysts. Disinfection efficiency is evaluated through the use of CT values. CT values are the product of the disinfectant residual concentration, C, and the contact time, T, at the point of residual measurement. CT values for disinfection with free chlorine are dependent upon (1) water temperature, (2) pH, (3) chlorine residual concentration, and (4) the level of *Giardia* cyst inactivation required, expressed in terms of log inactivation. EPA published tables that specify required CT values as a function of pH, temperature, chlorine residual and log *Giardia* inactivation in the SWTR "Guidance Manual" (October 1989).

The District has developed computer spreadsheets to assist in assessing the daily compliance with CT requirements. These spreadsheets incorporate the EPA CT tables and calculate plant-specific parameters, such as the disinfectant contact times provided as a function of the water storage reservoir (clearwell) operating levels. The spreadsheets are an effective tool for identifying and maintaining proper treatment conditions that ensure compliance with all applicable disinfection requirements.

As discussed above, the level of disinfection provided within the treatment facilities typically exceeds minimum KDOW-specified requirements by a substantial margin. However, review of daily disinfection performance data for February 2000 through May 2003 indicated that the reported CT ratio, i.e., the ratio of the CT provided within the treatment facility to the minimum required CT, was less than the minimum required 1.0 value at the Taylor Mill plant for four days (3 days during February 2000, and 1 day during January 2003).

Additional review of the District's current CT reporting practices revealed that the manner in which the spreadsheet determines the "CT Required" to assess compliance yields reported CT ratios that are considerably lower than are that which is actually being provided by the treatment facilities. In determining the required CT value for a specific set of disinfection conditions, the current spreadsheet does not interpolate between the published table values for specific pH and temperature conditions, but rather "defers" to CT values presented in the "next higher" pH table and/or the "next lower" temperature table. This approach results in a very "conservative" estimate of the required CT value. However, this practice of "rounding up" to the next higher pH vs. CT table, and of "rounding down" to the next lower temperature vs. CT table results in reported "CT Required" values that may exceed the actual requirements by 50% or more, with subsequent reported CT ratios of less than 1.0. Therefore, this conservative method of calculating the "CT Required" number effectively causes the District to show results which would be out of compliance, when this is not actually the case.

For example, using the Taylor Mill plant data for January 3, 2002 (compliance with the 1.0 minimum CT ratio was not achieved for this day, based on the calculations resulting from the District's current spreadsheet), at a pH of 7.6, a water temperature of 4 degrees C, and a free chlorine residual across the clearwell of 2.1 mg/L, the indicated "CT Required" calculated by the District's spreadsheet is 115 mg-min/L. However, the actual CT requirement for these conditions, as determined using a different CT compliance spreadsheet that incorporates EPA-developed equations to calculate the required CT for a given set of pH, temperature, and chlorine residual conditions, is 77 mg-min/L (a 33% reduction in the required CT value). Had the lower "CT Required" value of 77 mg-min/L been used in determining the CT ratio, the plant would have exceeded the minimum required CT ratio of 1.0 by a significant margin and been in compliance.

The District may want to consider obtaining a commercial CT compliance spreadsheet program that calculates required CTs as a function of specific temperature, pH, and chlorine residual conditions. One such program ("CT Profiler", a Microsoft Excel-based spreadsheet developed by the Utah Division of Water; available for downloading at *http://drinkingwater.utah.gov/blank_forms.htm*) has been used extensively by both water utilities and consultants in assessing CT compliance. This spreadsheet can be customized to fit almost any disinfection process configuration, and can assess and plot the total *Giardia* cyst log inactivation levels for up to 20 separate "segments" within the treatment process. The resulting monthly summary spreadsheet is also suitable for submittal to the state regulatory agency for compliance monitoring purposes. However, NKWD will need to discuss this matter with KDOW to determine their acceptance of other programs for performing the CT compliance calculations besides that currently being used before changing spreadsheets.

3. COLIFORM RULE

Under the revised 1989 Coliform Rule, the District collects 170 distribution system samples per month for analysis of total coliforms, and a maximum of 5 percent of these samples may exhibit the presence of total coliform organisms. (Under the current Coliform Rule the District is required to collect and analyze a minimum of 150 distribution samples per month, but currently collects an additional 20 samples per month.) A summary of the sample results for January 2000 through May 2003 is presented in Table IV-7 (note, those months with no positive samples with respect to presence of coliform organisms are not shown in Table IV-7). These data indicated that the District is in full compliance with the Coliform Rule requirements.

Table IV-7
Coliform Monitoring Results (January 2001 – May 2003)

Month / Year[1]	No. of Positive Samples	% Positive Samples[2]
04/2001	1	0.6
08/2001	1	0.6
10/2001	3	1.8
03/2002	1	0.6
08/2002	2	1.2

[1]Months not listed had no positive coliform samples.
[2]Values ≤ 5.0 indicate compliance with Coliform Rule; 170 samples collected per month.

4. LEAD AND COPPER RULE

NKWD's reported 90th percentile lead and copper concentrations at consumer taps have been consistently less than EPA "Action Levels" of 0.015 mg/L for lead and 1.3 mg/L for copper. A summary of results for the past three monitoring periods is shown in Table IV-8.

Table IV-8
Lead and Copper Monitoring Results

Year	Lead		Copper	
	90th Percentile Value, mg/L	No. of Samples > 0.015 mg/L	90th Percentile Value, mg/L	No. of Samples > 1.3 mg/L
2003	0.008	3	0.399	0
2001	0.003	1	0.236	0
1997	0.000	0	0.138	1

5. STAGE 1 DISINFECTION BY-PRODUCTS RULE

Stage 1 of the Disinfection By-Products Rule (DBPR) became effective on January 1, 2002 for those systems treating surface water and serving 10,000 or more consumers. An assessment of the District's current position with respect to compliance with the Stage 1 DBPR requirements is presented below.

a. Compliance with Revised MCLs. Total trihalomethane (TTHM) results from January 2001 through July 2003 and haloacetic acid (HAA5) results from February 2001 through July 2003 for the District's current distribution system monitoring sites are summarized in Table IV-9 and Table IV-10, respectively. Review of this historical DBP data indicates that compliance with the revised TTHM MCL of 0.080 mg/L and the new HAA5 MCL of 0.060 mg/L is being achieved by the District. The maximum 4-quarter running annual average TTHM concentration during this period was 0.056 mg/L, which is well below the revised MCL of 0.080 mg/L. Likewise, the maximum 4-quarter running annual average HAA5 concentration during this period was 0.035 mg/L, well below the new 0.060 mg/L MCL.

Table IV-9
Total Trihalomethane Concentrations
for Current Distribution System Monitoring Sites

Month / Year	Total Trihalomethanes Concentration, mg/L		
	Average	Range	4-Quarter Running Average
January 2001	0.024	0.018 – 0.037	-
April 2001	0.037	0.029 – 0.044	-
July 2001	0.065	0.046 – 0.116	-
November 2001	0.060	0.047 – 0.095	0.046
January 2002	0.033	0.025 – 0.052	0.049
April 2002	0.036	0.027 – 0.050	0.048
July 2002	0.065	0.045 – 0.116	0.048
October 2002	0.072	0.050 – 0.117	0.051
January 2003	0.017	0.013 – 0.022	0.047
April 2003	0.034	0.029 – 0.046	0.047
July 2003	0.077	0.054 – 0.118	0.050

Table IV-10
Haloacetic Acid Concentrations
for Current Distribution System Monitoring Sites

Month / Year	Total HAA5 Concentration, mg/L		
	Average	Range	4-Quarter Running Average
February 2001	0.018	0.015 – 0.025	-
April 2001	0.026	0.021 – 0.031	-
July 2001	0.038	0.026 – 0.058	-
November 2001	0.036	0.028 – 0.051	0.030
January 2002	0.026	0.021 – 0.041	0.032
April 2002	0.029	0.024 – 0.038	0.032
July 2002	0.038	0.026 – 0.065	0.032
October 2002	0.030	0.014 – 0.052	0.031
January 2003	0.015	0.011 – 0.019	0.028
April 2003	0.031	0.023 – 0.042	0.029
July 2003	0.066	0.035 – 0.115	0.035

b. Compliance with Maximum Residual Disinfectant Levels. The District's reported chlorine residuals for finished water entering the distribution system are typically below the Maximum Residual Disinfectant Level (MRDL) of 4.0 mg/L for all three treatment plants, and therefore NKWD is not expected to have any difficulties in complying with this requirement.

c. Compliance with Enhanced Coagulation Requirements. As is discussed in Appendix B, under the Stage 1 DBPR most systems that treat surface water with average raw water total organic carbon (TOC) concentrations exceeding 2.0 mg/L will be required to operate in an "enhanced coagulation" mode to achieve specified removal rates of TOC. Compliance with the enhanced coagulation requirements is determined based on a 12-month running annual average TOC "removal ratio". The TOC removal ratio is calculated as the ratio of the TOC removal percentage achieved as compared to the TOC removal percentage required. The required TOC removal percentage is based on the source water alkalinity and TOC concentrations. A 12-month running annual average TOC removal ratio equal to or greater than 1.00 indicates compliance with the enhanced coagulation requirements.

TOC removal data for NKWD's three treatment plants for January 2002 (when the enhanced coagulation requirements became effective) through August 2003 are summarized in Table IV-11. (TOC removal calculations for each plant are presented in

Appendix C.) As shown in Table IV-11, the TOC removal performance for the Taylor Mill Treatment Plant exceeds the minimum requirement by a significant margin, and the Memorial Parkway plant consistently exceeds the minimum TOC removal requirement. However, TOC removal ratios for the Fort Thomas plant since January 2002 are significantly lower than those for TMTP and MPTP, and exceed the minimum required 1.00 value by only a relatively small margin.

Table IV-11
TOC Removal Performance for NKWD Treatment Facilities[1]

Parameter	Fort Thomas	Taylor Mill	Memorial Parkway[2]
Average TOC, mg/L			
Source Water	2.91	4.28	2.84
Treated Water	1.96	2.00	1.64
TOC Removal Ratio[3]			
Range	1.06 – 1.16	1.87 – 2.05	1.36 – 1.49
Current (Aug. 2003)	1.10	1.94	1.36

[1]Includes monthly TOC data for January 2002 through August 2003
[2]Does not include January 2002 data (probable erroneous results)
[3]12-month running annual average values

While the Fort Thomas and Memorial Parkway Treatment Plants treat the same source water (Ohio River), it was noted that reported source water alkalinity and TOC concentration records for these plants prior to November 2002 differed, in some cases significantly. As these differences could have an influence on any conclusions regarding plant performance, a comparison of TOC removal performance since November 2002, when reporting of equivalent source water TOC and alkalinity values for both plants was initiated, was conducted. A summary of comparative TOC removal performance for the Fort Thomas and Memorial Parkway plants since November 2002 is presented in Table IV-12.

Table IV-12 Comparative TOC Removal Performance Fort Thomas and Memorial Parkway Treatment Plants		
Month / Year	**TOC Removal Ratio***	
	Fort Thomas	**Memorial Parkway**
November 2002	0.94	1.41
December 2002	1.42	1.32
January 2002	1.48	1.51
February 2002	1.24	1.00
March 2002	1.01	1.10
April 2002	1.47	1.68
May 2002	1.31	2.18
June 2002	0.70	1.19
July 2002	1.30	1.23
August 2002	0.79	1.42
10-Month Average	1.17	1.40
*Ratio = % TOC Removal Achieved / % TOC Removal Required		

The data shown in Table IV-12 confirm that the TOC removal efficiency for the Memorial Parkway Treatment Plant is typically superior to that achieved by the Fort Thomas plant. While a detailed assessment of the probable reasons for these differences in TOC removal performance is outside the scope of this project, several treatment-related factors or characteristics which could possibly contribute to these differences are summarized in Table IV-13.

Table IV-13 Coagulation Process Operating Conditions Fort Thomas and Memorial Parkway Treatment Plants		
Parameter	**Fort Thomas**	**Memorial Parkway**
Coagulation pH (typical)	7.3 – 7.6	6.5 – 6.9
Average Coagulant Dosages, mg/L		
Ferric Sulfate	8	35
Polyaluminum Chloride	33	5

The lower coagulation pH and a greater emphasis on the use of ferric sulfate for coagulation could be the primary factors contributing to the superior TOC removal being achieved by the Memorial Parkway Treatment Plant. However, the potential impacts of implementing a reduced coagulation pH and/or an expanded use of ferric sulfate on TOC removal performance at the Fort Thomas Treatment Plant cannot be readily predicted without first conducting bench-scale testing to examine the results. It is recommended that the District should therefore consider initiating a comprehensive bench-scale testing program at the Fort Thomas plant to assess the following:

- Impact of reduced operating pH on TOC removal and associated coagulant dosages.
- Impact of increased ferric sulfate dosages on TOC removal.
- Correlations between increased TOC removal and reduced disinfection by-product formation potentials.
- Impacts of modified coagulant dosage and different pH on residual solids production.

6. INTERIM ENHANCED SURFACE WATER TREATMENT RULE

The Interim Enhanced Surface Water Treatment Rule (IESWTR) became effective on January 1, 2002 for those systems treating surface water and serving more than 10,000 consumers. An assessment of the District's ability to comply with the new IESWTR requirements is presented below.

a. Compliance with Revised Turbidity Requirements. The District currently complies with the IESWTR requirement that the filtered water turbidity be monitored continuously for each individual filter. Provisions for monitoring effluent turbidity for individual filters at 15-minute intervals and storage of the resulting data for a minimum of three years are also reported to be already in place. As is discussed in Appendix B, under the IESWTR the turbidity of the combined filter effluent must be less than or equal to 0.3 NTU for a minimum of 95% of the monthly samples and cannot exceed 1.0 NTU at any time. The District's data, collected at 4-hour intervals between January 2002 (when the IESWTR became effective) and May 2003, indicate that the turbidity of the combined filter discharge did not exceed 0.3 NTU at any time during this period for any of the three treatment facilities. This suggests that the District should not anticipate any difficulties in complying with the more restrictive 0.3 NTU requirement under the IESWTR.

b. Compliance with *Cryptosporidium* Removal Requirements. The IESWTR specifies that water systems which are found to be in compliance with the revised 0.3 NTU filtered water turbidity requirement are automatically assumed to be achieving the required 2.0-log

(99 percent) removal of *Cryptosporidium* oocysts. As the District is not currently experiencing any difficulties in complying with the 0.3 NTU filtered water turbidity requirement, NKWD should be granted the full 2.0-log *Cryptosporidium* removal credit under the IESWTR.

c. Compliance with Disinfection Benchmarking Requirements. As NKWD's most recent running annual average TTHM and HAA5 concentrations were less than 80% of the Stage 1 DBPR MCLs of 0.080 mg/L and 0.060 mg/L, respectively, the District was not required to develop and submit a disinfection profile for *Giardia.* However, if for some reason the District enacts future changes in disinfection practices to include the use of ozone for primary disinfection, the preparation of a disinfection profile and determination of a disinfection "benchmark" for both *Giardia* and viruses will likely be required by KDOW. In such event, the District would need to consult with KDOW to determine the specific disinfection profile and disinfection benchmark development and submittal requirements. (Note: As is discussed in Section IV.C of this report, under Stage 2 of the Long-Term Enhanced Surface Water Treatment Rule the District will likely be required to prepare *Giardia* and virus inactivation profiles, if this regulation is promulgated as it is currently proposed.)

7. ARSENIC

Recent NKWD monitoring data indicate that arsenic concentrations in the treated water from the three treatment plants are consistently less than 0.0005 mg/L, suggesting that the District should not anticipate any difficulties in complying with the recently-promulgated arsenic MCL of 0.010 mg/L.

8. RADIONUCLIDES

During December 2000, EPA promulgated a final rule for the radionuclides which were identified for regulation in a 1991 proposed rule (radium, alpha, beta, and photon emitters, and uranium). This regulation established a new MCL for uranium of 30 ug/L, but maintained MCLs for the remaining radionuclides at existing levels (5 pCi/L for combined radium 226 and radium 228, 15 pCi/L for alpha emitters, and 4 mrem/yr for beta/photon emitters). Radionuclides normally present problems for utilities that treat groundwater from deep wells or withdraw surface water downstream from an industrial source of radiation. As these conditions do not apply to the District's source waters, continued compliance with these requirements is not expected to present any significant difficulties.

9. PHASE II, PHASE V CONTAMINANTS

The Phase II and Phase V Rules include MCLs or treatment techniques for a total of 45 synthetic organic chemicals (SOCs) and 14 inorganic chemicals (IOCs). Historical quarterly monitoring data for water produced by the District's three treatment facilities indicate that none of these contaminants were present at levels approaching their respective MCLs.

10. FILTER BACKWASH RECYCLING RULE

The Filter Backwash Recycling Rule (FBRR) is applicable to all plants that treat surface water supplies or groundwater which is under the direct influence of surface water. As is discussed in Appendix B of this report, under the FBRR those water treatment plants which are practicing the recycle of filter backwash flows must return them to a location:

1. such that all unit processes of a system's conventional or direct filtration process are employed in treatment of the recycle flow, or
2. "at an alternative location approved by the State".

The District was required to provide the following information to KDOW by December 2003 to assist in the evaluation of the adequacy of NKWD's current recycle practices:

- A process flow diagram illustrating the origin of all flows that are recycled, the method of conveyance of the recycle flow(s), and the location at which these flows are reintroduced back into the treatment process.
- Data on typical recycle flow rates (in gallons per minute), maximum plant flow rate during the previous year of operation, and plant design capacities and state-approved maximum plant operating capacities.

Systems must be in compliance with the recycle provisions of the FBRR no later than June 2004. If KDOW determines that an alternative backwash recycle return point must be provided for the facility, and significant capital improvements are required in order to modify the location of the recycle return, the Division may grant a two-year compliance extension, and the improvements must then be in place and operational no later than June 2006. Additional recordkeeping requirements under the FBRR will include maintaining data on:

1. typical filter operation and backwashing practices,

2. frequency of backwash recycling, and

3. the capacity and physical dimensions of any wash water recovery basins and associated facilities.

Filter backwash flows at the Fort Thomas Treatment Plant are collected in a basin and recycled to the north presedimentation reservoir inlet. Filter backwash flows at the Memorial Parkway plant currently discharge directly into the north reservoir, decant from the north reservoir then enters the south reservoir, from which the combined raw water and recycle flows are conveyed to the treatment process. No in-plant recycling of waste flows is practiced at the Taylor Mill Treatment Plant. As the recycled filter backwash flows at both the Fort Thomas and Memorial Parkway plants undergo complete treatment, the District should comply with the recycle location requirements of the FBRR, and the only impact of this regulation will be increased reporting and recordkeeping requirements.

C. PENDING REGULATIONS

1. GENERAL

Several new water quality rules are scheduled for promulgation and implementation within the next few years. As these new regulations have only recently been formally proposed, the requirements which are presented herein are subject to change in response to public comments received and/or new information that may be developed during the regulatory promulgation process. Therefore, the relative impact of these regulations on the District's current treatment operations is difficult to predict with any certainty at this time. However, Black & Veatch maintains close contact with those parties involved in the development and preparation of these new regulations, and the information presented in this section reflects the latest thinking with regard to the substance of these regulations. The information presented herein should be reviewed and revised as necessary when the rules are finalized or additional information is available.

2. STAGE 2 DISINFECTION BY-PRODUCTS RULE

Stage 2 of the Disinfection By-Products Rule was recently proposed in August 2003, and it is currently expected that this regulation will be finalized during mid-2005. The compliance assessment summarized below is based on the information presented in the proposed rule, and assumes that the regulation will be promulgated as it is currently scheduled.

"Stage 2A" of the DBPR regulation, which will become effective three years after promulgation (i.e., by July 2008), will require that water systems comply with locational running annual average (LRAA) TTHM and HAA5 MCLs of 0.120 mg/L and 0.100 mg/L, respectively, at each of their current DBP monitoring locations. Systems must also continue to comply with the impending Stage 1 MCLs for TTHMs and HAA5 of 0.080 mg/L and 0.060 mg/L, respectively, based on the system running annual average values.

"Stage 2B" of the DBPR regulation, which will become effective six years after the rule's promulgation, (i.e., by July 2011), will require compliance with running annual average TTHM and HAA5 MCLs of 0.080 mg/L and 0.060 mg/L, respectively, at individual "revised" distribution system monitoring locations. (KDOW has the option of extending this compliance deadline, on a case by case basis, by up to two years if significant capital expenditures will be required to achieve compliance.) As is discussed in Appendix B, for NKWD these revised monitoring locations will be selected based on one year of system DBP monitoring at 60-day intervals at 24 locations (8 locations per treatment plant), which are not currently included in the District's DBP monitoring program. This new monitoring is referred to in the proposed regulation as the Initial Distribution System Evaluation (IDSE) monitoring study. The primary purpose of this additional monitoring is to identify those areas within the distribution system where the DBP levels are highest.

It should be noted that alternative approaches to the method of selecting the number of monitoring sites utilized during this initial system monitoring are currently being evaluated by the Advisory Committee responsible for development of this regulation. Determination of the number of monitoring sites based on total population served, rather than the number of plants serving the system is one alternative reportedly receiving serious consideration.

This monitoring must be completed and a report summarizing the testing results and the District's recommended revisions to the current monitoring sites are required to be submitted to KDOW within two years of promulgation of the Stage 2 rule (i.e., by July

2007). It is also emphasized that under Stage 2B of this regulation, DBP monitoring at the revised locations identified during the IDSE study must be conducted during the month that has exhibited the highest historical DBP formation levels.

A summary of recent quarterly running annual average TTHM and HAA5 concentrations from each of the District's 12 current distribution system compliance monitoring locations is presented in Tables IV-14 and IV-15, respectively. These data suggest that NKWD should easily comply with the Stage 2A TTHM and HAA5 MCLs of 0.120 mg/L and 0.100 mg/L, respectively, at these individual monitoring sites using the current disinfection practices.

Table IV-14
Running Annual Average TTHM Concentrations vs. Monitoring Location

Monitoring Location	Location ID. No.	LRAA TTHM Concentration, mg/L[1]
5229 Taylor Mill Road	T01	0.037 – 0.049
1717 Dixie Highway (Lookout Corp.)	T04	0.039 – 0.048
UDF 18th & Overbrook / Shop Smart	T29 / T34[2]	0.040 – 0.055
Post Office, Ludlow	T31	0.040 – 0.051
4308 Winston Avenue, Latonia	T32	0.040 – 0.051
Cold Spring City Building	T38	0.038 – 0.044
432 Clay Ridge, Grants Lick	T40	0.053 – 0.065
Madison Pike	T44	0.076 – 0.084
330 York, Newport (Court House)[3]	T47	0.039 – 0.041
330 E. 10th, Newport (Speedway)[3]	T48	0.035 – 0.038
509 Grandview Ave., Newport[3]	T50	0.044 – 0.045
524 W. 12th Street, Newport (JSA)[3]	T51	0.050 – 0.051

[1]Includes data for 11/2001 (4th quarter) through 07/2003 (3rd quarter).
[2]Site T29 deleted from monitoring program 02/2003, site T34 added.
[3]Includes quarterly data for 07/2002 (3rd quarter) through 07/2003 (3rd quarter) only.

Table IV-15 Running Annual Average HAA5 Concentrations vs. Monitoring Location		
Monitoring Location	**Location ID. No.**	**LRAA HAA5 Concentration, mg/L[1]**
5229 Taylor Mill Road	T01	0.024 – 0.033
1717 Dixie Highway (Lookout Corp.)	T04	.0.25 – 0.031
UDF 18th & Overbrook / Shop Smart	T29 / T34[2]	0.025 – 0.043
Post Office, Ludlow	T31	0.026 – 0.036
4308 Winston Avenue, Latonia	T32	0.026 – 0.029
Cold Spring City Building	T38	0.024 – 0.041
432 Clay Ridge, Grants Lick	T40	0.036 – 0.047
Madison Pike	T44	0.039 – 0.057
330 York, Newport (Court House)[3]	T47	0.029
330 E. 10th, Newport (Speedway)[3]	T48	0.026
509 Grandview Ave., Newport[3]	T50	0.029
524 W. 12th Street, Newport (JSA)[3]	T51	0.029

[1]Includes quarterly data for 02/2001 (1st quarter) through 07/2003 (3rd quarter).
[2]Site T29 deleted from monitoring program 02/2003, site T34 added.
[3]Includes quarterly data for 10/2002 (4th quarter) through 07/2003 (3rd quarter) only.

Review of recent DBP monitoring data suggests that compliance with the more restrictive Stage 2B TTHM MCL of 0.080 mg/L at revised system monitoring locations will likely be difficult for the District to achieve using current treatment/disinfection practices. Locational running annual average TTHM concentrations have consistently approached or exceeded 0.080 mg/L at one of the District's current monitoring sites (Site T44; Madison Pike), and have approached 0.080 mg/L at one of the District's current monitoring sites not used for compliance reporting purposes (Site T33; Clarion Manufacturing, Walton). Other monitoring sites exhibit TTHM concentrations exceeding 0.120 to 0.130 mg/L during the summer months, and Site T44 (Madison Pike) exhibited a TTHM concentration of 0.164 mg/L during August 2001. The LRAA HAA5 concentration at Site T44 (0.057 mg/L) for the 3rd quarter 2003 monitoring period also approached the MCL of 0.060 mg/L.

It is anticipated that the required Initial Distribution System Evaluation (IDSE) monitoring will identify areas with higher TTHM and HAA5 concentrations than have been typically observed at the District's current DBP monitoring sites. It was also noted that the current practice of reporting of DBP monitoring data for the month of July does not result in reporting of TTHM concentrations for the month with historically highest concentrations, as will be required under Stage 2B. As shown in Table IV-16, recent monthly data for the District's current DBP compliance monitoring sites suggest that TTHM concentrations within the distribution system served by the District's three treatment facilities are typically higher during August and September than in July. Reporting of TTHM monitoring data for August or September during 2001/2002 would have resulted in values ranging from approximately 22 to 56 percent higher than for the July monitoring period. Modification of DBP reporting practices under the Stage 2 DBPR to incorporate the month of peak historical TTHM and HAA5 production, in conjunction with use of the revised DBP monitoring locations identified during the IDSE process will result in reported TTHM and HAA5 concentrations that exceed current values.

Table IV-16
Average TTHM Concentrations vs. Monitoring Period (Current Monitoring Sites)

Year	Average System TTHM Concentration, mg/L		
	July*	August	September
2001	0.065	0.102	0.089
2002	0.065	0.085	0.079

*July is current 3rd quarter DBP compliance monitoring month

Based on review of historical DBP monitoring data, it is clear that reductions in current DBP concentrations within the District's distribution system will be required in order to comply with the Stage 2B MCLs at individual monitoring sites, and to continue to provide high-quality finished water to the consecutive systems served by the District. Potential DBP reduction measures are discussed in Section IV.F.

3. LONG-TERM 2 ENHANCED SURFACE WATER TREATMENT RULE

The Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was proposed during August 2003, and it is currently expected that this regulation will be finalized during mid-2005, along with the Stage 2 DBPR. The compliance assessment summarized below is based on information presented in the proposed rule, and assumes that the regulation will be promulgated as currently scheduled. It is emphasized that EPA may elect to modify these regulatory provisions based on input received during the public comment period and/or new information developed during the regulatory promulgation process.

Specific treatment requirements under this regulation will be determined based on results from two years of monthly monitoring of the Ohio River and Licking River supplies to assess average source water *Cryptosporidium* concentrations. Source water monitoring will need to be completed, and a report summarizing the resulting data will need to be submitted to KDOW, within two and one-half years of promulgation of the LT2ESWTR, i.e., by January 2008. (Source water monitoring and reporting can be completed prior to January 2008 if the data is obtained in accordance with EPA-specified requirements.) If this monitoring reveals that 12-month running average source water *Cryptosporidium* concentrations equal or exceed 0.075 oocysts per Liter, the District will be required to provide increasingly-stringent levels of oocyst physical removal, in addition to a minimum 1-log inactivation by disinfection if average oocyst concentrations exceed 1.0 per Liter. Compliance with these more stringent treatment requirements would be required by mid-2011 at the earliest, and KDOW could grant compliance extensions of up to two years if significant capital improvements are required to achieve compliance.

The District has monitored source water *Cryptosporidium* levels at the Fort Thomas and Taylor Mill plants using EPA Method 1623 since February 2002, and initiated monthly source water *Cryptosporidium* monitoring at all plants during late April 2003. These preliminary monitoring results suggest that the District will be placed in "Bin 1" (no additional treatment required) if future monitoring results continue to be negative with respect to presence of *Cryptosporidium* oocysts in the source water. However, it is emphasized that only limited monitoring has been conducted thus far, and therefore firm recommendations regarding potential compliance requirements cannot be made until the required monitoring has been completed.

It is the District's intention that the *Cryptosporidium* monitoring data currently being collected be utilized as the basis for assessing bin placement under the LT2ESWTR. It is therefore critically important that this monitoring be conducted in accordance with the requirements presented in the proposed LT2ESWTR and the accompanying draft "Source Water Monitoring Guidance Manual for Public Water Systems for the Long Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule)" (EPA 815-D-03-005, June 2003). *Cryptosporidium* monitoring requirements specified in these documents for samples collected prior to promulgation of the LT2ESWTR include the following:

- It is recommended that utilities develop a monitoring schedule listing the calendar date on which each sample will be collected. Samples should be collected each month within 2 days of the dates specified in the monitoring plan prepared by the utility.

- *Cryptosporidium* analyses must be conducted by an EPA-approved laboratory.

- Minimum sample volume analyzed must be 10 L.

- Source water samples must be collected prior to any treatment.

- The utility must certify that all monitoring results collected are reported, that the samples analyzed were representative of the plant's source water(s), and that source water(s) have not changed.

- EPA recommends that utilities conducting early monitoring collect and analyze *E. coli* samples with each Cryptosporidium sample and measure source water turbidity during each sampling event.

The proposed LT2ESWTR states that systems are "requested, but not required, to notify EPA prior to promulgation of the LT2ESWTR of their intent to submit previously collected data." The proposed LT2ESWTR also states that:

> "Systems that have at least 2 years of previously collected data to grandfather when the LT2ESWTR is promulgated and do not intend to conduct new monitoring under the rule are required to submit the previously collected data to EPA within 2 months following promulgation. This will enable EPA to evaluate the data and report back to the utility in sufficient time to allow, if needed, the utility to contract with a laboratory to conduct monitoring under the LT2ESWTR."

As two years of monthly source water monitoring data will be available by March 2005, this provision will likely be applicable. Therefore, the District should plan to notify EPA of its intention to submit previously-collected *Cryptosporidium* monitoring data, and also discuss specific requirements for acceptance of the existing data with the Agency prior to July 2005.

As discussed in Appendix B, the proposed LT2ESWTR includes two allowable source water monitoring and bin classification approaches:

- If samples are collected once per month, bin classification is to be based on the highest 12-month running annual average of monitoring results.

- If samples are collected twice per month, bin classification is to be based on a 2-year mean value of <u>all</u> monitoring data. (This increased monitoring must be conducted at evenly distributed time intervals over the 2-year period.)

The increased analytical costs associated with twice-per-month *Cryptosporidium* monitoring are significant as compared to monthly monitoring (approximately $11,000 additional per source over the two-year monitoring period, based on a unit cost of $450 per sample). However, in most cases, this increased level of monitoring will be beneficial with respect to bin classification for systems treating source waters where *Cryptosporidium* oocysts may be present in the watershed. As costs associated with increased levels of *Cryptosporidium* removal/inactivation will likely be substantial, the District should consider increasing source water monitoring frequency to twice per month.

As chlorine is ineffective with respect to the inactivation of *Cryptosporidium* oocysts, provisions for performing primary disinfection using an alternative disinfection process such as ozonation or UV irradiation could be required if this regulation is implemented as it is currently proposed, and inactivation of *Cryptosporidium* is required based on the results of source water monitoring. As discussed in Appendix B, the District will be able to select from a wide range of available treatment methodologies in order to achieve the required level of *Cryptosporidium* removal/inactivation. Another treatment option that could be considered would be the use of membrane processes such as microfiltration and ultrafiltration, which provide positive physical removal of *Giardia* and *Cryptosporidium*.

All large systems which are required to monitor source water *Cryptosporidium* oocyst concentrations will also be required to prepare *Giardia* and virus inactivation profiles under the LT2ESWTR, if promulgated as currently proposed. The District would be required to document the total level of *Giardia* and virus inactivation achieved at each treatment facility at least once per week over a period of at least one year, beginning two years after promulgation of the LT2ESWTR (i.e., by July 2007, if this regulation is promulgated as currently anticipated). The District currently monitors and records daily disinfection CT levels provided and the level of *Giardia* cyst inactivation achieved within the treatment facilities. The spreadsheets currently used to determine the level of *Giardia* cyst inactivation achieved could be modified to also calculate the level of enteric virus inactivation achieved. Plant staff will need to develop this capability prior to the July 2007 deadline for initiating the disinfection profiling process.

Comments on potential compliance requirements presented in this report should be regarded as preliminary, and a reassessment of compliance requirements should be conducted immediately following completion of source water *Cryptosporidium* monitoring.

4. RADON

As discussed in Appendix B, EPA has proposed a new MCL for radon of 300 pCi/L, and an alternative MCL of 4,000 pCi/L when a multimedia radon mitigation program is put in place by state regulatory agencies. It is currently anticipated that a final radon rule will be issued during December 2004. Considerable controversy currently surrounds the regulation of radon in drinking water supplies, and modification of this regulation as currently proposed could significantly alter the requirements contained in the final rule. However, as the District treats only surface water supplies, which typically do not contain radon at levels approaching or exceeding the proposed MCL, it is expected that this regulation will have no impact on current District treatment practices.

D. FUTURE REGULATIONS

As discussed in Appendix B, during July 2003 EPA announced its intention to consider revisions to the 1989 Total Coliform Rule (TCR). This action is in response to recommendations presented in the May 2002 "Stage 2 M-DBP Agreement in Principle", which served as the basis for development of the proposed Stage 2 DBPR and the proposed LT2ESWTR. The Federal Advisory Committee responsible for development of the Agreement recommended that EPA (1) evaluate available data and research on public health risks related to distribution systems, and (2) work with stakeholders to initiate a process for addressing cross connection control and backflow prevention, in addition to considering other distribution system requirements related to significant health risks. This was based on the following points recognized in the Agreement:

- "Finished water storage and distribution systems may have an impact on water quality and may pose risks to public health."
- "Cross connections and backflow in distribution systems represent a significant public heath risk."
- "Water quality problems can be related to infrastructure problems and that aging of distribution systems may increase risks of infrastructure problems."
- "Distribution systems are highly complex and that there is a significant need for additional information and analysis on the nature and magnitude of risk associated with them."

EPA, in conjunction with several external distribution system experts, has developed nine "white papers" that address various distribution-related issues. The purpose of these white papers, which only present available information and do not reflect EPA policy, is to review available data on potential health risks associated with distribution system issues and to identify areas where additional research may be warranted. The nine white papers and the agency responsible for their preparation are as follows:

- "The Potential for Health Risks from Intrusion of Contaminants into the Distribution System from Pressure Gradients" (American Water Works Service Company)
- "Potential Contamination Due to Cross-connections and Backflow and the Associated Health Risks" (EPA)
- "Deteriorating Buried Infrastructure Management Challenges and Strategies" (American Water Works Service Company)
- "Permeation and Leaching" (American Water Works Association)
- "Nitrification" (American Water Works Association)
- "Finished Water Storage Facilities" (American Water Works Association)
- "Effects of Water Age on Distribution System Water Quality" (American Water Works Association)
- "Health Risks from Microbial Growth and Biofilms in Drinking Water Distribution Systems" (EPA)
- "New or Repaired Water Mains" (American Water Works Association)

Based on these considerations, EPA indicates that it intends to undertake a rulemaking process to initiate possible revisions to the TCR that may include new requirements for ensuring the integrity of distribution systems. The schedule for this process and probable outcomes are both uncertain at this time. However, as the potential cost implications associated with adoption of strict new distribution system regulations could be significant, the District should monitor developments related to revision of the TCR closely over the next few years.

E. KEY COMPLIANCE DATES

A summary of key compliance dates for impending regulatory requirements is presented in Table IV-17.

Table IV-17
Key Dates for SDWA Regulatory Compliance

Date	Regulation	Activity / Compliance Requirements
Dec. 8, 2003	FBRR	Deadline for written notification to KDOW regarding filter backwash recycle practices
Dec. 2003	Radionuclides	Revised MCLs for radionuclides effective
July 2005	LT2ESWTR Stage 2 DBPR	Projected regulatory promulgation date.
Oct. 2005[1]	LT2ESWTR	Deadline for submittal of source water monitoring schedule to EPA
Jan. 2006[2]	Stage 1 DBPR	Recommended deadline for initiating IDSE monitoring
Jan. 2006[1]	LT2ESWTR	Deadline for initiating 2-year source water *Cryptosporidium*, *E. coli*, & turbidity monitoring program
July 2007[2]	Stage 2 DBPR	Deadline for submittal of report to KDOW summarizing IDSE monitoring results
July 2007[1]	LT2ESWTR	Begin disinfection profiling
Jan. 2008[1]	LT2ESWTR	Deadline for submittal of results of 2-year source water monitoring program to KDOW
July 2008[2]	Stage 2 DBPR	Compliance with "Stage 2A" MCLs at individual system monitoring sites
July 2008[1]	LT2ESWTR	(1) KDOW determines *Cryptosporidium* bin classification (2) Complete disinfection profiling with one year of data
July 2011[1]	LT2ESWTR	(1) Deadline for compliance with additional *Cryptosporidium* treatment requirements[3] (2) Deadline for submittal of documentation for utilization of microbial toolbox options to IEPA
July 2011[2,3]	Stage 2 DBPR	Compliance with "Stage 2B" MCLs at individual system monitoring sites

[1]Assumes promulgation of LT2ESWTR during July 2005.
[2]Assumes promulgation of Stage 2 DBPR during July 2005.
[3]Extension of up to two years can be granted by KDOW if capital improvements are required to achieve compliance.

F. DISINFECTION BY-PRODUCT COMPLIANCE OPTIONS

As discussed above, the primary regulatory compliance issue that the District will need to address within the next 5 to 6 years will be implementing a strategy to reduce the level of disinfection by-products within the distribution system in order to meet the requirements of the Stage 2 DBPR at individual system monitoring sites. Various DBP control options were discussed in detail in the September 2001 Black & Veatch report "Northern Kentucky Water District; Fort Thomas Water Treatment Plant Evaluation", and therefore, detailed descriptions of the various DBP reduction options are not presented herein. This section presents an overview of the conclusions presented in the 2001 report and an updated assessment of potential DBP control measures and their applicability to the District's existing treatment facilities, based on new information developed since the initial evaluation of DBP control options was conducted during 2001.

The Fort Thomas Treatment Plant currently supplies the majority of the treated water delivered to the District's customers (approximately 70% of total system production over the past three years), and is the primary source of finished water for the consecutive systems (wholesale customers) served by the District. The hydraulic residence time of the Fort Thomas finished water within the distribution system is therefore believed to be significantly longer than that for the Taylor Mill and Memorial Parkway plants. As free chlorine is used to maintain a disinfectant residual within the distribution system, the long hydraulic retention times for Fort Thomas plant effluent results in the continued formation of DBPs as the water progresses through the system. The Fort Thomas plant should therefore be the primary focus of initial efforts to reduce treated water DBP concentrations in the system. However, the conclusions and recommendations presented herein would apply to all of the District's treatment facilities. Efforts to reduce finished water DBP concentrations at the Taylor Mill and Memorial Parkway plants may also be required as the areas served by these plants expand.

1. COAGULATION IMPROVEMENTS

As discussed above, review of recent NKWD monitoring data indicated that TOC removal performance at the Fort Thomas plant was notably less efficient than at the Taylor Mill and Memorial Parkway plants. The Fort Thomas plant produces a high-quality finished water that meets (and in many cases exceeds) all applicable minimum water quality requirements. However, it is emphasized that coagulation practices that are optimized to yield low settled and filtered water turbidities and acceptable filter productivities may not also provide optimal levels of TOC removal. Opportunities may therefore exist to reduce DBP formation by increasing current levels of TOC removal through the modification of coagulation practices and/or expanded use of powdered activated carbon to adsorb DBP precursor compounds. The extent to which modified coagulation practices could reduce DBP concentrations within the distribution system can be readily assessed through bench-scale testing, as is discussed later in this section.

2. ALTERNATIVE DISINFECTANTS

a. Chloramination. As was presented in the September 2001 Fort Thomas plant treatment evaluation report, one approach to reducing DBP concentrations within the distribution system would be to limit chlorine contact times to the minimum required to comply with disinfection requirements (with an appropriate factor of safety maintained to allow for typical variations in water quality and treatment conditions). This can be accomplished by adding ammonia to convert the free chlorine residual to chloramines ("combined chlorine") following the appropriate contact interval. When ammonia is added to water at dosages sufficient to convert all of the free chlorine residual to the chloramine form, TTHM and HAA5 formation is essentially halted. This approach has been successfully adopted by many utilities to comply with current DBP requirements. Additional benefits of using chloramines as a secondary disinfectant observed by these utilities include an improved ability to maintain adequate disinfectant residuals within the extremities of the distribution system, and improved control of biofilms within the distribution system. Potential disadvantages of chloramines include the increased potential for nitrification problems within the distribution system if appropriate chlorine/ammonia ratios are not maintained and/or if the chloramine residual concentrations are not maintained at adequate levels.

A review of monthly data on finished water TTHM concentrations at the discharge of each of the District's three treatment facilities suggests that conversion of the free chlorine residual to chloramines at the plant discharge could yield significant reductions in DBP concentrations within the distribution system. As is shown in Table IV-18, TTHM concentrations at the plant discharges averaged only 0.030 – 0.032 mg/L during the period evaluated. Assuming minimal additional formation of TTHMs were to occur following addition of ammonia to convert the free chlorine residual to the chloramine form, these data suggest that chloramination could be an effective approach to compliance with the more restrictive DBP requirements at individual monitoring sites under the Stage 2 DBPR.

Table IV-18
Historical TTHM Concentrations at Plant Discharge

Plant / Location	Period Reviewed*	TTHMs at Plant Discharge, mg/L	
		Average	Range
Fort Thomas	Jan. 2000 – July 2003	0.032	0.008 – 0.081
Taylor Mill	Jan. 2000 – July 2003	0.032	0.001 – 0.069
Memorial Parkway	Jan. 2003 – July 2003	0.030	0.009 – 0.051

*TTHM data collected monthly.

District staff has expressed strong reservations regarding the use of chloramines for DBP control, and a preference to thoroughly evaluate all other DBP control options prior to any decision to consider conversion to chloramines. However, it should be noted that this evaluation suggests that chloramines could be a cost-effective means of meeting future DBP control requirements, and should therefore be investigated further during future planning efforts as a potential DBP control technique.

b. Alternative Primary Disinfectants. Use of alternative primary disinfectant technologies, such as ozonation, chlorine dioxide, and ultraviolet irradiation were discussed in detail in the September 2001 Fort Thomas evaluation report. However, as these alternative disinfectants do not provide a sustainable disinfectant residual, they must typically be followed by a secondary disinfectant, such as free chlorine or chloramines, in order to maintain a disinfectant residual within the distribution system. As these alternative disinfectants do not by themselves reduce the DBP formation potential of the water being treated (and, in the case of ozone, may actually increase DBP formation potentials), continued use of free chlorine for residual maintenance would likely not result in any significant reduction in DBP concentrations within the distribution system. Use of ozone or chlorine dioxide for primary disinfection would require construction of covered contact basins in order to optimize disinfectant utilization and to prevent excessive formation of undesirable oxidation by-products, and the high CT values required for inactivation of *Cryptosporidium* under cold water conditions reduce the attractiveness of both ozone and chlorine dioxide as long-term solutions to potential future pathogen inactivation requirements. Some utilities have also experienced problems with persistent offensive odors attributable to off-gassing of chlorine dioxide at consumer taps when free chlorine is used for residual maintenance within the distribution system.

As discussed above, District staff has expressed reservations regarding the use of chloramines for residual maintenance within the distribution system. As significant reductions in current system DBP concentrations could not be achieved using ozone, chlorine dioxide, or UV irradiation unless implemented in conjunction with use of chloramines for secondary disinfection/residual maintenance, use of alternative primary disinfectants is not considered a viable approach to meeting the Stage 2 DBPR requirements at individual system monitoring sites.

3. GAC ADSORPTION

In its August 2003 proposed Stage 2 DBPR, EPA defines the following three treatment technologies as "best available technology" (BAT) for compliance with the TTHM and HAA5 MCLs:

- GAC adsorbers with at least 10 minutes of empty bed contact time and an annual average reactivation/replacement frequency no greater than 120 days, plus enhanced coagulation or enhanced softening.

- GAC adsorbers with at least 20 minutes of empty bed contact time and an annual average reactivation/replacement frequency no greater than 240 days.

- Nanofiltration (NF) using a membrane with a molecular weight cut off of 1000 Daltons or less (or demonstrated to reject at least 80% of the influent TOC concentration under typical operating conditions).

As suggested by EPA's definition of "best available technology" for DBP control using GAC, the parameter that has the greatest impact on GAC system design and performance is the empty bed contact time (EBCT). EBCT is equal to the volume of carbon media in the filter or contactor divided by the volumetric rate of flow through the filter or contactor, expressed in minutes. In general, GAC adsorption efficiency for a particular contaminant increases with increasing EBCT. The EBCTs and GAC regeneration/replacement intervals specified as BAT in the proposed Stage 2 DBPR were based primarily on pilot-scale treatment data developed during the Information Collection Rule (ICR) treatment studies.

Statistical analysis of GAC treatment data developed by the 63 utilities that participated in the ICR process suggests the following:

- A 10 minute EBCT was not sufficient to optimize GAC adsorption efficiency for TOC removal in most of the ICR trials. For example, comparison of 116 pairs of GAC treatment trials indicates that the mean number of bed volumes treated until 50% TOC breakthrough occurred was approximately 14% greater for contactors with EBCTs of 20 minutes as compared to contactors with EBCTs of 10 minutes. The ICR results suggest that most utilities will reduce operating costs by designing GAC contactors with an EBCT greater than 10 minutes.

- GAC particle size had a significant impact on GAC adsorption efficiency. When not restricted to large GAC particle size by headloss considerations, utilities could reduce GAC replacement costs by using smaller 12 x 40 mesh GAC, rather than 8 x 30 mesh.

As discussed in the September 2001 Fort Thomas evaluation report, there are two basic approaches to DBP control through removal of precursor compounds by granular activated carbon:

- Conversion of existing granular media filters to GAC filter adsorbers through removal of a portion of the anthracite/sand media and replacement with GAC.

- Construction of post-filtration GAC contactors.

Each of these approaches, and their applicability with respect to compliance with future DBP control requirements at NKWD are discussed below.

a. Filter Adsorbers. Evaluation of available filter box depths at the Fort Thomas plant suggests that conversion of the existing filters to GAC adsorbers would not yield EBCTs that would provide effective removal of disinfection by-product precursor compounds. This is based on the following:

- Replacement of the existing underdrains and support gravel with new underdrains and porous plate support media to eliminate the need for support gravel, thereby increasing available GAC media depth.

- 9 – 10 inches of fine sand below the GAC media to minimize passage of carbon fines through the filter and to ensure effective turbidity removal.

- Provisions for 25% - 30% expansion of the media during backwashing, with the expanded media surface just below the bottoms of the existing washwater collection troughs in order to minimize loss of GAC media.

- 11 filters in service at the rated plant production capacity of 44 mgd.

Using these assumed conditions, EBCTs for the converted Fort Thomas filters would be only about 4.2 minutes at a plant throughput rate of 44 mgd, and approximately 6.8 minutes at the current average plant production rate of 27 mgd. These EBCTs are considerably less than the 10-20 minute values recommended by EPA in the proposed Stage 2 DBPR, and would result in the need for frequent GAC media replacement (potentially as often as every 60-90 days) in order to maintain the ability to effectively remove DBP precursor compounds. Removal and replacement of the GAC media at these short intervals would significantly increase demands on plant maintenance staff and associated costs. Based on these considerations, conversion of the existing filters to GAC adsorbers for DBP control would not be recommended. (Note that required media replacement intervals for GAC filter adsorbers utilized primarily for control of tastes and odors would be significantly longer; experience at other locations indicates that GAC service lives of 2 to 3 years have been achieved.)

b. Post-Filtration GAC Contactors. Most utilities that elect to use GAC adsorption to meet the Stage 2 DBPR requirements will need to construct post-filtration GAC contactors in order to achieve EBCTs sufficient to provide efficient removal of DBP precursor compounds while maintaining reasonable GAC replacement intervals. The following discusses potential requirements for post-filtration GAC treatment at the Fort Thomas plant. (Design requirements would be similar for the District's Taylor Mill and Memorial Parkway plants, should the need for DBP precursor removal to meet Stage 2 DBPR criteria be determined to be required.)

Post-filtration GAC contactors would be concrete downflow units. Filtered water would be pumped to the contactors (construction of a transfer pumping station would be required to convey the filtered water to the new GAC contactors), and the GAC-treated water would flow to the existing treated water clearwells. A multiple contactor configuration, with contactors operating in parallel in a "staggered exhaustion" mode, would be used to maximize carbon utilization prior to replacement (contactors would be brought on line individually in a sequential manner over several months in order to avoid simultaneous breakthrough of all contactors). A total of ten GAC contactors is assumed; eight in service, plus two additional contactors; one for storage of virgin carbon upon delivery, and one standby contactor that would be placed in service when an in-service contactor becomes exhausted.

Preliminary design parameters for the GAC adsorption system utilized in the development of probable construction and annual operation and maintenance costs are summarized in Table IV-19. (It is emphasized that the information presented herein should be considered as preliminary, and is based on experience for other full-scale operating GAC systems. Site-specific testing should be conducted in order to optimize design parameters and to assess probable GAC replacement intervals.)

Table IV-19
Preliminary Design Parameters for Post-Filter GAC Adsorption System For DBP Control at Fort Thomas WTP

Parameter	Value
Number of GAC Contactors In service GAC transfer + standby Total	 8 2 10
Area per Contactor, sq ft	555
GAC Depth, feet	11.5
GAC Loading Rate, gpm/sq ft @ 44 mgd	6.9
GAC Media Size Average Density, lbs/cubic foot	 12 x 40 30
Empty Bed Contact Time, minutes At 44 mgd peak flow At 27 mgd average flow	 12.5 20
Average GAC Replacement Interval, days	180
Average GAC Utilization Rate Pounds per 1000 gallons treated* Pounds per day	 0.31 8,400

*At annual average plant production of 27 mgd, 180 day replacement interval

This analysis assumes periodic replacement of GAC under a contract removal/replacement arrangement. However, GAC utilization rates may be high enough to justify consideration of onsite thermal regeneration. Therefore, any future evaluation of GAC treatment for State 2 DBPR compliance should also include a detailed comparison of costs for contract GAC replacement vs. onsite regeneration. (Testing to identify probable site-specific GAC utilization rates should be conducted prior to development of comparative GAC replacement/regeneration costs.)

As discussed in the September 2001 Fort Thomas evaluation report, projected site area requirements for construction of post-filtration GAC contactors and required support facilities are substantial (approximately 13,500 square feet), and available area for new construction within the confines of the existing plant site is limited. Therefore, for the purposes of this evaluation, it is assumed that one of the existing flocculation/sedimentation basin trains would be removed from service to provide the area required for construction of the GAC treatment facility. One of the remaining basin trains would be retrofitted with high-rate treatment equipment in order to maintain the current 44 mgd total facility treatment capacity. Based on preliminary discussions with District staff, it is assumed that either basin train 2 or 3 would be demolished to provide site space for the GAC facility, and the other adjacent train retrofitted with ballasted flocculation (ACTIFLO®) process equipment. Based on the current typical basin flow split maintained by the operating staff (60% of total plant flow to basin trains 1 and 4, 40% of total plant flow to basin trains 2 and 3), the minimum required capacity of the ACTIFLO® process would be approximately 18 mgd in order to maintain the current rated plant capacity of 44 mgd. However, to maintain a 2.0 gpm/sq ft hydraulic loading rate for the tube settlers in basin trains 1 and 4, total flow to those trains would need to be limited to 22 mgd. Therefore, the capacity of the retrofitted ACTIFLO® process should be at least 22 mgd. (As noted in the 2001 Fort Thomas evaluation report, each of the existing basin trains has sufficient area to provide up to 32 mgd of ballasted flocculation process treatment capacity. However, an evaluation of basin train inlet/outlet hydraulic capacities would need to be conducted to assess ability to accommodate flows in excess of the current rated capacity of 11 mgd per basin train.)

Post-filtration GAC treatment will likely be the most costly approach to future DBP compliance in terms of both initial construction and annual operation and maintenance costs. However, in addition to reductions in system DBP concentrations, other potential benefits associated with post-filtration GAC treatment would include the following:

- Improved chemical spill protection
- Improved taste and odor control
- Reductions in chlorine demand
- Improved chlorine residual stability within the distribution system

4. MEMBRANE SEPARATION PROCESSES

As discussed above, nanofiltration is one treatment approach defined by EPA as "best available technology" in the August 2003 proposed Stage 2 DBPR. Pilot testing was conducted at the Fort Thomas plant between 1999 and 2001 to assess the ability of reverse osmosis (RO) and nanofiltration (NF) membranes to effectively remove organic precursor compounds that form regulated disinfection by-products when free chlorine is used for primary/secondary disinfection. While the pilot study demonstrated that both

RO and NF membranes would provide high levels of DBP precursor compound removal that would facilitate compliance with Stage 2 DBPR requirements, persistent biofouling of the membranes was experienced throughout the study. This biofouling problem resulted in the need for frequent membrane cleaning, which would lead to reduced system productivities and membrane life. Membrane pretreatment requirements to reduce/eliminate excessive biofouling problems, membrane concentrate disposal considerations, and the increased levels of settled/filtered water production required to compensate for process losses attributable to post-filter membrane treatment would result in significant increases in current finished water production costs, thereby making this DBP control option financially unattractive.

5. MIEX® PROCESS

Bench-scale and pilot-scale testing of the magnetized ion exchange (MIEX®) process was conducted at the Fort Thomas plant during May and June 2003 as part of an American Water Works Research Association (AWWARF) study to assess the response of the MIEX® process under a wide range of raw water and treatment conditions. Testing was conducted using raw Ohio River water. As evaluation of the resulting data from this pilot study has not yet been completed (all analytical data has not yet been submitted for review), firm conclusions regarding the applicability of this process for compliance with future Stage 2 DBPR requirements cannot be presented at this time. However, preliminary data indicate that the MIEX® process reduced dissolved organic carbon concentrations by 40 to 50 percent during the first four weeks of testing, and reduced 3-day TTHM formation by 42 to 44 percent, as compared to samples treated conventionally using ferric sulfate and polyaluminum chloride dosages similar to those currently used at the full-scale Fort Thomas plant.

Currently available results indicate that MIEX®-treated raw water samples exhibited 3-day TTHM formation potentials of approximately 0.062 mg/L and 0.068 mg/L following coagulation with ferric sulfate and an alum-polymer blend, which is less than the current Stage 1 DBPR MCL of 0.080 mg/L. Limited data on HAA5 formation potential reductions indicate that MIEX® also reduced 3-day HAA5 potential by approximately 70% (from approximately 0.041 mg/L for a raw water sample coagulated with both ferric sulfate and polyaluminum chloride to approximately 0.013 mg/L for the MIEX®-treated raw water sample following ferric/polyaluminum chloride coagulation).

While these preliminary results suggest that the MIEX® process should not be ruled out as a potential future DBP control methodology, additional testing and evaluation would be required to assess effectiveness under varying source water quality conditions and process waste disposal requirements.

G. LT2ESWTR COMPLIANCE OPTIONS

As discussed above, provisions for increased removal of, and potentially for inactivation of *Cryptosporidium* oocysts at one or more of the District's treatment facilities may be required under the impending LT2ESWTR. Firm conclusions regarding compliance requirements cannot be developed until required source water *Cryptosporidium* monitoring has been completed. Therefore, the following presents an overview of several potential *Cryptosporidium* treatment approaches that could be required, based on information presented in the August 2003 proposed LT2ESWTR. It is emphasized that EPA has requested comment on the many aspects of the proposed rule, and that the information presented in the LT2ESWTR proposed rule could be modified significantly prior to promulgation of this regulation during mid-2005.

1. *CRYPTOSPORIDIUM* REMOVAL (BIN 1 CLASSIFICATION)

Should source water monitoring conducted under the impending LT2ESWTR indicate the presence of *Cryptosporidium* at average annual concentrations of less than 0.075 oocysts per Liter ("Bin 1" classification), no additional treatment to address *Cryptosporidium* oocyst removal/inactivation would be required.

2. *CRYPTOSPORIDIUM* REMOVAL (BIN 2 CLASSIFICATION)

Should source water monitoring conducted under the impending LT2ESWTR indicate the presence of *Cryptosporidium* at average annual concentrations of 0.075 to 1.0 oocysts per Liter, the District would be required to provide an additional 1.0-log of treatment ("Bin 2" classification). (This would be in addition to the 3.0-log *Cryptosporidium* removal credit to be granted under the LT2ESWTR for well-operated conventional treatment facilities.)

Review of the microbial toolbox options presented in the proposed LT2ESWTR suggests that the District could potentially achieve the required 1-log total additional *Cryptosporidium* removal credit for the existing treatment facilities by utilizing available credits for any of the following:

- 0.5-log or 1.0-log credit for maintaining low treated water turbidity levels.

- 0.5-log credit for second-stage filtration, if post-filtration GAC adsorption capability is added for disinfection by-products control.

- Credit for demonstration of performance

Proposed design and implementation criteria for each of the above are discussed below.

a. Reduced Finished Water Turbidity. A 0.5-log *Cryptosporidium* removal credit will be granted to systems with a combined filtered turbidity less than or equal to 0.15 NTU in at least 95 percent of the measurements taken each month. Compliance with this criterion would be determined based on measurements of the combined filter effluent at intervals of no longer than 4 hours. A 1.0-log *Cryptosporidium* removal credit will be granted to systems that achieve a turbidity level in each individual filter effluent less than or equal to 0.15 NTU in at least 95 percent of the measurements taken each month. Compliance with this criterion would be determined based on measurements of the individual filter effluent at 15-minute intervals.

Review of plant performance data for January 2001 through August 2002 suggests that the District's treatment facilities should be able to comply with the 0.15 NTU combined filtered water turbidity criterion through optimization of filter aid polymer selection and dosage, and operational modifications such as more frequent backwashing during periods of high source water turbidity.

It is expected that maintaining turbidities of 0.15 NTU or less for individual filters for a minimum of 95% of the monthly samples will be difficult for most utilities to consistently achieve, particularly for utilities treating river supplies with highly-variable quality characteristics. The District's treatment facilities typically produce finished water with a turbidity of 0.10 NTU or less, which is indicative of excellent process operation and performance. However, review of recent filter operating data suggests that obtaining the 1.0-log *Cryptosporidium* removal credit based on maintaining turbidities for individual filters at 0.15 NTU or less would likely be difficult.

b. Second-Stage Filtration. The proposed LT2ESWTR allows utilities using a second filtration stage to receive an additional 0.5-log *Cryptosporidium* removal credit. The secondary filtration must consist of rapid sand, dual media, granular activated carbon (GAC) or "other fine grain media in a separate stage following rapid sand or dual media filtration". Both filtration stages must treat 100% of the flow delivered to the distribution system. Therefore, if post-filtration GAC contactors are constructed to meet future DBP requirements under the Stage 2 DBPR, the District would also be eligible for an additional 0.5-log *Cryptosporidium* removal credit. A potential disadvantage could be the need to operate the GAC system continuously in order to be granted this credit. (Continuous operation of the GAC system may not be required strictly to meet the Stage 2 DBP requirements at individual monitoring sites.)

c. Performance Demonstration. EPA recognizes that some treatment facilities can achieve mean log removals of *Cryptosporidium* oocysts greater than the presumptive 3-log credit that will be granted under the LT2ESWTR. However, it is generally not considered practical for systems to directly quantify log removals for *Cryptosporidium* across the treatment process due to finished water oocyst concentrations at below the detection limit for available methods. The proposed LT2ESWTR therefore allows the Stage regulatory agency to award a higher level of *Cryptosporidium* treatment credit to a system where the regulatory agency determines, based on site-specific testing conducted under a State-approved protocol, "that a treatment plant or a unit process within the plant reliably achieves a higher level of *Cryptosporidium* removal on a continuing basis." (Note that this does not apply to the use of chlorine dioxide, ozone, or UV light, as the proposed LT2ESWTR includes specific provisions for awarding disinfection credit to these technologies.) The "Toolbox Guidance Manual" (EPA 815-D-03-009) published concurrently with the proposed LT2ESWTR presents one approach to conducting a "demonstration of performance" study, and discusses use of aerobic spores as a surrogate indicator of *Cryptosporidium* oocyst removal by sedimentation and filtration.

3. *CRYPTOSPORIDIUM* REMOVAL / INACTIVATION (BIN 3, BIN 4 CLASSIFICATION)

Should source water monitoring conducted under the impending LT2ESWTR indicate the presence of *Cryptosporidium* at average annual concentrations of 1.0 oocysts per Liter or greater, the District would be required to provide an additional 2.0 to 2.5-log of treatment ("Bin 3" or "Bin 4" classification). This would be in addition to the 3.0-log *Cryptosporidium* removal credit granted for well-operated conventional treatment. The District would be required to achieve at least 1.0-log of this additional treatment using ozone, chlorine dioxide, UV, membrane treatment, bag/cartridge filtration, or bank filtration processes. Disinfection CT requirements for chlorine dioxide presented in the proposed LT2ESWTR are high enough to eliminate it from serious consideration as a viable *Cryptosporidium* inactivation process, while bag filtration / cartridge filtration processes are generally applicable only to relatively small-capacity treatment facilities.

Membrane processes, ozonation, UV disinfection treatment and bank filtration are discussed below.

a. Microfiltration / Ultrafiltration. Microfiltration (MF) and ultrafiltration (UF) are physical processes in which colloidal particles are removed from the water supply by straining through a porous medium. Both processes provide exceptional removal of turbidity (most operating facilities routinely produce treated water with turbidities of less than 0.05 NTU). MF membranes typically used for treatment of surface water supplies are hollow-fiber with a nominal pore size of 0.1 to 0.5 microns. UF membranes used in surface water treatment applications typically exhibit a nominal pore size of 0.01 to 0.05 microns. As these pore sizes are significantly smaller than *Cryptosporidium* oocysts (2 to 7 microns) and *Giardia* cysts (5 to 15 microns), MF and UF provide excellent removal of these microbial contaminants. Removal of *Giardia* cyst-sized particles in excess of 6 to 8 logs (99.9999 to 99.999999 percent) have been demonstrated during pilot-scale testing, and therefore many states grant 3-log, and, in some cases 4-log removal credits for MF and UF treatment.

Typical "average" feedwater pressures for conventional "encased" membrane configurations are 10 to 20 psi. Backwashing of MF/UF modules is typically initiated every 30 minutes (up to 60 minutes for exceptionally clean feedwaters), and the backwash cycle typically lasts approximately 2 minutes. Backwashing typically uses approximately 5 to 7 percent of the feedwater pumped to an MF system; however, recycling of the backwash flow to the plant influent following treatment to remove settleable solids can reduce overall losses to about 1 percent of plant production. Periodic cleaning with citric acid, caustic/hypochlorite solution, and/or proprietary detergent solutions may be required when conventional backwashing can no longer restore differential pressures across the membranes to original levels. Chemical cleaning is typically conducted at 4 week to 6 week intervals. In some cases, cleaning is augmented by more frequent, automated chemically-enhanced backwash cycles.

Another membrane option is the "immersed" membrane configuration. Immersed membrane systems consist of "modules" of membrane fibers suspended in conventional concrete or steel tanks containing the water to be treated. Unlike encased membrane systems, where the feedwater is pressurized to force the feedwater through the membranes, immersed membranes operate under a slight vacuum (typically 4 to 10 psig). Vacuum is produced by pumps located on the product water side of the membranes. The membranes are periodically "backpulsed" using product water to remove deposits on the membrane surfaces; this typically occurs every 30 minutes for a period of approximately one minute. Immersed membrane systems employ injection of air at the floor of the membrane chamber to scour the membrane surfaces and to maintain a homogeneous concentration of suspended solids within the chamber. Periodic chemical cleaning is required to maintain membrane flux rates; this is typically accomplished by backpulsing the membranes at a reduced rate with the concentrated cleaning solutions. Cleaning solutions typically include sodium hypochlorite and proprietary detergent solutions. The cleaning process is typically automated to reduce operator labor required. Most existing immersed membrane systems operate at raw-to-product recovery rates of approximately 95 percent. However, through recycling of the membrane reject stream and /or use of "secondary" membrane treatment systems, overall treatment process losses can typically be reduced to about 1 percent of the raw water treated.

As MF and UF treated water exhibits extremely low turbidities, which are difficult to monitor consistently, provisions for continuous monitoring of treated water particle counts are required to ensure that the membranes are operating properly. It is also typically recommended that an air integrity test be conducted at least once per day to ensure that the membranes and associated gaskets/seals are functioning properly, and that individual membrane fibers have not failed. (At least one state currently requires that membrane integrity testing be conducted every 8 hours for new plants until stable operations are demonstrated.)

A potential advantage of immersed membranes is their ability to be located in existing plant structures, such as filter boxes (the membranes would replace the conventional granular media). Minimum required basin depth for the immersed membranes is 10 to 11 feet, and membrane production rates at "conservative" hydraulic loading (flux) rates are approximately 3 to 6 gpm per square foot of basin plan area. (A newer product released during 2001 may allow a higher equivalent loading rate.)

For the District's treatment facilities, immersed MF/UF membranes could potentially be located within the existing granular media filter structures. Pilot-scale evaluation to assess feasible loading rates, operating pressures, and membrane cleaning requirements would be recommended prior to any decision to consider full-scale MF/UF implementation.

b. Ozonation. Ozone has been used with increasing frequency in U.S. treatment facilities over the past 10 to 15 years. In addition to disinfection, potential direct benefits associated with the use of ozone include the following:

- Improvement in filtered water turbidity when applied immediately preceding filtration.

- "Microcoagulation" of dissolved organic contaminants (transformation of soluble organic contaminants into insoluble forms that can be removed by conventional treatment techniques).

- Reduction of tastes and odors.

- Oxidation of iron and manganese.

Ozone oxidation must precede filtration to ensure effective removal of the flocculated particles resulting from the partial oxidation of dissolved organic materials. Ozone is applied to the process stream in gaseous form, and because of its instability, is generated onsite. A baffled contact chamber is typically required to achieve optimum ozone utilization and effectiveness, and to satisfy disinfection contact time requirements. As ozone treatment does not yield a sustainable disinfectant residual, a secondary disinfectant (chloramine) must continue to be added to prevent microbial regrowth within the distribution system. Because of its highly reactive nature, ozone should be applied prior to filtration at a point where water quality is highest (typically just prior to filtration.) This results in maximum disinfection efficiency, lower ozone demands, and minimum formation of potentially undesirable by-products.

Disadvantages of ozone include high construction costs for the ozone generation and contact equipment and high operating costs attributable to high energy consumption rates. Continuing concerns regarding the potential health impacts of bromate (a by-product of ozone oxidation of waters containing low levels of bromide, and a suspected carcinogen) may also limit application of ozone in some cases, unless effective bromate control measures can be implemented. (Bromate control measures would likely involve addition of ammonia prior to ozonation to convert bromide to bromamine, which decomposes rapidly, thereby reducing the formation of bromate during ozonation.) Required ozone CT values presented in the proposed LT2ESWTR also suggest that inactivation of *Cryptosporidium* will likely require significantly higher ozone dosages and longer ozone contact periods than originally anticipated, particularly under cold-water conditions, which would greatly reduce it's attractiveness for inactivation of this microbial contaminant. (CT values for inactivation of *Cryptosporidium* oocysts are approximately 20 to 40 times higher than CT values for inactivation of *Giardia* cysts published in the Surface Water Treatment Rule "Guidance Manual".)

While ozonation would provide positive inactivation of many microbial pathogens, implementation as the primary disinfectant is not considered cost-effective. The low water temperatures typically experienced during the winter months at the District's treatment facilities would require that high applied ozone dosages and long ozone contact times be employed to ensure positive inactivation of *Cryptosporidium* oocysts. (At this time, ability to maintain required ozone residuals for periods sufficient to meet required CT values cannot be determined with any certainty without conducting pilot-scale testing.)

c. Ultraviolet Disinfection. Ultraviolet (UV) light, historically used in this country primarily to disinfect wastewater effluents, is rapidly emerging as a viable disinfectant in the drinking water industry. While use in the U.S. is currently growing, there are reportedly more than 2,000 facilities in Europe currently utilizing UV for disinfection of public drinking water supplies. Current research results for the inactivation of *Cryptosporidium* and *Giardia* demonstrate that 3-log to 5-log inactivation of these microbial pathogens is readily achievable.

Benefits of UV disinfection include: (1) significantly lower costs than for comparable microbial control processes (ozone, microfiltration); (2) small facility area requirements; (3) ability to cost-effectively retrofit existing plant facilities; (4) significant reductions in formation of halogenated disinfection by-products (when free chlorine contact times following UV treatment are limited); and (5) high levels of achievable pathogen inactivation. Potential disadvantages include: (1) the potential for fouling/plating of the quartz sleeves which house the UV lamps; (2) reliability/accuracy of the UV sensors used to monitor process effectiveness; and (3) difficulties in securing state regulatory approval for disinfection of surface water supplies due to the lack of full-scale U.S. operating experience. Utilities should also be aware that one manufacturer of UV systems (Calgon Carbon Corporation) has obtained two patents for inactivation of *Cryptosporidium* and *Giardia* using UV, and will charge users a licensing fee equivalent to $0.015 per thousand gallons of water treated using UV. This licensing fee applies to all utilities that install UV for inactivation of *Cryptosporidium* and *Giardia*, regardless of the supplier selected to provide the UV equipment.

Several states have approved use of UV for disinfection of groundwater supplies, but none have approved its use for utilities treating surface water supplies. EPA intends to address this potential problem by publishing the following concurrent with promulgation of the LT2ESWTR:

- Tables specifying required UV dosages to achieve up to 3-log inactivation of *Giardia*, up to 3-log inactivation of *Cryptosporidium*, and up to 4-log inactivation of viruses.

- Minimum standards to determine if UV systems are acceptable for compliance with drinking water disinfection requirements.

- A UV Guidance Manual, the purpose of which is to facilitate design and planning of UV installations by familiarizing State/Primacy agencies and utilities with UV system design and operational issues.

These items are currently in draft form and were available for public comment through January 2004.

Newer UV system designs typically utilize medium-pressure or low-pressure high-output lamps enclosed in a stainless steel pipe-type reactor vessel, which facilitates incorporation into existing treatment facilities. Standby UV reactors are typically specified to provide reliability and to ensure continued plant operation should a single unit require servicing. The draft UV Disinfection Guidance Manual recommends that UV systems be placed after the filters. The stated drawbacks to placing the reactors upstream of filtration are lower UV transmittance and the potential for coagulation to shield microorganisms, thereby hindering their inactivation. Also, the LT2ESWTR UV dose requirements apply only to post-filter applications and to unfiltered supplies that meet criteria for filtration avoidance. UV has also been shown to be relatively ineffective for inactivation of enteric viruses at dosages typically considered cost-effective for inactivation of *Giardia* and *Cryptosporidium*; therefore, a brief free chlorine contact period either prior to or following UV would be required to ensure that conditions for positive inactivation of viruses are provided.

Evaluation of *Cryptosporidium* control requirements for other similar facilities indicates that both probable construction and annual operating costs associated with UV disinfection would be considerably less than for MF/UF membrane treatment or ozone disinfection. For the District's water treatment facilities, UV disinfection facilities could potentially be retrofitted within the transfer pipelines between the existing filters and the ground storage reservoirs, or within the effluent pipelines for individual filters.

d. <u>Riverbank Infiltration</u>. "Riverbank infiltration" (RBI), or "bank filtration" is a process that utilizes surface water that has naturally infiltrated into a subsurface aquifer and is recovered by one or more pumping wells. Microorganisms and other particles are removed by contact with aquifer materials as the water progresses through the aquifer. The proposed LT2ESWTR indicates that EPA will grant *Cryptosporidium* removal credits to systems that utilize bank filtration with either vertical wells or horizontal collector wells. Bank filtration wells would be required to be drilled in unconsolidated, predominantly granular/sandy aquifers, and the utility would be required to characterize the aquifer at the well site in order to receive *Cryptosporidium* removal credit. A vertical or horizontal well located adjacent to a surface water body would be eligible for riverbank infiltration credit if there is sufficient groundwater flow path length to ensure effective removal of oocysts.

Cryptosporidium removal credits presented in the proposed rule are as follows:

- 0.5-log credit for vertical wells located greater than 25 feet from the surface water source, and 1.0-log credit for vertical wells located greater than 50 feet from the surface water source. (Measured from the edge of the surface water source under high flow conditions.)

- 0.5-log credit for horizontal collector wells with laterals no closer than 25 feet to the bottom of the river channel, and 1.0-log credit when laterals are no closer than 50 feet to the river channel.

Utilities would be required to monitor the turbidity of the wells continuously to detect any system failure. If the monthly average turbidity (based on daily maximum values) exceeded 1 NTU, the utility would be required to determine if microbial removal had been compromised, and then report the exceedance to KDOW, along with an explanation of the basis for concluding that microbial removal had not been compromised. If KDOW should then determine that microbial removal had indeed been compromised, the District would not receive the *Cryptosporidium* removal credit until the problem is resolved.

Implementation of bank filtration as an alternative to the District's current Ohio River and/or Licking River supplies would be an extremely costly compliance option strictly for *Cryptosporidium* control, particularly when potential removal/inactivation credits that may be obtained for other processes at substantially lower costs are considered. However, when other potential benefits (reduction in chemical coagulant/pretreatment requirements, protection against contaminant spills upstream of the District's intakes, improved overall microbial quality, and attenuation of turbidity and temperature extremes) are also considered, bank filtration could represent a viable long-term alternative to the District's current supplies.

H. COMPLIANCE SUMMARY AND RECOMMENDATIONS

The District is well-positioned in most respects regarding compliance with pending and anticipated future water quality and treatment requirements. However, several potential future compliance concerns were identified during this review of the District's current facilities and treatment practices; recommended actions to address these concerns are summarized below.

1. FUTURE COMPLIANCE WITH STAGE 2 DBPR REQUIREMENTS

a. Post Filtration GAC Treatment. For long-range planning purposes, the District should budget for construction of post-filtration GAC adsorption treatment at the Fort Thomas plant, with initial operation by mid-2012. This proposed schedule assumes that the Stage 2 DBPR will be promulgated during mid-2005, and that KDOW will grant a two-year compliance extension, based on the need for significant capital expenditures to achieve compliance. While initial operation of the GAC facility would likely not be required until mid-2013, this slightly accelerated schedule will provide for a one-year initial operating period prior to the compliance deadline. During this initial operating period, the GAC contactors would be brought online sequentially such that exhaustion of GAC adsorption capacity would not occur simultaneously for all contactors. This initial operating period would also allow operators to become thoroughly familiar with GAC system characteristics and operational requirements prior to the compliance deadline.

Construction of the GAC adsorption system would require removal of one existing flocculation/sedimentation basin from service in order to provide sufficient site space for construction of the GAC system, and retrofitting of another basin train with high-rate ballasted flocculation (ACTIFLO®) capability in order to maintain the current rated plant capacity of 44 mgd. While minimum required ACTIFLO® system capacity would be 22 mgd, preliminary evaluation of ACTIFLO® requirements suggests that up to 32 mgd of treatment capacity could be installed in a single existing flocculation/sedimentation basin train. In order to provide additional treatment flexibility, and to ensure the ability to operate at high plant production rates with one basin train out of service, it is recommended that the District budget sufficient funds for construction of the full 32 mgd ACTIFLO® basin conversion.

b. Additional Analytical Testing. Additional bench-scale testing should be conducted at the Fort Thomas plant to evaluate the potential for further reductions in system DBP concentrations through coagulation process improvements. The testing program should be developed to address the following:

- Impact of reduced coagulation pH on TOC removal, required coagulant dosages, and DBP formation potential.

- Impact of increased ferric sulfate dosages on TOC removal and DBP formation potential.

- Impacts of modified coagulant and operating pH conditions on residual solids production.

- Impact of increased utilization of powdered activated carbon on DBP formation potential.

In addition to the assessments listed above, development of comparative data on disinfection formation potentials for Fort Thomas and Memorial Parkway finished water should be initiated. This information would be useful during future planning efforts to identify potential plant and/or treatment modifications that may be required to comply with Stage 2 DBPR requirements as the portion of the District's distribution system typically served primarily by the Memorial Parkway plant expands.

Chapter VIII of this report presents a recommendation that NKWD evaluate the possible construction of a new water treatment plant to serve the southern Kenton and Campbell Counties areas of the system, including some wholesale customers. Such a plant could conceivably be a means of addressing DBP issues in those areas remote from the existing plants.

c. Chloramination Experience Review. As chloramines for residual maintenance within the distribution system have been identified as a potential cost-effective means of achieving compliance with the more restrictive Stage 2 DBPR requirement at individual monitoring sites, the District should consider conducting informal surveys of other large utilities that have implemented chloramination treatment for DBP control and/or improved residual maintenance purposes. The information obtained from these surveys could be used to assist the District in determining if chloramines would be a viable treatment option for DBP control. (Note that in addition to other recently-published information on implementation of chloramine treatment, a new AWWARF report presenting information on chloramination practices and experience for more than 60 utilities is anticipated to be published in mid-2004.)

2. FUTURE COMPLIANCE WITH LT2ESWTR REQUIREMENTS

Treatment requirements to address the microbial control criteria of the Long-Term 2 Enhanced Surface Water Treatment Rule (effective mid-2011, based on current projected regulation promulgation schedules) cannot be determined with any certainty until the required source water *Cryptosporidium* monitoring is completed. Should monitoring under the LT2ESWTR reveal annual average source water *Cryptosporidium* oocyst concentrations exceeding 1.0 per Liter, the District could be required to install provisions for additional oocyst removal and/or inactivation. The most cost-effective treatment technology for meeting this requirement would be UV irradiation following filtration. However, as the need for these facilities has not been positively identified at this time, provisions for UV treatment at the District's treatment facilities have not been included in the CIP being prepared as part of the AMP development process.

The District is strongly encouraged to consider modifying the current source water *Cryptosporidium* monitoring program to incorporate collection of samples twice per month (samples are currently collected monthly). This change would allow the District to "average out" high *Cryptosporidium* monitoring results over the entire 2-year monitoring period, rather than having to use the 12-month period with the highest *Cryptosporidium* monitoring results when determining bin placement under the LT2ESWTR. (Note that the additional costs associated with this expanded source water monitoring would be negligible as compared to potential construction and operating costs that would be incurred should the District be required to implement additional treatment for *Cryptosporidium* removal/inactivation.)

V. AWWARF INFRASTRUCTURE ASSESSMENT MANAGER

For the AMP project B&V created a facilities tree of NKWD water supply facilities, treatment plants, pumping facilities, and storage tanks using the AWWARF Water Treatment Plant Infrastructure Assessment Manager program. This chapter presents a description of the Assessment Manager program, steps taken in developing the facilities tree, experience using the program, and summarizes the results from the program.

A. BACKGROUND

One of the main goals of the AWWARF software is to help organize the results of a complete facilities evaluation. The Assessment Manager program is aimed to help facilitate NKWD's decision-making process on which of its assets need attention, thereby contributing to a Capital Improvements Plan. Site investigations were conducted by B&V, accompanied by District Staff, focusing on the physical and operating conditions of units in all of the District's facilities. By assigning conditions to all units that are evaluated, a distributed weighted score is calculated by the software for subsystems, systems, and facilities. This allows for a comparison at different levels of the facility, based upon scores and weights assigned to the components.

The Manager User's manual lists several key objectives of the program:

- Recognize specific approaches for conducting facility assessments.
- Provide the user with a simple data collection and recording method while performing assessments as well as explaining assessment techniques.
- Allow modifications to the default facility tree to reflect a specific facility.
- Identify components that need the most attention.
- Provide information on how to assign condition scores while minimizing the subjectivity of the scoring process.
- Assign percentage weights to components of the tree to account for relative importance.

While conducting the assessment, B&V recognized some discrepancies from the objectives of the Manager and problems with the performance. It should be noted that the Manager that was used at the beginning of the project was version 1.1.0. During the course of the project, a new version was released by AWWA, version 1.2.0. The newer version corrected some of the problems experienced in the earlier version. Most notably, expanded export functions are now in the new version, allowing data to be exported directly as ASCII text. However, data still can not be imported into the Manager from another source; therefore, this program acts as a stand alone program.

One of the program's shortcomings is the subjectivity that is applied when assigning conditions to units. While the Manager does identify multiple factors to consider while making an assessment, the ultimate condition that is placed on a unit is still rather subjective. To solve this problem, B&V along with NKWD established definitions for each unit condition as outlined later in this section. Another important limitation is in the interpretation of the scores. For example, Subsystem A may score lower than Subsystem B because of the condition of units in Subsystem A. However, if Subsystem B is weighed more heavily in the overall system, then which subsystem needs the most attention becomes ambiguous. Careful analysis is needed when interpreting the scores to make sure all factors are accounted for.

In general though, the Manager accomplishes one of the most important goals of providing an easy and simple data collection and storage system while performing a facilities assessment.

B. PROGRAM INFORMATION AND FACILITY TREE DEVELOPMENT

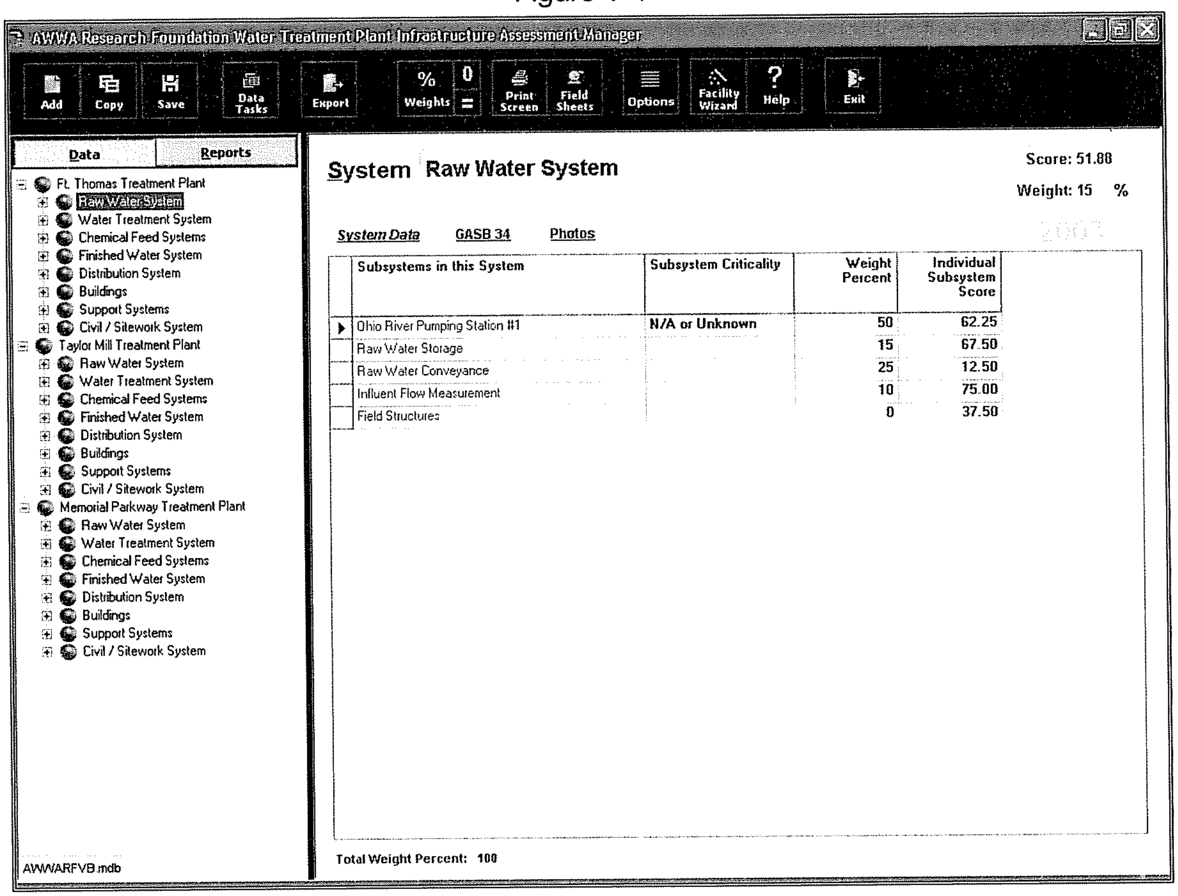
In accordance with the AWWARF Assessment Manager User's manual, the completed NKWD facilities tree is set up into facilities, systems, subsystems, and units. B&V worked closely with NKWD in developing the facilities tree to include all relevant units.

NKWD has three facilities as described earlier in this report, Fort Thomas Treatment Plant, Taylor Mill Treatment Plant, and Memorial Parkway Treatment Plant. Three separate facilities are listed as part of the tree to reflect the three plants. This differs from the software convention as only one facility was originally part of tree. Under each of the three facilities, eight systems were established. The eight systems are Raw Water, Water Treatment, Chemical Feed, Finished Water, Distribution, Buildings, Support Systems, and

Civil / Sitework. The Distribution Systems under each facility were added to reflect the District's system even though the software is not intended to handle facilities outside of the Plants. However, adding distribution pumping stations and storage tanks which are included in the Distribution Systems, did not affect the performance of the program as it was done uniformly for all three plants. It should be noted however, that no distribution water mains are incorporated into the tree, even though they play a major role in the Distribution Systems.

A typical systems screen is shown in Figure V-I. This figure displays the Raw Water System at FTTP. The left side of the screen shows the facilities tree consisting of the three plants opened to show all eight systems under each plant. The right side of the screen displays characteristics of the Raw Water System since it is the system selected. The characteristics include the subsystems under the Raw Water System, with their associated weight and individual subsystem score. Note that the weights of all subsystems in a system must total 100%. In the upper right corner are the overall system score for the Raw Water System and weight percent for the Raw Water System, here shown as a 51.88 and 15%, respectively.

Figure V-1

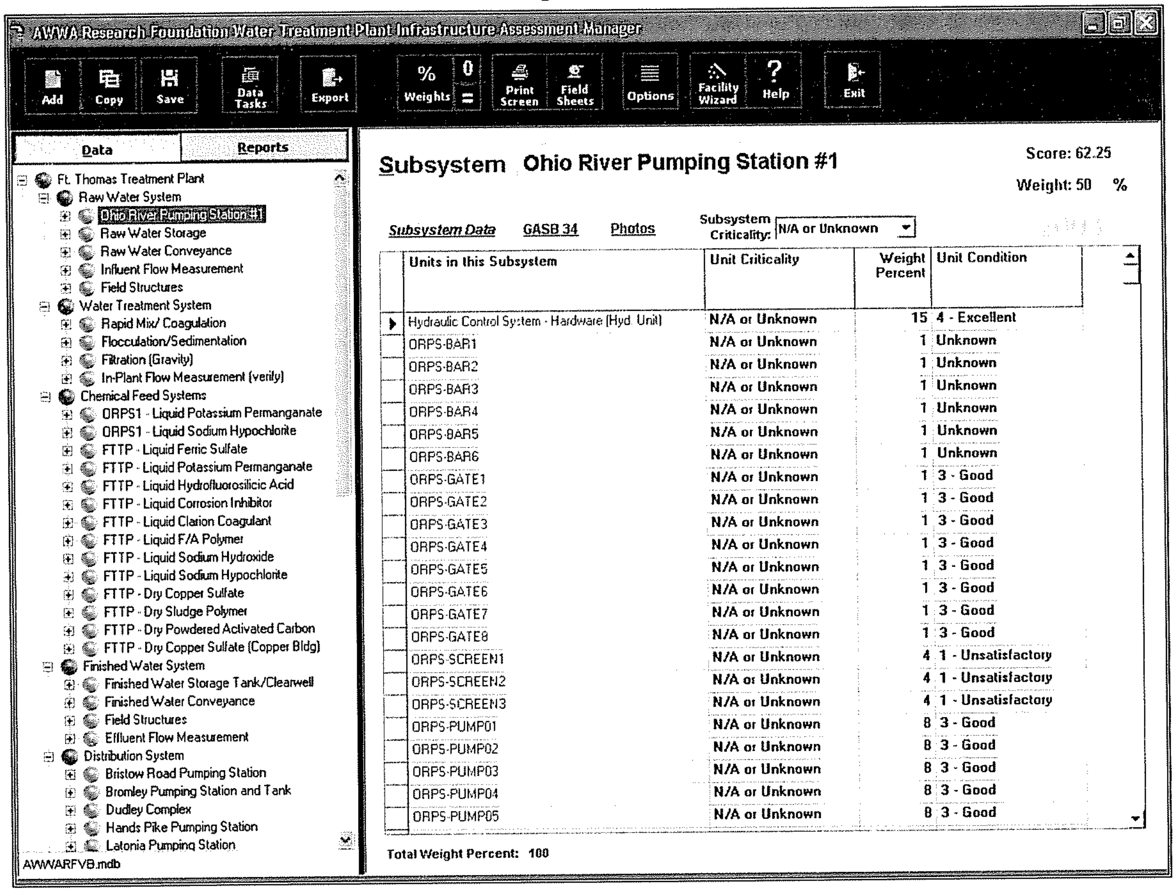


The subsystems are dependant upon which facility and system they are located under as they are slightly different in each of the three facilities. However, in general, the subsystems under each system are as follows:

- Raw Water System: Intake Pumping Stations, Raw Water Storage, Raw Water Conveyance, Influent Flow Measurement, and Field Structures.
- Water Treatment System: Rapid Mix, Flocculation/Sedimentation, Filtration, and In-Plant Flow Measurement.
- Chemical Feed System includes all the chemical feed systems used in the treatment process.
- The Finished Water System: Finished Water Storage, Finished Water Conveyance, Field Structures, and Flow Measurement.
- The Distribution System includes all Distribution Pumping Stations and Water Storage Tanks.
- The Building System includes the actual buildings located at all District treatment or conveyance sites.
- Support Systems: Control Systems, Electric Power Supply / Distribution, and Residuals Handling.
- The Civil / Sitework Systems: Site (stormwater) Drainage, Site Lighting / Site Security, Transportation, Sanitary Sewers, Plant Potable Water (outdoors), and Miscellaneous Yard Piping (buried).

Figure V-2 displays an example of the subsystems screen, here shown when the Ohio River Pumping Station No.1 (ORPS1) is selected. Again, on the left side of the screen is the facility tree, this time opened up more to show the subsystems under the systems in the FTTP. On the right side of the screen is the subsystem screen for ORPS1. The units that make up ORPS1 are listed with their weight percent and unit condition. Note that the weights of all the units in a subsystem must total 100%. In the upper right corner are the subsystem score and weight percentage for ORPS1, in this case 62.25 and 50%, respectively.

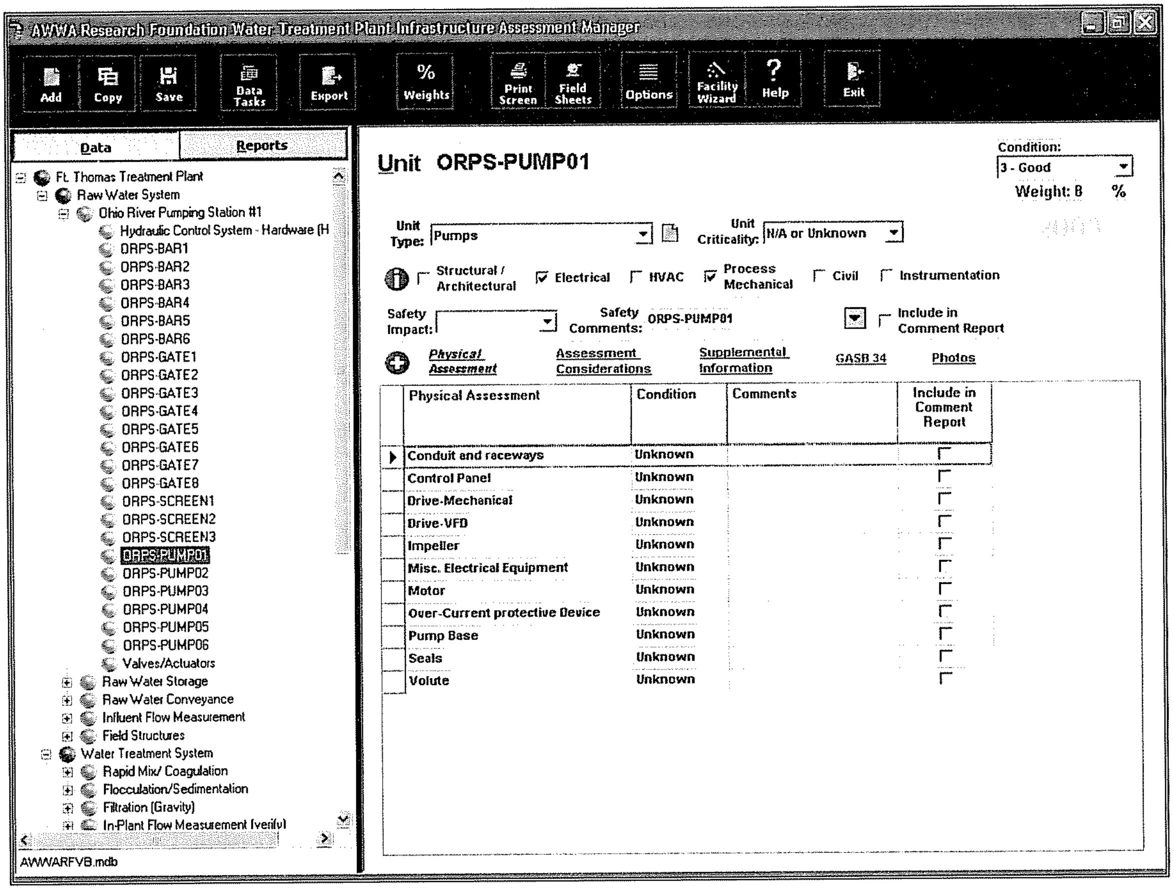
Figure V-2



The unit evaluation is the most basic component of the evaluation process. Units evaluated include, but are not necessarily limited to the following: screens; gates; actuators; pumps and piping (water and chemicals); motors; reservoirs; silos and tanks for chemical storage; control instruments and analyzers; process equipment (blowers, mixers, feeders, etc.); bowls (elevated tanks); tank vents; valves (tank sites and pumping station); basins; support structures; electrical and mechanical equipment necessary for treating and distributing water; roofs; walls; foundations; and yard piping at facilities that were identified as a critical asset in the previous Vulnerability Assessment study.

Figure V-3 is an example of a unit screen, the example shown here being for Pump No. 1 at ORPS1. The left side of the screen displays the facilities tree opened up under ORPS1 to display all of the units associated with this subsystem. The right side of the screen displays the characteristics of the unit that can be used while making evaluations for this unit. In the upper right corner of the screen are the condition and weight percentage of this unit. Here, the pump is in good condition with a weighting of 8 percent.

Figure V-3



The condition assessments were accomplished through a series of multiple site investigations at all of the NKWD facilities, discussions with District staff members noting any concerns or comments they had about components of the facilities, and review of previous documentation and reports. The knowledge and understanding of the NKWD system conveyed by the District staff played an important role in determining the relative importance and condition of the items. Nameplate data were gathered from equipment, where available, to obtain such records as pumping capacities, age of equipment, and manufacturer information. Operational histories were also discussed with the District staff. Non-destructive evaluations were performed, as all of the equipment items remained in service during the evaluations.

Detailed site inspection forms noting the conditions of equipment were completed during the site visits. The completed facility inspection forms are included in Appendix A for informational purposes.

C. PROJECT WORKSHOPS

B&V conducted workshops with NKWD to review information collected during the site inspections visits, and discuss weights assigned to components in the facilities tree.

Preliminary weights were assigned to units, subsystems, and systems. The preliminary weights were discussed with District staff at a Workshop to reach a consensus and finalize the weights. The weights assigned in the tree represent the importance of an item to the Plant's overall ability to produce water. Factors considered when assigning weights include the availability of redundant items, the proportion of plant requirements which rely on that item, the availability of spare parts for that item, and the item's vulnerability during a catastrophic event.

Conditions were assigned to all evaluated units. The unit conditions are assigned on a 0 to 4 scale from inoperable, unsatisfactory, satisfactory, good, and excellent, respectively. The definitions were arrived at by expanding the definitions given in the program and after discussions with NKWD. The definitions for each condition are as follows:

> Inoperable / Unknown - Inoperable or severely deteriorated condition. Unit does not work at all.
>
> Unsatisfactory – Unit is in unsatisfactory condition and has significant defects and/or wear. Unit requires immediate attention with reliability unknown. Unit is nearing the end of useful life, is a major maintenance problem, and has to be serviced more than normal. Unit may not function all the time.
>
> Satisfactory – Unit works as intended and is in satisfactory condition with minor defects and/or wear. Unit requires maintenance attention beyond routine procedures. Reliability is an issue; however, if the unit is maintained as needed, it will function properly.
>
> Good – Unit is in good condition with minimal to no noticeable defects. Unit does not require immediate attention, but should receive routine maintenance. No reliability questions.
>
> Excellent – Unit is in new or superior condition. No maintenance is required other than routine procedures. No reliability questions exist. Has full or almost full life span. Unit does not require any immediate attention. No noticeable defects.

D. INFRASTRUCTURE ASSESSMENT MANAGER RESULTS

Based upon the condition evaluations that are assigned to the individual units, along with their weights, the overall subsystem scores are calculated. The subsystem scores are also carried up to the next levels to calculate the associated system and facilities scores. The scoring system is designed so that on the subsystem level, subsystem scores may be compared to determine what the overall relative conditions are of the different subsystems. Conventionally, the higher the subsystem score, the better the overall condition of that subsystem. Similarly, systems and facilities may be contrasted based on their scores to evaluate the comparative conditions of each.

However, it is important to note that the program does not create individual weighted unit scores to compare units, so the only means to compare the conditions of individual units with their importance to the subsystem factored in is to sort the units by a different method, and then compare unit conditions, such as by criticality, or by having a knowledge of the overall system to see where improvements need to be performed based upon the subsystems scores.

By examining only the subsystem scores, the weights that are assigned to the subsystems are not factored in to the decision or ranking of what subsystems need improvements. For example, if there are two subsystems being compared and one has a much higher score than the other, the assumption would be that the lower scoring subsystem is most in need of attention and should be the higher priority for improvement. However, if the lower scoring subsystem is weighted substantially less, then this assumption may be misleading simply by comparing the scores. Again, careful analysis is needed when interpreting the scores to make sure all factors are accounted, as the score values are not necessarily indicative of which areas are most appropriate for upgrades.

Any results or conclusions that are obtained strictly from use of the Infrastructure Assessment Manager program need to be viewed with caution, based upon the discrepancies that exist in the scoring system. However, as presented below in Table V-1, certain deductions may be drawn from the scoring results. Table V-1 is a summary of the system scores, with their weight percentages, for each of the three treatment plants. These results can also be printed out from the software in the System Condition Report and sorted by score, alphabetically, or in the manner by which they appear in the facilities tree.

Table V-1 System Scores at Each Facility			
Plant **Overall Facility Score**	**FTTP** **63.81**	**TMTP** **57.74**	**MPTP** **52.29**
Raw Water System Score (Weight % Assigned)	56.88 (15)	43.11 (20)	38.38 (20)
Water Treatment System Score (Weight % Assigned)	66.84 (20)	69.31 (25)	75.45 (25)
Chemical Feed System Score (Weight % Assigned)	69.14 (15)	74.91 (15)	66.18 (15)
Finished Water System Score (Weight % Assigned)	50.00 (10)	43.12 (10)	17.75 (10)
Distribution System Score (Weight % Assigned)	84.24 (15)	51.75 (10)	60.62 (10)
Buildings Score (Weight % Assigned)	66.95 (10)	61.70 (5)	52.31 (5)
Support Systems Score (Weight % Assigned)	48.51 (10)	55.62 (10)	37.15 (10)
Civil / Sitework System Score (Weight % Assigned)	47.19 (5)	48.44 (5)	33.12 (5)

For example, from the information presented in Table V-1 the conclusion can be drawn that FTTP is in overall better condition than TMTP and MPTP because FTTP has the highest overall score. Likewise, MPTP has the lowest score and can therefore be thought of as being in the worst condition. These conclusions are true to actual conditions, as units and systems at MPTP generally need more attention than at the other two plants.

Another comparison that can be made is between certain systems. For example, the Raw Water System at MPTP is scored lower than those at FTTP and TMTP. This is mainly due to the fact that ORPS2 and the remainder of the MPTP Raw Water System is in worse condition that the other two intakes and associated systems. Likewise, the Finished Water System at MPTP scores much lower than the other two plant's Finished Water Systems mainly due to the fact that the condition of the clearwell at MPTP is unsatisfactory while the other clearwells are in good or excellent condition.

However, just because a system's score is lower does not mean that more attention should be paid to it. For example at FTTP, the Civil / Sitework System is scored lower than the Raw Water System. However, the weight percentage for the Civil / Sitework System is less than the Raw Water System as well because the Civil / Sitework System is not as important to the production of water to the plant. Therefore, it is not clear which system should receive attention. More analysis is needed than just to look at the scores.

The program generates many different types of summary reports to help the user interpret the results. Different sorting options are available to help organize various outcomes. One of the most useful types of reports is the Subsystems Criticality Report, which is included in Appendix F. The Criticality Reports directly summarize the units or subsystems that are most in need of attention, even if the Criticality rating is not filled out in the data screens. These reports display scores and weights of units or subsystems sorted by scores, weights, or criticality if entered. The Criticality rating can be assigned to subsystems and units and measures the relative importance of the subsystems to the plant or units to their subsystem to continue to produce water. This rating is not used directly in any of the scoring systems; however, it can be used as a sorting option in the Criticality Reports to further prioritize capital improvements. It is recommended that the District use their judgement and experience in assigning criticality rating to the subsystems and units.

A few types of interpretations can be drawn from the Subsystem Criticality Report that is included in Appendix F. Some of the subsystems that have low scores are because some of the units in that subsystem were not available to obtain condition assessments for and these units account for a majority of the weight percentage of that particular subsystem. The software does not recognize the difference between an inoperable unit and a unit for which the condition was unknown. An example is the Raw Water Conveyance Subsystem. The major unit in these subsystems at each plant was the buried raw water piping. The buried raw water piping was not evaluated because it could not be visually inspected. Also, at the end of the report there are approximately a dozen subsystems that no units were evaluated and the resulting subsystem score is zero. This does not mean that the subsystems are in poor condition. It simply means that no condition assessments were available on the units in these subsystems for entry into the program.

An example of how the Subsystem Criticality Report can be used effectively is on a low scoring subsystem like the Finished Water Storage at MPTP. As stated above, the clearwell is in unsatisfactory condition and therefore causes the subsystem to score very low. Or conversely, a subsystem like the Liquid Sodium Hydroxide at FTTP has a very high score because all the units associated with this subsystem are rated as excellent.

The Assessment Manager program does provide an easy to navigate, user friendly, facilities tree specific to the entire NKWD system. It is an organized list of all the District's Assets along with condition assessments that can be easily updated to reflect both changes in the system and condition assessments. It also provides a good location for maintenance information and inventory control.

The Assessment Manager database was turned over to NKWD at the completion of this project, and any updates of equipment changes, or changes in condition assessments will need to be updated for the software package to accurately reflect the NKWD system.

VI. IDENTIFIED NEEDS AND IMPROVEMENTS

This chapter presents the various improvement projects which have been identified through the previous studies prepared for the District or as a result of this Asset Management Program. The projects described herein are the basis for the Capital Improvement Plan (CIP) that is discussed in Chapter VII. These recommendations are classified by their respective areas of the NKWD operations.

A. RAW WATER SUPPLY

The three raw water intake and pumping facilities operated by the District are crucial to NKWD's ability to supply adequate water to its customers. As described previously in this report, the current condition of those intakes contrasts significantly. As part of the AMP, B&V reviewed the overall reliability of the raw water supplies for the three treatment plants, and specifically examined the intake and pumping facility conditions. It was determined that the primary concern for adequate raw water supply was the ORPS2 facility, because it is considered to be "at risk". This section summarizes the issues associated with ORPS2 for maintaining a reliable source of water for MPTP, and also addresses other areas of need that were identified for the intakes in general.

1. RAW WATER SUPPLY RELIABILITY

As discussed in Chapter II, ORPS2 has several deficiencies which should be addressed in order to have a reliable source of raw water for the Memorial Parkway plant. In addition to the repairs and rehabilitation needs of the facility, it is anticipated that MPTP will eventually be expanded to a treatment capacity of about 20 mgd, which would involve other upgrades to ORPS2 to satisfy the increased supply needs of the treatment plant. For the purposes of the AMP, four preliminary alternatives for resolving this situation were identified, as follows:

A. Rehabilitate and upgrade ORPS2
B. Replace ORPS2 with a new intake and pumping facility
C. Retire ORPS2 and supply MPTP from ORPS1
D. Retire ORPS2 and install collector wells for supply

This section provides a brief discussion of the four alternatives and provides a preliminary opinion of probable cost for each of these alternatives.

a. Option A – Rehabilitate and Upgrade ORPS2. The existing raw water intake pumping station was constructed in 1872 and shows obvious signs of its age. There are considerable upgrades that would be necessary to not only ensure the structure is in safe, working condition, but also to upgrade the pumping station to a firm 20 mgd capacity. The pumping station is listed as a historical site by the AWWA. The legality and ramifications of this classification should be considered prior to performing any work on the structure; it may be determined that some renovations will not be allowed due to this classification. It may also be found that some type of financial assistance may be available in order to keep the historical structure in a presentable condition.

It is suggested that any significant upgrades to ORPS2 be carefully evaluated prior to implementation to determine their financial viability for a facility of such age. Furthermore, there are many unknowns associated with construction on a structure of this age; unanticipated findings during design and construction of the pumping station rehabilitation may prove to be costly and/or risky.

It should also be understood that with this option the District will incur peak demand electric charges in the future, as the existing ORPS2 cannot be upgraded to 32 mgd capacity due to physical and structural limitations of the facility. (The rationale behind sizing the pumping station for 32 mgd is to be able to provide 20 mgd supply in a 15 hour time frame, which is the maximum pumping window the District is allowed by Cinergy without assessing peak electric demand charges.) It is recommended that careful consideration of the other alternatives presented in this report be made prior to a decision to perform upgrades to ORPS2.

To provide 20 mgd firm capacity, it is recommended that all three pumps be replaced with 10 mgd pumps. Two pumps will serve as duty pumps, and one will serve as standby. To carry the water to MPTP, the existing 20 inch pipe installed in 1984 is presumed to be in good condition, and can be reused. The other existing 20 inch pipe, installed in 1872, has been assumed to have exhausted its usable life. It is recommended to replace this water main with a new 20 inch pipe. Horizontal directional drilling (HDD) is the recommended technique for installing the section of pipe from the pumping station to the top of the hill. From the top of the hill to the MPTP, traditional trenching methods can be used if desired.

Figure VI-1 on the following page illustrates the location of ORPS2 and the approximate location of the new raw water main that should be constructed to MPTP, if this option was chosen.

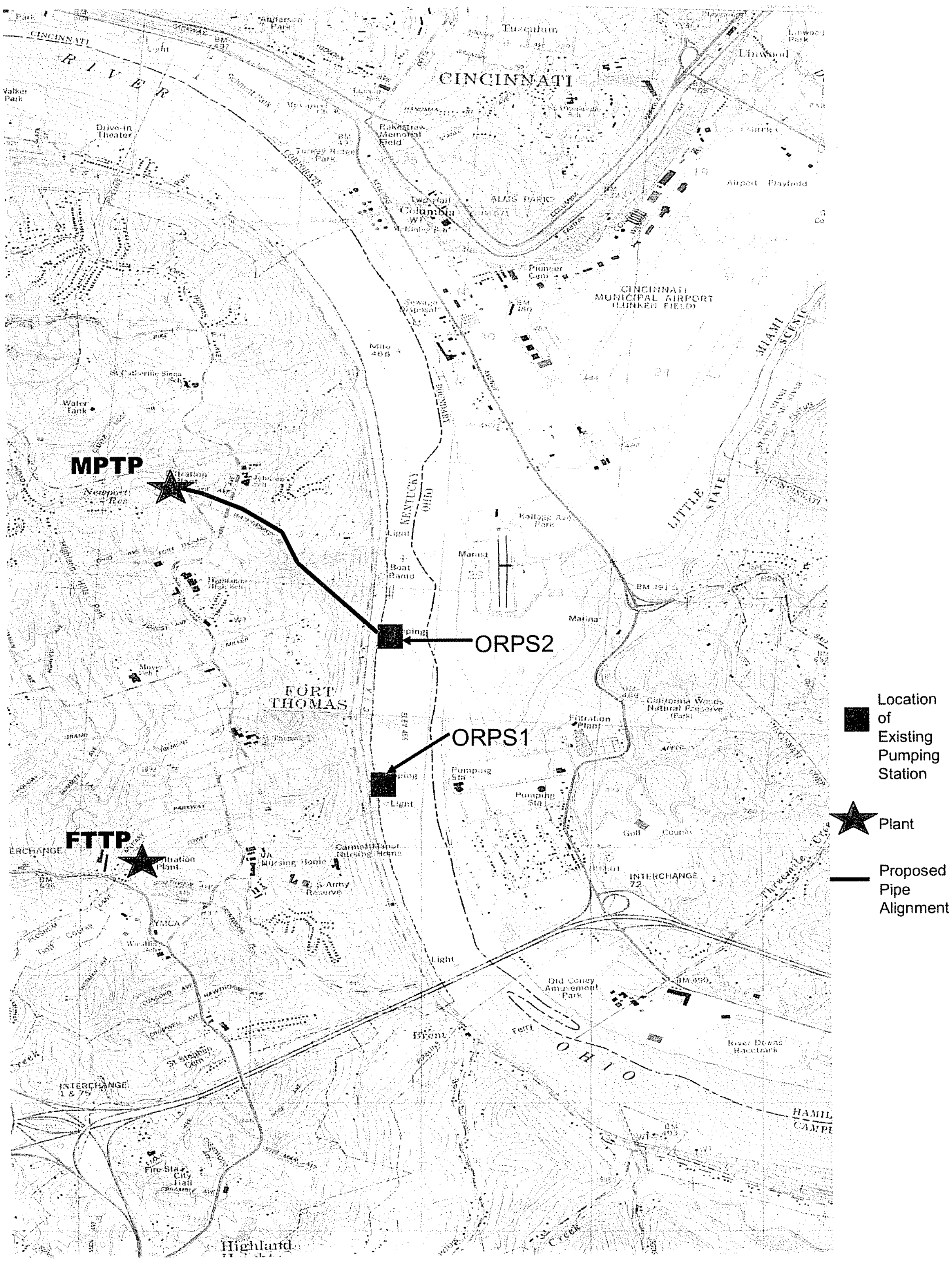


Figure VI-1: Option A – Rehabilitate and Upgrade ORPS2

The capabilities of the current electrical service to the ORPS2 site would need to be further evaluated to ensure that two of the future pumps and appurtenant equipment will be capable of operating simultaneously. NKWD staff indicated that the electrical service is adequate to operate two of the currently installed pumps simultaneously; however, it should be confirmed that the electrical service is adequate to also power the larger (10 mgd) pumps. For the purposes of this evaluation and cost comparison, electrical upgrades have not been included in the overall cost estimate. However, it is important to note that these costs may be substantial.

Table VI-1 summarizes the estimated major construction items and costs involved in the design and construction of upgrades to the ORPS2 facility.

Table VI-1
Opinion of Probable Costs for
Option A – Rehabilitate and Upgrade ORPS2

Item	Cost
Structural renovation (walls, roof, etc.)	$5,000,000
Protective cofferdams in river	$1,100,000
Misc. improvements (e.g. bar screen, stairs, lighting, etc.)	$1,000,000
Three 10 mgd pumps	$1,500,000
20" DIP from pumping station to top of hill (HDD)	$1,900,000
20" DIP from top of hill to MPTP (trenching)	$1,200,000
Miscellaneous	$2,100,000
Design and general administration	$2,200,000
TOTAL	**$16,000,000**

The primary advantages and disadvantages associated with adopting Option A for renovating ORPS2 are as follows:

Advantages:

- Lower capital cost
- Redundancy, each WTP would have its own raw water pumping source

Disadvantages:

- Not a long term solution
- Unknowns with performing renovations on a 125+ year old facility
- Difficult to keep station in operation during renovations
- On-peak pumping electrical demand charge

b. Option B – Replace ORPS2 with a New Intake and Pumping Facility. As part of this option, a new raw water intake pumping station, presumed to be of similar design and architecture as ORPS1, should be constructed to replace ORPS2. The pumping station should ideally be designed for a firm capacity of 32 mgd, so as to be able to provide 20 mgd supply to MPTP in a 15 hour time frame, which is the maximum pumping time the District is allowed by Cinergy without assessing peak electric demand charges.

Two possible locations for such an intake have been identified:

Alternate I - Adjacent to the existing ORPS2

Alternate II - North (downstream) of ORPS2, close to river mile marker 465

The new raw water intake pumping station should be designed to house three 16 mgd vertical pumps. Two pumps would serve as duty pumps, and one pump would be available to serve as standby. Piping and valve layout should be designed such that any pump may be taken out of service while keeping the other two in service. Chemical storage and feed systems should be installed for potassium permanganate. The potassium permanganate storage and feed system should provide for minimum three day storage at maximum feed rates, assuming the chemical is delivered in drum containers.

The new pumping station will have two 30 inch discharge mains, branching off of a common pump discharge header inside the building. For the Alternate I location, the two mains can be installed in a similar location parallel to the existing raw water piping. For Alternate II, the two mains can be installed along the alignment proposed in Figure VI-2. From the pumping station to the top of the hill (approximate elevation 800) for both alternates, it is recommended to install the pipes by horizontal directional drilling (HDD) means. While the cost of HDD is higher than conventional trenching, it is felt that due to the nature of the terrain, and in particular the known instability of the hillside in the area, it would be a better and more reliable option for the District. HDD will provide a more secure installation, and will be less obtrusive to the existing landscape. At the top of the hill, it is recommended to switch to conventional trenching installation along Waterworks Drive the remainder of the distance to MPTP. This section of pipe should be a single 36 inch main to minimize costs of pipe installation in the right-of-way.

Figure VI-2 on the following page illustrates potential locations for the new intake facility and the approximate location of the new raw water mains that should be constructed to MPTP if this Option B was chosen.

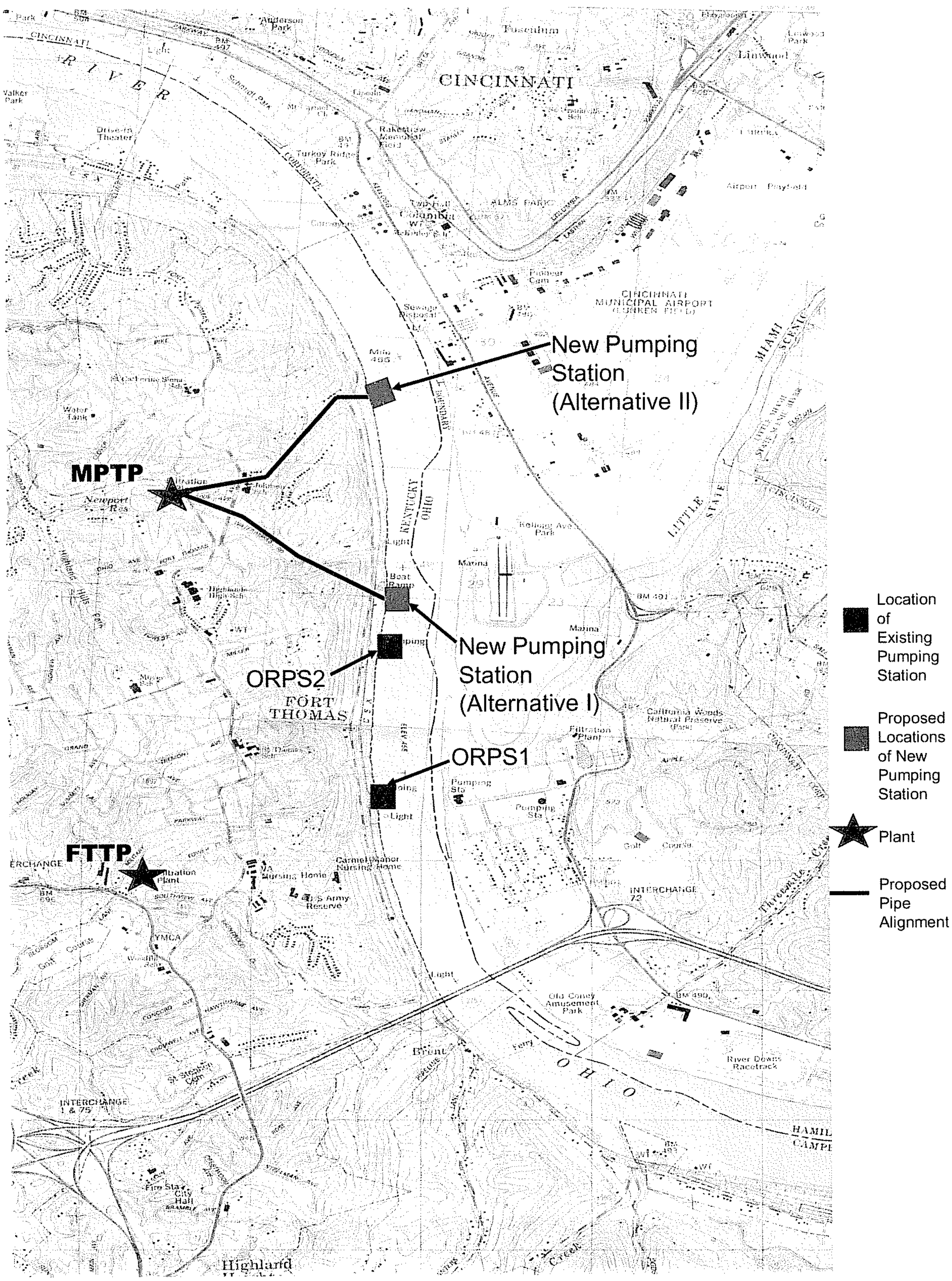


Figure VI-2: Option B – Replace ORPS2 with a New Intake and Pumping Facility

As was previously noted, it is understood that the present electrical supply to ORPS2 is adequate to run two of the existing pumps simultaneously. However, it was noted that the two larger existing pumps have not been run simultaneously in the last few years. Under Option B, with new 16 mgd pumps as part of the raw water intake, electrical requirements will be significantly increased. The electrical supply will need to be re-evaluated to determine if the existing supply can meet the new requirements. For the purposes of this study, it is assumed that some electrical upgrades will be required; however these have not been quantified to any degree. The power requirements for the new pumps would need to be determined, and the capacity of the existing electrical equipment should be reviewed during future detailed design. A cost has been reasonably assumed for the electrical upgrades for this evaluation. This value may vary upon more detailed analysis of electrical requirements and availability.

Table VI-2 summarizes the estimated major construction items and costs involved in the design and construction of a new intake facility to replace ORPS2.

Table VI-2
Opinion of Probable Costs for
Option B – Replace ORPS2 with a New Intake & Pumping Facility

Item	Cost
Pumping Station Structure and Equipment	$15,000,000
Electrical Services Upgrade	$500,000
Two 30" DIP from PS to top of hill (HDD)	$3,800,000
One 36" from top of hill to MPTP (Trenching)	$1,700,000
Miscellaneous	$4,200,000
Design and general administration	$3,800,000
TOTAL	**$29,000,000**

The advantages and disadvantages of building a new river intake pumping station to replace ORPS2 are as follows. The new intake could be designed based on a firm capacity of 32 mgd (to avoid peak electrical usage charges) or 20 mgd (to minimize construction costs). Note that the 32 mgd capacity pumping station is the recommended option, and the costs above are based on this capacity.

Advantages:

- New, reliable source of raw water pumping capability
- No retrofit to existing facilities, minimal effect on operations during construction
- Flexibility in design
- Redundancy, each WTP will have its own raw water pumping source
- Can be designed so no on-peak pumping is required with the 32 mgd option

Disadvantages:

- Time required for design and construction
- Construction cost

c. Option C – Retire ORPS2 and Supply MPTP from ORPS1. ORPS1 is the raw water supply source for the Fort Thomas Treatment Plant, and is a relatively new, reliable facility. Based on the 2001 Facilities Master Plan, FTTP has a current capacity of 44 mgd. The current firm capacity of ORPS1, with the five operational 12.1 mgd pumps, is 48.4 mgd, or approximately equal to the capacity of the FTTP. (Note that there is one pump slot that currently houses an inoperable pumping unit.) Option C considers the feasibility of upgrading ORPS1 to be able to feed 20 mgd to MPTP, in addition to its current operating mode of supplying 44 mgd to FTTP. With this option, the existing ORPS2 can be retired from service and all raw water for FTTP and MPTP will come from the same source.

As can be inferred from the description above, to provide the minimum 20 mgd supply to the MPTP, and 44 mgd to the FTTP, ORPS1 will need to be upgraded to a firm capacity of at least 64 mgd. This can be done theoretically by replacing the one existing inoperable pump with a new 16 mgd pumping unit, and replacing two of the existing 12.1 mgd pumps with new 16 mgd pumps. This will provide a total installed capacity of 84 mgd, and a firm capacity of approximately 68 mgd with one of the 16 mgd pumps out of service. In concept, each of the three divided cells of the station wetwell will house a 12.1 and 16 mgd pump.

It should be understood that electrical service to the pumping station needs to be further reviewed if this is option is chosen. With the proposed increase in pump sizes, it is assumed that electrical upgrades will be required. At this level of evaluation, a reasonable cost has been assumed for electrical upgrades.

The recommended means for transporting the raw water from ORPS1 to MPTP is to continue using the existing two 30 inch and one 42 inch pipes from ORPS1 to the FTTP, and run new piping from FTTP to MPTP. From the FTTP to MPTP, either a single pipe or two parallel pipes should transport the water. To minimize the amount of construction in the right-of-way, it is recommended to install a single 30 inch line to transport the 20 mgd in flow to MPTP. The new piping would run the majority of its route along Memorial Parkway through Fort Thomas.

The additional run of piping from the Fort Thomas plant to the Memorial Parkway plant will increase the required pumping head (pressure) on the system. This additional head imposed on the system cannot be overcome using the pumps at ORPS1. It is therefore recommended that a new 20 mgd raw water booster pumping station be installed to transport the raw water from FTTP to MPTP, and the ORPS1 pumps be designed primarily to deliver all the raw water to the FTTP. For the purposes of this evaluation, it is assumed that raw water from ORPS1 will continue to be discharged directly into the presedimentation basins at FTTP, and the new pumping station would be fed by gravity from the basins.

Another option to transport water from ORPS1 to MPTP is to run new piping north along Kentucky Route 8, and then connect to the existing 20 inch raw water pipe near ORPS2. The existing 20 inch pipe installed in 1872 should be replaced with new 20 inch pipe for reliability. However, this piping option is not recommended due to slope instability along Route 8. The slope consistently slides toward the river, as is evident by the repeated rehabilitation work that has been performed on the roadway. Installation of new pipe in such unstable ground would be difficult and costly, and the long term reliability of such an installation would be questionable. Furthermore, if this installation is chosen, it would likely necessitate the need to dedicate specific pumps to supplying MPTP, due to varying system head conditions between the two discharge points (i.e., one set of pumps to FTTP, and one set to MPTP). This would minimize operating flexibility of the pumping station if pumps need to be dedicated to specific discharge locations.

Option C has a considerable disadvantage in that power costs will increase significantly under this approach, regardless of which raw water piping method were selected. Off-peak pumping will not be practical during high water demand periods given the capacity limitations with the pumps. Construction of a second pumping station at FTTP will involve the “re-pumping” of water supplied to MPTP, also requiring additional electrical consumption. The alternative of constructing a main along Route 8 and dedicating pumps for supply to MPTP will likewise increase the electrical costs due to the higher pump discharge pressures required.

Figure VI-3 on the following page illustrates the location of ORPS1 and the approximate location of the new raw water main that should be constructed from the FTTP to the MPTP if this option was chosen.

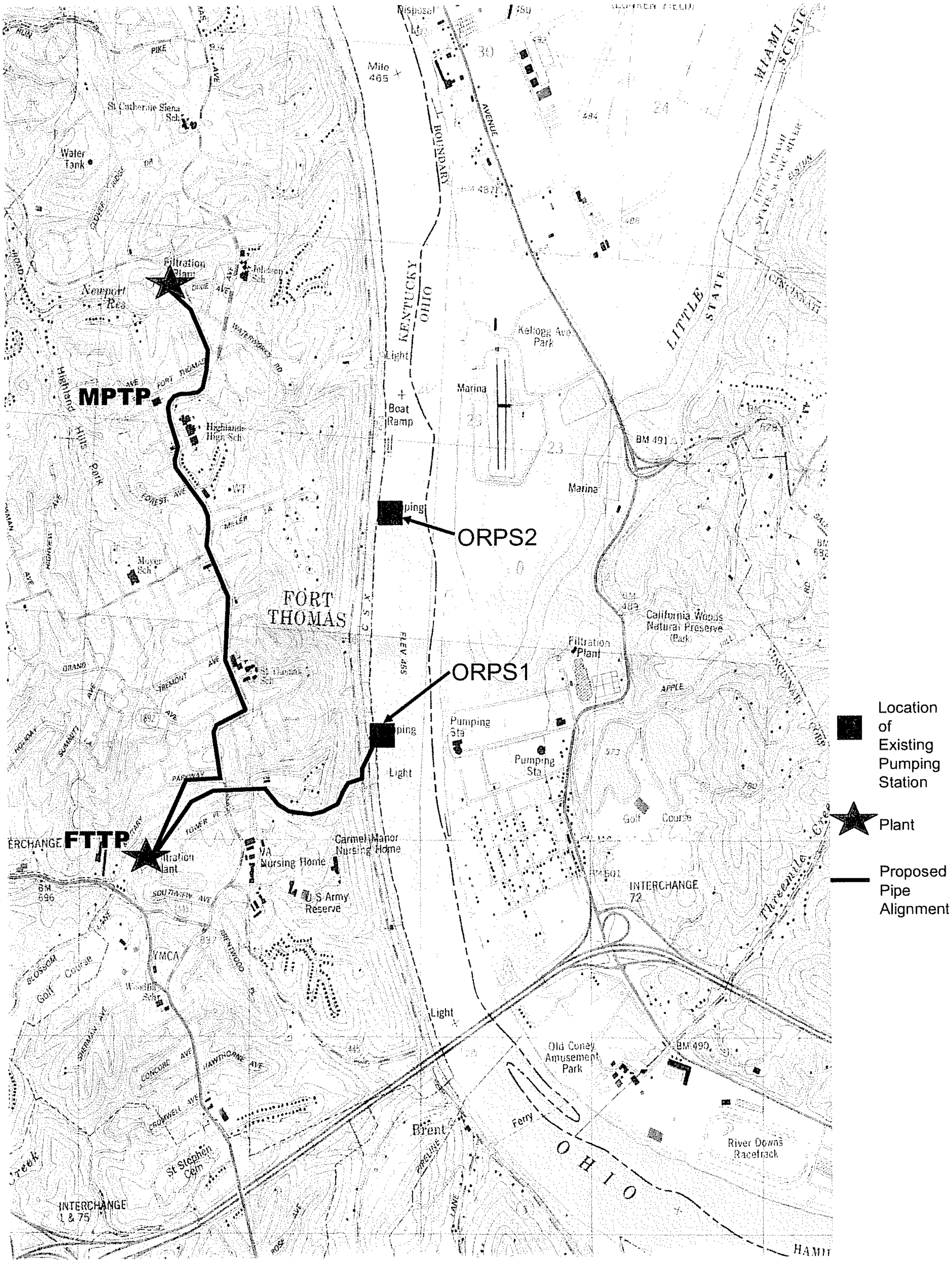


Figure VI-3: Option C – Retire ORPS2 and Supply MPTP from ORPS1

As explained previously, it should be noted that to provide a firm capacity of 64 mgd, the pumping station will need to operate during peak hours. Peak demand charges have not been accounted for in this evaluation.

Table VI-3
Opinion of Probable Costs for
Option C - Retire ORPS2 and Supply MPTP from ORPS1

Item	Total Cost
Three 16 mgd pumps and piping/valve modifications	$1,600,000
Pumping station structure upgrades*	$1,000,000
30" pipe from FTTP to MPTP (trenching)	$3,600,000
Electrical service upgrades	$500,000
Booster Pumping Station	$3,700,000
Miscellaneous	$2,100,000
Design and general administration	$2,500,000
TOTAL	**$15,000,000**

*May include structural reinforcing to account for heavier pumps and different dynamic loadings, crane upgrades, and other appurtenant modifications.

The primary advantages and disadvantages associated with Option C are as follows:

Advantages:

- No pipe installation in unstable slope, reuse existing 42 inch and two 30 inch pipes
- New intake not required
- Lowest capital cost

Disadvantages:

- Piping from FTTP to MPTP will be installed through congested areas
- No redundancy in raw water pumping sources
- Coordination required to implement modifications and maintain pumping operations
- On peak pumping electrical demand charge, increased power costs

d. Option D -- Retire ORPS2 and Install Collector Wells for Supply. As part of this option, collector wells could be installed near the Ohio River to draw groundwater and/or infiltrated river water as the raw water source for the MPTP. Three locations were evaluated for their potential to develop a ground water or infiltrated water supply:

1. Downstream of ORPS2 in the vicinity of Dayton, Kentucky (approximate river mile marker 466-468)

2. Upstream near Silver Grove, Kentucky (approximate river mile marker 461), and

3. Across the river in the vicinity of California, Ohio and the Lunken Airport (approximate river mile marker 463-465)

A brief description of each of these areas follows:

1. Dayton, KY. This area has an alluvial plain where it should be possible to install wells to develop a ground water supply. Available well information in this area suggests that the depth to bedrock is over 60 feet. There is about one mile of river frontage that appears to be somewhat undeveloped that may provide possible well sites, and an additional mile or so along the river that may have sites available adjacent to residential areas. This area appears to have the shortest distance along the river shoreline to the existing pumping station. However, even though the distance from the wells to MPTP is the shortest, the alignment would pass through congested areas.

2. Silver Grove, KY. This area has a more extensive alluvial plain along the river as compared to the Dayton site, extending several miles, and including a railroad yard about two miles long. It appears there may have been environmental problems there in the past due to the presence of ground water monitoring wells on file with the state, the status of which is unknown at this time. It appears that suitable alluvial deposits in this area may be as deep as 100 feet, which provide favorable sites for wells. However, it is too far away from the plant to be considered feasible economically and potential pipeline routes cross several congested areas. Furthermore, it is too long of a distance to utilize Horizontal Directional Drilling (HDD) or tunneling pipe installation methods.

3. California, OH. The alluvial plain at this location includes the junction of the Little Miami River valley with the Ohio River, providing the most favorable possible well location from a hydrogeologic viewpoint. Based upon limited well data available, it appears that well depths of 80-100 feet, or more, should be possible in this area, and there appears to be over five miles of river frontage available for consideration as possible well locations. This area is closest to the existing pumping station; however, utilization of this site would involve a river crossing.

Figure VI-4 on the following page illustrates the potential locations identified for installing collector wells and the approximate location of the new raw water mains that would be constructed to supply MPTP if this option was chosen.

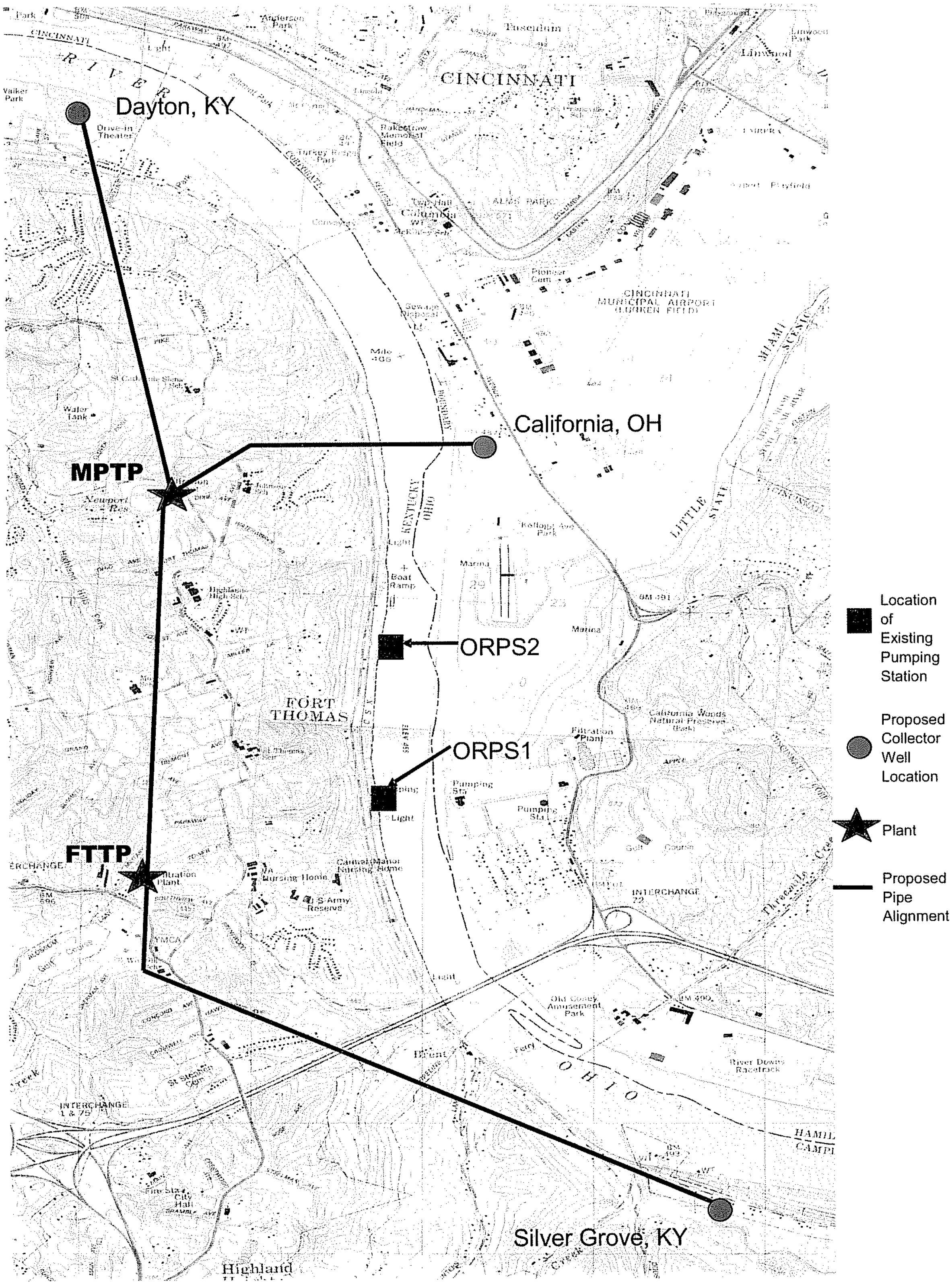


Figure VI-4: Option D – Retire ORPS2 and Install Collector Wells for Supply

To summarize, the California, Ohio location is the most favorable from a collector well viewpoint, and also piping from the wells to the MPTP through congested areas will be minimized. However, the pipes would need to be tunneled underneath the river from Ohio to Kentucky. The Dayton, Kentucky area will be of a comparatively similar expense to the California location due to congested areas and unstable terrain, however it does not provide as favorable well conditions. The Silver Grove site is located too far away to be a feasible option. As a result, the California option is discussed below in greater detail.

Based on geology of the area, a conservative estimate of the installation of five 5 mgd wells has been evaluated. It may be found on further detailed evaluation that the number of wells can be reduced after conducting hydrogeologic testing and analysis. The collector well pumps must remain above the 100 year flood plain elevation (about elevation 502). At the proposed location, grade is around elevation 490. Therefore, the pumping station should be elevated approximately 12 feet, or a mound should be constructed to a minimum grade of elevation 502 to keep the pumps above the flood elevation.

It is recommended to use either HDD or tunneling to cross the river, depending on results of geotechnical evaluations. Once on the Kentucky side, it is recommended to continue using HDD or tunneling methods to install the pipe up to the top of the hill. At this point, it is recommended to switch over to traditional trenching methods for pipe installation. From the wells to the top of the hill, it is proposed to install two parallel 24 inch lines. From the top of the hill to MPTP it is proposed to install a single 36 inch to minimize pipe installation in the right-of-way.

The cost breakdown listed below in Table VI-4 is indicated for the California, Ohio location. Costs for this area are estimated to be similar to the Dayton location.

Table VI-4
Opinion of Probable Costs for
Option D - Retire ORPS2 and Install Collector Wells for Supply

Item	Cost
Land acquisition	$250,000
Five 5 mgd collector wells	$10,000,000
Two 24" DIP under river (HDD or tunneling)	$6,250,000
Two 24" DIP up the hill (HDD or tunneling)	$6,125,000
36" from top of hill to MPTP (trenching)	$750,000
Miscellaneous	$4,700,000
Design and general administration	$3,925,000
TOTAL	**$32,000,000**

The significant advantages and disadvantages identified for Option D are summarized as follows:

Advantages:

- New, reliable source of raw water
- Water is partially filtered (e.g. no zebra mussels, low turbidity, etc.), hence, treatment costs may be decreased
- Minimal interference with pumping operations during construction
- Redundancy, each WTP would have its own raw water pumping source

Disadvantages:

- Land purchase
- Highest capital cost

e. Workshop Findings. A Workshop was conducted with the District on August 28, 2003, to discuss, among other topics, the options presented in this section for providing a reliable raw water supply to MPTP. The District personnel and B&V conducted careful review and discussion of the various options at the Workshop. For Option A, there was general consensus that it would be impractical to rehabilitate ORPS2 due to its age. As Option D was the most expensive, the District decided to forgo further investigation of this option. At the conclusion of the discussion, the District directed B&V to further investigate Option B – Replace ORPS2 with a New Intake and Pumping Facility, and Option C – Retire ORPS2 and Supply MPTP from ORPS1.

For Option B, the District further requested B&V to provide a preliminary cost estimate for a 20 mgd pumping station for comparison purposes, in addition to the 32 mgd pumping station considered by B&V.

f. Additional Investigation of Selected Options. As indicated above, B&V conducted further detailed investigations of Options B and C, as described in the following paragraphs.

i. Option B – Replace ORPS2 with a New Intake and Pumping Facility. At the District's request, B&V examined the option of a new 20 mgd river intake pumping station from a cost standpoint. The concept is similar to that of the 32 mgd pumping station (presented under Option B – Replace ORPS2 with a New Intake and Pumping Facility), except that instead of 16 mgd pumps, 10 mgd pumps should be used.

For this option, the existing 20 inch pipe installed in 1984 is assumed to be reused, and the 20 inch pipe installed in 1872 to be replaced. The new 20 inch pipe will be installed by

HDD means up the hill. At the top of the hill, the 20 inch pipe installation method will switch to conventional trenching means.

As discussed previously, District staff indicated that the existing electric supply may be capable of running two of the existing pumps simultaneously. However, with the 20 mgd option, two 10 mgd pumps need to be run simultaneously, which may not be possible with the existing electric supply. Hence, it has been assumed that electric upgrades will be necessary as part of this option. Detailed analysis for the electrical system has not been performed as part of this study.

Table VI-5 presents the major cost items associated with constructing Option B as a 20 mgd facility, instead of the 32 mgd capacity intake conceived previously for this option.

Table VI-5
Opinion of Probable Costs for
New 20 mgd Pumping Station (Modified Option B)

Item	Cost
Pumping Station Structure and Equipment	$13,000,000
Electrical Services Upgrade	$500,000
20" DIP from PS to top of hill (HDD)	$1,900,000
20" DIP from top of hill to MPTP (Trenching)	$1,200,000
Miscellaneous	$3,200,000
Design and general administration	$3,000,000
TOTAL	**$22,800,000**

It should be noted that for a 20 mgd firm capacity design the pumping station will need to be operated during peak hours. Peak demand charges have not been accounted for in this evaluation.

ii. Option C – Retire ORPS2 and Supply MPTP from ORPS1. As explained previously, this option considers the feasibility of upgrading ORPS1 to be able to feed 20 mgd to MPTP, in addition to its current operating mode of supplying 44 mgd to FTTP. Further investigation of this option was carried out subsequent to the Workshop. The investigation focused on the following principal areas, as these had the most bearing on the viability of this option:

1. Weight of the 16 mgd pumps
2. Peak demand electric charges

Investigation of Item 1 led to the conclusion that the proposed 16 mgd pumps were substantially heavier than previously assumed. Item 2 determined there would be significant operational costs for off-peak pumping. A description of these items is presented below.

1. Weight of 16 mgd Pumps. Upon detailed hydraulic analysis of the system, it was determined that three of the existing 12 mgd pumps should be replaced with three 16 mgd pumps with 2,000 hp motors to meet the minimum required 64 mgd firm pumping capacity. Based on records available with B&V from the original construction of ORPS1, it was found that the weight of one of the existing 12.1 mgd pumps, with motor, is approximately 26,000 pounds. Upon discussion with pump manufacturers, it was found that the total weight of a 16 mgd vertical pump with a 2,000 hp motor is estimated to be approximately 41,000 pounds, an increase of 15,000 pounds per pump.

Without performing a detailed structural analysis, it is assumed with a high level of certainty that the existing ORPS1 structure will not be capable of supporting this additional load. Furthermore, a vibration analysis must also be performed for the new pumps to ensure the vibration frequency of the pumps does not match that of the structure. As such, it is preliminarily considered impractical to modify ORPS1 for installation of 16 mgd pumps. A final conclusion regarding this option could be determined based on a more extensive study.

2. Peak Demand Electric Charges. Peak demand electrical charges are incurred by the District if any pump operates during a designated peak hour, for any amount of time, during the billing period. It is a flat charge rather than a rate charge, and is classified as a capacity allowance. The amount of power (kW) that was consumed during a peak hour is multiplied by $9.21, based on existing rate charges assessed against the District by Cinergy. This flat charge is the same whether it occurred once, or multiple times during a calendar month. For example, if a 1,000 hp pump operated for only 15 minutes during a peak hour, the charge for that month would be an additional $6,871 (1000 hp * 0.746 kW/hp * $9.21/kW). Note that a time factor is not involved for the 15 minutes duration; hence, it is called a flat charge. This would be charged whether it happened only once during the month, or every day during the month.

If ORPS1 is upgraded to a firm capacity of 64 mgd, and assuming the current rule of 15 hours a day of off-peak pumping time remains unchanged, the total capacity of the pumping station is effectively 40 mgd if it is only operated during off-peak hours. (Pumping at a rate of 64 mgd for 15 out of 24 hours would equal 40 million gallons over the 24 hour period.) Based on optimizing the hydraulic capacity of the pumping station, the 64 mgd capacity would be obtained by operating two new 2000 hp, 16 mgd pumps, and three of the existing 1,250 hp, 12 mgd pumps. This results in a total horsepower of 7,750 hp. If at any time the pumping station would need to operate at its maximum capacity during on-peak hours, the peak demand charge for that month would be $53,248 (7,750 hp * 0.746 kW/hp * $9.21/kW).

Historical usage data was used to estimate how many months of the year it may be presumed that the pumping station would have to be operated during on-peak hours, based on summing the capacity requirements for FTTP and MPTP. Wherever any month had a combined average daily usage of 40 mgd or more, it was assumed that on-peak pumping would be required during that month. Some capacity increase assumptions were made due to lack of information. For example, future projection for FTTP demand requirements assumed a 2.5% increase in water demands every five years, beginning with known usage data from 2002. Future values for average daily usage at MPTP were based on findings from the Water System Master Plan Addendum.

For purposes of cost impacts, it was determined that the cost that would be incurred by peak demand charges over an assumed 50 year usable lifespan of the pumping station is estimated to be approximately $9,900,000. For years 0 – 15, it was estimated that on-peak pumping would be required three months per year. For years 15 – 50 it was estimated that on-peak pumping would be required 4 months per year. It was assumed that the peak demand charge remained constant at $9.21/kW, and the total horsepower that would be operated is 7,750 hp (two 2,000 hp, 16 mgd pumps, and three 1,250 hp, 12 mgd pumps).

One theoretical method of addressing this problem would be to utilize on-site electric generation to mitigate peak demand charges. However, this would require a higher service duty generator system than the type used strictly for standby power purposes, due to its greater level of usage. Such a system would likely be fueled by natural gas, instead of the diesel generators typically employed for standby power use. It would also classify the District as a power producer, possibly involving more strict regulations on operation and emissions. Additional study would be necessary to determine the feasibility of this approach.

iii. Conclusion. Subsequent to the Workshop, further analysis of Option C – Retire ORPS2 and Supply MPTP from ORPS1 found that due to the significantly heavier 16 mgd pumps, the risk for structure damage and/or failure may exist. It may be theoretically possible to add additional structural reinforcement to the structure. However, this can not be decisively determined from the scope of this evaluation. It is considered likely that such an approach would prove to be cost prohibitive and impractical. In addition, the costs that would be incurred by peak demand charges significantly reduce the cost savings originally presented for this option.

As a result of the structural issues and significant cost increase determined during further investigation of Option C – Retire ORPS2 and Supply MPTP from ORPS1, it is not recommended to pursue upgrades to ORPS1 as a viable option for increasing raw water supply to MPTP without further analysis.

g. Summary. Four options were studied to provide a reliable raw water supply of 20 mgd to MPTP:

Option A – Rehabilitate and Upgrade ORPS2, and Option D – Retire ORPS2 and Install Collector Wells for Supply were rejected as viable options by the District during the Workshop.

Option B – Replace ORPS2 with a New Intake and Pumping Facility, and Option C – Retire ORPS2 and Supply MPTP from ORPS1 were studied in further detail subsequent to the Workshop.

Results from further investigations of Option C led to the conclusion that retiring ORPS2 and supplying MPTP from ORPS1 may not be feasible due to structural limitations of ORPS1, and increased cost due to peak electric demand charges. For Option B, the cost estimate for a new 20 mgd raw water pumping station was prepared as requested by the District. As compared to a 32 mgd facility, the cost savings were relatively small. Due to the significant advantages a new 32 mgd facility presents as compared to a 20 mgd facility, replacing ORPS2 with a new raw water intake pumping station sized for 32 mgd is recommended for providing the future raw water needs of MPTP.

2. OHIO RIVER PUMPING STATION #1

a. Pump Replacement. Due to the current inoperable condition of Pump No. 6 at ORPS1, the pump should be replaced with a new unit to bring the pumping station up to full capacity. The new pump should be identical in capacity and rated head to the existing units. The pump replacement is planned for 2007, per the Moderate version of the CIP.

b. ORPS1 to FTTP 36 inch Raw Water Main Replacement. As described above in the Raw Water Supply Reliability section, Option C was considered to provide raw water from

ORPS1 to both MPTP and FTTP. While this option was ruled out because of pump weights and structural limitations within the existing pumping station and peak electrical charges, the District mentioned that one of the existing 30 inch pipes from ORPS1 to FTTP was not in reliable condition and recommended replacing it if this option was chosen. Even though Option C was eliminated to supply MPTP, due to the age and unknown condition of the existing two 30 inch lines, as well as the instability in the hillside from ORPS1 to FTTP, it is recommended that one of the existing 30 inch lines be replaced with a 36 inch line to supply FTTP. This project is planned for 2014.

The proposed 36 inch line should be installed by HDD up the hillside for the same reasons as presented above. From the top of the hill to the plant the line could be open trenched to reduce cost.

c. Other Issues. Other identified concerns that do not require a specific capital project are listed below. These items can be handled by the Operations and Maintenance budget rather than the Capital Improvement budget.

- Provide adequate labeling of the chemical storage tanks to clearly indicate the chemicals being stored and fed from each area.

- Provide permanent routing of the chemical piping jumping between the existing potassium permanganate and sodium hypochlorite storage tanks to eliminate a tripping hazard.

Also, as described in Chapter II, the District is currently conducting an investigation into the reliability and condition of the three traveling water screens.

3. OHIO RIVER PUMPING STATION #2

a. ORPS2 Replacement and Raw Water Main Replacement. As described above in the Raw Water Supply Reliability section of this chapter, it is recommended ORPS2 be replaced with a new intake pumping station. Due to the significant advantages a new 32 mgd facility presents as compared to a 20 mgd facility as outlined above, replacing ORPS2 with a new raw water intake pumping station sized for 32 mgd is recommended. The project is currently planned for 2011.

Also, as part of the ORPS2 replacement project, two new 30 inch raw water mains up the hill and a single 36 inch raw water main from the top of the hill to the plant should be constructed to supply MPTP. Again, as described above, the two 30 inch lines should be horizontally directionally drilled up the hillside, and the single 36 inch line should be open trench cut. See Option B above for further explanation.

b. <u>Other Issues</u>. Other identified concerns and recommendations at ORPS2 that are based upon conditions noted during the site investigation and should be implemented to keep the pumping station operational until a new facility is constructed include the following:

- Provide automatic controls on the sump pump in the lower pumping station level to maintain a minimum water level, thereby minimizing corrosion and providing safe access to the lower level of the pumping station.
- Provide fixed lighting in the lower pump area (below the upper level grating).
- Examine the elevator for proper operation, repair/replace defective components to ensure adequate operation, or abandon its use and install adequate stairs to the lower pump area.
- Examine the integrity of the exterior walls of the pumping station. If possible remove the damaged material and provide additional structural steel and gunnite to provide a solid wall surface.

4. MEMORIAL PARKWAY TREATMENT PLANT RAW WATER PUMPING STATION

a. <u>Pump Improvements</u>. As part of the project planned for construction in 2005 at the MPTP (Chemical Building Replacement and reservoir transfer piping), it is recommended that the MPTP Raw Water Pumping Station be improved by replacing the three pumps as well as interior valves and associated piping.

The MPTP Raw Water Pumping Station would be a major limiting factor in the production of treated water if the MPTP increased capacity, as hydraulic limitations with the three existing raw water transfer pumps prevent less than 10 mgd to be pumped to the ACTIFLO® process, according to District staff. Normal pumping operation is to run Pump No. 1, rated at 8 mgd, or Pumps, No. 2 and 3, both rated at 6 mgd, to transfer water from the reservoirs to the ACTIFLO® process. Flow is controlled by throttling a valve at the plant, which is not a recommended means of flow control and wastes energy. All three pumps are from the original construction of the pumping station in 1961.

Due to the age and condition of the three existing raw water pumps and associated valves and piping, it is recommended that they be replaced with three new pumps with variable frequency drives (VFDs) and new piping and valves. VFDs would allow operators to precisely set the influent flow rate to the treatment process versus throttling a valve at the plant. They would also reduce wasted energy costs, as the pumps would no longer operate at higher than necessary horsepower levels in order to overcome the added resistance from the partially closed valve. Preliminary design for the pumps indicates that they should each be rated for 6 mgd. A separate room in the pumping station should be partitioned for the VFDs and a HVAC system should be installed in this room for maintaining appropriate conditions for the VFD equipment.

b. Other Issues. Other identified concerns and recommendations at the MPTP Raw Water Pumping Station that are based upon conditions noted during the site investigation include the following:

- Examine the cause for the differential settlement of the building and provide for stabilization of the structure.
- Replace pump shaft guards with OSHA approved units until new pumps are installed.
- Clean and provide adequate drains from each pump to properly drain seal water from the equipment to minimize corrosion and ponding on the floor.
- Replace metal grating over raw water piping.

5. LICKING RIVER PUMPING STATION

a. New Pump / VFD, Traveling Screen, Gates. The Licking River Pumping Station operates unlike the other two intake facilities because TMTP does not have presedimentation facilities. Water that is pumped from the LRPS goes immediately to the rapid mix basin and the treatment process. For this reason, the LRPS pumps do not operate on a fixed schedule as the pumps at ORPS1 and ORPS2 operate. Also, because demand to produce water is lower for TMTP, the majority of the time only one pump operates at the LRPS. District staff indicated that Pump No. 3 runs approximately 85-90% of the time because this pump is equipped with a variable frequency drive (VFD) for better flow control, and Pumps No. 2 and No. 3 are of larger capacity, which is not needed during most situations.

The District has recognized the concern of running one of the three raw water pumps the majority of the time. This pump cannot be taken out of service for maintenance without causing operational difficulties in the pumping station. Additionally, the condition of the traveling water screens and sluice gates are unknown, but based upon their age and previous maintenance procedures performed, District staff feel they may need to be replaced.

Possible resolutions to the pumping problems at LRPS are to replace either Pump No. 1 or No. 2 with a new pump and VFD. This would allow much greater flexibility in the operation of the pumping station. However, due to space limitations within the facility, it is questionable if the pumping station has sufficient space to house two VFDs. It is recommended further analysis be performed and other possible solutions be examined for operation of the LRPS.

b. Other Issues. Other identified concerns and recommendations at the Licking River Pumping Station include removing the out of service gate stem and operator stand from the exterior grating platform on the river side to improve maintenance access to the traveling screen drive.

During the site investigation, it was noted that the facility has some severe structural cracking. Black & Veatch conducted a structural assessment of this cracking in the summer of 2002 and presented a detailed description of findings and recommendations to the District at that time. To summarize the recommendations:

- The pumping station is structurally sound and is in a usable and safe condition.
- The cracking observed in the load bearing masonry wall support system should be repaired in an expeditious manner to eliminate further deterioration and potential unsafe conditions.
- The bridge / support corbels should be repaired in an expeditious manner to eliminate further deterioration and potential unsafe conditions.
- The cracked overhangs of the building slab should be mechanically removed to sound concrete and the section should be recast using a polymer modified repair mortar and / or the concrete repaired with an epoxy injection to close the crack and prevent further deterioration. The type of repair should be determined when the repairs commence and a portion of the concrete is chipped away.

- The bridge support corbels should be mechanically removed to sound concrete and reformed using a polymer modified repair mortar.

Black & Veatch is of the understanding that the District is actively monitoring the cracks in the facility to see if they become worse and is in the process of resolving this issue.

B. WATER QUALITY AND PRODUCTION

Obviously, the District's three water treatment plants are the focal point of NKWD's primary function: they treat the water for consumption by the customers. Under this AMP the plants have been evaluated for water quality, treatment capacity, and overall condition. This portion of the report describes the various improvements identified for the plants.

1. TREATMENT CAPACITY

The treatment plants currently have a combined treatment capacity of about 64 mgd. The individual capacity ratings of the WTPs are as follows:

Fort Thomas	44 mgd
Taylor Mill	10 mgd
Memorial Parkway	10 mgd

Table VI-6 lists the projected maximum day water demands for the NKWD system and the associated surplus or shortfall in treatment capacity, based on having a total available capacity of 64 mgd.

Table VI-6
Projected Maximum Day Water Demands vs. NKWD Treatment Capacity

Year	Maximum Day Demand (mgd)	Treatment Capacity Surplus or Shortfall (mgd)
2000	62.4	+1.6
2005	54.1	+9.9
2010	57.8	+6.2
2020	65.5	-1.5

Based on the data shown in Table VI-6, the combined treatment capacity of the District's plants is anticipated to become inadequate to meet demands in about year 2018. However, NKWD currently has about 10 mgd in excess treatment capacity, which would theoretically allow the District to operate without either the Taylor Mill or Memorial Parkway plants through approximately 2005. By the summer of 2006, it is expected that all three of the treatment plants would be needed to meet demands.

It must be stressed that Black & Veatch is not recommending that the District stop operations or "moth-ball" either the Taylor Mill or Memorial Parkway plants. The only benefit to be gained from such an approach would be a short-term reduction in operating costs. However, it is our opinion that the advantages presented by a plant shut-down are significantly outweighed by the disadvantages, as follows:

- If a plant were moth-balled, it would not be advisable to decrease the operating staff, considering the inherent knowledge and understanding they possess, as well as the difficulty in finding suitable persons for such positions. Thus, the personnel costs would not be saved, and assignments for these staff members would be needed.

- The District has made a considerable monetary investment in purchasing the Newport system. Based on the rate conditions which apply, if the Memorial Parkway plant were removed from service, NKWD would be unable to recover the associated costs through its rates, and thereby create a financial burden on the District.

- Because of the vital role the Taylor Mill Treatment Plant plays in the transmission and distribution network, it would not be practical to completely shut-down the facility. Continuing maintenance and upkeep would be needed, along with intermittent staffing.

- If either MPTP or TMTP were taken out of service, appropriate preparations for shut-down and future start-up would be needed. This would involve some added expense, and the plant would still require periodic maintenance, repairs, heating, and exercising of equipment. Without such activities, additional costs would be incurred making the plant ready for restarting.

- If Memorial Parkway were selected for shut-down, it would not alleviate the need for significant improvements at the facility. Because of NKWD's investment, and the future necessity of having supply available from MPTP, those repairs and upgrades will still need to be implemented.

- Given the relatively short time frame one of the plants could be moth-balled (about two years), any cost savings would be comparatively minor, as the same amount of water will need to be treated to meet demands, regardless of where it is produced.

For planning purposes, NKWD should assume that additional treatment capacity will be needed by year 2018. With the option of constructing a new treatment facility not being considered, the best available alternative for increasing the supply of finished water to the system appears to be expansion of the Memorial Parkway plant. This is largely due to the existing filtration capacity present at MPTP (22 mgd), which would reduce the scope of new facilities needed as compared to the other two treatment plants. By installing a new parallel ACTIFLO® process, along with some other improvements, MPTP could be expanded to a capacity of about 20 mgd. With the information currently available, such an expansion of the MPTP, with the available capacity of the other two plants, should provide adequate finished water supply for the District through approximately year 2035.

2. WATER QUALITY AND REGULATORY COMPLIANCE

As indicated in Chapter IV of this report, the most significant challenge to be faced by the District in meeting anticipated future water quality regulations will be the level of disinfection by-products (i.e. trihalomethanes) that occur within the distribution system. As required by the Stage 2 Disinfection By-Products Rule, NKWD will have to meet the maximum TTHM limit of 0.080 mg/L at all system monitoring sites, on a running annual average basis for each site. Based on data from the last several years, NKWD will be unable to comply with these limits when they become effective, which is currently anticipated to be in July 2011.

Because the Fort Thomas Treatment Plant plays such a significant role in the District's ability to meet the Stage 2 DBPR, producing over 70 percent of NKWD's treated water, it is recommended that it be the focal point for improvements. However, this should not be interpreted to imply that by improving water quality at FTTP alone the District will necessarily comply with the regulations; further evaluation of the Memorial Parkway and Taylor Mill plants is appropriate to determine whether process enhancements should also be incorporated into those facilities. This is especially important for MPTP, considering its projected expansion to 20 mgd treatment capacity in approximately fifteen years.

A variety of methods for minimizing DBP formation were considered. DBPs are formed by the combination of total organic carbon (TOC) in the water with a disinfectant; in the District's case, chlorine. DBPs can be reduced by changing disinfectants, reducing the levels of TOC, or a combination of the two.

TOC levels may be reduced by the following means:

- Enhanced Coagulation

- Addition of Powdered Activated Carbon (PAC)
- Granular Activated Carbon (GAC) Adsorption, by either Filter Adsorbers or Post-Filtration GAC Contactors
- Anionic Exchange Resins (MIEX® process)
- Physical Separation (membrane filtration)

Each of these methods for TOC reduction has disadvantages for application at the Fort Thomas plant. Enhanced coagulation and MIEX® are unproven in the District's case for meeting the DBP levels that will be required, and the MIEX® process involves a substantial brine waste discharge that must be addressed. Both PAC addition and GAC adsorption are relatively expensive processes, either in terms of operational costs and/or the capital investment required. Membrane processes (RO and NF) have been pilot tested at NKWD, but biological fouling of the membranes make this process impractical.

As mentioned above, another way to minimize DBP formation is to change disinfectants, which would include the following options:

- Chlorine plus Chloramines
- Chlorine Dioxide
- Ozone (plus biological filtration)
- Ultraviolet Light

All of the options listed above require the addition of chlorine or chloramines for maintaining a disinfectant residual in the distribution system. However, based on the raw water quality, little benefit would likely be realized for NKWD with the use of chlorine dioxide, ozone, or UV unless chloramines were used for the secondary disinfectant within the distribution system.

Evaluation of all of these possible techniques was previously performed as part of the 2001 Fort Thomas WTP Treatment Evaluation, and each was again reviewed under the AMP. It was determined that the only means which could be considered both reliable and feasible for the District to adopt, based on the information currently available, were switching disinfectants to chloramines or implementing GAC adsorption through the use of post-filtration contactors. Chloramines are not considered desirable by the District; however, further evaluation of this method may be appropriate as the decision point for meeting the future regulatory standards gets closer. Therefore, GAC appears to be the best approach for the District's planning at this time.

For the control of DBPs, the interval over which the GAC media is replaced plays a critical role in determining its effectiveness. EPA states in the proposed Stage 2 DBPR that the "best available technology" for compliance with the future DBP regulations is enhanced coagulation plus GAC adsorption. EPA also specifies the minimum required Empty Bed Contact Time (EBCT) for GAC: 10 minutes with replacement every 120 days, or 20 minutes with media replacement every 240 days. Achieving these EBCTs through the use of filter adsorbers (i.e., converting the existing filters to GAC media, as was done at the Taylor Mill plant) is generally not feasible. To accomplish this, the filter depths would need to be approximately 15 feet deep, which is not practical for FTTP.

As a result, the most practical means of incorporating GAC into the Fort Thomas Treatment Plant is by adding GAC contactors as a new process step following filtration. This would be a similar system to that used by the Greater Cincinnati Water Works (GCWW) at their Richard Miller Treatment Plant. There are some particular advantages and disadvantages associated with this approach, as follows.

Advantages:

- Additional barrier for chemical spills. Because of its highly absorptive nature, GAC is very good at reducing a wide variety of potential contaminants from the water. As NKWD is aware, the Ohio River is susceptible to potential pollutants from multiple sources, which has caused problems for water systems in the past.

- Removal of organics and additional taste and odor control. Activated carbon is well-proven to be an effective means of reducing offensive taste and odor occurrences in treated water. Many utilities utilize it in either the powdered or granular form to combat taste and odor problems.

Disadvantages:

- High construction and operating costs. GAC systems are both expensive to construct and operate. In particular, the carbon must either be replaced or removed and regenerated on a regular basis. GCWW regenerates their carbon on-site with furnaces that "burn-off" adsorbed materials. However this process is very costly in terms of the equipment needed and energy required. An alternative is to lease the carbon from a supplier and have it replaced periodically, thus putting the regeneration burden on the supplier.

- Chromatographic effects. As mentioned above, carbon is extremely effective in adsorption of chemical compounds from water. However after the carbon particles retain these chemicals, they are then susceptible to release back into the water when the concentrations of the chemical lessen or return to normal levels. This has been an issue in situations where carbon adsorbed some form of temporary contaminant, only to have the chemical "leach" back into the treated water after the event was over.

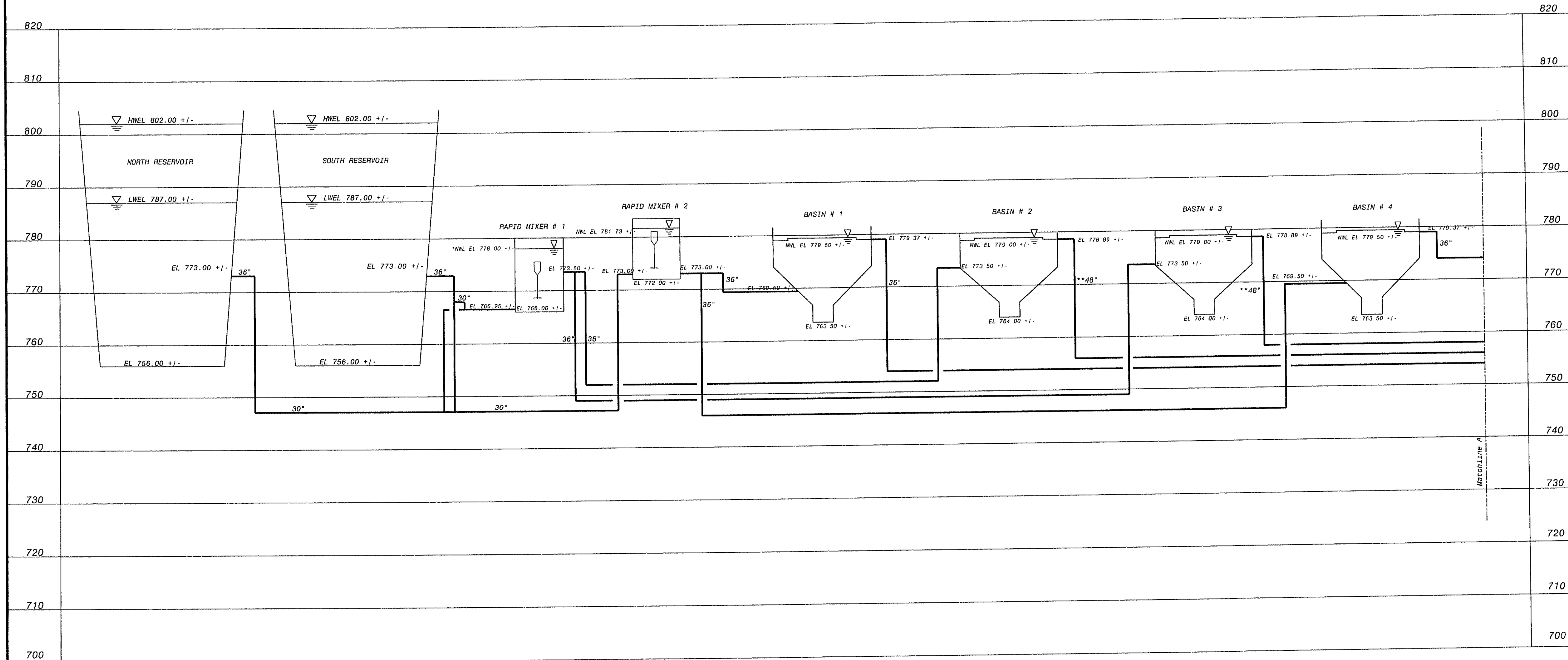
To accommodate GAC contactors at FTTP, it is anticipated one of the existing flocculation / sedimentation basins will be removed from service to provide the necessary space for the GAC facility. Discussions with District staff have determined that the two older floc/sed basins (No. 2 and 3, circa 1936) are less effective than the two newer basins (No. 1 and 4), and the plant is typically operated with about 40% of the flow through Basins No. 2 and 3, and the remaining 60% of flow through Basins No. 1 and 4. Therefore, it is recommended one of the older basins be selected for locating the GAC systems.

Figures VI-5 and VI-6 present the hydraulic profile of the FTTP as it currently exists and after the proposed GAC contactors and related systems are installed, respectively.

Removal of one of the existing floc/sed basins will require that the functions of that system be replaced in order to retain the 44 mgd total treatment capacity of the Fort Thomas plant. To accomplish this it is recommended that the other 1936 floc/sed basin be converted to a high-rate sedimentation process, such as the ACTIFLO® system that is installed at the Memorial Parkway plant. To replicate the sedimentation capacity of the two older floc/sed basins, the ACTIFLO® system will need to be rated for a minimum of 22 mgd. The District may wish to consider increasing the size of the new ACTIFLO® process to about 33 mgd, which would provide some redundant sedimentation capacity allowing either Basin No. 1 or 4 to be removed from service for repairs or cleaning and still maintain full capacity of the plant. Preliminary evaluation of the basin footprints indicates that they are large enough to accommodate a 33 mgd ACTIFLO® system.

In addition to the GAC system itself and the ACTIFLO® units, a new transfer pumping station will be required to convey effluent from the filters to the GAC facility. Due to the arrangement of the Fort Thomas Treatment Plant, it is not possible to provide flow from the filters to the new GAC system by gravity. The new pumping station may be located either within the new GAC facility or in a stand-alone structure at the south end of the existing filter gallery. It is anticipated that the pumps would be vertical propeller or mixed-flow units, equipped with variable frequency drives to allow operators to match the pumping rate to the filter effluent.

Figure VI-7 shows the proposed location of the new GAC facility, ACTIFLO® system, and the transfer pumping station.



NOTES:
1. PIPE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY EXCEPT WHERE ELEVATIONS AND SIZES ARE NOTED.
2. * NWEL IN RAPID MIXER #1 IS ASSUMED BASED ON NWEL IN RAPID MIXER #2.
3. ** EFFLUENTS FROM BASINS #2 AND #3 GO STRAIGHT FROM BASINS TO FILTER INFLUENT CHANNEL THROUGH 48" SLUICE GATES.

HYDRAULIC PROFILE

HORIZ NO SCALE
VERT 1" = 10'0"

NO.	BY	CK	APP

REVISIONS AND RECORD OF ISSUE

DATE
CYGNET ID:
SAVED:
DWG VER #:
PLOTTED: DUN38005, 6/4/2004 3:37:16 PM
USER:
XREF1 ID:
XREF2 ID:
XREF3 ID:
XREF4 ID:
XREF5 ID:
SW:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

FTTP
HYDRAULIC PROFILE (CURRENT)

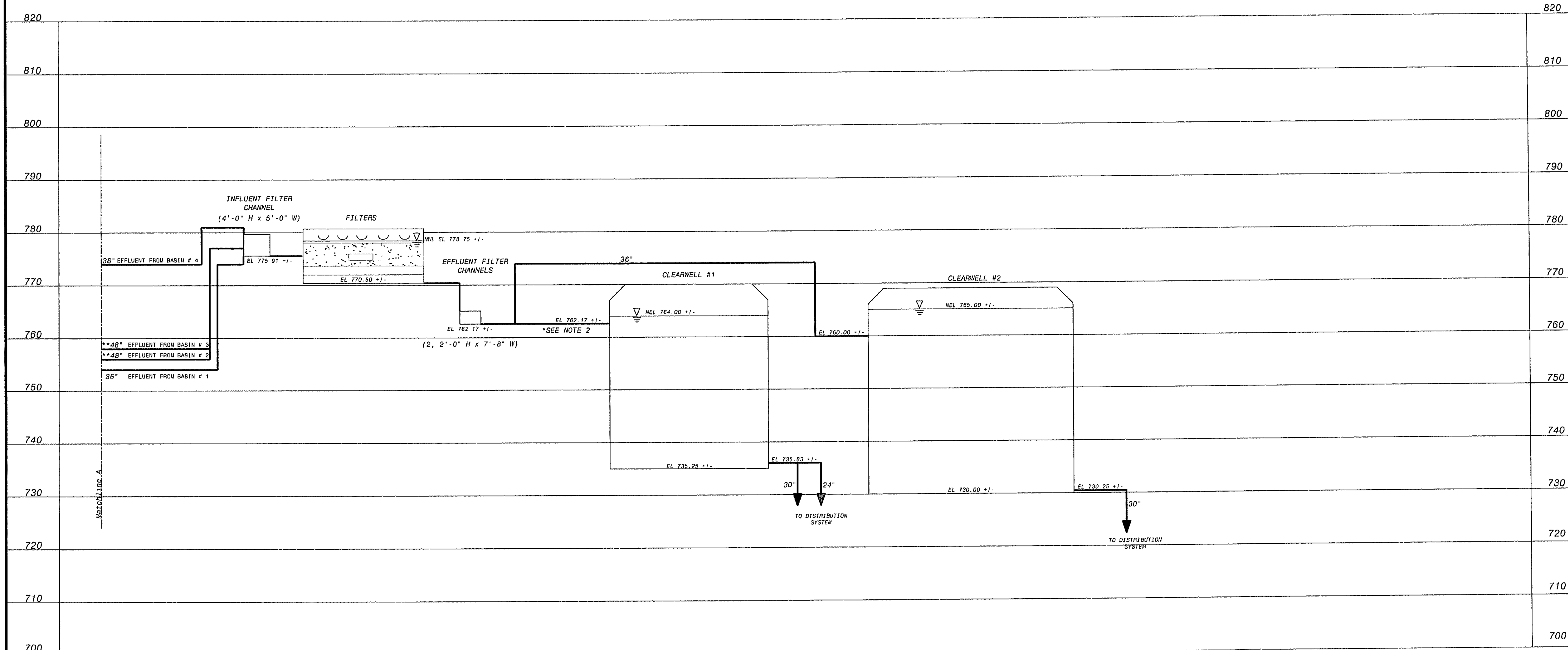
DESIGNED: APW, SES
DETAILED: APW, SES
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

Figure VI-5

1 SHEET OF 2

FD5000
DS009X



HYDRAULIC PROFILE

HORIZ NO SCALE
VERT 1" = 10'0"

NOTES:
1. PIPE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY EXCEPT WHERE ELEVATIONS AND SIZES ARE NOTED
2. * INFLUENT TO CLEARWELL #1 COMES STRAIGHT FROM THE FILTER EFFLUENT CHANNEL.
3. ** EFFLUENTS FROM BASINS #2 AND #3 GO STRAIGHT FROM BASINS TO FILTER INFLUENT CHANNEL THROUGH 48" SLUICE GATES.

NO.	BY	CK	APP

REVISIONS AND RECORD OF ISSUE

DATE

CYGNET ID: XREF1 ID:
SAVED: XREF2 ID:
DWG VER #: XREF3 ID:
PLOTTED: DUN38005, 6/4/2004 3:40:41 PM XREF4 ID:
USER: SW: XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

FTTP
HYDRAULIC PROFILE (CURRENT)

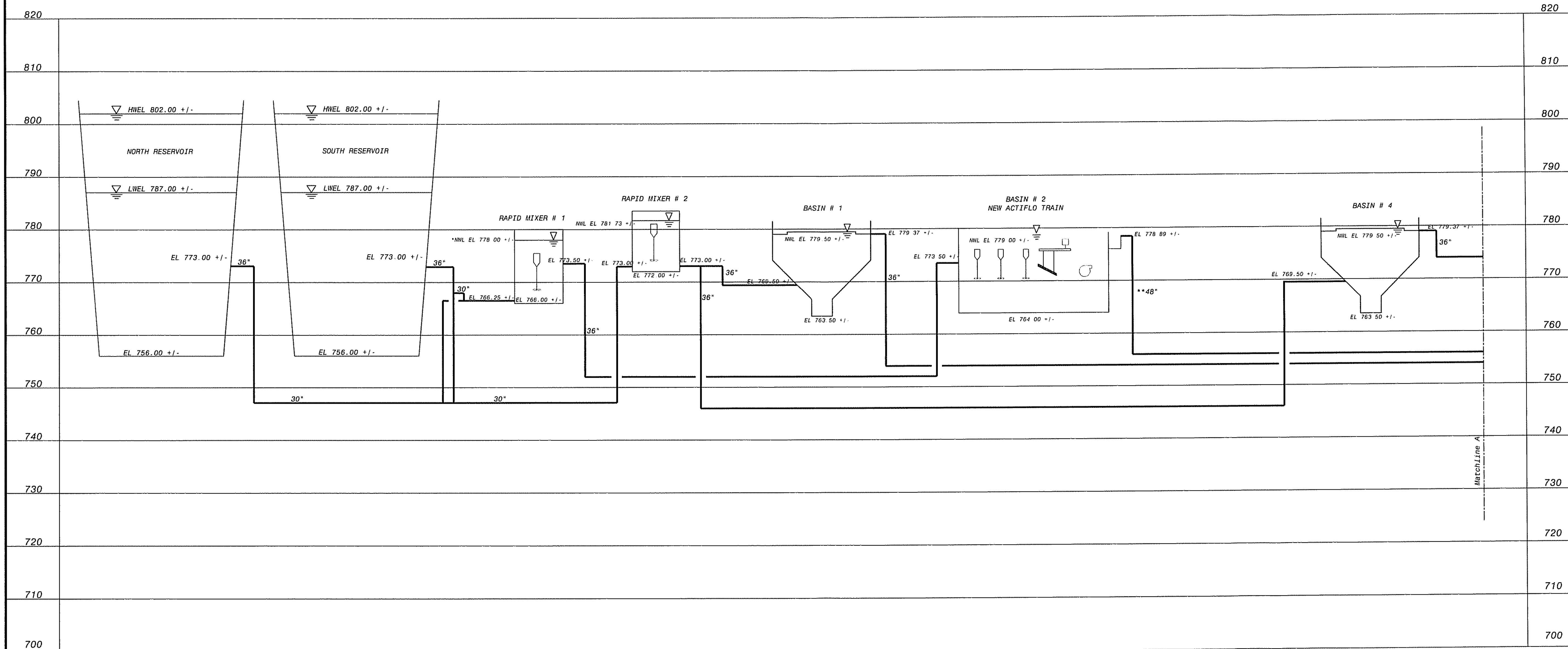
DESIGNED: APW, SES
DETAILED: APW, SES
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

Figure VI-5

2 SHEET OF 2

F05000
D5009X



HYDRAULIC PROFILE

HORIZ NO SCALE
VERT 1" = 10'0"

NOTES:

1. PIPE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY EXCEPT WHERE ELEVATIONS AND SIZES ARE NOTED.
2. * NWEL IN RAPID MIXER #1 IS ASSUMED BASED ON NWEL IN RAPID MIXER #2.
3. ** EFFLUENT FROM BASINS #2 TO GO STRAIGHT FROM BASIN TO FILTER INFLUENT CHANNEL THROUGH 48" SLUICE GATE.

NO.	BY	CK	APP	DATE	REVISIONS AND RECORD OF ISSUE

CYGNET ID: XREF1 ID:
SAVED: XREF2 ID:
DWG VER #: XREF3 ID:
PLOTTED: DUN38005, 6/4/2004 3:35:45 PM XREF4 ID:
USER: SW: XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

FTTP HYDRAULIC PROFILE
(PROPOSED IMPROVEMENTS)

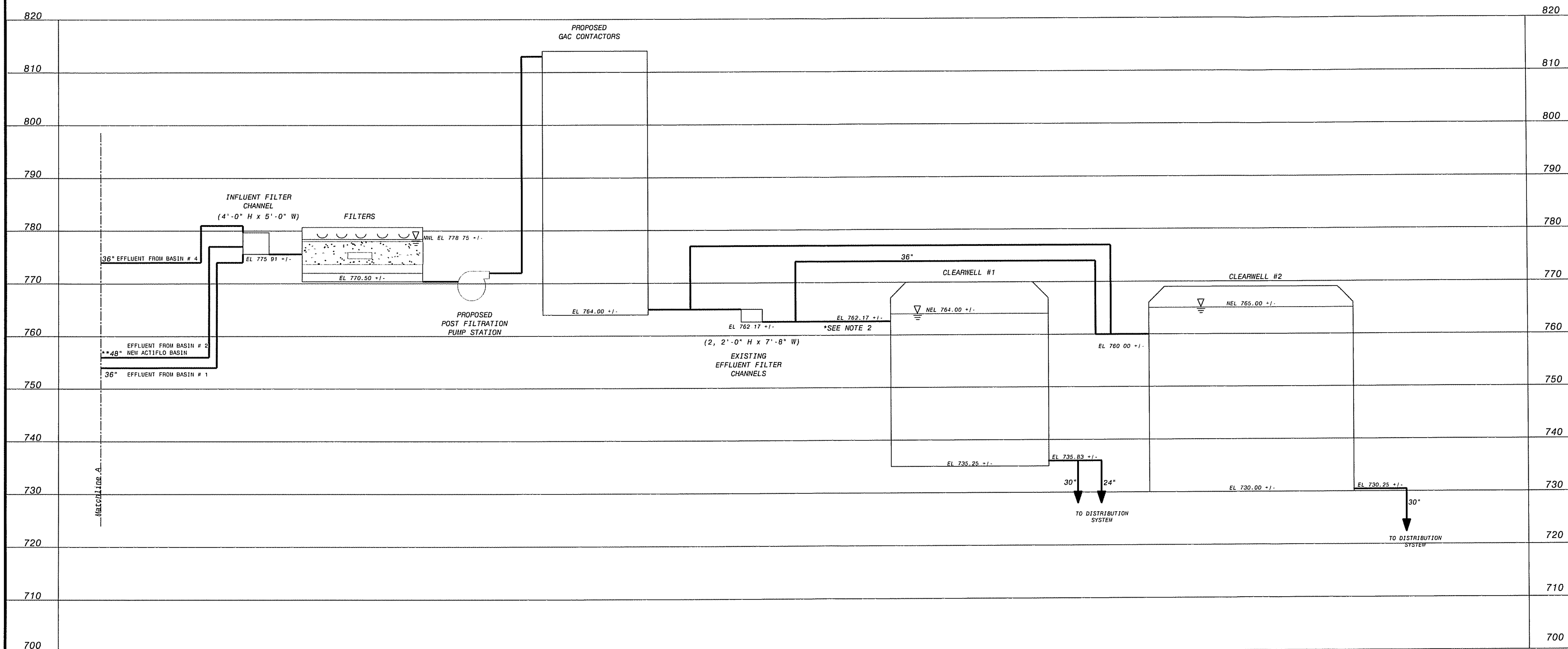
DESIGNED: APW, SES
DETAILED: APW, SES
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

Figure VI-6

1 SHEET OF 2

FD5000
D5009X



HYDRAULIC PROFILE

HORIZ NO SCALE
VERT 1" = 10'0"

NOTES:

1. PIPE LOCATIONS ARE SHOWN FOR INFORMATION PURPOSES ONLY EXCEPT WHERE ELEVATIONS AND SIZES ARE NOTED.
2. * INFLUENT TO CLEARWELL #1 COMES STRAIGHT FROM THE FILTER EFFLUENT CHANNEL.
3. ** EFFLUENT FROM BASINS #2 TO GO STRAIGHT FROM BASIN TO FILTER INFLUENT CHANNEL THROUGH 48" SLUICE GATE.

NO.	BY	CK	APP	DATE	REVISIONS AND RECORD OF ISSUE

CYGNET ID: XREF1 ID:
SAVED: XREF2 ID:
DWG VER #: XREF3 ID:
PLOTTED: DUN38005, 6/1/2004 3:36:46 PM XREF4 ID:
USER: SW: XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
ASSET MANAGEMENT PROGRAM

FTTP HYDRAULIC PROFILE
(PROPOSED IMPROVEMENTS)

DESIGNED: APW, SES
DETAILED: APW, SES
CHECKED:
APPROVED:
DATE:

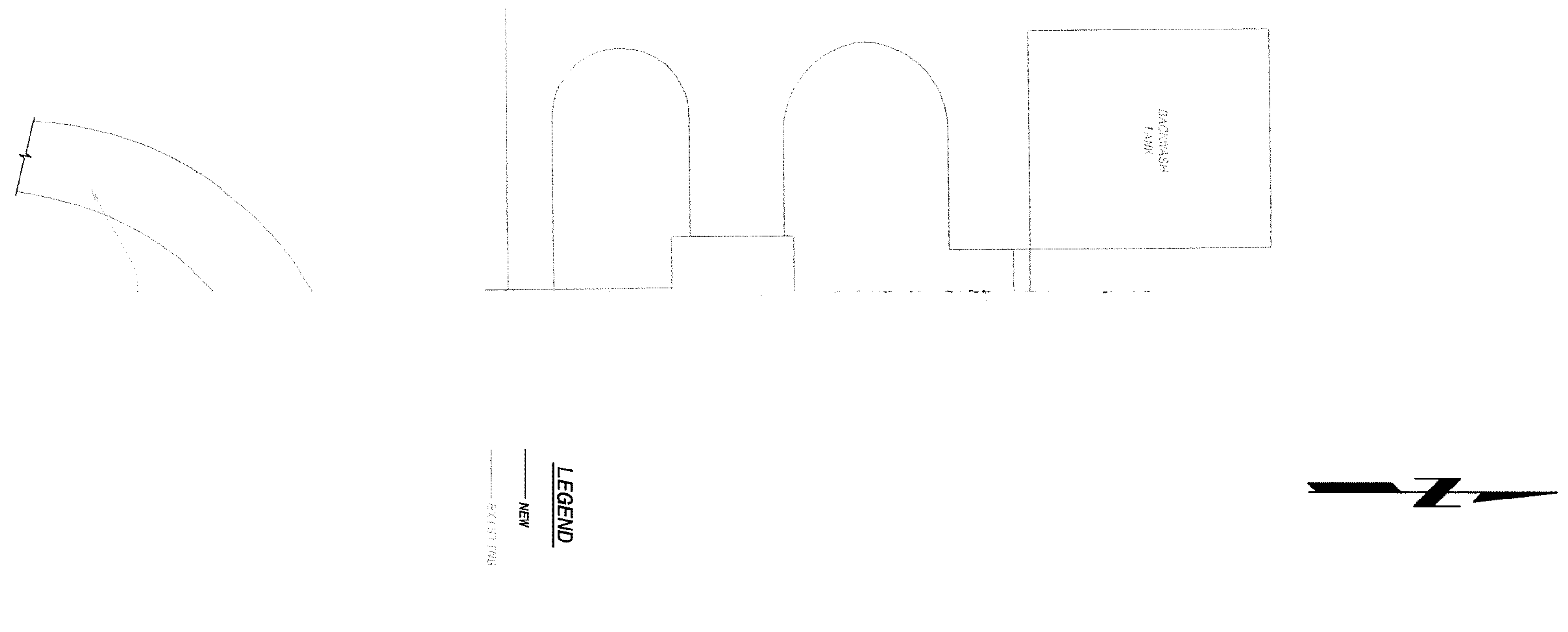
PROJECT NO.
135208

Figure VI-6

2 SHEET 2 OF

FD5000
DS009X

FD5000
D5009



DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

CYGNET ID:
SAVED: DUN38005, 10/17/2003 3:21:51 PM
DWG VER #:
PLOTTED: DUN38005, 10/17/2003 3:19:24 PM
USER: DUN38005 SW: ACAD-2000i
XREF1 ID:
XREF2 ID:
XREF3 ID:
XREF4 ID:
XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
FT THOMAS WATER TREATMENT PLANT
ASSET MANAGEMENT PROGRAM

PROPOSED GAC FACILITY, ACTIFLO TRAIN AND TRANSFER PUMPING STATION

DESIGNED: APW
DETAILED: DAD
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

FIGURE VI-7

The proposed GAC system at Fort Thomas is the only major project recommended under the AMP solely to address water quality and regulatory issues. However, it is important to note that other projects may eventually be necessary or desirable depending upon regulatory impacts, information that is developed through subsequent studies or evaluations, and preferences by the District. Such projects could include, but are not limited to installation of GAC at Memorial Parkway or UV disinfection at any or all of the three treatment plants.

3. FORT THOMAS TREATMENT PLANT

In addition to incorporating post-filtration GAC contactors and the related facility improvements described for the Fort Thomas Treatment Plant above, there are additional plant modifications or changes that are recommended for consideration by the District, as described in this section.

a. Tube Settlers Replacement. The existing tube settlers in the sedimentation basins at FTTP should be replaced by 2005 because of their condition and age. It is recommended that the existing tube settlers and support structures in each basin be evaluated at the time of replacement to determine if the entire support structure and tubes need replacement, or if just the tube settlers themselves need to be replaced and the support structures can be reused. The new tube settlers should be of inert, non-hygroscopic, and chemically resistant construction. Acceptable materials of construction are polyvinyl chloride (PVC) or acrylonitrile butadiene styrene (ABS) stabilized against ultraviolet light. Preliminary investigations show that tube settlers made of PVC plastic containing UV inhibitors should be installed. PVC plastic is a denser plastic and has a higher resistance to chemicals and acids than ABS plastic.

A previous investigation of the tube settlers at the Fort Thomas plant revealed that the primary deterioration of the tube settler elements is most likely a result of the natural degradation of ABS and PVC plastic due to UV exposure, combined with the high impact of pressurized water from the fire hoses used during cleaning procedures. The use of high-pressure water can create weak points in the plastic, eventually leading to breakage. Preliminary recommendations are that an alternative means of cleaning the tube settlers be examined, such as employing a low pressure water spray with a hose, or installing a permanent compressed air sparge system. Also, covering the settling basins to reduce direct sunlight on the tubes could prolong the life of the plastic elements by avoiding UV exposure.

b. Filter Media Replacement. Due to the current age of the media installed in Filters No. 7 through 12, the media in these filters should be replaced. District records indicate that the media may have last been rehabilitated in these filters as long ago as 1981/1982, and it is not clear when physical media inspections have been performed since. Generally, 15 to 20 years is considered to be an effective filter media life. While fine sand can be used for more than this period if it does not become excessively encrusted, anthracite's effectiveness as a filter media tends to degrade with time, as the anthracite's angularity is reduced with time. While the filters are apparently functioning well turbidity removal-wise at this time, the replacement of the media would ensure the filters continue to operate well.

c. Raw Water Influent Line Replacement to South Reservoir. Currently, a single 30 inch raw water main, that was installed in 1936, is the only influent line from ORPS1 to the South Reservoir at Fort Thomas. The condition of this line is unknown, although District staff indicated that the South Reservoir generally fills at a slower rate than the North Reservoir, possibly due to hydraulic limitations in this line. It is recommended that a second 36 inch line that is teed off one of the existing lines from ORPS1 to the reservoirs be installed to the South Reservoir. The new line could be horizontally directionally drilled or open trench cut to the South Reservoir. Both options need further investigation, although preliminary indications are that an open trench cut would be far less expensive and could follow the approximate location of the existing 30 inch line. The proposed second line would provide added redundancy and greater flexibility in the operation of the reservoirs.

d. Other Issues. Other identified concerns at FTTP that do not require a specific project that were recognized during the investigation are listed below. These items can be handled by the Operations and Maintenance budget rather than the Capital Improvement budget.

- As discussed in Chapter II, ventilation in the Sludge Pump Room is poor. The door is very difficult to open due to the suction effect that is caused while trying to open it. Also, the room temperature can become very hot, if all pumps are in operation, which could potentially lead to future pumping problems. The Sludge Pump Room ventilation matter should be further investigated to determine the cause and a potential remedy to the issue.

- Corrosion present on the backwash return pumps, transfer pump, and sludge pumps should be cleaned and the pumps re-coated. All of the associated piping, valves and pump discharge heads should also be cleaned and re-coated to remove the existing corrosion, and to protect against further corrosion.

- The Backwash Supply Tank should be investigated to determine the extent of the concrete deterioration. Concrete damage that is limited to just chipping should be patched. Walls and other areas where the concrete has eroded and reinforcing bars are exposed should be cleaned and patched with shotcrete, where practical. An epoxy injection grout should be used for minor crack repair. Possible concrete core samples may be necessary to determine the extent of the damage to the concrete.

- The filter aid polymer system should be improved with containment systems and the storage tank lids be positioned to properly fit the top of the tanks to avoid possible spills or accidents.

- District staff indicated that the sodium hypochlorite system continues to experience air binding difficulties. Alternative solutions should continue to be investigated that include different type of pumps and / or chemical feed piping arrangements.

4. MEMORIAL PARKWAY TREATMENT PLANT

The Memorial Parkway plant has several areas of need, as presented in Chapter II. It should be noted that one improvement that has been identified as a redundancy item, resulting from the Water System Master Plan Addendum, under the Transmission and Distribution Mains section, is installing interconnections between the 741 and 965 Newport service levels and the 763 and 1017 service areas. This project would provide a means by which the District could supply the City of Newport with water produced at the Fort Thomas plant, and thereby serve as a back-up for MPTP.

Three different improvement items (Chemical Building Replacement, Raw Water Pumping Station improvements, and installation of an additional transfer piping between the reservoirs) have been identified for the Memorial parkway plant, and are recommended to be implemented as one project beginning construction in 2004. The Raw Water PS improvements portion of the project is described above under the Raw Water Supply Section of this chapter. The Chemical Building Replacement and transfer pipe between the reservoirs are described below. In addition, other improvement needs have been identified for the plant, which are also described below.

a. <u>Transfer Pipe between the Reservoirs Installation</u>. The existing transfer pipe between the North and South Reservoir is hydraulically restricted, and over time the North Reservoir has overflowed into the South Reservoir causing the berm between the two to gradually erode. To stop the erosion of the dam between the reservoirs, the berm should be reconstructed where it is damaged and a new pipe should be installed under the berm so water can flow from one reservoir to the other. The water surface level in the reservoirs should be lowered during construction while the eroded section is repaired. Plant operation should not be affected. Preliminary design of the pipeline indicates that it should be a 36 inch line with a manual butterfly valve used for isolation.

b. Chemical Building Replacement. The existing Chemical Building is in such deteriorated condition that a new Chemical Building should be considered to replace the existing structure. (The District is currently in the process of selecting an engineering consultant to perform a study to evaluate potential rehabilitation options for the existing building.)

Several options were evaluated for the potential location and size of a replacement Chemical Building. Black & Veatch evaluated the feasibility of constructing a building sized for three different scenarios with overall plant capacity and different chemical building equipment characteristics. They are as follows:

- Building sized for 10 mgd treatment flow (current capacity), with chemical feed equipment sized for 10 mgd flow (current capacity)
- Building sized for future expansion of the plant (20 mgd), with chemical feed equipment sized for 10 mgd flow (current capacity)
- Building sized for future expansion of the plant (20 mgd), with chemical feed equipment sized for future expansion flow (20 mgd)

Conversations with District staff during the development of the AMP revealed that the option of constructing a Chemical Building sized for future expansion of the plant with equipment installed for future expansion as well was considered to be unrealistic since the plant is not planned to be expanded until 2016. Therefore this option was not evaluated any further.

Based upon the current chemical feed rates employed at MPTP with the present treatment flow rates, required storage capacities of chemicals were calculated for the two remaining scenarios. Presented in Table VI-7 are the existing chemical feed systems at the plant with the preliminary required chemical storage capacities for 10 mgd. The difference between the two options is that sizing the building initially for a 20 mgd plant capacity will allow enough space so that when the plant is actually expanded to 20 mgd only a second storage tank would need to be installed and the transfer and metering pumps would be exchanged with different models with more capacity. If the building were originally sized for the 10 mgd treatment capacity, the building would have to be expanded in the future when the plant capacity is increased.

Table VI-7
MPTP Chemical Feed Systems
In Proposed Chemical Building

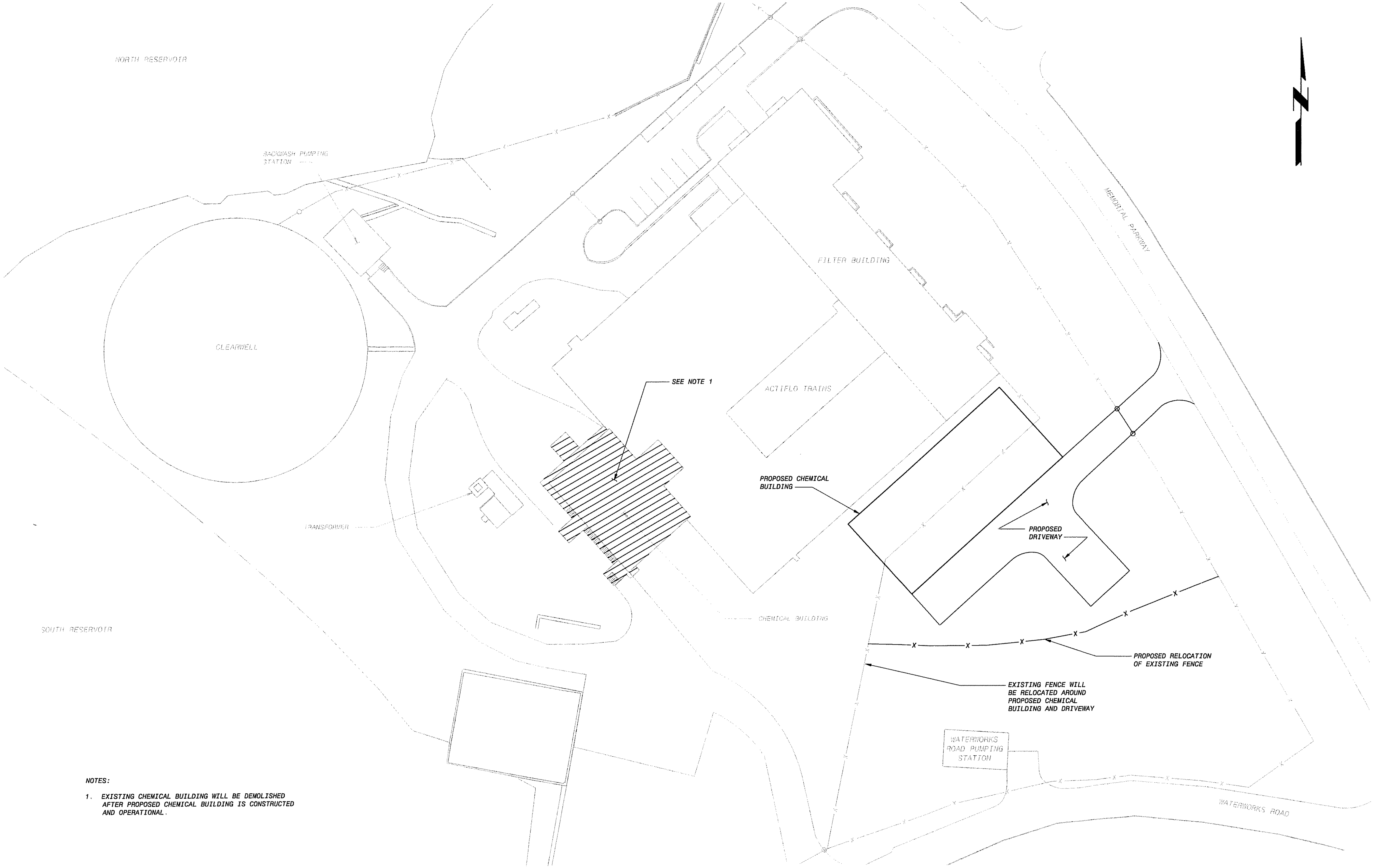
System	Storage Capacity (gal) for 10 mgd
Ferric Sulfate	13,090
Coagulant (Polyaluminum Chloride)	2,656
Polymer (solid)	n/a
Sodium Hypochlorite	12,217
Copper Sulfate (solid)	n/a
Corrosion Inhibitor	363
Hydrofluosilicic Acid	2,306
Sodium Hydroxide	6,932
Powdered Activated Carbon (solid)	n/a

There are several advantages associated with the construction of a new Chemical Building sized for future expansion of the plant, with equipment systems installed for current flow conditions:

- All plant chemicals could be centrally located and distributed
- Redesign of access to the building allowing chemical carriers safer and easier access
- Containment issues would be resolved
- 30 day operating supply of all chemicals would be provided
- All chemicals, feed systems, and storage tanks that are no longer in use would be removed
- Proper feed capacity provided for all treatment processes, including provisions for future capacity increases

Figure VI-8 presents a possible location of a new Chemical Building.

c. Filter Rehabilitation. Currently, MPTP operates only three of the six filters (Filters No. 4, 5, and 6), which were rehabilitated in 1996. Filters No. 1, 2, and 3 were not part of this



NOTES:

1. EXISTING CHEMICAL BUILDING WILL BE DEMOLISHED AFTER PROPOSED CHEMICAL BUILDING IS CONSTRUCTED AND OPERATIONAL.

MEMORIAL PARKWAY TREATMENT PLANT PROPOSED CHEMICAL BUILDING

1" = 30'-0"

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

CYGNET ID: | XREF1 ID:
SAVED: DUN38005, 10/22/2003 5:05:13 PM | XREF2 ID:
DWG VER #: | XREF3 ID:
PLOTTED: DUN38005, 10/23/2003 2:53:38 PM | XREF4 ID:
USER: DUN38005 | SW: ACAD-2000i | XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
MEMORIAL PARKWAY TREATMENT PLANT
ASSET MANAGEMENT PROGRAM

MEMORIAL PARKWAY TREATMENT PLANT
PROPOSED CHEMICAL BUILDING

DESIGNED: APW
DETAILED: DAD
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

FIGURE VI-8

FD5000
D5009

rehabilitation project and it is recommended that these filters be restored to working condition by 2006. As part of this project, it is proposed that Filters No. 1, 2, and 3 should have new underdrains and media installed. Also, it is recommended that air scour backwash capabilities and automated controls be added to these filters. It is believed that the blower currently installed will be of sufficient capacity to supply air wash capabilities to all six filters, although this should be further investigated at the time of the project.

By rehabilitating the Filters No. 1, 2, and 3, giving the MPTP six operational filters, capacity and flexibility would be significantly increased in the operation of the filters. If one of the filters needed to be taken out of service for repairs or for other reasons, doing so would not be a problem. Currently, by having only three operating filters, the District is running a risk if one filter should fail and needs to be taken out of service for an extended period of time.

Also as part of this project, new valves should be installed for at least Filters No. 2 and 3, and possibly Filter No. 1 as well. Based upon the current inoperable condition of the filter influent valves for Filters No. 2 and 3, they should be replaced for the filters to function correctly.

It is also recommended that handrails be installed around the filter access walkways for all the filters as this is a fall hazard and a personnel safety hazard.

d. Residuals Handling Improvements. A project to improve the residual handling system has been identified to begin in 2015. The residuals handling system is currently inoperable due to shortcomings in the Sludge Handling Building. The purpose of this project is to resolve these shortcomings and allow the MPTP to effectively manage the residuals produced from the treatment process and in the reservoirs.

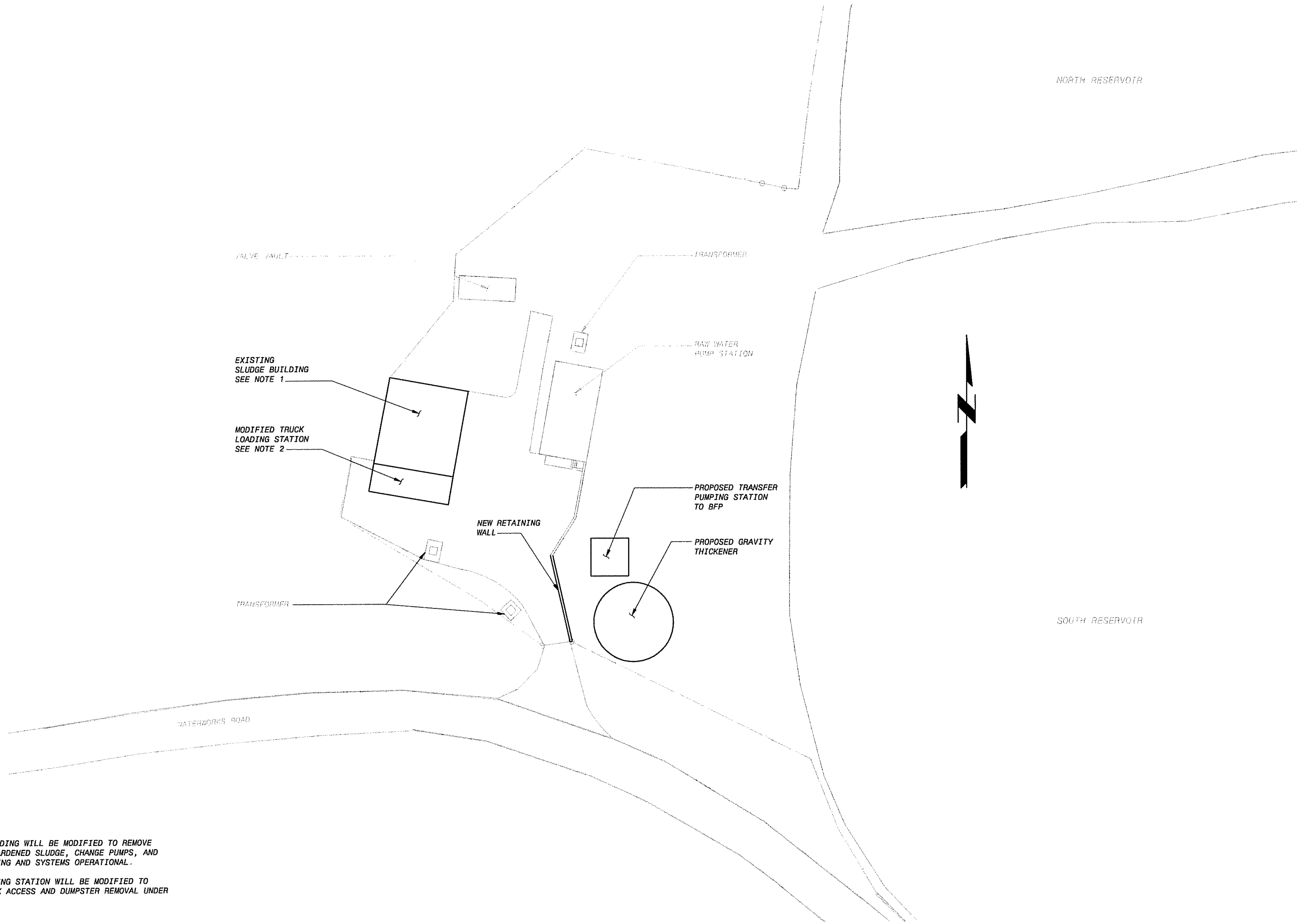
One of the main deficiencies with the Sludge Handling Building is the inability of the Belt Filter Press to constantly receive sludge. There are multiple reasons for this. As discussed in Chapter II, residuals from the ACTIFLO® process flow by gravity to the sludge holding tank. The tank is rectangular with a moderately sloped floor designed to facilitate movement of settled solids to a single collection point from which the sludge is pumped by two vertical turbine pumps to the belt filter press on the operating floor above. When the facility was operated, District staff noticed that as the higher percentage solids sludge collected in the holding tank it would not flow properly to the collection point. The sludge "mounded" in areas surrounding the tank influent pipe and did not flow to the press feed pumps. The slope of the floor is apparently not adequate to allow the thicker sludge to flow to the collection point. In addition, the sludge is of such low viscosity that the press feed pumps have difficulty pumping it to the belt filter press. Currently, the holding tank is full of unprocessed sludge, which will require removal by other means before operation of the facility may be resumed, due to this material having dried and solidified.

It is recommended that a new gravity thickener with positive displacement pumps be installed to properly deliver thickened sludge to the belt filter press. Preliminary design indicates the gravity thickener should be a 42 foot diameter circular basin with a sloped bottom to collect the thickened sludge. A scraper mechanism would be installed at the bottom of the basin to ensure that the sludge is collected to be pumped to the belt filter press. Three positive displacement, progressing cavity sludge pumps should be installed, similar to those at the Fort Thomas and Taylor Mill sludge facilities. These pumps are designed to handle sludge containing high amounts of solids. Preliminary observations by B&V personnel and District staff reveal that there is likely adequate space available near the Sludge Handling Facility to install a gravity thickener and pumping station. The identified location is west of the reservoirs between the Raw Water Pumping Station and the South Reservoir.

It is also suggested that the ACTIFLO® residuals and the discharge from the sludge dredge be directed to the gravity thickener. The thickened sludge would be dewatered by the belt filter press and sent to landfill. Modifications should be made to the existing truck loading area of the Sludge Handling Building, as District staff reported that the roof of the existing area is too low for trucks to deliver and pick up the dumpsters to be taken to the landfills. The filtrate of the belt filter press and the supernatant from the gravity thickener would be collected in the existing 200,000 gallon sludge holding tank, from where it could be pumped back to the reservoirs, or treated by a small package treatment system before being discharged into the nearby creek. The existing vertical turbine pumps may possibly be used for this purpose; however further investigation of the feasibility of this approach should be performed. It is recommended that the spent filter backwash water be pumped directly to the reservoirs. The spent backwash water is not of high solids content and processing it through the Sludge Handling Facility would be inefficient. The solids from the spent backwash water would eventually settle in the reservoir, where it would be collected by the sludge dredge and processed at the Sludge Handling Facility.

It is also recommended that the electric service to the building be improved to make full use of the facility; power supply to the facility is currently inadequate to utilize all of the intended equipment and appurtenances.

Figure VI-9 shows the location of the Gravity Thickener for the residuals handling improvements.



NOTES:

1. SLUDGE BUILDING WILL BE MODIFIED TO REMOVE EXISTING HARDENED SLUDGE, CHANGE PUMPS, AND MAKE BUILDING AND SYSTEMS OPERATIONAL.

2. TRUCK LOADING STATION WILL BE MODIFIED TO ALLOW TRUCK ACCESS AND DUMPSTER REMOVAL UNDER COVERING.

MEMORIAL PARKWAY TREATMENT PLANT RESIDUALS HANDLING IMPROVEMENTS

1" = 30'-0"

NO.	BY	CK	APP	DATE	REVISIONS AND RECORD OF ISSUE

CYGNET ID: | XREF1 ID:
SAVED: DUN38005, 10/23/2003 2:58:27 PM | XREF2 ID:
DWG VER #: | XREF3 ID:
PLOTTED: DUN38005, 10/23/2003 2:58:33 PM | XREF4 ID:
USER: DUN38005 | SM: ACAD-2000i | XREF5 ID:

BLACK & VEATCH Corporation
Cincinnati, Ohio

NO. KENTUCKY WATER DISTRICT
MEMORIAL PARKWAY TREATMENT PLANT
ASSET MANAGEMENT PROGRAM

MEMORIAL PARKWAY TREATMENT PLANT
RESIDUALS HANDLING IMPROVEMENTS

DESIGNED: APW
DETAILED: DAD
CHECKED:
APPROVED:
DATE:

PROJECT NO.
135208

FIGURE VI-9

FD5000
D5009

e. Clearwell Rehabilitation. Cleaning, inspection, and evaluation of the clearwell is long overdue, however, this cannot be done without taking the plant out of service. Subsequent to the planned interconnections between the 741 and 965 Newport service levels and the 763 and 1017 service areas, the District could then supply the City of Newport with water produced at FTTP, and thereby take MPTP out of service. Once the clearwell is able to be taken out of service, the clearwell control valves should be repaired or replaced. Structural repairs to the clearwell should be made as needed on various locations where exposed reinforcement is visible. Another issue for the clearwell is the absence of handrails on the access stairs and guardrails around the perimeter creating a potential fall hazard which could lead to serious personal injury.

f. Expansion to 20 mgd. Based on demand, it is expected that the MPTP will need to increase capacity to 20 mgd by 2018 to adequately serve the District's customers. Many of the other improvement projects that are planned for MPTP are made in view of this planned expansion, i.e. the size of the Chemical Building, and installed capacity of the new intake facility. However, certain other systems in the plant will need to be modified to account for the planned expansion project, planned to begin in 2016, as described below:

- The Raw Water Pumping Station will need to be upgraded to increase capacity. This part of the project should include replacing the three 6 mgd pumps and VFDs with three new 10 mgd units with VFDs. Also, the existing 24 inch waterline from the pumping station to the ACTIFLO® system should be replaced with a new 36 inch line to accommodate for the additional flow.

- A second ACTIFLO® process building will need to be constructed in one of the existing sedimentation basins for additional treatment capacity. The proposed ACTIFLO® system should mirror the existing process. The filters will not need additional upgrades as they were originally designed to treat 22 mgd with all six in operation.

- The residuals handling system should be upgraded to handle the additional flow. This should include constructing a second gravity thickener with adjacent progressing cavity sludge pumps to pump thickened sludge to the belt filter press. This part of the project is similar to the project identified to be constructed in 2006.

- Also, additional chemical storage tanks and new transfer pumps and metering pumps should be installed in the Chemical Building. However, if the Chemical Building is sized for 20 mgd as previously recommended by one of the options, this project should be minor in nature.

g. Other issues. Other identified concerns for MPTP that do not require a specific improvement project but were recognized during the site investigations are listed below. These items can be handled by the Operations and Maintenance budget rather than the Capital Improvement budget.

- Pipes in the pipe gallery are in need of repainting. Recommend labeling pipe contents and direction of flow. Recommend painting filter effluent pipe. Staff indicated that it has not been repainted since original installation.

- Interior walls of the filter boxes need to be recoated. The pipe gallery wall is leaking (common wall to the filter boxes) and in need of repainting. Leakage from the filter boxes is causing the paint failure on the pipe gallery wall.

- Upgrade heating for pipe gallery. District staff noted that it gets very cold in the pipe gallery during the winter.

- Air compressors need replacement; one tank is cracked. Only one air compressor is currently being used, the alternate compressor has a cracked tank and is non-functional. Recommend replacing both units.

- Replace hot water boiler. Hot water boiler is the original unit installed in 1961. District experiences problems with startup every season.

- Original switchgear used in backwash pumping station. Dated switchgear being used in backwash pumping station. Older electrical equipment is more susceptible to failure. Recommend replacing with new switchgear.

- Install a finished water sample line from the clearwell to the lab. Currently finished water test samples must be manually transported to the lab for analysis.

- Recommend improving exterior plant lighting for safety and security purposes.

- Install security cameras at Raw Water PS, River Intake PS, and Sludge Handling Facility for security purposes.

- Replace access hatch at valve pit near Raw Water PS. Access hatch to valve pit near Raw Water PS is broken and is currently positioned over the opening by placing the long side of the hatch cover over the short side of the opening. This does not adequately cover the opening. It is a fall hazard which could lead to serious personnel injury.

- Install sump pump at valve pit near Raw Water PS. Currently no sump in the valve pit near the Raw Water PS.

- Original transformer used at Raw Water PS, option to replace. The original transformer is still being used at the Raw Water PS. Recommend replacing the transformer.

- Increase ventilation/cooling in the Sludge Handling Facility electric room. The Sludge Handling Facility electric room currently only ventilates when the lights are switched on. Recommend either running permanent ventilation or cooling in the room. Room temperature is currently too high for safe and efficient electrical operation.

- Install flow control valve for backwash water supply. Currently no flow control valve for backwash water supply to the filters to vary the flow rate for efficient and controlled operation.

- Investigate the brick and block walls of the Filter Building and Raw Water PS. Cracking was observed in both buildings and should be investigated.

5. TAYLOR MILL TREATMENT PLANT

The Taylor Mill Treatment Plant has some identified areas of need, as were presented in Chapter II.

a. Tube Settler Replacement. The existing tube settlers at TMTP should be replaced by 2006 because of their condition and age. It is recommended that the existing tube settlers and support structures in each basin be evaluated at the time of replacement to determine if the entire support structure and tubes need replacement, or if just the tube settlers themselves need replaced and the support structures can be reused. The new tube settlers should be inert, non-hygroscopic, and chemically resistant. Acceptable materials of construction are polyvinyl chloride (PVC) or acrylonitrile butadiene styrene (ABS) stabilized against ultraviolet light. Preliminary investigations indicate that tube settlers made of PVC plastic containing UV inhibitors are recommended. PVC plastic is a denser plastic and has a higher resistance to chemicals and acids than ABS plastic.

b. Backwash Handling System Improvements. Previously, NKWD has evaluated implementing a backwash treatment facility at the TMTP in order to dispose of treated backwash water from the Backwash Holding Basin to the Banklick Creek. Due to continuously increasing sanitary sewer rate charges, it has been determined that a new backwash treatment facility is economically justifiable. This project is scheduled for 2013.

As part of the previous investigation of implementing a backwash treatment facility, it was recommended that either a clarifier with tube settlers or an ACTIFLO® package facility be installed. Both treatment approaches offer significant economic advantages over continuing discharge to the sanitary sewer. The previous analysis indicated that the clarifier with tube settlers would be the most effective option, long term. As part of the AMP project, a clarifier with tube settlers was re-evaluated and it was determined to still be the most effective option. As part of this project along with the clarifier and tube settlers, a chemical feed system would be installed for feeding polymer to the clarifier, and associated piping constructed to send flow from the Backwash Holding Basin to the clarifier and from the clarifier to the creek. Note that a portion of piping is already in place, as the overflow from the Filter to Waste Basin to the creek would also be used for flow from the clarifier to the creek. Due to emerging technologies in the treatment area, it is recommended that the situation be re-evaluated in the future to determine the most feasible and cost-effective solution.

c. UV Disinfection. At this time, available treatment data from TMTP and anticipated future regulations indicate that the TMTP will not need any additional treatment processes to meet future regulations. However, for additional protection, the District has chosen to implement Ultraviolet (UV) disinfection at TMTP to provide another treatment barrier. Therefore, at this time, UV disinfection is planned to be implemented at TMTP in 2010.

d. Other Issues. Other identified concerns that do not require a specific project are listed below. These items can be handled by the Operations and Maintenance budget rather than the Capital Improvement budget.

- During the site investigation of the TMTP, it was observed that only one transfer pump was in place for the sodium hypochlorite system and ferric sulfate system. It is recommended that a second transfer pump either be installed or be on site in case the operating transfer pump fails for each system.

- As discussed in Chapter II, the District is currently replacing the caustic soda chemical feed system with a sulfuric acid feed system. The only item of concern with this approach is to ensure that there are means in place in the event that the pH level needs to be brought back up since the caustic soda feed system will no longer be operational. A simple solution is to have caustic soda drums stored on site and have provisions available to be able to feed directly from the storage drums in an emergency.

- Also, as mentioned in Chapter II, the District is currently investigating the structural reliability of the sedimentation basins.

- NKWD has concerns with the ability of the TMTP clearwell to meet CT requirements under all temperature and flow conditions. As discussed in Chapter IV, the computer spreadsheets that the District utilizes to calculate CT compliance are overly conservative, indicating noncompliance under some circumstances when the facility is actually meeting regulatory standards. It is recommended that the District investigate the use of another CT spreadsheet that will yield more precise results.

C. DISTRIBUTION PUMPING STATIONS

1. BROMLEY PUMPING STATION

Minor concerns and recommendations at the Bromley Pumping Station, based upon conditions noted during the site investigation, can be addressed with the Operations and Maintenance budget, rather than the Capital Improvement budget, are as follows:

- Clean and re-coat all piping, valves and pump discharge heads to remove existing corrosion, and to protect against further corrosion.

- Review the existing pump room ventilation system for adequacy to remove heat generated by the pumping equipment. Install a high volume forced air ventilation system to minimize heat build-up within the pump room.

- Perform a detailed analysis of the causes for the differential settlement of the sodium hypochlorite building. Provide additional footings or other structural system to shore up the building.

2. CAROTHERS ROAD PUMPING STATION

Minor concerns and recommendations at the Carothers Road Pumping Station that are based upon conditions noted during the site investigation and can be taken care of with the Operations and Maintenance budget, rather than the Capital Improvement budget, include the following:

- Re-route the water quality instrumentation drains directly to the building sump pit to prevent back-flow in the building floor drainage system currently causing corrosion of the stair stringer and pipe supports.

- Provide structural support members to replace the extended threaded rods currently used to support the hoist monorail. (NKWD has corrected this item since the site investigation was conducted.)

- Consider replacement of the building exterior doors at locations where the mono-rail exits the building and the main entrance door due to excessive corrosion of the existing units.

3. DUDLEY PUMPING STATION

a. Sodium Hypochlorite Building. Based upon the conditions noted during the site investigation on the sodium hypochlorite system and as described in Chapter II, it is recommended that a new Sodium Hypochlorite Building be constructed to house the complete feed system. Currently, there are two separate buildings, one for the day tanks and metering pumps, and one housing the bulk storage tank and transfer pumps. Both of the buildings were originally used for the gaseous chlorine system. The building for the bulk storage tank is inadequately sized for the tank that is currently installed. The new facility, scheduled for construction in 2007, would house the complete feed and storage system components and is preliminarily sized to accommodate two 6,000 gallon bulk storage tanks, transfer pumps, day tanks, and metering pumps to feed at the rate sodium hypochlorite is fed now.

b. Other Issues. The minor concerns and recommendations at the Dudley Pumping Station that are based upon conditions noted during the site investigation and can be addressed with the Operations and Maintenance budget, rather than the Capital Improvement budget, include the following:

- Remove excessive moss buildup on piping within the 1040 station due to long term leakage.

- Prior to the construction of the new sodium hypochlorite building, it is recommended to consider adding a shield or extension to the sodium hypochlorite day tank containment system to direct potential leaks to the secondary containment area.

- Provide covers for all electrical boxes, and remove all wiring from conduit feeding equipment that has been removed.

4. HANDS PIKE PUMPING STATION

Minor concerns and recommendations at the Hands Pike Pumping Station that are based upon conditions noted during the site investigation and can be taken care of with the Operations and Maintenance budget, rather than the Capital Improvement budget, include the following:

- Clean and re-coat all piping, valves and pump discharge heads to remove existing corrosion, and to protect against further corrosion.

5. RICHARDSON ROAD PUMPING STATION

Minor concerns and recommendations at the Richardson Road Pumping Station that are based upon conditions noted during the site investigation and can be addressed with the Operations and Maintenance budget, instead of the Capital Improvement budget include the following:

- Provide a drain line from the pumping station floor level to the street to minimize the potential for future flooding of the pump area. As is discussed in Chapter II, District staff mentioned that flooding of the station has been a problem in the past. While high water alarms and shut down provisions are now included in the station systems, a drain line would provide added protection in the event of pipe breakage or other significant source of flooding.

6. RIPPLE CREEK PUMPING STATION

Based on the hydraulic analyses that were conducted under the 2001 Master Plan, it was determined that the Ripple Creek Pumping Station will require expansion, along with related water main improvements, to address increasing water demands in southern Campbell County. As such, it is recommended that a third pump be installed at Ripple

Creek, for which the station was designed. This improvement should be completed by 2006.

7. TAYLOR MILL PUMPING STATION

a. New Pump / Variable Frequency Drive. The Taylor Mill Pumping Station plays an important role in the District's system because it serves as both a booster pumping station and lift station pumping water treated at both the Taylor Mill and Fort Thomas Treatment Plants. Because of the wide range of pumping conditions and different size pumps installed, certain pumps operate more than others. The District has recognized that a new pump with a variable frequency drive (VFD) would be better suited to meet the range of pumping conditions. It is recommended that a new pump with a VFD be installed in 2004 to replace one existing pump so that the new pump will be able to operate under any conditions. This would give the District greater flexibility in operating the Taylor Mill PS.

b. Other Issues. Minor concerns and recommendations at the Taylor Mill Pumping Station that are based upon conditions noted during the site investigation and can be corrected through the Operations and Maintenance budget, rather than the Capital Improvement budget, include the following:

- Consider adding permanent ventilation fans to the pumping station (within the main building) to enhance airflow past the pumps to avoid overheating.
- Consider replacing the existing ventilation fans in the rear pumping station building to increase airflow across the pumps to lower the summer temperatures within the pump room.
- Remove all exposed wiring and conduit left behind from removed equipment.
- Provide permanent heating equipment and controllers in the rear pump building to eliminate the use of portable heating units.

A separate issue that the District is currently investigating is the clearwell influent diversion valve in the water main line from the FTTP. This valve has experienced repeated cavitation problems due to the hydraulic arrangement and head conditions the valve is under. The District was investigating potential solutions to the problem and Black & Veatch is currently unaware if this issue has been resolved.

8. US 27 PUMPING STATION

An improvement project was previously identified for the US 27 Pumping Station as part of the 2003 Master Plan Addendum. To increase the replenishment rate of the downstream storage tanks and provide sufficient flows to the areas south of the station, the pumping capacity will need to be increased. As was described in the Addendum, this modification could be accomplished by either replacing one of the existing pumps with a larger capacity unit, or installing an additional pump. The timing of this improvement was recommended to coincide with the interconnection of the Newport 741 and 965 service levels to the 763 and 1017 service areas, which had been originally planned for 2003.

Since the completion of the Master Plan Addendum, the situation with the US 27 PS has changed somewhat. Due to instrumentation limitations present in the chemical feed systems at FTTP, the Fort Thomas plant is unable to properly apply chemicals at low flow rates. With the reduced overall system demands since Boone County and Florence stopped their water purchases from NKWD, the District has decreased production at the Memorial Parkway Treatment Plant to account for the corresponding differences in required water treatment rates. As a result, the portions of the service area that were previously supplied from MPTP through the Waterworks Road PS (northern Fort Thomas) are now being served from FTTP and the US 27 PS, and only water being provided to the City of Newport is treated by MPTP. This modification in operations has created additional load on the US 27 facility, further exacerbating the need for this improvement.

Investigation of the US 27 PS as part of the AMP has determined that replacing one of the existing units with a larger pump is not likely to be practical due to hydraulic limitations that exist in the existing piping to and from the station. Therefore, it is recommended that a new second pumping station be constructed adjacent to the existing US 27 PS. Preliminary plans for the pumping station are to include three vertical diffusion vane pumps each rated for 7.5 mgd giving the pumping station a firm capacity of 15 mgd. However, hydraulic analyses should be conducted in order to verify the appropriate sizes of the new pumps before beginning design of the facility. The District has initiated a project to evaluate the existing station for expansion or construction of a new parallel pumping station, which should be completed in 2004 in order to be operational as soon as feasible.

9. WATERWORKS ROAD PUMPING STATION

As part of the anticipated expansion of the Memorial Parkway Treatment Plant by year 2018, described previously in this chapter, the Waterworks Road Pumping Station will require an increase in the capacity of the discharge piping to better accommodate demands in nearby areas. The PS expansion is planned to be included in the plant expansion project.

10. WEST COVINGTON PUMPING STATION

a. Expansion of the West Covington Pumping Station. The 2001 Master Plan identified a need for capacity expansion of the West Covington Pumping Station as a system hydraulic improvement for 2008. Based on the analyses conducted for the Master Plan, water demands in the area will regularly exceed the firm capacity provided by the existing pumps. It is recommended that the station be equipped with three pumping units having a capacity of 2.4 mgd (1,665 gpm) each. However, the existing facility cannot easily accommodate installation of a third pump; the interior piping system would have to be extensively reconfigured, and the resulting arrangement would be very difficult for on-going maintenance and repair activities. Furthermore, the station would have to be out of service for at least several weeks to facilitate such modifications. Therefore, it is recommended that a new pumping station be constructed to replace the existing West Covington PS.

b. Other Issues. Minor concerns and recommendations at the West Covington Pumping Station that are based upon conditions noted during the site investigation and can be taken care of by the Operations and Maintenance budget, rather than the Capital Improvement budget, include the following:

- Remove existing rust and corrosion from the exterior of the pumping station and repainting to provide additional protection.

D. DISTRIBUTION SYSTEM STORAGE

This section of the report presents the recommendations for improvements to the District's distribution storage facilities and a proposed inspection and maintenance schedule for the tanks. In general, the District has adequate system storage for all areas except for southern Campbell County, which will be addressed by the elevated tank already being planned, and northern Campbell County, where a replacement facility for the existing Rossford and Lumley Tanks is proposed (see item 2 below).

1. NEW INDEPENDENCE II TANK

Although the storage volume that is available in the Independence area is currently deemed adequate, continued growth is anticipated in this portion of the system. Eventually this area will encounter conditions similar to that currently being experienced in the southern part of Campbell County, where maintaining adequate water supply becomes very dependant upon the storage facilities present. Therefore, the District has identified the need for a future second storage facility in the Independence area. Preliminarily, this tank is planned to be 1 million gallons in capacity. A site for the tank has not been determined. Based on the current and projected water demands, the tank is planned for construction in 2013.

2. LUMLEY AND ROSSFORD TANKS

The existing Lumley and Rossford tanks were identified for retirement in 2008 under the 2001 Master Plan, with the Rossford Tank being replaced by a new 750,000 gallon elevated storage facility. The new Rossford Tank would be constructed in the general vicinity of the existing tank.

3. MAIN STREET TANK

At the District's option, the Main Street Tank may be retired from service once the proposed new South Campbell County Tank is completed (see item 4 below) and in service. Once the new tank is operational, it and the Old State Route 4 Tank will provide adequate storage volume for the area. It is recommended that before making a decision to retire the Main Street Tank, the District monitor the hydraulic and water quality conditions in southern Campbell County under a variety of conditions after the new tank is placed into service to verify that it can be removed from service with no resulting adverse effects.

4. NEW SOUTH CAMPBELL COUNTY TANK

In the 2001 Master Plan it was recommended that the District construct a new elevated storage tank in the southern part of Campbell County to meet increasing water demands in the area and to serve as a back-up for the existing Old State Route 4 Tank. The new tank is planned to have a 1 million gallon capacity with an overflow elevation suitable for the pressure zone (1017). At the time of this report, design of the tank had not been completed due to delays in land acquisition. It is expected that the new tank will be located on property near the Old State Route 4 Tank. This project is anticipated to resume in the later half of 2004.

5. TANK INSPECTION AND MAINTENANCE SCHEDULE

Over the last several years, NKWD has been very diligent about conducting regular condition assessments of the distribution storage facilities, and performing any needed re-painting or repairs in a timely manner. In order to help continue this successful program, and as part of the AMP, a suggested schedule has been developed for the District to plan and direct on-going cleaning and painting, repairs and rehabilitation, as well as routine inspections.

Table VI-8 provides the recommended scheduling of the tank maintenance program for these activities. As is outlined in the table, NKWD should plan to continue conducting detailed and regular maintenance inspections, and performing re-painting and renovation projects. The following describes the nature of these inspections and rehabilitation tasks, as designated in the table.

Detailed Inspection: Conduct a detailed examination of the tank coating systems, safety and structural items, the tank site, and other accessories or appurtenances. The inspection is intended to provide specific data for the purpose of preparing specifications and bidding documents for a rehabilitation project. The renovations and/or painting should be scheduled as conditions warrant.

Maintenance Inspection: Conduct visual inspection of the tank, coating systems, accessories, and tank site. The inspection is intended to monitor general status of tank. Perform any maintenance as appropriate.

Re-Painting Project: Clean, repair, or replace coating systems and other appurtenances as necessary. This type of rehabilitation is intended as a periodic maintenance project.

Renovation Project: Coating systems replaced, structural and safety items modified as appropriate and to meet current codes, other accessories repaired or replaced as needed. This is intended to be a major renovation project, critical to extending service life of facility.

The program of tank inspections and rehabilitation projects listed in Table VI-8 was developed based on the previous work the District has had performed on the tanks. In most cases, new, properly installed coating systems will last 15 to 20 years. With the majority of the District's storage facilities having been re-painted within the last ten years, most of these facilities should be several years from requiring new painting projects. In general, it is recommended that the tanks have maintenance inspections performed about every five years in order to stay abreast of their condition and properly plan for rehabilitation. Detailed inspections, as described above, are anticipated as the coating systems approach the end of their expected service life and planning for re-painting of the tanks becomes appropriate.

The proposed schedule was developed to limit the number of tank activities to a maximum of four per year. Renovation of the Old State Route 4 and South Newport Tanks as indicated in Table VI-8 is based on the assumed condition of these facilities and the information obtained through site visits during development of the AMP. The actual need for repainting and renovation projects will be dependant upon the condition assessments performed as part of the inspection activities.

As listed in Table VI-8, the tank inspection and rehabilitation efforts are designated as follows:

Detailed Inspection	DI
Maintenance Inspection	MI
Re-Painting Project	RP
Renovation Project	RV

Table VI-8
NKWD Tank Inspection and Maintenance Schedule

Year	Aqua Drive	Barrington	Bromley	Dayton	Devon	Dudley East	Dudley West	Harrison (Bellevue)	Ida Spence	Independence	Industrial Park	John's Hill	Kenton Lands	Lumley	Main Street	Old State Route 4	Rossford	South Newport
2004									MI				MI			DI		DI
2005												MI				RV[1]	MI[5]	RV
2006				MI				MI						MI[4]	MI[2]			
2007		MI	MI			MI	MI											
2008	MI				MI					MI[3]	MI							
2009									MI				MI					
2010												MI				MI	MI[5]	MI
2011				MI				MI						MI[4]	MI[2]			
2012		MI	RP			MI	MI											
2013	MI				MI					MI[3]	RP							
2014									DI				DI					
2015												DI				MI	DI[5]	MI
2016				MI				MI						MI[4]	MI[2]			
2017		DI	MI			MI	MI											
2018	MI				MI					MI[3]	MI							
2019									MI				MI					
2020												MI				MI	MI[5]	MI
2021				DI				DI						DI[4]	DI[2]			
2022		MI	MI			DI	DI											
2023	DI				DI					DI[3]	MI							

[1] = Subject to completion of new South Campbell County Tank.
[2] = Dependant upon retirement of Main Street Tank.
[3] = Assumes Independence Tank is repainted Fall 2003.
[4] = Tank recommended for retirement in 2008; schedule applies only if kept in service.
[5] = Tank recommended for replacement in 2008; schedule applies only if kept in service.

E. TRANSMISSION AND DISTRIBUTION MAINS

1. HYDRAULIC AND REDUNDANCY IMPROVEMENTS

A series of water main improvements were identified through year 2020 as part of the 2001 Master Plan and subsequent 2003 Addendum. These projects are needed to address current and anticipated hydraulic restrictions and provide redundancy to maintain service to customers. Eight redundancy improvements were recommended, as listed in Table VI-9.

Table VI-9
Recommended Redundancy Improvements - 2003 through 2007

Year	Description	Purpose	Dia. (in)	Length (ft)	Cost Opinion
2003	965 & 1017 Interconnect: 16" on Highland to 12" on Monmouth, PRV, upgrade of 1 US 27 Pump	Redundancy for MPTP	12	2,200	$225,000
	Newport Interconnect at MPTP		20	500	$150,000
	24" Redundancy Glenn Ave., Covington	Redundancy for supply to TMTP	24	2,400	$650,000
	Orphanage Rd. (from Dudley 1040 PS)	Redundancy for Dudley 1040 Discharge	20	1,500	$400,000
2004	Licking River crossing between South St. in Campbell Co. to Summit Dr. in Kenton Co.	Redundancy for 36" across Licking River	36	3,400	$1,400,000
	Bristow Road PS to Bristow Rd.	Redundancy for Bristow Road PS	12	1,540	$90,000
	Newport LS/HS Interconnect Regulated Woodlawn	Redundancy for MPTP	12 8	2,600 2,500	$530,000
2005	Newport 741 and 763 Interconnect: from 30" KY 9 near RR to 12" on Central		30	2,700	$750,000
	42" from FTTP to Moock Rd.	Redundancy FTTP to TMTP	42	8,500	$4,290,000
2006	KY 9 Moock Rd. to Newport Steel	Redundancy for 30" to Covington	36	4,000	$1,500,000
2007	Dudley Discharge; Dudley Pk. south on Horse Branch Rd. to Thomas More Pkwy.	Redundancy for Dudley 1080 Discharge	30	6,500	$1,800,000
	Thomas More Pkwy.; Medical Village Dr. to 16" dead end on Thomas More Pkwy.		30	850	$240,000
	Thomas More Pkwy.; Medical Village Dr. to 36" on Dudley Pk.		24	3,500	$690,000
	Thomas More Pkwy.; Medical Village Dr. to 12" dead end		12	750	$70,000
				TOTAL	**$12,785,000**

Additional details regarding each of these redundancy improvements are as follows:

- Redundancy for the MPTP: In the event that the MPTP is out of service, two sets of interconnections are recommended to supply the Newport 965 and 741 service levels with water from FTTP.

- Redundancy for the 36 inch Supply to TMTP: In order to provide a more reliable pathway to bring water from Covington in the event that the 36 inch supply to the TMTP was out of service, the main along Glenn Avenue is recommended to be increased to a 24 inch main.

- Redundancy for 16 inch Dudley 1040 Pumping Station Discharge: In the event that the Dudley 1040 discharge piping were out of service the pump station could not serve the 1040 service level in Kenton County. A redundant pipe along Orphanage Road is recommended.

- Redundancy for 36 inch to TMTP across Licking River: In the event that the current 36 inch river crossing was out of service, 150,000 people in Kenton County could be without water almost immediately. A redundant river crossing will ensure that service could still be provided.

- Redundancy for Bristow Road PS: In the event that the Bristow Road Pumping Station discharge piping were out of service the pump station could not serve approximately 14,000 people in southern Kenton County. A redundant pipe is recommended.

- Redundancy from FTTP to TMTP: This 42 inch main will run parallel to the existing 30 inch and 24 inch mains from FTTP. It will provide redundant service in order to transmit water from FTTP to TMTP in the event that the existing mains were out of service.

- Redundancy for 30 inch Main to Covington: In order to provide reliability and redundancy for the transmission of water from FTTP to the Covington 763 service level, a redundant 36 inch main along Moock Road is recommended.

- Redundancy for Dudley 1080 Pumping Station Discharge: In the event that the Dudley 1080 discharge piping were out of service, water could not be served to approximately 65,000 people in the 1080 service level in Kenton County. Several pipes are recommended near Thomas More Parkway to improve redundancy.

The complete list of recommended hydraulic improvements is lengthy, and will not be repeated in this chapter. However, those improvement projects are included in the Capital Improvement Plans elsewhere in this report. For the Master Plan and Addendum, the projects were divided into two groups, representing the implementation periods of 2003 to 2007 and 2008 to 2020. For the first period, 2003 – 2007, a total of 43 hydraulic improvement projects were identified, representing a total estimated construction cost of about $33.2 million (2003 dollars), not including water main replacement and rehabilitation projects. An additional budget amount of $10.5 million was designated for main replacement and rehabilitation work over that same period.

The second group of hydraulic improvements, 2008 – 2020, included a total of fourteen projects. The estimated construction cost of these items was $14.8 million. The water main rehabilitation and replacement program was budgeted for a total of $46.8 million over the same timeframe.

It should be noted that the hydraulic improvement projects included in the Master Plan and Addendum did not address or provide budget for extending water mains into unserved areas, as those projects will be funded through other programs.

2. REHABILITATION AND REPLACEMENT PROGRAM

The District recognized some time ago the need to implement a water main rehabilitation and replacement program. This is evidenced by the prior work the District has accomplished in this area, as well as the significant budget amounts included for these programs in the list of improvements included in the Master Plan and Addendum planned for the 2003 – 2007 and 2008 – 2020 periods ($57.3 million total).

F. VULNERABILITY ISSUES

In 2003 the consulting firm CH2M Hill completed a Vulnerability Assessment Report (VA) for NKWD. Due to security concerns, B&V had limited access to the VA report and its conclusions. However, B&V was provided with information regarding the recommendations that resulted from the VA, and specifically those recommendations that would result in capital improvement items.

The District determined that the VA items which should be included in the CIP would consist of the installation of back-up power generators at selected facilities and one water main improvement. The generators would be added over a phased period of time to mitigate the financial impacts. Ultimately, the District selected the facilities listed in Table VI-10 for adding back-up power capability, scheduled for the years indicated per the moderate version of the CIP.

Table VI-10
NKWD Facilities Planned for Back-Up Generators

Facility	Year
ORPS1	2005
Dudley Pumping Stations	2007
Taylor Mill Treatment Plant	2009
Ripple Creek Pumping Station	2011
Carothers Road Pumping Station	2013
Licking River Pumping Station	2015
US 27 Pumping Station	2017
Memorial Parkway Treatment Plant	2019

It should be noted that the VA report included estimated installation costs for the generators at these locations. Upon review of those costs, there were some with which B&V disagreed, and as a result the construction costs included in the AMP for these projects do not necessarily match those that were in the VA.

In addition to the standby generators, the VA report identified the relocation of the water main from the Licking River Pumping Station to the Taylor Mill Treatment Plant as a recommended project. This item was selected by the District for inclusion in the CIP, and planned for year 2011. The concern expressed in the VA was that due to this water main being in an exposed area, along the steel catwalk to LRPS, it was at risk for disrupting production at TMTP if it were damaged in some way. The VA recommended that the main be replaced by new piping which would not be exposed and in danger.

G. CENTRAL FACILITY

For several years NKWD has recognized the need for consolidating its operations into fewer locations and facilities than are currently utilized. Because of the widespread nature of the sites at which District activities now take place (e.g., Aqua Drive, Edgewood, Kenton Lands, etc.), and the desire to facilitate easy communications and interactions between the different units and staff, it has been proposed that a "campus" type complex be constructed or obtained for this purpose. Various studies and reviews have been conducted in order to quantify and qualify the amounts and types of space the District would require to effectively centralize as many functions as practical.

In 2002 Humpert Wolnitzek Architects completed a study for NKWD entitled "Proposed Central Facility Space Needs Assessment". The report for this study does not describe the purpose or goal of the study. It presents various size/area requirements for different functions, based on a proposed new campus facility to consolidate many of the District's staff and operations at a common location. As a result of this study, NKWD has moved forward in pursuing a centralized facility, and has now identified 2004 as the target year to implement or begin developing it as a reality, and the associated cost has been included in the CIP.

H. RADIO READ METERS

Many of the utilities throughout the nation are converting utility meters to some form of automatic meter reading technology (AMR). Radio read technology is best suited for most applications if the conversion is warranted. In an ongoing effort to continually increase productivity, the District is investigating a phased conversion of water meters to some form of "radio-read" technology. The District will contract and perform a feasibility study to determine the benefits of such a conversion and weigh the effectiveness of the investment. The return on investment NKWD could realize once a conversion is completed will be determined. Some of the District's older service areas with known deficiencies, such as the former Newport district, will be converted first.

AMR technology generally more than doubles the reading rate per hour at which a technician can gather meter consumption information. Another consideration to be evaluated is the Kentucky Division of Water mandate concerning the period of time a meter can be in service before testing and/or replacement is required. A strong meter testing and replacement program coupled with some type of AMR technology should result in greater accountability for water used and the generation of additional income as inefficient or malfunctioning meters are replaced.

I. NKWD STAFF INTERVIEWS

As part of the AMP project, B&V conducted interviews with various District staff members. These interviews were intended to provide input and perspective from a variety of personnel that are involved with the complete cross-section of District activities and areas or responsibility. The following are the NKWD staff positions which were included in the interview process:

President / CEO
Vice President Water Quality and Production
Vice President Engineering and Distribution
Vice President Finance
Vice President Services and Billing
Engineering Manager
Distribution Manager
Operations Manager
Laboratory Manager
Maintenance Manager
Controller
Engineering Supervisor
Instrumentation Supervisor
Maintenance Supervisor
Distribution Supervisors
Plant Supervisors
Field Service Supervisor

During the interviews, each of the NKWD staff members was informed that their responses and opinions would be kept confidential. Although the issues discussed were not considered volatile or divisive, an open atmosphere was encouraged, and it was hoped the staff would feel free to express their true feelings. Therefore, for the purposes of this report, the information gathered and attitudes voiced by the District personnel are presented in a very general manner.

The following summarizes the consolidated responses provided by NKWD staff during the interviews for those questions and topics that are either most relevant to the AMP, or of significance for the District's future management and planning functions.

Future of NKWD. The majority of the staff envisions the District continuing to evolve as a regional supplier of water to the Northern Kentucky area, and potentially expanding its service area beyond Kenton and Campbell Counties. However, future acquisitions and/or expansion will be largely influenced by a combination of political and economic factors. The most likely candidate for acquisition that was identified was the Taylor Mill water system. (In the period since the staff interviews were conducted NKWD has in fact purchased the Taylor Mill system.) Staff was nearly unanimous in believing that the District does a very good job in planning for the future.

Priority Issues. Opinions regarding the highest priorities for the District to resolve in the next few years varied somewhat, largely depending upon the role of each individual in the organization. Upper management personnel consider public relations, improved distribution system water quality, and meeting future water quality regulations as high priority items. Supervisors and middle-level management mentioned system redundancy concerns and water main replacement (which is related to distribution system water quality). Both groups placed a high value on proceeding with the Central Facility and full integration of the Newport system into the District's operations.

Comparison With Other Utilities. There was an overwhelming consensus among the District personnel that NKWD compares very positively with other utilities. The common opinion was that the District is one of the leading, if not the leading, utility in the state. Employees feel they have access to the proper resources to do their jobs well. Management is proactive and forward-thinking, and provides staff with a sense of pride and accomplishment.

Areas of Need. District staff clearly feels the facility most in need of attention is the Memorial Parkway Treatment Plant. There is significant concern that renovations are needed for the plant to consistently and reliably produce quality water. Second in priority to MPTP is ORPS2, which should be replaced by a new facility in the opinion of those interviewed. Other areas mentioned were the proposed Central Facility, older distribution mains, the Old State Route 4 Tank, the planned South Campbell County Tank, back-up power generators, and improvements to both FTTP and TMTP.

Water Main Rehabilitation and Replacement. Staff generally agrees that replacement and rehabilitation of water mains within the distribution system are a distinct area that justifies increased attention. The District has conducted a replacement and rehabilitation program for several years, which is seen as helpful. However, the degree of effectiveness realized by the program is perceived by individuals as being everywhere between "very successful" to only "more reactive than proactive". All of the personnel interviewed did agree that the program has produced tangible results, and the District would greatly benefit from an expanded budget for related improvements.

Security / Vulnerability. The District's susceptibility to terrorists or other security threats is regarded very seriously by the staff. But it is also believed that NKWD is probably not a high risk terrorism target, at least to no greater extent than other large utilities, and that more realistic security issues are vandalism and theft. Personnel feel the District is taking reasonable steps to address the recommendations that resulted from the recent

Vulnerability Assessment, and it is understood that budgetary considerations will impact the extent of those recommendations that can ultimately be implemented.

Communications. Opinions regarding the status of communications within the District, and especially across departmental lines, varied widely, and did not seem to be dependant upon each person's position within the organization. Most people felt communication inside their particular department was generally adequate, but appropriate exchange of information with other departments was lacking. Several staff members mentioned particular shortcomings or instances when they felt communications were insufficient. It was a common belief that a Central Facility would help reduce communication deficiencies.

Staffing and Training. The general consensus among upper management personnel, with a few exceptions, is that staffing within NKWD is currently adequate, and that training opportunities are encouraged and available but under-utilized. Conversely, staff at subordinate levels generally felt the personnel resources were inadequate in some areas. Specific workforce needs which were mentioned included:

- Instrumentation Technician; needed due to new security systems installed.
- Maintenance; one pump mechanic and one or more equipment service personnel.
- Solids Processing; if dredging operations are resumed in the presedimentation basins at FTTP.
- Water Quality Laboratory; additional lab staff may be needed if analysis work for *Cryptosporidium*, HAAs, or expanded contract services.
- Security; this area is viewed as deficient by some staff, in that a trained coordinator or manager of the District's security procedures, practices, and policies is needed.
- Customer Service; the number of "dirty water" calls are increasing and stretching capabilities of current staff.
- Engineering; expansion of the Water Main R&R program may require additional staff, and workload has increased with added responsibilities of bidding and engineering selection for all capital projects.
- Preparation for retirements; several key staff members are approaching eligibility for retirement, which could create a knowledge gap.

All of the persons interviewed had a high regard for their co-workers. It was apparent that the staff considers themselves to demonstrate a high level of professionalism. A common comment was that they have a lot of pride in NKWD, and they are very willing to pull together in times of need.

VII. RECOMMENDED STRATEGY

From its inception the principal focus of the Asset Management Program has been to provide a comprehensive source of guidance for the District in the planning and implementation of various programs and improvements in order to properly respond to customer's needs, changing regulatory requirements, and aging infrastructure systems. However, these different areas of need must be satisfied and accomplished while continuing to operate the utility in a sound fiscal manner, maximizing the return for the money spent, and minimizing resulting rate impacts on NKWD's customers.

The primary tool for plotting the District's future is the Capital Improvement Program (CIP), which outlines the significant projects that should be implemented and the timeline for their accomplishment. The CIP is basically a synopsis of the overall "strategy" for NKWD's future plans. As presented herein, it is intended to address the District's needs through year 2020. However, it is important that the reader understand that the CIP, and the AMP as a whole, represent the District's current status and needs as they stand today. It is essentially a "snapshot" of the situation as it exists in early 2004. The AMP and CIP should be dynamic and constantly evolving, as the circumstances confronted by the District also change with time. Therefore, the conclusions and recommendations that are a part of this report should be reexamined and reviewed at regular intervals to ensure that they keep pace with future developments.

A. DEVELOPMENT OF RECOMMENDED STRATEGY

As the creation of the Asset Management Program progressed and the list of recommended projects was developed, a "strategy" for implementing and scheduling the complete scope of projects was contemplated. The NKWD seeks to appropriately address various issues such as: increasing system water demands, emerging water quality regulatory requirements, aging and wear of equipment and facilities, attention to customer service, proper redundancy in system components, and various other factors. The recommended strategy must weigh the necessity of each improvement, its appropriate or required timing, and the associated magnitude of cost.

Combining these aspects of the planning process, B&V initially developed two different comprehensive improvement scenarios. One approach was referred to as the "Aggressive" scenario and one a contrasting "Minimal" scenario. The Aggressive scenario would be the recommended approach to address the issues described above, if constraints on economic resources did not exist.

The Minimal approach was prepared with a philosophy to defer or reduce the scope of improvement projects. While the Minimal approach would meet water demand and minimum regulatory requirements, areas such as system reliability and other areas important to consumer confidence and customer care may not be addressed. The Minimal approach removed the majority of the system redundancy improvements including back-up power generation capabilities. The Minimal approach held water main rehabilitation and replacement funding at its current level, even though this leads to a continued net deterioration of the distribution system. This approach also removed funding to add new customers desiring access to public water.

It is for these reasons that a third, or "Moderate" plan was developed. The Moderate plan was intended to embody an approach that balanced the District's needs with the practical financial limitations that exist. This approach was identified as being the best combination for prudent planning and utility management by weighing necessity and cost. Timing of the projects is important, as their absence will impact the District's operations.

All three of these schedules were presented to the District staff as part of the third AMP project workshop. During the course of the workshop it was determined by NKWD that the Moderate schedule was the most suitable to serve as the "draft" CIP. The presentation of these scenarios coincided with the District's annual budget development process, and the Moderate schedule was used as the starting point for preparing NKWD's five-year capital budget for 2004 - 2008.

Through late 2003 and into February 2004 the District continued to refine the CIP, giving it intense scrutiny to ensure that the plan was as thorough and balanced as possible. Ultimately NKWD, with some input from B&V, finalized the 20-year CIP, continuing with the Moderate, Minimal, and Aggressive versions. Although the Moderate plan is considered to be the selected approach and represents the adopted NKWD CIP, the other versions have been retained and revised as appropriate to continue representing alternative methods of planning the capital projects.

Table VII-1 lists the basic monetary differences between the three scenarios, listing the total estimated construction cost for all the projects identified over the 2004 – 2020 period.

Table VII-1
Alternative CIP Scenarios

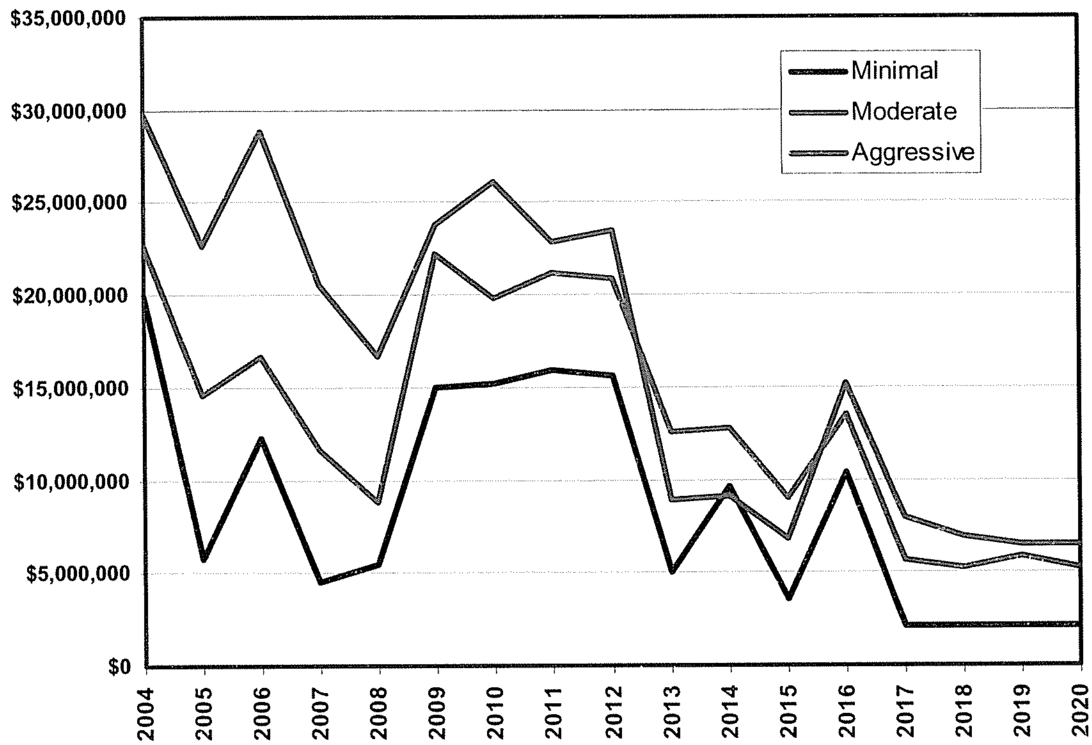
	Minimal	Moderate	Aggressive
Total Estimated Cost	$146,775,000	$228,475,000	$282,540,000

The comparison between the three scenarios shows a dramatic difference in the cost impact of the alternatives. As related to the Moderate option, the Minimal approach represents a reduction in total cost of about 35%, where the Aggressive scenario would result in an increase in cost of approximately 24% over that of the Moderate schedule.

Although the variation in total cost for the alternative approaches are significantly different over the entire planning period, the yearly amounts associated with each scenario track in nearly a parallel fashion over the period. This is largely due to the timing of the many projects not varying greatly from one scenario to another. This is considered to be a reflection of the thought and planning NKWD has invested in refining these scenarios, where projects are not scheduled for implementation until a real need exists. So, although there are minor differences in the timing of a few projects, the District has been very deliberate in arranging the projects when the required investment is truly justified.

Figure VII-1 graphically illustrates the total annual expenditures for each of the three scenarios over the planning period (2004 – 2020).

Figure VII-1
2004 - 2020 CIPs



The most significant differences between the Minimal and Aggressive plans, as compared to the Moderate scenario, are summarized as follows. (It should be noted that this list does not generally include those projects that were modified in schedule only; the list primarily shows only the projects which were deleted, added, or had adjustments to their scope and budget.)

Minimal

- "Systematic Water Main Replacement" projects identified for each year through the planning period are deleted. These projects, budgeted at $1,000,000 per year in the Moderate plan, were intended to address main replacement in specific small areas of the system, rather than an irregular pattern of replacement on a street by street basis. (Cost reduction = $17,000,000.)

- Deleting seven water main projects which were identified for transmission system redundancy. (Cost reduction = $11,480,000.)

- Deletion of annual projects for expansion into unserved areas, budgeted at $500,000 per year in the Moderate scenario. (Cost reduction = $8,500,000.)
- Canceling the planned Utility Information System project. (Cost reduction = $1,200,000.)

- Canceling system-wide replacement of water meters with radio read capability originally planned to occur 2004 – 2012, and reducing the scope and budget of radio read replacement meters for Newport. (Cost reduction = $12,610,000.)

- Deleting back-up power systems at ORPS1, Dudley PS, TMTP Pumping Station, Ripple Creek PS, Carothers Road PS, Licking River PS, U.S. 27 PS, and MPTP. (Cost reduction = $2,365,000.)

- Deletion of four water main hydraulic improvement projects. (Cost reduction = $4,760,000.)

- Reduction of the proposed annual budget amounts for the Water Main Rehabilitation & Replacement Program. (Cost reduction = $20,700,000.)

- Reducing the scope and budget of the new Chemical Building at MPTP. (Cost reduction = $3,085,000.)

Aggressive

- Increase the annual budget for the Water Main Replacement & Rehabilitation program to $4,000,000 per year. (Cost increase = $12,000,000.)
- Accelerate the schedule and broaden the scope of converting to radio read meters throughout the system. (No change in cost.)
- Increase the annual budget for to expand the water system into unserved areas from $500,000 to $1,500,000 per year. (Cost increase = $17,000,000.)
- Expand the scope and budget for the Utility Information System. (Cost increase = $2,050,000.)
- Modify the proposed installation of standby power at ORPS1 to provide full back-up capacity for all pumps. (Cost increase = $2,550,000.)
- Modify the proposed installation of standby power systems at the Dudley PS to provide full back-up capacity for the facility. (Cost increase = $1,925,000.)
- Modify the proposed installation of standby power at TMTP to provide full back-up capacity for the plant. (Cost increase = $2,705,000.)
- Include standby power systems with the West Covington Pump Station replacement project. (Cost increase = $200,000.)
- Modify the proposed installation of standby power at the Ripple Creek PS to provide full back-up capacity for all pumps. (Cost increase = $180,000.)
- Modify proposed installation of GAC post-filtration systems at FTTP to include UV disinfection equipment. (Cost increase = $8,100,000.)
- Modify the proposed installation of standby power at the Carothers Road PS to provide full back-up capacity for all pumps. (Cost increase = $100,000.)
- Modify the proposed installation of standby power at the Licking River PS to provide full back-up capacity for all pumps. (Cost increase = $900,000.)
- Modify the proposed installation of standby power systems at the U.S. 27 PS to provide full back-up capacity for all pumps. (Cost increase = $2,125,000.)

- Modify the proposed installation of standby power at MPTP to provide full back-up capacity for the plant. (Cost increase = $630,000.)

- Add projects to install standby power at the Latonia PS, Bristow Road PS, Bromley PS, Richardson Road PS, ORPS2, and Waterworks Road PS. (Cost increase = $3,600,000.)

The complete Moderate, Minimal, and Aggressive improvement scenarios are presented in Tables VII-6, VII-7, and VII-8, respectively, in section D of this Chapter VII.

B. 5-YEAR AND 20-YEAR CAPITAL IMPROVEMENT PROGRAM

As discussed earlier, the "5-Year" (2004 – 2008) and "20-Year" (2004 – 2020) Capital Improvement Programs are intended to consolidate all of NKWD's significant, known capital projects that have been identified, with a timeline based on their appropriate years for implementation. These projects are the result of the various studies and planning efforts the District has had performed in recent years, information that has been developed by B&V through the creation of the AMP, and significant input from the NKWD staff. The CIP that is presented herein has had several revisions, and is the CIP currently approved by the District. As described below, this represents the Moderate planning scenario.

The key components of the District's Capital Improvement Program include the following general categories of projects:

- Supply and Delivery Improvements
- Infrastructure Renewal
- Regulatory Compliance
- Treatment Enhancements
- Utility Operations and Management

Each of these key components is discussed below. Together they constitute the overall approach planned for NKWD to continue meeting the needs and expectations of its customers for many years to come.

1. SUPPLY AND DELIVERY IMPROVEMENTS

The CIP includes approximately $64 million for improvements to water supply and delivery functions. This component has the greatest number of projects, 73, to meet increased system service demands from growth and shifting population. These projects are intended to augment the supply or transmission of treated water, expand the service area, or improve system reliability. A variety of project types fall into this category, including:

- Water mains and valves to improve system hydraulics (34 projects, $26,525,000)
- Water mains into unserved areas (17 projects, $8,500,000)
- Water mains for transmission redundancy (8 projects, $12,010,000)
- Pumping station improvements and capacity upgrades (3 projects, $5,545,000)
- Back-up power generators at facilities (8 projects, $2,365,000)
- Finished water storage facilities (2 projects, $3,000,000, not including the Southern Campbell County Tank)
- Treatment plant capacity expansion (1 project, $6,100,000)

2. INFRASTRUCTURE RENEWAL AND REPLACEMENT

Through year 2020, the CIP commits about $129 million for infrastructure renewal and replacement projects, the largest single expenditure area of the five CIP components identified. This category comprises those projects identified for existing system elements which will either extend their service lives or will need to be replaced due to age and potential interruption of service. It does not include the addition of any "new" facilities, but only circumstances where a project will take the place of an existing facility, equipment item, or other system element. This also includes projects for replacing infrastructure (primarily water mains) in order to improve water quality and/or service to customers.

The projects covered by this grouping include the following:

- Systematic annual water main replacement (17 projects, $17,000,000)
- Meter replacement (9 projects, $13,430,000)
- Water main rehabilitation and replacement program (17 projects, $56,000,000)
- Facilities, equipment, and treatment component replacement or repair, including raw water mains (12 projects, $42,290,000)

3. REGULATORY COMPLIANCE

There is only one project in the CIP identified specifically to enable the District to meet future drinking water regulatory standards, which is the addition of Post-Filtration GAC systems at the Fort Thomas Treatment Plant. This project has an estimated total cost of $21 million, and is needed in order to comply with anticipated regulations that will modify the limits on the concentration of disinfection byproducts present in the distribution system.

4. TREATMENT ENHANCEMENTS

$3.85 million in enhancements to the treatment processes is included in the CIP, through four identified projects. These are projects which will improve the finished water quality, provide additional treatment barriers, or enable more efficient operation of the treatment facilities. However, as is noted above, a separate category has been identified for projects particular to enabling the District to meet drinking water regulatory standards.

5. UTILITY OPERATIONS AND MANAGEMENT

The CIP contains approximately $12 million in projects intended to augment NKWD's operations and management systems. These projects, seven in all, cover a variety of different areas of the District's operations, including:

- NKWD Central Facility (1 project, $8,000,000)
- Information technology systems and improvements, including SCADA (2 projects, $3,600,000)
- Laboratory enhancements (1 project, $160,000)

C. FINANCIAL AND RATE IMPACTS

An inherent part of the successful implementation of a CIP program is proper long-term financial planning. Without adequate financial capital, no projects can move forward, and without sufficient planning, NKWD cannot manage any potential customer rate shock. Presented in the following sections is an evaluation of the financial impact each CIP scenario has on NKWD's capital structure.

1. ASSUMPTIONS

The assumptions discussed below provide the basis for the financial analysis presented herein. The same set of assumptions were applied to each scenario; thereby allowing direct comparison of alternatives.

- *Growth.* As shown on the table below, from 2005 through 2020, the Master Plan projects that average day demand for NKWD will increase from 32.7 mgd to 39.7 mgd, or 21.4 percent. Under NKWD's existing rate structure, this increase in demand corresponds to a cumulative revenue increase of 20.7 percent over 2003 levels, based solely on increase in customer accounts.

Table VII-2
Growth Assumptions

Year	Water Demands		Revenue
	Average Day (mgd)	Percent Increase (2005 – 2020)	Cumulative Percent Increase
2000	37.8	-	-
2005	32.7	21.4%	3.3%
2010	35.1		8.3%
2020	39.7		22.7%

- *Inflation.* Summarized in Table VII-2 are annual inflation adjustment factors. These factors represent a compilation based on a review of NKWD's historical expenses and standard inflationary indices such as the Consumer Price Index, the Producer Price Index, Handy-Whitman Construction Index, and the Engineering News-Record Construction Cost Index.

Table VII-3
Annual Inflation Assumptions

O&M		CIP
Labor & Benefits	4%	2.5%
Health Insurance	8%	
Other	2% - 5%	
Cumulative	3% - 4%	

Excluding health insurance, labor and benefits were increased 4 percent per year. In the last few years, utilities have realized double-digit health insurance increases;

this trend should taper off over the planning period. Reflecting this anticipated slowdown, health insurance costs were adjusted 8 percent per year. As noted earlier in this report, NKWD is actively making process changes to address vulnerability issues and meet anticipated regulatory requirements. Over the planning period, chemical costs were increased 5 percent per year to reflect the result of some of these process changes.

The 2.5 percent inflation-based adjustments to CIP projections follow the trend reported by the construction industry.

- *Capital Financing.* NKWD uses a combination of debt, grants, and cash-on-hand to finance major capital improvements. Debt instruments include open-market revenue bonds and bond anticipation notes (BANS). The Public Service Commission (PSC) requires pre-approval of revenue bond issuances. Consequently, NKWD has elected to use BANS as a temporary financing mechanism to allow approved projects to proceed in anticipation of permanent financing approval from the PSC. The following assumptions apply for projects requiring debt financing.

  - Interest Rate – Three percent for BANS and 5.5 percent for long-term debt.

  - Tenure – Two years for BANS and 25 years for revenue bonds.

  - Issuance Date – February (BANS) or August (revenue bonds) of the applicable year.

  - Issuance Costs – Two percent for BANS and 3 percent for long-term debt.

  Routine annual repairs and replacements (R&R) are typically cash financed. For the financial analysis included in this report, the level of routine R&R is equal to the system's annual depreciation. This level of re-investment in the system provides reasonable assurance that NKWD is not gradually depleting the system's original assets. In addition to routine R&R, a small amount of the CIP program is cash-financed. Over the planning period, the level of cash financing for major capital projects starts at $500,000 and increases $250,000 per year thereafter.

- *Revenue Adjustments.* NKWD's rates are subject to approval by the PSC. In recognition of this requirement, and the PSC's regulation regarding time between rate case filings, the minimum time between effective dates of revenue adjustments is 18 months. All revenue adjustments are effective for 6 months in the year implemented.

2. OPERATING AND CAPITAL FLOW OF FUNDS

There are three approaches to establishing utility revenue requirements. The first approach identifies the cash requirements of utilities – operation and maintenance expense, principal and interest to satisfy debt service requirements of bonds or loan programs, capital improvements funded from revenues, and deposits to reserve funds. The second addresses the utilities' financial statements. Operation and maintenance expenses and bond or loan generated debt service interest are the same as in the cash approach. However, the financial statements recognize depreciation of existing assets instead of actual cash spent on capital related items. The third approach addresses covenants that the utilities have made to bond holders, financing agents, or District mandated policies in regards to minimum reserve balances.

NKWD's 1985 General Bond Resolution as amended (1985 Resolution) requires that the District maintain a cash operating reserve equivalent to 60 days of budgeted O&M expense. The financial plan presented herein for each CIP scenario satisfies annual revenue requirements determined under each of the three approaches.

a. Capital Improvement Program Financing Plan. As noted earlier, annual expenditures for each CIP scenario are anticipated to be met from a combination of available funds on hand, interest earnings, District revenues, and debt financing. The financing plans developed allow for end-of-year fund balances equal to approximately 2 months of the following year's CIP expenditures. This approach allows for continued work prior to obtaining temporary financing monies.

b. Operating Fund Financing Plan. In addition to the 18-month filing restriction between rate increase requests and bond covenant requirements, the District also has a policy of operating with a balanced budget. The levels of revenue adjustments proposed for each scenario reflect this policy as well as attempts to "levelize" adjustments so that the District's customers do not experience large rate swings. Figures VII-2 through VII-4 illustrate how implementation of the proposed rate adjustments for each scenario recovers total O&M and capital needs.

Figure VII-2
Operating Fund Financing Plan - Minimal Scenario

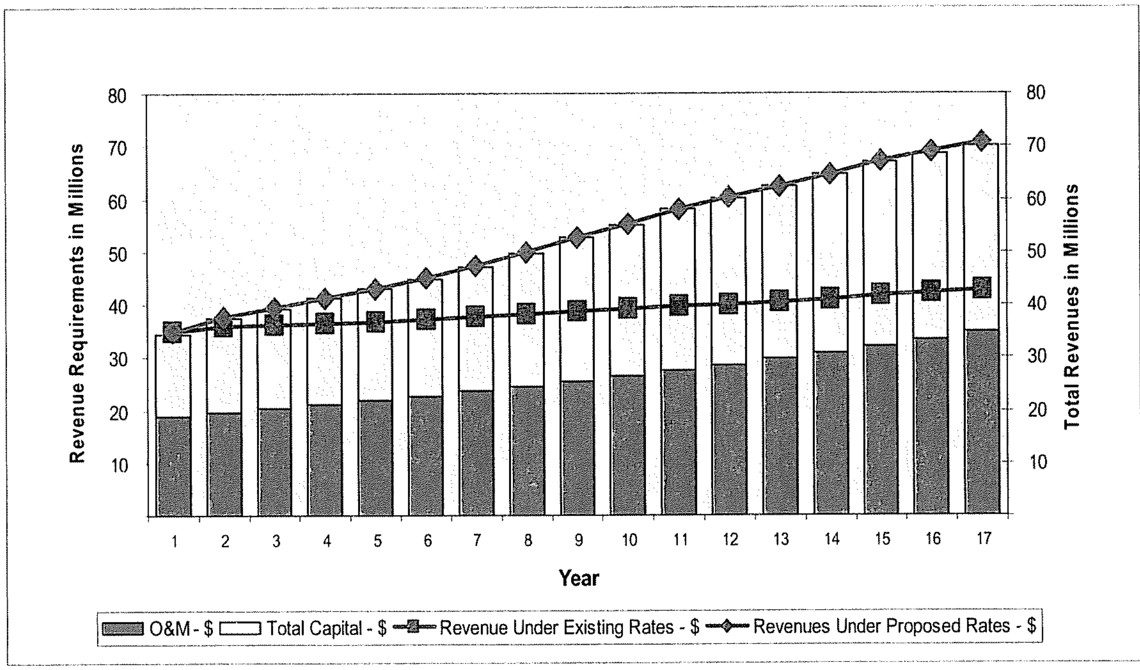


Figure VII-3
Operating Fund Financing Plan - Moderate Scenario

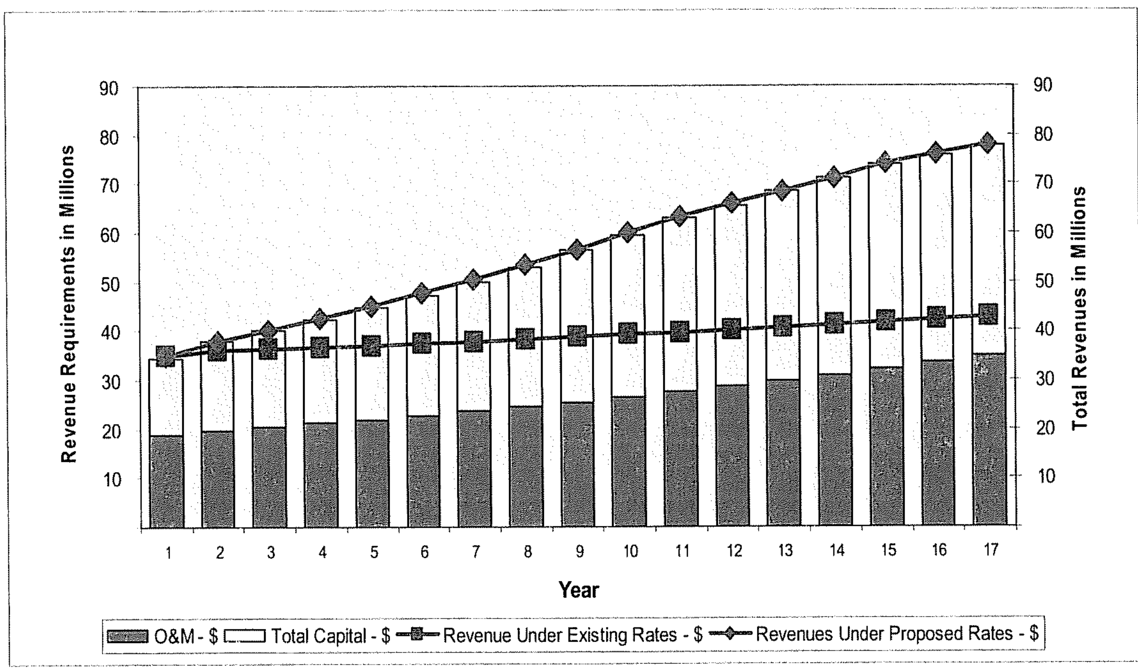
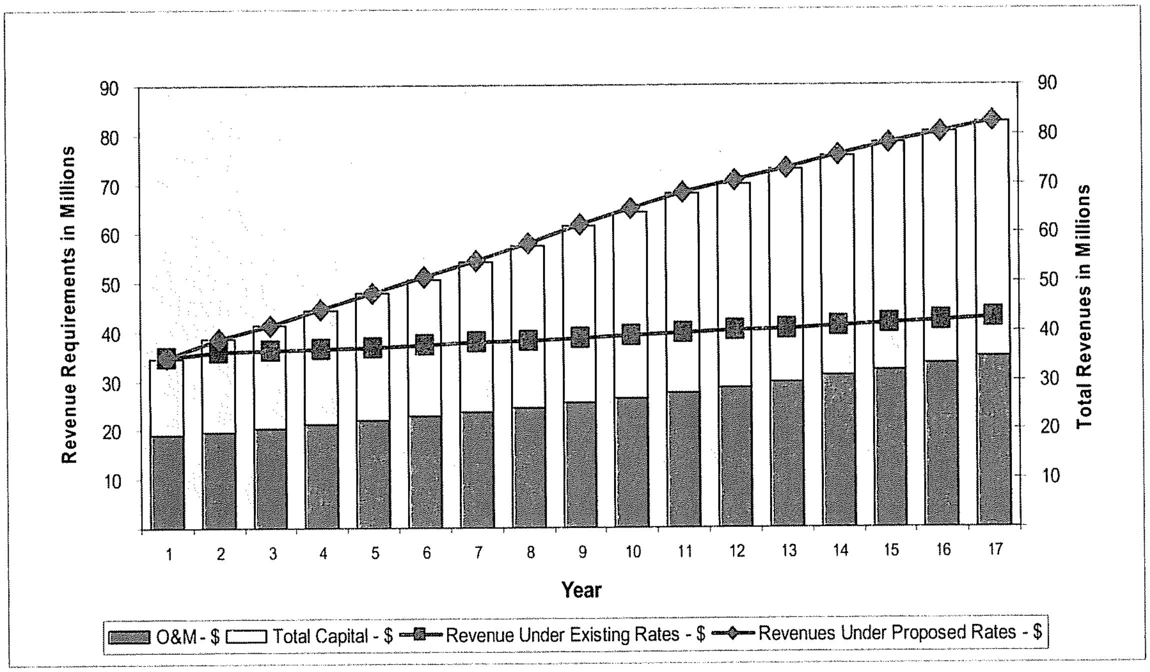


Figure VII-4
Operating Fund Financing Plan - Aggressive Scenario



3. SUMMARY OF RESULTS

Table VII-3 summarizes key findings from the financial analyses conducted for this report, showing the BANS, bonds, and associated revenue adjustments for the three capital improvement scenarios. In reviewing this table, it should be noted that there are two factors which impact revenue adjustments: (1) the magnitude of the adjustment needed, and (2) the timing of the adjustment. For example, under the Moderate Scenario, in 2009 the issuance of $21M in bonds results in a 9.75 percent revenue adjustment, following two 11.5 percent adjustments that had been previously implemented. The resulting cumulative adjustment in revenues is 36.4 percent. Similarly, by 2011, $50M in bonds are financed with the previous cumulative increase in revenue <u>plus</u> an additional 9.75 percent. There is no direct relationship between a bond issue and a single year increase.

Table VII-4
Results of Financial Analyses

	Minimal CIP Scenario				Moderate CIP Scenario				Aggressive CIP Scenario			
Year	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust.	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust	BANS	Bonds	Revenue Adjustment	Cumulative Rev Adjust
	$1,000	$1,000			$1,000	$1,000			$1,000	$1,000		
2004	20,758	0	0.00%	0.00%	23,587	0	0.00%	0.00%	30,987	0	0.00%	0.00%
2005	4,932	23,249	10.00%	10.00%	14,275	26,417	11.50%	11.50%	22,799	34,705	15.50%	15.50%
2006	11,937	0	0.00%	10.00%	16,633	0	0.00%	11.50%	29,731	0	0.00%	15.50%
2007	3,254	18,893	7.75%	18.53%	11,130	34,617	11.50%	24.32%	20,872	58,834	14.50%	32.25%
2008	4,268	0	0.00%	18.53%	8,018	0	0.00%	24.32%	16,693	0	0.00%	32.25%
2009	15,441	8,425	7.75%	27.71%	23,826	21,446	9.75%	36.44%	25,404	42,073	11.50%	47.46%
2010	15,804	0	0.00%	27.71%	21,191	0	0.00%	36.44%	28,639	0	0.00%	47.46%
2011	16,781	34,994	9.00%	39.20%	23,123	50,419	9.75%	49.75%	25,086	60,528	11.50%	64.41%
2012	16,551	0	0.00%	39.20%	23,087	0	0.00%	49.75%	26,214	0	0.00%	64.41%
2013	3,131	37,332	8.00%	50.34%	12,780	51,755	9.75%	64.35%	7,925	57,456	8.00%	77.57%
2014	9,152	0	0.00%	50.34%	13,156	0	0.00%	64.35%	8,305	0	0.00%	77.57%
2015	1,047	13,757	5.00%	57.86%	8,313	29,048	5.75%	73.80%	5,321	18,178	4.75%	86.00%
2016	10,459	0	0.00%	57.86%	14,701	0	0.00%	73.80%	17,147	0	0.00%	86.00%
2017	0	12,887	5.00%	65.75%	3,567	25,776	5.75%	83.79%	6,911	25,164	4.75%	94.84%
2018	0	0	0.00%	65.75%	2,963	0	0.00%	83.79%	5,434	0	0.00%	94.84%
2019	0	0	3.00%	70.72%	4,186	7,314	2.50%	88.39%	5,082	13,826	3.00%	100.68%
2020	0	0	0.00%	70.72%	3,454	0	0.00%	88.39%	5,347	0	0.00%	100.68%
CUMULATIVI	**$133,515**	**$149,537**	**70.72%**	**70.72%**	**$227,990**	**$246,792**	**88.39%**	**88.39%**	**$287,897**	**$310,764**	**100.68%**	**100.68%**

As can be seen above, under the Minimal scenario, delaying capital projects causes rates to increase in the middle of the planning period (2011 through 2014). That is, the longer rate increases are delayed, the larger the resulting magnitude these increases have to be in order to properly fund the capital program. Additionally, by delaying capital improvements until they are required by regulations or other causes impacts the ability of the District to minimize rate shock to customers. With the other two scenarios, the timing of the projects allows for a smooth decline in the revenue adjustments over the years.

4. BENCHMARKS

To assess the reasonableness of the proposed plans and to help the District identify areas of operational or financial improvement, benchmarking ratios were calculated to compare NKWD with other, similar utilities. Table VII-5 summarizes the results of this comparison. As shown in the table, the District's operating ratios (defined as O&M expense/Total Operating Revenues) exceed the benchmarking peer group and improve over the planning period. In other words, the District is prudently managing its O&M expenses, which enables it to cash finance more projects and rely less on debt. With respect to the debt ratio (defined as: [Net Utility Plant + Funds on Hand]/[Outstanding Long-Term Debt]), the District makes significant improvements over the planning period and reaches the benchmark ratio for all three scenarios. The declining debt ratio over the planning period supports the District's effort to improve its capital structure and decrease reliance on long-term debt financing.

Also presented in Table VII-5 are the typical residential customer bills resulting under each of the scenarios. Please note that these typical bills assume that the percentage distribution of costs across the functional cost components is essentially the same for each year.

Table VII-5
Benchmarking Comparison

	CIP Scenarios								
	Minimal			Moderate			Aggressive		
	Operating Ratio	Debt Ratio	Typical Bill	Operating Ratio	Debt Ratio	Typical Bill	Operating Ratio	Debt Ratio	Typical Bill
2004	52.3%	82.1%	26.27	51.9%	79.3%	26.27	51.0%	77.7%	26.27
2005	51.6%	75.2%	28.90	51.0%	71.5%	29.29	49.3%	67.0%	30.34
2010	49.1%	69.0%	33.55	45.9%	72.2%	35.85	42.3%	76.5%	38.74
2020	50.5%	29.5%	44.85	45.9%	31.5%	49.49	43.2%	31.7%	52.72
Benchmark*	**63.9%**	**31.6%**		**63.9%**	**31.6%**		**63.9%**	**31.6%**	

*Water & Sewer Revenue Bonds: Anatomy of a Rare Unenhanced Aaa-rating, Moody's Investor Service Municipal Credit Research, 2001.

D. MODERATE, MINIMAL, AND AGGRESSIVE CIPs

The following tables present the complete Moderate, Minimal, and Aggressive 2004 – 2020 Capital Improvement Plans. As listed in these tables, each of the identified projects has been given a designation based on the initial funding year for which it has been scheduled. This reflects when that project is recommended to begin and when NKWD will need to have money available to cover the associated project costs. It should be understood that many of these projects will span more than one year from inception through completion, and the actual monetary outlay by the District will be spread across that period.

There are three exceptions in the scenarios to the method of designating projects described above. Two of these have project funding divided into two parts, in two different years, due to the large scale of the specific work involved and significant expense. These are: Project 09-05 / 10-05 – Fort Thomas Treatment Plant GAC and Project 11-03 / 12-02 – ORPS2 Replacement. There is one project, which appears in year 2004, that has no designation (Southern Campbell County Tank) because it has already been funded, but has not been designed or constructed, and these costs remain to be incurred.

The same project designations as are listed in the Moderate CIP are retained for the Minimal and Aggressive schedules in order to be consistent and enable a direct comparison between them. If a project schedule has been modified for the Minimal or Aggressive scenarios, the original designation remains as it appeared in the Moderate plan.

The costs listed for projects were taken directly from their original source (i.e., study or report), provided by the District, or developed by Black & Veatch for the AMP. It should be noted that in a few instances the costs were adjusted by B&V from that originally identified in the source documents if there was sufficient reason to believe the project actual costs would vary significantly from the original amount. The costs shown include all related project expenses, such as engineering, legal, administrative, land acquisition (where applicable), etc.

Table VII-6 NKWD Minimal Capital Improvement Program				
Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$820,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$1,700,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	Subtotal - 2004			**$19,960,000**
2005	05-01	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$2,000,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$2,100,000
	Subtotal - 2005			**$5,795,000**
2006	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000
	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000
	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation	$480,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$2,100,000
	Subtotal - 2006			**$12,285,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000

Table VII-6
NKWD Minimal Capital Improvement Program

Year	Designation	Item	Description	Cost
2007	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$2,100,000
	Subtotal - 2007			**$4,490,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$1,900,000
	08-04	New Tank	New Rossford 0.75 MG Tank; Retire Existing Lumley and Rossford Tanks	$1,000,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$2,100,000
	Subtotal - 2008			**$5,450,000**
2009	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$10,500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$2,100,000
	Subtotal - 2009			**$15,000,000**
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$10,500,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$2,100,000
	Subtotal - 2010			**$15,235,000**
2011	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$2,100,000
	Subtotal – 2011			**$15,900,000**
2012	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$2,100,000
	Subtotal - 2012			**$15,600,000**
2013	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$2,100,000
	Subtotal - 2013			**$5,080,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$2,100,000
	Subtotal - 2014			**$9,610,000**
2015	15-02	WTP Improvement	MPTP Residuals Handling	$1,500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$2,100,000
	Subtotal - 2015			**$3,600,000**

Table VII-6 NKWD Minimal Capital Improvement Program				
Year	**Designation**	**Item**	**Description**	**Cost**
2016	**16-01**	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$2,100,000
	Subtotal - 2016			**$10,370,000**
2017	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$2,100,000
	Subtotal - 2017			**$2,100,000**
2018	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$2,100,000
	Subtotal - 2018			**$2,100,000**
2019	**19-04**	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$2,100,000
	Subtotal - 2019			**$2,100,000**
2020	**20-03**	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$2,100,000
	Subtotal - 2020			**$2,100,000**
2004 – 2020 TOTAL				**$146,775,000**

Table VII-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-02	12" Water Main	Bristow Rd. PS 12" to Bristow Rd.	$90,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-07	24" Water Main	Genn Ave., Covington (24" Redundancy)	$650,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$1,300,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-18	WM Rehab. & Repl.	Year 2004 Systematic WM Replacement	$1,000,000
	04-19	Unserved Expan.	Mains into Unserved Areas 2004 (Sub. H, Campbell)	$500,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$1,700,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	Subtotal - 2004			**$22,680,000**
2005	05-01	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-02	12" Water Main	Narrows Rd., Connect Existing 16" and 12"	$95,000
	05-03	36" Water Main	Licking River Crossing	$1,400,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-05	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	05-06	Inform. Tech. Impr.	Utility Information Management – CMMS / Inventory	$1,200,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$5,085,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-09	Back-Up Power	Standby Generator at ORPS1	$510,000
	05-10	WM Rehab. & Repl.	Year 2005 Systematic WM Replacement	$1,000,000
	05-11	Unserved Expan.	Mains into Unserved Areas 2005	$500,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$2,100,000
	Subtotal - 2005			**$14,585,000**
2006	06-01	36" Water Main	KY 9, 36" Moock Rd. to Newport Steel Entrance	$1,500,000
	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000

Table VII-7 NKWD Moderate Capital Improvement Program				
Year	**Designation**	**Item**	**Description**	**Cost**
2006	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000
	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-12	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation	$480,000
	06-16	WM Rehab. & Repl.	Year 2006 Systematic WM Replacement	$1,000,000
	06-17	Unserved Expan.	Mains into Unserved Areas 2006	$500,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$2,500,000
	Subtotal - 2006			**$16,685,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-03	30", 24", 12" WM	Dudley PS Discharge, 12", 24", and 30" WMs	$2,800,000
	07-04	30" Water Main	Newport Low Service interconnect	$750,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000
	07-06	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-08	Back-Up Power	Standby Generator at Dudley PS	$275,000
	07-09	WM Rehab. & Repl.	Year 2007 Systematic WM Replacement	$1,000,000
	07-10	Unserved Expan.	Mains into Unserved Areas 2007	$500,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$2,900,000
	Subtotal - 2007			**$11,615,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$1,900,000
	08-03	Meter Replace.	Radio Read Meters for Kenton & Campbell	$1,000,000
	08-04	New Tank	New Rossford; Retire Ex. Lumley & Rossford	$1,000,000
	08-05	WM Rehab. & Repl.	Year 2008 Systematic WM Replacement	$1,000,000
	08-06	Unserved Expan.	Mains into Unserved Areas 2008	$500,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$3,000,000
	Subtotal - 2008			**$8,850,000**
2009	09-01	12" Water Main	KY536, US 27 to Pond Creek Rd.	$1,990,000
	09-02	12" Water Main	Interconnect 1010 / 1017	$500,000
	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	09-04	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$10,500,000
	09-06	Back-Up Power	Standby Generator at TMTP PS	$235,000
	09-07	WM Rehab. & Repl.	Year 2009 Systematic WM Replacement	$1,000,000
	09-08	Unserved Expan.	Mains into Unserved Areas 2009	$500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$3,100,000
	Subtotal - 2009			**$22,225,000**

Table VII-7
NKWD Moderate Capital Improvement Program

Year	Designation	Item	Description	Cost
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-04	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$10,500,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	10-07	WM Rehab. & Repl.	Year 2010 Systematic WM Replacement	$1,000,000
	10-08	Unserved Expan.	Mains into Unserved Areas 2010	$500,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$3,200,000
	Subtotal - 2010			**$19,835,000**
2011	11-01	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,000,000
	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-04	Back-Up Power	Standby Generator at Ripple Creek PS	$90,000
	11-05	WM Rehab. & Repl.	Year 2011 Systematic WM Replacement	$1,000,000
	11-06	Unserved Expan.	Mains into Unserved Areas 2011	$500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$3,750,000
	Subtotal – 2011			**$21,140,000**
2012	12-01	Meter Replace.	Radio Read Meters for Kenton & Campbell	$2,130,000
	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-03	WM Rehab. & Repl.	Year 2012 Systematic WM Replacement	$1,000,000
	12-04	Unserved Expan.	Mains into Unserved Areas 2012	$500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$3,750,000
	Subtotal - 2012			**$20,880,000**
2013	13-01	42" Water Main	42" Transmission Main, FTTP to Moock Rd.	$4,290,000
	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-04	Back-Up Power	Standby Generator at Carothers Rd. PS	$100,000
	13-05	WM Rehab. & Repl.	Year 2013 Systematic WM Replacement	$1,000,000
	13-06	Unserved Expan.	Mains into Unserved Areas 2013	$500,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$3,750,000
	Subtotal - 2013			**$12,620,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	14-06	WM Rehab. & Repl.	Year 2014 Systematic WM Replacement	$1,000,000
	14-07	Unserved Expan.	Mains into Unserved Areas 2014	$500,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$3,750,000
	Subtotal - 2014			**$12,760,000**

Table VII-7 NKWD Moderate Capital Improvement Program				
Year	**Designation**	**Item**	**Description**	**Cost**
2015	**15-01**	36" Water Main	36" Along Moock Rd.	$2,175,000
	15-02	WTP Improvement	MPTP Residuals Handling	$1,500,000
	15-03	Back-Up Power	Standby Generator at LRPS	$100,000
	15-04	WM Rehab. & Repl.	Year 2015 Systematic WM Replacement	$1,000,000
	15-05	Unserved Expan.	Mains into Unserved Areas 2015	$500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$3,750,000
	Subtotal - 2015			**$9,025,000**
2016	**16-01**	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-03	WM Rehab. & Repl.	Year 2016 Systematic WM Replacement	$1,000,000
	16-04	Unserved Expan.	Mains into Unserved Areas 2016	$500,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$3,750,000
	Subtotal - 2016			**$13,520,000**
2017	**17-01**	Back-Up Power	Standby Generator at US 27 PS	$425,000
	17-02	WM Rehab. & Repl.	Year 2017 Systematic WM Replacement	$1,000,000
	17-03	Unserved Expan.	Mains into Unserved Areas 2017	$500,000
	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$3,750,000
	Subtotal - 2017			**$5,675,000**
2018	18-01	WM Rehab. & Repl.	Year 2018 Systematic WM Replacement	$1,000,000
	18-02	Unserved Expan.	Mains into Unserved Areas 2018	$500,000
	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$3,750,000
	Subtotal - 2018			**$5,250,000**
2019	**19-01**	Back-Up Power	Standby Power at MPTP	$630,000
	19-02	WM Rehab. & Repl.	Year 2019 Systematic WM Replacement	$1,000,000
	19-03	Unserved Expan.	Mains into Unserved Areas 2019	$500,000
	19-04	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$3,750,000
	Subtotal - 2019			**$5,880,000**
2020	**20-01**	WM Rehab. & Repl.	Year 2020 Systematic WM Replacement	$1,000,000
	20-02	Unserved Expan.	Mains into Unserved Areas 2020	$500,000
	20-03	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$3,750,000
	Subtotal - 2020			**$5,250,000**
2004 – 2020 TOTAL				**$228,475,000**

Table VII-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2004	04-01	12" Water Main	US 27, KY 824 to Pendleton Co. Meter	$770,000
	04-02	12" Water Main	Bristow Rd. PS 12" to Bristow Rd.	$90,000
	04-03	12" Water Main	Poplar Ridge Rd., Upper Tug Fork to Four Mile	$255,000
	04-04	12" Water Main	Four Mile Pk., Poplar Ridge to Nelson Rd.	$270,000
	04-05	12" Water Main	Nelson Rd., Four Mile to Four & Twelve Mile Rd.	$550,000
	04-06	8" Water Main	Low Gap Rd., KY 9 to Existing Dead End	$160,000
	04-07	24" Water Main	Genn Ave., Covington (24" Redundancy)	$650,000
	04-08	12" & 8" Water Main	Newport LS / HS Interconnect / Woodlawn	$530,000
	04-12	12" Water Main	Licking Pk., Trapp Rd. to Rifle Range	$900,000
	04-13	12" Water Main	Licking Pk., Rifle Range to Sub-D	$450,000
	04-14	Pump Sta. Impr.	TMTP PS New Pump / VFD	$140,000
	04-15	Pump Sta. Expan.	US 27 Pumping Station Expansion	$2,300,000
	04-16	Meter Replacement	Radio Read Meters for Newport	$1,100,000
	04-17	Central Facility	Central Facility	$8,000,000
	04-18	WM Rehab. & Repl.	Year 2004 Systematic WM Replacement	$1,000,000
	04-19	Unserved Expan.	Mains into Unserved Areas 2004 (Sub. H, Campbell)	$1,500,000
	04-20	WM Rehab. & Repl.	Year 2004 Water Main Replacement Program	$4,000,000
	*	New Tank	Southern Campbell County Tank	$2,045,000
	05-07	WTP Improvement	MPTP Chemical Bldg. Replacement, Raw Water PS, and Transfer Pipe	$5,085,000
	Subtotal - 2004			**$29,795,000**
2005	05-01	8" Water Main	Lower Tug Fork, Upper Tug Fork 6"	$585,000
	05-02	12" Water Main	Narrows Rd., Connect Existing 16" and 12"	$95,000
	05-03	36" Water Main	Licking River Crossing	$1,400,000
	05-04	Lab Inform. Tech.	Laboratory Information Management System	$160,000
	05-05	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	05-06	Inform. Tech. Impr.	Utility Information Management – CMMS / Inventory	$1,500,000
	05-08	WTP Improvement	FTTP Tube Settler Replacement	$950,000
	05-09	Back-Up Power	Standby Generator at ORPS1	$3,060,000
	05-10	WM Rehab. & Repl.	Year 2005 Systematic WM Replacement	$1,000,000
	05-11	Unserved Expan.	Mains into Unserved Areas 2005	$1,500,000
	05-12	WM Rehab. & Repl.	Year 2005 Water Main Replacement Program	$4,000,000
	13-01	42" Water Main	42" Transmission Main, FTTP to Moock Rd.	$4,290,000
	Subtotal - 2005			**$22,650,000**
2006	06-01	36" Water Main	KY 9, 36" Moock Rd. to Newport Steel Entrance	$1,500,000
	06-02	20" Water Main	US 27, Ripple Creek PS to East Alexandria Pk.	$1,700,000
	06-03	20" Water Main	US 27, East Alexandria Pk. To Main St.	$1,500,000
	06-04	12" Water Main	Washington Trace Rd., Twelve Mile to KY 1996	$1,245,000
	06-05	8" Water Main	Four Mile Pk., Uhl Rd. South to End of Line	$230,000
	06-06	8" Water Main	Gunkel Rd., Upper Eight Mile to Fender Rd.	$500,000
	06-07	12" Water Main	Four & Twelve Mile Rd., Nelson to KY 1566	$670,000
	06-08	12" Water Main	Hands Pk., KY 16 to Edwin Dr.	$285,000

Table VII-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2006	06-09	12" Water Main	KY 16, Hands Pk. To Klette Rd.	$275,000
	06-10	SCADA	SCADA Phase 3	$2,400,000
	06-11	Pump Sta. Expan.	Install 3rd Pump at Ripple Creek PS	$160,000
	06-12	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	06-13	WTP Improvement	MPTP Filter Rehabilitation	$530,000
	06-14	WTP Improvement	TMTP Tube Settler Replacement	$210,000
	06-15	WTP Improvement	MPTP Clearwell Rehabilitation & Residuals Handling	$1,980,000
	06-16	WM Rehab. & Repl.	Year 2006 Systematic WM Replacement	$1,000,000
	06-17	Unserved Expan.	Mains into Unserved Areas 2006	$1,500,000
	06-18	WM Rehab. & Repl.	Year 2006 Water Main Replacement Program	$4,000,000
	06-19	Inform. Tech. Impr.	Utility Information Management – Phase 3, CIS Interface, Asset Depreciation	$750,000
	04-09	16" Water Main	Pelly Rd., KY 17 to Senour Rd.	$370,000
	04-10	PRV & Valves	Senour Rd. PRV & Valves	$75,000
	04-11	12" Water Main	Senour Rd., Pelly Rd. to KY 16	$625,000
	07-08	Back-Up Power	Standby Generator at Dudley PS	$2,200,000
	13-02	WTP Improvement	TMTP Backwash Handling System	$980,000
	Subtotal - 2006			**$28,795,000**
2007	07-01	12" Water Main	KY 547, Washington St. to Nelson Rd.	$965,000
	07-02	12" Water Main	Four Mile Pk., Poplar Ridge to Upper Eight Mile	$510,000
	07-03	30", 24", 12" WM	Dudley PS Discharge, 12", 24", and 30" WMs	$2,800,000
	07-04	30" Water Main	Newport Low Service interconnect	$750,000
	07-05	Pump Replacement	ORPS1 Pump Replacement	$345,000
	07-06	Meter Replace.	Radio Read Meters for Kenton & Campbell	$4,110,000
	07-07	Pump Sta. Impr.	Dudley PS Sodium Hypochlorite Building	$570,000
	07-09	WM Rehab. & Repl.	Year 2007 Systematic WM Replacement	$1,000,000
	07-10	Unserved Expan.	Mains into Unserved Areas 2007	$1,500,000
	07-11	WM Rehab. & Repl.	Year 2007 Water Main Replacement Program	$4,000,000
	07-12	Inform. Tech. Impr.	Utility Information Management -- Phase 4, Dispatch / Tracking with CIS	$1,000,000
	09-06	Back-Up Power	Standby Generator at TMTP PS	$2,940,000
	Subtotal - 2007			**$20,490,000**
2008	08-01	8" Water Main	Twelve Mile Rd., KY 10 to KY 1566	$450,000
	08-02	Pump Sta. Replace.	Replace West Covington PS	$2,100,000
	08-04	New Tank	New Rossford 0.75 MG Tank; Retire Existing Lumley and Rossford Tanks	$1,000,000
	08-05	WM Rehab. & Repl.	Year 2008 Systematic WM Replacement	$1,000,000
	08-06	Unserved Expan.	Mains into Unserved Areas 2008	$1,500,000
	08-07	WM Rehab. & Repl.	Year 2008 Water Main Replacement Program	$4,000,000
	10-06	WTP Improvement	TMTP UV Disinfection	$950,000
	11-04	Back-Up Power	Standby Generator at Ripple Creek PS	$270,000
	14-04	WTP Improvement	FTTP Raw Water Influent to South Reservoir	$420,000
	14-05	Raw WM Replace.	ORPS1 to FTTP 36" Raw WM Replacement	$4,920,000
	Subtotal - 2008			**$16,610,000**

Table VII-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2009	09-01	12" Water Main	KY536, US 27 to Pond Creek Rd.	$1,990,000
	09-02	12" Water Main	Interconnect 1010 / 1017	$500,000
	09-05	WTP Improvement	FTTP Post-Filtration GAC (Part 1)	$14,550,000
	09-07	WM Rehab. & Repl.	Year 2009 Systematic WM Replacement	$1,000,000
	09-08	Unserved Expan.	Mains into Unserved Areas 2009	$1,500,000
	09-09	WM Rehab. & Repl.	Year 2009 Water Main Replacement Program	$4,000,000
	13-04	Back-Up Power	Standby Generator at Carothers Rd. PS	$200,000
	Subtotal - 2009			**$23,740,000**
2010	10-01	12" Water Main	Independence Rd., KY 17 to Existing 12" WM	$85,000
	10-02	8" Water Main	Burns Rd., Persimmon Grove to Flatwoods	$700,000
	10-03	8" Water Main	KY 1280, US 27 to Burns Rd.	$900,000
	10-05	WTP Improvement	FTTP Post-Filtration GAC (Part 2)	$14,550,000
	10-07	WM Rehab. & Repl.	Year 2010 Systematic WM Replacement	$1,000,000
	10-08	Unserved Expan.	Mains into Unserved Areas 2010	$1,500,000
	10-09	WM Rehab. & Repl.	Year 2010 Water Main Replacement Program	$4,000,000
	09-03	24" Water Main	KY 2043, Banklick Station Rd. to KY 16	$2,400,000
	15-03	Back-Up Power	Standby Generator at LRPS	$1,000,000
	Subtotal - 2010			**$26,135,000**
2011	11-02	WM Replacement	LRPS – TMTP Raw Water Main Relocation	$300,000
	11-03	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 1)	$13,500,000
	11-05	WM Rehab. & Repl.	Year 2011 Systematic WM Replacement	$1,000,000
	11-06	Unserved Expan.	Mains into Unserved Areas 2011	$1,500,000
	11-07	WM Rehab. & Repl.	Year 2011 Water Main Replacement Program	$4,000,000
	17-01	Back-Up Power	Standby Generator at US 27 PS	$2,550,000
	Subtotal – 2011			**$22,850,000**
2012	12-02	Intake Replacement	ORPS2 Replacement & 36" Raw Water Main (Part 2)	$13,500,000
	12-03	WM Rehab. & Repl.	Year 2012 Systematic WM Replacement	$1,000,000
	12-04	Unserved Expan.	Mains into Unserved Areas 2012	$1,500,000
	12-05	WM Rehab. & Repl.	Year 2012 Water Main Replacement Program	$4,000,000
	15-01	36" Water Main	36" Along Moock Rd.	$2,175,000
	19-01	Back-Up Power	Standby Power at MPTP	$1,260,000
	Subtotal - 2012			**$23,435,000**
2013	13-03	New Tank	New 1 MG Independence II Tank	$2,000,000
	13-05	WM Rehab. & Repl.	Year 2013 Systematic WM Replacement	$1,000,000
	13-06	Unserved Expan.	Mains into Unserved Areas 2013	$1,500,000
	13-07	WM Rehab. & Repl.	Year 2013 Water Main Replacement Program	$4,000,000
	13-08	Back-Up Power	Standby Power at Latonia PS	$450,000
	Subtotal - 2013			**$8,950,000**
2014	14-01	20" Water Main	Memorial Pkwy. Connector, Parallel to Existing 16" Water Main	$100,000
	14-02	24" Water Main	S. Ft. Thomas Ave., US 27 to Waterworks Rd.	$2,030,000
	14-03	36" Water Main	Waterworks Rd. PS to 20" Memorial Pky. Conn.	$40,000

Table VII-8
NKWD Aggressive Capital Improvement Program

Year	Designation	Item	Description	Cost
2014	14-06	WM Rehab. & Repl.	Year 2014 Systematic WM Replacement	$1,000,000
	14-07	Unserved Expan.	Mains into Unserved Areas 2014	$1,500,000
	14-08	WM Rehab. & Repl.	Year 2014 Water Main Replacement Program	$4,000,000
	14-09	Back-Up Power	Standby Generator at Bristow Rd. PS	$450,000
	Subtotal - 2014			**$9,120,000**
2015	15-04	WM Rehab. & Repl.	Year 2015 Systematic WM Replacement	$1,000,000
	15-05	Unserved Expan.	Mains into Unserved Areas 2015	$1,500,000
	15-06	WM Rehab. & Repl.	Year 2015 Water Main Replacement Program	$4,000,000
	15-07	Back-Up Power	Standby Generator at Bromley PS	$300,000
	Subtotal - 2015			**$6,800,000**
2016	16-01	24" Water Main	Martha Layne Collins Blvd. to Ripple Creek PS	$2,170,000
	16-02	WTP Expansion	MPTP Expansion to 20 mgd	$6,100,000
	16-03	WM Rehab. & Repl.	Year 2016 Systematic WM Replacement	$1,000,000
	16-04	Unserved Expan.	Mains into Unserved Areas 2016	$1,500,000
	16-05	WM Rehab. & Repl.	Year 2016 Water Main Replacement Program	$4,000,000
	16-06	Back-Up Power	Standby Generator at Richardson Rd. PS	$450,000
	Subtotal - 2016			**$15,220,000**
2017	17-02	WM Rehab. & Repl.	Year 2017 Systematic WM Replacement	$1,000,000
	17-03	Unserved Expan.	Mains into Unserved Areas 2017	$1,500,000
	17-04	WM Rehab. & Repl.	Year 2017 Water Main Replacement Program	$4,000,000
	17-05	Back-Up Power	Standby Generator at ORPS2	$1,500,000
	Subtotal - 2017			**$8,000,000**
2018	18-01	WM Rehab. & Repl.	Year 2018 Systematic WM Replacement	$1,000,000
	18-02	Unserved Expan.	Mains into Unserved Areas 2018	$1,500,000
	18-03	WM Rehab. & Repl.	Year 2018 Water Main Replacement Program	$4,000,000
	18-04	Back-Up Power	Standby Generator at Waterworks Rd. PS	$450,000
	Subtotal - 2018			**$6,950,000**
2019	19-02	WM Rehab. & Repl.	Year 2019 Systematic WM Replacement	$1,000,000
	19-03	Unserved Expan.	Mains into Unserved Areas 2019	$1,500,000
	19-04	WM Rehab. & Repl.	Year 2019 Water Main Replacement Program	$4,000,000
	Subtotal - 2019			**$6,500,000**
2020	20-01	WM Rehab. & Repl.	Year 2020 Systematic WM Replacement	$1,000,000
	20-02	Unserved Expan.	Mains into Unserved Areas 2020	$1,500,000
	20-03	WM Rehab. & Repl.	Year 2020 Water Main Replacement Program	$4,000,000
	Subtotal – 2020			**$6,500,000**
2004 – 2020 TOTAL				**$282,540,000**

VIII. RECOMMENDATIONS FOR ADDITIONAL STUDIES

As part of developing the AMP, B&V examined a wide variety of issues related to NKWD's operations and facilities. The District realized before the project started that because of the breadth of the AMP, it was likely that recommendations for additional studies, evaluations, or reviews would be a logical result. Therefore, when such recommendations were apparent these were to be formally communicated to NKWD. Most of these recommendations were provided by B&V through a series of memoranda addressing areas that would be of benefit to the District to explore further. One recommendation, item G below, was not presented as a separate memorandum, although it was discussed verbally with NKWD staff. This section highlights the significant suggestions contained in those recommendations. Each of the memoranda documents are presented in their entirety in Appendix C.

A. WATER MAIN REHABILITATION AND REPLACEMENT PROGRAM (August 8, 2003)

This memorandum provided preliminary recommendations for the District's water main rehabilitation and replacement (R&R) program. It was concluded that NKWD is proceeding in an appropriate manner with the R&R program, but that some enhancements would be beneficial. The more significant recommendations listed in the memo included the following:

- The data base maintained by the District is incomplete, missing installation dates for about 70% of water mains. Because of the significance age plays in the replacement and rehabilitation strategy, this information is important. To the extent practical, it is recommended the District attempt to estimate when each of the lines were installed. This could possibly be accomplished through review of as-built drawings, checking valve or hydrant cards, or inspecting tax records.

- The District should proceed with the planned selection of professional services to implement a unidirectional flushing program. Conventional flushing practices are useful for removing some of the loose deposits from the system, but a significant amount of this material is often simply transported to other piping. If the mains are badly tuberculated, the available cross section of the pipe may not be adequate to sufficiently flush out the debris. Unidirectional flushing can address these shortcomings. Unidirectional flushing systematically cleans the piping network from the source to the peripheries of the distribution system.

- Pipe leaks are often precursors of main breaks (by eroding the pipe bedding). Therefore, it is recommended that the District consider dedicating one full-time employee to leak detection. Currently leak detection is only performed on an as-needed basis. Although a formal leak detection program would represent a significant investment by the District, and would take a long time to cover the entire system, we believe the costs would be more than offset by locating potential main breaks before they become an emergency situation and helping the District spend water main rehabilitation and replacement dollars where they are most effective.

- There are two options available to the District to aid in identifying candidate water mains for replacement and rehabilitation; modify the existing NKWD model / database to include additional parameters, or purchase a commercially available software package. It is our experience that most of the models purchased from vendors are inflexible and cannot accommodate special needs or customization. Adapting the District's existing system would require programming assistance. However, the in-house model could be as simple as an Excel spreadsheet or Access database. We recommend that the District consider modifying its own model.

- In general, the District should allocate more funding for rehabilitation of unlined CIP. If it is assumed that 50% of the mains are unlined, the estimated length of cast iron in the system is about 200 miles. A budget of $2 million per year would enable the District to re-line an average of 10 miles of main per year, thus requiring about 20 years to completely eliminate unlined piping. Even with a considerable investment it will take several years for all the unlined piping to be addressed.

- It is worth noting that at the current rate of replacing cast iron water mains (5 miles per year at a cost of approximately $2.1 million) it will take the District about 80 years, to year 2083, to replace all the cast iron mains, assuming there are roughly 400 miles of cast iron mains. At that time the youngest cast iron main in the system would be 111 years old (installed in 1965).

- The District is currently in the process of utilizing the AWWARF KANEW model for planning long-term R&R strategies. The District should supplement its system data as recommended herein before this model will yield valid results.

B. TAYLOR MILL TREATMENT PLANT – DISINFECTION CT COMPLIANCE (September 11, 2003)

The purpose of this memorandum was to present a review of disinfection CT compliance for the TMTP. District staff had expressed concern regarding the ability of TMTP to comply with disinfection CT requirements at production rates exceeding 6 mgd and water temperatures less than 38 degrees F.

Review of CT compliance calculations for February 2000 through May 2003 indicates the following:

- Minimum water temperature during this period was 3 degrees C
- While the minimum single-day clearwell operating level was 6 feet, clearwell depth was only rarely less than 9 feet.
- "Typical" clearwell operating level was approximately 11 feet.
- Reported CT ratio (i.e., ratio of CT value provided to CT value required) did not comply with the minimum 1.00 requirement for three days during February 2000 and for one day during January 2002.

The spreadsheet utilized by the District in assessing CT compliance yields reported CT ratios considerably lower than are actually provided. For example, for January 3, 2002 compliance was not achieved, based on the District's spreadsheet calculations. However, actual CT required, as determined using a CT compliance spreadsheet that incorporates EPA-developed equations to calculate required CT would have exceeded the minimum required CT ratio by a significant margin.

The District may consider obtaining a commercial CT compliance program that calculates required CTs as a function of temperature, pH, and chlorine residual conditions.

Compliance with CT requirements under "worst case" conditions should be achieved if the clearwell level is maintained at a minimum of 9 feet. At lower levels chlorine residual requirements may be high enough to produce taste and odor complaints. As required chlorine residual concentrations increase with increasing pH, addition of sulfuric acid to maintain pH in the 7.3 to 7.5 range (or lower) would be beneficial, particularly when clearwell depths are less than 8 to 9 feet.

C. MEMORIAL PARKWAY TREATMENT PLANT – FUTURE DISINFECTION CT COMPLIANCE (September 19, 2003)

This memorandum summarized review of the MPTP's ability to meet disinfection CT requirements using current disinfection practices at a future expanded flow rate of 20 mgd. Ability to comply with disinfection CT requirements under anticipated "worst case" temperature, pH, and flow conditions was evaluated using the "CT Profiler" spreadsheet.

Compliance with CT requirements under "worst case" temperature and pH conditions can be achieved if the clearwell level is maintained at a minimum of approximately 11 to 13 feet. At levels less than 10 feet, required chlorine residual requirements may be high enough to produce complaints of excessive chlorine taste and/or odors.

Additional evaluation of clearwell inlet/outlet and operating conditions is required to confirm that the 0.3 baffle factor is appropriate. (The proximity of inlet and outlet piping for the inner cell suggest that a 0.3 factor may be too high.) The District should evaluate actual flow and retention time characteristics. Tracer testing could be conducted using the step-feed method, with fluoride as the tracer compound. Testing should be conducted at two to four throughput rates to accurately characterize flow characteristics.

D. RATE OF ACCEPTABLE MAIN BREAKAGE CRITERIA (September 30, 2003)

The purpose of this memorandum was to provide information to assist in establishing the acceptable number of water main breaks in the NKWD system. It is noted that there are no nationally accepted standards for the suitable amount of main breakage. Utilities develop such criteria based on the circumstances of their system and level of service they strive to maintain.

AWWARF recommends that 25 to 30 breaks per 100 main miles per year is a "reasonable" goal. However, depending on the nature of the problems and remediation costs involved, each system should set its own goal.

While the average break rate concept is useful in gauging health of the system, it should not be used as criteria for replacing mains. A model should be developed which considers factors such as pipe material, age, diameter, soil type, etc.

E. RECOMMENDATIONS FOR ADDITIONAL ANALYTICAL TESTING (October 7, 2003)

B&V reviewed the water quality monitoring conducted and concluded there are additional tests NKWD could perform to evaluate enhanced coagulation and granular activated carbon adsorption to better determine what methodologies would achieve compliance with the Stage 2 DBP requirements. MPTP is achieving higher TOC removal than FTTP. This may be due to greater use of ferric sulfate for coagulation and lower coagulation pH at MPTP. It is recommended the District initiate bench-scale testing to evaluate reduced coagulation pH and increased ferric sulfate dosages on TOC removal at FTTP. Testing should be conducted as follows:

- For current coagulant dosages, evaluate reduced coagulation pH on TOC removal and finished water DBPs (trihalomethanes and haloacetic acids). This can be accomplished by adding sulfuric acid for pH in the 6.0 to 6.5 range.

- Evaluate TOC removal and finished water DBPs as a function of ferric sulfate dosage, with and without sulfuric acid addition for coagulation pH of 6.5 or lower. (Polyaluminum chloride should not be added to the samples.)

- The testing described above should be repeated with addition of PAC at dosages of 10 mg/L and 20 mg/L to assess benefits of PAC addition on finished water TOC and DBP concentrations.

DBP analyses should be conducted using chlorinated sample holding times of 3 days and 7 days. Procedures for enhanced coagulation testing are found in the EPA "Enhanced Coagulation and Enhanced Precipitative Softening Guidance Manual" (EPA 815-R-99-012, May 1999). Prior to this testing, a testing protocol delineating all testing procedures and analytical requirements should be prepared.

The proposed Stage 2 DBPR lists the following treatment methods as "best available technology" for achieving compliance with the DBP MCLs:

- GAC adsorbers with at least 10 minutes EBCT and average carbon replacement / regeneration frequency no greater than 120 days, plus enhanced coagulation.

- GAC adsorbers with at least 20 minutes EBCT and average carbon replacement / regeneration frequency no greater than 240 days, plus enhanced coagulation.

- Nanofiltration using a membrane with a molecular weight cut off no greater than 1000 Daltons (or demonstrated to reject at least 80% of the influent TOC concentration under typical operating conditions).

Previous NKWD evaluation of membranes suggests it is not a viable treatment technique for compliance with the Stage 2 DBPR. It is recommended the District test GAC adsorption to evaluate DBP precursor compound removal, using conventional GAC pilot filters or Rapid Small Scale Column Test (RSSCT) procedures.

DBP precursor removal as a function of GAC contactor operating time should be assessed based on contactor influent and discharge TOC and DBP formation potentials for GAC-treated water at regular intervals throughout the run. It is recommended that testing to assess EBCTs of 10 and 20 minutes be conducted. The District's laboratory is equipped to perform TOC and DBP analyses and could conduct the GAC testing. Prior to initiating testing a protocol should be prepared.

F. INFORMATION TECHNOLOGY MASTER PLAN (October 8, 2003)

This memorandum provided recommendations related to the District's software systems and a proposed Information Technology (IT) Master Plan. The District is in the process of adding new computerized software systems for a variety of applications. Notable among these is the Customer Information System (CIS). NKWD also has some significant computer programs already in place for such areas as finances, GIS, and preventive maintenance. As more computer programs and functions are installed, and the District's need to manage its "assets" more efficiently increases, it will become important that the various systems communicate and share information.

It is recommended the District consider preparation of an IT Master Plan, either as a continuation of the AMP or as a stand-alone project. An IT Master Plan should address the interface between NKWD's existing software systems and identify any additional needs the District may have. Performing this Master Plan together with the next phase of Asset Management would ensure that the District's software is integrated and allowing the data to be utilized in a manner that considers all aspects of operating a utility (i.e., asset management). A comprehensive asset management program provides the information needed to make effective decisions while minimizing costs. The reliability of such information is dependant upon accurate and consistent data.

G. EVALUATION OF POTENTIAL SOUTHERN REGIONAL WATER TREATMENT PLANT

As NKWD is aware, future water quality regulations are expected to impact how the District serves portions of the system that are a significant distance from the treatment plants, including some wholesale customers. Because of an increasing regulatory emphasis on reducing disinfection byproducts, which are a direct result of water age, one possible method of meeting the DBP requirements may be to construct a small water treatment plant in the southern portion of the District's system, primarily to serve those areas that currently experience the higher DBP concentrations. Potentially, such a facility could be a joint venture between NKWD and adjacent water utilities, serving southern Kenton and Campbell Counties and other nearby customers.

Therefore, it is recommended that the District consider conducting an evaluation of this approach within the next one to three years. Based on the anticipated schedule for implementing new DBP regulations, that should provide adequate time for the District to plan based on the study's conclusions, and would be appropriate for consideration when NKWD anticipates next updating the AMP. The study is envisioned to include modeling of water quality impacts to establish an effective service area for the proposed plant. It is estimated that such a study project would cost in the range of \$65,000 - \$90,000, depending upon the final scope of work involved.

Northern Kentucky Water District

ASSET MANAGEMENT PROGRAM

Volume 2 of 2
Appendices

BLACK & VEATCH

May 2004

APPENDICES

APPENDIX A
Facility Inspection Data Forms

APPENDIX B
Water Treatment Regulatory Requirements

APPENDIX C
Total Organic Carbon (TOC) Removal Calculations

APPENDIX D
Recommendations for Additional Studies Memoranda

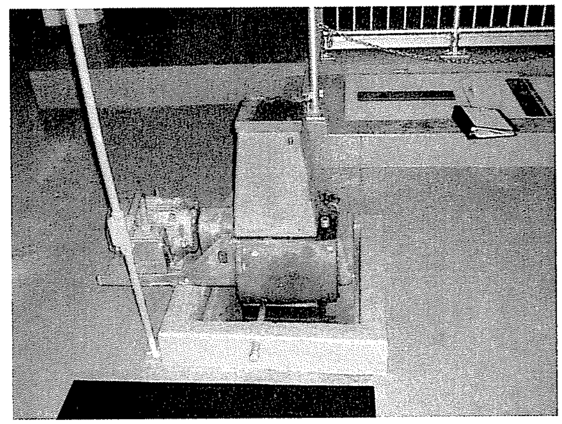
APPENDIX E
Water Main Replacement and Rehabilitation Tables and Figures

APPENDIX F
AWWARF Infrastructure Assessment Manager Subsystem Criticality Report

APPENDIX A

Facility Inspection Data Forms

Northern Kentucky Water District
Asset Management Program *Facility: FTTP*



General Information:

Equip Name:	Rapid Mixer No. 1
Tag ID:	RAPID MIX FT1
Service:	Feeds Basins 2 & 3
Make:	Lightnin
Model:	82 Q 7.5 LHR
Ratio:	14.4:1
No of Units:	1 (2 Total)
Installation Date:	1936
Replace Inst Date:	1990

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Very light corrosion. Appears to be in good working condition.

Operational History (Note any operational data available):

Output rpm - 125

Feeds Sedimentations Basins No. 2 and No. 3

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Siemens Motor – 7.5 hp, 1745 rpm, 460 volts

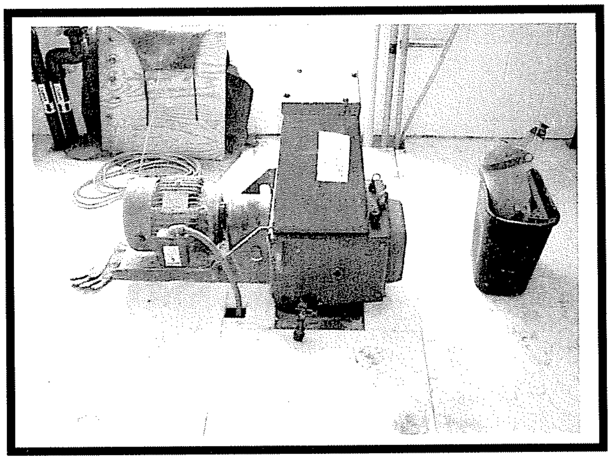
Basin Dimensions – 14'-0" x 14'-0" x 14'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Rapid Mixer No. 2
Tag ID:	RAPID MIX FT2
Service:	Feeds Basins 1 & 4
Make:	Lightnin
Model:	82 Q 7.5 LHR
Ratio:	11.5:1
No of Units:	1 (2 Total)
Installation Date:	1987
Replace Inst Date:	1990

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No noticeable defects.

Operational History (Note any operational data available):

Output rpm - 155

Distributes Flow to Basins No. 1 and No. 4.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Siemens Motor – 7.5 hp, 1745 rpm, 460 volts

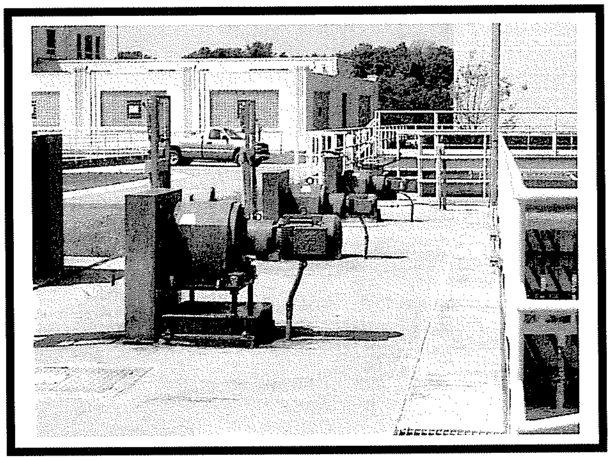
Basin Dimensions – 7'-0" x 10'-0" x 11'-6" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 1, Cell # 1 Flocculator
Tag ID:	FTTP FLOC 1-1
Service:	Flocculators
Make:	Amwell
Model:	R13370DV132H4
Ratio:	194:1
No of Units:	1 (3 Total Flocculators)
Installation Date:	1987
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Slight oil around drive mechanism from leak / spill.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

SEW Motor – 7.5 hp, 1740 rpm, 360 volt

Dimensions – 78'-0" x 14'-0" x 16'-6" (depth)

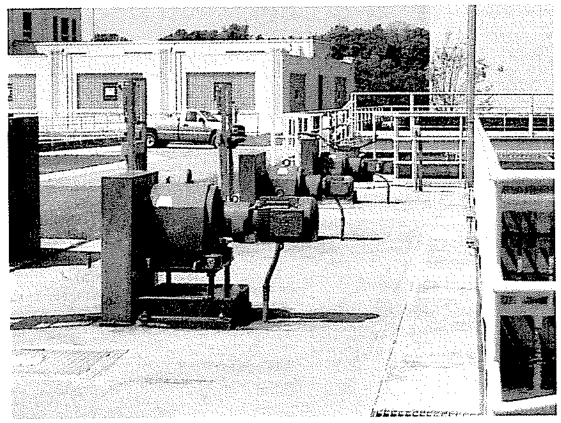
Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 1, Cells # 2 and # 3 Flocculators
Tag ID:	FTTP FLOC 1-2 (3)
Service:	Flocculators
Make:	Amwell
Model:	R10370DT100L4
Ratio:	203
No of Units:	2 (3 Total Flocculators)
Installation Date:	1987
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

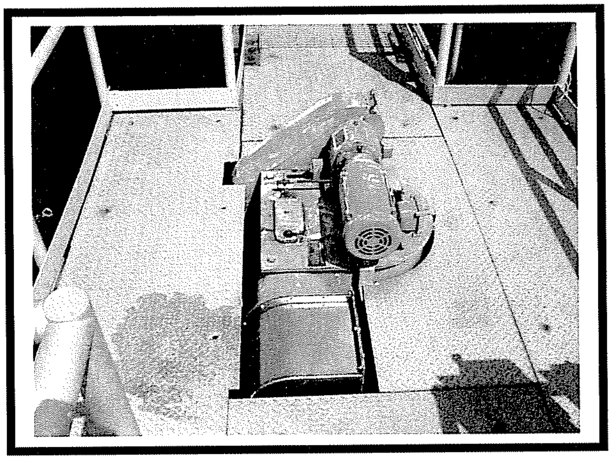
Notes:
SEW Eurodrive Motor – No information available
Cell No. 2 Dimensions – 78'-0" x 14'-0" x 16'-9" (depth)
Cell No. 2 Dimensions – 78'-0" x 14'-0" x 17'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Clarifier No. 1
Tag ID:	FTTP-RAKE-1
Service:	Sedimentation Rake
Make:	Amwell Drive
Model:	R63DLR
Ratio:	66.02:1
No of Units:	1
Installation Date:	1987
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Underwriter Labs Electric Motor – 1 hp, 1725 rpm, 460 volts
Drive Rake Model – 42.5
Dimensions - 90'-0" x 90'-0" x 18'-0" (depth)

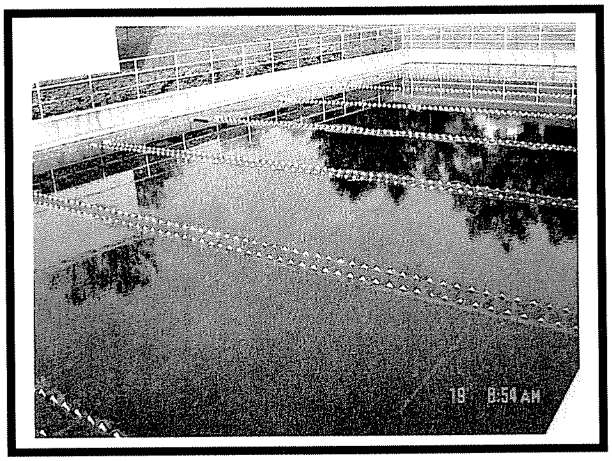
Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 1 Tube Settlers
Tag ID:	FTTP-Tubes 1
Service:	Tube Settlers
Make:	Unknown
Material:	
Capacity:	2' depth
No of Units:	1
Installation Date:	1987
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes were submerged at time of inspection. However, past inspections as well as District's staff comments about condition factored into overall condition.

Operational History (Note any operational data available):

Showing signs of deterioration. Brittle when taken out of service for cleaning

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Surface Area – 3,820 sq ft

Reviewed By: Adam Westermann Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:

Equip Name:	Basin # 2, Cell # 1 Flocculator
Tag ID:	FTTP FLOC 2-1
Service:	Flocculators
Make:	SEW-Eurodrive
Model:	R107HM213
Ratio:	115.63:1
No of Units:	1 (2 Total Flocculators)
Installation Date:	1936
Replace Inst Date:	1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

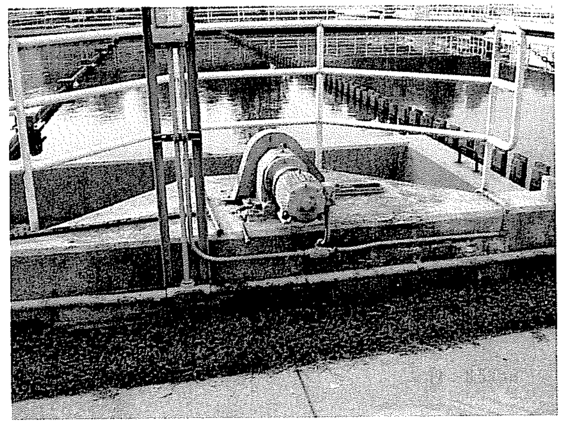
Notes:
Inverter Motor – 5 hp, 1760 rpm, 460 volts
Dimensions - 84'-6" x 13'-0" x 16'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 2, Cell # 2 Flocculator
Tag ID:	FTTP FLOC 2-2
Service:	Flocculators
Make:	Amwell
Model:	R83LP
Ratio:	107.42:1
No of Units:	1 (2 Total Flocculators)
Installation Date:	1936
Replace Inst Date:	1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

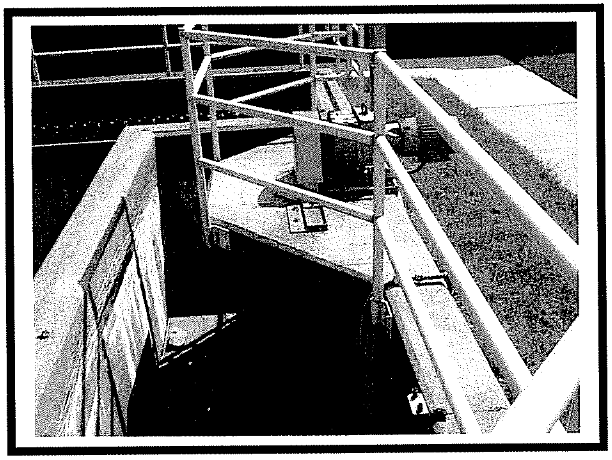
Notes:
Inverter Motor – 3 hp, 1750 rpm, 460 volts
Dimensions - 84'-6" x 17'-0" x 16'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 3, Cell # 1 Flocculator
Tag ID:	FTTP FLOC 3-1
Service:	Flocculators
Make:	SEW – Eurodrive
Model:	R107LP213
Ratio:	115.63:1
No of Units:	1 (2 Total Flocculators)
Installation Date:	1936
Replace Inst Date:	1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

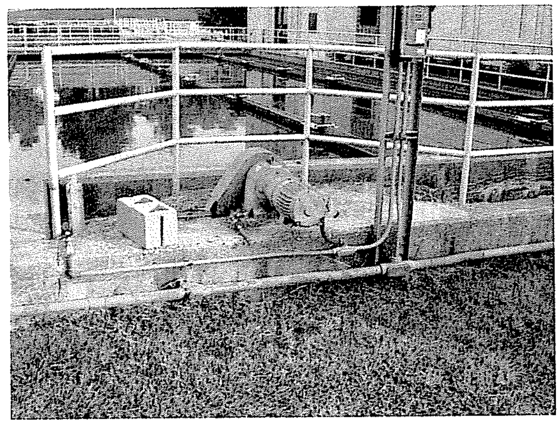
Notes:
Inverter Motor – 5 hp, 1750 rpm, 460 volts
Dimensions - 84'-6" x 13'-0" x 16'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 3, Cell # 2 Flocculator
Tag ID:	FTTP FLOC 3-2
Service:	Flocculators
Make:	Amwell
Model:	R83LP
Ratio:	107.42
No of Units:	1 (2 Total)
Installation Date:	1936
Replace Inst Date:	1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

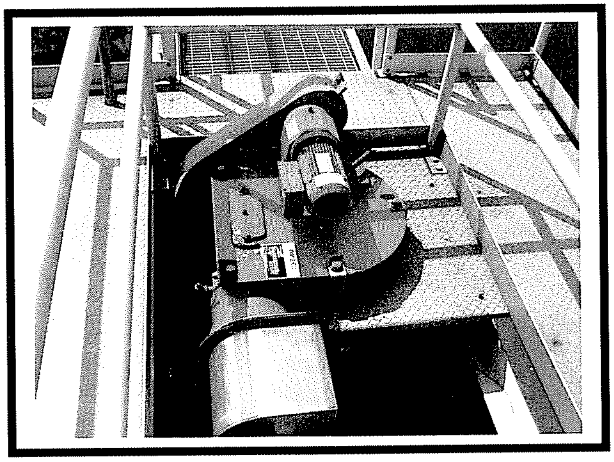
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Inverter Motor – 3 hp, 1750 rpm, 460 volts
Dimensions - 84'-6" x 17'-0" x 16'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP*

General Information:



Equip Name: Clarifier No. 2 and No. 3

Tag ID: FTTP-RAKE-2 (3)

Service: Sedimentation Rakes

Make: Amwell Drive

Model: R63DT80N4

Ratio: 48.65:1

No of Units: 2

Installation Date: 1936

Replace Inst Date: 1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on bolts, paint peeling.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Eurodrive Electric Motor – 1 hp, 1700 rpm

Drive – Amwell, 60H10

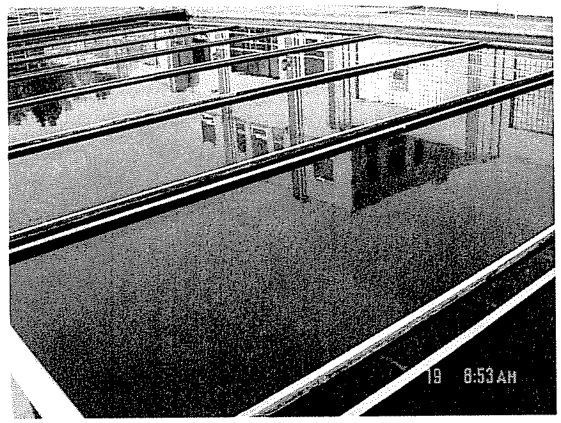
Dimensions – 89'-7" x 89'-7" x 16'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP*

General Information:



Equip Name:	Basin # 2 Tube Settlers							
Tag ID:	FTTP-Tubes 2							
Service:	Tube Settlers							
Make:	Enviropax							
Material:	ABS							
Capacity:	2' depth							
No of Units:	1							
Installation Date:	1991							
Major Rehab Date:								
Reliability:	☐	Excellent	☐	Satisfactory	x	Fair	☐	Poor
Functionality:	☐	Excellent	x	Satisfactory	☐	Fair	☐	Poor
Maint Access:	☐	Excellent	☐	Satisfactory	☐	Fair	☐	Poor
Corrosion:	☐	Extensive	x	Moderate	☐	Light	☐	None
Vibration:	☐	Heavy	☐	Moderate	☐	Light	☐	Other
Noise:	☐	Loud	☐	Normal	☐	Light		
Operating Temp:	☐	High	☐	Normal	☐	Low	☐	Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes were submerged at time of inspection. However, past inspections and reports as well as District's staff comments about condition factored into overall condition.

Operational History (Note any operational data available):

Showing signs of deterioration. Brittle when taken out of service for cleaning.

Spare Parts Available:	☐ Yes		☐ No			
Overall Condition:	☐	Excellent	☐	Good	x	Satisfactory
	☐	Unsatisfactory			☐	Inoperable
Vulnerability:	☐	Fatal	☐	Severe	☐	Moderate
	☐	Minor	☐	No Impact	☐	Unk/Not Applicable
Safety Impact:	☐	Extreme	☐	Significant	☐	Moderate
	☐	Minor	☐	No Impact	☐	Unk/Not Applicable

Notes:

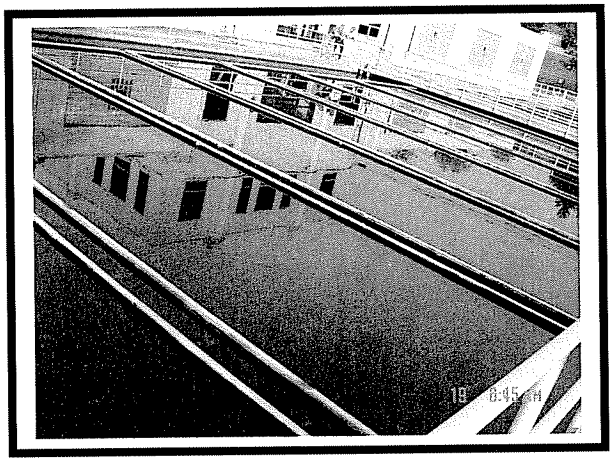
Surface Area – 3,820 sq ft

Reviewed By: Adam Westermann Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Basin # 3 Tube Settlers
Tag ID:	FTTP-Tubes 3
Service:	Tube Settlers
Make:	Enviropax
Material:	ABS
Capacity:	2' depth
No of Units:	1
Installation Date:	1991
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes were submerged at time of inspection. However, past inspections and reports as well as District's staff comments about condition factored into overall condition.

Operational History (Note any operational data available):

Showing signs of deterioration. Brittle when taken out of service for cleaning.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

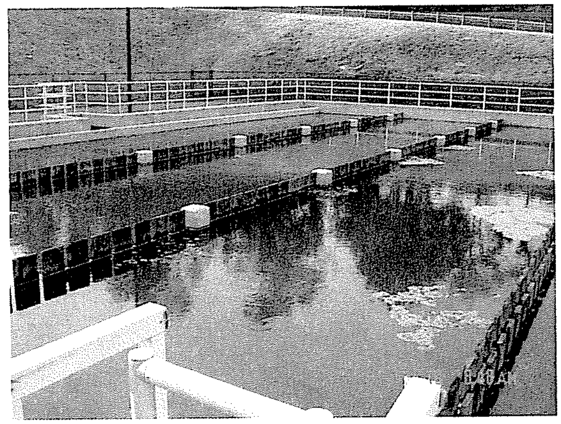
Notes:
Surface Area – 3,820 sq ft

Reviewed By: Adam Westermann   Date: 9/19/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP*

General Information:



Equip Name:	Basin # 4, Cell #1, 2, & 3 Flocculators
Tag ID:	FTTP FLOC 4-1 (2, 3)
Service:	Flocculators
Make:	DBS
Model:	154-2000-095
Ratio:	N/A
No of Units:	3
Installation Date:	1993
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Confined space entry to inspect drives. Visual inspected from above on grating and based condition on District's staffs comments.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Baldor Electric Motor – No information available.

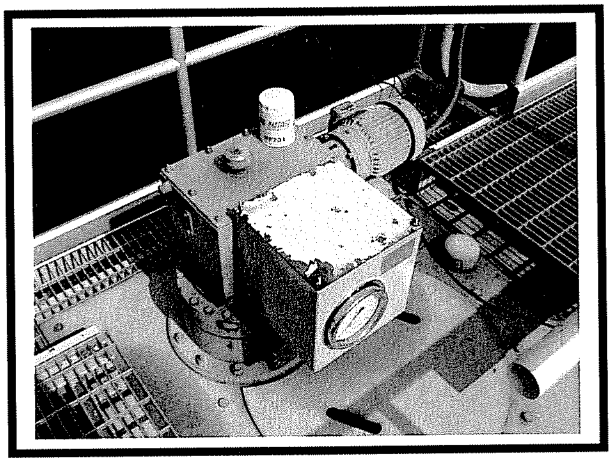
Dimensions – 90'-0" x 14'-0" x (16'-6", 16'-9", 17'0") (depth in Cells 1, 2, and 3, respectively)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP

General Information:



Equip Name:	Clarifier No. 4
Tag ID:	FTTP-RAKE-4
Service:	Sedimentation Rake
Make:	DBS
Model:	DF-42-7
Ratio:	N/A
No of Units:	1
Installation Date:	1993
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[x] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on bolts, paint peeling.

Operational History (Note any operational data available):

Rake – Fairfield Manufacturers, Model – 87AA4495

Design Torque – 35,000 ft-lbs, Output rpm - .035, hp - 1

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

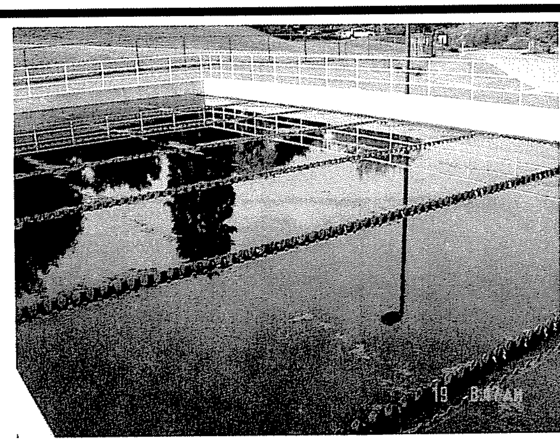
Baldor Electric Motor – 1 hp, 1725 rpm, 460 volt

Dimensions – 90'-0" x 90'-0" x 18'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP



General Information:

Equip Name:	Basin # 4 Tube Settlers
Tag ID:	FTTP-Tubes 4
Service:	Tube Settlers
Make:	MRI (Meurer Research Inc.)
Material:	PVC
Capacity:	2' depth
No of Units:	1
Installation Date:	1993
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[x] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes were submerged at time of inspection. However, past inspections and reports as well as District's staff comments about condition factored into overall condition.

Operational History (Note any operational data available):

Showing extensive signs of deterioration. Brittle when taken out of service for cleaning. Pieces of tubes have been found in the basin drain when it is taken down for service.

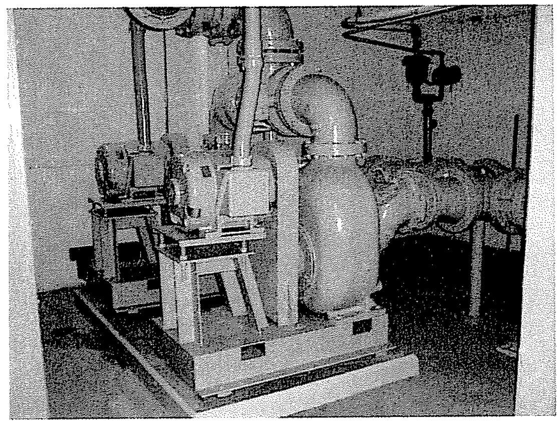
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Surface Area – 3,820 sq ft

Reviewed By: Adam Westermann   Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program — *Facility: FTTP Filter Building*

General Information:



Equip Name:	Backwash Pump
Tag ID:	FTTP-BCKW1 (2)
Service:	Filter Backwash Pumps
Make:	Gorman-Rupp Company
Model:	T10A61-B
Capacity:	2500 gpm
No of Units:	2
Installation Date:	1987
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

No longer in use. Serve as backups. Filters are now backwashed directly from U.S. 27 Pumping Station.

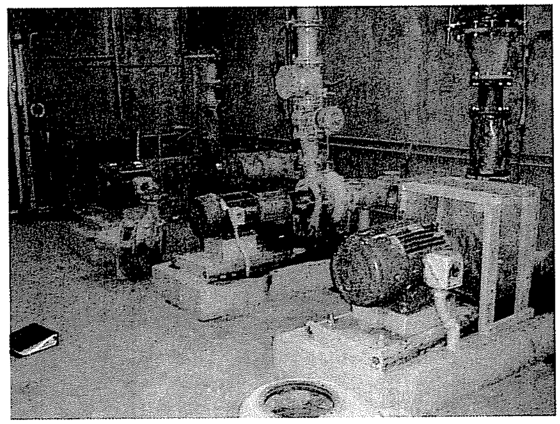
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Marathon Electric Motor – 75 hp, 1780 rpm, 208 volts

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program | *Facility: FTTP Sludge Pump Room*

General Information:



Equip Name: Backwash Return Pumps

Tag ID: Backwash Return Pump1 (2)

Service: Return Backwash to Head of Plant

Make: ITT Industries

Model: Type NSW 5x5x12

Capacity: 1200 gpm

No of Units: 2

Installation Date:

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☒ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible corrosion on pumps and bases.

Inlet Valve – 10" DeZurik manual butterfly valve

Discharge Valve – Red Valve Company, Series 33, 5" check valve

Operational History (Note any operational data available):

Spare Parts Available: ☒ Yes ☐ No

Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

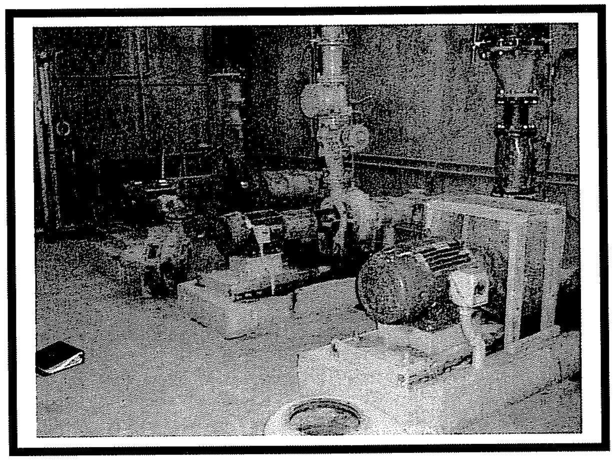
Notes:

Baldor Motor – 50 hp, 1770 rpm, 460 volts

Reviewed By: Adam Westermann Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Sludge Pump Room*

General Information:



Equip Name:	Backwash Transfer Pump
Tag ID:	Backwash Transfer Pump
Service:	Solids to Gravity Tckn
Make:	Allis – Chambers
Model:	Type NSW 6x4x12LC
Capacity:	200 gpm @ 25 feet
No of Units:	1
Installation Date:	1987
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☒ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible corrosion on pump and base.

Inlet Valve – 6" DeZurik manual butterfly valve

Discharge Valve – 6" DeZurik manual butterfly valve, 6" Kennedy check valve

Operational History (Note any operational data available):

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

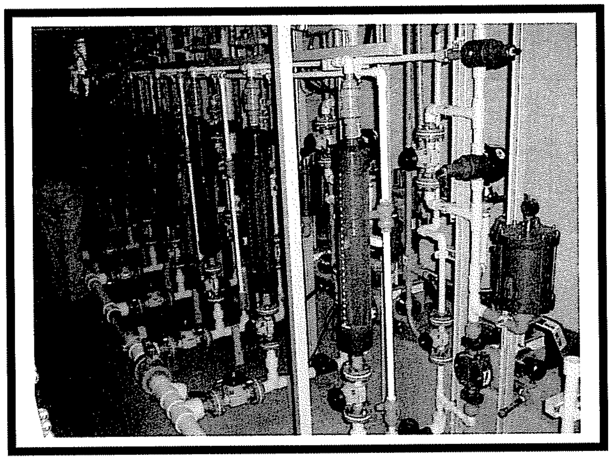
US Motor – 5 hp, 200 volts

Reviewed By: Adam Westermann Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Sodium Hypochlorite Building*

General Information:



Equip Name: Sodium Hypochlorite Metering Pumps

Tag ID: CP FT HYPO1 (2-8)

Service: Metering Pumps

Make: Wallace & Tiernan

Model: Encore 700 44 Series

Capacity: 77 gph

No of Units: 8

Installation Date: 1999

Major Rehab Date:

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion is evident on pumps, piping, and connections.

Operational History (Note any operational data available):

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

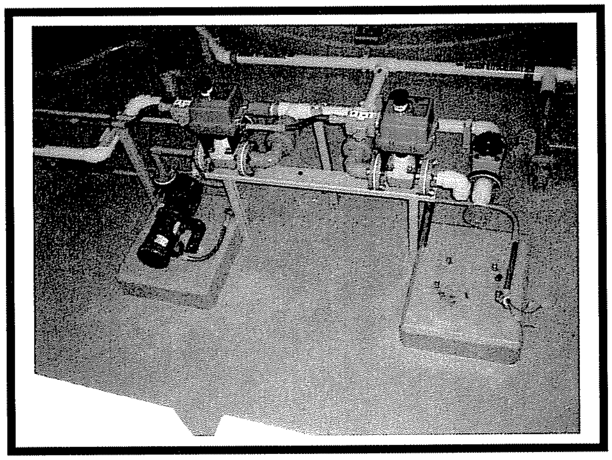
Baldor Electric Motor – 1 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Sodium Hypochlorite Building*

General Information:



Equip Name: Sodium Hypochlorite Transfer Pumps

Tag ID: CP FT HYPO TR1 (2)

Service: Transfer Pumps

Make: Pump Pro Anst Mag

Model: KM1515-CA

Capacity: Size x 3.50

No of Units: 2 (only 1 currently)

Installation Date: 1999

Major Rehab Date:

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pump No. 1 is out of service. Pump No. 2 is closest to the main exit door, and newly installed.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

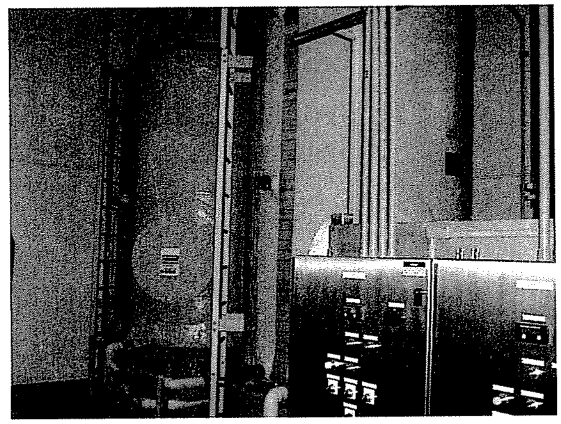
Baldor Electric Motor – 1.5 hp

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Sodium Hypochlorite Building*

General Information:



Equip Name:	Sodium Hypochlorite Day Tanks
Tag ID:	TANK HYPO FT 7 (8)
Service:	Day Tanks
Make:	Augusta Fiberglass
Model:	
Capacity:	1,850 gal
No of Units:	2
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

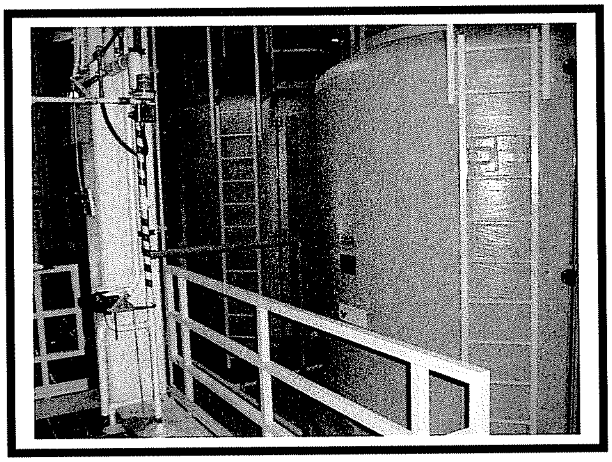
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Sodium Hypochlorite Building*



General Information:

Equip Name:	Sodium Hypochlorite Storage Tanks
Tag ID:	TANK HYPO FT1 (2-6)
Service:	Storage Tanks
Make:	Augusta Fiberglass
Model:	
Capacity:	8,670
No of Units:	6
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Currently, Tanks 1, 2, and 3 are empty. Tanks 4, 5, and 6 are in use.

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

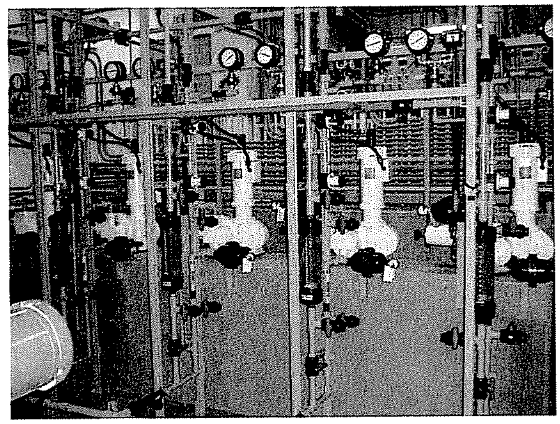
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Coagulant Metering Pumps
Tag ID:	CP FT CLARION1 (2, 3, 4, 5)
Service:	Clarion Metering Pumps
Make:	Milton Roy
Model:	231732-18
Capacity:	35.9 gph @ 100 psig
No of Units:	5
Installation Date:	2001
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible Light Corrosion were past spills have occurred.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

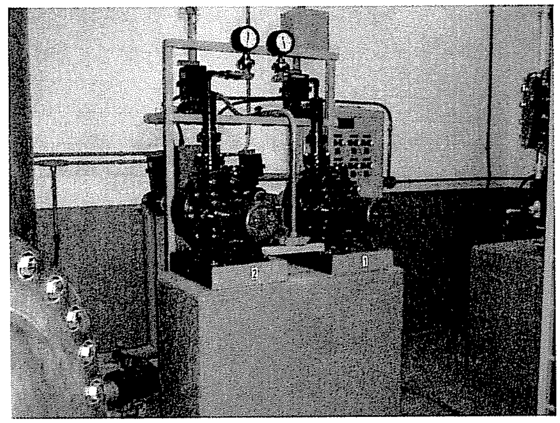
Reliance Electric Motor – 0.75 hp, 1750 rpm

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Coagulant Transfer Pumps
Tag ID:	CP FT CLARION TR1 (2)
Service:	Clarion Transfer Pumps
Make:	Pump Pro Anst Mag
Model:	KP326CA
Capacity:	Size 5.75, 285 psig
No of Units:	2
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

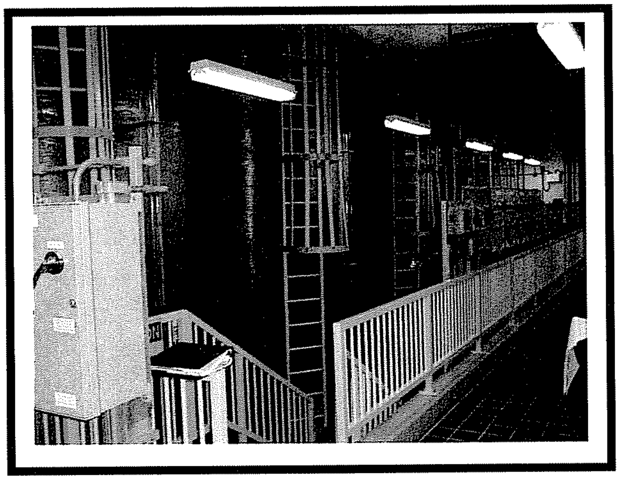
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building



General Information:

Equip Name:	Coagulant Storage Tanks
Tag ID:	TANK CLARION FT1 (2, 3)
Service:	Clarion Storage Tanks
Make:	Plas – Tank Industries
Model:	
Capacity:	9,056 gal
No of Units:	3
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

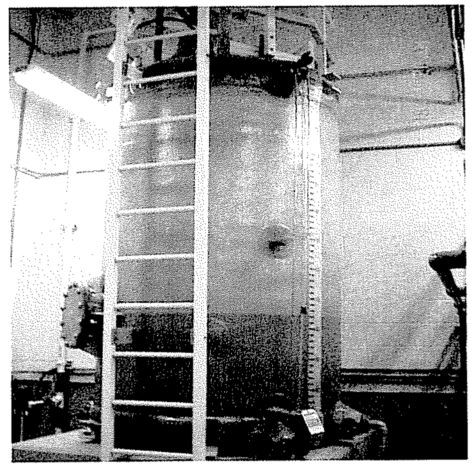
Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program — *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Coagulant Day Tank
Tag ID:	TANK CLARION FT4
Service:	Clarion Day Tank
Make:	Plas – Tank Industries
Model:	
Capacity:	1,132 gal
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

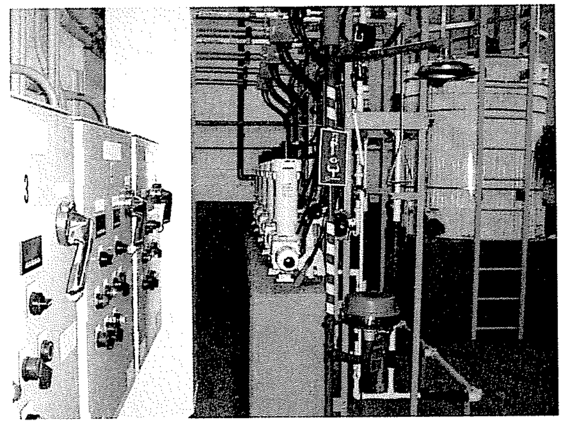
Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Caustic Soda Metering Pumps
Tag ID:	CP FT CAUSTIC1 (2, 3, 4, 5)
Service:	Metering Pumps
Make:	Milton Roy
Model:	PPRW212RMH
Capacity:	35.9 gph, 100 psig
No of Units:	5
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Pump No. 1 feeds Rapid Mix No. 1. Pump No. 2 feeds Rapid Mix No. 2. Pump No. 3 feeds Clearwell No. 1. Pump No. 4 feeds Clearwell No. 2. Pump No. 5 is a spare.

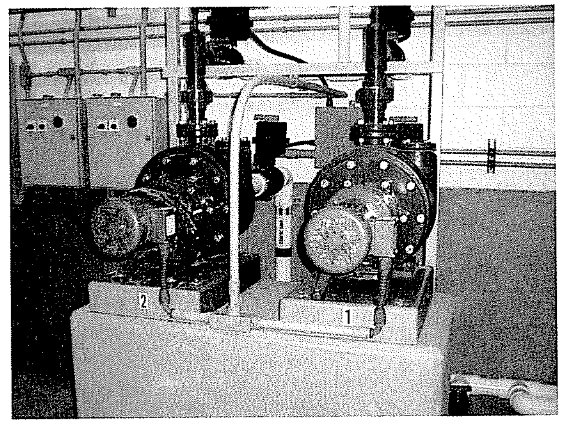
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reliance Electric Motors – 0.75 hp, 1750 rpm, 115 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*



General Information:

Equip Name: Caustic Soda Transfer Pumps
Tag ID: CP FT CAU TR1 (2)
Service: Transfer Pumps
Make: Pump Pro Anst Mag
Model: KP326CA
Capacity: Size 5.75, 285 psig
No of Units: 2
Installation Date: 2001
Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

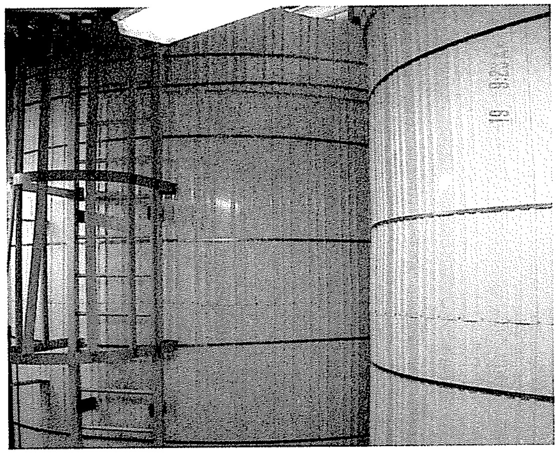
Notes:
Baldor Motor – 2 hp, 1725 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program — *Facility: FTTP Chemical Building*

General Information:



Equip Name: Caustic Soda Storage Tanks

Tag ID: TANK CAUSTIC FT 1 (2)

Service: Storage Tanks

Make:

Model:

Capacity: 8,810

No of Units: 2

Installation Date: 2001

Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No nameplates were visible on the tanks

Operational History (Note any operational data available):

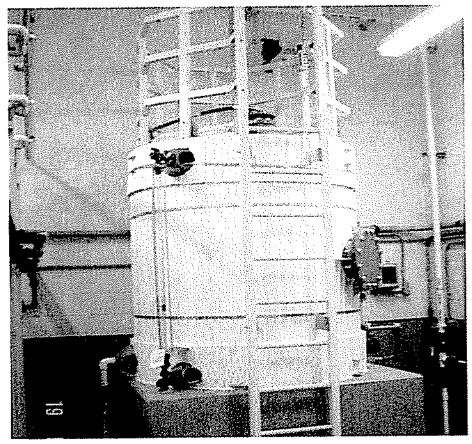
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name: Caustic Soda Day Tank
Tag ID: TANK CAUSTIC FT3
Service: Day Tank
Make:
Model:
Capacity: 735 gal
No of Units: 1
Installation Date: 2001
Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
No nameplate was visible on the tank

Operational History (Note any operational data available):

Spare Parts Available: [ ] Yes [ ] No

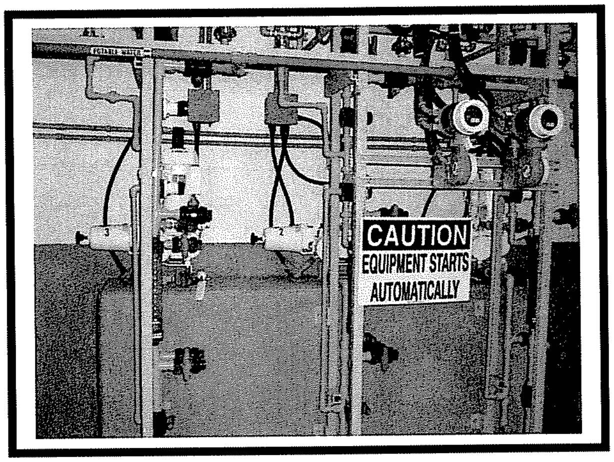
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4591

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building



General Information:

Equip Name: Hydrofluorosilicic Acid Metering Pumps

Tag ID: CP FT HFS1 (2, 3)

Service: Metering Pumps

Make: Milton Roy

Model:

Capacity: 5.0 gph

No of Units: 3

Installation Date: 2001

Major Rehab Date:

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on pumps, piping from past spills / leaks.

Nameplates are between the pumps and wall making it impossible to read.

Operational History (Note any operational data available):

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

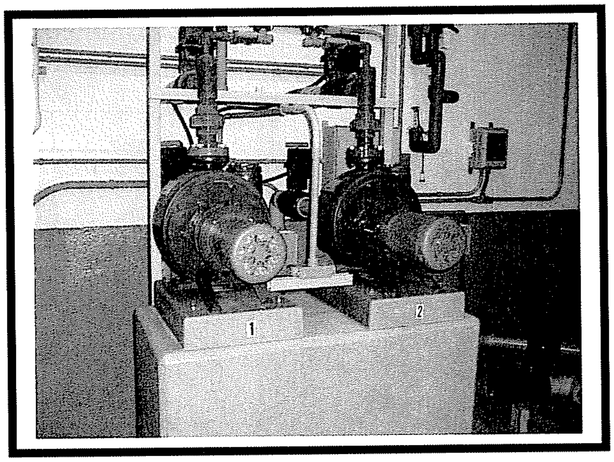
Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Hydrofluorosilicic Acid Transfer Pumps
Tag ID:	CP FT HFS TR1 (2)
Service:	Transfer Pumps
Make:	Pump Pro Anst Mag
Model:	KP326CA
Capacity:	Size x 5.75, 285 psig
No of Units:	2
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

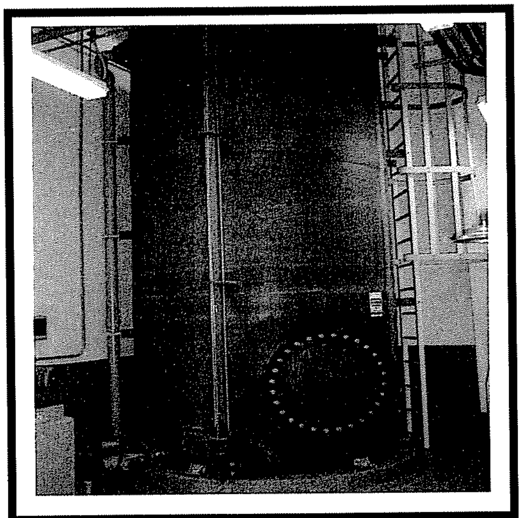
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Hydrofluorosilicic Acid Storage Tank
Tag ID:	TANK HFS FT 1
Service:	Storage Tank
Make:	Plas – Tank Industries
Model:	
Capacity:	6,391 gal
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

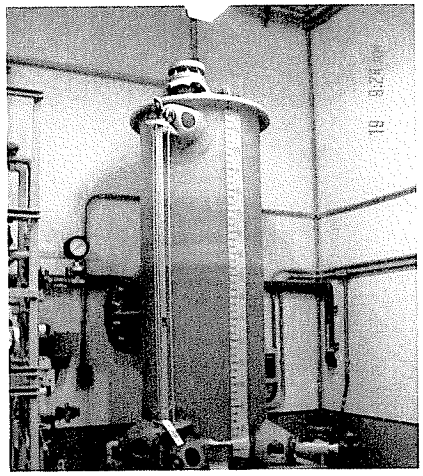
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Hydrofluorosilicic Acid Day Tank
Tag ID:	TANK HFS FT 2
Service:	Day Tank
Make:	
Model:	
Capacity:	255 gal
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

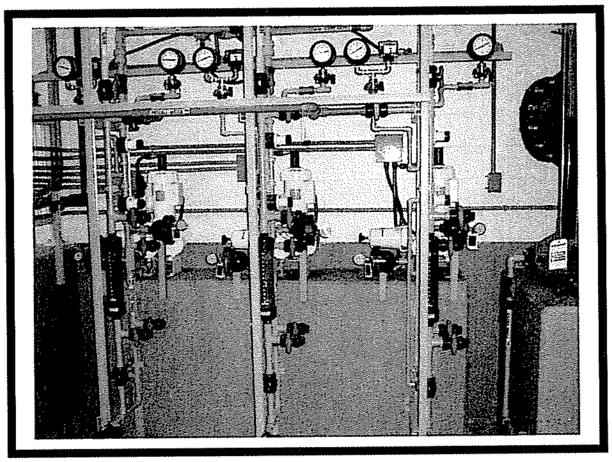
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Metering Pumps
Tag ID:	CP FT FERRIC1 (2, 3)
Service:	Metering Pumps
Make:	Milton Roy
Model:	
Capacity:	11.0 gph
No of Units:	3
Installation Date:	2001
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor Corrosion around valves pipe connections from leaks. Floor had a slight coating on it from leaks or spills.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

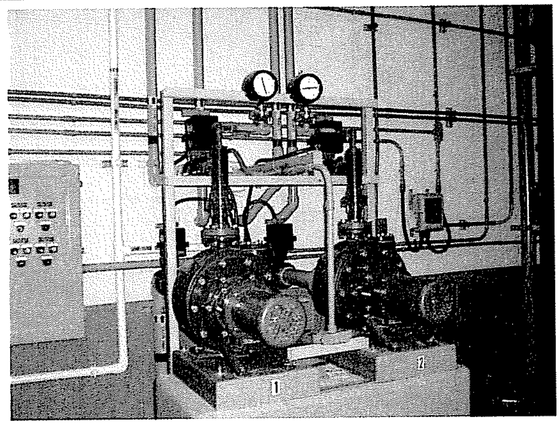
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Transfer Pumps
Tag ID:	CP FT FER TRAN1 (2)
Service:	Transfer Pumps
Make:	Pump Pro Anst Mag
Model:	KP326CA
Capacity:	Size x 5.75, 285 psig
No of Units:	2
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

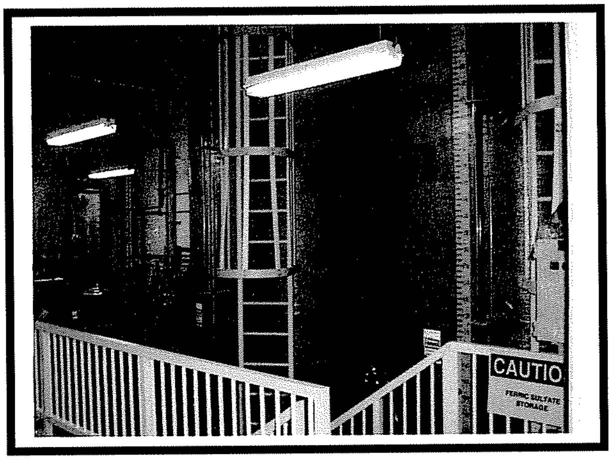
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Storage Tank
Tag ID:	TANK FERRIC FT 1 (2)
Service:	Storage Tanks
Make:	Plas – Tank Industries
Model:	
Capacity:	6,391 gal
No of Units:	2
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

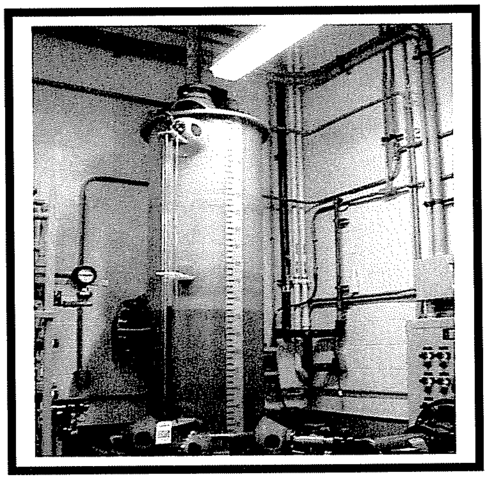
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name: Ferric Sulfate Day Tank

Tag ID: TANK FERRIC FT 3

Service: Day Tank

Make:

Model:

Capacity: 285 gal

No of Units: 1

Installation Date: 2001

Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Level Indicator was at a different level than what was in the tank during inspection.

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

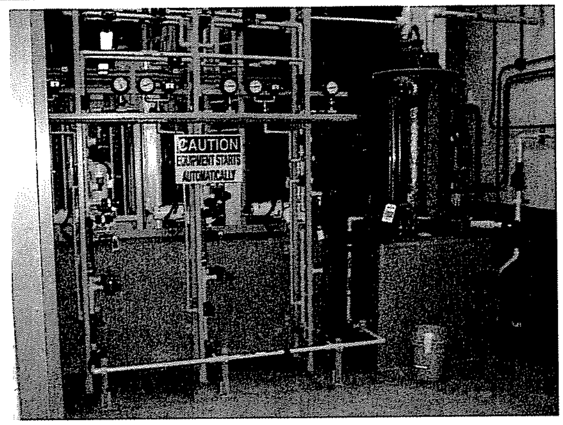
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Corrosion Inhibitor Metering Pumps
Tag ID:	CP FT K-5 1 (2, 3)
Service:	Metering Pumps
Make:	Milton Roy
Model:	231732-8
Capacity:	1.6 gph, 100 psig
No of Units:	3
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor visible evidence of where spills or leaks have occurred.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

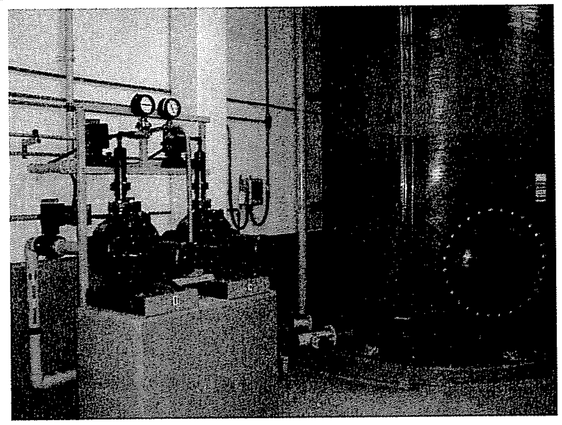
Electric Motor – 0.5 hp

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Chemical Building

General Information:



Equip Name:	Corrosion Inhibitor Transfer Pumps
Tag ID:	CP FT K-5 TR1 (2)
Service:	Transfer Pumps
Make:	Pump Pro Anst Mag
Model:	KP326CA
Capacity:	Size 5.75, 285 psig
No of Units:	2
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

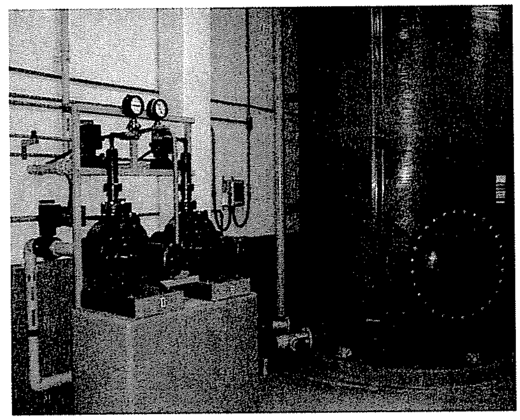
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name: Corrosion Inhibitor Storage Tank

Tag ID: TANK K-5 FT 1

Service: Storage Tank

Make: Plas – Tank Industries

Model:

Capacity: 6,391 gal

No of Units: 1

Installation Date: 2001

Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

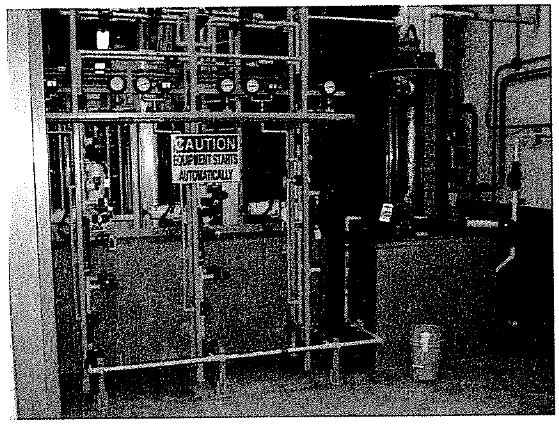
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Corrosion Inhibitor Day Tank
Tag ID:	TANK K-5 FT 2
Service:	Day Tank
Make:	Plas -- Tank Industries
Model:	
Capacity:	105 gal
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

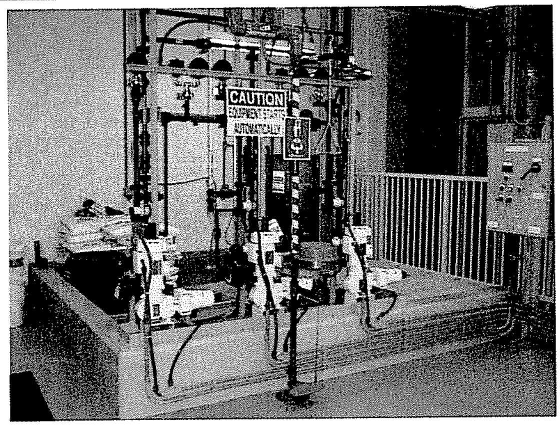
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program — *Facility: FTTP Chemical Building*

General Information:



Equip Name:	Copper Sulfate Metering Pumps
Tag ID:	CP FT COPPER1 (2, 3)
Service:	Metering Pumps
Make:	Milton Roy
Model:	321732-22
Capacity:	17.4 gph, 100 psig
No of Units:	3
Installation Date:	2001
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Metering pumps sit on top of the containment wall, if there were a spill, the chemical would not be contained.

Operational History (Note any operational data available):

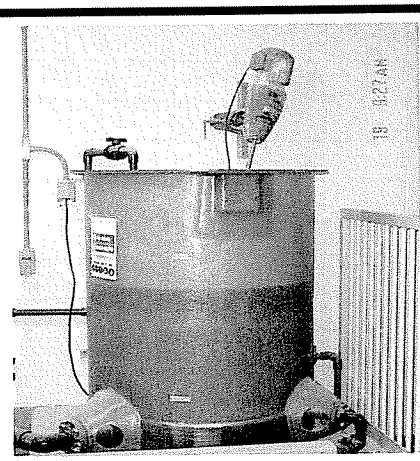
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Reliance Electric Motors – 0.5 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Chemical Building*

General Information:



Equip Name: Copper Sulfate Mixing Tank

Tag ID: TANK COPPER FT1

Service: Mixing Tank

Make:

Model:

Capacity: 211 gal

No of Units: 1

Installation Date: 2001

Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

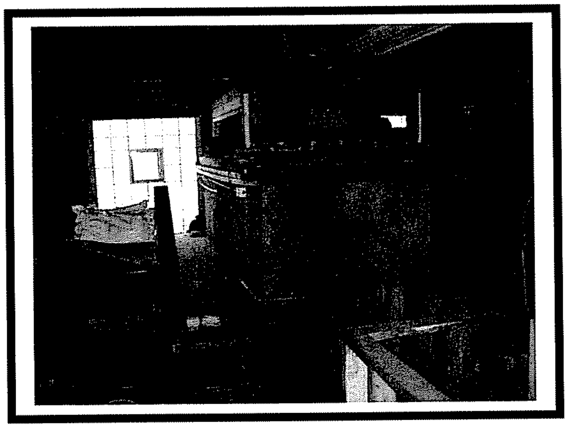
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Copper Building



General Information:

Equip Name: Copper Sulfate Feeder/Mixer

Tag ID: CP FT COP FEED

Service: Feeder

Make: NKWD

Model:

Capacity: N/A

No of Units: 1

Installation Date: N/A

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

No information available

Spare Parts Available: ☐ Yes ☐ No

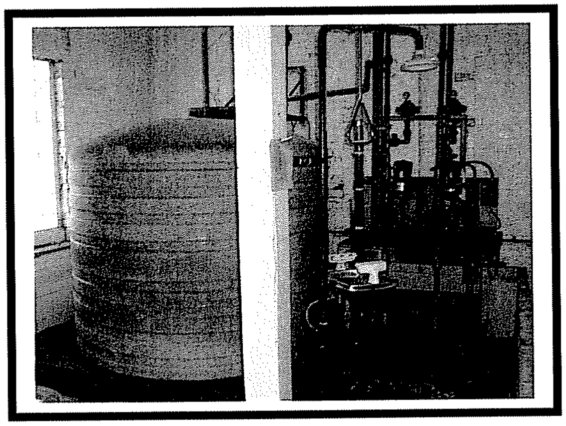
Overall Condition:	☐ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Copper Building*

General Information:



Equip Name:	Potassium Permanganate Metering Pumps
Tag ID:	CP FT KMNO4-1 (2)
Service:	Metering Pumps
Make:	Milton Roy
Model:	YB1M60ALIDD
Capacity:	195 gph, 50 psi
No of Units:	2
Installation Date:	1992
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible residue around pumps, piping

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

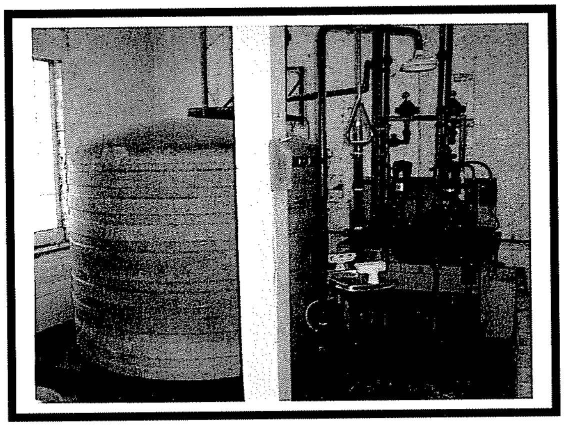
Baldor Motor – 0.75 hp, 1750 rpm, 90 Volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Copper Building

General Information:



Equip Name:	Potassium Permanganate Day Tank
Tag ID:	TANK FT-KMNO4
Service:	Day Tank
Make:	
Model:	
Capacity:	1,750 gal
No of Units:	1
Installation Date:	
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Very hot / humid inside the building causing the tank to excessively "sweat".

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

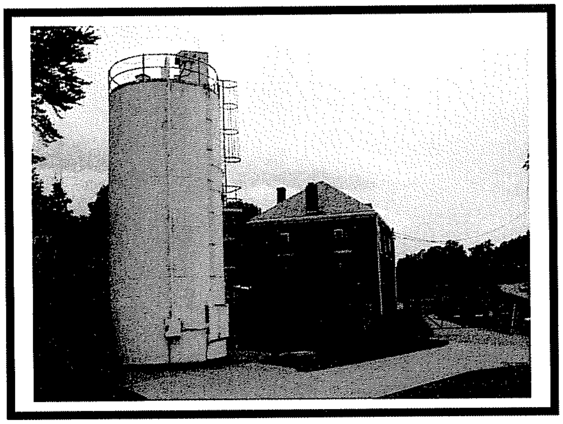
Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Carbon Silo

General Information:



Equip Name:	Carbon Metering Pumps
Tag ID:	CP FT CARBON1 (2)
Service:	Metering Pumps
Make:	Warman Pumps
Model:	B005-MM10
Capacity:	N/A
No of Units:	2
Installation Date:	1993
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps covered by carbon residue. Very difficult to obtain information from nameplates. Condition based upon comments from District Staff.

Operational History (Note any operational data available):

The carbon silo is used to store PAC.

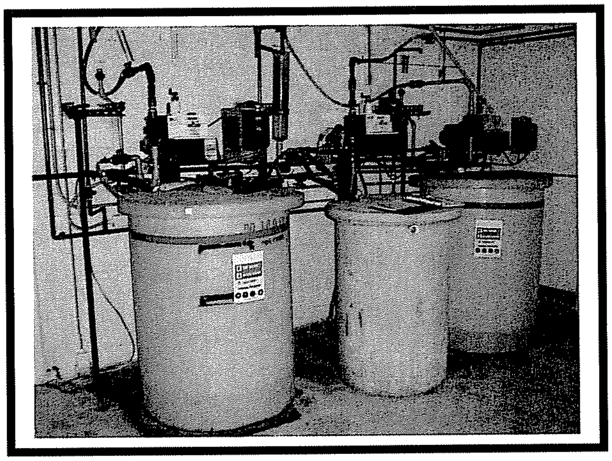
Spare Parts Available:	☐ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Filter Building*

General Information:



Equip Name:	Filter Aid Polymer Metering Pumps
Tag ID:	CP FT F/A 1 (2, 3)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Series 44-114 M9P
Capacity:	500 gpd = 20.8 gph
No of Units:	3
Installation Date:	1992
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion noted. No containment.

Operational History (Note any operational data available):

Filter Aid Polymer System is not used that often.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

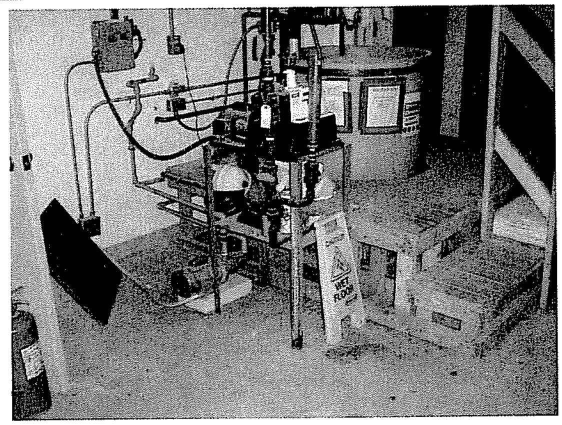
Notes:

Dart Electric Motors – 0.25 hp

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Filter Building*

General Information:



Equip Name: Filter Aid Polymer Transfer Pump

Tag ID: CP FT F/A TR1

Service: Transfer Pump

Make: Robbins Myers

Model: 34T51-5593

Capacity: N/A

No of Units: 1

Installation Date: 1996

Major Rehab Date:

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion. No containment.

Operational History (Note any operational data available):

Filter Aid Polymer System is not used that often.

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

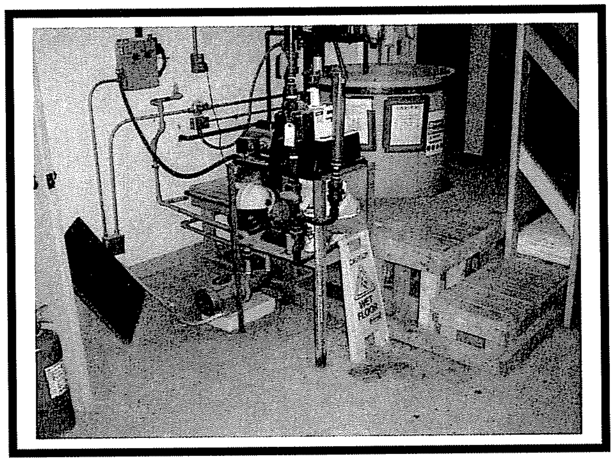
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Filter Building

General Information:



Equip Name:	Filter Aid Polymer Storage/Mixing Tank
Tag ID:	TANK F/A FT1
Service:	Batch/Mixing Tank
Make:	
Model:	
Capacity:	180 gal
No of Units:	1
Installation Date:	
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Filter Aid Polymer System is not used that often.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

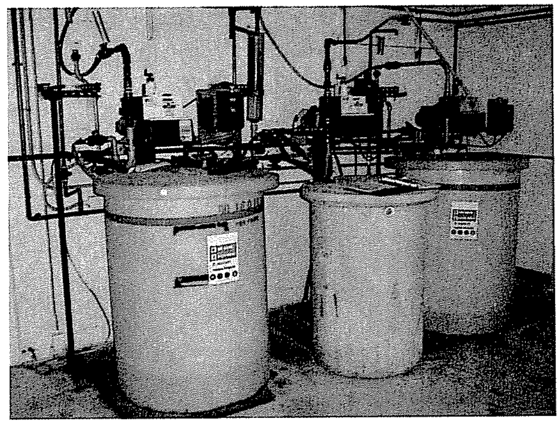
Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District

Asset Management Program *Facility: FTTP Filter Building*

General Information:

Equip Name:	Filter Aid Polymer Day Tank
Tag ID:	TANK F/A FT2 (3, 4)
Service:	Day Tank
Make:	
Model:	
Capacity:	180 gal
No of Units:	3
Installation Date:	
Major Rehab Date:	



Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Top of tanks do not fit securely

Operational History (Note any operational data available):

Filter Aid Polymer System is not used that often.

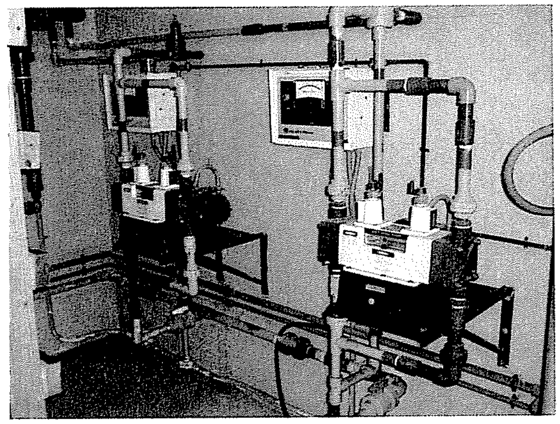
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Sludge Building*

General Information:



Equip Name:	Sludge Polymer Pumps
Tag ID:	SLUDGE POLY FT1 (2)
Service:	Polymer Metering Pumps
Make:	Wallace & Tiernan
Model:	Series 44 125 M2P
Capacity:	208 gph
No of Units:	2
Installation Date:	1991
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Evidence of spills and leaks

Operational History (Note any operational data available):

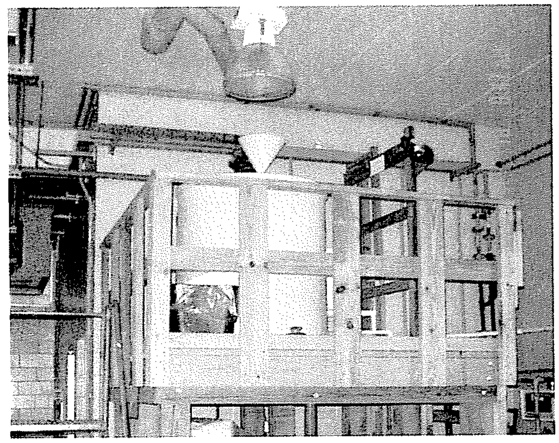
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Sludge Building*

General Information:



Equip Name:	Sludge Polymer Tank
Tag ID:	TANK SLUDGE POLY 1
Service:	Polymer Storage Tank
Make:	
Model:	
Capacity:	200 gal
No of Units:	1
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Evidence of spills and leaks

Operational History (Note any operational data available):

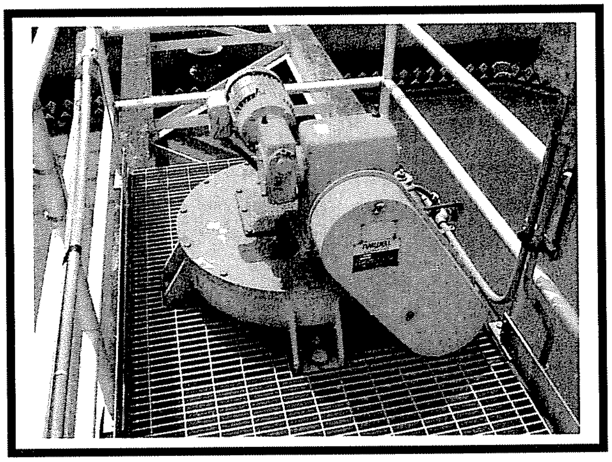
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP



General Information:

Equip Name: Gravity Thickener Drive

Tag ID: SLUDGE RAKE FT

Service: Gravity Thickener

Make: Amwell

Model: W28M

Ratio: N/A

No of Units: 1

Installation Date: 1987

Major Rehab Date: 1991

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor corrosion / rust noted on the drive assembly

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Baldor Motor – 1 hp, 1725 rpm, 460 volt

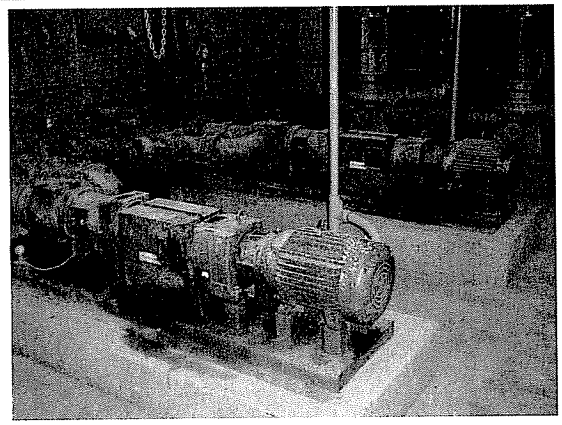
Basin Dimensions – 30'-0" x 30'-0" x 16'-3" (depth)

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Sludge Pump Room

General Information:



Equip Name:	Sludge Pumps
Tag ID:	SLUDGE FT PUMP1 (2)
Service:	Sludge Progressing Cavity
Make:	Moyno
Model:	Type 1H115G1CDQ
Capacity:	N/A Variable Speed
No of Units:	2
Installation Date:	1987
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☒ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Moderate visible corrosion on pumps and bases.

Inlet Valve – DeZurik 6" manual plug valve

Discharge Valve – 6" check valve, 6" plug valve

Operational History (Note any operational data available):

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

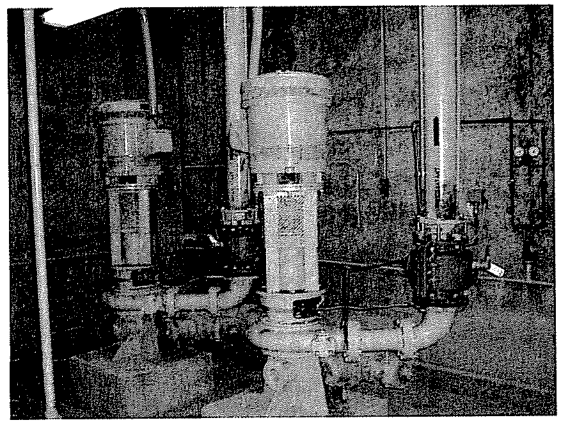
Notes:

Super E Motor – 20 hp, 1760 rpm, 208 Volts

Reviewed By: Adam Westermann   Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: FTTP Sludge Pump Room*

General Information:



Equip Name:	Sludge Supernatant Pumps
Tag ID:	SUPERNATANT FT PUMP1 (2)
Service:	Decant from Gravity Thck.
Make:	Fairbanks Morse
Model:	K3X1-071793
Capacity:	750 gpm
No of Units:	2
Installation Date:	1991
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☒ Normal	☐ Light	
Operating Temp:	☐ High	☒ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on pumps.

Inlet Valve – DeZurik 6" manual butterfly valve

Discharge Valve – 6" Red Valve Company electric ball valve

Operational History (Note any operational data available):

When Pump No. 2 turned on, ran at about 610 to 630 gpm

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

US Motors – 40 hp, 1775 rpm, 206 volt

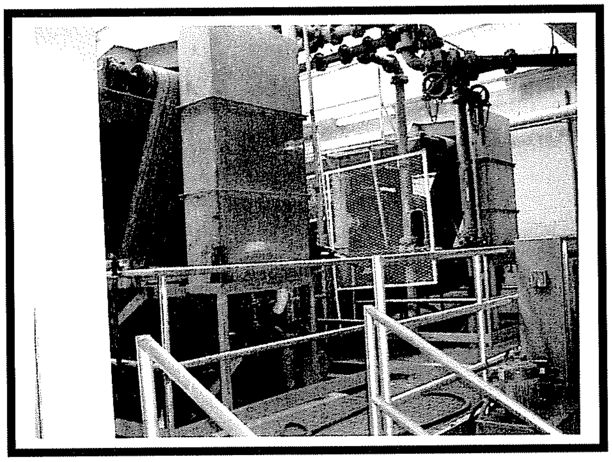
Reviewed By: Adam Westermann Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program

Facility: FTTP Sludge Building

General Information:



Equip Name:	Sludge Belt Press
Tag ID:	SLUDGE PRESS 1 (2)
Service:	
Make:	Enviroquip
Model:	Series 4 (1.2 meter)
Capacity:	1,700 lbs/hr per press
No of Units:	2
Installation Date:	1991
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Inlet Consistency – 2.0% to 8.0% TSS   Min. Cake Solids – 28.5%

Hydraulic Loading Rate – 40 to 180 gpm   Min. Solids Capture – 92%

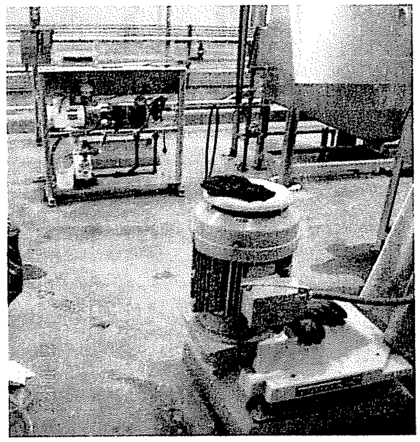
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
SEW Eurodrive Motor – 3 hp, 1200 rpm, 208 volts

Reviewed By: Adam Westermann/Doug Elder   Date: 7/8/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Coagulation Mixers
Tag ID:	MPTP COAG-A (B)
Service:	Coagulation
Make:	Lightnin
Model:	Series 10
Ratio:	
No of Units:	2
Installation Date:	1999
Major Rehab Date:	2003

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Detention Time – 2 minutes at 7.5 mgd

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Siemens Motor – 5 hp, 460 Volts, 3 Phase, 60 Hz each w/ helical gear reducers.

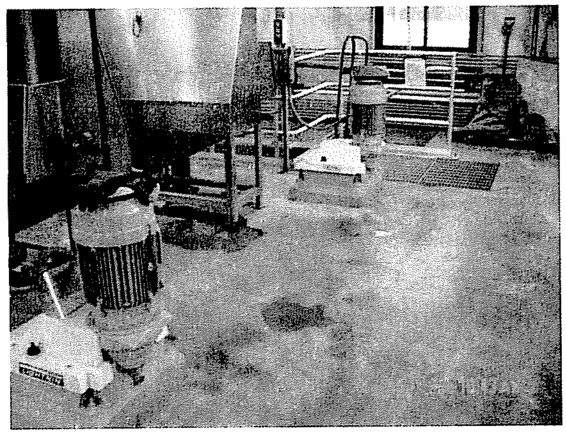
Dimensions – 9'-11" x 9'-11" x 14'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Injection Mixers
Tag ID:	MPTP INJECT-A (B)
Service:	Injection
Make:	Lightnin
Model:	Series 10
Ratio:	
No of Units:	2
Installation Date:	1999
Major Rehab Date:	2003

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Grating is loose in certain locations. District staff noted that that this is a safety concern.

Operational History (Note any operational data available):

Detention Time – 2 minutes at 7.5 mgd

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Motor – 5 hp, 460 Volts, 3 Phase, 60 Hz w/ Variable Frequency Drives

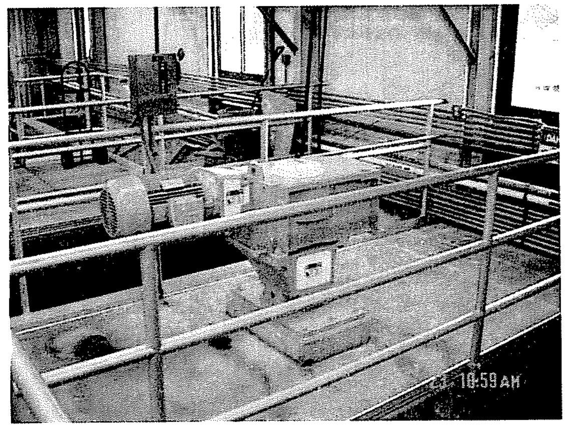
Dimensions – 9'-11" x 9'-11" x 14'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Maturation Mixers
Tag ID:	MPTP MATURE-A (B)
Service:	Maturation
Make:	Lightnin
Model:	50607.50
Ratio:	38.10:1
No of Units:	2
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Detention Time – 5.7 minutes at 7.5 mgd

Output RPM – 22.8

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Siemens Motor – 7.5 hp, 860 rpm, 460 volt, w/ Helical Gear Reducers and VFDs.

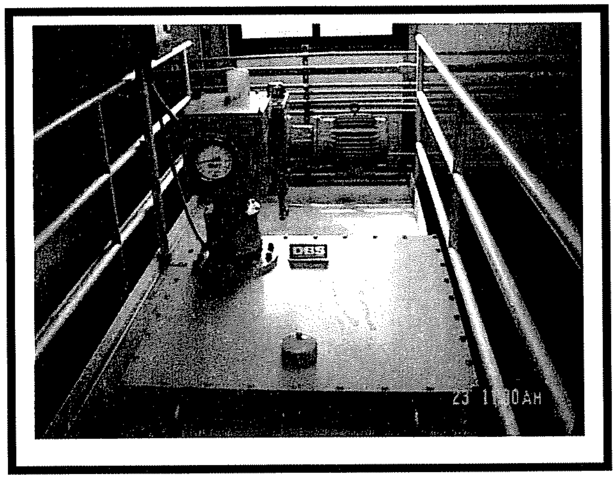
Dimensions – 18'-9" x 15'-0" x 14'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name: Scrapers

Tag ID: MPTP SCRAPER-A (B)

Service: Scrapers

Make: DBS Manufacturers

Model: SF-34-12

Torque Rating: 18,500 ft-lbs

No of Units: 2

Installation Date: 1999

Major Rehab Date:

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Rise Rate – 30 gpm/sf at 7.5 mgd

Output RPM – 22.8

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

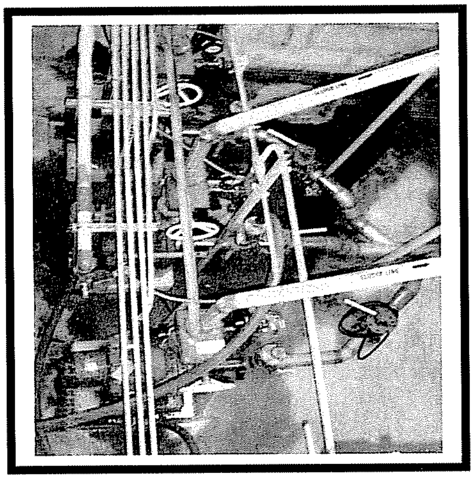
Inverter Motor – 2 hp, 1725 rpm, 460 volt, 3 Phase, 60 Hz, with VFD's

Dimensions – 15'-0" x 15'-0" x 14'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name: Sand Pumps

Tag ID: MPTP SAND PUMP A1 (2, 3)

Service: Sand Recycle Pumps

Make: Ingersoll-Dresser, Flowserve

Model: Type R 2 ½ RO 90

Capacity: 120 gpm

No of Units: 3 (6 Total)

Installation Date: 1999 (A1, A2) 2003 (A3)

Major Rehab Date: 2001 (A1, A2)

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Some corrosion, leaks on pumps.

Operational History (Note any operational data available):

Pump A3 was replaced in 2003 with a Flowserve Pump.

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

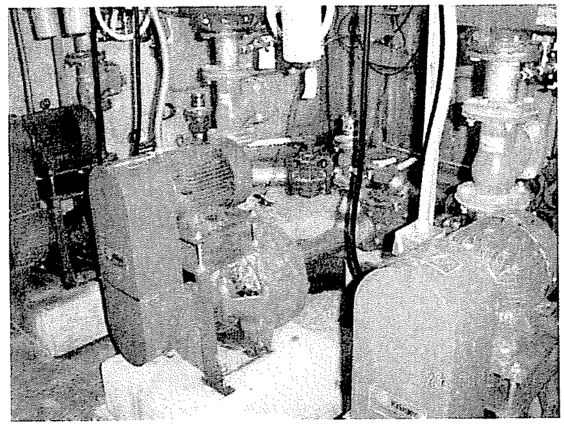
Siemens Motor – 7.5 hp, 1750 rpm, 460 volt, 3 phase, 60 Hz

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Sand Pumps
Tag ID:	MPTP SAND PUMP B1 (2, 3)
Service:	Sand Recycle Pumps
Make:	Ingersoll-Dresser
Model:	Type R 2 ½ RO 90
Capacity:	120 gpm
No of Units:	3 (6 Total)
Installation Date:	1999
Major Rehab Date:	2001

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Some corrosion, leaks on pumps.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

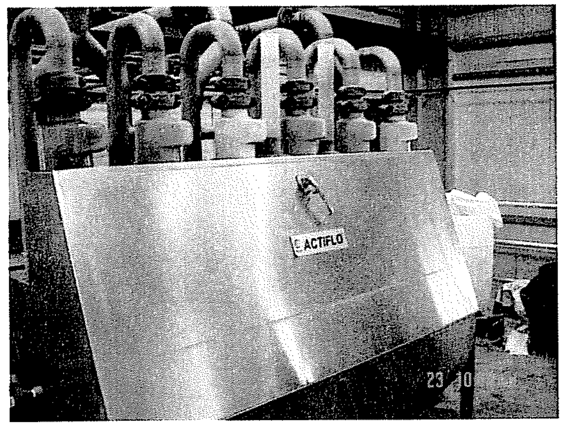
Notes:

Siemens Motor – 7.5 hp, 1750 rpm, 460 volt, 3 phase, 60 Hz

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program — *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Hydrocyclones
Tag ID:	HYDROCYCLONE A (B)
Service:	
Make:	Krebs
Model:	U4B-10
Capacity:	
No of Units:	12 (6 each train)
Installation Date:	1999
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Problems with pieces of tubes plugging the cyclones. Kruger is checking into retrofit with different tube material.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

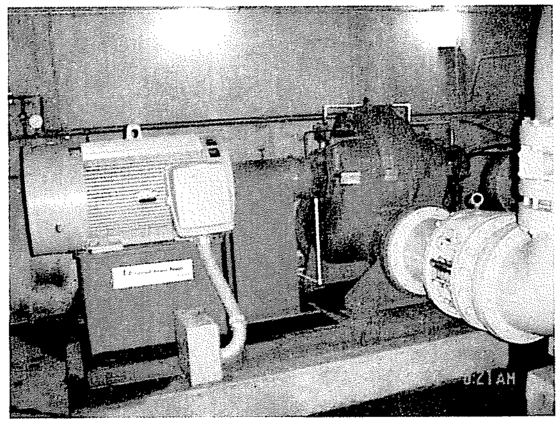
Inlet Orifice Size – 1.25 inches
Vortex Finder Size – 1.0 inch
Apex Size – 0.75 inches

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Backwash Pumping Station*

General Information:



Equip Name:	Backwash Pump
Tag ID:	MPTP-BCKW1
Service:	Filter Backwash Pump
Make:	Ingersoll Dresser
Model:	N/A
Capacity:	9000 gpm @ 45 ft
No of Units:	1 (2 Total)
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Inlet Valve – 24" Keystone manual butterfly valve

Discharge Valves – 16" check valve, 16" Pratt manual butterfly valve

Heavy to moderate corrosion on pumps, bases, connections, piping, valves.

Operational History (Note any operational data available):

The two pumps can pump 9000 gpm separately, but only 12000 gpm together. Both need to operate to backwash a filter.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

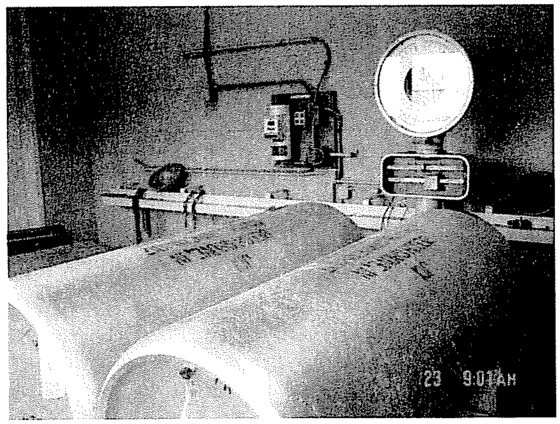
US Motor – 150 hp, 890 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Backwash Pumping Station*

General Information:



Equip Name:	Chlorine Scales
Tag ID:	Storage
Service:	Chlorine Storage
Make:	N/A
Model:	N/A
Capacity:	4000 lbs each
No of Units:	2
Installation Date:	N/A
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Room for 2 tanks on each scale. Also, room for 3 tanks off of scales.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

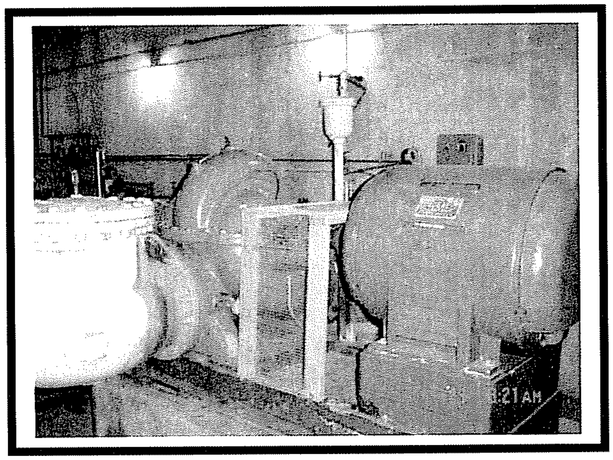
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Backwash Pumping Station*

General Information:



Equip Name:	Backwash Pump
Tag ID:	MPTP-BCKW2
Service:	Filter Backwash Pump
Make:	Worthington
Model:	16LA1
Capacity:	9000 gpm @ 45 ft
No of Units:	1 (2 Total)
Installation Date:	1961
Major Rehab Date:	2000

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Inlet Valve -- 24" Keystone manual butterfly valve

Discharge Valves – 16" check valve, 16" Pratt manual butterfly valve

Heavy to moderate corrosion on pumps, bases, connections, piping, valves.

Operational History (Note any operational data available):

The two pumps can pump 9000 gpm separately, but only 12000 gpm together. Both need to operate to backwash a filter.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

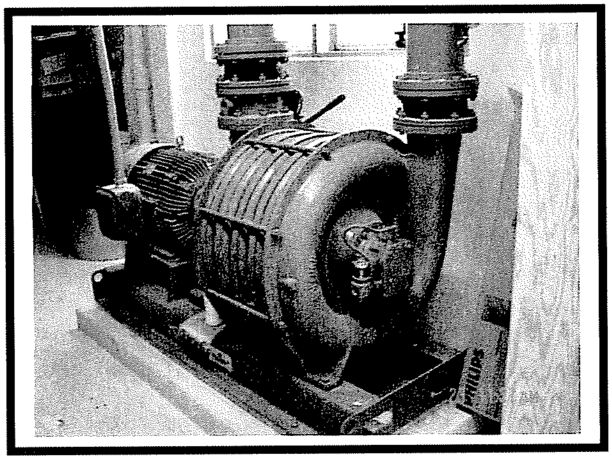
Ideal Electric Motor – 125 hp, 878 rpm, 440 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Filter Building*

General Information:



Equip Name:	Filter Blower
Tag ID:	MPTP BLOWER
Service:	Air Scour
Make:	Hoffman
Model:	74105A7
Load:	25 psig 1790
No of Units:	1
Installation Date:	1996
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

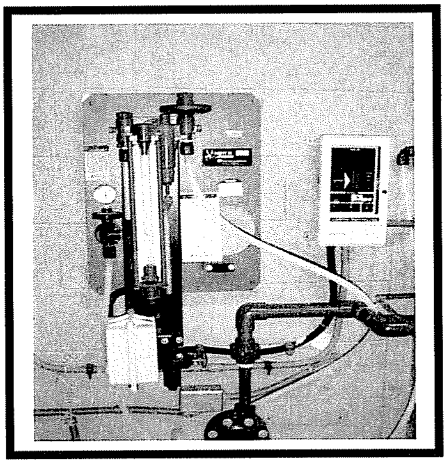
Notes:

Reliance Electric Motor – 100 hp, 3565 rpm, 460 volt

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Chlorine Room*

General Information:



Equip Name:	Chlorine Feeder
Tag ID:	CF MP CL1
Service:	Pre-Cl
Make:	Wallace & Tiernan
Model:	V-Notch
Capacity:	~300 ppd
No of Units:	1 (2 Total)
Installation Date:	1992
Major Rehab Date:	2001

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Equipped with 500 ppd rotometer.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

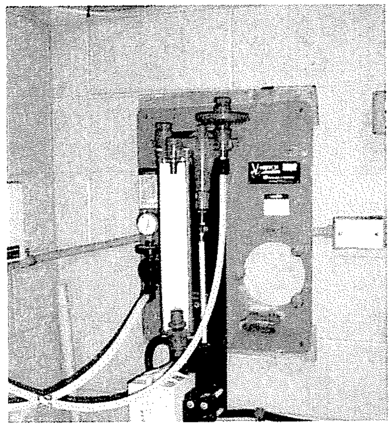
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Chlorine Room*

General Information:



Equip Name:	Chlorine Feeder
Tag ID:	CF MP CL2
Service:	Post-Cl
Make:	Wallace & Tiernan
Model:	V-Notch
Capacity:	~400 ppd
No of Units:	1 (2 Total)
Installation Date:	1992
Major Rehab Date:	2001

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Equipped with 500 ppd rotometer.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

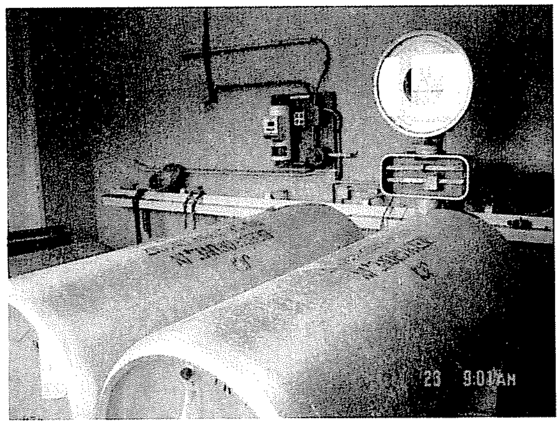
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Chlorine Storage*

General Information:



Equip Name:	Chlorine Scales
Tag ID:	Storage
Service:	Chlorine Storage
Make:	N/A
Model:	N/A
Capacity:	4000 lbs each
No of Units:	2
Installation Date:	N/A
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Room for 2 tanks on each scale. Also, room for 3 tanks off of scales.

Operational History (Note any operational data available):

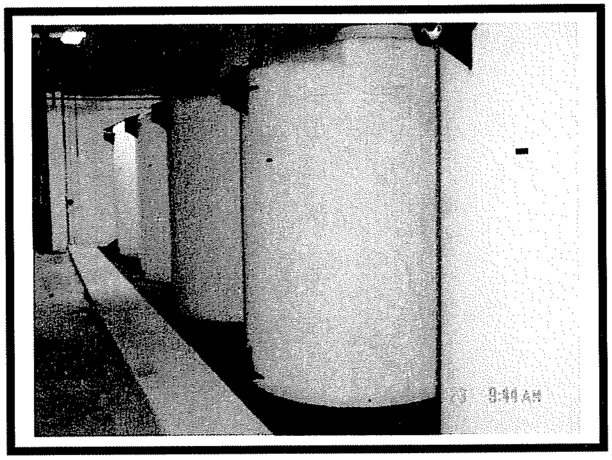
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program — *Facility: MPTP Chemical Building*

General Information:



Equip Name: Sodium Hypochlorite Storage Tanks

Tag ID: TANK HYPO MP1 (2-5)

Service: Storage Tanks

Make:

Model:

Capacity: ~1,100 gal

No of Units: 5

Installation Date: 2003

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Not in service at time of the site investigation. District staff indicated that system should be operational by November, 2003.

Spare Parts Available: ☐ Yes ☐ No

Overall Condition:	☒ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

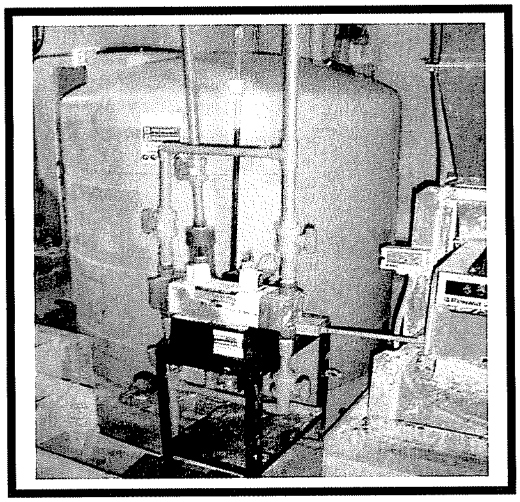
Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Metering Pump
Tag ID:	CP MP FERRIC1
Service:	Metering Pump
Make:	Wallace & Tiernan
Model:	Series 44
Capacity:	~2000 mL/ min
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion evident from past leaks or spills on pipe connections, pump, and floor.

Metering Pump appeared to be an old unit, rehabilitated and placed in service here.

Operational History (Note any operational data available):

Four old LMI Milton Roy Metering pumps from old feed system are still in area not in use.

Capacity - 25 gpd, 30 psig.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

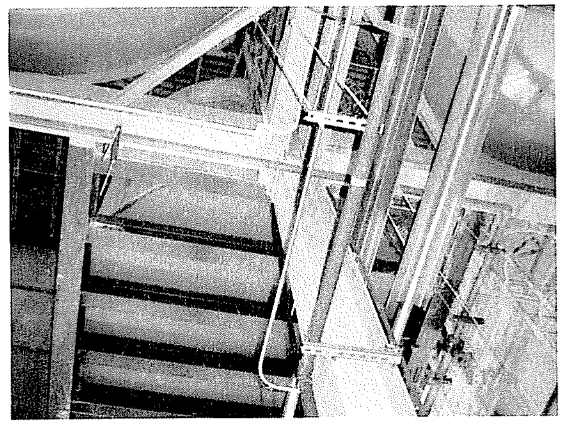
Reliance Electric Motor – 0.5 hp, 1750 rpm, 90 volts.

Reviewed By: Adam Westermann Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Storage Tank
Tag ID:	TANK FERRIC MP1
Service:	Storage Tank
Make:	
Model:	
Capacity:	~6,000 gal
No of Units:	1
Installation Date:	1961
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Elevated, no containment. Noted rusting at the bottom of the tank.

Operational History (Note any operational data available):

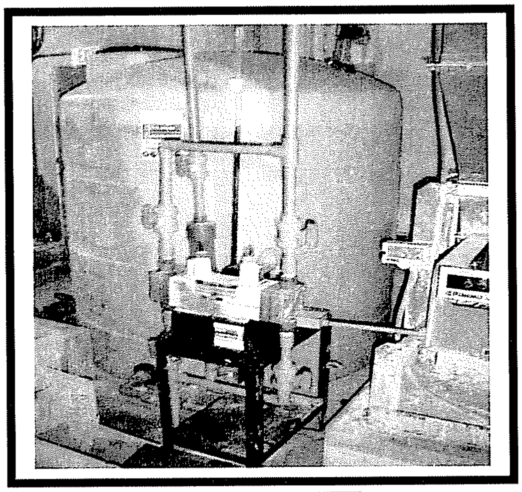
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Day Tank
Tag ID:	TANK FERRIC MP2
Service:	Day Tank
Make:	
Model:	
Capacity:	~1000 gal
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Old Day tank is sitting in bigger tank for containment propped up on wood blocks still in area, not in use.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

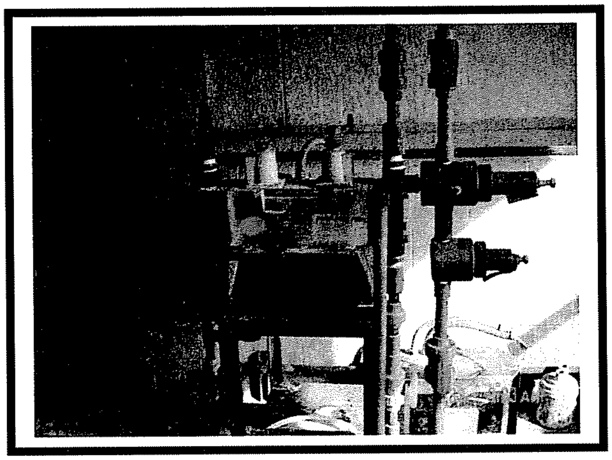
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Coagulant Metering Pump
Tag ID:	CP MP COAG1
Service:	Polyaluminum Chloride
Make:	Wallace & Tiernan
Model:	Series 44 – 125 M9P
Capacity:	~2000 mL/min
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible Corrosion where past spills or leaks have occurred.

Metering Pump appeared to be an old unit, rehabilitated and placed in service here.

Operational History (Note any operational data available):

Typical Dosage – Appox. 6-8 mg/L

Four old LMI Milton Roy Metering Pumps still in area, 108 gpd @ 50 psig. Not in use.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reliance Electric Motor – Data Unknown

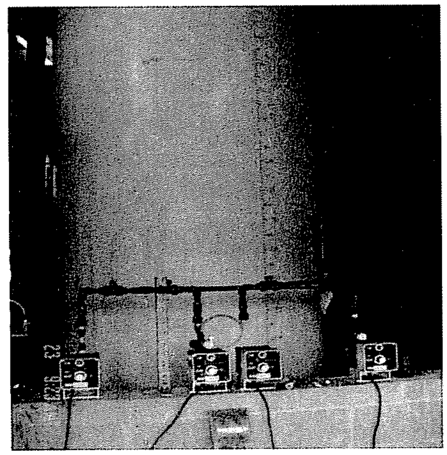
Currently using product from "Kemiron-Atlantic", Savanah GA

Product Spec - 2 mg/m3 (as Al), 8-24% as aluminum oxide, 20-83 basicity, 1.15-1.40 SG

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Chemical Building*

General Information:



Equip Name: Coagulant Storage Tank

Tag ID: TANK COAG MP1

Service: Polyaluminum Chloride

Make:

Model:

Capacity: 2,000 gal

No of Units: 1

Installation Date: 1994

Major Rehab Date:

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible Corrosion where past spills or leaks have occurred.

Inadequate Storage Capacity. Currently paying for full loads but can only handle about half to 2/3 of a load. Additional cost.

Operational History (Note any operational data available):

Four old LMI Milton Roy Metering Pumps still in area, 108 gpd @ 50 psig. Not in use.

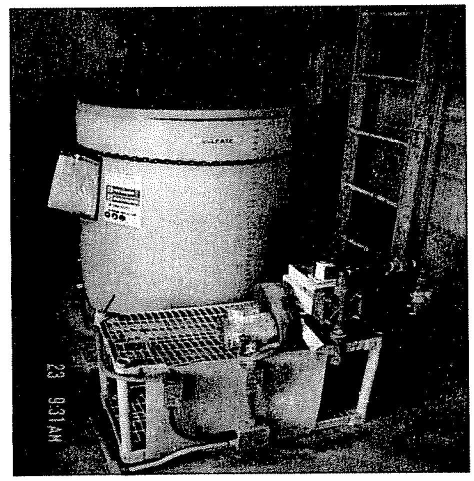
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program — *Facility: MPTP Chemical Building*

General Information:



Equip Name: Copper Sulfate Metering Pump

Tag ID: CP MP COPPER1

Service: Metering Pump

Make: Wallace & Tiernan

Model: Series 44-118

Capacity: ~500 mL/min

No of Units: 1

Installation Date: 1999

Major Rehab Date: 2003

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[x] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No containment, sitting on plastic shelves.

Moderate corrosion on piping, pump.

The metering pump appears to be an old unit, rehabilitated, and placed in service here.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Dayton Electric Motors – 0.25 hp, 1725 rpm

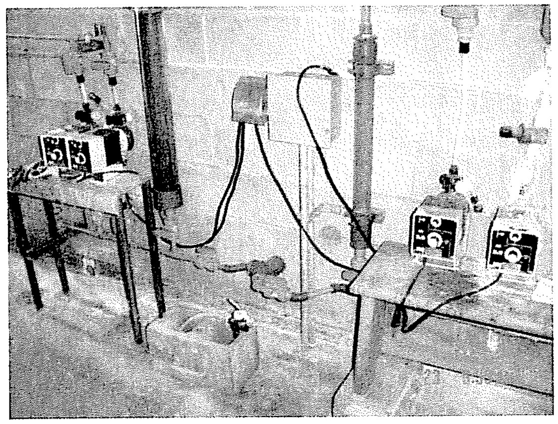
Also, 200 gal storage/mixing tank (TANK COPPER MP1) – Installed in 1999, Good Condition.

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Caustic Soda Metering Pumps
Tag ID:	CP MP CAUSTIC1 (2, 3, 4)
Service:	Metering Pumps
Make:	LMI Milton Roy
Model:	C731-26
Capacity:	9.0 gph (1) 8.0 gph (2-4), 60 psig
No of Units:	4
Installation Date:	
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No Containment for pumps. Sitting on wooden benches.
Noted connections on piping are leaking (minor)

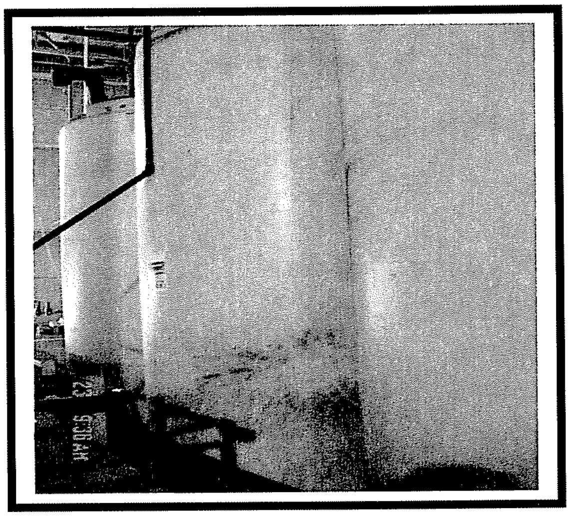
Operational History (Note any operational data available):

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:
Electric Motors – N/A

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Chemical Building*



General Information:

Equip Name:	Caustic Soda Storage Tanks
Tag ID:	TANK CAUSTIC MP1 (2, 3)
Service:	Storage Tanks
Make:	
Model:	
Capacity:	~2,000 gal
No of Units:	3
Installation Date:	1999
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

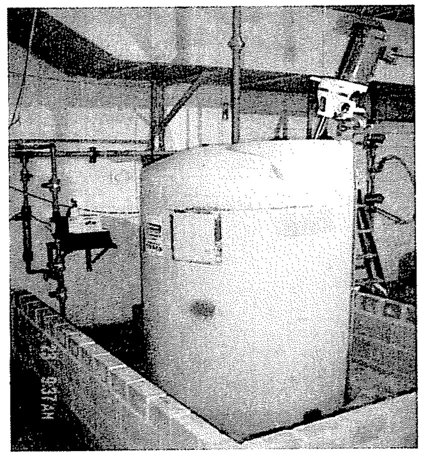
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Chemical Building*

General Information:



Equip Name:	Carbon Metering Pump
Tag ID:	CP MP CARBON1
Service:	Metering Pump
Make:	Wallace & Tiernan
Model:	214-M1P
Capacity:	~200 mL/min
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Has not been put in service at the time of the site investigation.

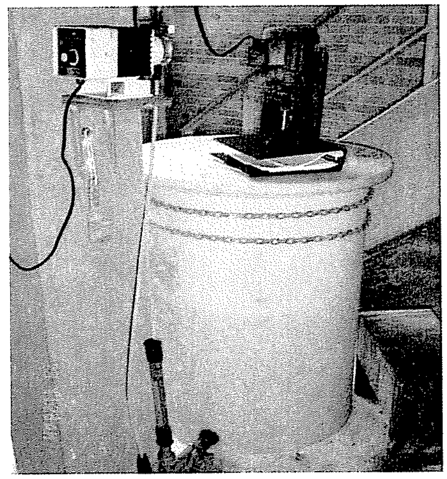
Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Magmetek Electric Motor – 0.25 hp, 1750 rpm, 90 volts.
Also, 500 gallon mixing tank (TANK CARBON MP1) – Installed in 2003, Excellent Condition

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Filter Building*

General Information:



Equip Name:	Corrosion Inhibitor Metering Pump
Tag ID:	CP MP K-5 1
Service:	Metering Pump
Make:	LMI Milton Roy
Model:	B911-91FS
Capacity:	1.60 gph, 150 psig
No of Units:	1
Installation Date:	1994
Major Rehab Date:	2003

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No containment for pump or for tank.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

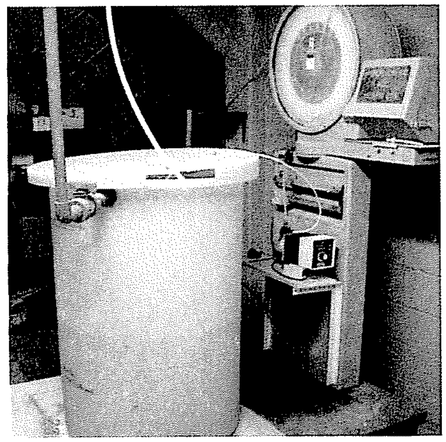
Notes:
Electric Motors – N/A
Also, 100 gallon mixing/storage tank (TANK MP K-5 1) – Installed in 1994, Good Condition.

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Filter Building*

General Information:



Equip Name:	Fluoride Metering Pump
Tag ID:	CP MP HFS 1
Service:	Metering Pump
Make:	LMI Milton Roy
Model:	B911-91FS
Capacity:	1.60 gph, 150 psig
No of Units:	1
Installation Date:	1961
Major Rehab Date:	2003

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No containment for pump or for tank.

Operational History (Note any operational data available):

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Electric Motors – N/A

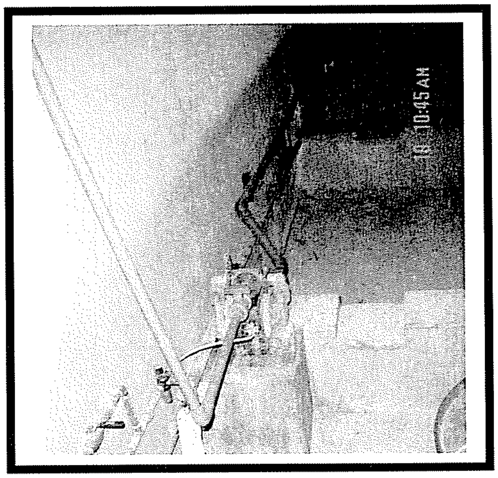
Also, 100 gallon day tank (TANK HFS MP 2) – Installed in 2003, Good Condition.

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program — *Facility: MPTP Filter Building*

General Information:

Equip Name:	Fluoride Transfer Pump
Tag ID:	CP MP HFS TRAN1
Service:	Transfer Pump
Make:	ARO
Model:	N/A
Capacity:	N/A
No of Units:	1
Installation Date:	1998
Major Rehab Date:	



Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No Containment for pump. Very difficult to access.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

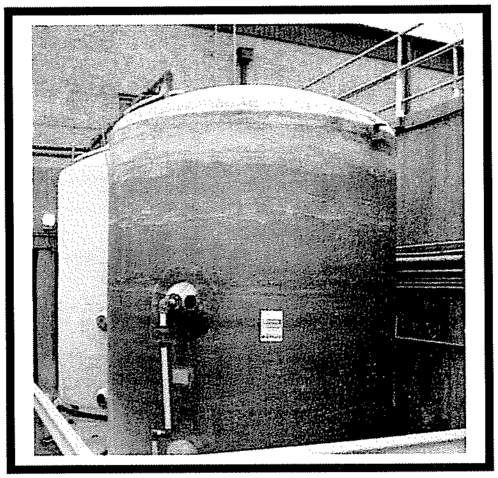
Notes:
Electric Motor – N/A

Reviewed By: Adam Westermann — Date: 9/19/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP*

General Information:



Equip Name:	Fluoride Storage Tank
Tag ID:	TANK HFS MP 1
Service:	Storage Tank
Make:	Air Plastics
Model:	
Capacity:	6,457 gal
No of Units:	1
Installation Date:	1989
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

No Containment for tank. Located outside.

Operational History (Note any operational data available):

Spare Parts Available: [ ] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

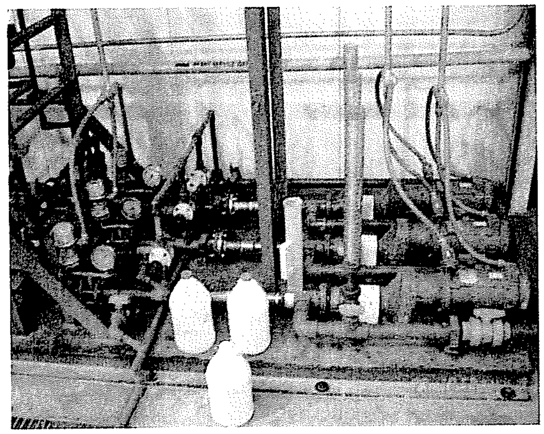
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program

Facility: MPTP Actiflo Building

General Information:



Equip Name:	Polymer Metering Pumps
Tag ID:	CP MP POLY1 (2, 3)
Service:	Metering Pumps
Make:	SEW – Eurodrive - Moyno
Model:	RX 611 P56
Capacity:	190 gph
No of Units:	3
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor corrosion on pipe connections.

Operational History (Note any operational data available):

Dry polymer will soon be switched to liquid polymer. Only 2 feed pumps will then be needed.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

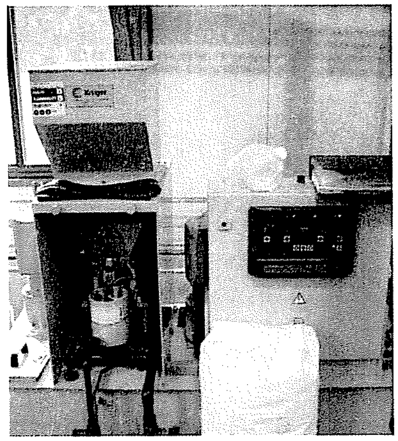
Notes:

Warner Electric Motor – 0.75 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Actiflo Building*

General Information:



Equip Name:	Polymer Feeder
Tag ID:	TANK POLY MP1
Service:	Feeder/Tank
Make:	Pro Minent
Model:	AT-400/96-SANSI
Capacity:	100 gph
No of Units:	1
Installation Date:	1999
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

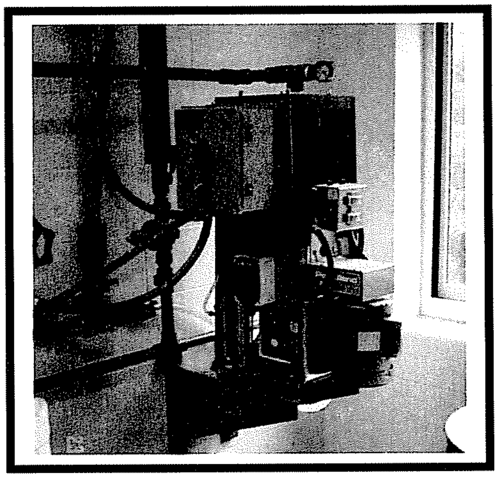
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Sludge Building*

General Information:



Equip Name:	Sludge Polymer Pump
Tag ID:	SLUDGE POLY MP1
Service:	Polymer Metering Pump
Make:	LMI Milton Roy
Model:	CP31-20PB
Capacity:	9 gph, 60 psig
No of Units:	1
Installation Date:	1997
Major Rehab Date:	

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☒ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Stranco "Polyblend" polymer feed system. Model – PB600/PB1000

Operational History (Note any operational data available):

Minimal use due to problems in the Sludge Building.

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☒ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

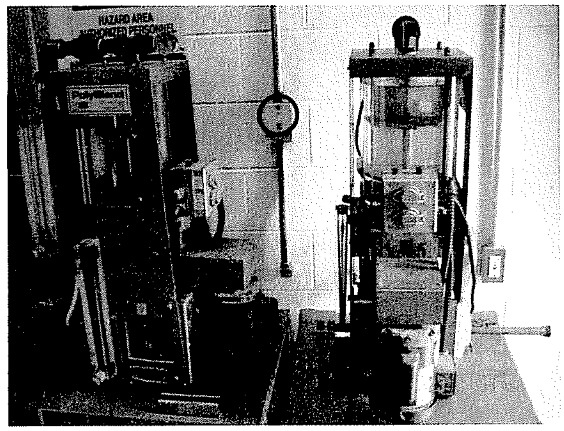
Notes:

Baldor Motor – 0.33 hp, 1725 rpm, 115-208/230 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Sludge Building*

General Information:



Equip Name: Sludge Polymer Pumps
Tag ID:
Service: Spare Units
Make: LMI Milton Roy
Model: BP31-76PB
Capacity: 108 gpd, 50 psig
No of Units: 2
Installation Date:
Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Stranco "Polyblend" polymer feed system. Model – PB600/PB1000

Operational History (Note any operational data available):
Spare Units

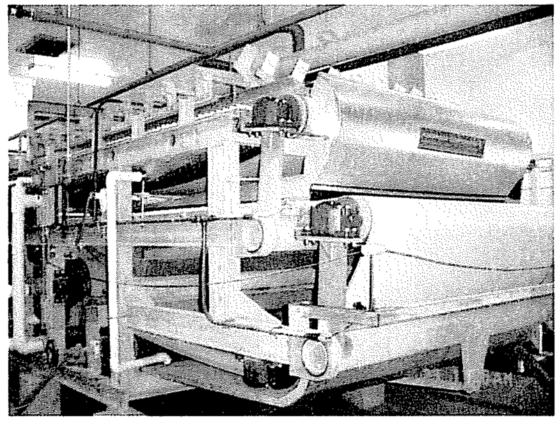
Spare Parts Available:	☐ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:
Baldor Motor – 0.33 hp, 1725 rpm, 115-208/230 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program *Facility: MPTP Sludge Building*

General Information:



Equip Name:	Sludge Belt Press
Tag ID:	SLUDGE PRESS 4
Service:	
Make:	Ashbrook
Model:	"Klampress" (2 meter)
Capacity:	N/A
No of Units:	1
Installation Date:	1997
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minimal use due to problems in the Sludge Building.

Is a "top of the line" model.

Operational History (Note any operational data available):

Inlet Consistency – N/A

Hydraulic Loading Rate – N/A

Spare Parts Available: [ ] Yes [ ] No

Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

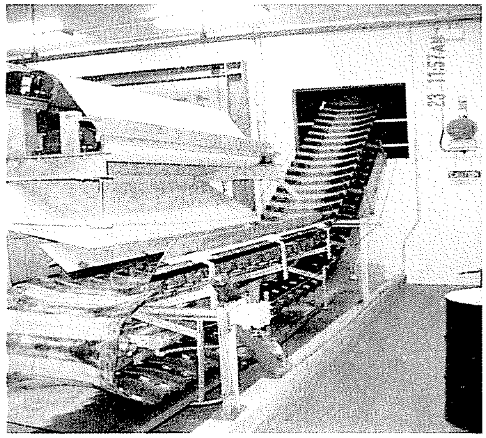
Motor data – N/A

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP Sludge Building*

General Information:



Equip Name:	Sludge Press Conveyor
Tag ID:	SLUDGE CONV 4
Service:	Conveyor
Make:	
Model:	
Capacity:	
No of Units:	1
Installation Date:	1997
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

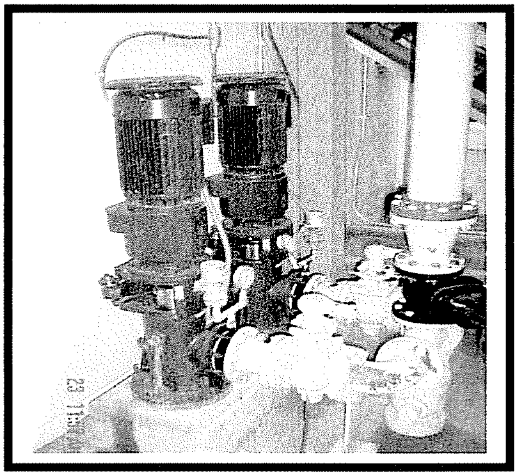
Notes:

Reviewed By: Adam Westermann — Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Sludge Building*

General Information:



Equip Name: Sludge Pumps

Tag ID: SLUDGE MP PUMP1 (2)

Service: Vertical Turbine Pumps

Make: Seepex

Model: Size 70

Capacity: 40-250 gpm

No of Units: 2

Installation Date: 1997

Major Rehab Date:

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Vertical turbine type pumps created problems pumping sludge from the Sludge Holding Basin. Inappropriate application for these type of pumps.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[x] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

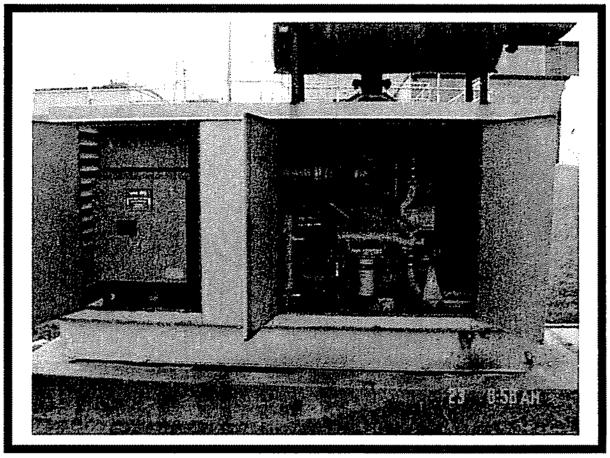
Notes:
SEW – Eurodrive Motor – 10.7 hp, 1740 rpm, 460 volt

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program — *Facility: MPTP*

General Information:



Equip Name:	Engine Generator
Tag ID:	MPTP-GEN
Service:	
Make:	Caterpillar
Model:	
Capacity:	3013 KVA, 250 KW
No of Units:	1
Installation Date:	1986
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Can power filter building, backwash pumping station, chemical building, raw water ps, but not Actiflo system.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

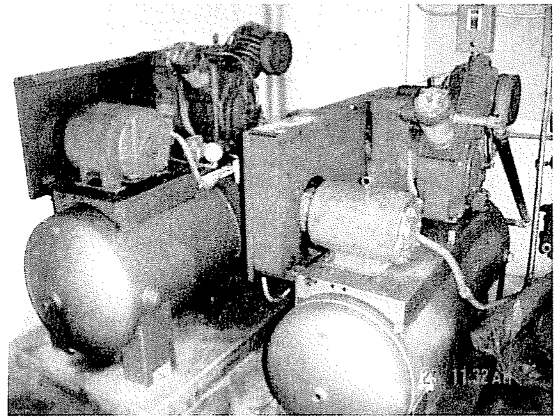
Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Filter Building*

General Information:



Equip Name:	Compressors
Tag ID:	MPTP COMPRESS1 (2)
Service:	Air
Make:	Ingersoll-Rand
Model:	
Load:	
No of Units:	2
Installation Date:	1961
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):
One tank is cracked, not in use. Still use the compressor though.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

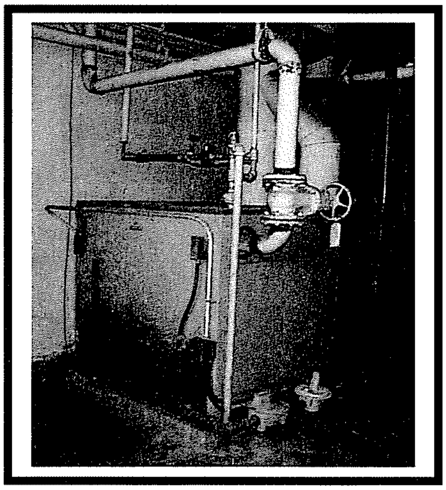
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/23/2003

Northern Kentucky Water District

Asset Management Program *Facility: MPTP*

General Information:



Equip Name: Boiler

Tag ID:

Service:

Make:

Model:

Load:

No of Units: 1

Installation Date: 1961

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Unreliable.

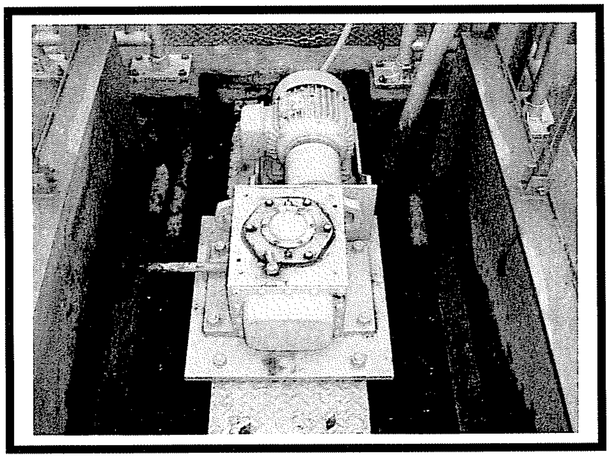
Spare Parts Available: ☐ Yes ☐ No

Overall Condition:	☐ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann Date: 7/23/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP*



General Information:

Equip Name:	Rapid Mixer
Tag ID:	RAPID MIX TM
Service:	
Make:	Lightnin
Model:	N/A
Ratio:	N/A
No of Units:	1
Installation Date:	1953
Replace Inst Date:	1989

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on base plates, supports, and bolts.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

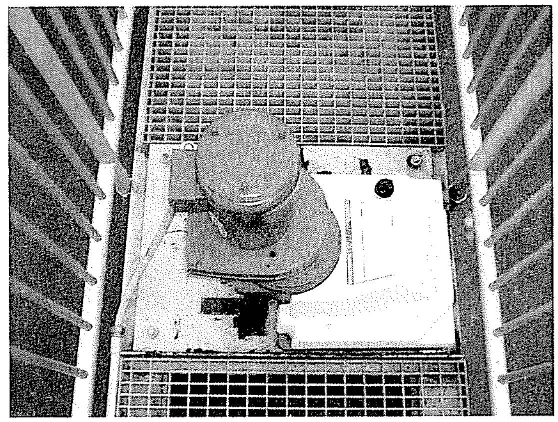
Siemens Motor – 3 hp, 1730 rpm

Dimensions – 4'-6" x 4'-6" x 6'-0" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP*

General Information:



Equip Name:	Flocculators
Tag ID:	TMTP-FLOC-N1 (2-4) (S1-S4)
Service:	Vertical Turbine Flocs.
Make:	Lightnin
Model:	Series 10, LFD4501CMX
Ratio:	87.5:1
No of Units:	8 (1 in each cell)
Installation Date:	1953 (N) 1960 (S)
Replace Inst Date:	2003

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Light corrosion on base plates.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

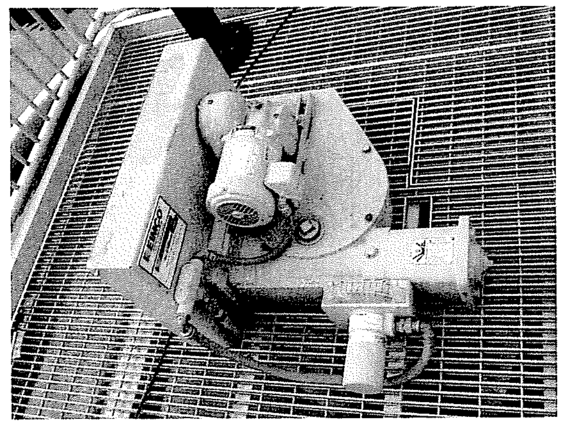
Notes:
Baldor Motor – 1 hp, 1725 rpm, 460 volt
Dimensions – Cell 1 - 14'-0" x 18'-7" x 17'-2" (depth) Cell 2 - 14'-0" x 11'-9" x 16'-10" (depth)
Cell 3 - 14'-0" x 13'-9" x 16'-6" (depth) Cell 4 - 14'-0" x 16'-7" x 16'-2" (depth)

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP

General Information:



Equip Name:	Clarifiers (North and South)
Tag ID:	TMTP-RAKE-N (S)
Service:	Rakes
Make:	Eimco
Model:	C30HT
Ratio:	57.0:1
No of Units:	2
Installation Date:	1953 (N) 1960 (S)
Replace Inst Date:	1997

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Light corrosion on bolts, paint peeling.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

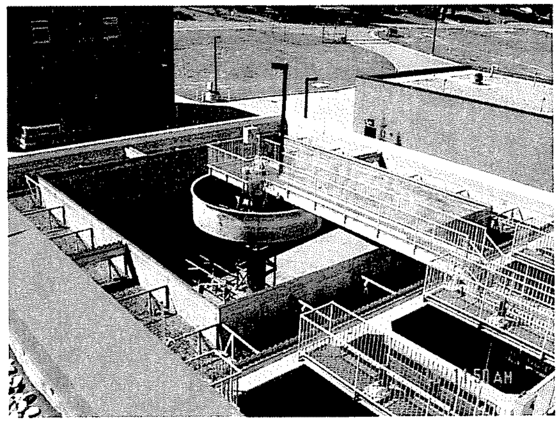
Notes:
US Electric Motor – 5 hp, 1745 rpm, 460 volt
NKWD ID No. – 4636

Reviewed By: Adam Westermann/Doug Elder   Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program *Facility: TMTP*

General Information:



Equip Name:	South Basin Tube Settlers
Tag ID:	TMTP Tubes S
Service:	Tube Settlers
Make:	N/A
Material:	N/A
Capacity:	2' depth
No of Units:	1
Installation Date:	1997
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes appear to be in good shape.

Operational History (Note any operational data available):

Showing signs of deterioration. Brittle when taken out of service for cleaning

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

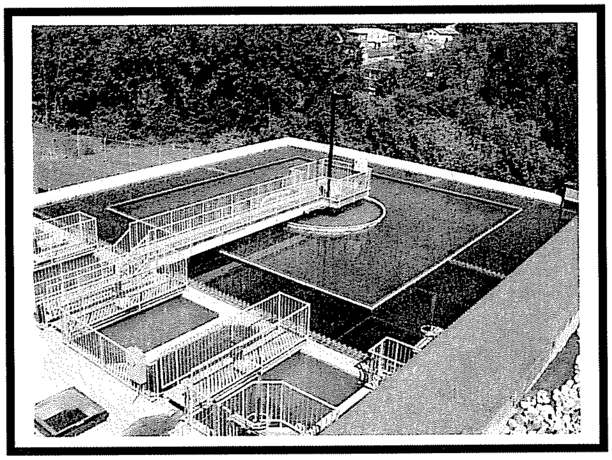
Notes:

Surface Area - ~ 1,750 sq. ft.

Reviewed By: Adam Westermann Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP*

General Information:



Equip Name:	North Basin Tube Settlers
Tag ID:	TMTP Tubes N
Service:	Tube Settlers
Make:	N/A
Material:	N/A
Capacity:	2' depth
No of Units:	1
Installation Date:	1997
Major Rehab Date:	

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Tubes appear to be in good shape.

Operational History (Note any operational data available):

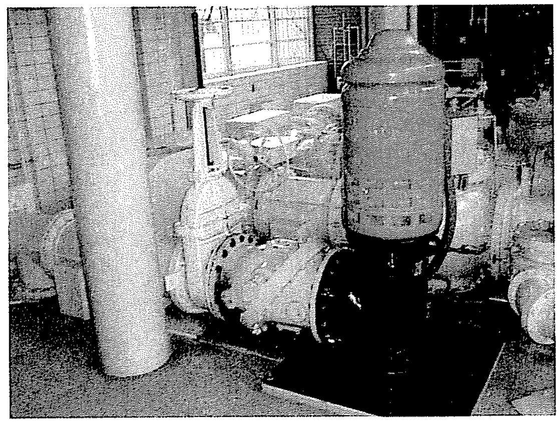
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Surface Area - ~1,750 sq ft

Reviewed By: Adam Westermann   Date: 9/19/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Filter Building*

General Information:



Equip Name:	Backwash Pump
Tag ID:	TMTP-BWPUMP
Service:	Filter Backwash Pump
Make:	Cascade Pump
Model:	Size 12MFCA
Capacity:	4,500 gpm
No of Units:	1
Installation Date:	2003
Major Rehab Date:	2003

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Light corrosion on check valve on discharge of pump.

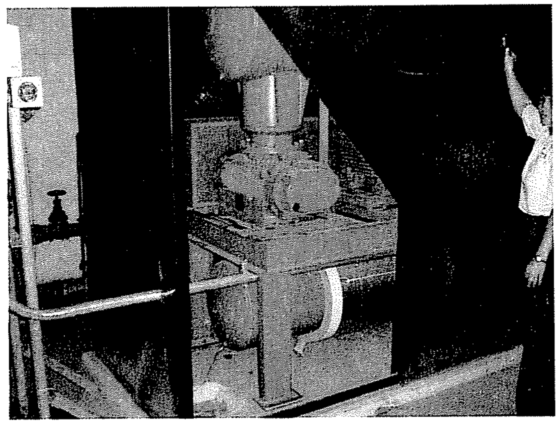
Operational History (Note any operational data available):
Discharge Valves – Chapman 16" check valve, 16" manual gate valve
Filters are typically backwashed from the Distribution System

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Fairbanks Morse Motor -- 75 hp, 1755 rpm, 416 Volts, 3 phase, 60 Hz

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP Filter Building*



General Information:

Equip Name:	Filter Blower
Tag ID:	TMTP BLOWER
Service:	Air Scour
Make:	United Blower Inc.
Model:	4513-DVOF/W
Load:	6.0
No of Units:	1
Installation Date:	2000
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

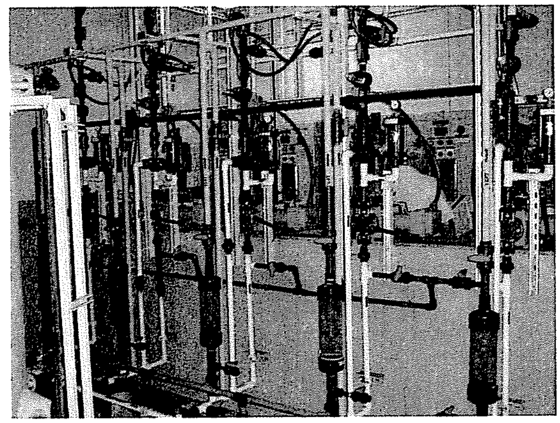
Notes:

Reviewed By: Adam Westermann/Doug Elder — Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program — *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Sodium Hypochlorite Metering Pumps
Tag ID:	CP TM HYPO1 (4, 5)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	22.5 gph
No of Units:	3 (5 total)
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion is evident on pumps, piping, any exposed metal in area.

Operational History (Note any operational data available):

Pump No. 1 feeds to Raw or is a Spare, Pump No. 4 feeds the clearwell, Pump No. 5 is a spare.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

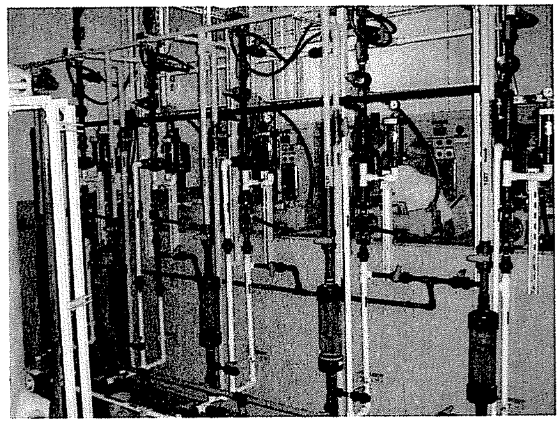
Reliance Electric Motor – 0.75 hp, 1750 rpm, 90 volts

Pumps 1, 4, and 5 are the same. Pump 5 is closest to the door.

Reviewed By: Adam Westermann/Doug Elder — Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Sodium Hypochlorite Metering Pump
Tag ID:	CP TM HYPO2 (3)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	5 gph
No of Units:	2 (5 total)
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion is evident on pumps, piping, any exposed metal in area.

Operational History (Note any operational data available):

Pump No. 2 feeds to the North Clarifier Influent. Pump No. 3 feeds to the South Clarifier Influent.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

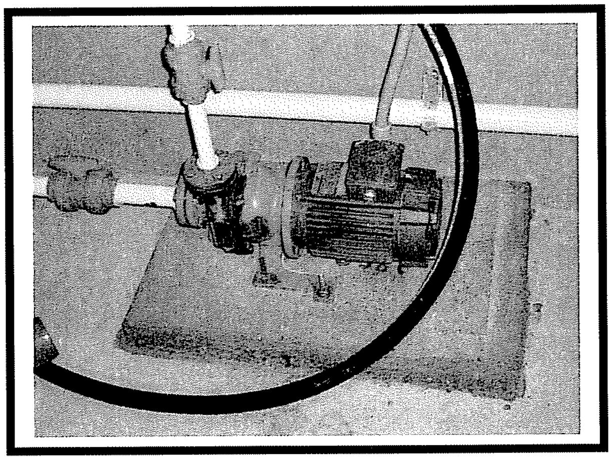
Reliance Electric Motor – 0.75 hp, 1750 rpm, 90 volts

Pumps 2 and 3 are the same.

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Sodium Hypochlorite Transfer Pump
Tag ID:	CP TM HYPO TR1
Service:	Transfer Pump
Make:	Goulds Pump
Model:	3298
Capacity:	40 gpm
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible corrosion on pipe connections and pump.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Location of original transfer pumps was too high, relocated to lower elevation. Only 1 pump currently installed.

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Chemical Building

General Information:

Equip Name:	Sodium Hypochlorite Storage Tank
Tag ID:	TANK HYPO TM1
Service:	Storage Tank
Make:	Air Plastics
Model:	
Capacity:	15,535 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4582

Reviewed By: Adam Westermann/Doug Elder   Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:

Equip Name:	Sodium Hypochlorite Day Tank
Tag ID:	TANK HYPO TM2
Service:	Day Tank
Make:	Air Plastics
Model:	
Capacity:	658 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

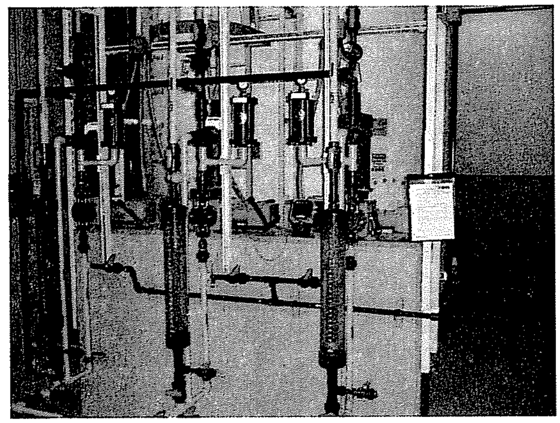
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4583

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Coagulant Metering Pumps
Tag ID:	CP TM HYPER1 (2, 3)
Service:	Hyperion Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	90 gph
No of Units:	3
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible Corrosion were past spills have occurred.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

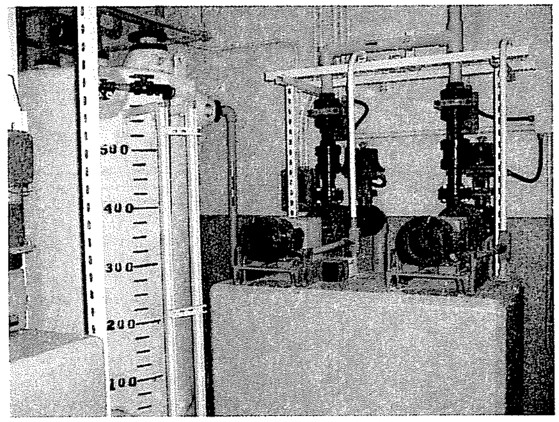
Notes:

Reliance Electric Motor – 1.0 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name: Coagulant Transfer Pumps

Tag ID: CP TM HYP TRAN1 (2)

Service: Hyperion Transfer Pumps

Make: Goulds Pump

Model: 3200 Size 2-3-6

Capacity: 50 gpm

No of Units: 2

Installation Date: 1998

Major Rehab Date:

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available: ☒ Yes ☐ No

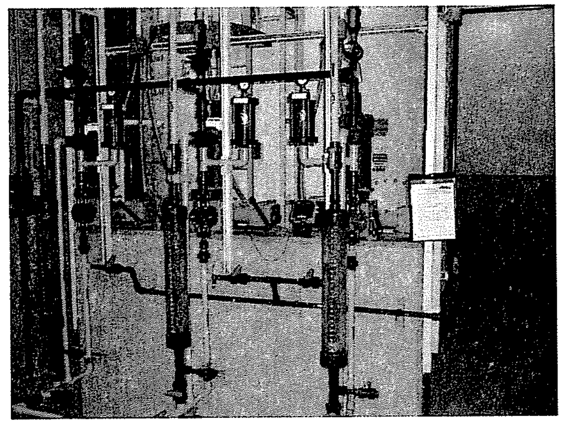
Overall Condition:	☒ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:
General Electric Motor – 1.5 hp, 1725 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Coagulant Storage Tank
Tag ID:	TANK HYPERION TM 1
Service:	Hyperion Storage Tank
Make:	Air Plastics
Model:	
Capacity:	13,535 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4587

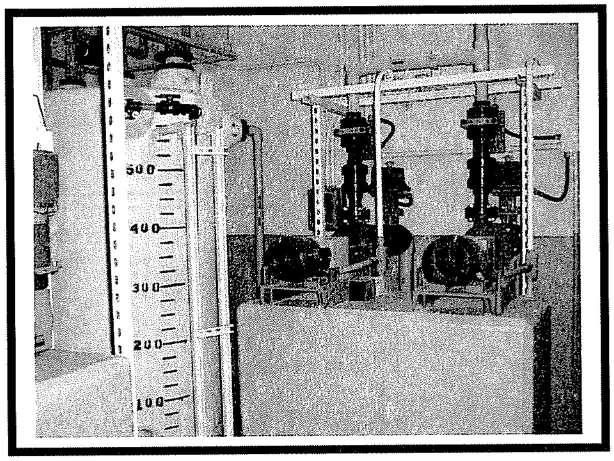
Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name:	Coagulant Day Tank
Tag ID:	TANK HYPERION TM 2
Service:	Hyperion Day Tank
Make:	Air Plastics
Model:	
Capacity:	658 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

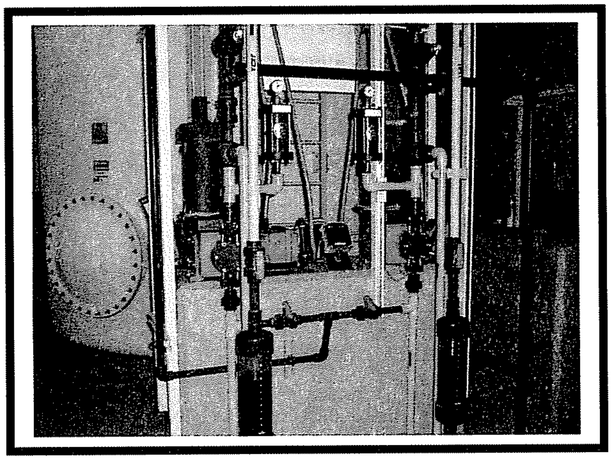
Notes:
NKWD ID No. - 4586

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Metering Pumps
Tag ID:	CP TM FERRIC1 (2)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	22.5 gph
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Past leaks visible on pumps and valves.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

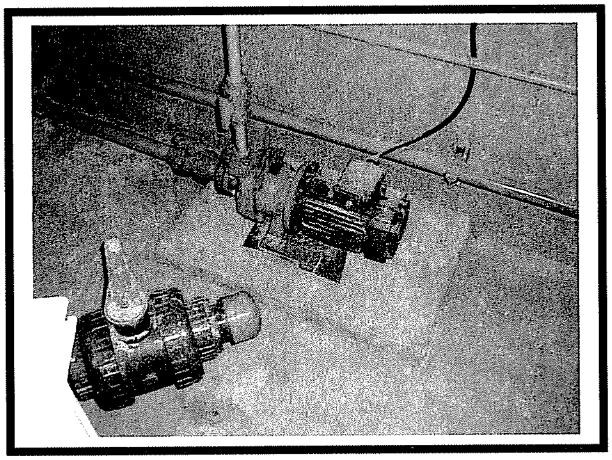
Notes:

Reliance Electric Motor – 0.75 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Ferric Sulfate Transfer Pump
Tag ID:	CP TM FER TRAN1
Service:	Transfer Pumps
Make:	Goulds Pump
Model:	Size 1x1.60-S
Capacity:	45 gpm
No of Units:	1 (currently)
Installation Date:	1998
Major Rehab Date:	

Reliability:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☒ Poor
Corrosion:	☐ Extensive	☒ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Leaks visible on pumps and valves. Traces of spills are evident. Only one transfer pumps replaced two that were originally constructed on platform.

Operational History (Note any operational data available):

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:
Reliance Electric Motor – 1.5 hp, 3450 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program *Facility: TMTP Chemical Building*

General Information:

Equip Name: Ferric Sulfate Storage Tank

Tag ID: TANK FERRIC TM1

Service: Storage Tank

Make: Air Plastics

Model:

Capacity: 13,535 gal

No of Units: 1

Installation Date: 1998

Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available: [ ] Yes [ ] No

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4584

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP Chemical Building*

General Information:

Equip Name: Ferric Sulfate Day Tank
Tag ID: TANK FERRIC TM2
Service: Day Tank
Make: Air Plastics
Model:
Capacity: 658 gal
No of Units: 1
Installation Date: 1998
Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

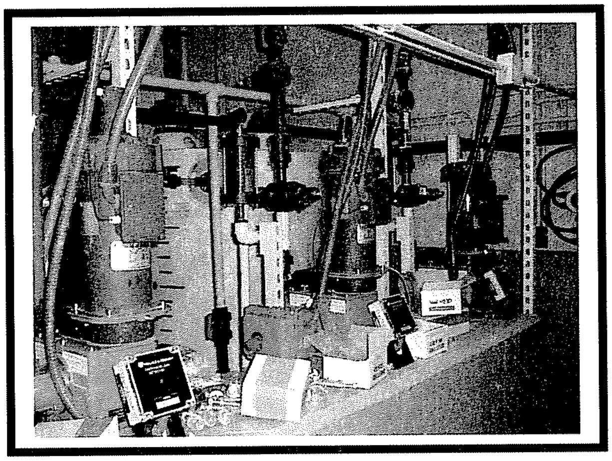
Spare Parts Available:		[ ] Yes	[ ] No
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4585

Reviewed By: Adam Westermann/Doug Elder   Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Caustic Soda Metering Pumps
Tag ID:	CP TM CAUSTIC1 (2, 3)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	22.5 gph
No of Units:	3
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion from leak and spill around connections and on the floor.

Operational History (Note any operational data available):

Caustic Soda is currently being replaced with Sulfuric Acid.

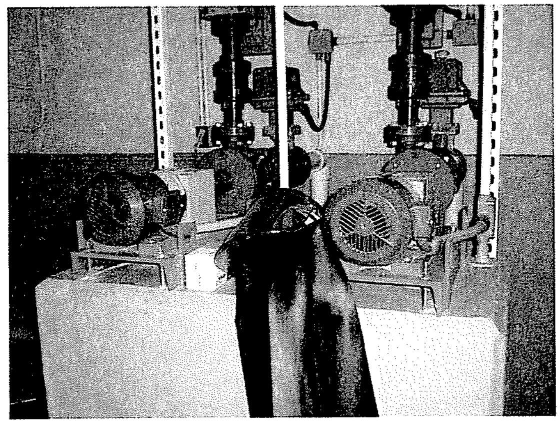
Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reliance Electric Motors – 0.75 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder   Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*



General Information:

Equip Name:	Caustic Soda Transfer Pumps
Tag ID:	CP TM CAU TRAN1 (2)
Service:	Transfer Pumps
Make:	Goulds Pump
Model:	3200 Size 2-3-6
Capacity:	50 gpm
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Corrosion from leak and spill around connections and on the floor.

Operational History (Note any operational data available):

Caustic Soda is currently being replaced with Sulfuric Acid.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

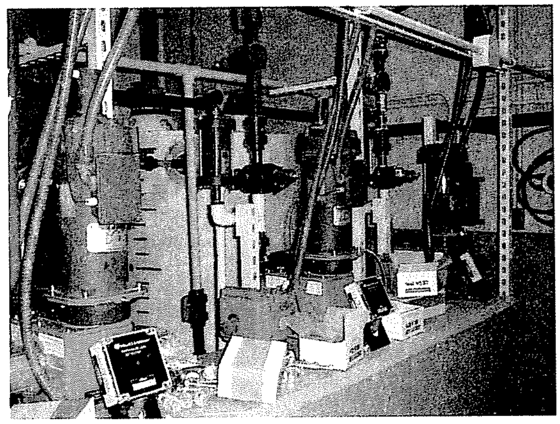
General Electric Motor -- 1.5 hp, 1725 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name: Caustic Soda Day Tank

Tag ID: TANK CAUSTIC TM2

Service: Day Tank

Make:

Model:

Capacity: ~ 500 gal

No of Units: 1

Installation Date: 1998

Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Caustic Soda is currently being replaced with Sulfuric Acid.

Spare Parts Available: [ ] Yes [ ] No

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

NKWD ID No. - 4591

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP Chemical Building*

General Information:

Equip Name:	Caustic Soda Storage Tank
Tag ID:	TANK CAUSTIC TM1
Service:	Storage Tank
Make:	
Model:	
Capacity:	~ 13,500 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Caustic Soda is currently being replaced with Sulfuric Acid.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

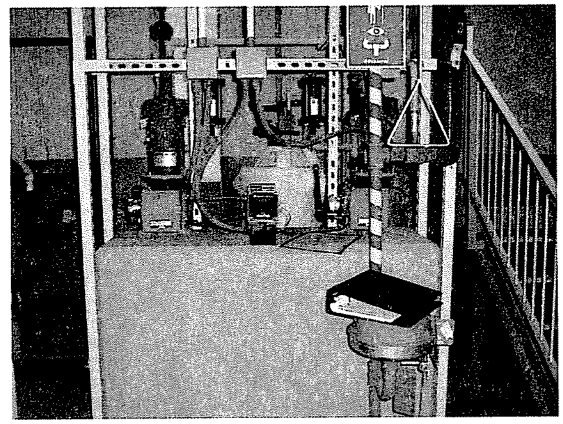
NKWD ID No. - 4590

Reviewed By: Adam Westermann/Doug Elder — Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program — *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Hydrofluorosilicic Acid Metering Pumps
Tag ID:	CP TM HFS1 (2)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	6 gph
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor Corrosion on pumps and piping.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

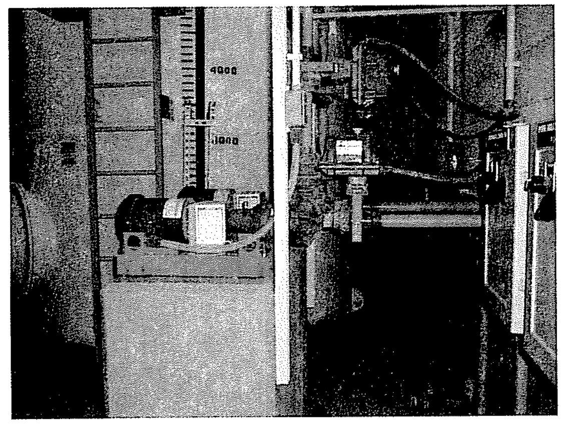
Notes:

Reliance Electric Motor -- 0.5 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder — Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Hydrofluorosilicic Acid Transfer Pumps
Tag ID:	CP TM HFS TRAN1 (2)
Service:	Transfer Pumps
Make:	Goulds Pump
Model:	3200
Capacity:	12 gpm
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Minor Corrosion on pump base. Visible places where spills or leaks have occurred.

Operational History (Note any operational data available):

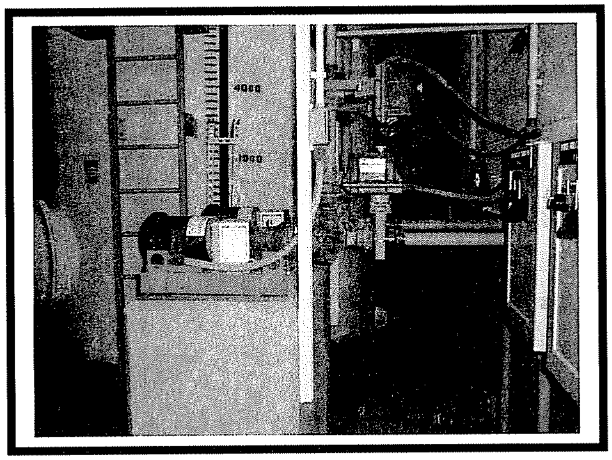
Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
General Electric Motor – 1.5 hp, 1725 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Hydrofluorosilicic Acid Storage Tank
Tag ID:	TANK HFS TM1
Service:	Storage Tank
Make:	Airplastics Inc.
Model:	
Capacity:	7,049 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

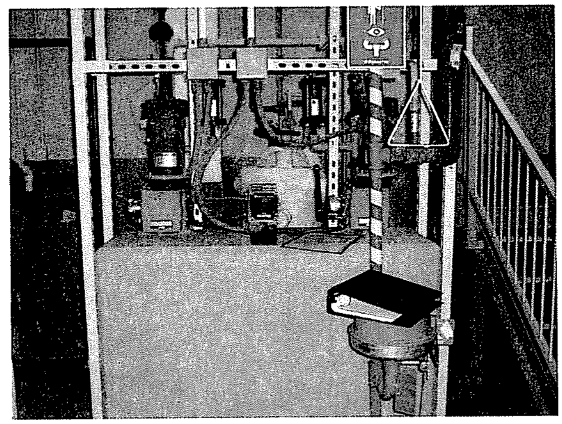
Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name:	Hydrofluorosilicic Acid Day Tank
Tag ID:	TANK HFS TM2
Service:	Day Tank
Make:	Airplastics Inc.
Model:	
Capacity:	90 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

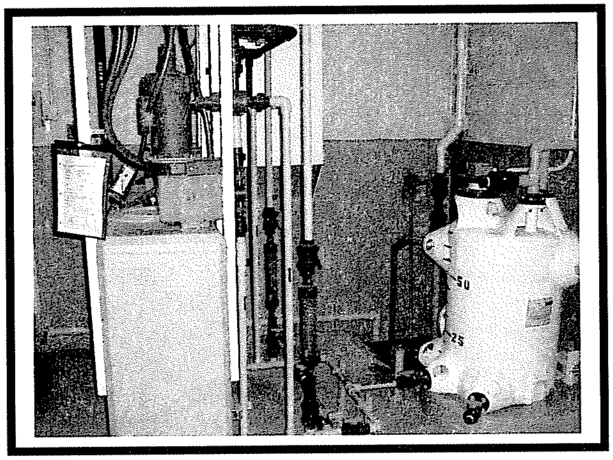
Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder   Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*



General Information:

Equip Name: Corrosion Inhibitor Metering Pumps

Tag ID: CP TM K-5 1 (2)

Service: Metering Pumps

Make: Wallace & Tiernan

Model: Encore 700

Capacity: 2.5 gph

No of Units: 2

Installation Date: 1998

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible evidence of where spills have occurred. Some standing chemical on floor around concrete pump support.

Operational History (Note any operational data available):

Spare Parts Available: [X] Yes [ ] No

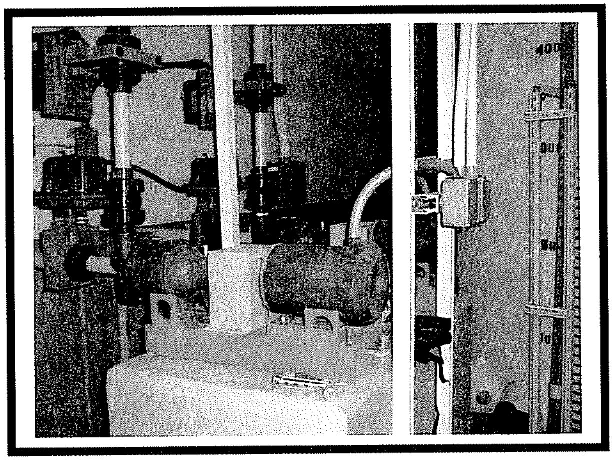
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Reliance Electric Motor – 0.5 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Corrosion Inhibitor Transfer Pumps
Tag ID:	CP TM K-5 TRAN1 (2)
Service:	Transfer Pumps
Make:	Goulds Pump
Model:	3200
Capacity:	6 gpm
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Visible evidence of where spills have occurred.

Leakage around pipe connections for Pump No. 1. (Closer to Storage Tank)

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

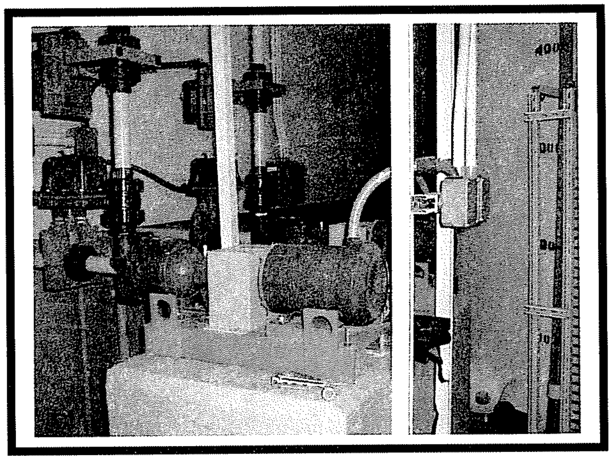
General Electric Motor – 1.5 hp, 1725 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program — *Facility: TMTP Chemical Building*

General Information:



Equip Name: Corrosion Inhibitor Storage Tank

Tag ID: TANK K-5 TM1

Service: Storage Tank

Make: Air Plastics

Model:

Capacity: 7,049 gal

No of Units: 1

Installation Date: 1998

Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

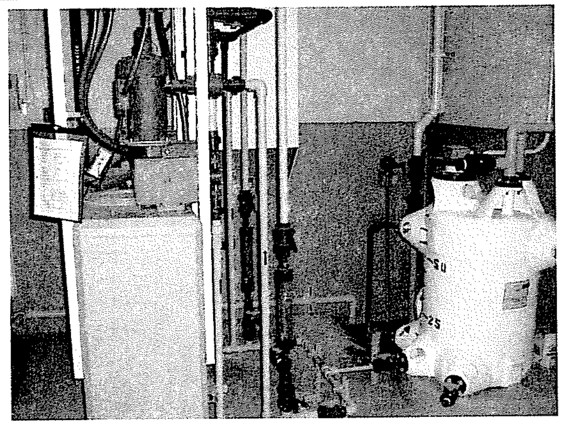
Notes:

NKWD ID No. - 4588

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Corrosion Inhibitor Day Tank
Tag ID:	TANK K-5 TM2
Service:	Day Tank
Make:	Air Plastics
Model:	
Capacity:	70 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

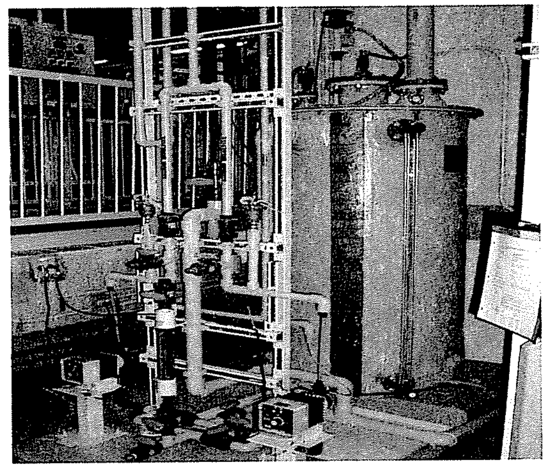
Notes:
NKWD ID No. - 4589

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name:	Sodium Bisulfite Metering Pumps
Tag ID:	CP TM SB 1 (2)
Service:	Metering Pumps
Make:	Milton Roy
Model:	B731-468S1
Capacity:	4.5 gph at 50 psig
No of Units:	2
Installation Date:	2003
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

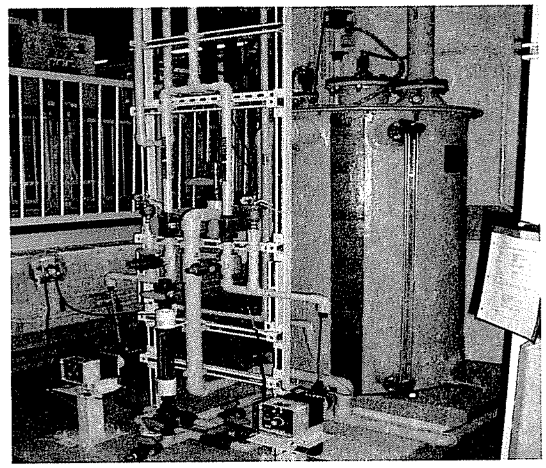
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name:	Sodium Bisulfite Storage Tank
Tag ID:	TANK SB TM1
Service:	Storage/Feed Tank
Make:	Augusta Fiberglass
Model:	
Capacity:	250 gal
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

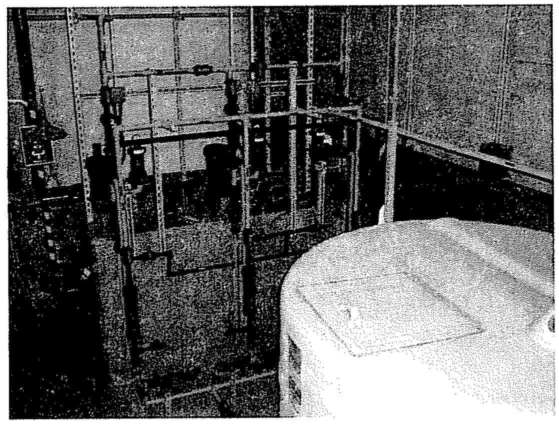
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name: Filter Aid Polymer Metering Pumps

Tag ID: CP TM F/A 1(2, 3)

Service: Metering Pumps

Make: Wallace & Tiernan

Model: Encore 700

Capacity: 12 gph

No of Units: 3

Installation Date: 1998

Major Rehab Date: ______

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Reliance Electric Motors – 0.5 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program — *Facility: TMTP Chemical Building*

General Information:

Equip Name:	Filter Aid Polymer Storage/ Mixing Tank
Tag ID:	TANK F/A TM1
Service:	Mixing/Storage Tank
Make:	Air Plastics
Model:	
Capacity:	863 gal
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

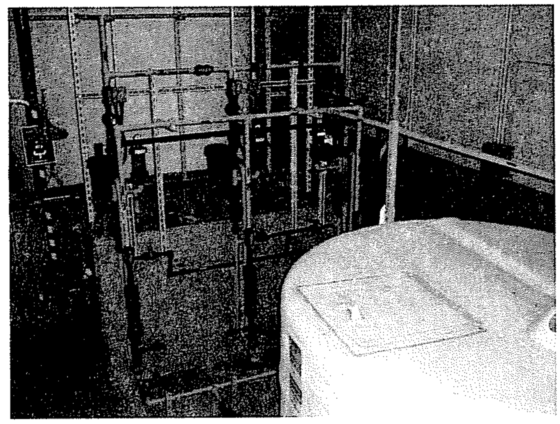
Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
NKWD ID No. - 4580

Reviewed By: Adam Westermann/Doug Elder — Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name: Filter Aid Polymer Day Tank

Tag ID: TANK F/A TM2

Service: Day Tank

Make: Air Plastics

Model:

Capacity: 863 gal

No of Units: 1

Installation Date: 1998

Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

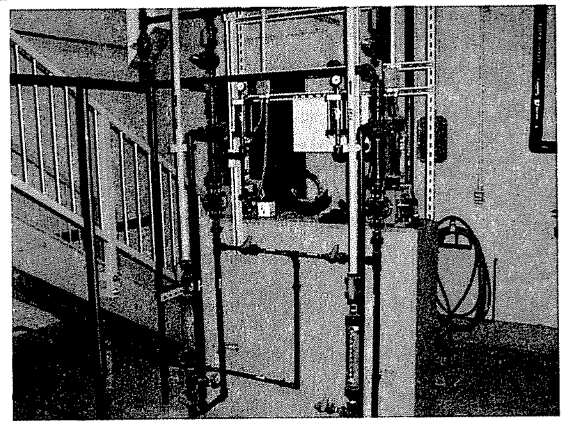
Notes:
NKWD ID No. - 4581

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Chemical Building

General Information:



Equip Name:	Copper Sulfate Metering Pumps
Tag ID:	CP TM COPPER1 (2)
Service:	Metering Pumps
Make:	Wallace & Tiernan
Model:	Encore 700
Capacity:	6 gph
No of Units:	2
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Also used to feed Carbon (PAC).

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

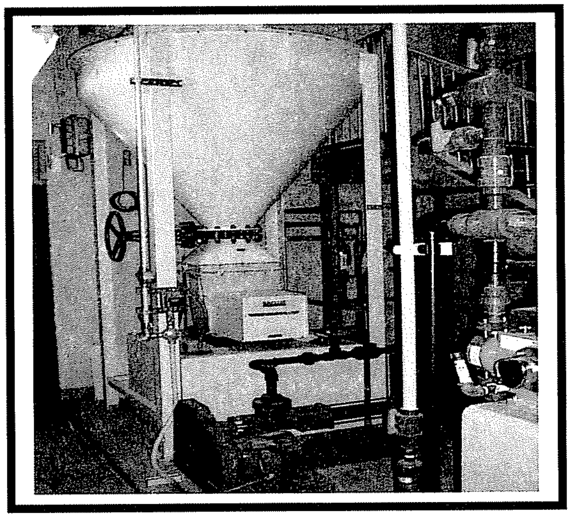
Notes:

Reliance Electric Motors – 0.5 hp, 1750 rpm, 90 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program — *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Copper Sulfate Feeder/Mixer
Tag ID:	CP TM COP FEED
Service:	Feeder/Hopper
Make:	Wallace & Tiernan
Model:	
Capacity:	Volumetric
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Also used to feed Carbon. (PAC)

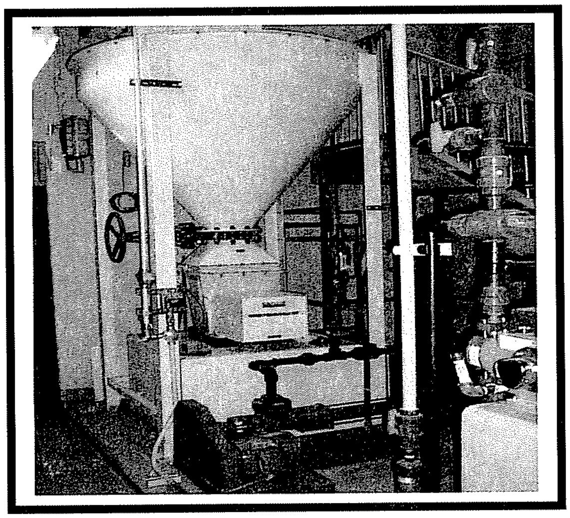
Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Chemical Building*

General Information:



Equip Name:	Powdered Activated Carbon Transfer Pump
Tag ID:	CP TM CARBON TR1
Service:	Transfer Pump
Make:	Netzsch
Model:	Type NM038SY
Capacity:	N/A
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

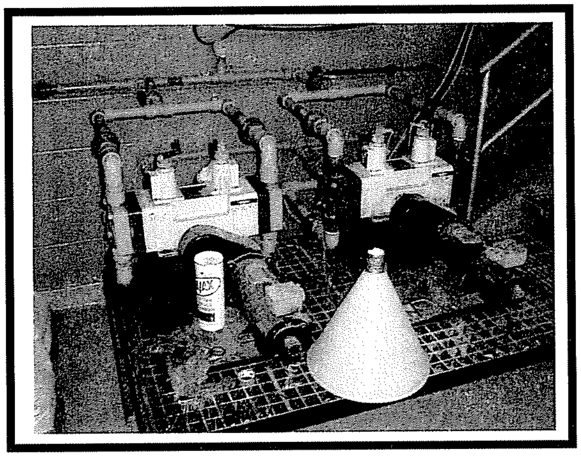
Notes:
US Electric Motor – 3 hp, 1765 rpm, 460 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program *Facility: TMTP Sludge Building*

General Information:



Equip Name: Sludge Polymer Pumps

Tag ID: SLUDGE POLY TM1 (2)

Service: Polymer Metering Pumps

Make: Wallace & Tiernan

Model: Series 44-125

Capacity: 208 gpm

No of Units: 2

Installation Date: 1989

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

A few minor places on pumps and connecting piping where spills or leaks have occurred.

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

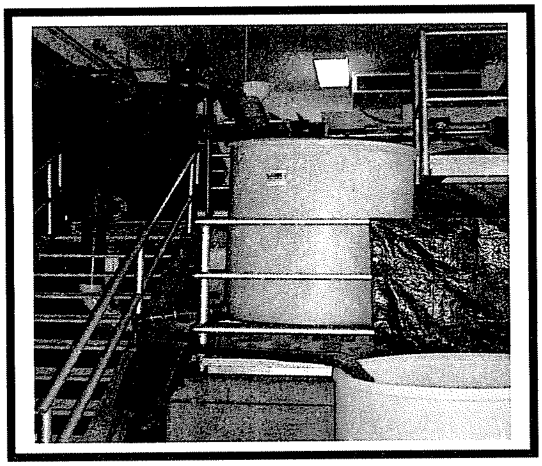
Notes:

Dart Motor – 0.5 hp, 1750 rpm, 90 Volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Sludge Building*

General Information:



Equip Name:	Sludge Polymer Tanks
Tag ID:	TANK SLUDGE POLY TM1 (2)
Service:	Mixing/Storage Tanks
Make:	
Model:	
Capacity:	200 gal
No of Units:	2
Installation Date:	1989
Major Rehab Date:	

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
No tops on tanks. One tank is used for overflow.

Operational History (Note any operational data available):

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP

General Information:

Equip Name:	Sludge Clarifier Pumps
Tag ID:	SLUDGE CLARI 1 (2)
Service:	Submersible Pumps
Make:	ABS
Model:	
Capacity:	400 gpm
No of Units:	2
Installation Date:	1989
Major Rehab Date:	

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Unknown condition. Pumps not pulled out of pit.

Operational History (Note any operational data available):

Pump settled sludge from clarifiers to the sludge holding tanks.

Spare Parts Available:	☐ Yes	☐ No	
Overall Condition:	☐ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

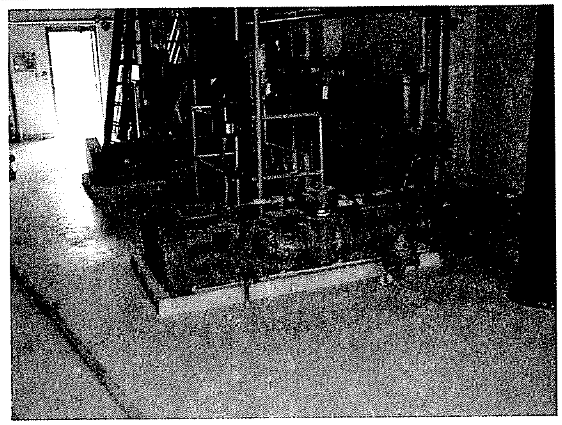
Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP Sludge Building

General Information:



Equip Name: Sludge Pumps
Tag ID: SLUDGE TM PUMP1 (2)
Service: Sludge Progressing Cavity
Make: Netzsch
Model: Type NE 80A
Capacity: N/A, Variable Speed
No of Units: 2
Installation Date: 1989
Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Moderate corrosion around bases of pumps, pumps, valves, and piping.

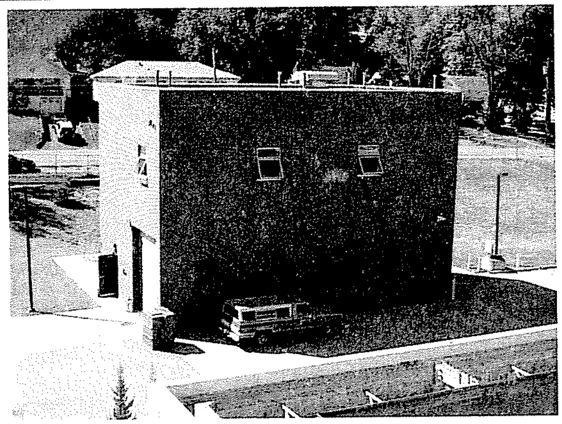
Operational History (Note any operational data available):
Inlet Valves – DeZurik manual plug valve

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
GE Motor – 10 hp, 1165 rpm, 416 Volts
Pumps 1 and 2 are the same. Pump 1 is to the West.

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Sludge Building*



General Information:

Equip Name: Sludge Backwash Pumps to Sewer

Tag ID: SLUDGE BACK1 (2)

Service: Backwash to Sewer

Make: ABS

Model:

Capacity: 700 gpm

No of Units: 2

Installation Date: 2001

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
Submersible Pumps. No visual inspection. Condition based upon District's comments, and expected condition based upon age.

Operational History (Note any operational data available):

Spare Parts Available:	☐ Yes	☐ No	
Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

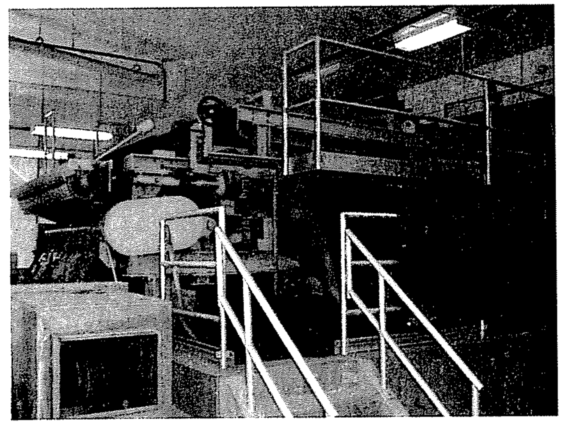
Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District

Asset Management Program

Facility: TMTP Sludge Building

General Information:



Equip Name: Sludge Belt Press

Tag ID: SLUDGE PRESS 3

Service:

Make: Andritz

Model: CPF 2.0 SMK (S8P)

Capacity: 2000 lbs/hr

No of Units: 1

Installation Date: 1989

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Running at time of site investigation.

Operational History (Note any operational data available):

Inlet Consistency – 2.0 – 8.0 % TSS ODS @ 3% FS

Min. Cake Solids – 35%

Min. Solids Capture – 95%

Spare Parts Available: [X] Yes [ ] No

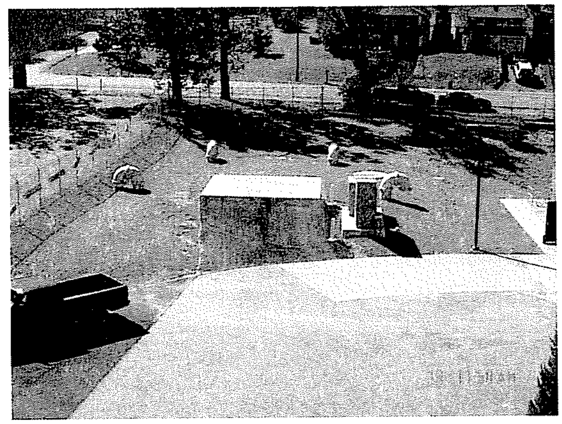
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: TMTP Filter to Waste Basin*

General Information:



Equip Name:	Filter to Waste Pumps
Tag ID:	TM FTW Pump 1 (2-4)
Service:	Submersible Pumps
Make:	Pumpex
Model:	K 103 F-CF3250
Capacity:	375 gpm @ 64 ft
No of Units:	4
Installation Date:	2003
Major Rehab Date:	

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Submersible Pumps. No visual inspection. Condition based upon District's comments and expected condition based upon age.

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No		
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory	
	[ ] Unsatisfactory		[ ] Inoperable	
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate	
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable	
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate	
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable	

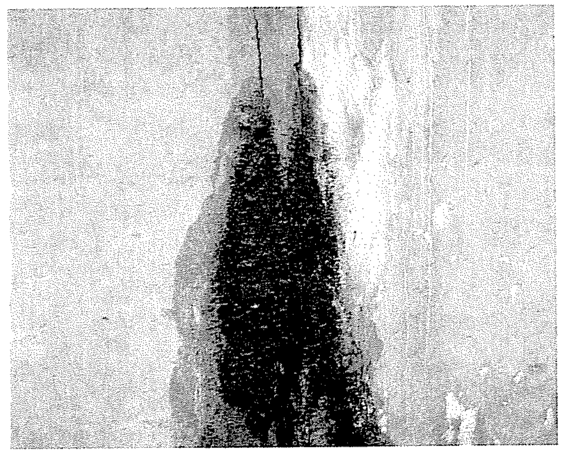
Notes:
Pumpex Motor – 15 hp, 1724 rpm, 3 phase, 60 Hz, 208 volts

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program

Facility: TMTP

General Information:



Equip Name: North and South Basins

Tag ID: TMTP-BASIN-N (S)

Service:

Make:

Model:

Capacity:

No of Units: 2

Installation Date: 1953 (N) 1960 (S)

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☐ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Major cracking at points in North Basin. Visible Leaks.
District staff indicated an investigation is currently underway on the structural integrity of the basins.

Operational History (Note any operational data available):

Spare Parts Available: ☐ Yes ☐ No

Overall Condition: ☐ Excellent ☐ Good ☐ Satisfactory ☒ Unsatisfactory ☐ Inoperable

Vulnerability: ☐ Fatal ☐ Severe ☐ Moderate ☐ Minor ☐ No Impact ☐ Unk/Not Applicable

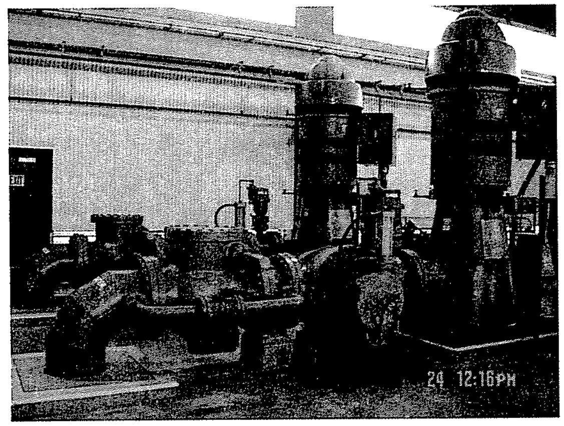
Safety Impact: ☐ Extreme ☐ Significant ☐ Moderate ☐ Minor ☐ No Impact ☐ Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Doug Elder Date: 7/9/2003

Northern Kentucky Water District
Asset Management Program *Facility: Ohio River Pumping Station No. 1*

General Information:



Equip Name: Pumps Nos. 1 - 6

Tag ID: ORPS-PUMP01 (2-6)

Service: Raw Water Booster

Make: Ingersoll Dresser (1-4, 6)

Model: 16QL21 (1-4, 6)

Capacity: 8400 gpm @ 430 ft

No of Units: 6

Installation Date: 1997 (1-4), 1999 (5), 1994 (6)

Major Rehab Date: N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
The pumps are in excellent condition, minor leaking of hydraulic fluid was noted from several of the discharge valves. Valves for Pump No. 2 were noted to have more fluid leaks than the others.

Operational History (Note any operational data available):
The pumps are approximately six years old, and have operated well since their installation. Operations staff indicated no problems.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

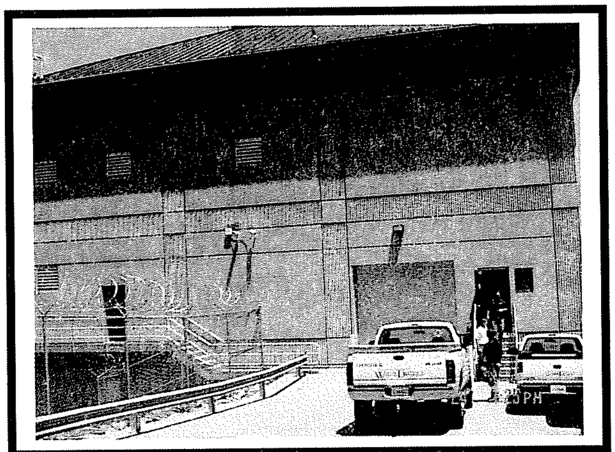
Notes:
Pump No 5 (Byron Jackson 23H00) was installed in 1999 and has operated well since its installation. Pump No. 6 (Ingersoll Dresser) was relocated from the old pumping station in 2000, and is no longer operational.

Reviewed By: Mark Wilson/Adam Westermann Date: 06/24/2003

Northern Kentucky Water District

Asset Management Program *Facility: Ohio River Pumping Station No. 1*

General Information:



Equip Name:	Building
Tag ID:	N/A
Service:	House Pumps and Equip
Make:	N/A
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	1997
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[X] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building houses six raw water pumping units, electrical MCC's and support equipment associated with the pumps. (See additional notes)

Operational History (Note any operational data available):

District Operations staff indicated no problems with the pump station since its completion in 1997.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Mark Wilson/Adam Westermann Date: 06/24/2003

Additional Visual Observation Notes

1. There are three traveling screens (FMC) each feeding a separate wetwell section. All were observed to be in good working order. There was minor corrosion noted on the base of the head unit of two of the units.
2. The screens are provided with a wash water system with automatic self cleaning strainers, all of which were noted to be in good working order.
3. A service air compressor system (Quincy) is located on the main pump room floor, and it was noted to be in good working order.
4. A single hydraulic power unit is provided for powering a number of gates and the pump discharge cone valves. The unit is in excellent condition and only minor accumulation of hydraulic fluid was noted on the pump skid.
5. The main pump room is equipped with a 10 Ton bridge crane with electric wire rope hoist. Both of which were observed to be in good working order.
6. Two 2 Ton monorails are provided, one with a chain pull hoist, and the second with an electric wire rope hoist. Both were observed to be in good working order. Minor corrosion was noted on the outdoor unit.
7. Ventilation of the main pump room is provided by four vaneaxial fans located on an upper mezzanine above the pump floor. Operations staff indicated that they operate well.
8. Electrical MCC equipment is located in a separate room adjacent to the pump room. The MCC room is ventilated by three wall mounted fans.
9. Heating of the main pump room is provided by 5 electric unit heaters, all of which were in good condition.
10. Lighting is a mixture of high bay metal halide and florescent. Lighting levels were noted to be good, and the fixtures were in excellent shape.
11. A potasium permanganate and sodium hypochlorite storage and feed area is located on a lower level adjacent to the pump room. The sodium hypochlorite storage and feed system has been transformed to a permanganate feed system and operations staff indicated that it works well. Heavy corrosion was noted around the metering pumps and the piping in the pump area, most likely due to minor leaks in the piping and pump connections.

Northern Kentucky Water District

Asset Management Program *Facility: Ohio River Pumping Station No. 2*

General Information:

Equip Name: Pumps

Tag ID: ORPS2-PUMP01 (2,3)

Service: Raw water booster

Make: Fairbanks Morse (3), N/A (1,2)

Model: N/A

Capacity: 6000 gpm (1, 2) 4000 gpm (3) @ 430 ft

No of Units: 3

Installation Date: 2001 (1), 2001 (2), 1999 (3)

Major Rehab Date: 2002 (3)

Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The pumps are in rough condition, pump No. 1's bearing are shot, and it is no longer used.

Pump No. 2 has had the bearings rebuilt and operates satisfactorily.

Capacities are based upon District's Staff knowledge as no nameplates are available.

Operational History (Note any operational data available):

Operational data was generally not available as the pumping station was formerly owned by the Newport Water District, and only minimal records and no nameplate data were available.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Access to the lower pump area for maintenance is dangerous do to limited lighting, safe egress, and excessive water leaking into the lower pump area.

Reviewed By: Mark Wilson/Adam Westermann Date: 06/26/2003

Northern Kentucky Water District

Asset Management Program *Facility: Ohio River Pumping Station No. 2*

General Information:

Equip Name: Building and Misc. Equip.

Tag ID: ORPS2

Service: House pumps and eqip.

Make: N/A

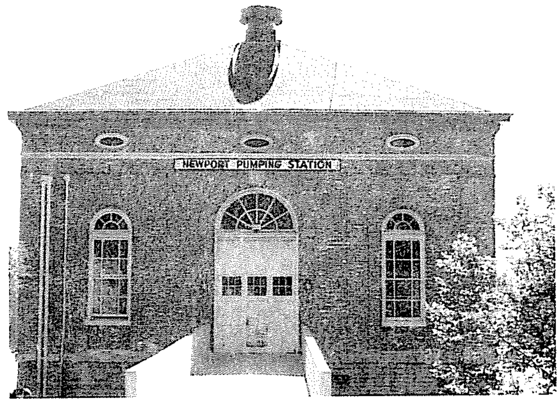
Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: 1872

Major Rehab Date: Various



Reliability:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Corrosion:	[X] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[X] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The pumping station building is a concrete and brick structure. The building is in very rough condition. Corrosion and deterioration of the concrete structure is extensive and may start to affect the ability to keep the pumping station in operation.

Operational History (Note any operational data available):

Limited information is available, but Operations staff indicated that the history of the pumping station has been to provide fixes to problems as they arose to maintain operation

Spare Parts Available:	[ ] Yes	[X] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Mark Wilson/Adam Westermann Date: 06/26/2003

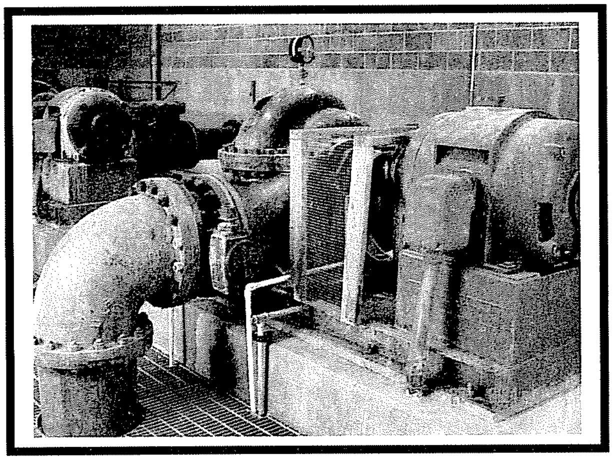
Additional Visual Observation Notes

1. The pumping station is constructed of concrete and brick. The lower pump room is constructed of cast-in-place concrete and shows many signs of excessive corrosion and deterioration.
2. The upper portion of the pumping station is brick and there are a number of areas where differential settlement of the building is evident due to the cracking and separation of the brickwork is evident.
3. The lower pump pit is accessed by an elevator or by a spiral staircase. The elevator is old and operation is sporadic. The spiral stairs are structurally sound, however they provide inadequate egress by current standards.
4. Lighting within the pumping station is a mixture of incandescent and metal halide. Lighting levels were adequate, with the exception of the lower pump area which had minimal lighting. Portable fixtures would be required to provide adequate lighting for maintenance activities.
5. A potasium permanganate system was added recently, and a secondary containment area is provided by a CMU wall around the pumps and storage tanks. The system is adequate, however storage of 55 gallon drums was noted outside the containment wall, leaving no secondary containment.
6. The pump heads are located on an upper mezzanine, which also houses the electrical MCC's and hydraulic power units. The mezzanine is in good condition, however maintenance access around equipment located on the mezzanine is poor.
7. A rough screen (chain link fence) is provided, and access to the screen area is through a single floor hatch. Access to the area is confined and ventilation and lighting is inadequate.
8. A single traveling screen is provided and appears to be in good working order.

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Raw Water Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	RES-PUMP01 (2,3)
Service:	Raw Water Booster
Make:	Worthington
Model:	12 LN17
Capacity:	5300 (1), 3675 gpm (2,3) @ 64 ft
No of Units:	3
Installation Date:	1961
Major Rehab Date:	Unk

Reliability:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[x] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[x] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[x] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and the associated piping and valves are operable, but in very rough condition. The pumps and the piping are heavily corroded. Pumps were noted to have excessive leakage at seals, etc. (See additional notes)

Operational History (Note any operational data available):

Operations staff did not have much information on the history of the pumping station as it was previously operated as part of the Newport Water System; however, they did note that the pumps were maintenance intensive when taken over by the District.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

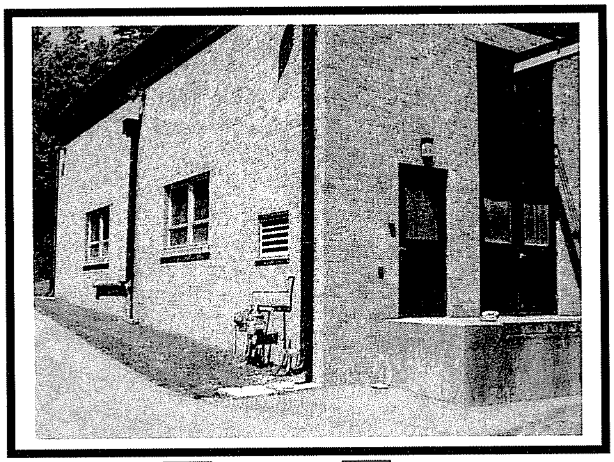
Additional Visual Observation Notes:

1. Corrosion of the pump bases, bearing races, and pump casings, etc. was excessive.
2. Piping and leakage at the check valves, and pump discharge valve shaft seals was noted to be excessive, and in several cases promoted corrosion on adjacent areas, including trench grating, pipe supports, etc.
3. Safety guards placed over the pump shafts are inadequate and space between the guard and the pump base/motor were large enough to allow for personal injury.

Northern Kentucky Water District

Asset Management Program *Facility: MPTP Raw Water Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	RES-PS
Service:	House Pumps & Equip
Make:	CMU/Brick
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	1961
Major Rehab Date:	Unk

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[X] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[X] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building is constructed of CMU blocks with brick facing. Floor is concrete with a depressed grating covered pipe trench for pump suction piping. (See additional notes)

Operational History (Note any operational data available):

Operations staff did not know much about the operating history of the facility due to the fact that it was part of the Newport Water System prior to being acquired by the District.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

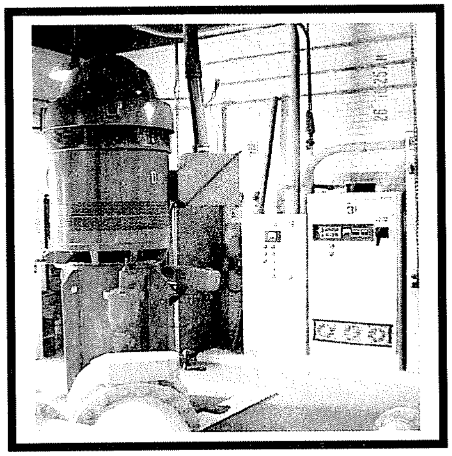
Additional Visual Observation Notes:

1. Leakage from pump and valve seals is extensive, resulting in large areas of wet floor. In several areas the grating covering the pipe trench has corroded to a point where the structural integrity may soon be compromised.
2. Corrosion of the pump baseplates is extensive, and may be beyond what is repairable.
3. The building structure shows signs of differential settlement. Cracking in the CMU walls was evident on the north east and south west walls.
4. Pipe supports for the pump discharge lines are cracked and (as observed on Pump No. 2 discharge) is in some cases has cracked away to a point where there is no actual support.
5. The building is equipped with a single 3-ton Robbins/Meyers monorail, which appeared to be in good shape.
6. Ventilation is provided through side windows on the south wall, and two gravity dampers in the roof. The room was noted to be warm, and very little air was moving through the facility.
7. Heating is provided by two gas fired unit heaters: one Janitrol which appeared to be non-operational, and a second Sterling, which was recently installed.
8. Electrical MCC panels were replaced within the past two to three years, including relocation of the main electrical service feeding the building. All of the gear was in good condition.

Northern Kentucky Water District

Asset Management Program — *Facility: Licking River Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	LRPS-PUMP1 (2, 3)
Service:	Raw Water Pumping
Make:	See Below
Model:	See Below
Capacity:	See Below
No of Units:	3
Installation Date:	1-1990,2-1971,3-1993
Major Rehab Date:	See Below

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The pumps appeared to be in good working condition. Minor corrosion was noted on the piping, valves, and pump bases, but was not significant enough to cause concern.

Operational History (Note any operational data available):

Operations staff indicated that the pumps operate well, and did not note any specific problems with the pumps. Subsequent comments from District staff indicated that Pump No. 3 operates the majority of the time because it is equipped with a VFD.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Pmp 1 – Fairbanks Morse 28HC, 6250 gpm @ 126 ft. Pmp 2 – Goulds 28", 6250 gpm @ 126 ft.
Pmp 3 – Peerless 24MA-2, 4900 gpm @ 133 ft.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

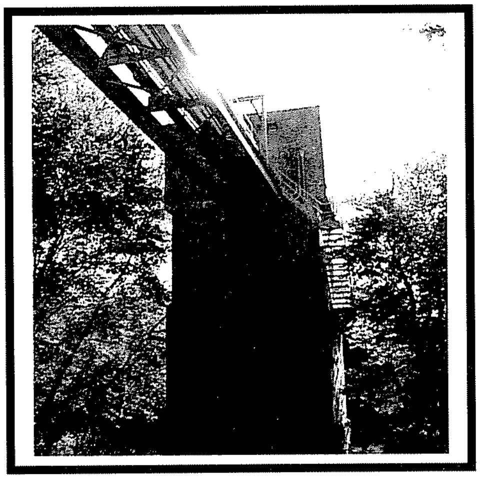
Additional Visual Observation Notes:

1. Pump number 2 was completely overhauled in 1995 and received new bearings and wear rings.
2. Pump number 3 was complete overhauled in 1994 by the factory, approximately 1 year after its installation. Pump number 3 was overhauled again in 1998.

Northern Kentucky Water District

Asset Management Program *Facility: Licking River Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	LRPS-PS
Service:	House Pumps & Equip
Make:	N/A
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	1971
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The building is constructed of concrete and brick and houses the pumps, MCC's, and a single influent screen. See additional notes.

Operational History (Note any operational data available):

Operations staff indicated that the pump station operates satisfactorily without requiring excessive maintenance.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

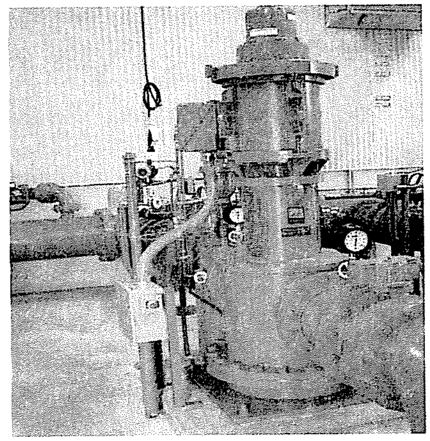
Additional Visual Observation Notes:

1. The facility houses three VT pumps that were installed at different times throughout the life of the pump station.
2. A 2-ton monorail is provided for pulling the pumps and equipment within the pump station. Large equipment must be pulled through roof hatches via a crane on the Licking River.
3. Building is constructed of concrete and brick. A number of cracks were observed on the exterior of the building. Refer to a separate structural analysis of the building for further information.
4. Ventilation is provided by one roof mounted fan and one wall fan with fresh air inlets along the river side of the building. Although both ventilation fans were operating, the temp in the building was higher than normal.
5. Lighting in the pump station is incandescent and is in satisfactory condition. However lighting levels in the pump station are low.
6. Heating is provided by a single electric unit heater which appeared to be in good working order.
7. The electrical and control equipment are located in the pump room on a 4" tall housecleaning pad.

Northern Kentucky Water District

Asset Management Program *Facility: Bristow Road Pumping Station*

General Information:



Equip Name:	Pumps 1, 2, 3
Tag ID:	BRIS-PUMP1 (2, 3)
Service:	Low Service Booster
Make:	Floway
Model:	MKL
Capacity:	2900 gpm @ 65 ft
No of Units:	3
Installation Date:	2002
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[ ] Normal	[X] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps are essentially new, and the District Operations staff indicated that they have had no problems with the pumps since their installation in 2002.

Operational History (Note any operational data available):

Vibration data collected by the District indicated normal operation of the pumps and no other problems were noted.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

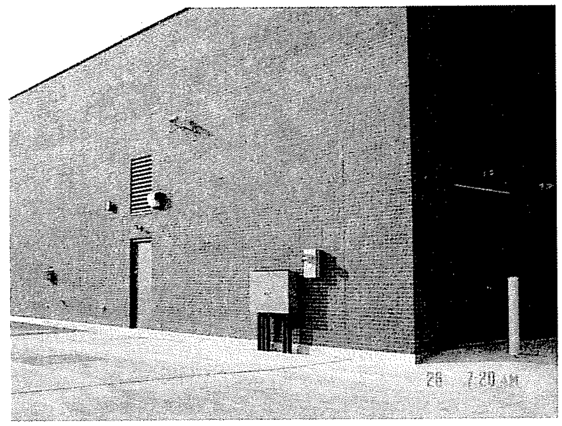
Pump suction and discharge valves are 12" Dezurik Butterfly. Pump control valves are Cla-Val. Each pump has 75 hp motors.

Reviewed By: Mark Wilson/Adam Westermann Date: 6/26/03

Northern Kentucky Water District

Asset Management Program *Facility: Bristow Road Pumping Station*

General Information:



Equip Name: Building

Tag ID: BRIS-PS

Service: House Pumps and Equip.

Make: CMU Block and Brick

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: 2002

Major Rehab Date: N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The pump station is essentially new. No visible corrosion or broken equipment was noted. The District's operations staff indicated that they have had some problems with the sodium hypochlorite feed pumps due to air binding of the pumps.

Operational History (Note any operational data available):

The facility has only been in operation for a short time, but the Operations Staff indicated that the facility has operated well for the time that it has been in operation.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

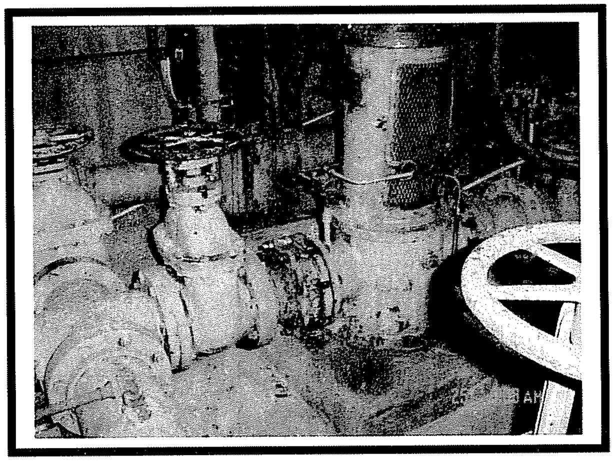
Reviewed By: Mark Wilson/Adam Westermann Date: 6/26/03

Additional Visual Observations:

1. Pump Room is heated by two electric unit heaters.
2. The Sodium Hypochlorite storage and feed room is heated and cooled by a make-up air unit mounted on the roof.
3. A single eyewash and shower is provided in the chemical storage and feed room.
4. Electrical MCC panels and control system panels are located on the pump room floor, adjacent to the pumps. Panels, and internal components are like new.
5. Ventilation of the pump room is provided by a single duct fan located in the pump room.
6. A 2-ton monorail system with electric hoist is provided for pump, piping, and valving maintenance.
7. The Sodium Hypochlorite room consists of one 825 gallon storage tank, two Jesco diaphragm metering pumps, and associated piping and valves.

Northern Kentucky Water District
Asset Management Program — *Facility: Bromley Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	BROM-PUMP1 (2,3)
Service:	Treated Water Booster
Make:	Johnston (1) & Goulds (2&3)
Model:	10M50 (1), 8x13AHC (2&3)
Capacity:	500 (1) & 700 (2&3) gpm
No of Units:	3
Installation Date:	1968 (1), 1986 (2 & 3)
Major Rehab Date:	2000, 1999, 1997

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Corrosion:	[X] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps appear to be in satisfactory working order, however heavy corrosion was noted on each pump and the associated piping. (See building review form for additional comments).

Operational History (Note any operational data available):

Operations staff noted that the pumps have operated satisfactorily. Records noted that the bowl was replaced on Pump No. 1 in 1996, Repaired motor on Pump No. 3 in 1996.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[X] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Motor hp – 60 (1), 75 (2,3)

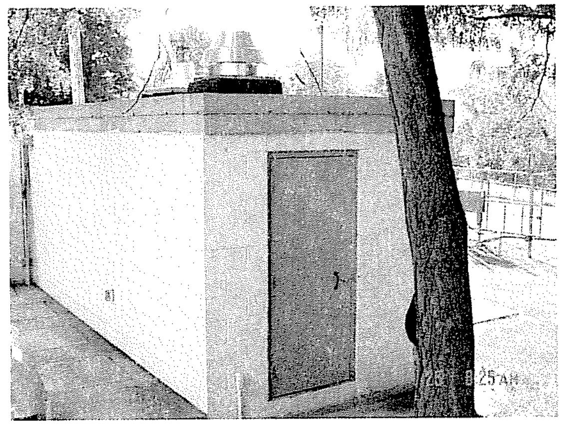
Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

Additional Visual Observation Notes:

1. Due to the excessive leakage from pump and valve stem seals, corrosion of the pump and piping systems was noted to be excessive:
   a. The concrete and steel sub-base of Pump No. 1 was noted to be in very rough condition due to excessive corrosion.
   b. Spacer between the pump and the motor was noted to have very heavy corrosion due to pump seal leakage.
   c. The discharge piping for Pump No. 2 control valve was supported by a wood block, with no anchorage.
   d. Pump suction and discharge piping was noted to have very heavy corrosion and should be cleaned and re-painted to avoid further degradation of the piping.

Northern Kentucky Water District
Asset Management Program — *Facility: Bromley Pumping Station*

General Information:



Equip Name: Pump Station Building

Tag ID: BROM-PS

Service: House Pumps & Equip

Make: CMU Block

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: 1968

Major Rehab Date: N/A

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Corrosion:	[X] Extensive	[ ] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[X] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The condition of the building itself was satisfactory, however the operation of a number of pieces of support equipment resulted in poor overall conditions. (See additional notes)

Operational History (Note any operational data available):

Operations staff indicated that the facility has a good operating history, however it was noted that the conditions within the pump room have been as noted for some time.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[ ] Satisfactory
	[x] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

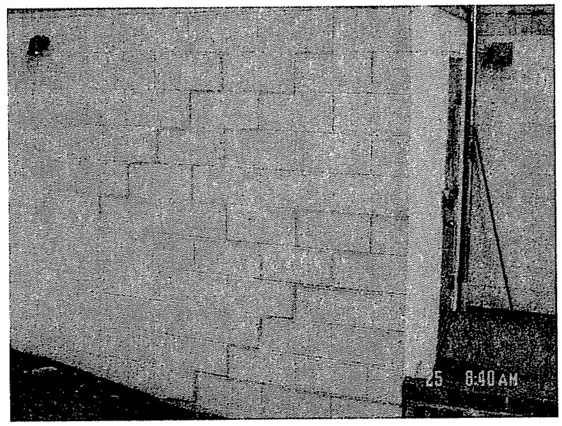
Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

Additional Visual Observation Notes:

1. Lighting within the pump room is provided by incandescent bulbs. Levels in the pump room are poor.
2. Ventilation within the pump room is provided by a single fan located at the ceiling of the pump room. The discharge damper was noted to be disconnected. Ambient temperatures on the day of the site investigation was approximately 78 F, temperature within the pump room was approximately 85 F or higher (with the fan running).
3. Pump suction and discharge piping is arranged such that there is no path through the pump room without jumping over piping, which is approximately 30 inches above the floor. In the event of an emergency, anyone in the pumping station would be required to navigate their way over the piping to exit the facility.
4. The majority of the valves and piping for the pumps were noted to have heavy corrosion due to leaking from the pump and valve stem seals.
5. MCC's are located one level (approx 8 ft) above the pump room and appeared to be in good shape. No corrosion was noted in the electrical cabinets, however the temperature in the room was high as it is connected to the pump room via an open stairwell.

Northern Kentucky Water District
Asset Management Program *Facility: Bromley Pumping Station*

General Information:



Equip Name:	Hypochlorite Room
Tag ID:	BROM-HYPO
Service:	NaOCl Store & Feed
Make:	CMU Block
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	Unk
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Hypochlorite Storage Room houses NaOCl storage and feed equip as well as ancillary equipment. (See additional notes.)

Operational History (Note any operational data available):

Operations staff indicated that the facility has operated satisfactorily since it was added to the Pumping Station. The original Jasco chemical metering pumps have been disconnected due to problems with the diaphragm material.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

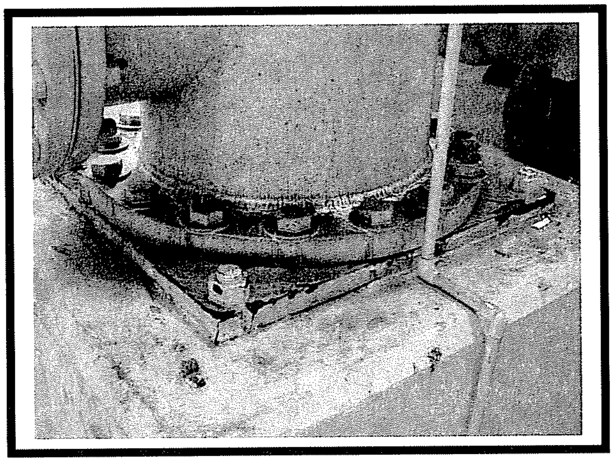
Additional Visual Observation Notes:

1. Building itself was constructed by adding a concrete slab and CMU blockwork to the side of the original pumping station building. The hypochlorite building is settling differentially with respect to the pumping station causing cracking in the blockwork.
2. Hypochlorite is stored in a single storage tank with a prefabricated FRP secondary containment tank. The secondary containment, although adequately sized for the volume of chemical, is inadequately sized to capture a chemical leak from the storage tank or the piping.
3. The building is heated by a single electric unit heater.
4. Cooling is provided by a single Frigid Air wall AC unit.
5. A single eyewash shower is provided within the storage room.

Northern Kentucky Water District

Asset Management Program *Facility: Carothers Road Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	CAROTHERS-PUMP1 (2)
Service:	Treated Water Booster
Make:	Ingersoll-Dresser
Model:	12 NKH
Capacity:	1800 gpm @ 263 ft
No of Units:	2
Installation Date:	1996
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps appeared to be in satisfactory operating condition. Some minor leakage noted from the pump seals. Corrosion of the pump sub-base, piping and valving noted. (See Building notes for additional comments)

Operational History (Note any operational data available):

Operations staff noted satisfactory operation.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

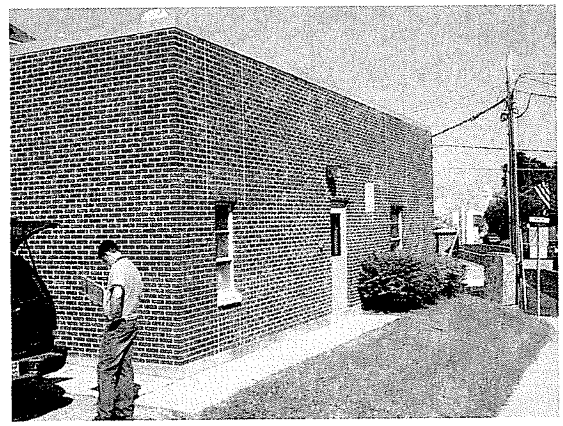
Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program *Facility: Carothers Road Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	CAROTHERS PS
Service:	House Pumps & Equip
Make:	Brick
Model:	N/A
Capacity:	N/A
No of Units:	
Installation Date:	N/A
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[X] Moderate	[ ] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Facility, pumps, and piping/supports all exhibited varying levels of corrosion. Water was observed to be draining across floor causing corrosion of pipe, stair, and conduit supports. building doors were also observed to be heavily corroded at bottom. (See additional notes)

Operational History (Note any operational data available):

Operations staff noted that the facility operates reliably, however noted corrosion could result in future problems if left as is.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

See attached additional notes on facility.

Carothers Road Pumping Station is also known as the 16th Street Pumping Station.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Additional Visual Observation Notes:

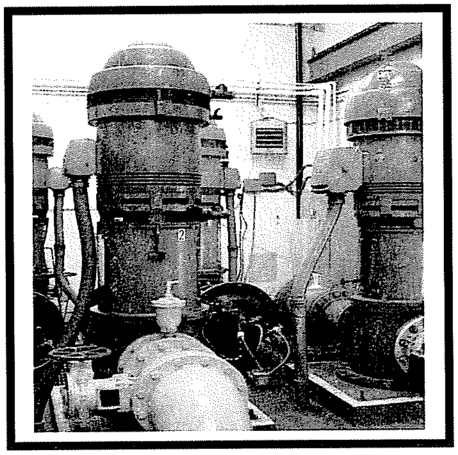
A number of items were noted during the site investigation, including:

1. Grating adjacent to the water quality instrumentation has some localized heavy corrosion, potentially leading to failure in the future.
2. Corrosion noted on the exterior of the pump suction and discharge piping, including areas where the paint coating has pealed off leaving the piping exposed to future corrosion.
3. Water quality drain piping was routed to a floor drain in the center of the building, flow was backing up in the drain causing moderate corrosion of the stair stringers, and pipe/conduit supports in the area of the floor drain. One conduit support was noted to be completely corroded through.
4. A single 2-ton chain pull monorail hoist was mounted by extension threaded rods (approx 6-9 inches). Potential for excessive movement during lifting could result.
5. Lighting is adequate
6. Corrosion at rear doors (at monorail exit) is fairly extensive.
7. Restroom and small storage room are structurally in good shape, however restroom is essentially non-operable.

Northern Kentucky Water District

Asset Management Program *Facility: Dudley 1040 Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	DUD-PUMP1 (2, 3, 4)
Service:	Treated Water Booster
Make:	See "Notes" Below
Model:	See "Notes" Below
Capacity:	2225 gpm @ 375 ft
No of Units:	4
Installation Date:	(#1, 2, 3)-'65,(#4) –'79
Major Rehab Date:	N/A

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps are in good condition, and only minor corrosion on the pumps and piping were noted. Heavy moss buildup was noted on the pump control valve of Pump No 1.

Operational History (Note any operational data available):

Operations staff indicated that the pumps have operated well since their installation. No major problems were noted.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Pump Nos 1&2 – Layne-Bowler 250BS14R5 Pump No. 3 – Worthington 15M185-4

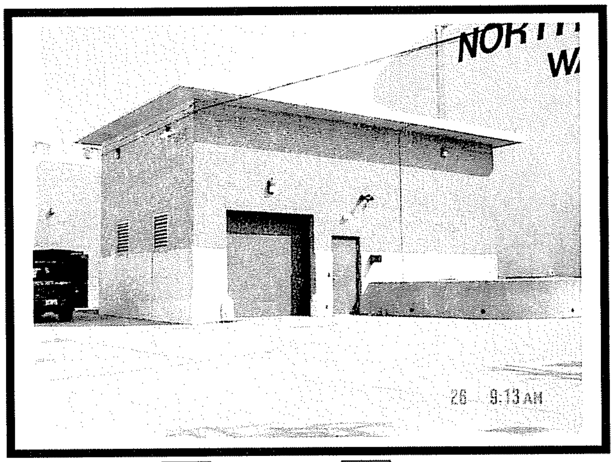
Pump No 4 - Goulds VIC 12X14 HMC-5

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

Northern Kentucky Water District

Asset Management Program *Facility: Dudley 1040 Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	DUD-1040PS
Service:	House pumps & Equip
Make:	Concrete/Brick
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	1965
Major Rehab Date:	N/A

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The building is constructed of concrete with brick exterior. The facility is in good shape With no visible cracking or differential settlement. (See additional notes)

Operational History (Note any operational data available):

Operations staff indicated that the pump station has operated well since it was completed No major upgrades or changes have been made to the facility since it was completed.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

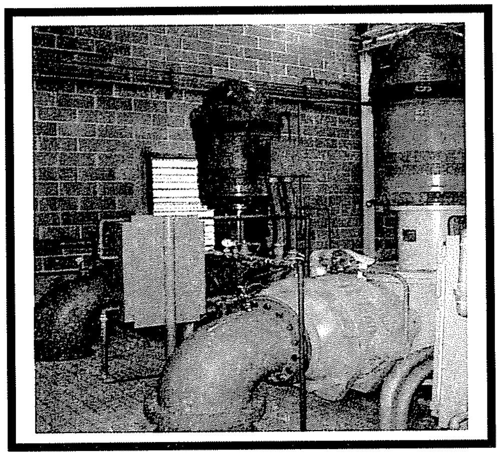
Additional Visual Observation Notes:

1. The building structure is constructed of concrete with a brick exterior. No differential settlement of cracking was observed.
2. A single roll-up door is provided and appeared to be in good working order, the head box was observed to have a number of dents caused be piping and/or equipment as it was being loaded onto trucks.
3. Lighting within the building is florescent and is in good shape. In addition, 4 skylights with clear glass are provided and provide ample light within the facility.
4. Heating within the room is provided by two "Electromode", electric unit heaters with separate thermostat controls.
5. Ventilation is provided by two power roof ventilators with gravity dampers. Both were operating and appeared to move an adequate amount of air to maintain a good working temperature within the room.
6. A single chain pull operated bridge crane is provided, and appeared to be in good working order.
7. Maintenance space between the pumps and piping is very tight and could result in safety issues in the event of an emergency.
8. Electrical switchgear is located on the same floor as the pumps, and appeared to be in good condition. Minor corrosion was noted at the base of the switchgear, and no accumulation of debris was noted.

Northern Kentucky Water District

Asset Management Program *Facility: Dudley 1080 Pumping Station*

General Information:



Equip Name: Dudley 1080 Pumps

Tag ID: DUD-Pump5 (6,7,8)

Service: Treated Water Booster

Make: Goulds

Model: VIC 18x20 EHC

Capacity: 6000 gpm @ 282 ft

No of Units: 4

Installation Date: 1990 (5,6,7) 1994 (8)

Major Rehab Date: See Notes Below

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and the connecting piping are in excellent shape. Very minor corrosion was noted on the supply piping to the pumps. The pumps and motors were in excellent shape.

Operational History (Note any operational data available):

Operations staff indicated that the pump station has operated reliably since it began operation in 1990. No problems were noted.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Pump 5 – 1996 bearing and wear rings replaced, 1998 stuffing box busing and motor bearings replaced. Pump 6 – No repairs since new. Pump 7 – 1996 New bearings and wear rings. Pump 8 – See additional notes

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

Additional Visual Observation Notes:

1. Pump 8 was modified in 1995 due to excessive cavitation. A new bowl and impeller was supplied to produce approximately 5200 gpm at 282 ft.
2. Inlet valves are Pratt 20" butterfly valves.
3. Discharge valves are Pratt 18" butterfly valves.
4. Motors are 600 hp, 1775 rpm units manufactured by US motors.

Northern Kentucky Water District

Asset Management Program *Facility: Dudley 1080 Pumping Station*

General Information:

Equip Name: Building

Tag ID: DUD-1080PS

Service: House Pumps & Equip

Make: Brick

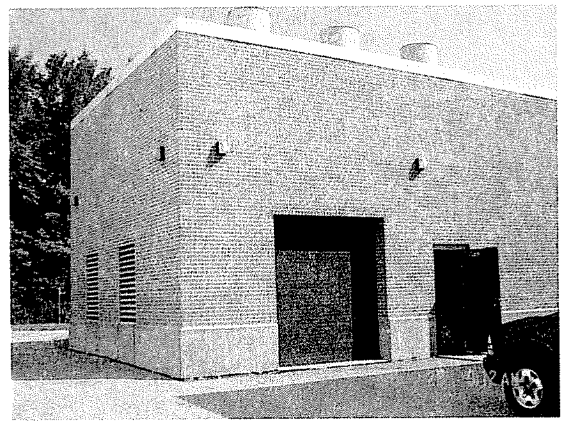
Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: 1990

Major Rehab Date: Unk



Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building is in excellent condition. Very minor corrosion noted on the pump supply piping and within the piping trench, otherwise the building is very well maintained. (See additional notes)

Operational History (Note any operational data available):

Operations staff indicated that the pump station has operated reliably since it began operation in 1990.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

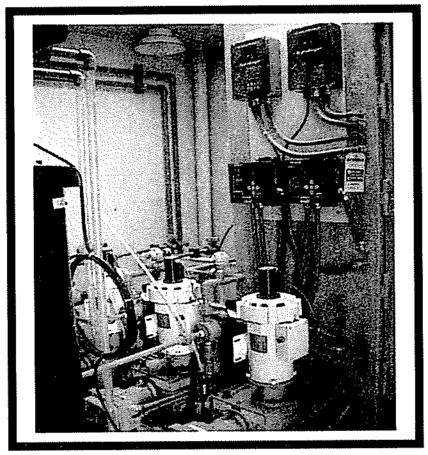
Additional Visual Observation Notes:

1. The building is constructed of concrete and brick. There were no visible signs of differential settlement, or cracking that gave the impression of a problem.
2. Ventilation is provided by three roof mounted tubeaxial fans with discharge dampers. All the fans were noted to operate satisfactorily. Air movement within the pump room was significant, and the temperature within the pump room was good.
3. The pumps have good access for maintenance with the exception of the westernmost pump which was located close to the exterior wall of the facility making access to that side of the pump difficult.
4. Wiring between the MCC cabinets and the pumps is via cable trays in the pipe trenchs giving good access for maintenance purposes. All wiring and cable trays were in good condition.
5. The pump room is provided with a single roll-up door which was in excellent condition.
6. A single 3-ton top running bridge crane (Shepard Niles) is provided for maintenance of the pumps.
7. Lighting is florescent and is in good shape. Lighting levels are good.
8. Heating for the pump room is provided by 2 CRT-Mfgr electric unit heaters which appeared to be in good working order.
9. Water quality instrumentation for the 1040 and 1080 pressure zones is provided in the building, and appeared to be in good working order.
10. The electrical MCC panels are located in the building adjacent to the pumps on a 3" concrete housecleaning pad. No corrosion or accumulation of debris was noted within the panels.

Northern Kentucky Water District

Asset Management Program *Facility: Dudley Pumping Station*

General Information:



Equip Name:	Hypo Metering Pumps
Tag ID:	DUD-HYPO1 (2, 3)
Service:	Hypo Feed
Make:	Various
Model:	Various
Capacity:	N/A
No of Units:	3
Installation Date:	Unk
Major Rehab Date:	Unk

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[x] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):
The hypochlorite system is housed in the old chlorine feed building. See additional notes.

Operational History (Note any operational data available):
Operations staff indicated that the system works well, and did not note any specific problems with components of the system.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
2 Day tanks – TANK HYPO DUD2 (3) – Good condition.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

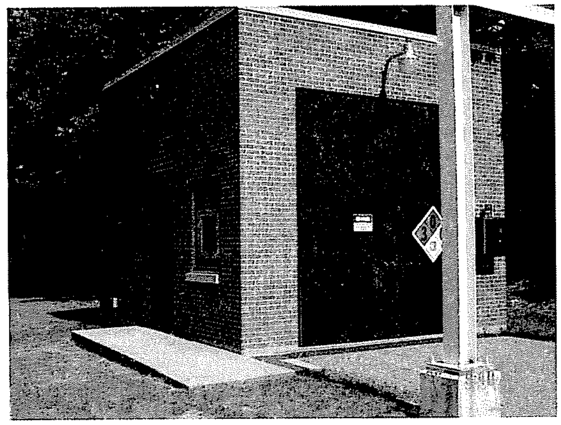
Additional Visual Observation Notes:

1. The hypochlorite feed system consists of two 100 gallon storage tanks, three feed metering pumps, and associated piping, valves, etc.
2. The tanks and metering pumps are mounted on a pre-fabricated FRP secondary containment system. The secondary containment has adequate capacity, however the tanks, and much of the piping hangs over the edges of the containment tank which could lead to accidental spills.
3. The building itself is in fair condition. A number of items require attention such as a potentially leaking roof drain leader, block wall damage due to the installation of a wall mounted AC unit, and removal of old conduit and wiring from removed equipment.
4. Structurally the building is in good shape, there were no signs of differential settlement or other signs of structural damage.
5. Lighting is incadescent and is in good condition.
6. Ventilation is provided by a single wall mounted vent fan.

Northern Kentucky Water District

Asset Management Program *Facility: Dudley Pumping Station*

General Information:



Equip Name: Bulk Chemical Storage

Tag ID: TANK HYPO DUD1

Service: Bulk Hypo Store & Trans

Make: Brick

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: N/A

Major Rehab Date: N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[x] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[x] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building is in good condition. Sodium Hypochlorite is stored in a single 5,000 gallon double wall storage tank. In addition there are three pumps for transferring chemical to the daytank in the feed room.

Operational History (Note any operational data available):

Operations staff indicated that the facility has operated well since the facility was converted from chlorine to sodium hypochlorite.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

3 Transfer Pumps – DUD-HYPO TR1 (2, 3) are located in the building. They are in satisfactory condition.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

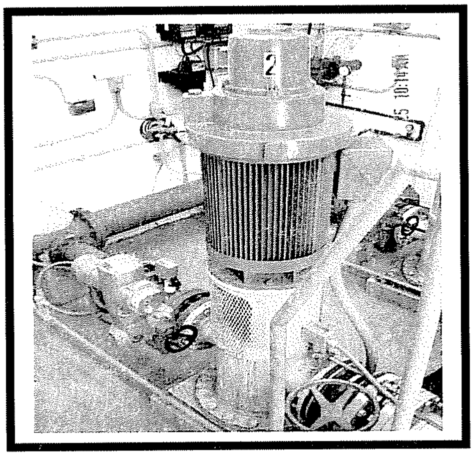
Additional Visual Observation Notes:

1. The facility contains a single 5,000 gallon horizontal double wall storage tank.
2. Ventilation for the room is provided by a single ventilation fan.
3. Lighting in the building is florescent. Fixtures are in good shape and the lighting level is good.
4. Heating is provided by a single electric unit heater.
5. A single eye wash shower is located within the facility.
6. Building is in good shape, however the building itself is too small to house the 5,000 gallon storage tank. The size of the storage tank leaves approximately 1'6" on the sides and the ends of the tank, making personnel movement within the building difficult, and unsafe in the event of an emergency.

Northern Kentucky Water District

Asset Management Program *Facility: Hands Pike Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	HAND – PUMP1 (2)
Service:	Treated Water Booster
Make:	Goulds
Model:	6x10 GLC-14
Capacity:	500 gpm at 426 ft
No of Units:	2
Installation Date:	1983
Major Rehab Date:	N/A

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps are in good operating condition, and appear to be in good mechanical condition. Light corrosion was noted around the pump sub-bases.

Operational History (Note any operational data available):

Operations staff indicated that the pumps have operated well since their installation.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

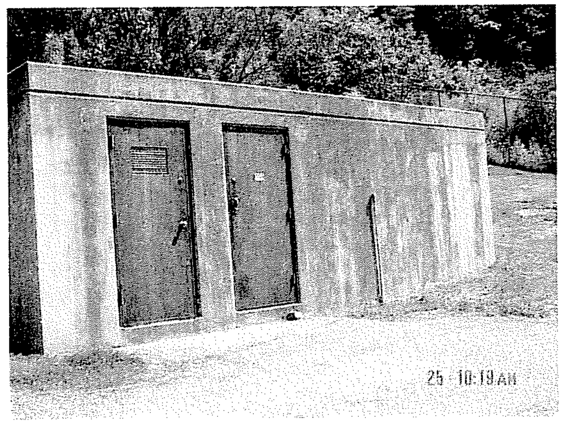
Suction and discharge valves – 8" Dezurik butterfly valves. Each pump equipped with a GE 75 hp motor.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

Northern Kentucky Water District

Asset Management Program *Facility: Hands Pike Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	HAND - PS
Service:	Treated Water Booster
Make:	N/A
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	1983
Major Rehab Date:	N/A

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building is of concrete construction with a stucco finish. Portions of the building exterior are discolored; however, the overall condition of the pumping station is excellent. (See additional notes)

Operational History (Note any operational data available):

Operations staff indicate that the facility is in good operating condition, and note that it has a good operating history

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

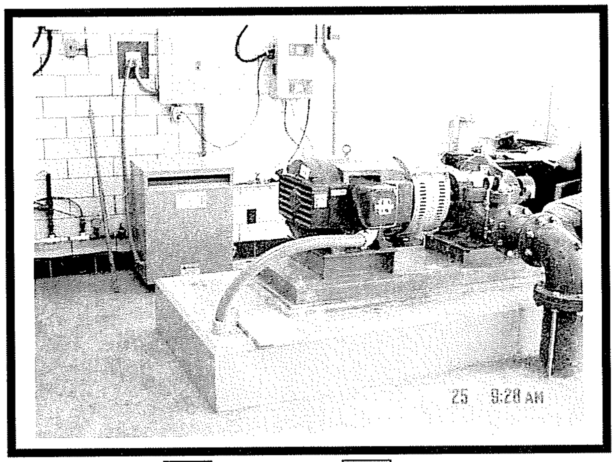
Additional Visual Observation Notes:

1. Interior of the pumping station is in excellent shape, no visible cracks, corrosion, or roof leaks.
2. Building exterior is stucco finish, with some discoloring, but overall the condition of the pumping station is excellent.
3. Ventilation is provided by a single wall fan (Dayton) operated by a wall mounted thermostat.
4. Heating is provided by a single "Federal Pacific" electric unit heater.
5. Roof openings with removable access hatches are provided above each of the pumps to facilitate pump removal. Hatches and openings are in excellent condition.
6. Lighting is florescent, and is in good condition, lighting level is good.
7. Building includes a small room set up for hypochlorite storage and feed, however it has never been used.

Northern Kentucky Water District

Asset Management Program — *Facility: Latonia Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	LAT-PUMP1 (2)
Service:	Treated Water Booster
Make:	Goulds
Model:	4x6-10L Type 3408
Capacity:	720 gpm @255 ft
No of Units:	2
Installation Date:	2003
Major Rehab Date:	N/A

Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[x] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and the associated suction and discharge piping are in excellent condition.

No corrosion of the piping or valves was noted.

Operational History (Note any operational data available):

Pumps were installed in early 2003, no problems have been noted since their installation.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Each pump equipped with a US Motor – 75 HP motor. Suction and Disch valves 8" Pratt Butterfly Discharge. Check valves 8" GA Industries

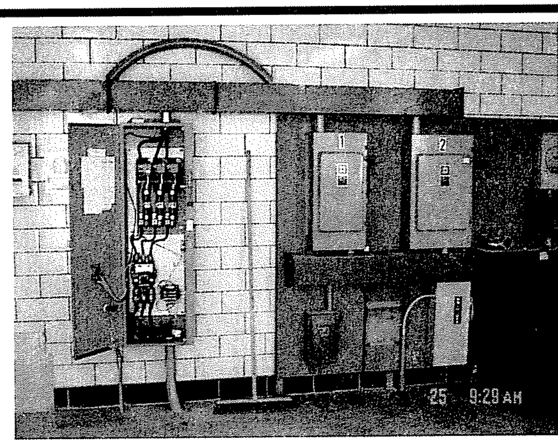
Reviewed By: Adam Westermann/Mark Wilson   Date: 6/25/03

Northern Kentucky Water District

Asset Management Program *Facility: Latonia Pumping Station*

General Information:

Equip Name:	Pump Station Building
Tag ID:	LAT-PS
Service:	Treated Water Booster
Make:	CMU Block/Concrete
Model:	N/A
Capacity:	N/A
No of Units:	N/A
Installation Date:	N/A
Major Rehab Date:	N/A



Reliability:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[x] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building is in excellent shape, no notable corrosion, cracking, differential settlement, or roof leakage was noted. (See additional comments)

Operational History (Note any operational data available):

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[x] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

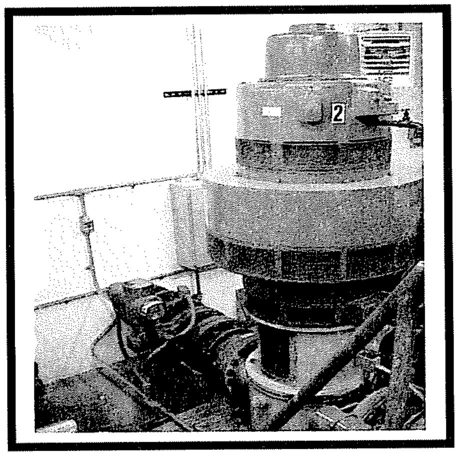
Additional Visual Observation Notes:

1. Ventilation of the pumping station is provided by a single wall fan with themostat.
2. Building interior is glazed CMU blocks, sidelights provided by glass blocks.
3. Electrical disconnects and MCC panels are located on the main pump room floor, adjacent to the pumps.
4. Heating of the pumping station is provided by a single gas (Reznor) unit heater.
5. Water quality instrumentation (Hach Cl2 Analy, 1720D Turbidimeter, Aquatrend SCM, and pH.
6. Basement level of the pumping station houses the suction and discharge piping, valves, and flow metering. The majority of the piping and valving was replaced at the time the new pumps were installed.
7. A small "restroom" located in the basement is no longer in service.

Northern Kentucky Water District

Asset Management Program *Facility: Richardson Road Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	RICH-PUMP1 (2,3)
Service:	Treated Water Booster
Make:	Goulds
Model:	10x16 BHC-4
Capacity:	2100 gpm @ 515 ft
No of Units:	3
Installation Date:	#1-'81, #2-'01, #3-'98
Major Rehab Date:	See Notes

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps were in good working order. No notable external damage or excessive corrosion was noted. Pumps operating during site investigation were operating within noise and vibration tolerance.

Operational History (Note any operational data available):

Operations staff indicated that the pumps have operated well. Pump No. 1 had motor bearings replaced in 1995, and bearings and wear rings were replaced in 1996. Pump No. 2 had wear rings replaced in 1994, and bearings replaced in 1995.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

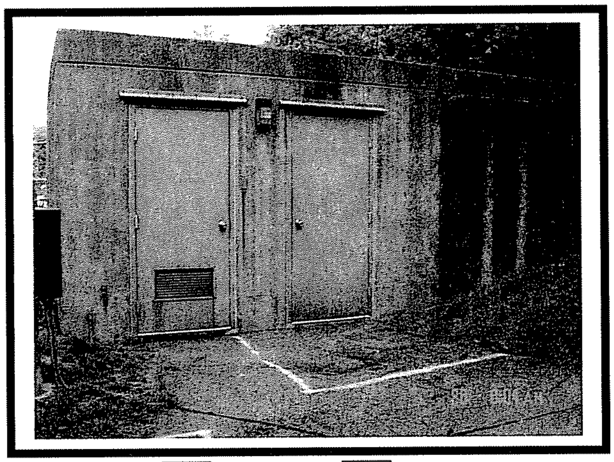
Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

Northern Kentucky Water District

Asset Management Program *Facility: Richardson Road Pumping Station*

General Information:



Equip Name: Building

Tag ID: RICH-PS

Service: House Pumps & Equip

Make: Concrete

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: 1981

Major Rehab Date: N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[x] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The building is constructed of concrete with a concrete floor with depressed area for the pumps. The building is in excellent structural condition, some discoloring of the exterior was noted. The old chlorine storage room has some corrosion noted. (See additional notes)

Operational History (Note any operational data available):

Operations staff indicated that the pumping station has operated well since coming on line in 1981. The pumping station has had several potential dangerous accidents. (A chlorine leak and two flooding events.)

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

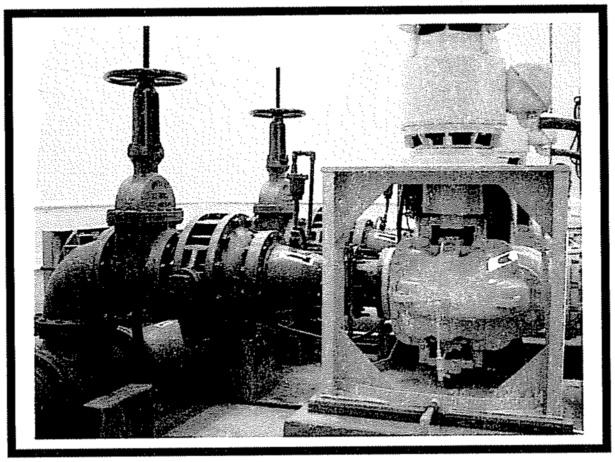
Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

Additional Visual Observation Notes:

1. The building is constructed of concrete, with a concrete floor slab. No visible cracks or differential settlement was noted.
2. Ventilation is provided by two wall mounted fans (Coolair). Air is drawn through a single wall inlet air louver. The fans were in operation during the site investigation and were observed to be noisy, not due to wear or damage, but simply due to the amount of air being moved through the room. This was a major contributor to the amount of noise from the facility.
3. The pumping station has flooded due to breakage in the supply piping within the pumping station. The District installed flood switches to automatically shut down the inlet valves to the pumps in the event of a flood.
4. Lighting within the room is florescent, lighting levels are good and the fixtures are in good shape.
5. A roof hatch is provided above each pump for removal of the pumps from outside the facility. Hatches and the openings are in good shape.
6. Maintenance access around the pumps and piping is good. Maintenance staff must jump over the discharge piping of Pump No. 3 to access items on the far side.
7. Electrical switchgear was refurbished approximately 3 years ago and is in excellent condition. No corrosion or accumulation of debris was noted.
8. The building is equipped with a small chlorine storage room, which is no longer in use. The facility experienced a chlorine leak several years ago, and since then the District has no longer fed chlorine from this location. Minor to moderate corrosion was noted on the door, and metal components within the old chlorine storage room.

Northern Kentucky Water District
Asset Management Program *Facility: Ripple Creek Pumping Station*

General Information:



Equip Name:	Pumps No. 1, 2
Tag ID:	RIP-PUMP1 (and 2)
Service:	Treated Water Booster
Make:	Goulds
Model:	3410
Capacity:	2050 gpm @ 100 ft
No of Units:	2
Installation Date:	1992
Major Rehab Date:	1998 (No 2)

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and associated piping and valves were in good condition. Inlet valves – Muller 12" gate valve. Outlet valves – Pratt 12" electric, and Mueller 12" gate (manual)

Operational History (Note any operational data available):

Operations staff indicated that the operation of the facility has been good since the facility was completed in 1992

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

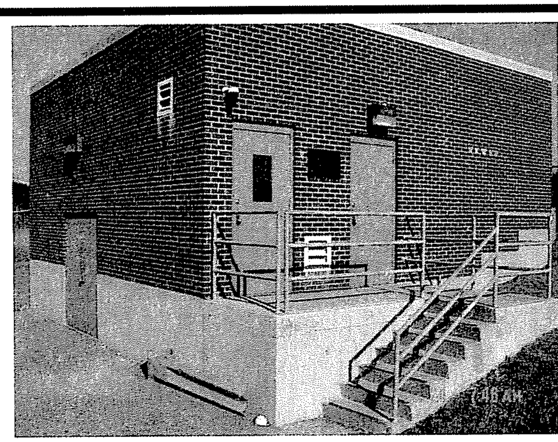
Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program *Facility: Ripple Creek Pumping Station*

General Information:



Equip Name: Building

Tag ID: N/A

Service: House pump and equip

Make: Brick/concrete

Model: N/A

Capacity:

No of Units:

Installation Date: 1992

Major Rehab Date: N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building houses pumps, MCC panels, piping and valves, and ancillary equipment including, 1-ton monorail, vent fan, electric unit heater, and water quality monitoring equipment. Space is provided for one additional pump.

Operational History (Note any operational data available):

Operations staff indicated that the pump station has operated well since it's completion in 1992. No major problems were noted.

Spare Parts Available: [X] Yes [ ] No

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[X] No Impact	[ ] Unk/Not Applicable

Notes:

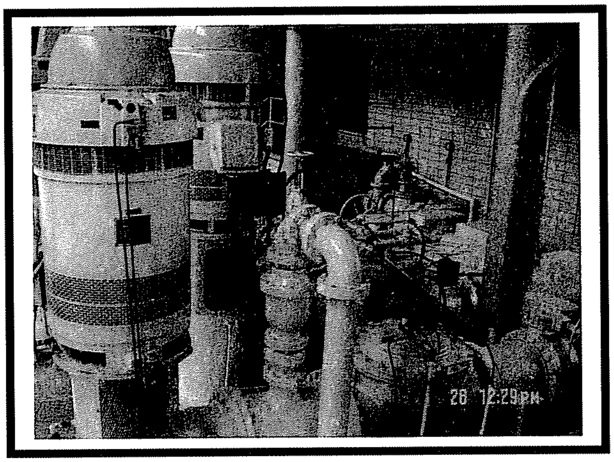
Overall condition of the facility is excellent, and all ancillary equipment was noted to be in excellent operating condition

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program — *Facility: Taylor Mill Pumping Station*

General Information:



Equip Name:	Pumps 1-3
Tag ID:	TMTP-PUMP1 (2, 3)
Service:	See Below
Make:	See Below
Model:	See Below
Capacity:	See Below
No of Units:	3
Installation Date:	1982 (1), 1994 (2), 1996 (3)
Major Rehab Date:	N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The pumping units were noted to be in good condition, and no abnormalities were noted. Operations staff indicated that the operation of the pumps has been satisfactory since their installation.

Operational History (Note any operational data available):

Operations staff indicated that the pumps have operated well since their installation. Pump 3 was being serviced at the time of the site investigation.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Pump No. 1 (Booster Pump) – Byron Jackson, model 20HQ-4, 6945 gpm at 250 ft.

Pump No. 2 (Booster Pump) – Peerless model 27MA-2, 8500 gpm at 145 ft.

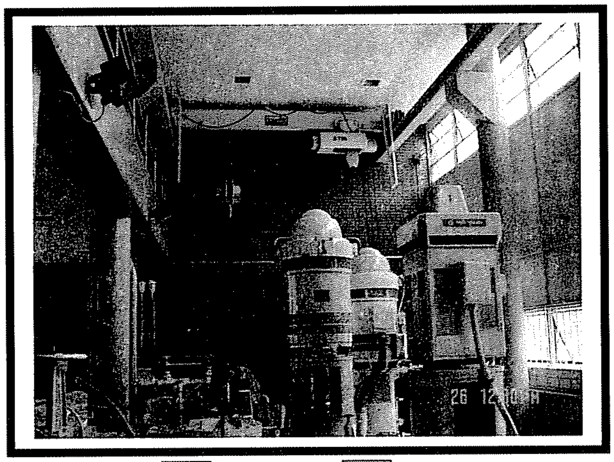
Pump No. 3 (Lift Pump) - Goulds, model 20ELC-3, 5600 gpm at 375 ft.

Reviewed By: Adam Westermann/Mark Wilson — Date: 6/26/03

Northern Kentucky Water District

Asset Management Program *Facility: Taylor Mill Pumping Station*

General Information:



Equip Name: Pump Building 1

Tag ID: N/A

Service: House Pumps and Equip

Make: N/A

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: N/A

Major Rehab Date: N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Overall condition of the pumping station is satisfactory. No cracking or differential settlement was noted, and only minor corrosion was noted on the building side windows. See additional notes.

Operational History (Note any operational data available):

Operations staff indicated that the pump station has operated well since it's construction, and no major problems were noted

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

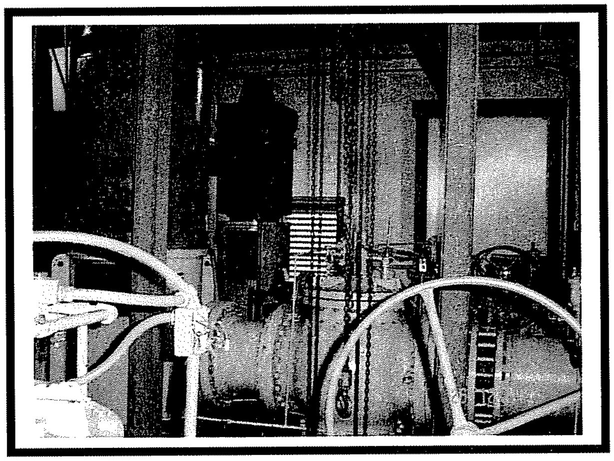
Additional Visual Observation Notes:

1. Building interior is in excellent shape, no cracking or differential settlement was noted.
2. The exterior of the pump station is brick which was noted to be in excellent shape.
3. The room ventilation air enters the building through side-windows which were noted to have minor corrosion on the frames.
4. An upper level mezzanine is provided (approx 18 feet above the pump operating level) which houses the MCC and pump control equipment.
5. Pump inlet valves are located in the basement of the facility. Refer to the treatment plant investigation forms for additional information on the condition of the treatment plant and the condition of the piping galleries.
6. A single 5-ton bridge crane with electrical hoist is provided for pump and valve maintenance. The unit was noted to be in good condition, and operations staff indicated no problems with it's operation.
7. Lighting within the pump room is a combination of floursecent and metal halide. Both systems were in good condition. During daylight hours, ample light is provided through the side windows.
8. Ventilation is provided by a portable fan for air movement, and through natural ventilation by air through the side windows.
9. Heating is provided by two electric wall heaters which were noted to be in good working order.

Northern Kentucky Water District

Asset Management Program *Facility: Taylor Mill Pumping Station*

General Information:



Equip Name: Pumps 4-6

Tag ID: TMTP-PUMP4 (5, 6)

Service: See Below

Make: See Below

Model: See Below

Capacity: See Below

No of Units: 3

Installation Date: 1974 (4), 1987 (5), 1982 (6)

Major Rehab Date:

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[x] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[ ] High	[x] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps were in good operating condition. Minor corrosion was noted on the base of pumps 4 and 6.

Operational History (Note any operational data available):

Operations staff indicated no problems with the pumps. Pump No. 5 had one impeller removed after installation to reduce cavitation. Pump 4's motor bearings were replaced and the motor Was re-wound in 1997. The shaft guard for pump No. 6 was damaged and replacemed.

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Pump No. 4 (Lift Pump) – Layne Bowler, Model 24EXHX, 6945 gpm at 490 ft.

Pump No. 5 (Lift Pump) – Unk mfgr,Simmons discharge head, 6945 gpm, 365 ft.

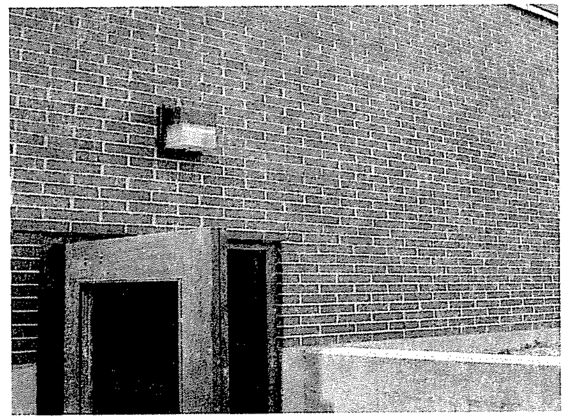
Pump No. 6 (Booster Pump) – Byron Jackson, Model 20HQ-4, 6945 gpm at 250 ft.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

Northern Kentucky Water District

Asset Management Program *Facility: Taylor Mill Pumping Station*

General Information:



Equip Name: Pump Building 2

Tag ID: N/A

Service: House Pumps and Equip

Make: N/A

Model: N/A

Capacity: N/A

No of Units: N/A

Installation Date: N/A

Major Rehab Date: N/A

Reliability:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[x] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[x] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[x] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[x] Normal	[ ] Light	
Operating Temp:	[x] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

The overall condition of the pump station is satisfactory. The building is constructed of a combination of steel framing with block and brick veneer. See additional notes for additional information.

Operational History (Note any operational data available):

Operations staff indicated that the pumping station has operated well since it's construction.

Spare Parts Available: [x] Yes [ ] No

Overall Condition:	[ ] Excellent	[ ] Good	[x] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/26/03

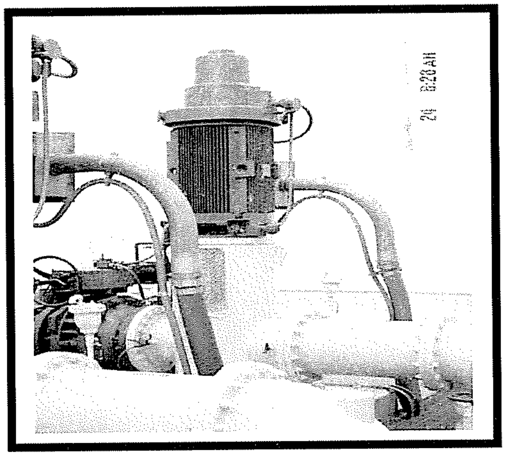
Additional Visual Observation Notes:

1. The exterior walls of the pumping station are constructed of CMU block with brick veneer. No cracking or missing mortar were noted, and there was no indication of differential settlement.
2. The structural steel framing is in good condition, and did not appear to have any major corrosion or damage.
3. A single 3-ton monorail with chain pull hoist is provided. The location of the monorail with respect to the pumps and several of the valves make its use difficult. However, the hoist itself appeared to be in good condition.
4. Lighting within the pump room is provided by wall mounted metal halide. Lighting levels within the pump room is poor.
5. The pump room is not equipped with any permanent heating equipment. Operations staff utilize portable electrical heaters as required to maintain the temperature within the pump room.
6. Cooling is provided by three roof mounted propeller fans mounted directly above the pumps. Ventilation rates, during the site investigation, were noted to be inadequate as the temperature within the pump room were high with only one pump operating.

Northern Kentucky Water District

Asset Management Program — *Facility: US 27 Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	US27-PUMP1 (2,3)
Service:	Treated Water Booster
Make:	Peerless
Model:	16 HxB
Capacity:	3500 gpm @ 300ft
No of Units:	3
Installation Date:	1992
Major Rehab Date:	2002 (1), 1998 (2)

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[X] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and associated piping and accessories were in excellent condition, no excessive corrosion or leakage was noted.

Operational History (Note any operational data available):

Operations staff indicated that the pumps have not experienced any significant problems since their installation.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[X] Unk/Not Applicable

Notes:

GE Motor, 350 HP, 1785 RPM

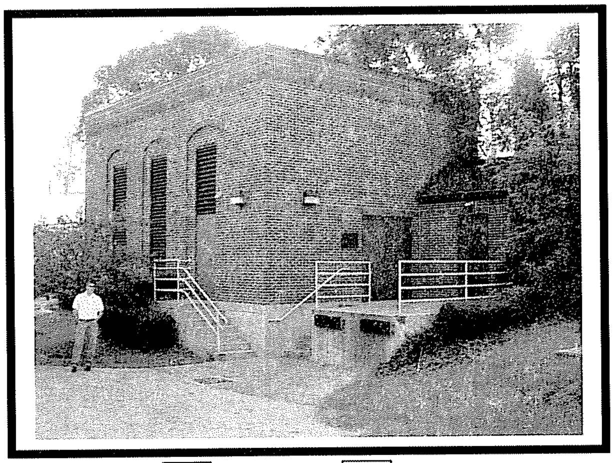
US 27 Pumping Station is also known as the Fort Thomas Pumping Station.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District
Asset Management Program

Facility: US 27 Pumping Station

General Information:



Equip Name:	Building
Tag ID:	US27-PS
Service:	House pumps and Eq
Make:	Brick
Model:	N/A
Capacity:	
No of Units:	
Installation Date:	1992
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building and ancillary equipment are in excellent shape. Ancillary equip includes lighting, 3-ton crane, vent fans, electric unit heaters, electrical MCC panels, and piping and valves associated with the pumping systems

Operational History (Note any operational data available):

Operations staff noted that the facility has operated well since it's completion in 1992. No major problems were noted.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

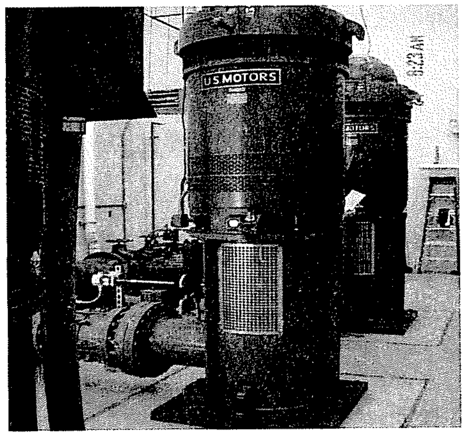
Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program *Facility: Waterworks Road Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	NEW-PUMP1 (2,3)
Service:	Treated Water Booster
Make:	Byron Jackson
Model:	17 HQH
Capacity:	4200 gpm @ 372 ft
No of Units:	3
Installation Date:	2000
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps are in excellent shape. No corrosion, leaking or other malfunctioning noted.

Operational History (Note any operational data available):

Operations staff indicated that there has been not major problems since their installation in 2000.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

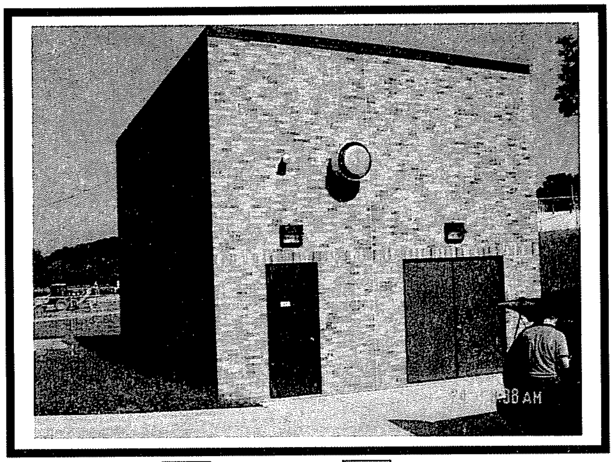
The Waterworks Road Pumping Station is also known as the Newport Pumping Station.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program *Facility: Waterworks Road Pumping Station*

General Information:



Equip Name:	Building
Tag ID:	NEW-PS
Service:	House Pumps and Eq
Make:	Brick
Model:	N/A
Capacity:	N/A
No of Units:	
Installation Date:	2000
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[ ] Normal	[ ] Light	
Operating Temp:	[ ] High	[ ] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and ancillary equipment in excellent shape. Ancillary equip includes three vent fans two gas unit heaters, water quality instrumentation, hypochlorite storage and feed equip, 4-ton monorail, lighting, and MCC equipment

Operational History (Note any operational data available):

Operations staff indicated no major problems since its completion in 2000.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

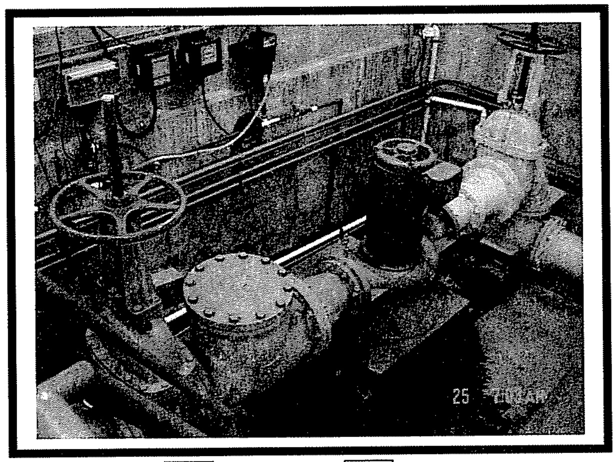
Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/24/03

Northern Kentucky Water District

Asset Management Program *Facility: West Covington Pumping Station*

General Information:



Equip Name:	Pumps
Tag ID:	WCOV-PUMP1 (2)
Service:	Treated Water Booster
Make:	Paco
Model:	16-80951X
Capacity:	2000 gpm @ 60 ft
No of Units:	2
Installation Date:	Unk
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Vibration:	[ ] Heavy	[ ] Moderate	[X] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Pumps and piping appeared in good condition. Some light to moderate corrosion was noted on the piping and valves associated with the pumps. Also some leaking from pump and valve seals was noted (i.e. leaks from check valve seals on Pump 2 were noted).

Operational History (Note any operational data available):

Operations staff indicated that operating history of the pumps has been good. No major problems were noted.

Spare Parts Available:	[x] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[x] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

See additional notes.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

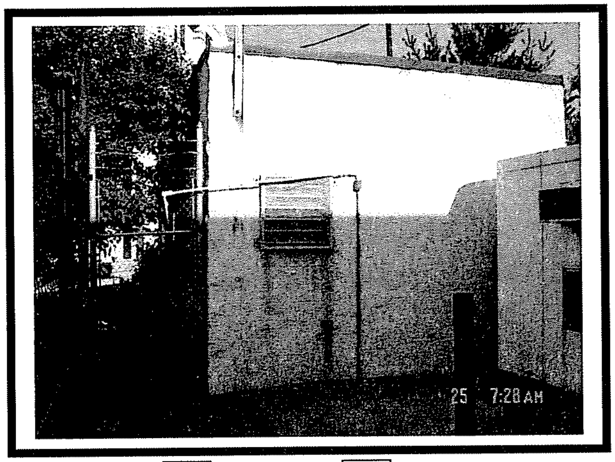
Addition Visual Observation Notes:

1. Pump suction and discharge valves - 12" Kennedy manually operated gate valves. Visual corrosion noted on all valves (light to moderate).
2. Visual leakage noted from pump No. 2 shaft seal.
3. Visual leakage noted from pump No. 1 discharge check valve shaft seals.
4. Pump motors were noted to be Baldor 40 hp, 1760 RPM.

Northern Kentucky Water District

Asset Management Program *Facility: West Covington Pumping Station*

General Information:



Equip Name:	Pump Station Building
Tag ID:	WCOV-PS
Service:	House pumps & equip
Make:	CMU
Model:	N/A
Capacity:	N/A
No of Units:	
Installation Date:	Unk
Major Rehab Date:	N/A

Reliability:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Vibration:	☐ Heavy	☐ Moderate	☐ Light	☐ Other
Noise:	☐ Loud	☒ Normal	☐ Light	
Operating Temp:	☐ High	☐ Normal	☐ Low	☐ Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Overall the condition of the building was good. Exterior of the building showed signs of age (paint chipping, rust stains, etc.) Interior of the building was in good condition and no excessive Corrosion or damage was noted. (See additional notes for additional information)

Operational History (Note any operational data available):

Operations staff indicated that the facility has a good operating history, with no major concerns.

Spare Parts Available:	☒ Yes	☐ No	
Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

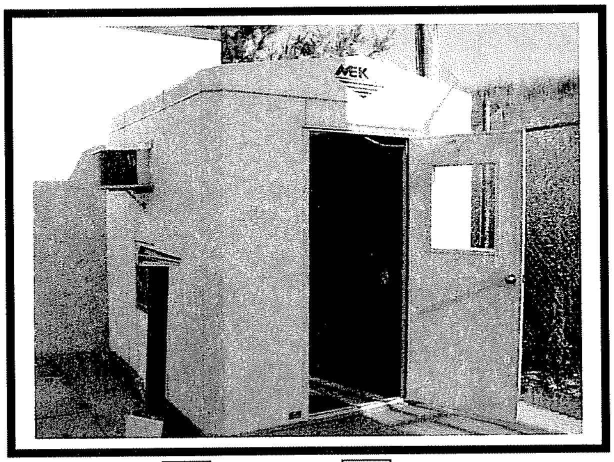
Additional Visual Observations:

1. Florescent lighting inside the facility in good condition, lighting levels are good.
2. Monorail with removable hoist in good condition, capacity un-available.
3. Water noted to be pooling on floor due to leakage from Pump No. 2 seals. This resulted in corrosion of conduit existing from the floor, and pipe supports in the area.
4. Ventilation provided by a single "Coolair" wall fan with gravity damper. Fan controller noted to be noisy, possibly due to dirty start/stop contacts.
5. Heating provided by a single "Carolina Production Enterprises", 10 Kw unit heater. Unit appeared to be in good working order.

Northern Kentucky Water District

Asset Management Program *Facility: West Covington Pumping Station*

General Information:



Equip Name:	Hypo Store & Feed
Tag ID:	WCOV – HYPO
Service:	Storage & Feed
Make:	MEKCO
Model:	N/A
Capacity:	N/A
No of Units:	1
Installation Date:	Unk
Major Rehab Date:	N/A

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Vibration:	[ ] Heavy	[ ] Moderate	[ ] Light	[ ] Other
Noise:	[ ] Loud	[X] Normal	[ ] Light	
Operating Temp:	[ ] High	[X] Normal	[ ] Low	[ ] Other

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Building and the hypochlorite system were in excellent condition. Building is constructed of Fiberglass and all storage and feed equipment is housed within the interior of the building. (See additional notes).

Operational History (Note any operational data available):

Operations staff indicated that the building and the equipment have operated well since their Installation.

Spare Parts Available:	[ ] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Minor safety impact due to the chemical stored.

Reviewed By: Adam Westermann/Mark Wilson Date: 6/25/03

Additional Visual Observation Notes:

1. Building is heated by a single Q-Mark electric unit heater.
2. Building is cooled by a single Whirlpool electric wall mounted air conditioning.
3. Building is constructed of fiberglass, with full secondary containment below the floor grating.
4. A single eye-wash station is provided in the building.
5. Minor corrosion noted at the base of the hypochlorite feed pumps. Most likely caused by spilled chemical during maintenance activities, no other leaks were noted.

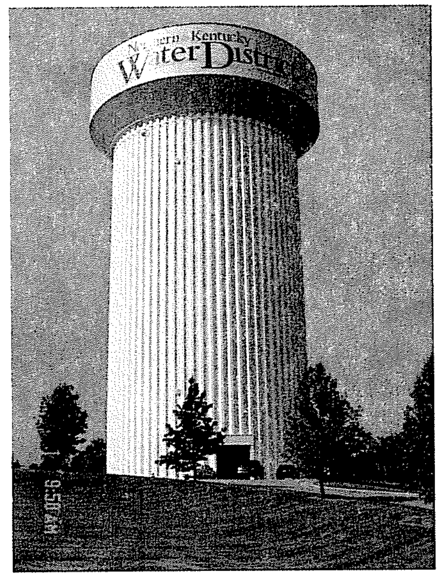
Northern Kentucky Water District

Asset Management Program

Facility: Aqua Drive Tank

General Information:

Equip Name:	Aqua Drive Tank
Tag ID:	AQUA-TANK
Capacity:	2.0 Million Gallons
Type:	Hydropillar
Construction:	Welded
Construction Date:	1990
Major Rehab Date:	2003



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating systems are in new condition.

Operational History (Note any operational data available):

The Aqua Drive Tank was renovated in the Spring of 2003. Ladder safety cages, fall protection and climb prevention devices were added as part of the renovation.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located in dry column.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter	5099	
2) Ph Meter	4576	
3) Chlorine Analyzer	2396	
4) SCADA Inst.		
5)		

Equipment:	Comments:
1) Cathodic Protection	Impressed Current – Not activated
2) Antenna - 1	Roof mounted
3) Flood Lights – 3	
4)	
5)	

Valves and Fittings

1) Check Valve 18" - 2 ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

2) BFV 18" – 4 ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

3) Hydrant ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: On site

Site Notes:
Tank does not have a perimeter fence. Facility security fence terminates at tank column.
No security cameras.

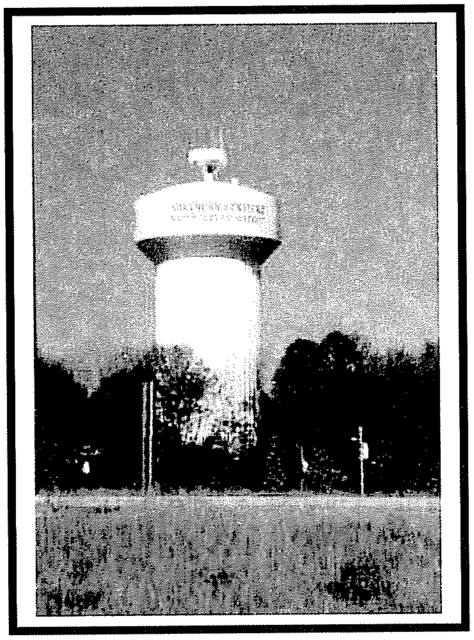
Miscellaneous Notes:

Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program *Facility: Barrington Woods Tank*

General Information:

Equip Name:	Barrington Woods Tank
Tag ID:	BAR-TANK
Capacity:	1.0 Million Gallons
Type:	Hydropillar
Construction:	Welded
Construction Date:	1972
Major Rehab Date:	1997



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating system in good condition.

Operational History (Note any operational data available):

The Barrington Woods Tank was renovated in 1997. The renovation included removal of existing coating systems containing lead and application of new coating systems on the exterior of the structure and the interior of the bowl. Renovation also included miscellaneous structural improvements.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program *Facility: Barrington Woods Tank*

Other Equipment on Site:

Instrumentation Bldg: None

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		SCADA antenna mounted on column.
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Antenna	Multiple antenna mounted on structural pod on tank roof.
2)	
3)	
4)	
5)	

Valves and Fittings

1) BFV 16" - 2 ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

2) Altitude Valve 16" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

3) Gate Valve 8" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

4) Gate Valve 6" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column

Site Notes:
Padlock on gate.
Fence overgrown with brush on approximately 75% of perimeter.
Fence around fuel tank in poor condition and gate does not have lock.
Graffiti on tank door.

Miscellaneous Notes:
Antenna systems enclosure located in column.
Two antenna systems structures located on site.

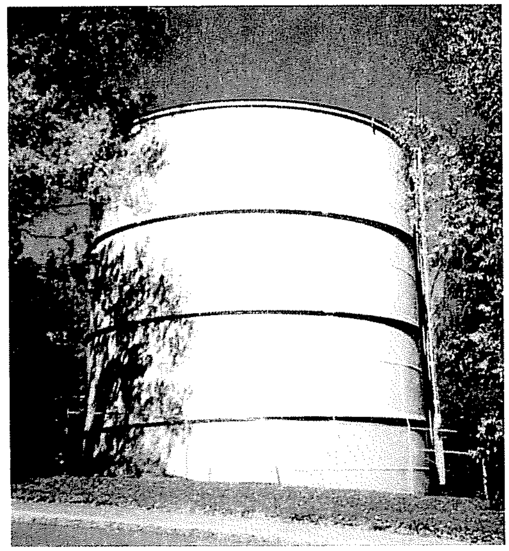
Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District

Asset Management Program — *Facility: Bellevue Tank*

General Information:

Equip Name:	Bellevue Tank
Tag ID:	BELL-TANK
Capacity:	600,000 Gallons
Type:	Standpipe
Construction:	Riveted
Construction Date:	1930
Major Rehab Date:	1999



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

The coating system is in good condition.

Operational History (Note any operational data available):

The Bellevue Tank was renovated in 1999. The renovation included replacement of the interior coating system, overcoating of the exterior system, replacement of the roof support system and improvements to miscellaneous structural accessories.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program *Facility: Bellevue Tank*

Other Equipment on Site:

Instrumentation Bldg: Instruments located in light weight structure on site.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☒ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic Protection	System 4 years old. Not activated.
2)	
3)	
4)	
5)	

Valves:

1) Gate Valve 6" ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Buried – Condition unknown

2) Gate Valve 12" - 2 ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Buried – Condition unknown

3) ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

Site Notes:
Padlock on gate and instrumentation enclosure.
12" Gate valves buried. Influent valve outside of perimeter fence. Effluent valve inside of fence.

Miscellaneous Notes:
Intrusion alarm switch on ladder.
Instrumentation building overgrown with weeds and of very light weight construction.
The Bellevue Tank is also known as the Harrison Road Tank.

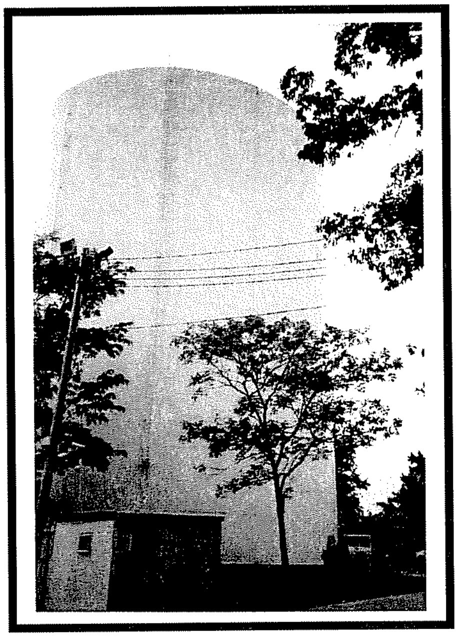
Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District

Asset Management Program *Facility: Bromley Tank*

General Information:

Equip Name:	Bromley Tank
Tag ID:	BROM-TANK
Capacity:	3 Million Gallons
Type:	Standpipe
Construction:	Welded
Construction Date:	1967
Major Rehab Date:	1993



Corrosion:	☐ Extensive	☐ Moderate	☒ Light	☐ None
Foundation:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Fence:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Site Lighting:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Climb Prevent:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Safety Devices:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

The coating system is in good condition.

Operational History (Note any operational data available):

Overall Condition:	☐ Excellent	☒ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: Instruments located in pump station at site.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter	2831	
2) Ph Meter	2776	
3) Chlorine Analyzer	2841	
4) SCADA Inst.		
5)		

Equipment:	Comments:
1)	
2)	
3)	
4)	
5)	

Valves:

1) ______ ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

2) ______ ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

3) ______ ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

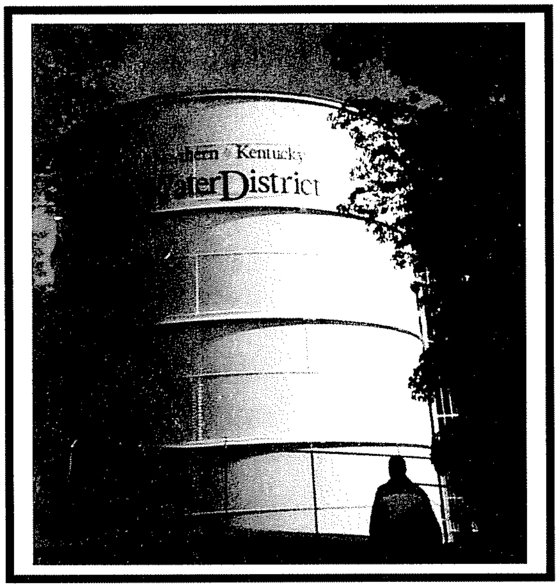
Site Notes:
Card reader at facility access gate.
24 hour site lighting and cameras.
Fence in poor condition and overgrown on approximately 70% of perimeter
All valving buried beneath pavement. Four actuator's.

Miscellaneous Notes:
Site intrusion in the Spring of 2003. Climb prevention devices improvements made following intrusion.

Reviewed By: Daniel Kay Date: 7-1-03

General Information:

Equip Name:	Dayton Tank
Tag ID:	DAYTON-TANK
Capacity:	600,000 Gallons
Type:	Standpipe
Construction:	Riveted
Construction Date:	1930
Major Rehab Date:	2001



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

The coating system is in good condition.

Operational History (Note any operational data available):

The Dayton Tank was renovated in 2001. The renovation included replacement of the interior coating system, overcoating of the exterior system, replacement of the roof support system and improvements to miscellaneous structural accessories.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: Instruments located in light frame structure on site.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☒ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic protection	Not activated.
2)	
3)	
4)	
5)	

Valves:

1) Gate Valve 6" ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Buried – Condition unknown

2) Gate Valve 12" - 2 ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Buried – Condition unknown

3) ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

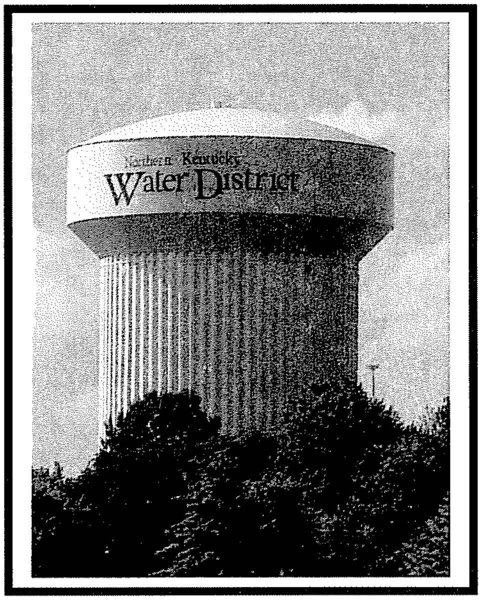
Site Notes:
Padlock on gate and instrumentation enclosure.
Fence overgrown with brush by gate.
12" Gate valves buried. Influent valve outside of perimeter fence. Effluent valve inside of fence.

Miscellaneous Notes:
Intrusion alarm switch on ladder.
Instrumentation building overgrown with weeds and of very light weight construction.

Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program *Facility: Devon Tank*

General Information:



Equip Name:	Devon Tank
Tag ID:	DEVON-TANK
Capacity:	2.0 Million Gallons
Type:	Hydropillar
Construction:	Welded
Construction Date:	1990
Major Rehab Date:	2001

Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating system in new condition.

Operational History (Note any operational data available):

The Devon Tank was renovated in 2001. Coating systems and miscellaneous structural accessories were improved or replaced as part of the renovation.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located in dry column.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter		
2) Ph Meter	2768	
3) Chlorine Analyzer	2842	
4) SCADA Inst.		SCADA antenna mounted on column.
5)		

Equipment:	Comments:
1) Cathodic protection	Not activated.
2)	
3)	
4)	
5)	

Valves:

1) BFV 18" – 4 ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column valve enclosure

2) Check Valve 18" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column valve enclosure

3) Altitude Valve 18" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: In Column valve enclosure

Site Notes:
Padlock on gate.
Area light over vehicle door. No other exterior site lighting.
Tree overhanging fence on East side.
No security cameras.

Miscellaneous Notes:

Reviewed By: Daniel Kay Date: 7-2-03

Northern Kentucky Water District

Asset Management Program *Facility: Dudley Tank – Service Level 1040*

General Information:

Equip Name:	Dudley Tank – Service Level 1040
Tag ID:	DUD-TANK1
Capacity:	5 Million Gallons
Type:	Ground Storage Tank
Construction:	Welded
Construction Date:	1964
Major Rehab Date:	2000

Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☒ None
Foundation:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Fence:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Site Lighting:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Climb Prevent:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Safety Devices:	☒ Excellent	☐ Satisfactory	☐ Fair	☐ Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating system in good condition

Operational History (Note any operational data available):

The Old Dudley Tank (Service level 1040) was renovated in 2000. Coating systems, and miscellaneous structural accessories were improved as part of the renovation.

Overall Condition:	☒ Excellent	☐ Good	☐ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: Instruments located in Pumping Station.

Condition: [X] Excellent [ ] Satisfactory [ ] Fair [ ] Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter	2828	
2) Chlorine Analyzer		
3) SCADA Inst.		SCADA antenna mounted on handrail.
4)		
5)		

Equipment:	Comments:
1)	
2)	
3)	
4)	
5)	

Valves:

1) [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

2) [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

3) [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

Site Notes:
Trees and brush overhanging fence on 2 sides.
Card reader at facility access gate.
Four security cameras on site.

Miscellaneous Notes:
All valving incorporated as part of Dudley Pumping Station.

Reviewed By: Daniel Kay Date: 7-2-03

Northern Kentucky Water District

Asset Management Program *Facility: Dudley Tank – Service Level 1080*

General Information:

Equip Name:	Dudley Tank – Service Level 1080
Tag ID:	DUD-TANK2
Capacity:	5 Million Gallons
Type:	Ground Storage Tank
Construction:	Welded
Construction Date:	1990
Major Rehab Date:	2000

Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Climb Prevent:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating system in good condition.

Operational History (Note any operational data available):

The New Dudley Tank (Service level 1080) was renovated in 2000. Coating systems and miscellaneous structural accessories were improved as part of the renovation.
An additional coat of paint was added to the exterior coating system in 2003.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program *Facility: Dudley Tank – Service Level 1080*

Other Equipment on Site:

Instrumentation Bldg: Instruments located in Pumping Station

Condition: [X] Excellent [ ] Satisfactory [ ] Fair [ ] Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter		
2) Chlorine Analyzer	4571	
3) SCADA Inst.		
4)		
5)		

Equipment:	Comments:
1) Cathodic Protection	System 3 years old. Not activated.
2)	
3)	
4)	
5)	

Valves:

1) ______ [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

2) ______ [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

3) ______ [ ] Excellent [ ] Good [ ] Satisfactory [ ] Unsatisfactory
Location:

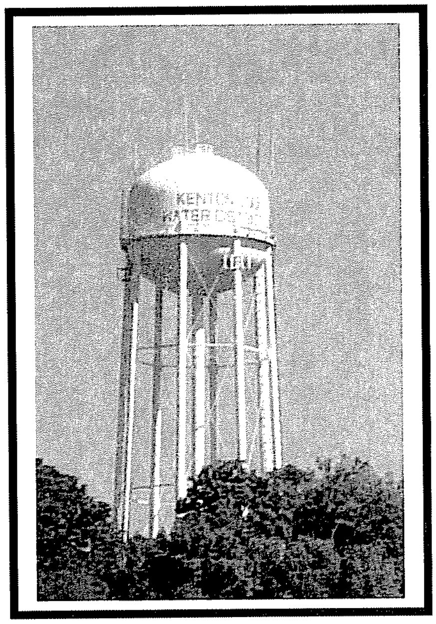
Site Notes:
Trees and brush overhanging fence on 2 sides.
Card reader and facility access gate.
Four security cameras on site.
Fence located within 10 feet of tank.

Miscellaneous Notes:
All valving incorporated as part of the Dudley Pumping Station.

Reviewed By: Daniel Kay Date: 7-2-03

General Information:

Equip Name:	Ida Spence Tank
Tag ID:	IDA-TANK
Capacity:	500,000 Gallons
Type:	Elevated Double Ellipsoidal Style
Construction:	Welded
Construction Date:	1953
Major Rehab Date:	1995



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating systems are in good condition.

Operational History (Note any operational data available):

The Ida Spence Tank was renovated in 1995. Coating systems, guardrails, fall protection devices and climb prevention devices were improved as part of the renovation.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program *Facility: Ida Spence Tank*

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located in dry column.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		SCADA antenna mounted on tank leg.
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Antenna	Multiple antenna mounted on platform and roof.
2)	
3)	
4)	
5)	

Valves:

1) Check Valve 12" ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Buried outside of perimeter fence

2) Gate Valve 12" ☐ Excellent ☒ Good ☐ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

3) ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory
Location:

Site Notes:
Padlock on gate.
Fence overgrown with brush by gate and antenna systems structure.
No lock on the valve vault access hatch.
No site lighting or security cameras.

Miscellaneous Notes:
Intrusion alarm switch on ladder.
Multiple antenna systems structures at tank base.

Reviewed By: Daniel Kay Date: 7-2-03

General Information:

Equip Name:	Independence Tank
Tag ID:	INDE-TANK
Capacity:	1.0 Million Gallons
Type:	Hydropillar
Construction:	Welded
Construction Date:	1982
Major Rehab Date:	1994

Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Safety Devices:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

The coating system is in poor condition.

Operational History (Note any operational data available):

The Independence Tank was renovated in 1994. The renovation was limited to application of new coating systems.

Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program *Facility: Independence Tank*

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located in dry column.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		SCADA antenna mounted on column.
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic Protection	Not activated. Condition unknown.
2) Antenna	One antenna mounted on roof.
3)	
4)	
5)	

Valves:

1) Gate Valve 12"-2 ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: In Column

2) BFV 16" ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: In Column

3) Altitude Valve 12" ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: In Column

Site Notes:
Padlock on gate.
Fence overgrown with brush on corner.
No site lighting.
No security cameras.

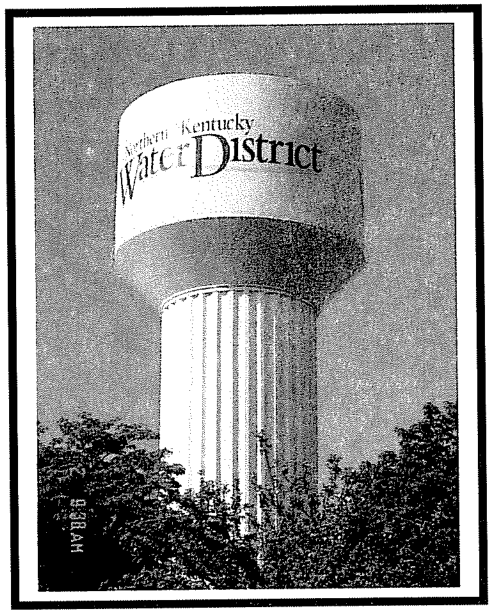
Miscellaneous Notes:
Drain Hydrant located outside of perimeter fence.
Column base used for material storage
Column equipped with monorail hoist.
Interior climb prevention cage incomplete.

Reviewed By: Daniel Kay Date: 7-2-03

Northern Kentucky Water District
Asset Management Program — *Facility: Industrial Park Tank*

General Information:

Equip Name:	Industrial Park Tank
Tag ID:	INDU-TANK
Capacity:	500,000 Gallons
Type:	Hydropillar
Construction:	Welded
Construction Date:	1962
Major Rehab Date:	1996



Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Climb Prevent:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Exterior coating systems are in good condition.

Interior coating systems are in fair condition.

Fall protection devices are in fair condition.

Operational History (Note any operational data available):

The Industrial Park Tank was renovated in 1996. The renovation was limited to overcoating of exterior coating systems.

Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program

Facility: Industrial Park Tank

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located in dry column.

Condition: ☐ Excellent ☐ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		SCADA antenna mounted on column.
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic protection	Not activated. Condition unknown.
2)	
3)	
4)	
5)	

Valves:

1) Gate Valve 12" — ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: Valve Vault

2) BFV 12" - 2 — ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: Valve Vault

3) Altitude Valve 12" — ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: Valve Vault

4) Gate Valve 10" — ☐ Excellent ☐ Satisfactory ☒ Good ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Padlock on gate.
Chain and padlock on valve vault access hatch.
Perimeter fence insulated from adjacent electrical facility fence with 2' wood privacy panel.
No site lighting or security cameras.

Miscellaneous Notes:
No access drive. Access through grass only.

Reviewed By: Daniel Kay Date: 7-2-03

Northern Kentucky Water District
Asset Management Program

Facility: John's Hill Tank

General Information:

Equip Name: John's Hill Tank

Tag ID: JHILLT-TANK

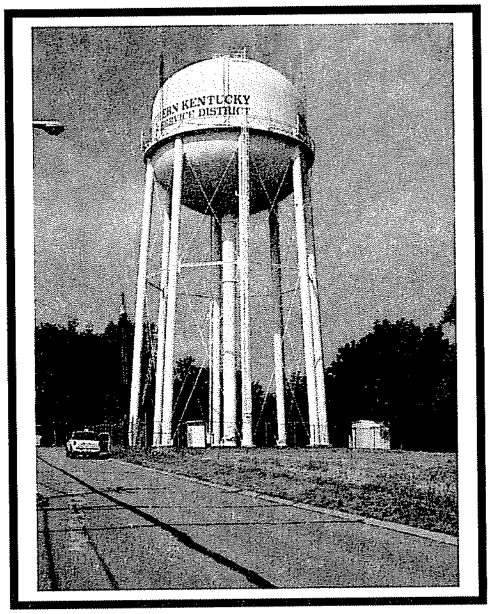
Capacity: 500,000 Gallons

Type: Elevated Double Ellipsoidal Style

Construction: Welded

Construction Date: 1959

Major Rehab Date: 1997



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

The coating system is in good condition.

Operational History (Note any operational data available):

The John's Hill Tank was renovated in 1998. Coating systems, guardrails, access hatches, fall protection and climb prevention devices were improved as part of the renovation.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: Instrumentation Building on site.

Condition: ☐ Excellent ☐ Satisfactory ☒ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic Protection	Not Activated
2) Antenna	Multiple antenna mounted on platform and roof.
3)	
4)	
5)	

Valves:

1) Gate Valve 12" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

2) Check Valve 12" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

3) Gate Valve 8" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: In Column

4) Altitude Valve 8" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Padlock on gate.
Intrusion alarm switch on ladder.
Fence overgrown with brush and trees on approximately 20% of perimeter.

Miscellaneous Notes:
Antenna systems structure located on site.

Reviewed By: Daniel Kay Date: 7-2-03

Northern Kentucky Water District
Asset Management Program

Facility: Kenton Lands Tank

General Information:

Equip Name: Kenton Lands Tank

Tag ID: KEN-TANK

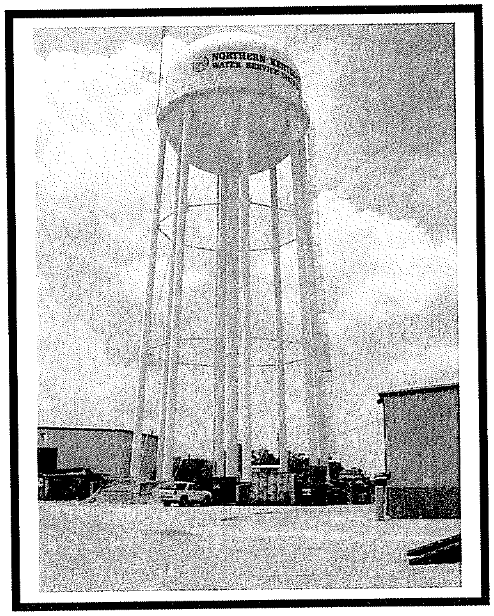
Capacity: 500,000 Gallons

Type: Elevated Double Ellipsoidal Style

Construction: Welded

Construction Date: 1954

Major Rehab Date: 1996



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Tank is located at NKWD maintenance facility.

The coating systems are in good condition.

Operational History (Note any operational data available):

The Kenton Lands Tank was renovated in 1996. Coating systems, guardrails and fall protection devices were improved as part of the renovation.

A new roof vent was installed in 2003.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program

Facility: Kenton Lands Tank

Other Equipment on Site:

Instrumentation Bldg: Instrument building at site.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		
2) Antenna		Antenna mounted on platform and roof.
3)		
4)		
5)		

Equipment:	Comments:
1)	
2)	
3)	
4)	
5)	

Valves:

1) Gate Valve 12" - 2
☐ Excellent ☐ Good
☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

2) Altitude Valve 12"
☐ Excellent ☐ Good
☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

3) Gate Valve 8" - 3
☐ Excellent ☐ Good
☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Card reader access at facility gate.
Maintenance facility garage, storage, parking and structures within close proximity to tank base.

Miscellaneous Notes:

Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program

Facility: Lumley Tank

General Information:

Equip Name: Lumley Tank

Tag ID: LUM-TANK

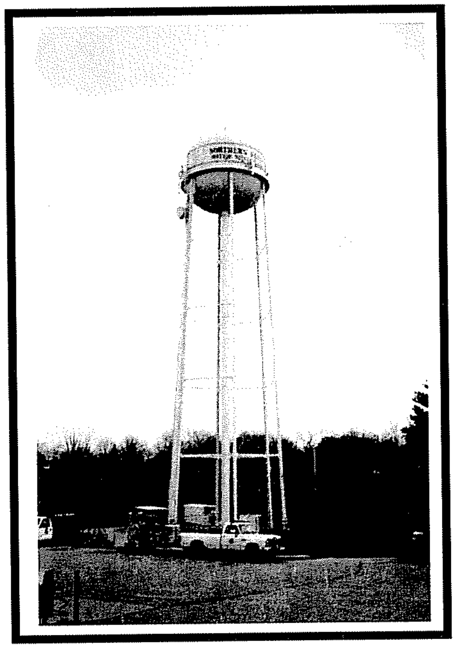
Capacity: 275,000 Gallons

Type: Elevated Double Ellipsoidal Style

Construction: Riveted

Construction Date: 1934

Major Rehab Date: 1999



Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Light corrosion on riser seams and anchor bolts.

Possible leaking at some riser seams.

Operational History (Note any operational data available):

The Lumley Tank was renovated in 1999. The coating systems, ladders, cages, fall protection, And climb prevention devices were improved as part of the renovation.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program

Facility: Lumley Tank

Other Equipment on Site:

Instrumentation Bldg: Instrument building located at site. Valve vault access in Inst. Bldg

Condition: ☐ Excellent ☐ Satisfactory ☒ Fair ☐ Poor

Instruments: Tag ID: Comments:

1) SCADA Inst.
2)
3)
4)
5)

Equipment: Comments:

1) Cathodic Protection — System 4 years old – not activated.
2) Obstruction Lights — System 4 years old / Operating
3) Antennas — Multiple antenna mounted on leg, platform and roof.
4)
5)

Valves:

1) Gate Valve 8" - 2 — ☐ Excellent ☒ Satisfactory ☐ Good ☐ Unsatisfactory
Location: Valve Vault

2) BFV 8" - 2 — ☐ Excellent ☒ Satisfactory ☐ Good ☐ Unsatisfactory
Location: Valve Vault

3) Check Valve 8" — ☐ Excellent ☒ Satisfactory ☐ Good ☐ Unsatisfactory
Location: Valve Vault

4) Altitude Valve 8" — ☐ Excellent ☒ Satisfactory ☐ Good ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Padlock on gate and instrumentation building.
Intrusion alarm switch on ladder.
Two buried valves at base of riser.
Perimeter fence adjacent to antenna systems buildings in fair condition.

Miscellaneous Notes:
Antenna systems buildings located outside of perimeter fence.

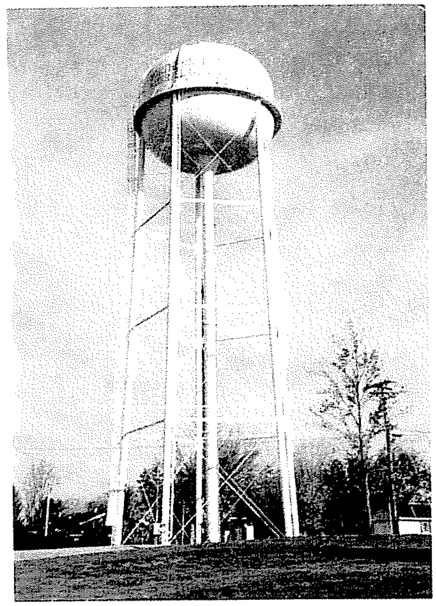
Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program

Facility: Main Street Tank

General Information:

Equip Name:	Main Street Tank
Tag ID:	MAIN-TANK
Capacity:	300,000 Gallons
Type:	Elevated Double Ellipsoidal Style
Construction:	Welded
Construction Date:	1962
Major Rehab Date:	1998



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Operational History (Note any operational data available):
The Main Street Tank underwent renovation in 1998. The coating systems, ladders, cages, fall protection and climb prevention devices were improved as part of the renovation.
A new perimeter fence was installed at the site in 1998.

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program

Facility: Main Street Tank

Other Equipment on Site:

Instrumentation Bldg: None – Instruments located on covered panel at base of riser.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) Cathodic Protection		C.P. System installed & calibrated in 1998. Not activated.
2) SCADA Inst.		
3)		
4)		
5)		

Equipment:	Comments:
1) Hydrant on site.	
2) Antennas – Cellphone	Antenna system's pad and enclosure at base of tank.
3)	
4)	
5)	

Valves:

2) Check Valve 12" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

2) Gate Valve 12" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

2) Altitude Valve 8" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

4) Gate Valve 8" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Padlock on gate.
Fence overgrown with brush at corner.
No site lighting.
No security cameras.

Miscellaneous Notes:
Intrusion alarm switch on ladder.

Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program

Facility: Old St Rt 4 Tank

General Information:

Equip Name: Old St Rt 4 Tank

Tag ID: OLDST4-TANK

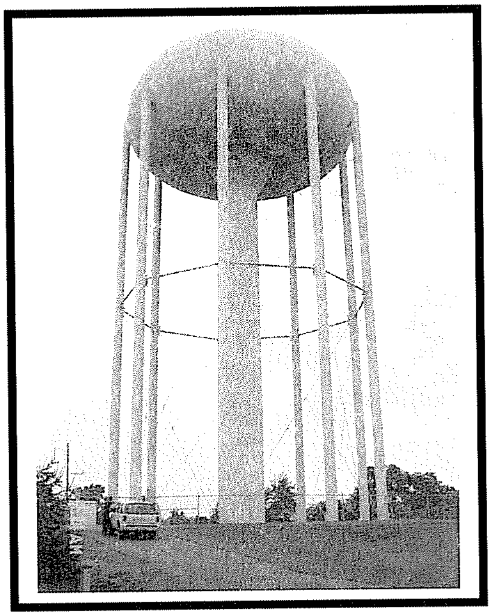
Capacity: 1.0 Million gallon

Type: Elevated Torosphere

Construction: Welded

Construction Date: 1976

Major Rehab Date: None



Corrosion:	☐ Extensive	☒ Moderate	☐ Light	☐ None
Foundation:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Fence:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Site Lighting:	☐ Excellent	☐ Satisfactory	☐ Fair	☒ Poor
Climb Prevent:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Safety Devices:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coatings are chalking and faded. Numerous localized corrosion cells on exterior.
Tank is in need of renovation of coating systems and safety devices.

Operational History (Note any operational data available):

The Old St Rt 4 Tank was removed from service in the Spring of 2003 and the interior of the Bowl and riser was cleaned and abandoned cathodic protection rods removed.

Overall Condition:	☐ Excellent	☐ Good	☐ Satisfactory
	☒ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Other Equipment on Site:

Instrumentation Bldg: On site.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) Turbidity Meter		
2) Ph Meter		
3) Chlorine Analyzer		
4) SCADA Inst.		
5)		

Equipment:	Comments:
1) Cathodic Protection	Not operational. Manufacturer: Harco
2) Drain Hydrant	On site at base of dry riser.
3)	
4)	
5)	

Valves:

1) Valve 12" - 2 ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory

Location: See note below

2) ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory

Location:

Site Notes:

Padlock on gate.
Valves buried on site. One each site of yard hydrant.
No site lighting.
No security cameras.

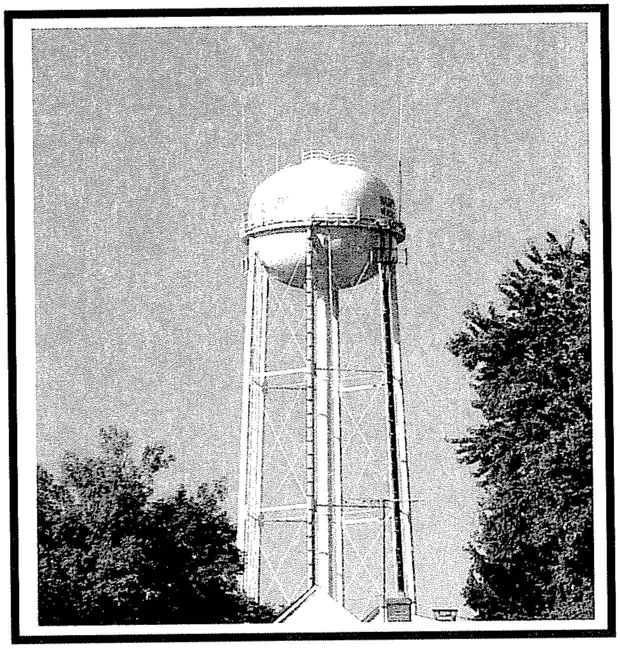
Miscellaneous Notes:

The Old State Route 4 Tank is also known as the South County Tank.

Reviewed By: Daniel Kay Date: 7-1-03

General Information:

Equip Name:	Rossford Tank
Tag ID:	ROSS-TANK
Capacity:	300,000 Gallons
Type:	Elevated Double Ellipsoidal Style
Construction:	Welded
Construction Date:	1958
Major Rehab Date:	1997



Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Safety Devices:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coating systems are in good condition.

Operational History (Note any operational data available):

Rossford tank was painted and renovated in 1997. Ladder safety cages, fall protection and climb prevention devices were improved as part of the renovation.

Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program — *Facility: Rossford Tank*

Other Equipment on Site:

Instrumentation Bldg: On site. Padlock on entry. Intrusion alarm switch on door.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		SCADA antenna mounted on tank leg.
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Obstruction Lights	Operating / Photo sensor controlled.
2) Antenna	Multiple antenna mounted on tank.
3)	
4)	
5)	

Valves:

1) Gate Valve 12" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

2) Check Valve 12" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

3) Altitude Valve 12" — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

4) Gate Valve 8" - 2 — ☐ Excellent ☐ Good ☒ Satisfactory ☐ Unsatisfactory
Location: Valve Vault

Site Notes:
Fence overgrown by brush and trees along approximately 40% of perimeter
Logs piled against fence adjacent to gate.
Poor site lighting.
No security cameras.

Miscellaneous Notes:
Padlock on gate.
Intrusion switches on ladder and instrumentation building door.
Four antenna system buildings on site.

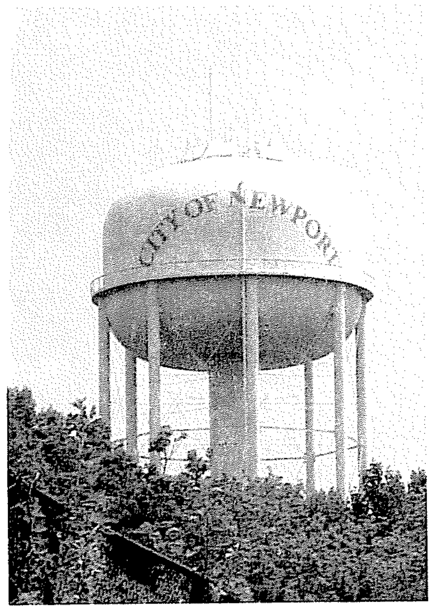
Reviewed By: Daniel Kay — Date: 7-1-03

Northern Kentucky Water District
Asset Management Program

Facility: South Newport Tank

General Information:

Equip Name:	South Newport Tank
Tag ID:	S.NEWPORT-TANK
Capacity:	1.0 Million Gallons
Type:	Elevated Double Ellipsoidal Style
Construction:	Welded
Construction Date:	1972
Major Rehab Date:	



Corrosion:	[ ] Extensive	[ ] Moderate	[X] Light	[ ] None
Foundation:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Fence:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Site Lighting:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Climb Prevent:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Safety Devices:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor

Visual Observations (Note any visible corrosion, concrete spalling/cracking, safety devices, external damage or other items noted during site inspection):

Coatings chalking and faded.

Operational History (Note any operational data available):

Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Northern Kentucky Water District
Asset Management Program

Facility: South Newport Tank

Other Equipment on Site:

Instrumentation Bldg: On Site.

Condition: ☐ Excellent ☒ Satisfactory ☐ Fair ☐ Poor

Instruments:	Tag ID:	Comments:
1) SCADA Inst.		
2)		
3)		
4)		
5)		

Equipment:	Comments:
1) Cathodic Protection	Not activated. Condition unknown. Manufacturer: Harco
2) Antenna	Multiple antenna mounted on tank roof.
3)	
4)	
5)	

Valves:

1) Size/Type unknown ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory

Location: Buried

2) ☐ Excellent ☐ Good ☐ Satisfactory ☐ Unsatisfactory

Location:

Site Notes:

Fence overgrown with brush on approximately 25% of perimeter.

Valves buried on site. Sizes unknown.

Padlock on gate.

Cable with padlock across access drive at street.

Miscellaneous Notes:

Antenna facility on site.

No climb prevention devices.

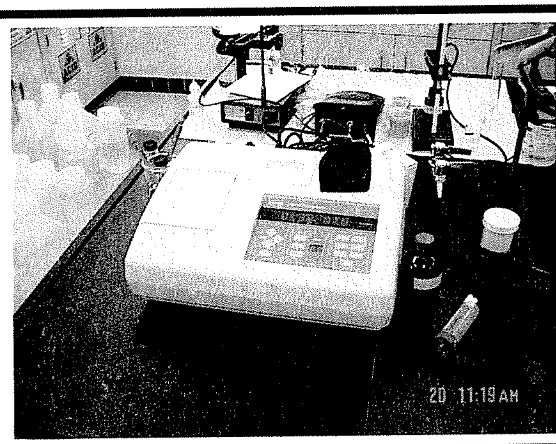
Overflow manhole does not have manhole casting or lid.

Reviewed By: Daniel Kay Date: 7-1-03

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name: Turbidimeter

Tag ID:

Service: Wet Chemistry Lab

Make: Hach

Model: 21 AN

Capacity:

No of Units: 1

Installation Date: 2003

Major Rehab Date:

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:

Equip Name: Spectrometer

Tag ID:

Service: Wet Chemistry Lab

Make: Hach

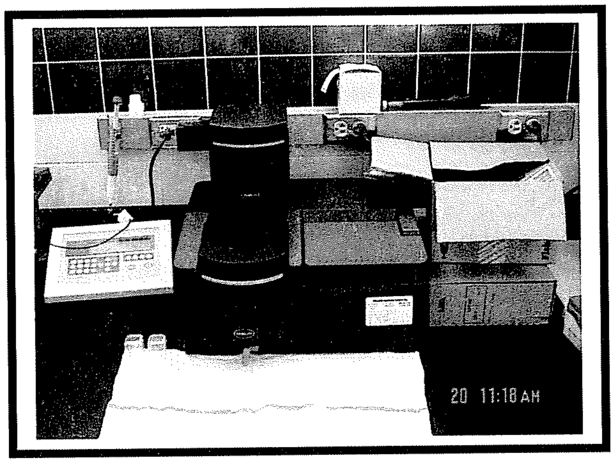
Model: DR4000

Capacity:

No of Units: 1

Installation Date: N/A

Major Rehab Date:



Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:
Actually have 2 of them; however, 1 does not work.

Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:

Equip Name:	pH/Fluoride Meter
Tag ID:	
Service:	Wet Chemistry Lab
Make:	Hach
Model:	Sension 4
Capacity:	
No of Units:	1
Installation Date:	2001
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

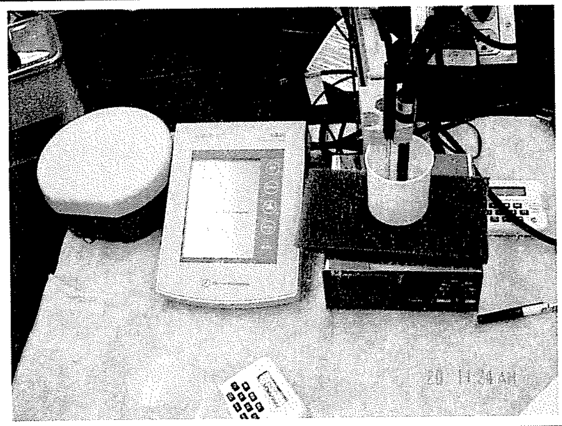
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name:	Conductivity Meter
Tag ID:	
Service:	Wet Chemistry Lab
Make:	Accumet
Model:	AB30
Capacity:	
No of Units:	1
Installation Date:	2003
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Jessica Edwards/ Adam Westermann

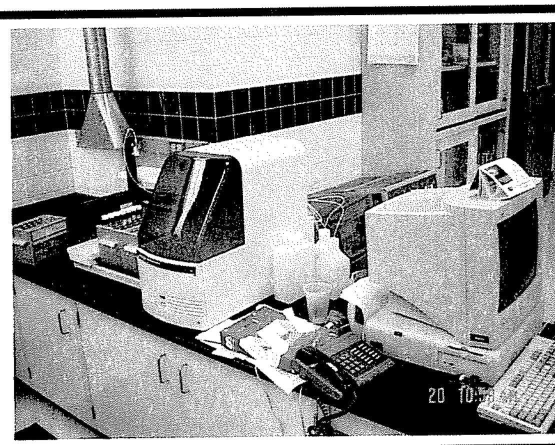
Date: 8/20/2003

Northern Kentucky Water District

Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name:	TOC Analyzer
Tag ID:	
Service:	Organics Lab
Make:	Tekmar Dohrman
Model:	Phoenix 8000
Capacity:	
No of Units:	1
Installation Date:	2000
Major Rehab Date:	

Reliability:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Had to be rebuilt when first installed because of problems. No problems reported now.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

The Phoenix 8000 TOC Analyzer and the Aqua Tek 70 Auto Sampler are not Network accessible.

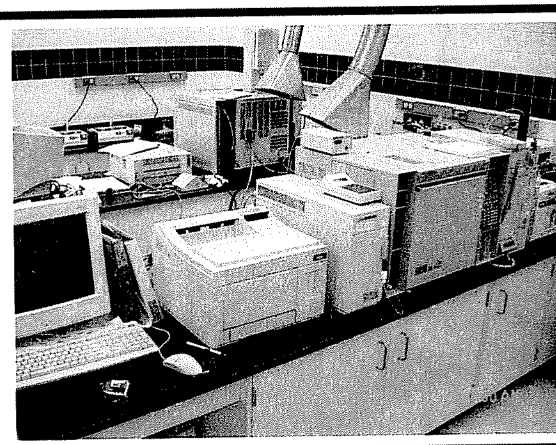
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name: Mass Spectrometer

Tag ID:

Service: Organics Lab

Make: Hewlett Packard

Model: 5972

Capacity:

No of Units: 1

Installation Date: ~1994

Major Rehab Date:

Reliability:	☐ Excellent	☐ Satisfactory	☒ Fair	☐ Poor
Functionality:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Maint Access:	☐ Excellent	☒ Satisfactory	☐ Fair	☐ Poor
Corrosion:	☐ Extensive	☐ Moderate	☐ Light	☒ None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Also at this workstation are the following: HP 5890 GC Series II Plus; HP Purge & Trap; and Tekmar Dohrman Aqua Tek 70 Auto Sampler that was installed in 2000.

Operational History (Note any operational data available):

Possible leak in the Helium line inside the instrument.

Spare Parts Available:	☐ Yes	☒ No	
Overall Condition:	☐ Excellent	☐ Good	☒ Satisfactory
	☐ Unsatisfactory		☐ Inoperable
Vulnerability:	☐ Fatal	☐ Severe	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable
Safety Impact:	☐ Extreme	☐ Significant	☐ Moderate
	☐ Minor	☐ No Impact	☐ Unk/Not Applicable

Notes:

Hewlett Packard is not producing the 5972 Mass Spec anymore. Spare parts are hard to find.

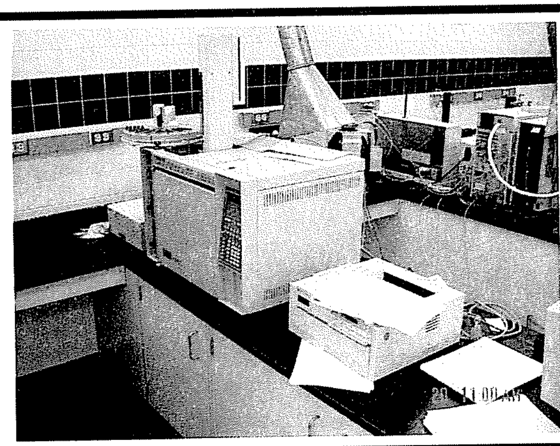
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name: Gas Chromatograph

Tag ID:

Service: Organics Lab

Make: Hewlett Packard

Model: 5890 Series II

Capacity:

No of Units: 1

Installation Date: 1988

Major Rehab Date:

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[ ] Fair	[X] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Also at this workstation was the following: HP 6890 Series Injector and Autosampler

Operational History (Note any operational data available):

Age causes problems. Older software. Is using a rebuilt computer.

Spare Parts Available: [ ] Yes [X] No

Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

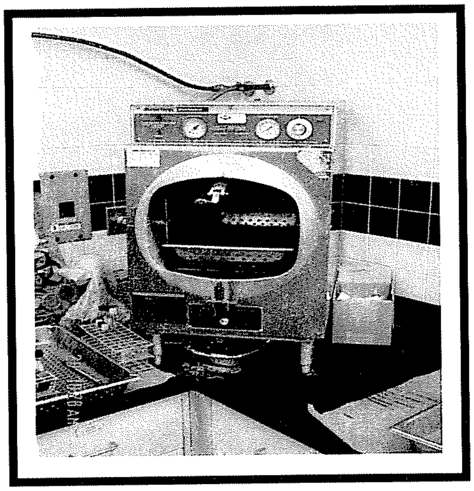
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name: Autoclaves

Tag ID:

Service: Microbiology Lab

Make: Market Forge

Model: Sterilmatic

Capacity:

No of Units: 2

Installation Date: 1994, 1988

Major Rehab Date:

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):
Some operational problems have occurred that have been fixed. Maintained on a yearly basis.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:

Equip Name: CO2 Incubator

Tag ID:

Service: Microbiology Lab

Make: Fisher Scietific

Model: 605

Capacity:

No of Units: 1

Installation Date: 1988

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):
No humidity control available.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

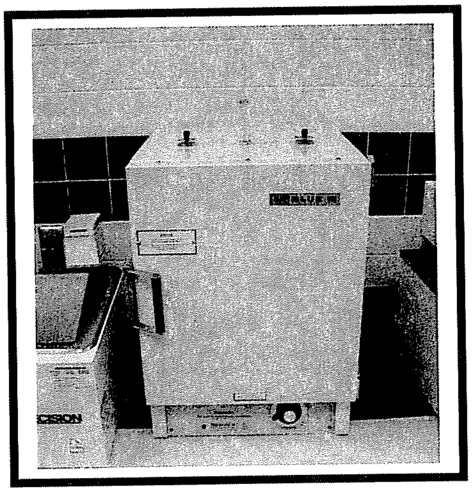
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name:	Incubator
Tag ID:	
Service:	Microbiology Lab
Make:	Blue M
Model:	HPC
Capacity:	
No of Units:	1
Installation Date:	N/A
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

No humidity control available.

Can not get lower temperature.

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Reviewed By: Jessica Edwards/ Adam Westermann   Date: 8/20/2003

General Information:

Equip Name: Centrifuge

Tag ID:

Service: Pathogen Room

Make: Centra

Model: GP8R

Capacity:

No of Units: 1

Installation Date: 1994

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Operational History (Note any operational data available):

Spare Parts Available:	[X] Yes	[ ] No	
Overall Condition:	[ ] Excellent	[X] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

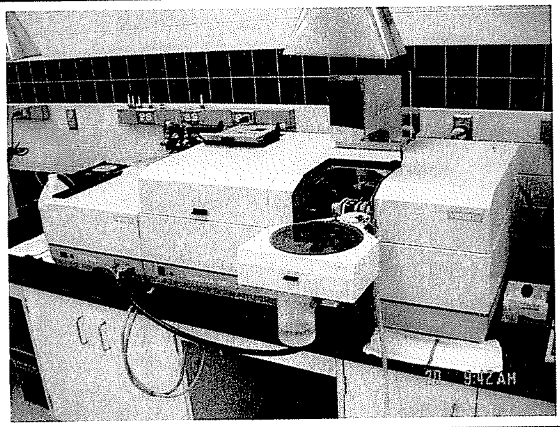
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name: Atomic Adsorption Spectrophotometer

Tag ID:

Service: Inorganics Lab

Make: Varian

Model: Spectra 880

Capacity:

No of Units: 1

Installation Date: 2000

Major Rehab Date:

Reliability:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Also at this workstation were the following: Varian "GTA 100 Furnace and Autosampler"; Computer.

Operational History (Note any operational data available):

The furnace only runs elements individually.

Spare Parts Available: [X] Yes [ ] No

Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Switching from the furnace to the flame is not done often because of spare flame in other equipment. Also cause excess wear and tear and too much time.

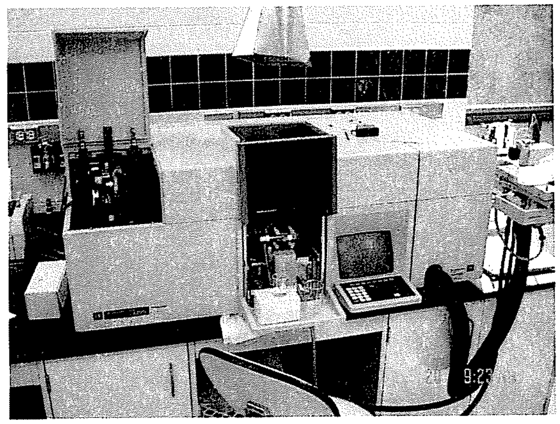
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name:	Atomic Adsorption Spectrophotometer
Tag ID:	
Service:	Inorganics Lab
Make:	Perkin Elmer
Model:	1100B Flame
Capacity:	
No of Units:	1
Installation Date:	~1988
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Also at this workstation were the following: Perkin Elmer HGA700 Furnace; Perkin Elmer AS-70 Autosampler.

Operational History (Note any operational data available):

The furnace does not work and no replacement parts are available. The flame works now, however, no replacement parts are available. The Auto Sampler leaks.

Spare Parts Available:	[ ] Yes	[X] No	
Overall Condition:	[ ] Excellent	[ ] Good	[X] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

Looking at an ICP Mass Spectrometer for replacement.

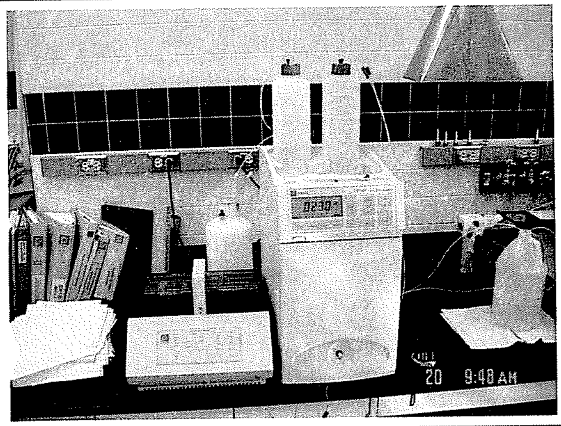
Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

Northern Kentucky Water District
Asset Management Program

Facility: FTTP Laboratory

General Information:



Equip Name:	Ion Chromatograph
Tag ID:	
Service:	Inorganics Lab
Make:	Dionex
Model:	DX-120
Capacity:	
No of Units:	1
Installation Date:	1998
Major Rehab Date:	

Reliability:	[ ] Excellent	[ ] Satisfactory	[X] Fair	[ ] Poor
Functionality:	[X] Excellent	[ ] Satisfactory	[ ] Fair	[ ] Poor
Maint Access:	[ ] Excellent	[X] Satisfactory	[ ] Fair	[ ] Poor
Corrosion:	[ ] Extensive	[ ] Moderate	[ ] Light	[X] None

Visual Observations (Note any visible corrosion, clogging, drive equipment problems, external damage or other items noted during site inspection):

Also at this workstation was the following: Dionex AS40 Automated Sampler - In good condition and Dionex is still producing replacement parts.

Operational History (Note any operational data available):

Spare parts are hard to find for the IC. Dionex does not produce this model anymore.

Spare Parts Available:	[ ] Yes	[X] No	
Overall Condition:	[X] Excellent	[ ] Good	[ ] Satisfactory
	[ ] Unsatisfactory		[ ] Inoperable
Vulnerability:	[ ] Fatal	[ ] Severe	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable
Safety Impact:	[ ] Extreme	[ ] Significant	[ ] Moderate
	[ ] Minor	[ ] No Impact	[ ] Unk/Not Applicable

Notes:

The upgrade IC model has new software that is more user friendly.

Reviewed By: Jessica Edwards/ Adam Westermann

Date: 8/20/2003

APPENDIX B

Water Treatment Regulatory Requirements

APPENDIX B
Water Treatment Regulatory Requirements

The first national regulatory standards addressing drinking water quality were established by the U.S. Public Health Service in 1914. The standards were subsequently revised in 1925, 1942, 1946, and 1962. In 1974, the Safe Drinking Water Act (SDWA) transferred all responsibility for public water supplies to the U. S. Environmental Protection Agency (EPA). EPA later revised the SDWA to regulate a broad spectrum of contaminants. This Appendix B discusses the current, pending, and anticipated future drinking water regulations.

A. Current Regulations

1. Safe Drinking Water Act of 1974

The Safe Drinking Water Act was promulgated in 1974. It mandated that National Primary Drinking Water Regulations be established for a number of chemical, physical, and biological contaminants. The regulations set maximum contaminant levels (MCLs) for individual contaminants and identified treatment technologies that could be used to remove the contaminants.

Following passage of this law, EPA promulgated National Interim Primary Drinking Water Regulations, which became effective in June 1977. These regulations established Maximum Contaminant Levels for ten inorganic chemicals, six organic chemicals, two radioactive categories, turbidity, and coliforms. In 1979, an MCL for trihalomethanes of 0.10 mg/L was added, and in April 1986, EPA promulgated an MCL for fluoride of 4.0 mg/L, and a Secondary MCL (SMCL) of 2.0 mg/L. (While the fluoride SMCL is not a federally enforceable standard, individual State Regulatory Agencies are free to make the SMCL mandatory for public water supplies, which has been directed by KDOW. However, EPA requires water systems which exceed the SMCL to notify their consumers.)

2. 1986 Amendments to the Safe Drinking Water Act

In June 1986, Congress passed comprehensive Amendments to the SDWA which have dramatically affected the operation of virtually every public water system in the United States. These Amendments empowered EPA to set enforceable standards for contaminants in drinking water based on the degree of removal that could be achieved using the "best available technology". EPA was also granted significant regulatory enforcement powers through the use of administrative orders. Thus, EPA was no longer limited to the legal system in its efforts to correct any deficiencies in water supply systems.

The Amendments required EPA to initially develop regulations for a total of 83 contaminants. Additional contaminants were to be added every three years (although the subsequent 1996 Amendments modified this requirement). Specific aspects of several existing regulations promulgated under the 1986 SDWA Amendments are discussed below.

a. Surface Water Treatment Rule. The Surface Water Treatment Rule (SWTR) pertains specifically to those utilities which use surface water sources or groundwater sources "under the direct influence of surface water". Major provisions of the SWTR are as follows:

- Filtered water turbidity is to be equal to or less than 0.5 NTU in 95 percent of the monthly samples collected. The maximum allowable interval between turbidity measurements is four hours.

- The disinfectant concentration in the water entering the distribution system must be at least 0.2 mg/L

- The disinfectant residual within the distribution system must be "detectable" in at least 95 percent of the monthly monitoring samples.

- Removal and/or inactivation of *Giardia* cysts must be at least 3.0 logs (99.9 percent), and removal and/or inactivation of enteric viruses must be at least 4.0 logs (99.99 percent).

b. Lead and Copper Rule. The Lead and Copper Rule, as promulgated during May 1991, establishes "Action Levels" for lead and copper. Based on first-draw samples (i.e., no flushing prior to sample collection) collected at taps within the distribution system, lead and copper concentrations must be less than 0.015 mg/L and 1.3 mg/L, respectively, in ninety percent of the samples. Selected sample sites must consist of single-family residences which:

- contain copper piping with lead solder installed after 1982
- contain lead pipes, or

- are served by a lead service line

Following implementation of state-specified "optimal" treatment techniques to minimize lead and copper concentrations at consumer taps, annual follow-up monitoring is required. If the results of the follow-up monitoring indicated that the system is consistently in compliance with the lead and copper Action Levels, the state may elect to reduce the annual monitoring requirements. Should follow-up monitoring indicate noncompliance, the utility is required to initiate a public education program, collect additional water quality samples, and possibly begin a program of replacing lead service lines.

c. Phase II, Phase V SOC / IOC Regulations. The Phase II regulation for synthetic organic chemicals (SOCs) and inorganic chemicals (IOCs) lists MCLs and Maximum Contaminant Level Goals (MCLGs) for 30 SOCs and nine IOCs. Establishment of limits for three Phase II SOCs (aldicarb, aldicarb sulfone, and aldicarb sulfoxide) has been delayed. (A final rule for aldicarb is not currently expected to be promulgated until August 2005.)

The Phase V regulation lists MCLs and MCLGs for an additional 23 contaminants (18 SOCs and five IOCs). The MCL and MCLG for nickel that was included in the Phase V regulation were remanded by the US District Court during February 1995. Therefore, while utilities must continue to monitor for nickel in their treated water supplies, there currently is no EPA legal limit on the amount of nickel in drinking water supplies. Contaminants regulated under the Phase II and Phase V regulations are primarily volatile organic compounds and pesticides/herbicides.

d. Total Coliform Rule. During June 1989, EPA promulgated revisions to the current regulation governing total coliform levels in water distribution systems. The revised rule expands current coliform monitoring requirements and specifies new MCLs. Compliance with the monthly MCL under the Coliform Rule is determined based on the presence or absence of coliform organisms. The Coliform Rule allows for up to 5 percent of the monthly water quality samples collected within the distribution system to test positive for coliforms. Fecal or *Escherichia* coliform levels are to be monitored for each sample where the presence of total coliforms is indicated. Public notification by electronic media (TV or radio) is required within 72 hours if a positive result indicates the presence of either fecal or *Escherichia* coliforms.

EPA subsequently modified the Total Coliform Rule to allow states to used a variance procedure for utilities encountering nonfecal biofilm problems in their distribution systems. Some coliform species, which are not classified as fecal, produce positive analytical results in total coliform and fecal coliform tests. Under the revised rule, states are allowed to disregard any coliform-positive analytical results that are speciated and not found to be of fecal origin.

3. 1996 Amendments to the Safe Drinking Water Act

The Safe Drinking Water Act was further amended in 1996, primarily to:

- Strengthen preventive approaches such as protecting source waters and providing operator certification.
- Provide consumers with more and better information about their public water systems.
- Implement regulatory improvements regarding contaminant selection, cost-benefits, and application of regulations to small systems.
- Establish a Drinking Water State Revolving Fund to assist communities in installing and upgrading drinking water treatment facilities.

Under the 1986 SDWA Amendments, utilities typically were allowed 18 months to comply with new regulations following their final promulgation. The 1996 Amendments extend the compliance period following promulgation to three years; EPA or individual states may also grant an additional 2 years if it is necessary for utilities to implement significant capital improvements. The 1996 Amendments establish specific schedules for promulgation of new regulations governing disinfection by-products (DBPs), microbial contaminants, arsenic, radon, and disinfection of groundwater supplies, and require EPA and the Centers for Disease Control to conduct a joint study of the potential health impacts of sulfate in drinking water supplies.

4. Stage 1 Disinfection By-Products Rule

Stage 1 of the Disinfection By-Products Rule (DBPR) was finalized during late November 1998, and became effective during January 2002 for systems serving 10,000 or more consumers. The primary objective of this rule is to protect human health by reducing the concentrations of disinfection by-products (DBPs) in drinking water. Major provisions of the Stage 1 DBPR are as follows:

- The MCL for total trihalomethanes has been reduced to 0.080 mg/L.
- New MCLs have been established for total haloacetic acids, bromate (a by-product of disinfection using ozone), and chlorite ion (a by-product of disinfection using chlorine dioxide).
- Maximum Residual Disinfectant Levels (MRDLs) and MRDL Goals (MRDLGs) have been established for free chlorine, chloramine, and chlorine dioxide.
- A treatment technique has been established which requires that surface water systems (or groundwater systems under direct surface water influence) operate in either an enhanced coagulation or enhanced softening mode to achieve specified removals of total organic carbon (TOC).

As stated above, under the Stage 1 DBPR, the MCL for total trihalomethanes has been reduced to 0.080 mg/L. In addition, a new MCL of 0.060 mg/L has been established for total haloacetic acids (referred to as HAA5, as five of the nine known haloacetic acid compounds are regulated under the Stage 1 rule). New MCLs for bromate and chlorite ion of 0.010 mg/L and 1.0 mg/L, respectively, have also been established. Compliance with these MCLs is assessed based on the "running annual average" of quarterly monitoring data.

Under the Stage 1 DBPR, the maximum allowable disinfectant residual in the water leaving the treatment facility, based on a running annual average of monthly monitoring data, is 4.0 mg/L for free chlorine and chloramines, and 0.8 mg/L for chlorine dioxide. (Higher residuals are permissible on a short-term basis if necessary to address specific water quality problems, providing that running annual average concentrations do not exceed the MRDLs.)

A primary goal of the DBPR is to reduce the levels of organic/humic compounds (collectively referred to as DBP precursors) which react with chlorine-based disinfectants to form DBPs. This is to be accomplished through operation of treatment facilities in an "enhanced coagulation" or "enhanced softening" mode, which will typically involve increases in coagulant dosages and/or adjustment of operating pH to optimize the removal of the precursor compounds. Precursor removal is to be quantified by measuring the removal of TOC across the treatment process. In general, for systems with average source water TOC concentrations exceeding 2.0 mg/L, enhanced coagulation/enhanced softening treatment will be required. TOC removals must be determined monthly, and compliance is assessed quarterly based on a running annual average of monthly TOC removals.

Minimum TOC removal levels are summarized in Table B-1.

Table B-1 Step 1 TOC Removal Requirements for Enhanced Coagulation/Enhanced Softening			
Source Water TOC, mg/L	**Percent TOC Removal Required at Indicated Source Water Alkalinity**		
	0 – 60 mg/L	**>60 – 120 mg/L**	**>120 mg/L***
>2.0 – 4.0	35%	25%	15%
>4.0 – 8.0	45%	35%	25%
>8.0	50%	40%	30%
*Systems practicing softening must meet the TOC removals shown in this column.			

The Stage 1 DBP rule also provides alternative compliance criteria that are independent of the criteria which are discussed above. Systems can be exempted from the enhanced coagulation/enhanced softening requirements if any of the following conditions are met:

- The system's source water TOC is less than 2.0 mg/L (calculated quarterly as a running annual average of monthly monitoring data).
- The system's treated water TOC is less than 2.0 mg/L (calculated quarterly as a running annual average of monthly monitoring data).
- The system's source water TOC is less than 4.0 mg/L, the source water alkalinity is greater than 60 mg/L (as $CaCO_3$), and the system is achieving TTHM concentrations less than 0.040 mg/L and HAA5 concentrations less than 0.030 mg/L.
- The system's running annual average TTHM concentration is less than 0.040 mg/L, and annual average HAA5 concentration is less than 0.030 mg/L, when only free chlorine is used for disinfection and maintenance of a residual in the distribution system. (Systems using chloramines would not comply with these conditions.)
- The system's source water specific UV absorbance (SUVA, defined as the ratio of the water's ultraviolet absorbance at 254 nm (UV_{254}) to its dissolved organic carbon (DOC) concentration) prior to any treatment is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average of monthly monitoring data.

- The system's finished water SUVA is less than or equal to 2.0 L/mg-m, calculated on a quarterly basis as a running annual average of monthly monitoring data. (This measurement must be made prior to the addition of a chemical oxidant, which will likely be problematic for most utilities).

Systems that elect to utilize one of these alternative criteria must still conduct monthly monitoring of source water TOC and alkalinity concentrations, and treated water TOC concentrations. Systems practicing lime softening may demonstrate compliance if they meet any of the six alternative compliance criteria listed above, or one of the following criteria:

- Softening that results in a reduction in the alkalinity of the treated water to less than 60 mg/L (as $CaCO_3$), measured monthly and calculated quarterly as a running annual average.

- Softening that results in removal of at least 10 mg/L of magnesium hardness (as $CaCO_3$), measured monthly and calculated quarterly as a running annual average.

Following the first 12 months of TOC removal monitoring, if a system determines that it cannot achieve the required TOC removals specified in Table B-1 on a running annual average basis, and it does not meet any of the alternative compliance criteria listed above, the utility will be required to perform bench-scale or pilot-scale testing to set an alternative TOC removal requirement. (This is referred to as Step 2 testing.) Results of this testing must be reported to the state within three months of failing to achieve the TOC removal percentages presented in Table B-1.

Under the Stage 1 DBPR, water utilities serving more than 10,000 consumers must collect four DBP samples per quarter per treatment plant, and at least 25 percent of these samples must be collected at locations which reflect maximum system residence time. The Stage 1 rule also includes provisions for reduced monitoring if the following conditions are met:

- Source water TOC concentration (prior to any treatment) is less than or equal to 4.0 mg/L (based on a running annual average of monthly TOC data).

- The system annual average TTHM and HAA5 concentrations are less than or equal to 0.040 mg/L and 0.030 mg/L, respectively.

Systems that meet these requirements will be required to collect only one TTHM/HAA5 sample per quarter per plant at a distribution system location considered to reflect maximum residence time. Systems on a reduced monitoring schedule may remain on that schedule as long as running annual TTHM and HAA5 concentrations remain at 0.060 mg/L and 0.045 mg/L, respectively, and the annual average source water TOC concentration remains at 4.0 mg/L or less.

5. Interim Enhanced Surface Water Treatment Rule

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was finalized during late November 1998, and became effective during January 2002 for systems serving 10,000 or more consumers. The rule applies to systems using surface water, or groundwater supplies under the influence of surface water. The primary objectives of this rule are to improve the control of microbial pathogens in drinking water (particularly *Cryptosporidium*), and to guard against significant increases in microbial risk that might occur when systems implement the Stage 1 DBPR. Primary requirements of the IESWTR are as follows:

- Systems with DBP levels exceeding or approaching the Stage 1 MCLs for trihalomethanes and haloacetic acids (0.080 mg/L and 0.060 mg/L, as discussed above) may consider changing their disinfection practices in order to comply with the new limits. However, in an effort to avoid increasing the risk from microbial contaminants while attempting to lower DBPs, EPA will require systems which have annual average DBP concentrations within 80% of the new MCLs (i.e., >0.064 mg/L for TTHMs or 0.048 mg/L for HAA5) for the most recent 12-month monitoring period to prepare a "disinfection profile" for state review prior to altering disinfection practices. The disinfection profile is a compilation of daily criteria that affect the overall efficacy of the disinfection process, collected over a minimum of one year. The average level of microbial inactivation for each month is developed from the disinfection profile, and the lowest monthly average inactivation becomes the disinfection benchmark. A minimum of one year, and a maximum of three years of daily disinfection performance data must be used to develop the disinfection profile. If the State does not approve changes in disinfection, systems must develop alternate ways of reducing DBPs to meet the new MCLs.

- For those systems that do not have four quarters of distribution system HAA5 monitoring data available, HAA5 monitoring must be conducted for four consecutive quarters and completed by March 2000.

- Allowable finished water turbidity is reduced from the present 0.5 NTU allowed under the SWTR to 0.3 NTU. This standard applies to the combined filtered water, and a minimum of 95 percent of the monthly turbidity measurements must meet the revised turbidity criteria. The turbidity of the combined filter effluent cannot exceed 1 NTU at any time. (The current SWTR allows for a maximum filter effluent turbidity of 5 NTU.)

- Continuous turbidity monitoring is required for each individual filter, and specific performance criteria will apply to each filter. Systems must record the results of individual filter turbidity monitoring at 15-minute intervals, and must maintain the records of individual filter performance for a minimum of three years.

- Systems treating surface water (or groundwater under direct surface water influence) and serving more than 10,000 consumers must achieve at least a 2-log (99%) removal of *Cryptosporidium*. (The regulation states that systems that comply with the revised finished water turbidity requirement of 0.3 NTU are assumed to be achieving compliance with the 2-log *Cryptosporidium* removal requirement.)

- States will be required to conduct sanitary surveys for all public water systems (regardless of size) no less frequently than every 3 years.

Under the IESWTR, systems are required to provide "an exceptions report to the State on a monthly basis". Exceptions to be reported consist of the following:

- Any individual filter with a turbidity level greater than 1.0 NTU based on 2 consecutive measurements 15 minutes apart.

- Any individual filter with a turbidity level greater than 0.5 NTU at the end of the first 4 hours of operation, based on 2 consecutive measurements 15 minutes apart.

A "filter profile" is to be produced if "no obvious reason for the abnormal filter performance can be identified". Other requirements are as follows:

- If an individual filter has turbidity levels greater than 1.0 NTU, based on 2 consecutive measurements 15 minutes apart at any time in each of three consecutive months, the water system is required to conduct a self-assessment of the filter utilizing “relevant portions” of guidance issued by EPA under its Comprehensive Performance Evaluation (CPE) program.

- If an individual filter has turbidity levels greater than 2.0 NTU based on two consecutive measurements, 15 minutes apart, at any time in each of two consecutive months, the water system must arrange for a CPE to be conducted by the State or a third party approved by the State. The State will ensure that the recommendations resulting from the CPE are implemented.

Methods for conducting CPEs and individual filter performance assessments are detailed in the April 1999 EPA publication “Guidance Manual for Compliance with the Interim Enhanced Surface Water Treatment Rule: Turbidity Provisions”.

6. Consumer Confidence Reports Rule

As directed by the 1996 SDWA Amendments, all Public Water Systems serving more than 500 consumers will need to prepare annual reports (beginning no later than October 1999) to advise their users of the quality of the distributed water. The reports must contain a specific list of material such as information on the source water, an explanation of terms such as MCLs and MCLGs, data on levels of currently-regulated contaminants in the treated water, and information regarding potential health effects of the contaminants.

7. Secondary MCLs

Secondary Maximum Contaminant Levels (SMCLs) for 13 contaminants were initially established in 1979. Contaminants included in these secondary regulations do not have a direct impact on consumer health; however, if present in excessive amounts, they may affect the palatability and aesthetic quality of the water. SMCLs are not federally enforceable, although state regulatory agencies may elect to promulgate enforceable MCLs for any of the contaminants included in the secondary regulations. The SMCL for fluoride was revised in 1986, and new SMCLs for aluminum and silver were added in 1991.

8. Arsenic

EPA proposed revisions to the current drinking water standard for arsenic during May 2000, and promulgated a new MCL of 0.01 mg/L during January 2001. The new MCL becomes effective 5 years after promulgation, i.e., during January 2006. Some aspects of the rule, such as monitoring and reporting requirements, will be effective prior to January 2006, but the original MCL of 0.05 mg/L will remain effective until January 2006. Utilities must begin providing health information and data on treated water arsenic concentrations in their annual Consumer Confidence Report by July 2002 if the water supply contains more than 0.005 mg/L of arsenic.

Considerable controversy currently surrounds the regulation of arsenic in drinking water supplies, and during March 2001, EPA announced its intention to withdraw this regulation as currently promulgated to allow further review. During July 2001, EPA requested additional comment on whether to set the new arsenic MCL at 0.003, 0.005, 0.010, or 0.020 mg/L. However, on October 31^{st}, 2001, the EPA Administrator announced that the Agency would retain the 0.01 mg/L MCL, and that the original compliance date of January 2006 would not be altered.

9. Radionuclides

Radionuclides normally present problems for systems that treat groundwater from deep wells or that are located downstream from an industrial source of radiation. A proposed rule for several radionuclides (radon, radium, alpha, beta, and photon emitters, and radium) was released in 1991, but not finalized until December 2000. This rule established a new MCL for uranium of 30 ug/L; however, EPA elected to retain the MCLs for radium and alpha, beta, and photon emitters established under the original SDWA in 1976 with no modifications. (The new regulation does include separate monitoring requirements for radium-228 under the combined MCL for radium-226 and radium-228.)

10. Filter Backwash Recycling Rule

The Filter Backwash Recycling Rule (FBRR) was originally proposed concurrently with the LT1ESWTR during April 2000, but was actually promulgated as a separate regulation during June 2001. Provisions of the FBRR addressing in-plant recycling of wastestreams apply to all systems. In addition to filter backwash flows, recycle streams which are covered under this regulation consist of sludge thickener supernatant and flows associated with sludge dewatering processes. Plants which practice recycle of these streams within the treatment plant must return them to a location such that all unit processes of a system's conventional or direct filtration process are employed in the treatment of the recycle flow. (This location will typically be at the plant headworks prior to the addition of coagulant.)

All systems that recycle these flows must submit a plant process schematic to the state regulatory agency for review by December 2003 showing the current recycle return location and the proposed return location that will be used to establish compliance. Data on typical recycle flow rates, maximum recycle flow rates, and the plant design capacity and state-approved maximum operating capacity must also be submitted to the state regulatory agency by December 2003. Systems must also collect and maintain additional information on filter operating data, recycle flow treatment provided, physical dimensions of recycle flow equalization and/or treatment units, and recycle flow rate and frequency data for review and evaluation by the state regulatory agency beginning June 2004.

Public water systems must comply with the recycle return provisions of the FBRR no later than June 2004. If the system requires capital improvements to modify the location of the recycle return, these improvements must be in place and operational by June 2006.

The regulation does not address recycle of filter-to-waste flows. Process solids recycle flows from lime softening and contact clarification units are also not covered by the FBRR. However, softening systems may not return spent filter backwash, thickener supernatant, or liquids from solids dewatering processes to a location that does not incorporate all unit treatment processes.

11. Summary of Current MCLs and SMCLs

Current drinking water standards (MCLs and Maximum Contaminant Level Goals (MCLGs)) are summarized in Table B-2. (Table B-2 includes only currently effective, or "enforceable" MCLs.) Current Secondary Maximum Contaminant Levels are summarized in Table B-3.

Table B-2
Current Drinking Water Standards (as of 10/2003)

Contaminant	Regulation	MCL, mg/L	MCLG, mg/L
Organic Substances			
Acrylamide	Phase II	Treatment Technique	Zero
Alachlor	Phase II	0.002	Zero
Atrazine	Phase II	0.003	0.003
Benzene	Phase I	0.005	Zero
Benzo(a)pyrene	Phase V	0.0002	Zero
Carbofuran	Phase II	0.04	0.04
Carbon tetrachloride	Phase I	0.005	Zero
Chlordane	Phase II	0.002	Zero
2,4-D	Phase II	0.07	0.07
Dalapon	Phase V	0.2	0.2
Di(2-ethylhexyl) adipate	Phase V	0.4	0.4
Di(2-ethylhexyl) phthalate	Phase V	0.006	Zero
Dibromochloropropane (DBCP)	Phase II	0.0002	Zero
p-dichlorobenzene	Phase I	0.075	0.075
o-dichlorobenzene	Phase II	0.6	0.6
1,2-dichloroethane	Phase I	0.005	Zero
1,1-dichloroethylene	Phase I	0.007	0.007
cis-1,2-dichloroethylene	Phase II	0.07	0.07
Trans-1,2-dichloroethylene	Phase II	0.1	0.1
Dichloromethane (methylene chloride)	Phase V	0.005	Zero
1,2-dichloropropane	Phase II	0.005	Zero
Dinoseb	Phase V	0.007	0.007
Diquat	Phase V	0.02	0.02
Endothall	Phase V	0.1	0.1
Endrin	Phase V	0.002	0.002
Epichlorohydrin	Phase II	Treatment Technique	Zero
Ethylbenzene	Phase II	0.7	0.7
Ethylene dibromide	Phase II	0.00005	Zero
Glyphosate	Phase V	0.7	0.7
Haloacetic Acids (total)	Stage 1 DBPR	0.060	-
Heptachlor	Phase II	0.0004	Zero
Heptachlor epoxide	Phase II	0.0002	Zero
Hexachlorobenzene	Phase V	0.001	Zero
Hexachlorocyclopentadiene	Phase V	0.05	0.05
Lindane	Phase II	0.0002	0.0002
Methoxychlor	Phase II	0.04	0.04
Monochlorobenzene	Phase II	0.1	0.1
Oxamyl (vydate)	Phase V	0.2	0.2
Pentachlorophenol	Phase II	0.001	Zero

Table B-2 (continued)
Current Drinking Water Standards (as of 10/2003)

Contaminant	Regulation	MCL, mg/L	MCLG, mg/L
Picloram	Phase V	0.5	0.5
Polychlorinated biphenols	Phase II	0.0005	Zero
Simazine	Phase V	0.004	0.004
Styrene	Phase II	0.1	0.1
2,3,7,8-TCDD (dioxin)	Phase V	3×10^{-8}	Zero
Tetrachloroethylene	Phase II	0.005	Zero
Toluene	Phase II	1	1
Toxaphene	Phase II	0.003	Zero
2,4,5-TP (silvex)	Phase II	0.05	0.05
Organic Substances			
1,2,4-trichlorobenzene	Phase V	0.07	0.07
1,1,1-trichloroethane	Phase I	0.2	0.20
1,1,2-trichloroethane	Phase V	0.005	0.003
Trichloroethylene	Phase I	0.005	Zero
Trihalomethanes (total)	Stage 1 DBPR	0.080	NA
Vinyl chloride	Phase I	0.002	Zero
Xylenes (total)	Phase II	10	10
Inorganic Substances			
Antimony	Phase V	0.006	0.006
Arsenic	Interim	0.05	NA
Asbestos (fibers/L > 10 um)	Phase II	7 million	7 million
Barium	Phase II	2	2
Beryllium	Phase V	0.004	0.004
Bromate	Stage 1 DBPR	0.010	Zero
Cadmium	Phase II	0.005	0.005
Chlorite	Stage 1 DBPR	1.0	0.8
Chromium (total)	Phase II	0.1	0.1
Copper	LCR	Treatment Technique	1.3
Cyanide	Phase V	0.2	0.2
Fluoride	-	4	4
Lead	LCR	Treatment Technique	Zero
Mercury	Phase II	0.002	0.002
Nitrate (as N)	Phase II	10	10
Nitrite (as N)	Phase II	1	1
Nitrate + Nitrite (both as N)	Phase II	10	10
Selenium	Phase II	0.05	0.05
Thallium	Phase V	0.002	0.0005
Radionuclides			
Beta-particle and photon emitters	Interim	4 mrem/yr	Zero
Alpha emitters	Interim	15 pCi/L	Zero
Radium 226 + 228	Interim	5 pCi/L	Zero

Table B-2 (continued)
Current Drinking Water Standards (as of 10/2003)

Contaminant	Regulation	MCL, mg/L	MCLG, mg/L
Microorganisms			
Cryptosporidium	IESWTR	2-log Removal	Zero
Escherichia coli	TCR	Treatment Technique	Zero
Fecal coliforms	TCR	Treatment Technique	Zero
Giardia lamblia	SWTR	Treatment Technique	Zero
Heterotrophic bacteria	SWTR	Treatment Technique	NA
Legionella	SWTR	Treatment Technique	Zero
Total coliforms	TCR	(1)	Zero
Turbidity	SWTR	0.3[2]	NA
Viruses	SWTR	Treatment Technique	Zero

[1]No more than 5 percent of monthly samples may be positive for presence of coliforms.
[2]Performance standard; no more than 5 percent of monthly samples may exceed 0.3 NTU.
DBPR = Disinfection By-Products Rule
IESWTR = Interim Enhanced Surface Water Treatment Rule
LCR = Lead and Copper Rule
SWTR = Surface Water Treatment Rule
TCR = Total Coliform Rule

Table B-3 Current Secondary Drinking Water Standards	
Contaminant	**SMCL**
Aluminum	0.05 - 0.2 mg/L
Chloride	250 mg/L
Color	15 Color Units
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 Threshold Odor Units
pH	6.5 – 8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

B. Pending Regulations

1. Stage 2 Microbial and Disinfection By-Products Rules

As part of the 1996 amendments to the SDWA, Congress established deadlines for promulgation of new regulations governing both disinfection by-products and microbial contaminants. These deadlines include a requirement that EPA promulgate a Stage 2 regulation for disinfection by-products, and a Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). These two rules are closely related and together are referred to collectively as the Stage 2 M-DBP. Like their predecessors, these rules are being developed simultaneously in order to balance trade-offs in risk between the control of pathogens and the desire to limit exposure to disinfection by-products. The Advisory Committee convened by EPA during early 1999 to develop recommendations for implementation of these regulations reached consensus in September 2000 on an agreement to be presented to EPA. The "Stage 2 M-DBP Agreement in Principle" summarized the committee's recommendations for implementation of these rules, and was the basis for EPA's development of the Stage 2 DBPR and the LT2ESWTR. A draft version of the proposed Stage 2 DBPR was made available for comment in November 2001, and both rules were proposed during August 2003, with final promulgation now expected in mid-2005.

a. Stage 2 Disinfectants and Disinfection By-Products Rule. The Stage 2 DBPR requirements will apply to all community water systems and non-transient non-community water systems that add a disinfectant (other than UV) or deliver water that has been disinfected by a primary or residual disinfectant other than UV. This rule will utilize a risk-targeted approach to better identify locations where consumers may be exposed to high levels of disinfection by-products. Key points pertaining to the Stage 2 DBPR are summarized below. (It is emphasized that EPA has requested comment on many of the requirements presented in the proposed rule, and therefore these requirements are subject to change prior to final promulgation.)

Review of disinfection by-product occurrence data obtained under the Information Collection Rule suggested that many systems were achieving compliance with the original TTHM regulation by selecting quarterly monitoring dates to obtain samples that may not be representative of the actual variations in DBP formation that occur through the year. This was often accomplished by avoiding monitoring when water temperatures are warmest and when DBP formation rates are highest. The Stage 2 M-DBP Advisory Committee therefore developed recommendations regarding appropriate monitoring intervals to correct this problem under the Stage 2 rule. As discussed in the proposed Stage 2 DBPR, MCLs for total trihalomethanes and haloacetic acids will remain at the levels established under the Stage 1 rule, i.e., 0.080 mg/L and 0.060 mg/L, respectively. However, monitoring procedures and schedules will be modified to ensure that the data obtained more closely represent actual long-term exposure conditions. Initial compliance efforts will focus on identifying points within the system where DBP concentrations are typically highest, and would involve the following:

- For systems serving 10,000 or more consumers; one year of monitoring of TTHM and HAA5 concentrations at 60-day intervals (+/- 3 days) at 8 additional locations within the distribution system. Systems served by more than one treatment facility would be required to monitor at 8 locations per treatment plant.

  For systems that maintain a free chlorine residual within the distribution system, the 8 monitoring sites per plant would consist of:

  - 1 sample near the distribution system entry point,

- 2 sites considered to reflect "average" system DBP concentrations, and
- 5 sites considered to reflect "maximum" system DBP concentrations

For systems that maintain a chloramine residual within the distribution system, the 8 monitoring sites per plant would consist of:

- 2 samples near the distribution system entry point,
- 2 sites considered to reflect "average" system DBP concentrations, and
- 4 sites considered to reflect "maximum" system DBP concentrations.

This monitoring, referred to in the proposed regulation as the Initial Distribution System Evaluation (IDSE) monitoring study, would be conducted in addition to the quarterly compliance monitoring conducted under the current TTHM regulation and the impending Stage 1 DBPR. A report summarizing the IDSE monitoring results must be submitted to the State/Primacy Agency within two years of promulgation of the Stage 2 DBPR. (The proposed rule includes provisions for exemption from IDSE monitoring requirements, based on low historical system DBP concentrations. It should be noted that alternative approaches to selection of the number of monitoring sites to be utilized during this initial system monitoring are currently being evaluated by the Advisory Committee responsible for development of this regulation. Determination of the number of monitoring sites based on total population served, rather than the number of plants serving the system is one alternative that is reportedly receiving serious consideration.)

- Following completion of the IDSE, systems will recommend new or revised monitoring sites to their State/Primacy Agency based on their ISDE study. Monitoring site locations (four per system if served by a single treatment plant; four per system per plant if served by multiple treatment plants) are to be selected as follows:

  - One location representative of the highest TTHM or HAA5 LRAA from among current Stage 1 DBPR compliance monitoring locations representative of average system residence time.

  - One location representative of highest LRAA HAA5 concentrations identified under the IDSE.

  - Two locations representative of highest LRAA TTHM concentrations identified under the IDSE.

Quarterly monitoring of DBP concentrations at four locations per plant within the distribution system would continue to be conducted for compliance monitoring purposes. At least one quarterly monitoring period would be required to reflect "peak historical" DBP formation level periods, and systems will be required to monitor on a regular schedule of approximately every 90 days. MCL compliance will be determined based on a "Locational Running Annual Average" (LRAA) basis, i.e., a running annual average must be calculated at each monitoring location. Systems will be required to comply with the Stage 2 MCLs in two phases:

- 3 years after promulgation, all systems must comply with locational running annual average MCLs of 0.120 mg/L for TTHMs and 0.100 mg/L for HAA5 at current Stage 1 DBPR monitoring sites, while continuing to comply with the Stage 1 MCLs of 0.080 mg/L for TTHMs and 0.060 mg/L for HAA5. (These are currently being referred to as "Stage 2A" requirements.)

- 6 years after promulgation (with an additional two-year extension available if significant capital improvements are required), large and medium-sized systems must comply with locational running annual average MCLs of 0.080 mg/L for TTHMs and 0.060 mg/L for HAA5 at the approved sampling locations identified under the IDSE. (These are currently referred to as "Stage 2B" requirements.)

Should an MCL be exceeded at one or more system monitoring points (based on annual running average DBP concentrations), the system would be considered to be in violation of the Stage 2 regulation, regardless of results for the remaining monitoring sites. This represents a major change from current TTHM and Stage 1 DBP regulations, as the "system averaging" concept would be eliminated under the Stage 2 regulation.

During Stage 2B, systems that have completed one year of routine monitoring at IDSE sites, and that exhibit TTHM and HAA5 locational running annual average concentrations of no more than 0.040 mg/L and 0.030 mg/L, respectively, at all sites, and annual average source water TOC levels of 4.0 mg/L or less will be allowed to reduce the number of dual DBP samples collected to two per quarter per treatment plant. (For each quarterly sample pair, one sample would need to be collected at a location reflecting maximum TTHM levels, while the remaining sample would need to be collected at a location reflecting maximum HAA5 levels.)

The Stage 2 M-DBP Advisory Committee also recommended that systems document peaks in TTHM and HAA5 concentrations that may occur in their distribution systems as part of the sanitary survey process, and EPA has adopted this recommendation in the proposed Stage 2 DBPR. (Water suppliers objected to an earlier plan to set specific numerical DBP values defining significant excursions, and therefore the proposed rule gives individual state primacy agencies the flexibility to define what constitutes a significant excursion.) EPA has prepared guidance for systems and state primacy agencies on how to conduct peak excursion evaluations and how to reduce peaks. Utilities experiencing these peaks would be required to (1) evaluate system operational practices to identify opportunities to reduce DBP levels, (2) prepare a written report of the evaluation, and (3) review the evaluation with the State regulatory agency.

The following is proposed by EPA in the proposed Stage 2 DBPR as Best Available Technology (BAT) for compliance with the LRAA MCLs when free chlorine is used as the primary and secondary (system residual) disinfectant:

- GAC adsorbers with at least 10 minutes of empty bed contact time and an annual average carbon reactivation/replacement frequency no greater than 120 days, plus enhanced coagulation / enhanced softening.

- GAC adsorbers with at least 20 minutes of empty bed contact time and an annual average carbon reactivation/replacement frequency no greater than 240 days.

- Nanofiltration using a membrane with a molecular weight cutoff of 1000 Daltons or less (or demonstrated to reject at least 80% of the influent TOC concentration under typical operating conditions).

For consecutive systems (i.e., systems that purchase or otherwise receive some or all of their finished water from one or more wholesale systems for at least 60 days per year), the proposed Stage 2 DBPR specifies that BAT is chloramination with management of system hydraulic flow and storage to minimize residence time in the distribution system.

Considerable pressure to reduce the Stage 1 MCL for bromate to 0.005 mg/L or less currently exists, as ongoing research suggests this contaminant may be more carcinogenic than originally believed. This change would primarily impact utilities practicing ozonation for primary disinfection. However, the proposed Stage 2 DBPR recommends that the MCL for bromate remain at the current value of 0.010 mg/L. As recommended by the Stage 2 M-DBP Advisory Committee, EPA would review the bromate MCL as part of the 6-year regulatory review process required under the Safe Drinking Water Act to determine whether the MCL should remain at 0.010 mg/L or be reduced to 0.005 mg/L or lower.

b. Long-Term Enhanced Surface Water Treatment Rule. A long-term Enhanced Surface Water Treatment Rule which extends the IESWTR requirements to systems serving less than 10,000 consumers was promulgated during January 2002 and will become effective during January 2005. (This regulation is referred to as the Stage 1 Long-Term Enhanced Surface Water Treatment Rule, or LT1ESWTR.)

As discussed above, a long-term Stage 2 ESWTR (LT2ESWTR) is expected to be promulgated during mid-2005. This rule will apply to all public water systems that use surface water or groundwater under direct influence of surface water. The primary purpose of this rule is to improve control of microbial pathogens, specifically *Cryptosporidium*. The proposed rule includes an initial period of raw water microbial monitoring, with treatment requirements established based on microbial contaminant levels present in the supply. Utilities serving 10,000 or more consumers and practicing "conventional treatment" (coagulation, sedimentation, and filtration) will be required to conduct monthly monitoring of the raw water for *Cryptosporidium* (using EPA Method 1622/23, minimum 10L samples), *E. coli*, and turbidity over a 24-month period. Specific regulatory compliance requirements will then be established based on the following:

- If monthly samples are collected, classification is to be based on the highest 12-month running annual average.

- If the system conducts monitoring twice per month, classification is to be based on a 2-year mean value of all monitoring data. (This increased monitoring must be conducted at evenly distributed time intervals over the 2-year period.)

Systems serving 10,000 or more consumers must submit a sampling schedule electronically to EPA for approval within 3 months of final rule promulgation, and must complete this monitoring and submit a report summarizing the monitoring results to their State/Primacy Agency within two and one half years of promulgation of this regulation. Samples are to be collected from the raw water supply prior to any treatment, but after any pretreatment processes such as presedimentation basins, off-steam storage, or riverbank filtration. As specified in the proposed rule, systems practicing conventional treatment will be presumed to provide 3.0-log removal of *Cryptosporidium* oocysts. Additional treatment requirements under the LT2ESWTR, based on average raw water *Cryptosporidium* oocyst concentrations, are summarized in Table B-4.

Table B-4
***Cryptosporidium* Treatment Requirements under LT2ESWTR**

Raw Water *Cryptosporidium* Conc., oocysts per Liter[1]	Additional Treatment Required for Conventional Treatment Systems in Full Compliance with IESWTR
Cryptosporidium < 0.075/L	No action required
0.075/L ≤ *Cryptosporidium* <1.0/L	1-log treatment[2]
1.0/L ≤ *Cryptosporidium* <3.0/L	2-log treatment[3]
Cryptosporidium ≥ 3.0/L	2.5-log treatment[3]

[1]Based on maximum value for 12-month running annual average, or 2-year mean if twice-monthly monitoring is conducted.
[2]Systems may use any combination of technologies to achieve 1-log credit.
[3]Systems must achieve at least 1.0-log of total treatment requirement using ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration.

Systems will chose technologies to comply with additional treatment requirements from a "toolbox" of options, including improved watershed control, improved treatment system and/or disinfection performance, and additional treatment barriers. Specific "tools" identified, and associated log treatment credits, as presented in the August 2003 proposed rule, are summarized in Table B-5. It is emphasized that EPA has requested comment on the proposed log credits presented in Table B-5, and may modify assigned credits in the final rule based on comments received.

Table B-5
Microbial Toolbox Options, Log Credits, and Design/Implementation Criteria

Toolbox Option	Proposed Cryptosporidium Log Credit
Watershed Control Program	0.5 log credit for State-approved program comprising EPA specified elements. Does not apply to unfiltered systems.
Alternative Source / Intake Management	No presumptive credit. Systems may conduct simultaneous monitoring of LT2ESWTR bin classification at alternative intake locations or under alternative intake management strategies.
Off-Stream Raw Water Storage	No presumptive credit. Systems using off-stream storage must conduct LT2ESWTR sampling after raw water reservoir to determine bin classification.
Pre-Sedimentation Basin with Coagulation	0.5 log credit with continuous operation and coagulant addition; basins must achieve 0.5 log turbidity reduction based on the monthly mean of daily measurements in 11 of 12 previous months; all flow must pass through the basins. Systems using existing pre-sed basins must sample after basins to determine bin classification and are not eligible for presumptive credit.
Lime Softening	0.5 log credit for two-stage softening (single-stage softening is credited as equivalent to conventional treatment). Coagulant must be present in both stages – includes metal salts, polymers, lime, or magnesium precipitation. Both stages must treat 100% of flow.
Bank Filtration (as pretreatment)	0.5 log credit for 25 ft. setback; 1.0 log credit for 50 ft. setback; aquifer must be unconsolidated sand containing at least 10% fines; average turbidity in wells must be < 1 NTU. Systems using existing wells followed by filtration must monitor well effluent to determine bin classification and are not eligible for presumptive credit.
Combined Filter Performance	0.5 log credit for combined filter effluent ≤ 0.15 NTU in 95% of samples each month.
Roughing Filters	No presumptive credit proposed.
Slow Sand Filters	2.5 log credit as secondary filtration step; 3.0 log credit as a primary filtration process. No prior chlorination.
Second Stage Filtration	0.5 log credit for second separate filtration stage; treatment train must include coagulation prior to first filter. No presumptive credit for roughing filters.
Membranes	Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing.
Bag Filters	1 log credit with demonstration of at least 2 log removal efficiency in challenge test.
Cartridge Filters	2 log credit with demonstration of at least 3 log removal efficiency in challenge test.
Chlorine Dioxide	Log credit based on demonstration of log inactivation using CT table.
Ozone	Log credit based on demonstration of log inactivation using CT table.
UV	Log credit based on demonstration of inactivation with UV dose table; reactor testing required to establish validated operating conditions
Individual Filter Performance	1.0 log credit for demonstration of filter water turbidity < 0.1 NTU in 95% of daily max values from individual filters (excluding 15 min period following backwashes) and no individual filter >0.3 NTU in two consecutive measurements taken 15 minutes apart.
Demonstration of Performance	Credit awarded to unit process or treatment train based on demonstration to the State, through use of a State-approved protocol.

Four years after completion of initial system classification, EPA will initiate a stakeholder process to review available microbial analytical methods and the classification structures. This process will develop the basis for a second round of national assessment monitoring. Six years after completion of initial system classification, systems will be required to initiate a second round of source water monitoring "equivalent or superior to the initial round from a statistical perspective". This process could result in system reclassification (to determine additional treatment requirements for *Cryptosporidium*) under the current regulatory structure, or in promulgation of a revised regulation, which reflects recommended changes, developed during the stakeholder process.

Compliance schedules for the LT2ESWTR will be contingent upon (1) the availability of sufficient analytical capacity at approved laboratories to conduct the required *Cryptosporidium* and *E. coli* analyses, and (2) the availability of software for transferring, storing, and evaluating the results of all of the microbial analyses. If either of these 2 items is determined to be insufficient to support the level of analytical testing required, then monitoring, implementation, and compliance schedules for both the LT2ESWTR and the Stage 2 DBPR will be delayed by an equivalent time period. (Comments by EPA during December 2002 suggest that the Agency believes that both analytical capacity and software availability will be adequate to allow promulgation of this regulation as currently scheduled.)

If the scenario discussed above is promulgated as currently proposed, many utilities practicing conventional treatment may need to begin to think in terms of having a process to provide an additional 1-log to 2.5-log removal/inactivation of *Cryptosporidium* oocysts in operation by mid-2011. (Mid-2013, if significant capital improvements are required, with state regulatory agency approval). Based on current research results, it appears that only ozone and ultraviolet (UV) irradiation are serious contenders for inactivation of *Cryptosporidium* oocysts. (The proposed rule indicates that membrane filtration processes, such as microfiltration and ultrafiltration, are acceptable substitutes for inactivation processes.)

The proposed rule includes disinfection profiling and benchmarking requirements for *Giardia* cysts and viruses similar to those included in the Interim Enhanced Surface Water Treatment Rule that would apply to large surface water systems that are not currently providing 5.5-log treatment for *Cryptosporidium* or (for smaller systems) if disinfection by-product concentrations in the distribution system exceed specified levels. Disinfection profiles must be prepared using weekly *Giardia* and virus log inactivation data over a one-year to three-year period; this data must be representative of inactivation levels provided through the entire treatment facility, and not just for certain treatment segments. Systems serving more than 10,000 consumers will need to begin collecting data needed to develop disinfection profiles within 24 months of promulgation of the LT2ESWTR. The proposed rule does include provisions for utilization of existing ("grandfathered") *Giardia* and virus inactivation data in preparing disinfection profiles, providing that the existing data meets specified requirements.

2. Radon

EPA proposed new regulations for radon during October 1999, and it is anticipated that a final rule will be issued during December 2004. Two alternative compliance approaches were included in the proposed radon rule:

- States can elect to develop programs to address the health risks from radon in indoor air through adoption and implementation of a multimedia mitigation program. Under this approach, individual water systems would be required to reduce radon levels in the treated water to 4,000 pCi/L or lower. EPA will encourage States to adopt this approach, as it is considered the most cost-effective way to achieve the greatest reduction in radon exposure risk.

- If the State elects not to develop a multimedia radon mitigation program, individual water systems will be required to reduce radon levels in their system's treated water to 300 pCi/L, or to develop local multimedia mitigation programs and reduce radon levels in drinking water to 4,000 pCi/L.

Systems with radon levels at or below 300 pCi/L would not be required to treat their water to remove radon. States will likely be granted fairly wide latitude in developing and implementing the multimedia mitigation programs, and it is expected that the programs will differ significantly from state to state. The need for radon treatment will be based on results of quarterly monitoring. If the state regulatory agency commits to the multimedia mitigation and alternative MCL compliance approach within 90 days of final promulgation of the rule, it will be granted an additional 18 months to achieve compliance. Considerable controversy currently surrounds the regulation of radon in drinking water supplies, and modification of this regulation as currently proposed could significantly alter the requirements contained in the final rule.

3. Ground Water Rule

The Ground Water Rule (GWR) was proposed in May 2000, and is currently scheduled for promulgation during mid-2004. Communities that use ground water as a source of drinking water (either for their entire supply or a portion of their supply) are covered under this regulation. (Public water systems that use ground water under the influence of surface water, or that blend ground water with surface water prior to treatment are not affected by this regulation.) A key aspect of the GWR is whether shallow ground water supplies are susceptible to microbial contamination. These supplies will be termed "vulnerable", and disinfection will be required. State-led sanitary surveys will determine if disinfection is necessary.

Other aspects of the proposed Ground Water Rule are as follows:

- Sanitary surveys; to be conducted by the State every 3 years.
- Hydrogeologic Sensitivity Assessment; will apply only to those systems that do not provide disinfection/treatment to achieve at least 4-log removal/inactivation.
- Source Water Monitoring; again, will apply only to those systems that do not provide disinfection/treatment to achieve at least 4-log removal/inactivation.
- Corrective Actions; necessary only for systems found to have significant deficiencies or fecal contamination in the source water.
- Compliance Monitoring; required reporting to the State regarding disinfection concentrations.

4. MTBE

EPA's semi-annual rulemaking agenda published in the May 13, 2002 *Federal Register* indicated that the Agency plans to propose a Secondary Maximum Contaminant Level for MTBE, based primarily on taste/odor concerns. However, the subsequent rulemaking agenda (published in the December 9, 2002 *Federal Register*) indicated that the schedule for proposal and promulgation of an SMCL for MTBE is uncertain at this time.

C. Future Regulations

1. General

In addition to the pending regulations discussed above, there are several additional regulations that will eventually be promulgated under the current SDWA agenda. These rules will be promulgated under the procedures established by the 1996 Amendments to the SDWA, meaning that EPA will no longer establish an MCL for a contaminant based solely on projected health related issues. The Amendments require the use of sound science, and allow for consideration of other factors such as cost, benefits, and competing risks.

2. Drinking Water Contaminants Candidate List

During March 1998, EPA finalized the first Drinking Water Contaminant Candidate List (CCL), which is to be used to set regulatory, research, and occurrence-investigation priorities. This list included 19 chemicals and one microbial contaminant, which the Agency considered as "high priority" with respect to determination of the need to regulate. Since the March 1998 publication of the CCL, EPA narrowed the list of 20 contaminants to a total of 9; these contaminants are summarized in Table B-6. During

Table B-6 Contaminants to be Considered for Future Regulation
Acanthamoeba (guidance for contact lens wearers)
Naphthalene
Hexachlorobutadiene
Aldrin
Dieldrin
Metribuzin
Sodium (guidance)
Manganese
Sulfate

June 2002, the Agency announced its preliminary decision that no regulatory action is needed for these 9 contaminants. A second CCL with no more than 30 contaminants is expected to be published during August 2004.

3. Total Coliform Rule Revisions / Distribution System Rule

As part of the mandated 6-year regulatory review process, EPA announced during July 2003 that it will decline to revise MCLs for 68 contaminants regulated prior to 1997, but that it is considering revisions to the 1989 Total Coliform Rule. These revisions may be expanded into a Distribution System Rule, and may consider issues such as cross connection control, nitrification, impact of biofilms, and the sanitary condition of storage tanks. A proposal to revise this rule, however, is not expected until mid-2006, with final action two years later.

4. Other Rules

Additional rules are likely to be proposed by EPA, but these will primarily address administrative issues such as the reformatting of drinking water amendments, streamlining of public notification requirements, and analytical methods updates. EPA presently plans to defer action on regulation of contaminants such as nickel and atrazine, and has indicated that it likely will not propose a new regulation for aldicarb until August 2004, with a final regulation expected by August 2005.

D. Regulatory Schedule

EPA's current regulatory promulgation schedule is presented in Table B-7. Table B-7 includes both existing and pending/future SDWA regulations. Compliance dates presented in Table B-7 are based on EPA's most recent semi-annual rulemaking agenda and on recent comments by officials involved in the regulatory development process.

Table B-7
Schedule for Promulgation of SDWA Regulations (as of May 2004)

Regulation	Proposed	Final	Effective
Fluoride	11/1985	04/1986	10/1987
8 VOCs (Phase I)	11/1985	07/1987	01/1989
Surface Water Treatment Rule	11/1987	06/1989	06/1993
Coliform Rule[1]	11/1987	06/1989	12/1990
Lead & Copper Minor Revisions	08/1988 04/1998	06/1991 01/2000	01/1992[2] 01/2001
26 Synthetic Organic Contaminants[3], 7 Inorganic Contaminants (Phase II)	05/1989	01/1991	07/1992
MCLs for barium, pentachlorophenol (Phase II)	01/1991	07/1991	01/1993
Phase V Organics, Inorganics	07/1990	07/1992	01/1994
Information Collection Rule (ICR)	02/1994	05/1996	07/1997
Consumer Confidence Reports Rule (CCR)	02/1998	08/1998	09/98
Unregulated Contaminants (monitoring)[4]	02/1999	09/1999	01/2001
Radionuclides (Phase III) – except radon Radon	07/1991 11/1999	12/2000 12/2004	12/2003 12/2007[5]
Disinfectants/Disinfection By-Products Stage 1 Stage 2	 07/1994 08/2003	 12/1998 07/2005	 01/2002[6,7] 07/2011[8]
Interim Enhanced SWTR Stage 1 – Long-Term Enhanced SWTR Stage 2 – Long-Term Enhanced SWTR	07/1994 04/2000 08/2003	12/1998 01/2002 07/2005	01/2002[6] 01/2005 07/2011[9]
Filter Backwash Recycling Rule (FBRR)	04/2000	06/2001	06/2004[10]
Ground Water Rule (GWR)	05/2000	07/2004	07/2007[5]
Arsenic	06/2000	01/2001	01/2006[11]
MCLs for aldicarb, aldicarb sulfoxide, aldicarb sulfone	08/2004	08/2005	08/2008[5]

[1]Revisions expected by 2005; revised TCR may become Distribution System Rule.
[2]Start date for tap monitoring; systems serving more than 50,000 consumers.
[3]MCL, MCLG for atrazine to be reconsidered.
[4]Tiered monitoring approach pending availability of analytical methods.
[5]Assumes regulation in effect 3 years after final promulgation.
[6]For systems serving more than 10,000 consumers.
[7]Effective 01/2004 for groundwater and small surface water systems.
[8]Phased compliance schedule; 07/2011 is projected deadline for compliance with locational TTHM and HAA5 values of 0.080 mg/L and 0.060 mg/L, respectively.
[9]Phased compliance schedule; 07/2011 is projected deadline for compliance with additional *Cryptosporidium* treatment requirements.
[10]Deadline for modifying recycle point location, if required; 2-year extension available if capital improvements required.
[11]Deadline for compliance with revised arsenic MCL.

APPENDIX C

Total Organic Carbon (TOC) Removal Calculations

APPENDIX C
Total Organic Carbon (TOC) Removal Calculations

The following summarizes the total organic carbon (TOC) removal performance for the Fort Thomas, Memorial Parkway, and Taylor Mill Treatment Plants during the period of January 2002 through August 2003.

Table C-1
Fort Thomas WTP TOC Removal Performance

Month/Yr.	TOC, mg/L		Source Alkalinity	% TOC Removal		TOC Removal Ratio		Compliance Basis
	Source	Treated		Provided	Required	Month	Annual	
Jan. 2002	3.42	2.35	85.0	31.3	25	1.25		Step 1
Feb. 2002	2.95	1.55	67.8	47.5	25	1.90		Step 1
Mar. 2002	2.34	1.46	70.0	37.6	25	1.50		Step 1
Apr. 2002	3.11	1.67	55.0	46.3	35	1.32		Step 1
May 2002	2.70	1.88	48.4	30.4	35	1.00		Alternative
Jun. 2002	2.95	2.23	66.7	24.4	25	0.98		Step 1
Jul. 2002	2.36	1.72	78.2	27.1	25	1.08		Step 1
Aug. 2002	2.48	2.05	72.0	17.3	25	0.69		Step 1
Sep. 2002	3.26	2.44	62.0	25.2	25	1.01		Step 1
Oct. 2002	2.39	2.06	67.0	13.8	25	0.55		Step 1
Nov. 2002	2.90	2.22	75.0	23.4	25	0.94		Step 1
Dec. 2002	2.70	1.74	62.0	35.6	25	1.42	1.14	Step 1
Jan. 2003	3.72	1.79	58.0	51.9	35	1.48	1.16	Step 1
Feb. 2003	2.19	1.51	72.0	31.1	25	1.24	1.10	Step 1
Mar. 2003	2.33	1.51	55.2	35.2	35	1.01	1.06	Step 1
Apr. 2003	2.40	1.52	64.1	36.7	25	1.47	1.07	Step 1
May 2003	3.05	2.05	70.8	32.8	25	1.31	1.10	Step 1
Jun. 2003	3.06	2.31	59.9	24.5	35	0.70	1.08	Step 1
Jul. 2003	3.62	2.44	62.4	32.6	25	1.30	1.09	Step 1
Aug. 2003	4.24	2.73	60.0	35.6	45	0.79	1.10	Step 1
Average	2.91	1.96	65.6	32.0				

Table C-2
Memorial Parkway WTP TOC Removal Performance

Month/Yr.	TOC, mg/L		Source Alkalinity	% TOC Removal		TOC Removal Ratio		Compliance Basis
	Source	Treated		Provided	Required	Month	Annual	
Jan. 2002	1.20	1.70	90.0	-41.7	0	1.00		Alternative
Feb. 2002	2.30	1.40	59.0	39.1	35	1.12		Step 1
Mar. 2002	2.30	1.30	63.0	43.5	25	1.74		Step 1
Apr. 2002	2.20	1.20	54.0	45.5	35	1.30		Step 1
May 2002	3.30	2.00	21.4	39.4	35	1.13		Step 1
Jun. 2002	3.65	1.96	73.6	46.3	25	1.85		Step 1
Jul. 2002	2.89	1.54	73.6	46.7	25	1.87		Step 1
Aug. 2002	3.00	1.72	70.0	42.7	25	1.71		Step 1
Sep. 2002	2.66	1.99	70.0	25.2	25	1.01		Step 1
Oct. 2002	2.36	1.60	69.0	32.2	25	1.29		Step 1
Nov. 2002	2.90	1.88	75.0	35.2	25	1.41		Step 1
Dec. 2002	2.70	1.81	62.0	33.0	25	1.32	1.39	Step 1
Jan. 2003	3.72	1.75	58.0	53.0	35	1.51	1.44	Step 1
Feb. 2003	2.19	1.64	72.0	25.1	25	1.00	1.43	Step 1
Mar. 2003	2.33	1.43	55.2	38.6	35	1.10	1.37	Step 1
Apr. 2003	2.40	1.39	64.1	42.1	25	1.68	1.41	Step 1
May 2003	3.05	1.39	70.8	54.4	25	2.18	1.49	Step 1
Jun. 2003	3.06	1.79	59.9	41.5	35	1.19	1.44	Step 1
Jul. 2003	2.76	1.91	61.0	30.8	25	1.23	1.39	Step 1
Aug. 2003	4.24	1.54	60.0	63.7	45	1.42	1.36	Step 1
Average	2.84	1.64	62.7	40.9				

Table C-3
Taylor Mill WTP TOC Removal Performance

Month/Yr.	TOC, mg/L		Source Alkalinity	% TOC Removal		TOC Removal Ratio		Compliance Basis
	Source	Treated		Provided	Required	Month	Annual	
Jan. 2002	2.47	1.56	180.0	36.8	15	2.46		Step 1
Feb. 2002	2.56	1.40	152.0	45.3	15	3.02		Step 1
Mar. 2002	3.25	1.56	137.0	52.0	15	3.47		Step 1
Apr. 2002	3.50	2.06	99.0	41.1	25	1.65		Step 1
May 2002	8.98	2.25	68.2	74.9	40	1.87		Step 1
Jun. 2002	3.40	1.65	59.8	51.5	35	1.47		Step 1
Jul. 2002	4.64	2.38	124.2	48.7	25	1.95		Step 1
Aug. 2002	3.35	1.70	60.0	49.3	35	1.41		Step 1
Sep. 2002	3.96	2.66	92.0	32.8	25	1.31		Step 1
Oct. 2002	4.27	2.35	99.0	45.0	35	1.28		Step 1
Nov. 2002	5.31	2.51	123.0	52.7	25	2.11		Step 1
Dec. 2002	2.64	1.60	127.0	39.4	15	2.63	2.05	Step 1
Jan. 2003	4.04	1.70	114.0	57.9	35	1.65	1.99	Step 1
Feb. 2003	3.06	1.47	148.4	52.0	15	3.46	2.02	Step 1
Mar. 2003	2.54	1.47	103.9	42.1	25	1.69	1.87	Step 1
Apr. 2003	3.08	1.43	115.0	53.6	25	2.14	1.91	Step 1
May 2003	8.56	3.03	110.0	64.6	40	1.62	1.89	Step 1
Jun. 2003	5.77	2.63	124.3	54.4	25	2.18	1.95	Step 1
Jul. 2003	2.71	1.65	63.2	39.1	25	1.56	1.92	Step 1
Aug. 2003	7.44	3.01	92.0	59.5	35	1.70	1.94	Step 1
Average	4.28	2.00	109.6	49.6				

APPENDIX D

Recommendations for Additional Studies Memoranda

APPENDIX D

Recommendations for Additional Studies Memoranda

1. **WATER MAIN REHABILITATION AND REPLACEMENT PROGRAM (August 8, 2003)**
2. **TAYLOR MILL TREATMENT PLANT – DISINFECTION CT COMPLIANCE (September 11, 2003)**
3. **MEMORIAL PARKWAY TREATMENT PLANT – FUTURE DISINFECTION CT COMPLIANCE (September 19, 2003)**
4. **RATE OF ACCEPTABLE MAIN BREAKAGE CRITERIA (September 30, 2003)**
5. **RECOMMENDATIONS FOR ADDITIONAL ANAYTICAL TESTING (October 7, 2003)**
6. **NKWD INFORMATION TECHNOLOGY MASTER PLAN (October 8, 2003)**

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
September 19, 2003

To: Bari Joslyn, Bill Wulfeck, Amy Kramer

From: Larry Gaddis, Doug Elder

Re: Phase 600 – Provide Recommendations for Additional Studies
Memorial Parkway Treatment Plant – Future Disinfection CT Compliance

As part of the Asset Management Program project, Black & Veatch has examined the Memorial Parkway Treatment Plant (MPTP) clearwell for future compliance with disinfection contact time (CT) requirements after the assumed expansion of the plant to a capacity of 20 mgd. This memorandum summarizes the results of that review.

1. Background and Operating Conditions.

The total MPTP clearwell capacity is 3,000,000 gallons at a water depth of 19 feet. A 65 feet diameter "inner wall" divides the clearwell into two separate cells. However, it is our understanding that the valves used to hydraulically segregate the cells cannot be operated and are currently fixed in the open position. Therefore, filtered water flows to both the inner and outer cells and the finished water discharges from both cells. It should also be noted that the inlet and outlet points within the inner cell are separated by less than 50 feet.

The CT compliance calculations performed using the District's spreadsheet utilize a "baffle factor" (the ratio of the T_{10} detention time to the unit's theoretical hydraulic retention time) of 0.3 for the clearwell. The spreadsheet also incorporates a disinfection segment with a volume of 109,200 gallons for interconnecting piping between the filters and the clearwell and for other unspecified volume between the point of chorine addition and the clearwell inlet point. A baffle factor of 1.0 is assumed for this disinfection segment. However, as the accuracy of these volumes cannot readily be verified based on the available information, and as this segment contributes relatively little to the overall disinfection time provided, this segment was ignored in preparing this assessment.

2. Evaluation of CT Compliance Requirements at 20 mgd Plant Flow Rate

Ability of MPTP to comply with disinfection CT requirements under anticipated "worst case" temperature, pH, and flow conditions was evaluated using the "CT Profiler" spreadsheet program. Assumed operating conditions were as follows:

- Clearwell throughput rate = 20 mgd
- 1.0-log *Giardia* cyst inactivation required
- Minimum water temperature = 2 degrees C
- Maximum finished water pH = 7.6
- Effective clearwell volume = 3,000,000 gallons at 19 ft. water depth
- Minimum clearwell operating depth = 11-12 ft.
- Baffle factor (T_{10}/DT ratio) for clearwell = 0.3

Table 1
Chlorine Residual Requirements for CT Compliance

Clearwell Water Depth (feet)	pH	Min. Chlorine Residual (mg/L)	Log *Giardia* Inactivation Achieved
13.0	7.6	1.6	1.03
12.0	7.6	1.7	1.01
11.0	7.6	1.9	1.02
10.0	7.6	2.1	1.03

Flow = 20 mgd
Water Temperature = 2 degrees C

Based on the information presented in Table 1, compliance with CT requirements under "worst case" pH and temperature conditions can be achieved if the clearwell level is maintained at a minimum of approximately 11 to 13 feet. At levels less than 10 feet, chlorine residual requirements may be high enough to produce complaints of excessive chlorine taste and/or odors, particularly for consumers relatively close to the plant site.

3. Verification of Clearwell Baffle Factor

Additional evaluation of clearwell inlet/outlet and operating conditions is necessary to confirm that the use of a 3.0 baffle factor is appropriate for the current reservoir configuration at both the current rated plant capacity and a potential future expanded 20 mgd flow rate. (The relative proximity of the inlet and outlet piping for the inner cell suggest that a factor as high as 3.0 may not be appropriate, based on experience obtained through full-scale testing and modeling of circular clearwells at other facilities.) As hydraulic flow patterns within the clearwell as currently configured cannot be readily determined without conducting tracer testing, the District should consider conducting this testing in order to evaluate actual flow and hydraulic retention time characteristics. Tracer testing could readily be conducted using the step-feed (continuous feed) tracer method, with fluoride as the tracer compound. (The fluoride would be added at the clearwell inlet using the existing feed system.) Testing should ideally be conducted at two to four different throughput rates in order to accurately characterize clearwell flow characteristics.

Cc: Bruce Long
Sid Sengupta

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
August 8, 2003

To: Richard Harrison, Amy Kramer

From: Larry Gaddis

Re: Phase 600 – Provide Recommendations For Additional Studies
Water Main Rehabilitation and Replacement Program

As part of the Asset Management Program project, Ahmad Habibian and Paul Hsiung of Black & Veatch have reviewed the District's Water Main Rehabilitation and Replacement Program (WMR&R). This memorandum provides information for the District concerning preliminary recommendations for the WMR&R that may be helpful in advance of completing the project report. The complete listing of the findings and recommendations, and a description of our evaluation process will be presented in the project report.

The following recommendations have been developed thus far for the District's WMR&R program:

1. Because there are differences in the types of failures typically associated with cast iron and ductile iron mains, the District should attempt to tally and record them distinctly. In general, it appears that the District switched from CIP to DIP in approximately 1965. Therefore, it would be reasonable to classify all iron pipelines installed after 1965 as DIP.

2. The District should attempt to determine the quantity and locations of all unlined cast iron mains and unwrapped ductile iron mains. It is our understanding that poly-wrapping of DIP was started in 1992.

3. The data base maintained by the District is incomplete, missing the installation dates for about 70% of water mains. Because of the significance age plays in the replacement and rehabilitation strategy, this information is considered important. To the extent reasonably practical, it is recommended that the District attempt to estimate when each of lines were installed. This could possibly be

accomplished through review of as-built drawings, checking valve or hydrant cards, or inspecting tax records.

4. The District tracks customer complaints for discolored water, categorizing them into explained and unexplained calls. However, a significant portion of these are considered unexplained (over 80%). In order to better understand the causes of water quality complaints, it is recommended that the District also attempt to record the basis or reason for complaints to the extent they can be determined. This would involve adding another field to the database.

5. The GBA Master Series software used by the District is used for address matching (geocoding) to identify the location of main breaks. However, the address matching does not always produce accurate results. We suggest that the District consider using parcel information for this purpose. The GDT system utilized by most telephone companies and the 911 service may have better data for address matching.

6. The District should proceed with the planned selection of professional services to implement a unidirectional flushing program. Conventional flushing practices are useful for removing some of the loose deposits from the system, but a significant amount of this material is often simply transported to other piping. If the mains are badly tuberculated, the available cross section of the pipe may not be adequate to sufficiently flush out the debris. Unidirectional flushing can address these shortcomings. Unidirectional flushing systematically cleans the piping network from the source to the peripheries of the distribution system.

7. It is recommended that the District consider testing small diameter water meters at a more frequent interval than the current practice of once every ten years.

8. We suggest that the District investigate the cost of installing automated blow-offs on the system instead of the existing manual blow-offs to reduce costs.

9. Pipe leaks are often precursors of main breaks (by eroding the pipe bedding). Therefore, it is recommended that the District consider dedicating one full-time employee to leak detection. Currently leak detection is only performed on an as-needed basis. Although a formal leak detection program would represent a significant investment by the District, and would take a long time to cover the entire system, we believe the costs would be more than offset by locating potential main breaks before they become an emergency situation and helping the District spend water main rehabilitation and replacement dollars where they are most effective.

10. Due to the fairly recent acquisition of the Newport water system, and merger of the two systems that formed NKWD in 1996, it appears that the maintenance personnel serving Campbell and Kenton Counties and Newport are not well-

integrated. Certain staff members have a better understanding of the Kenton system versus Campbell or Newport, or are more knowledgeable about Newport than Campbell or Kenton, etc. The same set of Standard Operating Procedures (SOPs) may not be followed depending upon the area of the system and the personnel involved. Like many other water utilities, a significant portion of the maintenance staff may be close to retirement age. The District should consider implementing some form of knowledge management base through which as much of the existing inherent information related to the system can be recorded, captured, and organized for effective use throughout the NKWD service area.

11. It is recommended that the District consider including cement mortar lining in its specifications for water main rehabilitation in order to improve bid pricing competitiveness and responsiveness. There are a significant number of contractors qualified to perform this type of work, as opposed to epoxy lining, which is relatively specialized.

12. The District should consider the use of trenchless technologies for main replacement/rehabilitation when cost effective. Directional drilling, pipe bursting, and alternative lining methods may be suitable for certain installations, such as highway or railroad crossings, urban locations, and environmentally sensitive areas.

13. To better understand the causes of water main breaks in the system, we recommend that the District begin collecting and analyzing pipe samples (ring and coupon samples) and soil samples. These can be obtained at locations where breaks have occurred and access to the pipe trench is available. Although this would not be practical for all main breaks, if a significant number of samples can be collected we believe it will enable the District to better identify the causes of main breaks. It is recommended that this program be started as soon as possible and continue for at least two years.

14. The District should consider developing a soil corrosivity map for the service area. USDA Soil Survey maps can be used for the basis of this information. Soil samples collected at main breaks can be used to verify the accuracy of the map and make adjustments as necessary.

15. There are two options available to the District to aid in identifying candidate water mains for replacement and rehabilitation; modify the existing NKWD model / database to include additional parameters, or purchase a commercially available software package. It is our experience that most of the models purchased from vendors are inflexible and cannot special needs or customization. Adapting the District's existing system would require programming assistance. However, the in-house model could be as simple as an Excel spreadsheet or Access database. We recommend that the District consider modifying its own model. Good examples which may be used to help develop such a model are those

used by the Louisville Water Company or Black & Veatch. The B&V model includes a cost benefit analysis of replacement versus continuing to repair breaks.

16. In general, the District should allocate more funding for the rehabilitation of unlined CIP. If it is assumed that 50% of the NKWD water mains designated as iron pipe are cast iron, and 50% of those mains are unlined, then the estimated length of unlined cast iron in the system is about 200 miles. A budget of about $2 million per year would enable the District to re-line an average of approximately 10 miles of main per year, thus requiring about 20 years to completely eliminate any unlined piping. Although these assumptions may be somewhat inaccurate, the point is that even with a considerable investment it will take several years for all the unlined piping to be addressed.

17. It is worth noting that at the current rate of replacing cast iron water mains (5 miles per year at a cost of approximately $2.1 million) it will take the District about 80 years, to year 2083, to replace all the cast iron mains, assuming there are roughly 400 miles of cast iron mains. At that time the youngest cast iron main in the system would be 111 years old (installed in 1965). Main replacement should be prioritized based on the frequency of breaks.

18. The District may wish to eventually initiate a program for protection of ductile iron piping; however this is not an urgent or critical need and can be delayed until more pressing issues are addressed. There is a considerable amount of DIP in the system which is not poly-wrapped. Although stronger and more resistive to corrosion than cast iron, ductile iron pipe is typically of thinner wall construction.

19. We believe there would be benefit for the District to establish a utility-wide task force with representatives from the engineering, maintenance, information systems, and customer service areas. The objective of the task force would be to facilitate coordination and appropriate input to the WMR&R program.

20. The District should consider implementing a bar code system for inventory management.

21. The District is currently in the process of utilizing the AWWARF KANEW model for planning long-term R&R strategies. The District should supplement its system data as recommended herein before this model will yield valid results. Once available, the model results can be used to develop funding needs over the next 50 years. These funding needs will form the supporting basis for rate adjustment applications to the PSC. It is recommended that the data collection items described in this memorandum be implemented as soon as possible.

22. Existing steel transmission mains should continue to be replaced.

23. We believe the District would benefit from performing post-rehabilitation evaluations to determine how effective these practices have been. It is suggested that these lines be inspected one year and three years after rehabilitation, and every five years thereafter.

In general, the District is proceeding in an appropriate manner with the WMR&R program. The enhancements recommended herein should further enable NKWD to deal with the related reliability and water quality issues.

Cc: Sid Sengupta

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
September 11, 2003

To: Bari Joslyn, Bill Wulfeck, Amy Kramer

From: Larry Gaddis, Doug Elder

Re: Phase 600 – Provide Recommendations for Additional Studies
Taylor Mill Treatment Plant – Disinfection CT Compliance

In conjunction with the Asset Management Program project, Black & Veatch has examined the District's treatment plants for compliance with relevant requirements for disinfection contact time (CT). In particular, there are aspects of CT compliance for the Taylor Mill Treatment Plant that we believe are worthy of bringing to the District's attention, as described herein.

1. Background and Operating Conditions.

During an initial project meeting between B&V and NKWD on July 7, 2003, District staff expressed concerns regarding the ability of TMTP to comply with disinfection CT requirements at plant production rates exceeding 6 mgd and at water temperatures less than 38 degrees F (3.3 degrees C). Current rated plant capacity is 10 mgd, and staff indicated that minimum historical water temperature is approximately 36 degrees F (2.2 degrees C). Chlorine is initially added at the filter inlet, and a low free chlorine residual (<0.2 mg/L) is maintained at the filter discharge. Additional chlorine is added at the filter discharge to yield a free chlorine residual of 2.0 to 2.5 mg/L at the plant discharge.

Total effective plant clearwell capacity is 700,900 gallons (the clearwell consists of four separate cells, but the cell designated as "Clearwell 1" is not used in the determination of CT compliance, as water from the Fort Thomas Treatment Plant can be intermixed with treated water from TMTP in this cell). The computer spreadsheet used by the District to assess CT compliance indicates that the maximum clearwell depth is 14 feet. A review of CT compliance calculations for February 2000 through May 2003 indicates the following:

- Minimum water temperature during this period was 3 degrees C.
- While the minimum single-day clearwell operating level was 6 feet, clearwell depth was only rarely less than 9 feet.
- "Typical" clearwell operating level was approximately 11 feet.
- The reported CT ratio (i.e., the ratio of the CT value provided to the CT value required) did not comply with the minimum 1.00 requirement for three days during February 2000, and for one day during January 2002.

The CT compliance calculations performed using the current spreadsheet also incorporate a "baffle factor" (the ratio of the T_{10} detention time to the clearwell's theoretical hydraulic retention time) of 0.7. Based on the substantial level of baffling provided within the clearwell, it is our opinion that the 0.7 factor used in calculating T_{10} disinfectant contact times is appropriate.

2. Review of CT Compliance Spreadsheet Calculations.

The current spreadsheet utilized by District staff in assessing CT disinfection compliance is an effective tool for identifying and maintaining treatment conditions that ensure conformity with all applicable disinfection requirements. However, the manner in which the spreadsheet determines the "CT Required" to assess compliance yields reported CT ratios that are considerably lower than are actually being provided by the treatment facilities. The practice of "rounding up" to the next higher pH vs. CT table and of "rounding down" to the next lower temperature vs. CT table results in reported "CT Required" values that may exceed actual requirements by 50% or more.

For example, for January 3, 2002 (compliance with the 1.0 minimum CT ratio was not achieved for this day, based on the District's spreadsheet calculations), at a pH of 7.6, a water temperature of 4 degrees C, and a free chlorine residual across the clearwell of 2.1 mg/L, the indicated "CT Required" is 115 mg-min/L. However, the actual CT requirement for these conditions, as determined using a CT compliance spreadsheet that incorporates EPA-developed equations to calculate the required CT for a given set of pH, temperature, and chlorine residual conditions, is 77 mg-min/L (a 33% reduction in the required CT value). Had the lower "CT Required" value of 77 mg-min/L been used in determining the CT ratio, the plant would have exceeded the minimum required CT ratio of 1.0 by a significant margin. (We calculated a CT ratio of about 1.4 for these conditions.)

It is recommended that the District consider obtaining a commercial CT compliance spreadsheet program that calculates required CTs as a function of specific temperature, pH, and chlorine residual conditions. One such program ("CT Profiler", a Microsoft Excel-based spreadsheet developed by the Utah Division of Water; available for downloading at *http://drinkingwater.utah.gov/blank_forms.htm*) has been used extensively by both utilities and consultants in assessing CT compliance. This spreadsheet can be customized to fit almost any disinfection process configuration, and can assess and plot total *Giardia* cyst log inactivation levels for up to 20 separate "segments" within the treatment process. The resulting monthly summary spreadsheet is also suitable for submittal to state regulatory agencies for compliance monitoring purposes.

3. Evaluation of CT Compliance Requirements at High Plant Flow Rates.

Ability to comply with disinfection CT requirements under anticipated worst case operating conditions was evaluated using the CT Profiler spreadsheet. Assumed operating conditions are as follows:

- Plant flow rate = 10 mgd
- 1.0-log *Giardia* cyst inactivation required
- Minimum water temperature = 2 degrees C
- Typical finished water pH range = 7.3 – 7.5
- Effective clearwell volume = 700,900 gallons
- Min. clearwell operating depth = 6 feet
- "Typical minimum" clearwell operating depth = 9 feet
- Typical clearwell operating depth = 11 feet
- Baffle factor (T_{10}/DT ratio) for clearwell = 0.7

For the purposes of this evaluation, the contribution of the chlorine residual across the filters was not included, as this value is typically very low and does not contribute significantly to the overall CT achieved. Results of this evaluation are summarized in Table 1 below.

Table 1
Chlorine Residual Requirements for CT Compliance

Clearwell Water Depth (feet)	pH	Min. Chlorine Residual* (mg/L)	Log *Giardia* Inactivation Achieved
6.0	7.3	2.7	1.00
6.0	7.5	3.0	1.01
9.0	7.3	1.6	1.00
9.0	7.5	1.8	1.02
11.0	7.3	1.25	1.00
11.0	7.5	1.4	1.02

*Residual as measured at clearwell discharge
Flow = 10 mgd
Temperature = 2 degrees C
No credit for available CT across filters is assumed.

Based on the information presented in Table 1, compliance with CT requirements under anticipated "worst case" flow and temperature conditions should be readily achieved if the clearwell level is maintained at a minimum of approximately 9 feet. At levels less than 8 to 9 feet, required chlorine residual requirements may be high enough to produce complaints of excessive chlorine taste and/or odors, particularly for consumers relatively close to the plant site. As required chlorine residual concentrations will also increase with increasing pH, addition of sulfuric acid to maintain pH within the 7.3 to 7.5 range (or lower) would be beneficial with respect to CT compliance, particularly when clearwell water depths are less than 8 to 9 feet.

Cc: Bruce Long
Sid Sengupta

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
September 30, 2003

To: Richard Harrison, Amy Kramer

From: Larry Gaddis, Ahmad Habibian

Re: Phase 600 – Provide Recommendations for Additional Studies
Rate of Acceptable Main Breakage Criteria

The purpose of this memorandum is to provide information and help develop criteria for the acceptable number of water main breaks in the NKWD distribution system. Such criteria are important to ensure that the District is maintaining the system at an appropriate level and to evaluate its condition.

It should be noted that there are no nationally accepted criteria or standards for the suitable amount of main breakage. Utilities often develop such criteria based on the specific condition and circumstances of their system and the level of service they strive to maintain. Nevertheless, there is some data available through the industry that may be useful as a basis for developing these criteria.

Based on the analysis of historical main break information from various water systems, the AWWARF's "Distribution System Performance Evaluation" report recommends that 25 to 30 breaks per 100 main miles per year is a "reasonable" goal for water systems in North America. The report continues to say that depending on the nature of the problems and remediation costs involved, each water system should set its own goal.

In another study performed by the National Research Council (NRC) of Canada, the historical break rate from 21 Canadian cities was analyzed and further delineated by material type as shown in Table 1.

Table 1 Canadian Water Main Break Rates By Material Type	
Material Type	Break Rate (Break/100 Miles/Year)
Cast Iron	57.4
Ductile Iron	15.2
AC	9.3
PVC	1.1
Weighted Average	33.5

The weighted average break rate from the NRC report is consistent with the recommendations of the AWWARF study. The recommendation results in a system which is slightly better than average (i.e. 25 to 30 breaks per 100 miles per year as compared with an average of 33.5 breaks per 100 miles per year). NKWD can use this data to help select an appropriate break rate threshold that meets its goals and desires.

While the average break rate concept is a useful tool in gauging the overall health of the system, it should not be used as criteria for replacing water mains except in a very general way. As was discussed in a previous project memo, a model should be developed which considers many factors such as pipe material, age, diameter, soil type, etc.

Cc: Sid Sengupta

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
October 7, 2003

To: Bari Joslyn, Bill Wulfeck, Amy Kramer

From: Larry Gaddis, Doug Elder

Re: Phase 600 – Provide Recommendations for Additional Studies
Recommendations for Additional Analytical Testing

Black & Veatch's review of recent NKWD water quality monitoring for the distribution system served by the District's three water treatment facilities indicates that measures to reduce concentrations of disinfection by-products will be required in order to comply with the Locational Running Annual Average (LRAA) provisions of the impending Stage 2 Disinfection By-Products (DBP) Rule. This memorandum summarizes recommendations for additional testing that the District should consider conducting to evaluate the ability of enhanced coagulation and granular activated carbon adsorption to assist in achieving compliance with the Stage 2 DBP requirements.

1. Bench-Scale Testing at Fort Thomas Treatment Plant.

Review of total organic carbon (TOC) removal data for the Fort Thomas and Memorial Parkway plants indicates that Memorial Parkway is achieving a higher level of TOC removal than Fort Thomas. As discussed during Workshop No. 2 on August 28, it is believed that the higher level of TOC removal being realized at MPTP may be attributed to increased reliance on ferric sulfate for coagulation, and to the lower coagulation pH maintained (typically pH 6.5 to 6.9 at MPTP, vs. pH 7.3 to 7.6 at FTTP).

It is therefore recommended that the District initiate bench-scale testing to evaluate the impact of both reduced coagulation pH and increased ferric sulfate dosages on TOC removal at the Fort Thomas plant. The NKWD Water Quality Laboratory is well-equipped to conduct this testing, and can perform all required analyses in-house. The testing should be conducted as follows:

- For current "typical" coagulant dosages, evaluate the impact of reduced coagulation pH on TOC removal efficiency and finished water DBP concentrations (both total trihalomethanes and haloacetic acids). This can be accomplished by adding sulfuric acid to achieve coagulation pH levels in the 6.0 to 6.5 range.

- Evaluate TOC removal efficiency and finished water DBP concentrations as a function of ferric sulfate dosage, both with and without sulfuric acid addition to achieve coagulation pH levels of approximately 6.5 or lower. (For this evaluation, polyaluminum chloride should not be added to the samples.)

- The testing described above should be repeated with addition of powdered activated carbon (PAC) at dosages of approximately 10 mg/L and 20 mg/L in order to assess benefits of PAC addition on finished water TOC and DBP concentrations.

DBP analyses should be conducted using chlorinated sample holding times of 3 days and 7 days (ultimate DBP formation potential). Detailed procedures for conducting enhanced coagulation testing can be found in the EPA publication "Enhanced Coagulation and Enhanced Precipitative Softening Guidance Manual" (EPA 815-R-99-012, May, 1999). Prior to initiating this testing, a detailed testing protocol that delineates all required testing procedures and analytical requirements should be prepared. Black & Veatch can assist in the preparation of this testing protocol, and/or in conducting the actual testing if desired.

2. Evaluation of GAC Adsorption.

The proposed Stage 2 Disinfection By-Products Rule (August 2003) lists the following treatment methodologies as "best available technology" for achieving compliance with the DBP MCLs at individual monitoring sites:

- Granular activated carbon (GAC) adsorbers with at least 10 minutes empty bed contact time (EBCT) and an annual average carbon replacement/regeneration frequency no greater than 120 days, plus enhanced coagulation.

- GAC adsorbers with at least 20 minutes empty bed contact time (EBCT) and an annual average carbon replacement/regeneration frequency no greater than 240 days, plus enhanced coagulation.

- Nanofiltration (NF) using a membrane with a molecular weight cut off of 1000 Daltons or less (or demonstrated to reject at least 80% of the influent TOC concentration under typical operating conditions).

Pilot-scale evaluation of membrane treatment previously conducted by the District suggests that membranes will likely not be a viable long-term treatment technique for achieving compliance with the Stage 2 DBPR requirements. It is therefore recommended that the District initiate testing of GAC adsorption at the Fort Thomas plant to evaluate DBP precursor compound removal capabilities, using either conventional GAC pilot filters or Rapid Small Scale Column Test (RSSCT) procedures. (The RSSCT method can produce results equivalent to those obtained using conventional GAC pilot filters, but testing can be completed in a fraction of the time typically required for conventional pilot filter assessments, thereby allowing a broader spectrum of operating and water quality conditions to be evaluated within a relatively short testing period.)

DBP precursor compound removal as a function of GAC contactor operating time should be assessed based on results of contactor influent and discharge TOC concentrations and DBP formation potentials (3-day and 7-day) for the GAC-treated water at regular intervals throughout the contactor/column run. It is recommended that testing to assess performance at EBCTs of both 10 minutes and 20 minutes be conducted. Source water for GAC pilot column and/or RSSCT testing should be the settled water prior to addition of chlorine.

While RSSCT testing can be performed by carbon manufacturers and some contract analytical laboratories, using settled/filtered water samples provided by the District, the District's laboratory at the Fort Thomas plant is equipped to perform all of the required TOC and DBP analyses, and could therefore conduct the GAC testing in-house if desired. Prior to initiating this testing, a detailed testing protocol should be prepared.

3. Assessment of DBP Formation Potentials

Concerns have been expressed regarding the potential for non-compliance with MCLs for disinfection by-products within the system served primarily by the Memorial Parkway plant, should future increases in system demands result in the need for expanded utilization of this treatment facility. The Memorial Parkway plant treats the same source water as currently treated at the Fort Thomas plant, using similar treatment technologies (coagulation, sedimentation, filtration, primary/secondary disinfection with free chlorine). It is therefore reasonable to assume that future DBP compliance difficulties similar to those anticipated for the Fort Thomas plant could be experienced if increased demands and/or expansion of service areas result in longer hydraulic detention times within the system served by the Memorial Parkway plant.

It is therefore recommended that the District consider conducting DBP formation potential testing for the finished water produced at the Memorial Parkway plant in order to assess the potential for compliance difficulties as system hydraulic retention times increase. This testing should ideally be conducted in conjunction with quarterly system DBP monitoring in order to facilitate comparison of current system DBP concentrations and potential DBP formation levels at increased system detention times. This testing should be conducted on finished water produced at the Memorial Parkway plant, with TTHM and HAA5 concentrations determined for samples held for 1, 3, and 7 days. (Results for samples held for 7 days should reflect maximum DBP formation potentials.) Free chlorine residual concentrations should also be recorded for each sample analyzed. (As a free chlorine residual must be present in the samples in order for the DBP formation potential test to be valid, experience may indicate that additional chlorine will need to be added initially to the finished water samples in order to ensure that a free chlorine residual is present after 7 days.)

Cc: Sid Sengupta

BLACK & VEATCH

MEMORANDUM

Northern Kentucky Water District
Asset Management Program

B&V Project 135208.100
B&V File B
October 8, 2003

To: Richard Harrison, Bari Joslyn, Amy Kramer

From: Larry Gaddis, Peggy Howe

Re: Phase 600 – Provide Recommendations for Additional Studies
NKWD Information Technology Master Plan

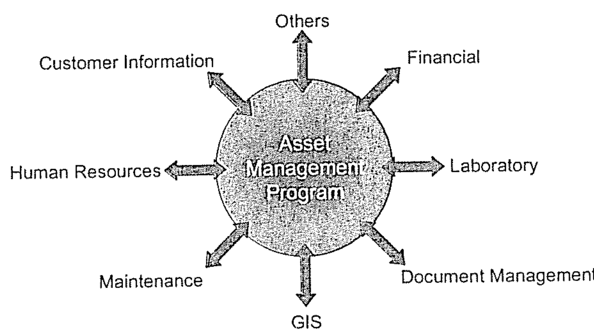
Through the course of conducting the Asset Management Program, Black & Veatch has examined several aspects of the District's operations, some of which involved components of the hardware and/or software systems currently being utilized. In addition, the AMP project itself included a software element, with the AWWARF "Water Treatment Plant Infrastructure Assessment Manager" program. This memorandum provides recommendations related to the software systems and a proposed Information Technology (IT) Master Plan.

One of the deliverable items from the AMP is the populated AWWARF software database. The objective of that software is to assist users in organizing, conducting, and recording the results of a water treatment plant condition assessment. The current version of the software provides for assets inventory and condition information. The relative importance of each unit, system, and subsystem is based upon engineering judgment as it pertains to its impact on the plant's ability to produce water. The combination of the condition assessment and the importance rating provides the program with the parameters needed to generate a prioritized list of capital requirements. The current program has shortcomings in consistently generating the same prioritization. Proposed upgrades may correct the prioritization issue, incorporate some financial data, and allow for the import and export of data.

The AWWARF software is limited to addressing "above ground" assets such as the treatment plants and pumping stations. It does not have the capabilities to include "below ground" assets such as water mains, valves, and service connections. Although the proposed upgrades will address some financial issues, it is our understanding that they will not seamlessly integrate with the District's existing financial systems.

In addition to the AWWARF software, the District is in the process of procuring and implementing a new Customer Information System (CIS). The CIS specifications recognize the need for sharing with the District's financial and technical IT applications. These recent software procurements combined with other ongoing functions (GIS and preventive maintenance) have prompted the District to investigate the compatibility of all existing and proposed IT applications. Such compatibility can be reviewed and commented upon in an IT Master Plan. The District should strongly consider the preparation of an IT Master Plan, either as a continuation of the AMP or as a stand-alone project. Performing such a Master Plan as part of the next phase of Asset Management would offer some advantages in not only ensuring that the District's software is integrated, but also in allowing the District to utilize the data in a manner that considers all aspects of operating a utility (i.e., asset management).

A comprehensive asset management program provides the information needed to make effective decisions while minimizing operating costs and capital investments. The reliability of such information is dependant upon accurate and consistent data. When more than one software application uses the same data, consistency is an issue if the applications do not seamlessly communicate with one another. For example, data about a distribution main present in the GIS application should be consistent with maintenance records of that main, the customers connected to that main (CIS), complaints logged about the main (CIS), and continuing property records in the financial systems. Knowledge about the condition of such a main, the number of service calls, the investment in the main, and the condition assessment can provide needed information for decision makers to choose between repair or replacement and the corresponding timing of the capital expenditure. An asset management program, as illustrated in the figure at right, incorporates data from all utility sources, defines and optimizes processes and procedures governing the use of the data, and quantifies the targets and benchmarks which will move a utility towards improved performance.



The District has existing a potential IT "backbone" for the development of a comprehensive asset management program. It is currently using George Butler Associates, Inc. (GBA) software, which has the following modules:

- Work Master
- Equipment Master
- Water Master
- Inventory Master
- GIS Tools

The above modules are well-suited to tracking above- and below-ground assets in terms of depreciation, inventory, etc. and sharing whatever individual fields or rolled-up tables are required for financial tracking. The GBA modules use an SQL database, which should make interfacing easy. In addition, GBA has user-configurable interfaces, so that any desired calculations can be done behind the scenes.

Continuing the asset management activities the District has begun, including a master plan for information technology, should address the interface between existing software, including GBA, ALLMAX and Great Plains, and also identify any additional needs the District may have.

Cc: Sid Sengupta

APPENDIX E

Water Main Replacement and Rehabilitation Tables and Figures

APPENDIX E

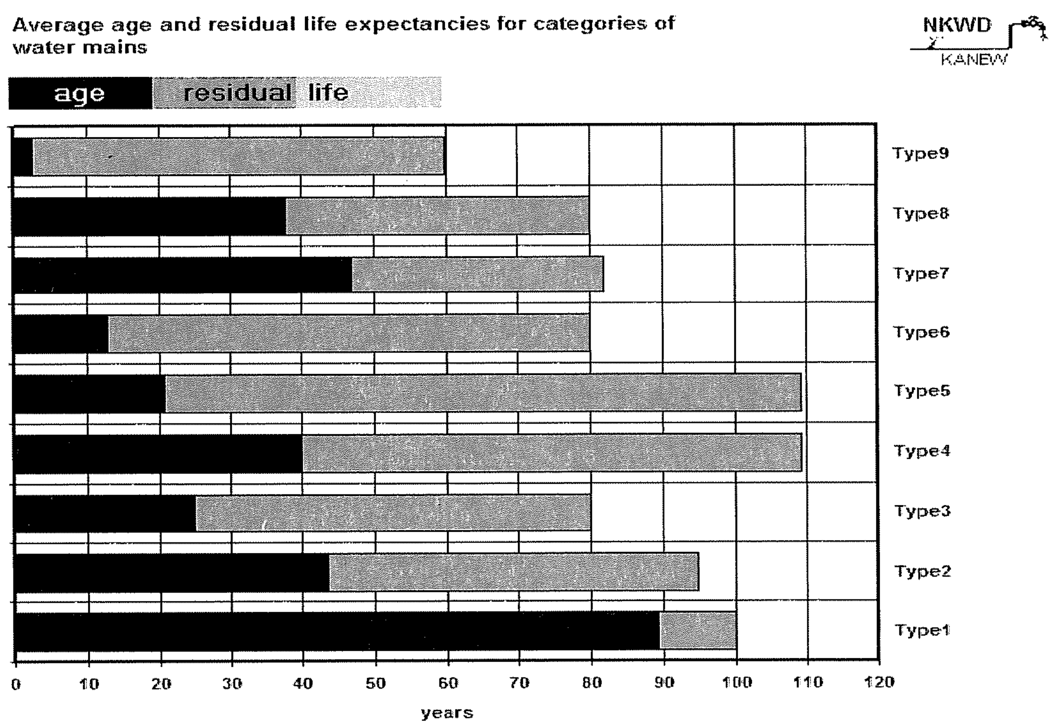
Water Main Replacement and Rehabilitation Tables and Figures

The information in this Appendix E was provided by NKWD.

*Table 1: Categories of Water Mains

Type	Description	Life Expectancy (yrs)		
		100%	50%	10%
Type 1	Cast iron installed before 1935 - unlined	80	90	100
Type 2	Cast iron installed after 1935 - lined	85	95	105
Type 3	Concrete	50	80	100
Type 4	Copper	90	110	120
Type 5	Ductile Iron	90	110	120
Type 6	PVC	50	80	100
Type 7	Steel	50	80	100
Type 8	Transite	50	80	100
Type 9	Relined Main	30	60	80

*Figure 1: Average Age and Life Expectancies of Water Mains by Category



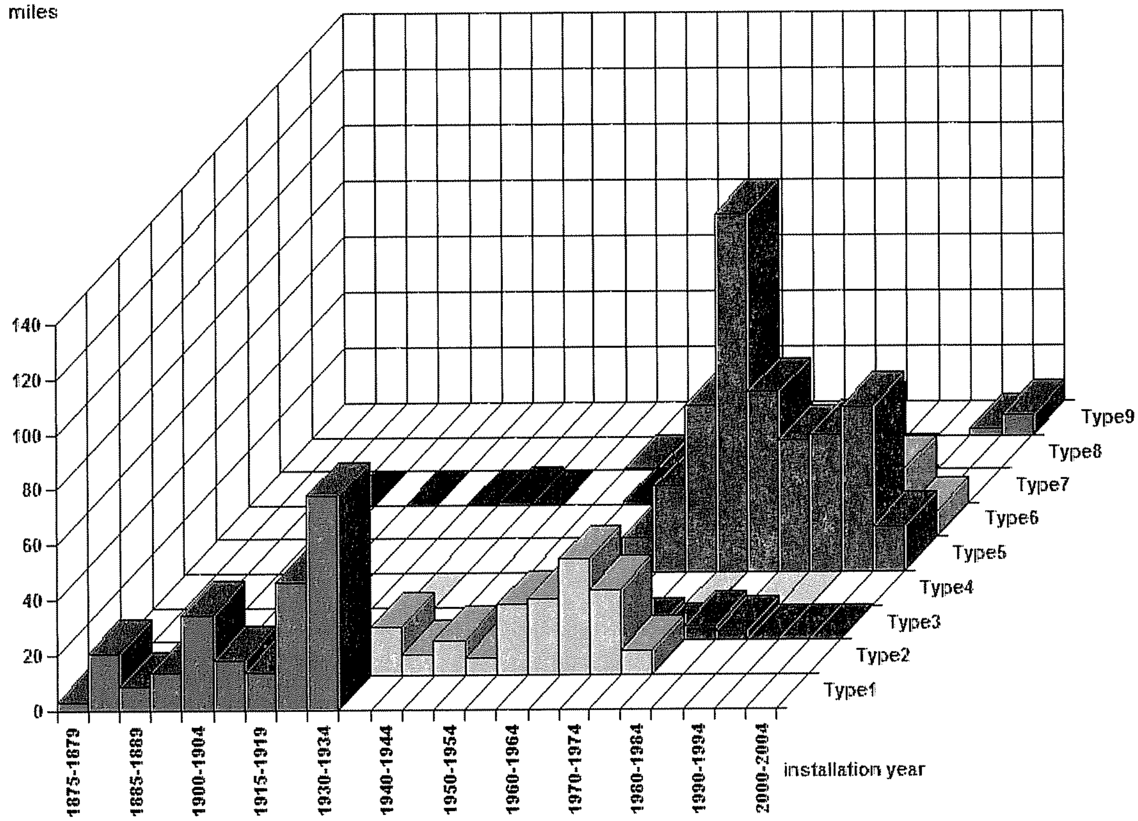
* Data subject to revision.

*Table 2: Water Main Inventory

Year of Installation	Type1	Type2	Type3	Type4	Type5	Type6	Type7	Type8	Type9
1875-1879	2.92								
1880-1884	20.74								
1885-1889	8.66								
1895-1899	13.56						0.02		
1900-1904	34.19								
1905-1909	18.10						0.02		
1915-1919	13.69								
1925-1929	46.15						0.08		
1930-1934	77.22			0.11			1.20		
1935-1939		17.51					0.21		
1940-1944		7.52							
1945-1949		12.50						0.81	
1950-1954		6.26	0.52				0.81	0.03	
1955-1959		25.47					1.67	1.23	
1960-1964		27.67			12.42			0.88	
1965-1969		41.75	2.20		31.06	1.63	0.29	8.65	
1970-1974		30.56	2.77		60.40	9.54	0.17	0.60	
1975-1979		8.99	1.04	0.13	129.39	7.70		0.77	0.10
1980-1984			5.23		65.40	0.46	0.21		
1985-1989			3.62	0.03	47.98	1.03		0.51	
1990-1994			0.22	0.03	49.88	44.02	0.87		
1995-1999			0.39		59.81	24.43			2.65
2000-2004			0.13		16.44	9.17			7.49

* Data subject to revision.

*Figure 2: Water Main Inventory Chart from the KANEW Software Program



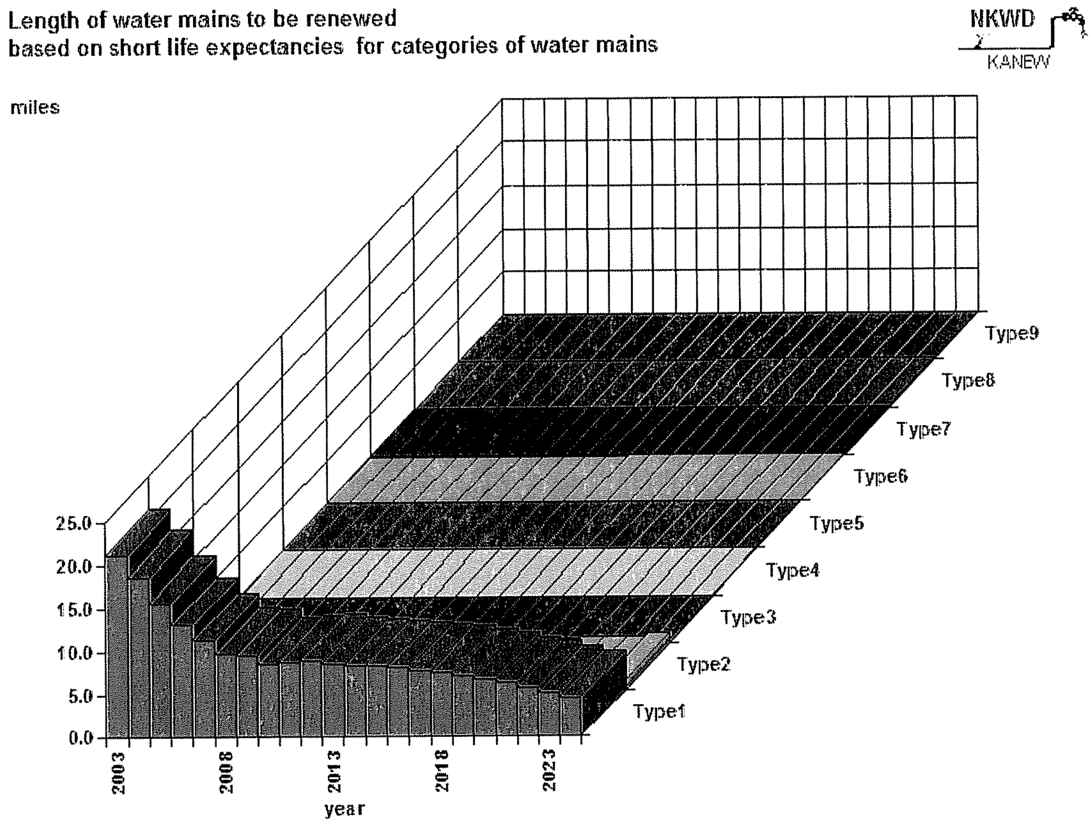
* Data subject to revision.

*Table 3: Estimated Annual Main Replacement Needs

Year	Type1	Type2	Type3	Type4	Type5	Type6	Type7	Type8	Type9	Total Replacement (miles)
2003	21.179	0	0.003	0	0	0	0.057	0.009	0	21.248
2004	18.664	0	0.003	0	0	0	0.066	0.015	0	18.749
2005	15.685	0	0.003	0	0	0	0.069	0.017	0	15.774
2006	13.289	0	0.004	0	0	0	0.071	0.018	0	13.383
2007	11.367	0	0.004	0	0	0	0.074	0.020	0.001	11.465
2008	9.828	0	0.005	0	0	0	0.076	0.021	0.001	9.931
2009	9.551	0	0.005	0	0	0	0.079	0.023	0.001	9.659
2010	8.697	0	0.005	0	0	0	0.081	0.026	0.001	8.810
2011	8.900	0	0.006	0	0	0	0.083	0.028	0.001	9.017
2012	8.941	0	0.006	0	0	0	0.084	0.033	0.001	9.065
2013	8.693	0	0.007	0	0	0	0.086	0.036	0.001	8.822
2014	8.491	0	0.008	0	0	0.004	0.087	0.038	0.001	8.628
2015	8.305	0	0.015	0	0	0.007	0.090	0.077	0.001	8.495
2016	8.101	0	0.016	0	0	0.008	0.091	0.085	0.001	8.302
2017	7.858	0	0.020	0	0	0.009	0.092	0.092	0.001	8.073
2018	7.557	0	0.022	0	0	0.010	0.093	0.100	0.001	7.784
2019	7.194	0.520	0.028	0	0	0.011	0.094	0.108	0.002	7.957
2020	6.772	0.602	0.031	0	0	0.012	0.095	0.116	0.002	7.629
2021	6.286	0.687	0.041	0	0	0.022	0.097	0.125	0.002	7.260
2022	5.755	0.775	0.045	0	0	0.057	0.097	0.136	0.002	6.867
2023	5.196	0.860	0.049	0	0	0.063	0.098	0.146	0.002	6.414
2024	4.628	1.161	0.052	0.001	0	0.087	0.099	0.159	0.002	6.189

* Data subject to revision.

*Figure 3: Estimated Annual Water Main Replacement Needs by Category Chart from the KANEW Software Program



* Data subject to revision.

APPENDIX F

AWWARF Infrastructure Assessment Manager Subsystem Criticality Report

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Memorial Parkway Treatment Plant	Finished Water System	Finished Water Conveyance		3.75	40.00
Memorial Parkway Treatment Plant	Raw Water System	Raw Water Conveyance		8.75	20.00
Ft. Thomas Treatment Plant	Raw Water System	Raw Water Conveyance		12.50	25.00
Taylor Mill Treatment Plant	Raw Water System	Raw Water Conveyance		15.00	30.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Sodium Hypochlorite (future)		20.00	0.00
Ft. Thomas Treatment Plant	Distribution System	Old State Route 4 Tank		23.75	1.00
Memorial Parkway Treatment Plant	Finished Water System	Finished Water Storage Tank/Reservoir		25.00	55.00
Memorial Parkway Treatment Plant	Raw Water System	MPTP Raw Water Pumping Station		25.00	20.00
Memorial Parkway Treatment Plant	Buildings	Carothers Road Pumping Station		26.25	10.00
Memorial Parkway Treatment Plant	Civil / Sitework System	Transportation		30.00	25.00
Ft. Thomas Treatment Plant	Buildings	Copper Building		30.00	1.00
Memorial Parkway Treatment Plant	Buildings	Ohio River Pumping Station #2		33.75	15.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Dry Powdered Activated Carbon		35.00	7.00
Memorial Parkway Treatment Plant	Buildings	Backwash Pumping Station		35.00	5.00
Ft. Thomas Treatment Plant	Buildings	Bromley PS		37.50	2.00
Ft. Thomas Treatment Plant	Raw Water System	Field Structures		37.50	0.00
Ft. Thomas Treatment Plant	Distribution System	Bromley Pumping Station and Tank		40.75	5.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Polyaluminum Chloride Coagulant		43.75	8.00
Memorial Parkway Treatment Plant	Raw Water System	Ohio River Pumping Station #2		44.50	25.00
Memorial Parkway Treatment Plant	Distribution System	South Newport Tank		45.00	25.00
Ft. Thomas Treatment Plant	Buildings	Sludge Pump Room		45.75	3.00
Taylor Mill Treatment Plant	Water Treatment System	Rapid Mix/ Coagulation		46.25	25.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Taylor Mill Treatment Plant	Raw Water System	Licking River Pumping Station		49.75	55.00
Memorial Parkway Treatment Plant	Distribution System	Carothers Road Pumping Station		50.00	50.00
Taylor Mill Treatment Plant	Buildings	Licking River PS		50.00	25.00
Memorial Parkway Treatment Plant	Support Systems	Compressed Air		50.00	12.00
Memorial Parkway Treatment Plant	Raw Water System	Field Structures		50.00	5.00
Memorial Parkway Treatment Plant	Finished Water System	Field Structures		50.00	5.00
Ft. Thomas Treatment Plant	Distribution System	Independence Tank		51.25	2.00
Ft. Thomas Treatment Plant	Distribution System	Industrial Park Tank		51.25	1.00
Taylor Mill Treatment Plant	Distribution System	Taylor Mill Pumping Station		51.75	100.00
Memorial Parkway Treatment Plant	Raw Water System	Raw Water Storage		52.50	20.00
Memorial Parkway Treatment Plant	Buildings	Reservoir Raw Water Pumping Station		53.75	15.00
Memorial Parkway Treatment Plant	Buildings	Chemical Building		53.75	15.00
Memorial Parkway Treatment Plant	Support Systems	Residuals Handling		55.00	13.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Ferric Sulfate		55.00	12.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Dry Sludge Polymer		55.00	2.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Dry Sludge Polymer		55.75	2.00
Memorial Parkway Treatment Plant	Buildings	MPTP Main Building & Actiflo		56.25	25.00
Ft. Thomas Treatment Plant	Buildings	Latonia PS		57.50	2.00
Ft. Thomas Treatment Plant	Buildings	West Covington PS		57.50	2.00
Taylor Mill Treatment Plant	Buildings	Filter Building		58.50	35.00
Ft. Thomas Treatment Plant	Buildings	Filter Building		58.50	15.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Dry Copper Sulfate		58.75	5.00
Ft. Thomas Treatment Plant	Buildings	Richardson PS		58.75	3.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Memorial Parkway Treatment Plant	Water Treatment System	Filtration (Gravity)		59.50	40.00
Memorial Parkway Treatment Plant	Support Systems	Electric Power Supply/Distribution		60.00	40.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Gaseous Chlorine		60.00	20.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	ORPS2- Liquid Potassium Permanganate		60.00	10.00
Ft. Thomas Treatment Plant	Buildings	Dudley 1080 PS		60.00	8.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	ORPS1 - Liquid Potassium Permanganate		61.25	10.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Hydrofluorosilicic Acid		61.25	5.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid F/A Polymer		61.50	3.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Sodium Hypochlorite		62.50	29.00
Taylor Mill Treatment Plant	Support Systems	Residuals Handling		62.50	15.00
Ft. Thomas Treatment Plant	Water Treatment System	Flocculation/Sedimentation		63.25	30.00
Ft. Thomas Treatment Plant	Buildings	Hands Pike PS		63.75	1.00
Ft. Thomas Treatment Plant	Buildings	Dudley 1040 PS		65.00	6.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	ORPS1 - Liquid Sodium Hypochlorite		65.00	0.00
Ft. Thomas Treatment Plant	Water Treatment System	Filtration (Gravity)		65.75	40.00
Ft. Thomas Treatment Plant	Buildings	Sludge Building		66.25	6.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Site Lighting/Site Security		67.50	25.00
Ft. Thomas Treatment Plant	Raw Water System	Raw Water Storage		67.50	15.00
Taylor Mill Treatment Plant	Finished Water System	Field Structures		67.50	5.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Sodium Hypochlorite		68.25	29.00
Ft. Thomas Treatment Plant	Buildings	Chemical Building		68.50	10.00
Taylor Mill Treatment Plant	Buildings	Sludge Handling Building		70.50	5.00
Taylor Mill Treatment Plant	Finished Water System	Finished Water Storage Tank/Reservoir		71.25	40.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Ft. Thomas Treatment Plant	Water Treatment System	Rapid Mix/ Coagulation		71.25	25.00
Taylor Mill Treatment Plant	Buildings	Chemical Building		72.00	35.00
Ft. Thomas Treatment Plant	Raw Water System	Ohio River Pumping Station #1	N/A or Unknown	72.25	50.00
Taylor Mill Treatment Plant	Civil / Sitework System	Site Lighting/Site Security		72.50	25.00
Memorial Parkway Treatment Plant	Civil / Sitework System	Site Lighting/Site Security		72.50	25.00
Taylor Mill Treatment Plant	Chemical Feed Systems	LRPS - Liquid Potassium Permanganate		72.50	12.00
Ft. Thomas Treatment Plant	Buildings	US 27 PS		72.50	5.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Ferric Sulfate		73.75	10.00
Memorial Parkway Treatment Plant	Buildings	Sludge Handling Building		73.75	5.00
Ft. Thomas Treatment Plant	Distribution System	John's Hill Road Tank		73.75	1.00
Ft. Thomas Treatment Plant	Distribution System	Kenton Lands Tank		73.75	1.00
Ft. Thomas Treatment Plant	Distribution System	Lumley Tank		73.75	1.00
Ft. Thomas Treatment Plant	Distribution System	Rossford Tank		73.75	1.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Sodium Hydroxide		73.75	1.00
Ft. Thomas Treatment Plant	Buildings	Sodium Hypochlorite Building		74.25	10.00
Ft. Thomas Treatment Plant	Support Systems	Electric Power Supply/Distribution		75.00	42.00
Taylor Mill Treatment Plant	Support Systems	Electric Power Supply/Distribution		75.00	35.00
Ft. Thomas Treatment Plant	Finished Water System	Effluent Flow Measurement		75.00	15.00
Taylor Mill Treatment Plant	Raw Water System	Influent Flow Measurement		75.00	15.00
Taylor Mill Treatment Plant	Finished Water System	Effluent Flow Measurement		75.00	15.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Sodium Hydroxide		75.00	12.00
Ft. Thomas Treatment Plant	Raw Water System	Influent Flow Measurement		75.00	10.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Site (Stormwater) Drainage		75.00	10.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Taylor Mill Treatment Plant	Civil / Sitework System	Site (Stormwater) Drainage		75.00	10.00
Memorial Parkway Treatment Plant	Raw Water System	Influent Flow Measurement		75.00	10.00
Memorial Parkway Treatment Plant	Civil / Sitework System	Site (Stormwater) Drainage		75.00	10.00
Ft. Thomas Treatment Plant	Water Treatment System	In-Plant Flow Measurement (verify)		75.00	5.00
Ft. Thomas Treatment Plant	Finished Water System	Field Structures		75.00	5.00
Taylor Mill Treatment Plant	Water Treatment System	In-Plant Flow Measurement		75.00	5.00
Memorial Parkway Treatment Plant	Water Treatment System	In-Plant Flow Measurement		75.00	5.00
Memorial Parkway Treatment Plant	Water Treatment System	Field Structures		75.00	5.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Corrosion Inhibitor		75.00	5.00
Ft. Thomas Treatment Plant	Distribution System	Richardson Road Pumping Station		75.00	3.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Potassium Permanganate		75.00	2.00
Ft. Thomas Treatment Plant	Distribution System	Hands Pike Pumping Station		75.00	1.00
Ft. Thomas Treatment Plant	Distribution System	Barrington Road Tank		75.00	1.00
Ft. Thomas Treatment Plant	Distribution System	Ida Spence Tank		75.00	1.00
Ft. Thomas Treatment Plant	Distribution System	West Covington Pumping Station		75.50	3.00
Taylor Mill Treatment Plant	Water Treatment System	Flocculation/Sedimentation		77.00	30.00
Taylor Mill Treatment Plant	Water Treatment System	Filtration (Gravity)		77.25	40.00
Ft. Thomas Treatment Plant	Buildings	Ohio River Pumping Station #1		77.50	10.00
Ft. Thomas Treatment Plant	Buildings	Ripple Creek PS		77.50	3.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Dry Polymer (Actiflo)		80.00	15.00
Ft. Thomas Treatment Plant	Support Systems	Residuals Handling		81.00	21.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Corrosion Inhibitor		81.25	7.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Hydrofluorosilicic Acid		81.25	3.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Memorial Parkway Treatment Plant	Water Treatment System	Sedimentation/Clarification		82.00	15.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Hyperion Coagulant		82.50	28.00
Ft. Thomas Treatment Plant	Buildings	Bristow Road PS		85.00	4.00
Ft. Thomas Treatment Plant	Distribution System	Dudley Complex		85.25	44.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Clarion Coagulant		86.25	20.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Corrosion Inhibitor		86.25	6.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Ferric Sulfate		86.25	5.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Hydrofluorosilicic Acid		86.25	3.00
Ft. Thomas Treatment Plant	Finished Water System	Finished Water Storage Tank/Clearwell		87.50	40.00
Ft. Thomas Treatment Plant	Buildings	Laboratory		87.50	8.00
Memorial Parkway Treatment Plant	Buildings	Waterworks Road Pumping Station		90.00	10.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Dry Powdered Activated Carbon		90.25	5.00
Memorial Parkway Treatment Plant	Water Treatment System	Ballasted Flocculation		91.00	35.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Transportation		91.25	25.00
Taylor Mill Treatment Plant	Civil / Sitework System	Transportation		91.25	25.00
Ft. Thomas Treatment Plant	Distribution System	Bristow Road Pumping Station		91.75	6.00
Memorial Parkway Treatment Plant	Chemical Feed Systems	MPTP - Liquid Sludge Polymer		93.75	3.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Dry Copper Sulfate/PAC		93.75	2.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Filter Aid Polymer		94.25	4.00
Ft. Thomas Treatment Plant	Distribution System	Bellevue Tank		95.00	1.00
Ft. Thomas Treatment Plant	Distribution System	Dayton Tank		95.00	1.00
Memorial Parkway Treatment Plant	Distribution System	Waterworks Road Pumping Station		97.50	25.00
Ft. Thomas Treatment Plant	Distribution System	Main Street Tank		97.50	1.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Ft. Thomas Treatment Plant	Distribution System	Aqua Drive Tank		98.75	2.00
Ft. Thomas Treatment Plant	Distribution System	Devon Tank		98.75	2.00
Ft. Thomas Treatment Plant	Distribution System	US 27 Pumping Station		99.25	11.00
Ft. Thomas Treatment Plant	Distribution System	Latonia Pumping Station		99.50	7.00
Ft. Thomas Treatment Plant	Distribution System	Ripple Creek Pumping Station		99.50	3.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Dry Copper Sulfate (Chem. Bldg)		99.50	2.00
Taylor Mill Treatment Plant	Support Systems	Filter to Waste System (excluding piping/valves in Filter Bldg.)		100.00	20.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Liquid Sodium Hydroxide		100.00	5.00
Taylor Mill Treatment Plant	Chemical Feed Systems	TMTP - Liquid Sodium Bisulfite		100.00	2.00
Ft. Thomas Treatment Plant	Finished Water System	Finished Water Conveyance		0.00	40.00
Taylor Mill Treatment Plant	Finished Water System	Finished Water Conveyance		0.00	40.00
Ft. Thomas Treatment Plant	Support Systems	Control System		0.00	37.00
Memorial Parkway Treatment Plant	Support Systems	Control System		0.00	35.00
Taylor Mill Treatment Plant	Support Systems	Control System		0.00	30.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Sanitary Sewers		0.00	20.00
Taylor Mill Treatment Plant	Civil / Sitework System	Sanitary Sewers		0.00	20.00
Memorial Parkway Treatment Plant	Civil / Sitework System	Sanitary Sewers		0.00	20.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Plant Potable Water (Outdoors)		0.00	10.00
Ft. Thomas Treatment Plant	Civil / Sitework System	Misc. Yard Piping (buried)		0.00	10.00
Taylor Mill Treatment Plant	Civil / Sitework System	Plant Potable Water (Outdoors)		0.00	10.00
Taylor Mill Treatment Plant	Civil / Sitework System	Misc. Yard Piping (buried)		0.00	10.00
Memorial Parkway Treatment Plant	Civil / Sitework System	Plant Potable Water (Outdoors)		0.00	10.00

Source: Water Treatment Plant Infrastructure Assessment Manager by Elliott, et al. c2001 AWWARF and AWWA

Criticality Report - Subsystem

Subsystem Criticality Report

Sort Order : Score, Weight, Criticality

Current Year: 2003

Facility	System	Subsystem	Criticality	Subsystem Score	Subsystem Weight
Memorial Parkway Treatment Plant	Civil / Sitework System	Misc. Yard Piping (buried)		0.00	10.00
Ft. Thomas Treatment Plant	Chemical Feed Systems	FTTP - Dry Copper Sulfate (Copper Bldg)		0.00	6.00
Ft. Thomas Treatment Plant	Buildings	Maintenance Building (US 27)		0.00	1.00